DARWIN CHAMBERS

Reach In Series Owner's Manual

Chamber Operation

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NAVIGATING THE USB DRIVE

This product manual has been produced to provide a simplified overview of each chamber. Each USB Drive consists of multiple folders used to categorize the contents. The USB consists of the Product Manual, Quick Start, Spec Sheets, Schematics and Drawings, and a Warranty folder.

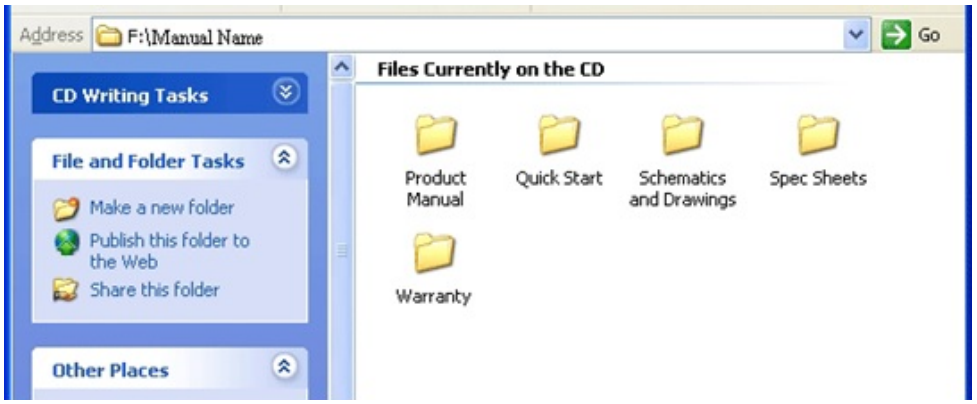


Figure 1

Product Manual

The product manual is in an Adobe PDF format. With bookmarks built into the document, navigation has been simplified. In addition, the manual can be emailed, saved to a pc, and when saved to a pc notes can be placed within the document for future reference.

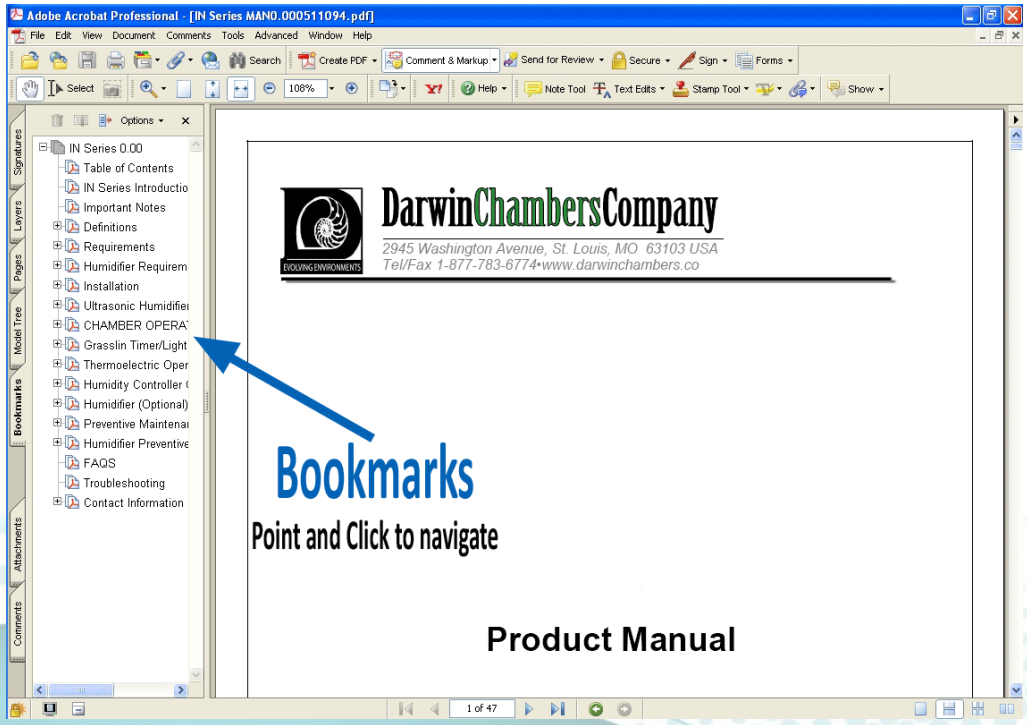


Figure 2

Quick Start

The Quick Start folder is the location of the USB Drive to find installation instructions for the chamber and our most popular accessories. Please read all applicable instructions before proceeding with the installation process.

Schematics and Drawings

The Schematics and Drawings folder includes the chamber's electrical schematic and the chamber's dimensions.

Spec Sheets

The Spec Sheets folder includes manufacturer documentation for all chamber instrumentation and possible accessories. Please refer to this section of the USB Drive if component specifications are required.

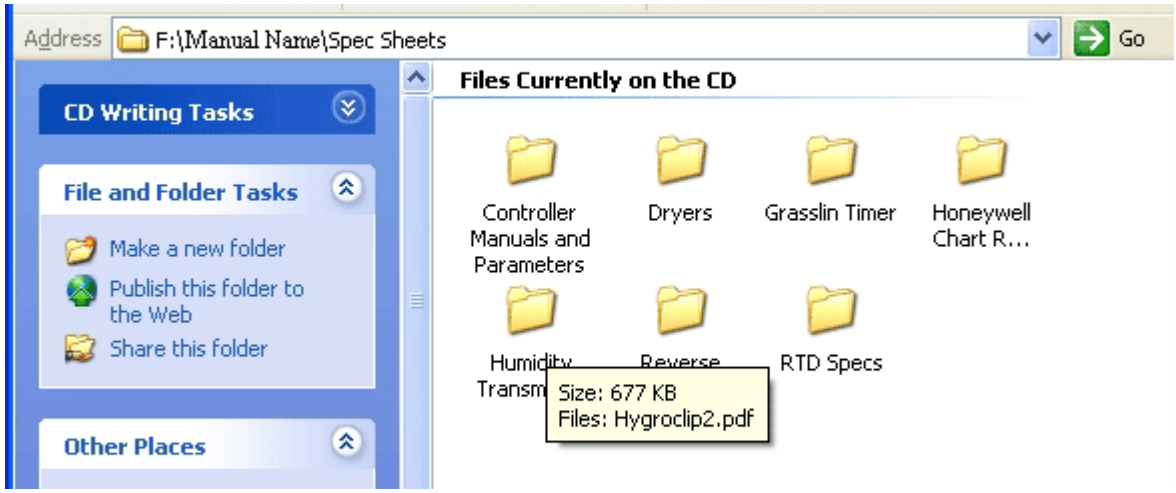


Figure 3

Warranty

The Warranty folder contains the Darwin Chambers Co. standard reach-in warranty statement.

MODEL NUMBER MATRIX

Introduction

Currently several available options may be selected during the chamber ordering process. The Standard Chamber Configurations (Table 1) and Model Number Matrix (* Formally *known has the 09 size* Table 2) is a breakdown of the standard configurations and designations that references the installed options.

Please Note: *Not all configurations may be applicable to your chamber.*

Standard Components	Mechanical Thermostat	Temperature Controller	Automatic Heat Only	Hot-gas bypass	Refrigeration System	Thermoelectric Cooling	%RH Controller	Exterior Humidifier	Internal Humidifier	Light Timer	Defrost Timer	Ramp/Soak Capabilities
Model	S = Standard								O = Optional			
KB Series		S	S	S	S		S	S		O	O	O
PG Series												
TC Series												
MJ Series												
MC Series												
TH Series		S	S	S	S						S	S
DB Series		S	S	S	S						O	O
ST Series		S		S	S							O
AR Series												
IN Series		S	S			S	O		O	O		O
INR Series												
PH Series		S	S			S	S	S				O
TE Series		S	S			S						O
DR Series												
HH Series		S					S	S				
HT Series		S					O	O				
FZ Series		S			S						S	
FS Series		S		S	S						S	O
LT Series	S	S			S							

Table 1

Model Number Matrix

Chamber Matrix					
Size	**Material**	**Electrical**	**Temperature**	**Humidity (Humidity Only Chambers)**	**Custom**
03	AA= Aluminum Interior and Exterior	CC = Custom Controller	CF = Custom Fan(s)	CH = Custom Humidifier	MA = Make up Air Requirement
011*	SS = Stainless Steel Interior and Exterior	LT = Lights	ER = Extended Range	DD15 = Munters HC-150	AP = Additional Access Port
030		RC = Recorder Custom	HV = Heater Variation	DA = Compressed Air (Flow Meter and Solenoid)	HN = Humidifier is not switched
034				DD = MG90/DD200	FD = Floor Drain
055				DM = Compressed Membrane Dryer	GD = Glass Door
084				IN = Interior Humidifier (Designate only on non IN Series Chambers)	GF = GFCI
				WR = Water Pressure Regulator	ID = Interior Door
				MP = Microprocessor Control (Designate only on Nonstandard IN Units)	NP = No Access Port

**** Formally known has the 09 size***

Table 2

CUSTOM SERIES CHAMBER'S INTRODUCTION

Darwin Chambers Co. also builds chambers to end user needs and specifications. These chambers will have a model series designation of **CU Series**. These chambers may use thermoelectrics or refrigeration for cooling. Sometimes cooling is provided by building chilled water. Please refer to this manual for general operation. If support is beyond the scope of this manual, please refer to technical support with chamber model name and company of original purchase.

HEATED SERIES CHAMBER'S INTRODUCTION

Darwin Chamber Co. line of products includes stability chambers that operate by utilizing electric heat, and/or humidification. The primary method of stability control depends on the type of chamber.

Heated Chambers

The HT Series, also known as heat only chambers. The basic HT Series model utilizes effective control of temperature through the application of electric heat and a mechanical blower. The HT Series of chambers has a designed operating range of 5.0°C above ambient to 50.0°C.

The HH Series of stability chambers, also known as heat and humidity maintains the control of temperature by electric heat, a mechanical blower, and an ultrasonic humidifier. The HH Series of chambers have a designed operating range of 5.0°C above ambient to 50.0°C and ambient to 90.0% RH.

The DR Series of chambers used for drying of electrical components like integrated circuits**.** The basic DR Series model utilizes effective control of temperature through the application of electric heat and a mechanical blower. The DR Series of chambers has a designed operating range of 40.0°C above ambient to 150.0°C. With a humidity range of less 5% RH throughout the temperature range.

THERMOELECTRIC SERIES CHAMBER'S INTRODUCTION

Darwin Chambers Co. line of products includes stability chambers that operate by utilizing thermoelectric assemblies, electric heat, and/or humidification. The primary method of stability control depends on the type of chamber model purchased.

Thermoelectric Chambers

The IN Series of chambers uses thermoelectric cooling with the assistance of electric heat to achieve effective control of temperature. Through the addition of an optional ultrasonic humidifier, control of relative humidity can then be adjusted to suit your testing needs. The IN series of chambers have a designed at an operating range of 18.0°C to 50.0°C (12.0°C to 50.0°C for the IN011) and ambient absolute humidity to 90% RH (with optional humidifier).

The PH Series of chambers use effective control of both temperature and relative humidity through the application of traditional heating methods, thermoelectric cooling, and our exclusive ultrasonic humidification system. The PH Series of chambers have a designed operating range of 20.0°C to 50.0°C (12.0°C to 50.0°C for the PH011) and ambient to 90.0% RH (Relative Humidity) based upon a 52.0°F dew point. Please refer to your chamber's sales documentation for the applicable chamber operation range.

The TE Series of environmental chambers utilizes effective control of temperature through traditional heating methods and our super quiet thermoelectric cooling technology. The TE Series has a designed operating range of 20.0°C to 50.0°C.

REFRIGERATED SERIES CHAMBER'S INTRODUCTION

Darwin Chambers Co. line of products includes stability chambers that operate by utilizing mechanical refrigeration, electric heat, and/or humidification. The primary method of stability control depends on the type of chamber.

Refrigerated Units

The AR Series (Archival Chamber) of chambers controls temperature and relative humidity though the use of a mechanical refrigeration system, a hot gas bypass, and a PID controlled heated regenerative desiccant dehumidifier. The AR Series has a designed operating range of 0.0°C to 25.0°C and 10% to 60% RH as limited by a dew point range of -12°C to ambient.

The KB Series of chambers utilize control of both temperature and relative humidity through the application of traditional heating methods, mechanical refrigeration (that includes the use of a hot gas bypass), and an ultrasonic humidification system. The KB Series of chambers has a designed operating range of 2.0°C to 50.0°C (70.0°C as an extended range option) and ambient absolute humidity to 90.0% RH based upon a 52.0°F dew point.

The DB Series employs effective control of temperature through traditional electric heat and mechanical refrigeration with a hot gas bypass system. The DB Series has a designed operating range of 2.0°C to 50.0°C (70.0°C as an extended range option).

The FS Series, Darwin Chambers Co.'s line of stability Freezers maintains precise temperature control using a microprocessor controller, mechanical refrigeration in conjunction with a hot-gas bypass system, and a plenum that incorporates a special thermal mass, and digital defrost control. The thermal mass and digital defrost controller limit the temperature swings created by the defrost cycle in standard freezers. As a result of the special thermal mass and digital defrost controller, the FS can maintain very precise temperature control and an internal temperature of +/- 5.0°C during the defrost cycle. The FS has a designed operational range of -25.0°C to 15.0°C.

The ST Series of chambers controls temperature though the use of a mechanical refrigeration system and a hot gas bypass. The ST Series has a designed operating range of 2.0°C to 15.0°C.

The TH Series of chambers, also known as Freeze Thaw chambers. The basic TH Series chamber offers the same flexibility as the basic DB Series chamber in that they both control temperature using traditional heating methods and mechanical refrigeration in conjunction with a hot gas bypass system. However, the TH Series of chambers also use an R404a compressor, which enables the TH chambers to be used for freezing applications. The TH Series has a designed operational range of -25.0°C to 50.0°C.

The MJ Series of chambers, for drying of marijuana leaves. The MJ Series chambers utilize control of both temperature and relative humidity through the application of traditional heating methods, mechanical refrigeration (that includes the use of a hot gas bypass), an ultrasonic humidification system, and controlled heated regenerative desiccant dehumidifier. The MJ Series of chambers has a designed operating range of 15.0°C to 30.0°C.

The PG Series of chambers used for plant growth in horticulture. The PG Series chambers utilize control of both temperature and relative humidity through the application of traditional heating methods, mechanical refrigeration (that includes the use of a hot gas bypass), and an ultrasonic humidification system. The PG Series of chambers has a designed operating range of 2.0°C to 40.0°C.

The INR Series of chambers uses of a mechanical refrigeration system and a hot gas bypass with the assistance of electric heat to achieve effective control of temperature. Through the addition of an optional ultrasonic humidifier, control of relative humidity can then be adjusted to suit your testing needs. The INR series of chambers have a designed operating range of operating range is 2.0°C to 50.0°C and ambient absolute humidity to 90% RH (with optional humidifier).

The MC Series of chambers used for concrete curing and other related industries. The construction of these units is what separates MC from other series like KB Series. They are designed to be more robust to take the abuse of heavy and coarse material. Chambers use a mechanical refrigeration system and a hot gas bypass with the assistance of electric heat to achieve effective control of temperature. Through the addition of an optional ultrasonic humidifier, control of relative humidity can then be adjusted to suit your testing needs. The MC series of chambers have a designed operating range of operating range is 2.0°C to 50.0°C and ambient absolute humidity to 90% RH

CYCLING CHAMBER SERIES INTRODUCTION

Darwin Chambers Co. line of products includes stability chambers that operate by utilizing mechanical refrigeration and a Loop Controller. The primary method of stability control depends on the refrigerant and chamber type.

Cycling Chambers

The FZ Series is Darwin Chambers Co.'s line of freezers. The basic FZ Series models maintain control of temperature by utilizing a microprocessor controller and an R404a mechanical refrigeration system. The FZ Series of chambers has a designed operational range of -25.0°C to -5.0°C.

The LT Series is our standard laboratory refrigerators. Each LT Series model utilizes effective control of temperature using highly sensitive electronic control and R134a mechanical refrigeration. The LT Series of chambers have a designed operating range of 2.0°C to 15.0°C.

In addition to the basic chamber models, Darwin Chambers Co. also offers numerous optional chamber additions. With the use of the additions, a chamber may be adapted to suit a testing environment. For more information, please visit www.darwinchambers.com or email our sales team at sales@darwinchambers.com.

NOTE: *All operating ranges specified are for precautionary purposes to preserve the integrity of the chamber. Chamber operation outside of Darwin Chambers Co. specified operating range may result in damage to the unit, should be avoided, and may void the chamber's warranty.*

IMPORTANT NOTES

NOTE 1: *Pictures within this manual may vary due to product improvement.*

NOTE 2: *If an optional circular chart recorder has been purchased, do not plug in the environmental chamber until the recorder's pen caps and any packing material has been removed from both the pens and chart plate. Failure to remove the pen caps and packing material could result in damage to the chart recorder pens and / or result in a voided calibration.*

NOTE 3: *The Fuji controller setup parameters vary from cabinet to cabinet due to the AUTO-TUNE feature. To avoid any unnecessary difficulties in chamber operation, do not attempt to change any parameters, except for the set value (SV), without first taking note of all stored values. Failure to do so may result in extra expenses for customer service visits and possible replacement of parts.*

NOTE 4: *Through alarms, each Fuji Microcontroller does act as a component fail safe and protect your chamber from further damage in the event the process value (PV) excessively deviates for some unforeseen reason. For your convenience, Darwin Chambers typically pre-sets these alarms with a 15-minute delay to allow an adequate amount of time for the PV to recover in the event of a power outage/door opening.*

NOTE 5: *If your chamber includes the optional ultrasonic humidification system, a possible situation of the chamber producing condensation can occur. The condensation is channeled to the outside of the cabinet by polyurethane tubing on the rear of the chamber. It is strongly recommended that your new chamber be positioned near a drain or that a condensate removal kit be purchased from Darwin Chambers to facilitate condensate removal.*

NOTE 6: *When utilizing the optional ultrasonic humidification system, softened water should not be connected to the chamber. The use of soft water will introduce 5 to 7 times more salts into the humidifier. The salts may result in a humidifier failure and/or damage to the metals within the chamber.*

NOTE 7: *Your chamber comes equipped with an access port. This port should remain securely closed (with the provided insulation inserted) to ensure that unnecessary condensation will not occur and that consistent uniformity will be maintained.*

NOTE 8: *If the optional heated regenerative desiccant dehumidifier has been purchased and the desired chamber application requires a high temperature and medium to high humidity, the dehumidifier and its high temperature ducts should be disconnected from the chamber. Failure to remove the dehumidifier and its ducts under such circumstances may result in the accumulation of condensation within the unit's ducts/piping, thus becoming an electrical and safety hazard.*

NOTE 9: *The TH and FS Series of chambers utilize a 30 second timed delay during chamber startups and immediately following a defrost cycles before providing power to the evaporator fan(s). This helps ensure that the evaporator is cold and can rapidly dissipate heat in an efficient manner.*

NOTE 10: *The FS Series chamber utilizes a Dwyer Temperature Switch to maintain precise control over the defrost cycle. The set points for the defrost settings should not be adjusted without first contacting a technical support representative to avoid undesirable chamber operation.*

NOTE 11: *The AR Series of chambers includes an electrical outlet mounted on the chamber's rear. The intent of the outlet is to provide a means to remove power from the dehumidification system in the event of a high temperature alarm. Failure to utilize this outlet may unnecessarily place product at risk in the event of a chamber malfunction.*

DEFINITIONS

Throughout the product manual, several key terms are employed. A basic knowledge of the terms discussed may help to clarify sections of the product manual. It is strongly recommended that each term be reviewed prior to proceeding to the next section of the product manual.

Symbol Definitions

CAUTION	Appears next to required safety related information in the manual.
	PERSONAL INJURY WARNING: Meaning risk of electrical shock.
WARNING	This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages that could result in serious injury or death can occur.
TECH TIP O	Technical advice and special instructions are given wherever this symbol is found.
NOTE	This symbol denotes special advice.

Figure 4

Key Definitions

Alarms – Set parameters designed to alert the user of testing deviation that performs a timed component shut down to protect the environmental chamber from potential damage.

Absolute Alarms – A type of alarm that is dependent upon a fixed value or limit, that when reached/crossed indicates the process is out of tolerance by an audible/visual indicator.

Absolute Humidity- is the measure of water vapor (moisture) in the air, regardless of temperature. It is expressed as grams of moisture per cubic meter of air (g/m3).

Deviation Alarms – A type of alarm that has a set limit/range which automatically adjusts at a fixed value from a variable (Set Value) that when reached/crossed indicates the process is out of tolerance by an audible/visual indicator.

Deionized Water (DI) – Also known as demineralized water, is water that has had its mineral ions removed, such as cations from sodium, calcium, iron, copper, and anions such as chloride and bromide.

Conductivity – A measure of the ionic activity of a solution in term of its capacity to transmit current.

Dedicated Circuit – A circuit that is designated specifically for a single item.

Parts Per Million (PPM) – The number of parts by weight of a substance per million parts of water.

Polyvinyl Chloride (PVC) – A white, water-insoluble, thermoplastic resin, derived by the polymerization of vinyl chloride; used chiefly for thin coatings, insulation, and piping.

Polyurethane Tubing – A flexible thermoplastic tubing that exhibits the properties of both plastic and rubber.

Process Value (PV) – The current / actual condition within the environmental chamber.

Relative Humidity (RH) – The amount of water vapor in the air, expressed as a percentage of the maximum amount that the air could hold at the given temperature, the ratio of the actual water vapor pressure to the saturation vapor pressure.

Reverse Osmosis (R.O.) – The process by which pure water is produced as a result of forcing waste or saline water through a semi permeable membrane.

Set Value (SV) – The user-determined set point of the environmental chamber.

Total Dissolved Solids (TDS) – An expression used to describe the combined content of all inorganic and organic substances contained in a liquid (which are present in a molecular, ionized, or micro-granular suspended form).

REQUIREMENTS

Electrical

*120 Volt AC, Single Phase, 60 Hz,
**15 Amp dedicated circuit.
* Overseas models utilize an optional step-down transformer to achieve 120 Volt AC operation.

** Values may vary depending on the unit. Please refer to the chamber's Data Label for model specific values.
Required NEMA Plugs and Receptacles

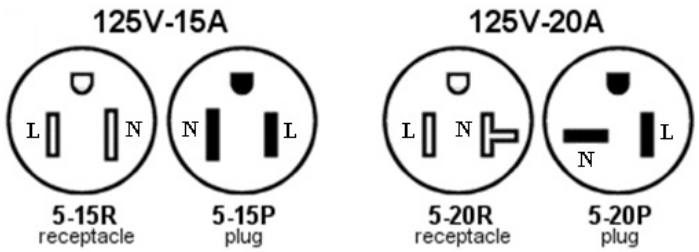


Figure 5

In the event of a malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This machine is equipped with an electric cord that has an equipment-grounding conductor and a grounding plug. The plug must be inserted into a matching outlet that has been properly installed and grounded in accordance with all local codes and ordinances. Do not modify the plug provided; if it will not fit the outlet, have the proper outlet installed by a qualified electrician. Improper connection of the equipment-grounding conductor can result in risk of electric shock. If repair or replacement of the electric cord or plug is necessary, do not connect the grounding conductor to a live terminal. Check with qualified electrician or service personnel if the grounding instructions are not clear, or if there is doubt as to whether the machine is properly grounded.

Chamber designed for indoor use only.

Intended Use:	This chamber is intended to be used for close tolerance temperature and/or humidity conditioning of laboratory samples.
Unintended Uses:	This chamber is not designed for storage of flammables, explosives, hazardous materials, human occupants, etc. Failure to follow the proper intended uses may result in fire, serious injury, or death.

Chamber Fuses:

Heater:	10 Amp 250 Volt 3AG
*Humidifier:	5 Amp 250 Volt 3AG
**Door Frame Heater:	5 Amp 250 Volt 3AG

*Chambers with humidity control only.

** 011 Chambers with humidity control only

General Specifications:

Voltage:	120VAC ±10%
Phase:	1
Hertz:	50/60 Hz.

Pollution Degree: 2

Overvoltage Category: II

Ambient Temperature: 72°F ±8°F and a dewpoint at or below 52°F (72°F / 50% RH)

Altitude: ≤ 2500 Meters

THERMOELECTRIC COOLING With Out HUMIDITY

Amperage (RLA): @30.0°C Set point

Size:	03	011	30	34	55	84
RLA:	3.5	3.9	4.1	3.9	7.5	7.8

Operating Range 12.0°C to 50.0°C (011 model only)
20.0°C to 50.0°C (Sizes 30, 34, 55, & 84)
Operating range maybe affected by optional lighting, ambient conditions, product spacing, and/or quantity.

THERMOELECTRIC COOLING With HUMIDITY

Amperage (RLA): @30.0°C 65.0% RH Set points

Size:	03	011	30	34	55	84
RLA:	4	4.2	4.5	4.2	7.0	9.5

Operating Range 20.0°C to 50.0°C and 57.0% to 90.0%RH (011 model can operate as low as 12.0°C)

NOTE: Due to continued product improvement stated amperages are subject to change. Please refer to your chamber's data label for your chamber's applicable RLA.

STANDARD REFRIGERATION With Out HUMIDITY

Amperage (RLA): R134a systems @30.0°C

Size:	011	30	34	55	84
RLA:	8.0	7.0	8.0	12.0	12.0

Refrigerant Amount:

Size:	011	30	34	55	84
Amount:	12.5 oz.	13.5 oz.	12.5 oz.	18.5 oz.	18.5 oz.

Operating Range 2.0°C to 60.0°C Operating range maybe affected by ambient conditions, product spacing, and/or quantity.

STANDARD REFRIGERATION With HUMIDITY

Amperage (RLA): R134a systems @30.0°C & 65.0%RH

Size:	011	30	34	55	84
RLA:	8.0	6.5	8.0	12.0	12.0

Refrigerant Amount:

Size:	011	30	34	55	84
Amount:	12.5 oz.	13.5 oz.	12.5 oz.	18.5 oz.	18.5 oz.

Operating Range 2.0°C to 60.0°C and 60.0% to 90.0%RH Operating range maybe affected by ambient conditions, product spacing, and/or quantity.

NOTE: *Does not include the PG Series which cannot be documented due to light fixture customization.*

TH Series, FZ Series AND FS Series

Amperage (RLA): R404a systems @-20.0°C

Size:	011	30	34	55	84
RLA:	7.4	10.0	8.0	13.8	12.0

Refrigerant Amount:

Size:	011	30	34	55	84
Amount:	10 oz.	10 oz.	10 oz.	19 oz.	19 oz.

Operating Range -20.0°C to 50.0°C (TH Series)

-25.0°C to 15.0°C (FS Series))
Operating range maybe affected by ambient conditions, product spacing, and/or quantity.

NOTE: *All amperages are subject to change. Please refer to your chamber's data label for all chamber specific information.*

Ambient

A surrounding environment of 72°F ±8°F and a dew point at or below 52°F (72°F 50%Relative Humidity) is recommended.

Exterior Operating Space

A minimum of 12 inches of clearance from the top of each chamber, and six inches on all sides is required.

TECH TIP *To achieve the best performance from your chamber, it is important to keep the unit in an area that is air-conditioned during the summer months. The reason for this is mainly due to high ambient dew points, which may introduce more humidity into the chamber than the standard chamber can remove during the normal course of operation. The recommended solution for areas that may fall outside*

the desired temperature and humidity levels is normally the application of a dehumidification system: either electric heat regenerated desiccant type or compressed air type.

Interior Operating Space

Proper product and shelf placement are essential to the flow of air and directly affects the chamber uniformity. Darwin Chambers recommends that the bottom shelf be placed no lower than three inches from the floor and one inch from the rear wall of the chamber. Similar care should be given to the placement of product throughout the unit. It is strongly suggested that all product remains a minimum of two inches from each side and the rear of the chamber and no less than four inches away from the ceiling of the chamber.

HUMIDIFIER (OPTIONAL) REQUIREMENTS

Electrical


(US Models & Overseas Models)
Chamber Supplied 24 Volts AC, Single Phase, 50/60 Hz, ≤2.8 FLA per Mister

Figure 6

Water Quality

The ultrasonic humidifier requires the use of a water supply that can meet the following water specifications: A conductivity of 0.1 µS – 10 µS (Micro Siemens), TDS (Total Dissolved Solids) of less than 10 PPM (Parts per Million), and 1-10 PSI (Pounds per Square Inch) of supply water pressure. The conductivity requirements are necessary to ensure that the humidifier's ultrasonic transducer's conductivity sensor can adequately detect the presence of water. Without the proper conductivity, the ultrasonic transducer may burn out and/or function improperly. Meeting the TDS requirements will ensure that sediment within the water supply will not accumulate within the humidifier or be dispersed throughout the chamber. The accumulation of sediment within the humidifier may result in humidifier deterioration and/or malfunction. Sediment being dispersed throughout the chamber could also result in corrosion, mechanical/electrical problems, and samples placed within the chamber being blanketed by the sediment.

PLEASE NOTE: *Darwin Chambers Co. recommends the use of an R.O. system, a Darwin Chambers Co. brand D.I. water filtration system, or a Darwin Chambers R.O./D.I. filtration system to meet the water quality specifications. In addition, the use of a water softener will void the chamber warranty.*

Water Level

When the humidifier's reservoir has been filled, there should be approximately three quarter (3/4") inches of water above the crossbeam/conductivity sensor of the ultrasonic transducer.

NOTE: *If the water level exceeds the 1" inch level, the transducer's capacity to produce humidity will be greatly diminished. In addition, water MUST cover the crossbeam of the ultrasonic transducer by a minimum of ¼" otherwise the transducer will stop generating humidity automatically.*

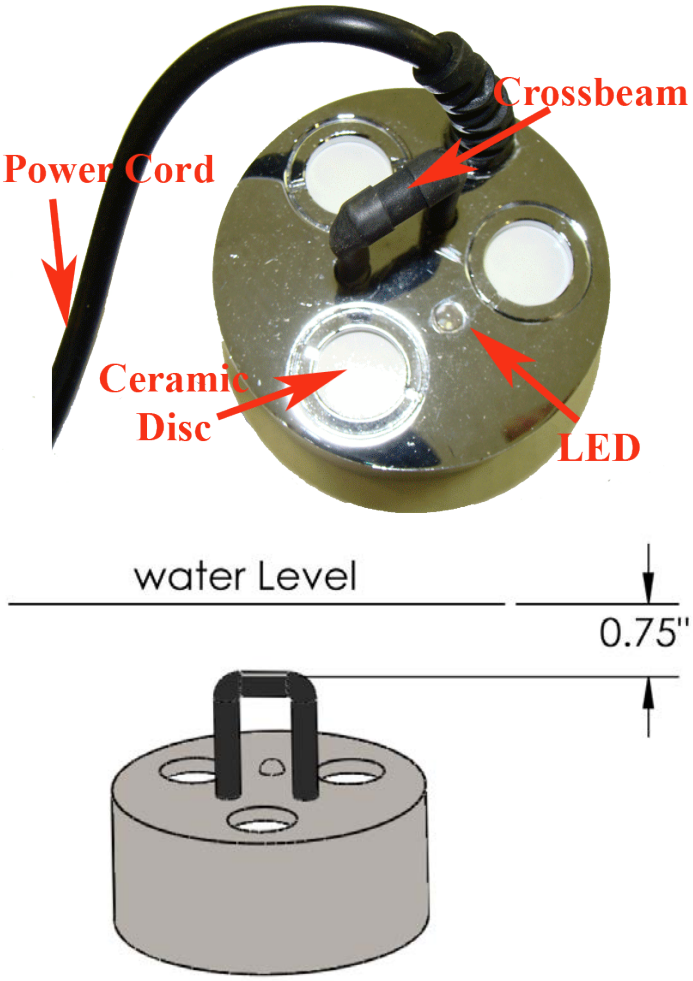


Figure 7

INSTALLATION

Tools Required

- Level
- ¾" socket and ratchet

Procedure

1. Make certain the chamber is as close to the final location as possible.
2. Unpack the chamber and ensure that the unit includes wire shelves, 4 shelf clips per shelf, and any optional accessories.

⚠ This is not a one-person job; at least two strong people will be needed to move and steady the chamber.

3. Remove the chamber from the shipping pallet. Typically, the shipping pallet will be attached to the chamber with four bolts — use a ratchet and a ¾" socket to remove the bolts.

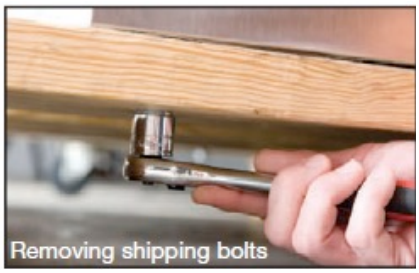


Figure 8

4. Once all the bolts are removed, carefully reposition the chamber so that the one side of the chamber is slid off the pallet one corner at a time while fully installing the castors and/or leveling legs until they are flush with the chamber's frame. Make certain the unit is well supported, as most chambers are top heavy and can cause significant injury or death if they fall.

Figure 9

5. Set the chamber in its final location.
6. Level the chamber, first from front to back and side to side. This can be accomplished by placing shims in between the castor plate and the chamber. Proper leveling ensures effective condensate removal from within the chamber and if applicable, a tighter relative humidity process value.

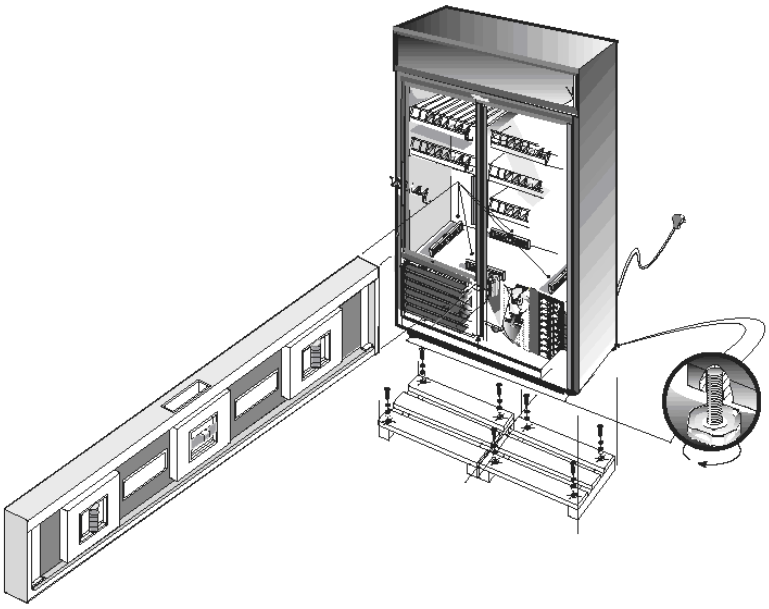


Figure 10

7. Install the chamber's shelving. Proper shelf placement is essential to the flow of air directly affecting the chamber's uniformity. Darwin Chambers recommends that the bottom shelf be placed no lower than three inches from the floor and one inch from the rear wall of the chamber. Similar care should be given to the placement of product throughout the unit. It is strongly suggested that all product remains a minimum of two inches from each side and the rear of the chamber and no less than four inches away from the ceiling of the chamber.
8. Plug the chamber into its own dedicated circuit that meets the minimum dedicated circuit requirements specified on the chambers data label.

NOTE: Connecting the chamber to an extension cord may void the warranty and should be avoided.

ULTRASONIC HUMIDIFIER (OPTIONAL)

Darwin Chambers Co. uses ultrasonic humidification to generate humidity. The most common humidifier, the external humidifier, is available on all humidity capable chambers. Typically located on the chamber's top exterior (below the safety grill), the ultrasonic humidifier provides an easily serviceable energy efficient means of chamber humidification.

Humidifier Installation Instructions

1 The ultrasonic humidifier is shipped pre-installed upon each chamber. Installation consists merely of supplying a ¼" polyurethane tube from the filtered water supply (not included) to a ¼" union (located on the top rear of the chamber). To connect the tubing from the supply, simply insert the water line securely into the union.

Figure 11

2 Open the water supply to the chamber and allow the humidifier to fill with water.

Note: To avoid damage to the humidifier ensure the water supply has been regulated to 1-10 psi.

Once the utilities have been connected, secured and shelves, drain lines (when applicable) and chamber put in place. You are now ready to turn on the chamber.

Powering the Chamber On and Off

Figure 12

To power the chamber on/off the chamber includes a rocker switch actuated thermal circuit breaker is mounted within the controller(s) face plate. Switch the breaker to the right to the (−) right hand/closed side to enable the chamber's power. To remove power from the chamber, switch the breaker to the (O) left/open side.

Your chamber will now run and the last set points that were set in the controller. To change set points, see the controller section applicable to the controller on your chamber.

Controller Types

Fuji PXF4 Controls	West EC44 Controller	Future Design Controls MCT4 Controller (Touchscreen)	Future Design Control MCT-CM (Touchscreen Controller)
			

Table 3

SEQUENCE OF OPERATION / ALARM OUTPUT FUNCTIONS.

This section describes the sequence of operation / alarm output functions by chamber series, meaning what is enabled and disabled by the alarms after power is applied to the chamber. This does not describe any indicators or how to change the alarms. This is because of different controller types. Click on the name of the controller type in Table 3 to visit your controller section in this manual to see the "how to" for your controller type.

When able, all alarms follow an order of Temperature then Humidity in high then low alarms audible alarms sequence. Some alarms are not audible but either enable or disable components for better operation or performance. See section "Putting the Thermoelectric to Use" for the Thermoelectrics and see section

“Refrigeration in Use” for chambers with a mechanical condensing unit. This will give better guidance when the cooling capabilities are on or off. For Chamber with a dehumidifier or dry air solenoid see section “ Dehumidification Controller operation” for operation of these outputs.

The follow tables indicate when output types are enabled or disabled based on the Alarm output of the controller. Heaters, hot gas, and humidity are enabled by the outputs listed below but will be “on” based on the control output. This will be indicated on the controller by indicator light or duty cycle level. The heater, hot gas or humidity will be “on” when the controller calls for heat or humidity and the heater, hot gas or humidity is in the on (enabled) state.

Heated Series Alarm Outputs

	Controller Type			
Output Type	**Fuji PXF**	**West EC44**	**MCT-CM**	**MCT4**
Heater	Output: Off; Audible: Yes; Name: EV1	Output: Off; Audible: Yes; Name: Alarm 1	Output: Off; Audible: Yes; Name: Alarm 1	Output: Off; Audible: Yes; Name: Alarm 1
Hot Gas	N/A	N/A	N/A	N/A
Evaporator Fan	Output: Off; Audible: Yes; Name: EV1	Output: Off; Audible: Yes; Name: Alarm 1	Output: Off; Audible: Yes; Name: Alarm 1	Output: Off; Audible: Yes; Name: Alarm 1
Cooling	N/A	N/A	N/A	N/A
Humidifier	Output: Off; Audible: Yes; Name: EV1	Output: Off; Audible: Yes; Name: Alarm 3	Output: Off; Audible: Yes; Name: Alarm 3	Output: Off; Audible: Yes; Name: Alarm 4
Dehumidifier	Output: Off; Audible: Yes; Name: EV2 Output: On; Audible: No; Name: EV3	Output: Off; Audible: Yes; Name: Alarm 4 Output: On; Audible: No; Name: Alarm 6	Output: Off; Audible: Yes; Name: Alarm 4 Output: On; Audible: No; Name: Alarm 7	Output: Off; Audible: Yes; Name: Alarm 5

Table 4

Thermoelectric Series Alarm Outputs

Output Type	Controller Type			
	Fuji PXF	West EC44	MCT-CM	MCT4
Heater	Output: Off; Audible: Yes; Name: EV1	Output: Off; Audible: Yes; Name: Alarm 1	Output: Off; Audible: Yes; Name: Alarm 1	N/A
Hot Gas	N/A	N/A	N/A	N/A
Evaporator Fan	Output: Off; Audible: Yes; Name: EV1	Output: Off; Audible: Yes; Name: Alarm 1	Output: Off; Audible: Yes; Name: Alarm 1	N/A
Cooling	Output: Off; Audible: Yes; Name: EV2 Output: Off; Audible: No; Name: EV3	Output: Off; Audible: Yes; Name: Alarm 2 Output: Off; Audible: No; Name: Alarm 5	Output: Off; Audible: Yes; Name: Alarm 2 Output: Off; Audible: No; Name: Alarm 5 Output: Off; Audible: No; Name: Alarm 6	N/A
Humidifier	Output: Off; Audible: Yes; Name: EV1	Output: Off; Audible: Yes; Name: Alarm 3	Output: Off; Audible: Yes; Name: Alarm 3	N/A
Dehumidifier	Output: Off; Audible: Yes; Name: EV2 Output: On; Audible: No; Name: EV3	Output: Off; Audible: Yes; Name: Alarm 4 Output: On; Audible: No; Name: Alarm 7	Output: Off; Audible: Yes; Name: Alarm 4 Output: On; Audible: No; Name: Alarm 7	N/A

Table 5

Refrigerated Series Alarm Outputs

Output Type	Controller Type: Fuji PXF	West EC44	MCT-CM	MCT4
Heater	Output: Off; Audible: Yes; Name: EV1	Output: Off; Audible: Yes; Name: Alarm 1	Output: Off; Audible: Yes; Name: Alarm 1	Output: Off; Audible: Yes; Name: Alarm 1
Hot Gas	Output: Off; Audible: Yes; Name: EV1 Output: Off; Audible: Yes; Name: EV2 Output: Off; Audible: No; Name: Ev3	Output: Off; Audible: Yes; Name: Alarm 1 Output: Off; Audible: Yes; Name: Alarm 2 Output: Off; Audible: No; Name: Alarm 5	Output: Off; Audible: Yes; Name: Alarm 1 Output: Off; Audible: Yes; Name: Alarm 2 Output: Off; Audible: No; Name: Alarm 5 Output: Off; Audible: No; Name: Alarm 6	Output: Off; Audible: Yes; Name: Alarm 1
Evaporator Fan	N/A (see Defrost)	N/A (see Defrost)	N/A (see Defrost)	N/A (see Defrost)
Cooling	Output: Off; Audible: Yes; Name: EV2 Output: Off; Audible: No; Name: EV3	Output: Off; Audible: Yes; Name: Alarm 2 Output: Off; Audible: No; Name: Alarm 5	Output: Off; Audible: Yes; Name: Alarm 2 Output: Off; Audible: No; Name: Alarm 5 Output: Off; Audible: No; Name: Alarm 6	Output: Off; Audible: Yes; Name: Alarm 2
Humidifier	Output: Off; Audible: Yes; Name: EV1	Output: Off; Audible: Yes; Name: Alarm 3	Output: Off; Audible: Yes; Name: Alarm 3	Output: Off; Audible: Yes; Name: Alarm 4
Dehumidifier	Output: Off; Audible: Yes; Name: EV2 Output: On; Audible: No; Name: EV3	Output: Off; Audible: Yes; Name: Alarm 4 Output: On; Audible: No; Name: Alarm 6	Output: Off; Audible: Yes; Name: Alarm 4 Output: On; Audible: No; Name: Alarm 7	Output: Off; Audible: Yes; Name: Alarm 5

Table 6

Cycling Series Alarm Outputs

Output Type	Controller Type			
	Fuji PXF	West EC44	MCT-CM	MCT4
Heater	N/A	N/A	N/A	N/A
Hot Gas	N/A	N/A	N/A	N/A
Evaporator Fan	N/A (see Defrost)	N/A (see Defrost)	N/A (see Defrost)	N/A (see Defrost)
Cooling	Output: Off; Audible: Yes; Name: EV2	Output: Off; Audible: Yes; Name: Alarm 2	Output: Off; Audible: Yes; Name: Alarm 2	Output: Off; Audible: Yes; Name: Alarm 2
Humidifier	N/A	N/A	N/A	N/A
Dehumidifier	N/A	N/A	N/A	N/A

Table 7

BMS (Building Monitor System) Alarm Outputs

Building Monitor system alarm output is a dry contact for the chamber in an alarm condition. A dry contact has no electrical potential from the chamber. The dry contact will consist of a common connection along with a normally open and closed contact in reference to common. Therefore, the person managing your BMS system can trigger an alarm in a closed or open state. Best practice is to use an energized normally closed state. This way you will know either a problem has occurred with the chamber or the BMS system when checking an alarm.

Most Chambers come standard with a BMS output. The alarms may be tied with the high and low alarm of the controller. Some controllers the setting will be separate from the high and low alarms of the controller to either give earlier or later warning of chamber alarm. The alarms will be labeled as such for BMS. This is due to some alarms turning off components to prevent run away performance or extended door openings for loading

the chamber causing the BMS monitor to check on the chamber. Looking in the mechanical area at the electrical din rail you will find a connector with mating connector with no wires. The wires will be labeled for com (common), NO (normally open), and NC (normally closed). Some chambers will have a thin relay labeled BMS relay. The relay base will determine the wire connections. Some chambers will have temperature and humidity alarms tied together on one output and some chamber may separate them. Regardless of the output there is no indication if the alarm is high or low for temperature or humidity.

CHAMBER LOOP CONTROLS

Darwin Chambers uses various PID loop controllers. They may be models found in this manual or may be models customer specified. Controllers not found in this manual will have the Controllers manual included with this manual. Use this manual for mechanical features of your chamber and retain the controller manual to see how to interface with that device.

***NOTE**: Controllers may have a "Factory Reset" option. This factory reset will reset to the controller manufacture parameters not Darwin Chambers parameters. Please document any or all parameters before making a change to parameters Darwin Chambers has set.*

Controllers found in this manual.

Controller Types

Fuji PXF4 Controls	West EC44 Controller	Future Design Controls MCT4 Controller (Touchscreen)	Future Design Control MCT-CM (Touchscreen Controller)
			

Table 8

Controller referred to as **Loop1 in this manual will refer to the temperature controller. ***Loop 2 may refer to Relative Humidity controller, Light controller, CO2 controller, or Oxygen controller. When more than 2 controllers' relative humidity will be ***Loop 2. ****Loop 3 will then be Light controller or any among the other loop controls. The light control typically does not have a feedback sensor. Therefore, controls the lights in an open loop format.

Fuji Controller may also be used with a virtual touch screen. This gives the simplicity on the front of the chamber of basic controls. However, gives the complexity of touchscreen features being able to interface with the touch screen on most formats like smart phone, tablet, or PC. This includes Datalogging and interacting with the chamber remotely over the internet with no special IT assistance.

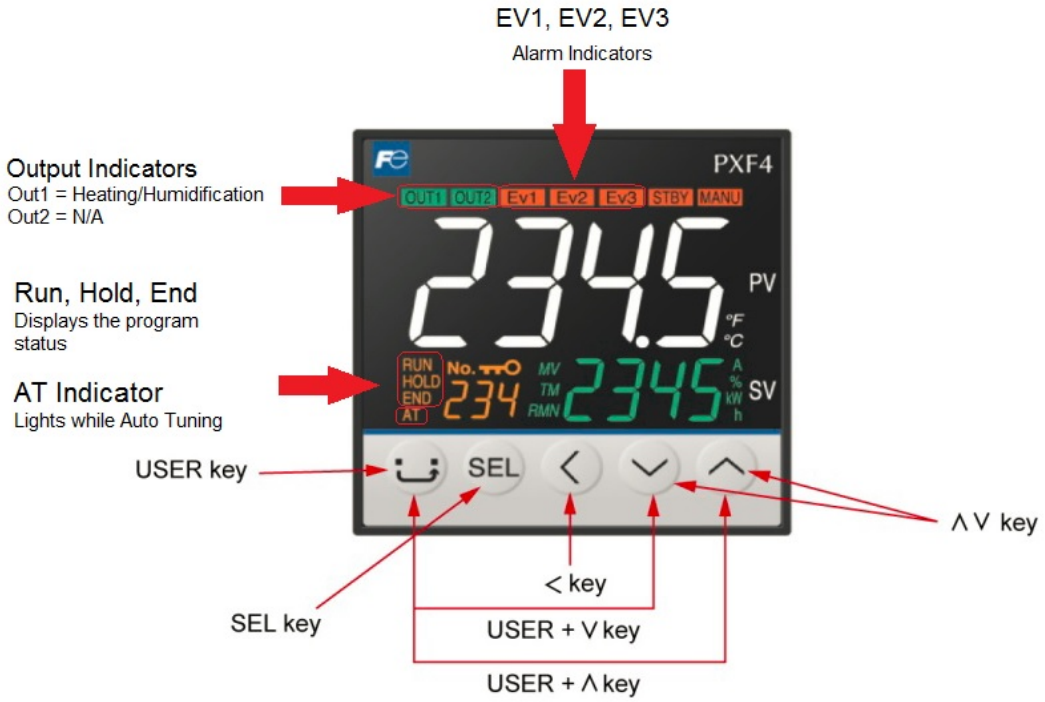


Figure 13

This diagram is intended as a quick reference to the controller's functionality. Some functions are dependent upon the chamber type, the controller type, and which options have been purchased.

Changing the Set Value (SV) for Temperature or Relative Humidity

Press the up (∧) or down (∨) arrow to change the set value. When changing the set value (SV), if the process value and the new set point are far enough apart, an adjustment to the alarms is suggested. This will prevent a premature alarm and help ensure the chamber will reach set point. The high alarm (AL1) and a low alarm (AL2) values will need to be increased. Please refer to the section "Changing Alarm Parameters" for more information.

For the initial setup or a much different set point from before, more than ±5°C or %RH an auto-tune is recommended. Wait until the chamber has reached or within 1° or 1% before auto tuning. See the "Auto-Tune the Controller" section of this manual.

Navigating the Menu

The Fuji PXF4 Micro Controller offers a large range of customizable settings that have been preprogrammed from the factory to best suit the chambers intended operation. To adjust any parameters other than the Set Value (SV) the user is required to navigate the controller's menu system. The first portion of the menu system is known as Operation Control Mode. In Operation Control Mode the user will have the ability to start/stop a ramp soak program, perform an Auto-Tune, increase/decrease alarm values, and lock (Loc) the controller. To enter the Operation Control Mode simply tap the SEL button one time and the PV display will read either PRG or AT (Auto-Tune) depending upon the chamber type. The arrow keys (∨∧) are utilized to

scroll from parameter to parameter and adjust parameter values. The SEL button is utilized to enter menus, select parameters, confirm a parameter, and exit a channel.

The second part of the menu system is the Main menu. To enter the controller's Main menu, press and hold the "SEL" (Select) key until Channel 1 (Ch1) appears on the upper, white PV screen. There are 13 possible channels within the PXF4's menus. Navigating from channel to channel simply requires pressing the up and down arrows on the controller's face. To enter the desired channel, press the "SEL" key when the appropriate channel is displayed. To change a setting, first press the "SEL" key and the current value displayed on the SV screen (lower green screen) will begin to flash. Using the arrow keys, the parameters can be adjusted. To confirm a parameter simply press the "SEL" key one more time. To return to the main menu of channels, hold down "SEL" until the current channel is displayed on the SV screen. To exit the menu, press the User key (smiley face).

NOTE: *Of the 13 channels within the standard PXF4 several of the channels and parameters are not utilized and have been masked to expedite the menu navigation process. It is not recommended to alter any preprogrammed parameters without first documenting the current parameter and/or adjusting any parameter not discussed within this user manual. For any parameter information not available within this product manual, please refer to the Fuji PXF4 User Manual.*

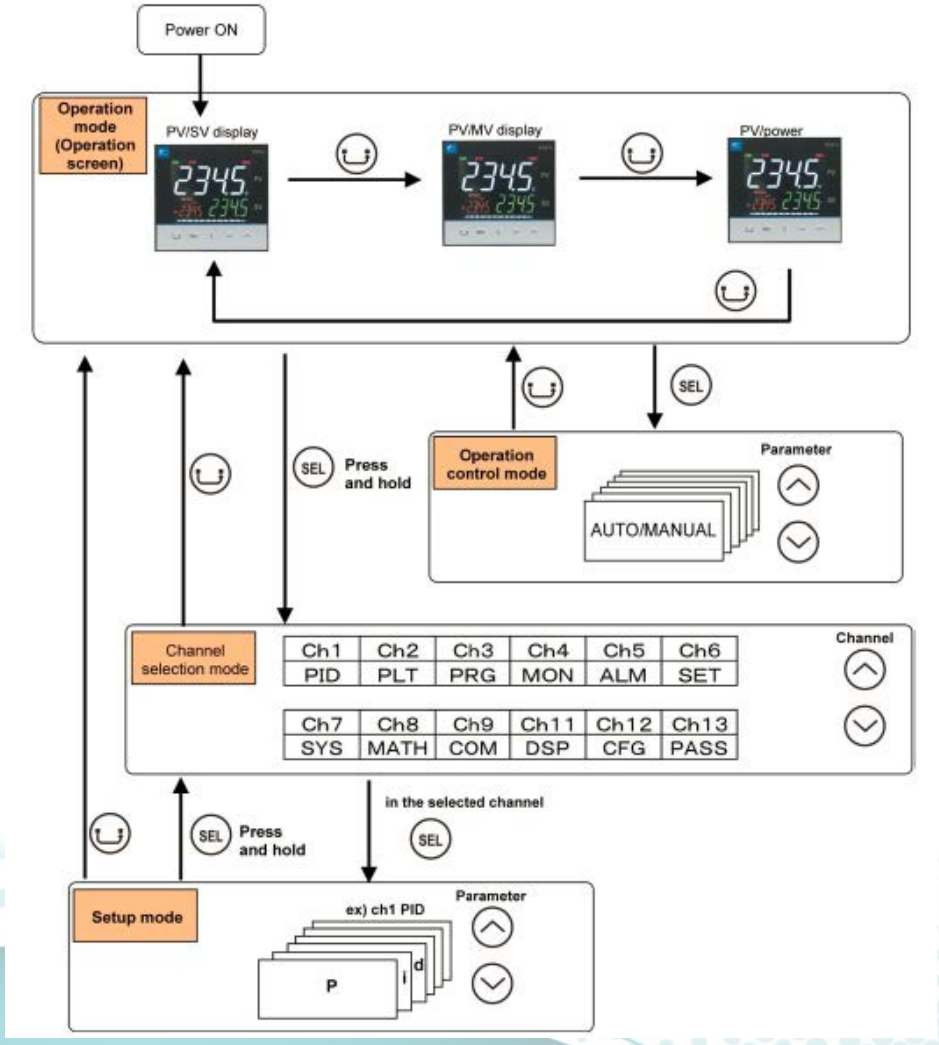


Figure 14

Auto-Tune the Controller

Auto-Tuning allows the controller to calculate the optimum level of control required to maintain the desired setting value (SV). This feature will not "fix" a chamber with a problem — it only fine-tunes an already controlling chamber. Do this if the SV or some other important variable (load, outside temperature, etc.) has changed and the control is less than desirable.

Figure 15

TECH TIP *If an Auto-Tune is required, it should be performed after the process value (PV) has stabilized at the desired set value (SV). For chambers that have two Fuji PXF4 controllers (one for temperature and one for humidity), the temperature controller must be Auto-Tuned first. Then allow the temperature to stabilize before performing an Auto-Tune on the chamber's humidity controller.*

To enter the Auto-Tune mode, press "SEL" key to enter the Operation Control Mode. Press arrow keys to scroll until (At) is displayed in the PV screen. Press "SEL" once and "off" will start to flash on the SV screen. To change the value from "off" to "on", simply press the up-arrow key. Then press "SEL" once to activate the Auto-Tune (At) mode. Once the Auto-tune mode is activated, the "on" value will stop flashing and a red indicator light (on the lower-left corner of the controller) will start flashing. This indicates the controller is now in the Auto-Tune mode. When the indicator light stops flashing, the Auto-Tune process will then be completed. To exit the menu, simply press the User Key and the default PV/SV screen will then be displayed.

NOTE: *Do not open the door(s) or make any changes while the unit is Auto-Tuning. Auto-Tuning typically will take anywhere from 5 minutes to 20 minutes—there will be a light flashing in the lower left-hand corner of the controller during this process.*

Changing Alarm Parameters

The controller has a high alarm ("AL1" heater(s), hot gas bypass, and/or lights) and a low alarm ("AL2" - cooling). For ease of use, these alarms are preset from the factory with deviation alarms that are typically triggered at ±2.0ºC (AL1=2.0°C and AL2=2.0°C are set as positive values).

NOTE: *The factory preset alarm parameters values (AL1 and AL2) may vary depending upon the chamber type and the intended operation range. Please refer to Table 9 for the standard factory preset alarm values by chamber type.*

EXAMPLE: *A temperature controller with deviation alarms set at ±2.0ºC is programmed to control at 30.0ºC. In this configuration, AL1 would be equivalent to 30.0ºC + 2.0ºC (or 32.0ºC). AL2 would equal 30.0ºC – 2.0ºC (or 28.0ºC). With these alarms if the temperature reaches 32.1ºC then AL1 will go into alarm. If the process value reaches 27.9°C, AL2 will go into alarm.*

Typical Factory Preset Alarm Values by Chamber Designed Operating Range				
Alarm PV	**4.0°C to 60.0°C**	**2.0°C to 8.0°C or 5.0°C**	**<0.0°C**	**-20.0°C to >0.0°C**
±2.0ºC				
±3.0ºC				
±5.0ºC				

Table 9

AL1 and AL2 both have a delay of 15 minutes before an alarm is triggered and the alarm audible begins to sound. This delay allows access to the chamber without the alarm going off every time the chamber deviates from the controlling set value. The delay time is set in minutes and adjustable, please refer to the following section: Adjusting the Alarm Delay Time for additional information.

Some of the wide-range chamber controllers feature an AL3 alarm. The AL3 alarm parameters are programmed to be a designated switchover point that when triggered, will automatically switch from cooling to heating control. On the temperature controller the alarm is set as an upper limit absolute lower limit deviation alarm. It is controlled through two settings, AL3L and AL3H. AL3L is preset from the factory to a value of 1.0ºC. The 1.0°C is a set range. If a chamber's process value exceeds 1.0°C below the set value, the automatic switch is triggered. When the process value comes back within 1.0°C of the set value the automatic switch is turned off. In addition, the alarm has an absolute high limit (AL3H) that triggers the automatic switch when the set value exceeds 32.0ºC.

EXAMPLE: *If a chamber that is controlling at 25.0ºC has its SV raised to 40.0ºC, AL3L will then cause the chamber to operate in "Heat Only Mode." AL3L is triggered at any PV that exceeds 1.0ºC less than the SV. AL3H will be triggered when the chamber reaches 32.0ºC or above in temperature. If the same chamber's door is opened, or the chamber is turned off, and upon startup or recovery in temperature; the chamber will be in "Heat Only Mode" as well until its PV reaches less than 1.0ºC of the set value or if the SV remains above 32.0°C.*

To change the factory preset AL3 (AL3L and AL3H) alarms, go into the Operation Control Mode and use the down arrow key to scroll through the parameters until the controller displays AL3L or AL3H. Adjust the desired setting by first pressing SEL button and then utilizing the arrow keys (1.0ºC is the factory preset) to change the parameter. Confirm the new parameter by pressing SEL one additional time.

NOTE: *Once the temperature exceeds more than the value of AL3L below the set value, or if it reaches AL3H, then the cooling portion of the chamber will shut off and go into "Heat Only Mode." For the cooling control to regain control, the temperature must fall below the AL3H setting or less than AL3L below the set value.*

Adjusting the Alarm Delay Time

To change the alarm delay time, press and hold down the SEL button for 3 seconds until Ch1 appears on the display. Press the down arrow key until Ch5 is displayed. Press SEL to enter Ch5 and then use the down arrow key to reach DLY1. When DLY1 appears press the SEL key one time (until the displayed value begins to flash). Using the up/down arrow keys, adjust the DLY1 time to 15 minutes or another desired setting.

Press the SEL key to confirm the setting. Using the same procedure, adjust the DLY2 time to the desired setting.

Figure 16

Alarm Condition

Once the high and low alarms have been set and the process value has passed the set alarm values (AL1 and AL2), and if the chamber does not come back within the alarm limits before the delay time fully elapse the unit will then enter alarm condition. When in an Alarm Condition, the Ev1 and/or Ev2 indicators on the controller will illuminate and the chamber will create an audible sound to alert the end user.

NOTE: *If the alarm condition is not cleared the chamber may not be able to come back into specification or function as designed.*

Several key indicators will signal an alarm condition. The first of these indicators will be an audible siren. If the alarm was silenced by pressing the alarm silence button on the control panel, this audible will not be present. And the most important method that can be utilized to determine the alarm condition is by looking for the Ev1 and Ev2 indicators to be illuminated on the controller(s).

NOTE: *The Ev1 and Ev2 lights indicate whether the chamber is in a high or low alarm condition. If the Ev1 light is illuminated, your chamber is in high alarm. If the Ev2 light is illuminated your chamber is in low alarm.*

To clear the alarm condition, you first must recognize whether the chamber is in high or low alarm (see above). Then press the SEL button to enter the Operation Control Mode. Once inside the Operation Control Mode menu use the up/down keys to navigate until you see either the AL1 or AL2 parameter, depending on the type of alarm the chamber is in (high or low). Once you reach the appropriate parameter, press the SEL button. This will cause the value displayed to flash. Document the current alarm value; then press the up key to increase the current value considerably. Confirm the new parameter by pressing the SEL button and the alarm will disable.

EXAMPLE: *If your chamber is in low alarm and the process value is at 15.0ºC while the set value is 30.0ºC, AL2 needs to be increased to 15.0°C or greater (30.0°C (SV) – 15.0°C (PV) = 15.0°C) to clear the alarm. If the chamber is in high alarm and hypothetically had a process value of 40.0ºC and the set value was 30.0ºC, AL1 requires an adjustment of 10.0°C or greater (40.0°C (PV) – 30.0°C (SV) = 10.0°C) to clear the alarm. Once the appropriate value has been increased, press the SEL button one last time to confirm the changes. Press the User Key to exit the menu.*

Once the chamber has returned to its normal operating range, remember to return the alarms to their original settings.

Silencing the Alarm

Figure 17

During an alarm condition, the chamber will trigger an audible warning. The warning is also indicated by the by the illumination of the Ev1 and Ev2 indicator(s) on the affected controller. In the event of an alarm, and the expiration of the alarm delay, the associated component will be disabled, and an audible alarm will sound. Located upon the controller's faceplate, the alarm silence button provides a simplified means to mute the alarm until the associated alarm has been cleared. To make use of the alarm silence, simply press the button and the audible will cease.

NOTE: *The alarm silence button only provides a means to mute/disable the audible warning. To ensure that the chamber functions as designed it is strongly recommended that once an alarm has been silenced that the alarm condition is cleared within the controller. Failure to clear the alarm may result in the chamber not returning to specification and/or damage to the chamber.*

Ramp Soak Operation

The Fuji PXF4 can control and adjust set values based upon a user specified program; this process is known as a ramp soak. Ramping refers to the changing of the set value over a given interval. Soaking is the length of time the chamber remains at set value. To setup the ramp soak operation you first must enter the setup menu. This can be accomplished by pressing and holding the SEL button for 3 seconds until Ch1 is displayed on the controller. Once Ch1 is displayed on the controller use the down arrow to scroll until the controller says Ch3, this is where the parameters needed to the setup of the ramp soak operation are located.

Figure 18

Enter Ch3 by pressing the SEL button. The first parameter within Ch3 is pattern (PTn). The pattern parameter is utilized to set which steps are utilized within the ramp soak operation. There are seven possible patterns, each that utilize a specific portion of the available ramp soak steps. Please refer to Figure 19 to select the pattern that incorporates the number of steps required to complete the desired operation. Please Note: It is possible to store and utilize more than one program by placing SV's, ramp, and soak times into steps belonging to separate patterns. In such a scenario, the program utilized would be solely dependent upon the pattern selected. For instance, pattern 0 would select steps 1 – 8 and then pattern 1 would be selected to utilize steps 9 – 15.

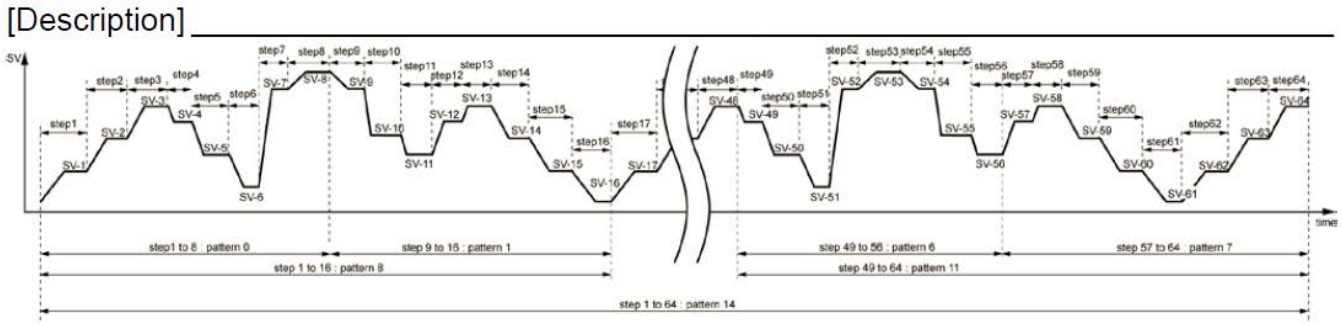


Figure 19

NOTE: *The PXF4 controller is capable of 64 segments, however many steps may be masked. If additional steps are required, please email technicalsupport@darwinchambers.com for assistance.*

Once the desired pattern has been selected, press the down arrow button to scroll until the parameter "SV-1" is visible on the top (White) screen. "SV-1" is the first desired set value. To change the SV, quickly press the SEL button to make the parameter begin to flash. Then utilize the up/down buttons to adjust the set value to the desired setting. Press the SEL button one more time to confirm the parameter (the SV will cease to flash). Once the parameter has been confirmed, press the down arrow to scroll to the next parameter.

Figure 20

The next parameter is "TM1r". "TM1r" is the ramp time for the 1st segment. When the "TM1r" has been set, scroll to the next parameter "TM1S". "TM1S" is the 1st segment soak time, or how long the chamber stays at the "SV-1" parameter prior to the 2nd segment of the program. After the 1st segment has been completed, the 2nd segment parameters will appear in the same format as the 1st parameters except for utilizing the number 2 (i.e., SV-2, TM2r, and TM2S).

Figure 21

Once the all the SV's, ramp, and soak times have been placed into the controller utilize the down arrow button to scroll to the Gsok parameter. The guaranty soak parameter ensures that the chamber soaks within set tolerance/Limits for the duration of the soak. If the chamber deviates from the set limits or fails to reach the programmed SV, then no soak time will be utilized until the chamber reaches and/or returns into the specified limits. The guaranty soak limits are determined by the GS-L and the GS-H. Preset from the factory the guaranty soak parameter is set to "On" and the limits are set at ±5.0°C.

Figure 22

Finally, scroll using the up/down button until the parameter, "Mod" is visible. Set "Mod" to a value of 0 if it is desired that the chamber maintains the last set value after the program has expired. Set "Mod" to a value of 1 if it is desired to have the program repeat continuously. If "Mod" is set to "9" the program will also continuously repeat in a manner like setting the parameter to a 1. However, by setting "Mod" to a 9, if the chamber is turned off and/or loses power and upon having power reapplied, the chamber will initiate the ramp soak cycle regardless of whether the chamber was running a program prior to the loss/removal of power.

Figure 23

To initiate the ramp soak operation, you must enter the Operation Control Mode and scroll to the “PRG” parameter. Turn this parameter to “Run” to start the operation. For additional ramp soak operation guidance please visit pages 8, 9, 15, and 16 of the Fuji Manual. ***Please NOTE:*** *At the completion of the ramp soak operation, set value adjustments cannot be made without first changing the “PRG” parameter to “Off.”*

Locking the Controller

Scroll to "LOC" in the Operation Control Mode menu. To change any settings, enter a "0." To "lock" all settings including the SV, change the parameter to a "1." To lock all settings except the SV set the parameter to a value of “2.”

Figure 24

Standby Mode

Controllers used for humidity may have the option for a standby mode. Standby mode will cease the control of humidity and dehumidifier if equipped. Audibles alarms will also be disabled in standby mode. If the need arises to have the alarms still operate in standby mode, contact technical support for guidance on reconfiguring standby mode. Note that the dehumidifier will now be enabled if using dry air or heated desiccant dryer. For dry air you will want to close off the flow meter or the air supply valve. Check with your utilities / maintenance department to see how to do this. For heated desiccant dryers simply unplug the dryer or put in manual mode.

To enable standby mode with standard settings from the main screen press USER + ^ key. For nonstandard (see User Keys) or standard setting alternatively you can press the SEL button quickly. STbY will appear on the display. Press the SEL button again quickly and oFF will begin to flash. Use the ^ key to select On. Press the SEL button again to accept the change. The controller is now in standby mode. To disable standby mode, repeat the steps. Except for select On to Off.

Controllers used for temperature will not have the option for standby mode, as this may cause the chamber to go into a fool cool mode.

User Keys

The User Key on the fuji controller may be programmed from factory for quick access. The following are options available on the Fuji controller.

Figure 25

Standard User Key

USER key

- Press this key once in PV/SV display to switch between SV display and MV display.
- Press and hold this key in PV/SV display to start the assigned function. (No function is allocated at the factory.)
- Press this key once in operation control mode, channel-selection mode, or setup mode to return to PV/SV display.

USER + ^ key

- Press and hold this key in PV/SV display to start the assigned function of switching between RUN and standby.

USER + v key

- Press and hold this key in PV/SV display to start the assigned function of switching between start/stop of auto-tuning.)

Figure 26

Program select user key

On some chambers the ramp soak option can be quickly changed programs from 0-14 and start, hold, and turn off a program using the User Keys.

Operating procedure

Press and hold this key in PV/SV display to start the assigned function of Ramp soak pattern +1. *(Up to 15 ramp soak programs could be configured)* The display will flash new available program. Release and hold button again to increment to next program.

Ptn	Steps	Ptn	Steps
0	Steps 1 to 8	8	Steps 1 to 16
1	Steps 9 to 16	9	Steps 17 to 32
2	Steps 17 to 24	10	Steps 33 to 48
3	Steps 25 to 32	11	Steps 49 to 64
4	Steps 33 to 40	12	Steps 1 to 32
5	Steps 41 to 48	13	Steps 33 to 64
6	Steps 49 to 56	14	Steps 1 to 64
7	Steps 57 to 64		

Table 10

USER + ^ key

Press and hold the USER + ^ key in PV/SV display to start the assigned function of ramp soak Run / Off (starts or ends program.)

USER + ∨ key

• Press and hold the USER + ∨ key in PV/SV display to start the assigned function of Ramp soak Run / Hold (pauses the ramp or soak)

Timer Alarm Function

EV3 on some chambers is used as a countdown timer. This is to give a notification that the set time has expired. This is useful for when decontaminating product in the chamber or the chamber. This only sounds a horn and does not disable any components. See alarm delays in "Adjusting the Alarm Delay Time" to set the time interval for delay 3.

Figure 27

Press and hold the user key in PV/SV display to start the assigned function of Timer EV3. The SV value will blink once when activated. When the time has expired alarm will sound. The EV3 light will also illuminate. Hold the User Key again till SV display blinks and the alarm will silence and reset the timer.

Note: *The Silence alarm button will not work to silence the timer alarm. This is so that if chamber alarms when not running timer, the chamber can make an audible sound.*

The remaining time on timer 3 can be viewed in Channel 4.

Operating procedure

1. Check that the PV/SV display is shown.
2. Press and hold the SEL key to display CH1 (PID parameters).
3. Use the ᵛ key to access CH4 (Monitor parameters).
4. Press the SEL key to enter CH4 (Monitor parameters). tM3 is displayed.
5.The remaining time on the timer 3 is displayed.
6. Press the user key to return to the PV/SV display.

Controller Parameter Settings

The factory preset controller parameter values should be included with the owner's documentation. If this information is missing, or if it has been lost or misplaced, please contact Darwin Chambers Company at 877-783-6774, you can also send an email to technicalsupport@darwinchambers.com.

Virtual Touch Screen (VTS)

The Virtual Touch Screen is a way to interface with the fuji controllers remotely. This includes being able to control somewhere else in the laboratory or somewhere else in the world with internet connection. Use of the fuji controllers stays the same. However, with the VTS the user may interact with chamber using their smart phone, tablet or on a PC/Laptop. This allows for capacitive touchscreen that feel more familiar than the other touchscreens in the manual. As your using a familiar device to interface with the system. The ergonomics is setup to use with a smart device in portrait mode to allow thumb control/operation while being able to view most of the screen.

cMT-SVR Startup Guide

Figure 28

Specification

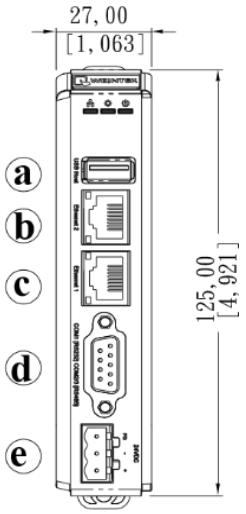
Features Supports Display on cMT Viewer Clients Compact Design and DIN-rail Mountable Fan-less Cooling System Built-in 256 MB Flash Memory SD Card Slot for Expansion of Storage One USB Host Port One Gigabit Ethernet Port Supports E-mail Suports MPI 187.5K Built-in Power Isolator Built-in EasyAccess 2.0 License (cMT-SVR-102/202) Wi-Fi compatible with 802.11 b/g/n (cMT-SVR- 200/202) Wide input voltage range:10.5~28VDC (cMT-SVR-200/202)			
		cMT-SVR-100/102	cMT-SVR-200/202
Memory	Flash	256 MB	256 MB
	RAM	256 MB	256 MB
Processor		32-bit RISC 600MHz	32-bit RISC 600MHz
I/O Port	SD Card Slot	SD/SDHC	SD/SDHC
	USB Host	USB 2.0 x 1	USB 2.0 x 1
	USB Client	N/A	N/A
	Ethernet	10/100/1000 Base-T x 2	10/100/1000 Base-T x 1
	Wi-Fi	N/A	IEEE 802.11 b/g/n 802.11b: max 18.01 dBm 802.11g: max 11.02 dBm 802.11n: max 12.20 dBm
	COM Port	COM1: RS-232	COM1: RS-232
		COM2: RS-485 2W/4W	COM2: RS-485 2W/4W
		COM3: RS-485 2W	COM3: RS-485 2W
RTC		Built-in	Built-in
Power	Input Power	24±20%VDC	10.5~28VDC
	Power Isolation	Built-in	Built-in
	Power Consumption	230mA@24VDC	1000mA@12VDC ; 450mA@24VDC
	Voltage Resistance	500VAC (1 Minute)	500VAC (1 Minute)
	Isolation Resistance	Exceed 50MΩ at 500VDC	Exceed 50MΩ at 500VDC
	Vibration Endurance	10 to 25Hz (X, Y, Z direction 2G 30 minutes)	10 to 25Hz (X, Y, Z direction 2G 30 minutes)
Specification	PCB Coating	Yes	Yes
	Enclosure	Plastic	Plastic
	Dimensions WxHxD	27 x 130 x 115 mm	27 x 130 x 115 mm
	Weight	Approx. 0.18 kg	Approx. 0.18 kg
	Mount	35 mm DIN rail mounting	35 mm DIN rail mounting
Environment	Protection Structure	IP20	IP20
	Storage Temperature	-20° ~ 70°C (-4° ~ 158°F)	-20° ~ 70°C (-4° ~ 158°F)
	Operating Temperature	-20° ~ 55°C (-4° ~ 131°F)	-10° ~ 55°C (14° ~ 131°F)
	Relative Humidity	10% ~ 90% (non-condensing)	10% ~ 90% (non-condensing)

Table 11

Dimensions

cMT-SVR-100/102

Front View



Side View

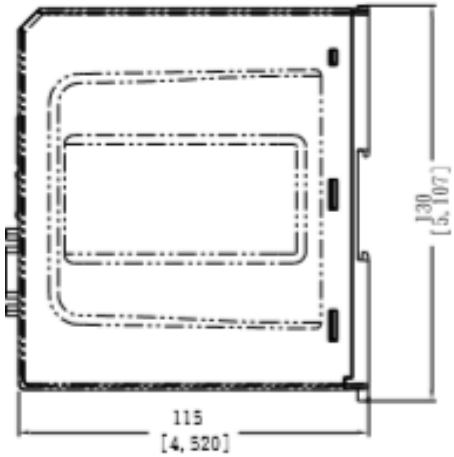


Figure 29

Top View

Bottom View

Figure 30

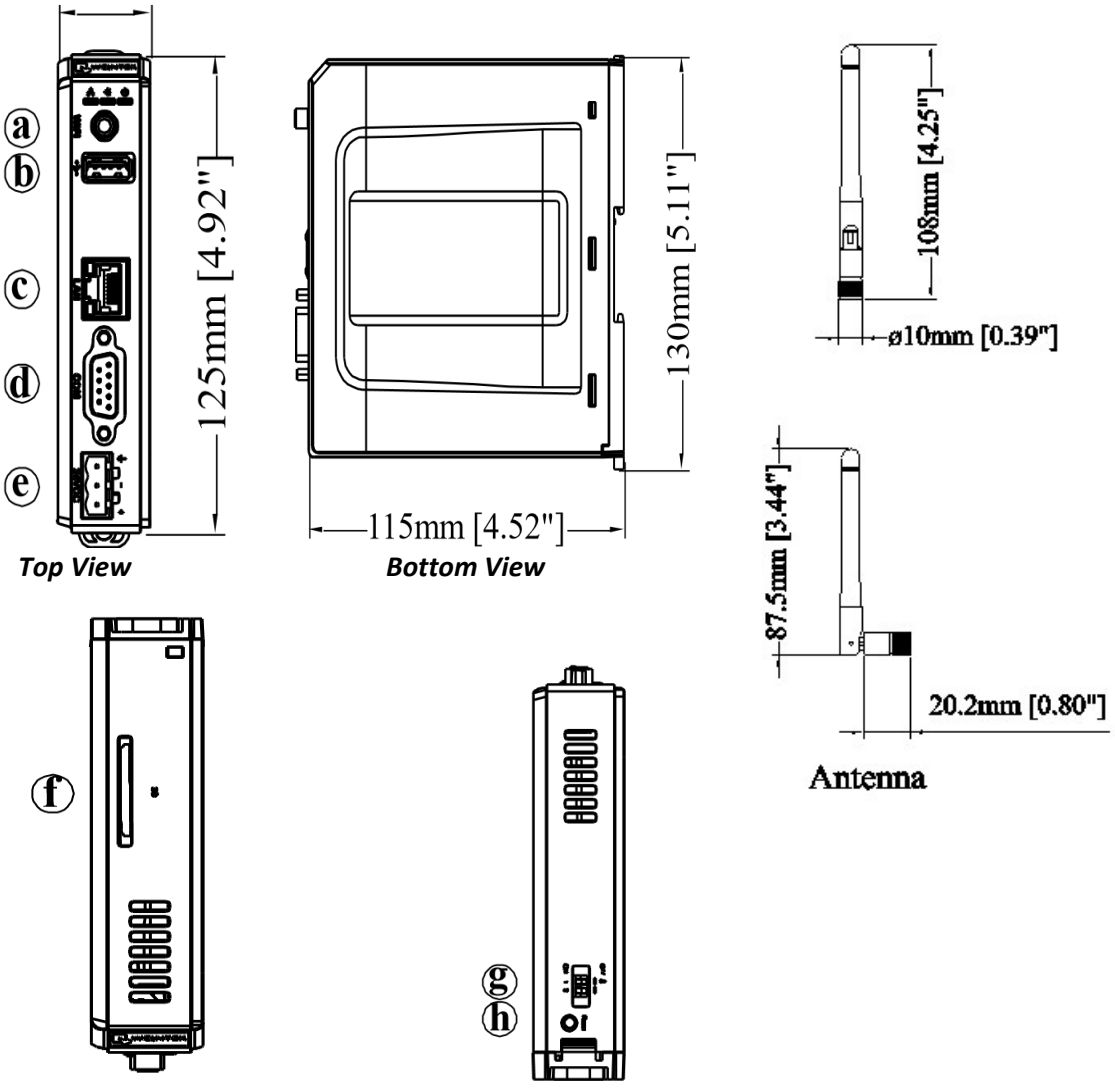
a	USB Host Port	e	Power Connector
b	Ethernet 2 Port	f	SD Card Slot
c	Ethernet 1 Port	g	DIP Switch
d	COM1 RS-232, COM2 RS-485 2W/4W, COM3 RS-485 2W	h	Reset Button

Table 12

cMTSVR-200/202

27mm [1.06"]

Front View Side View



Top View *Bottom View*

a	Wi-Fi	e	Power Connector
b	USB Host Port	f	SD Card Slot
c	Ethernet Port	g	DIP Switch
d	COM1 RS-232, COM2 RS-485 2W/4W, COM3 RS-485 2W	h	Reset Button

Table 13

Connector pin designations

PIN#	COM1 RS-232	COM2 RS-485		COM3 RS-485
		2W	4W	
1				Data+
2	RxD			
3	TxD			
4				Data-
5	Ground			
6		Data+	RX+	
7		Data-	RX-	
8			TX+	
9			TX-	

Table 14

USB host port and SD card slot

USB 2.0 full speed host interface supports USB drive. While using external hard drive, use external power supply. Do not use USB port to charge external device. The SD card is used as an expansion of storage 32GB.

Ethernet port

The unit has one/two 10/100/1000M Gigabit Ethernet ports.

The LED indicators on the Ethernet port indicate:

Orange LED: LAN link status

Green LED: Active communication status

DIP switch

Each unit is equipped with a reset button and a set of DIP switches. When using the DIP switches to change modes, the corresponding functions will be triggered.

When SW1 is turned ON position and chamber is turned on again, the IP setting is restored to default:

cMT-SVR-100/102

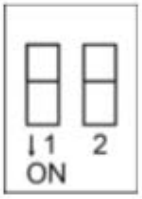
Ethernet 1: DHCP

Ethernet 2: 192.168.100.1

cMT-SVR-200/202

Ethernet 1: DHCP

Wi-Fi: DHCP



SW1	SW2	Mode
OFF	OFF	Normal mode
ON	OFF	Restore Ethernet IP settings
OFF	**ON**	Boot loader mode
ON	**ON**	Restore factory default

Figure 31

Note: *Reboot cMT-SVR after adjusting DIP switches to start the corresponding mode. When restore factory default, the project file and history data stored in the unit are all cleared.*

LED indicator

LED indicators show the operation status of cMT-SVR.

Power (Orange)	Indicates power status.
CPU (Green)	Indicates CPU status.
Communication (Blue)	Indicates communication status. It flashes during communication and may stay on when communication is good.

Table 15

Lithium battery

A cMT-SVR Series HMI requires a CR1225/CR1220 coin type lithium battery to keep the RTC running. Due to the difference in manufacturing time, the battery type can either be CR1225 or CR1220 3V lithium battery. To change the battery, please choose the type depending on the model you use.

Power connection

Power: The unit can be powered by DC power only, cMT-SVR-100/102 voltage range: 24±20% Volts DC, cMT-SVR-200/202 voltage range: 10.5~28 Volts DC, compatible with most controller DC systems.

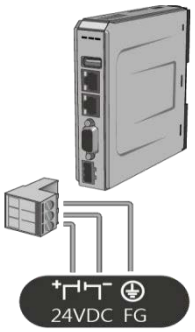


Figure 32

Note: *Connect positive DC line to the '+' terminal and the DC ground to the '-' terminal.*

System Setting

Connect cMT-SVR via Ethernet cable or Wi-Fi and configure system settings using the following two ways.

Set in internet browser

Open internet browser (IE, Chrome, or Firefox), and enter cMT-SVR IP address (for example:

192.168.1.15/web_ihmi) to configure cMT-SVR.

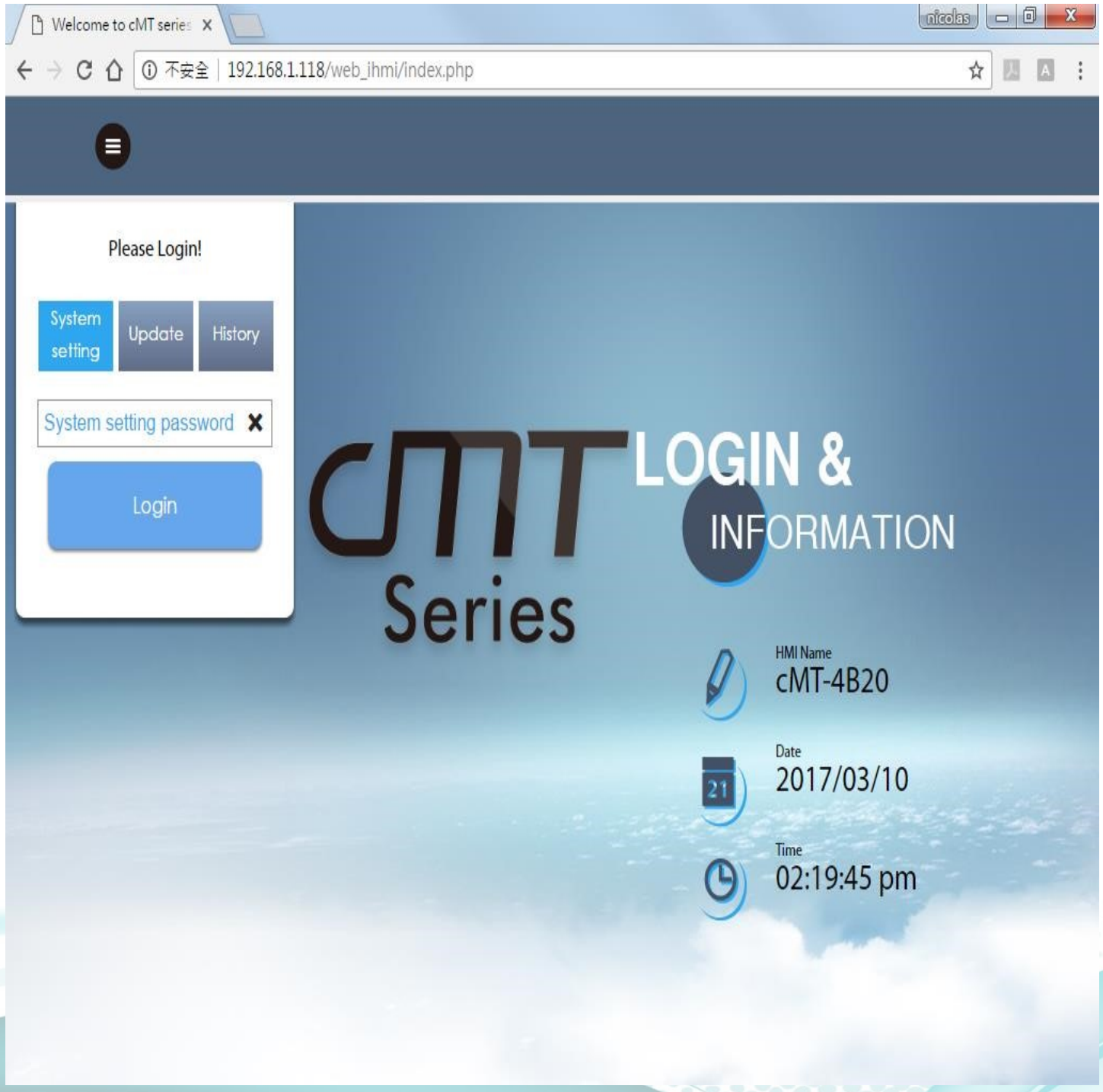


Figure 33

Install cMT Viewer on PC or via App or Play store devices

cMT Viewer application for PC will be available on the flash drive sent with the chamber. When using a smart device can be downloaded via the App store for Apple devices (https://apps.apple.com/us/app/cmt-viewer/id553431850)and the Play store for Android devices (https://play.google.com/store/apps/details?id=com.weintek&hl=en_US). Search for cMT viewer.

Apple Devices

Android Devices

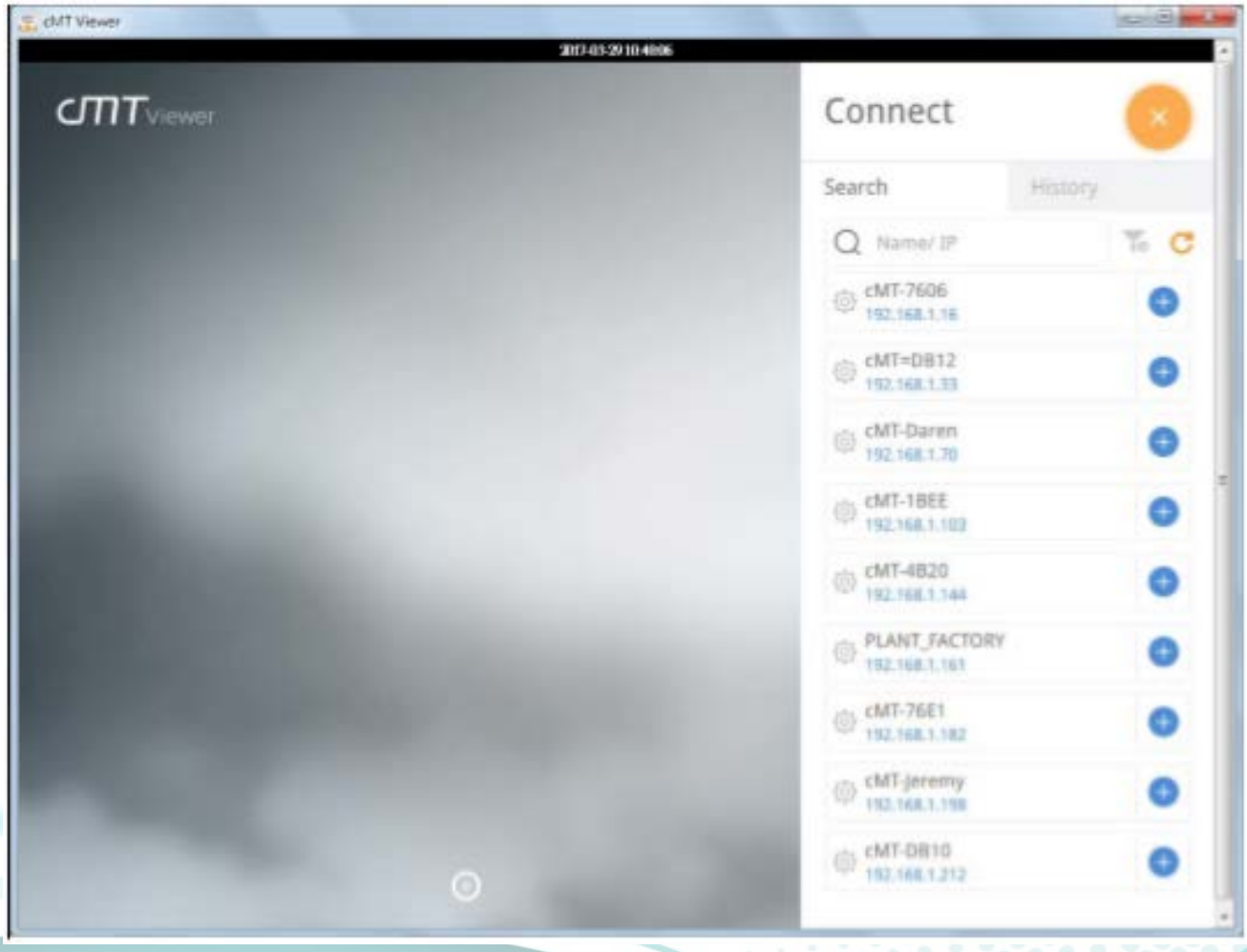


Figure 34

Note: *For the initial setup we recommend using a PC and connecting both devices via the LAN port.*

Once installed launch cMT Viewer App, tap Search, select the cMT-SVR and tap  icon to configure.

cMT SVR System Setting

Information

The following part introduces cMT-SVR system information.

Figure 35

Icon	Description
	Displays HMI name.
	Displays current date.
	Displays current time.

Table 16

System Setting

The following part introduces cMT-SVR system setting.

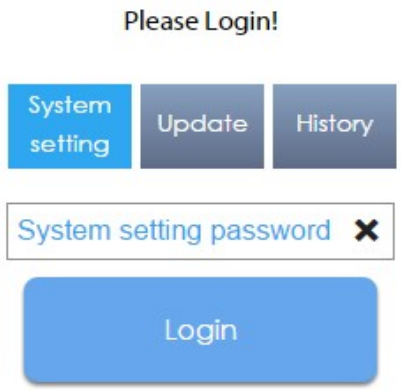


Figure 36

There are two modes, [System setting] and [Update]. [System Setting] controls all the settings while [Update] controls limited items. For safety, specify password for configuration. Enter password to log in and then select [History] to back up history data. The password from Initial setup is 111111.

Network

Set the IP address of Ethernet port. cMT-SVR-100/102 has two Ethernet ports while cMT-SVR-200/202 only has one.

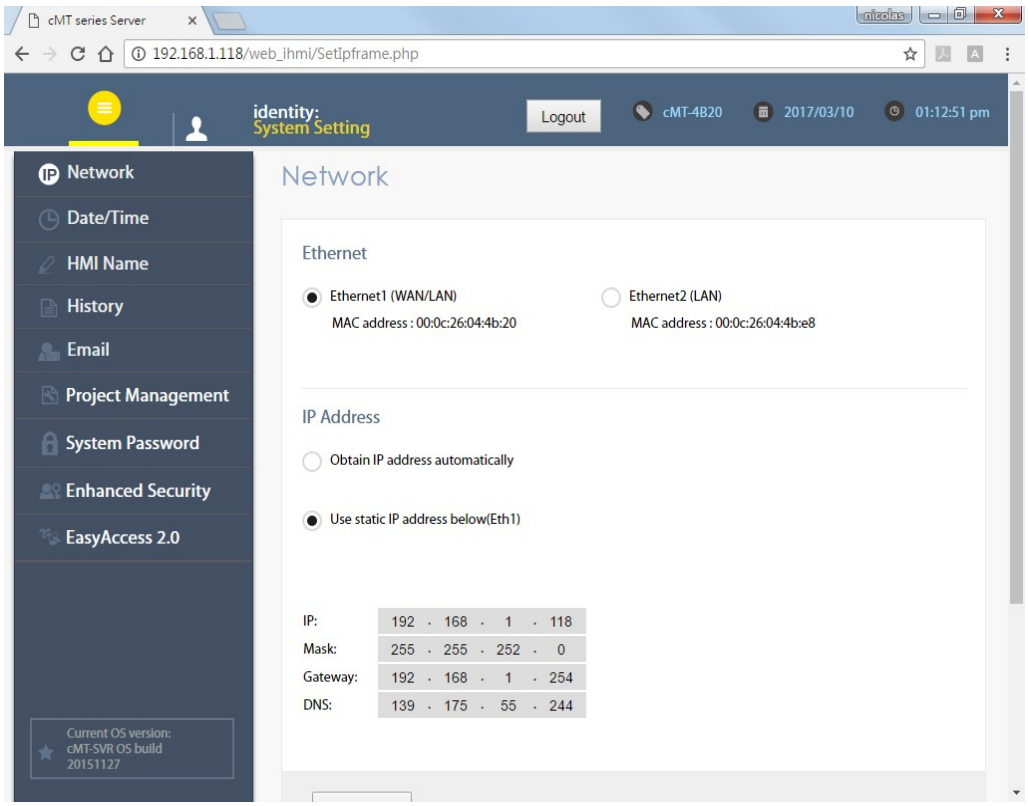


Figure 37

Wi-Fi cMT-SVR-200/202 can be connected via Wi-Fi. The settings page is shown below.

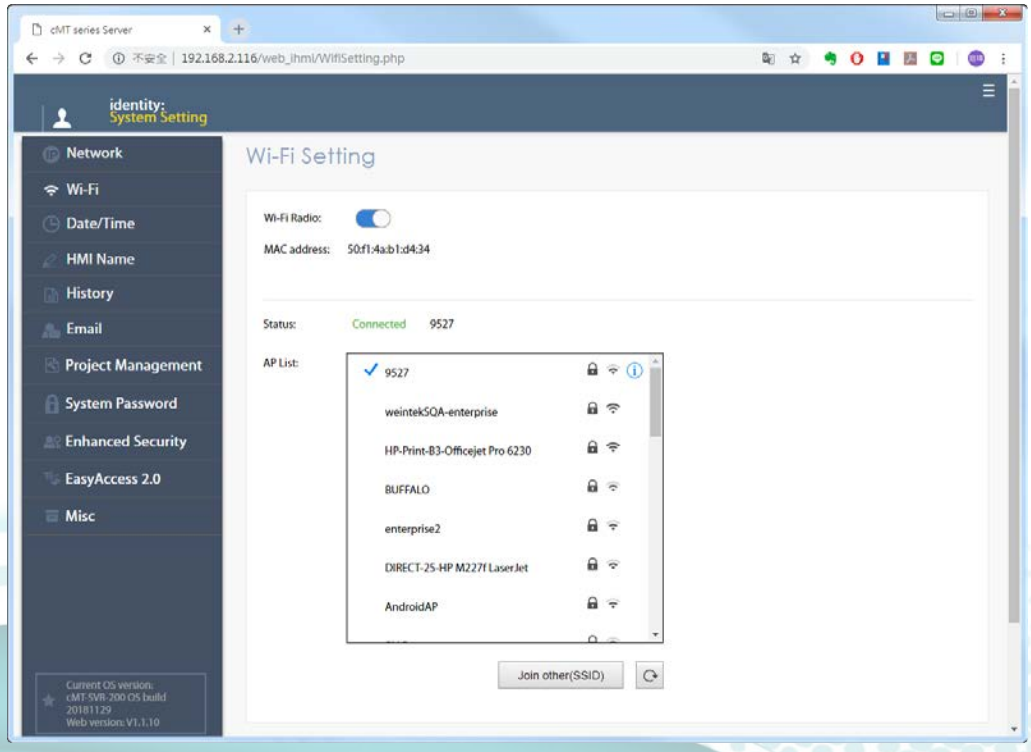


Figure 38

Wi-Fi Hotspot

Using Wi-Fi hotspot on cMT-SVR-200/202 is possible.

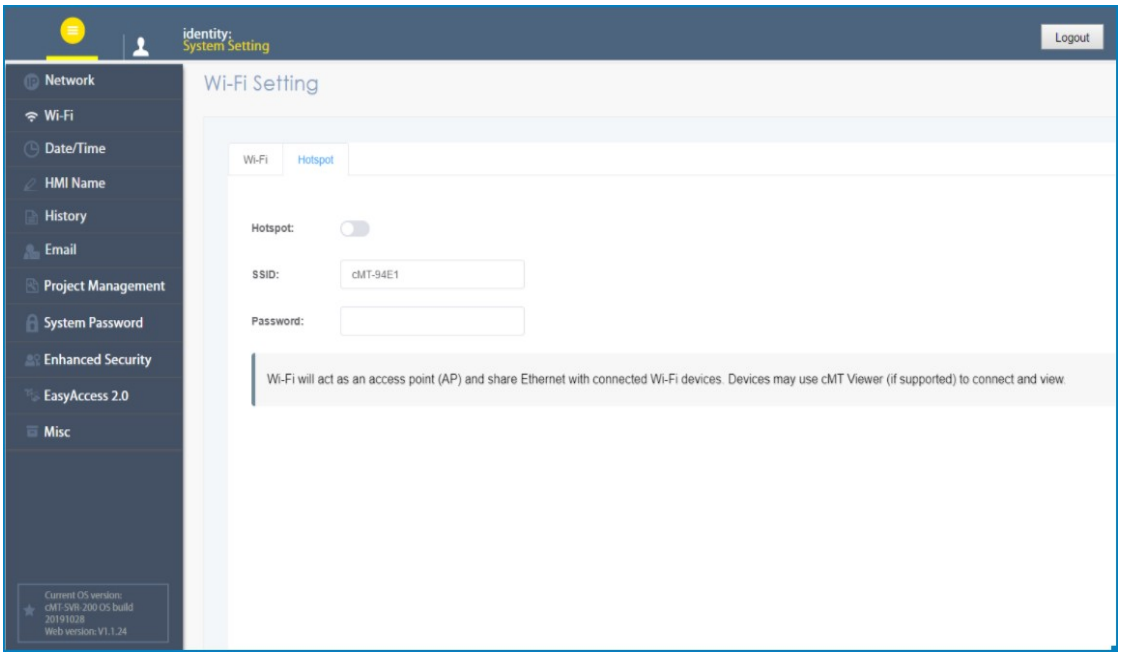


Figure 39

After setting hotspot, computers and portable devices that support Wi-Fi can connect with cMT-SVR-200/202 to wirelessly edit the project, download files, or monitor using cMT Viewer.

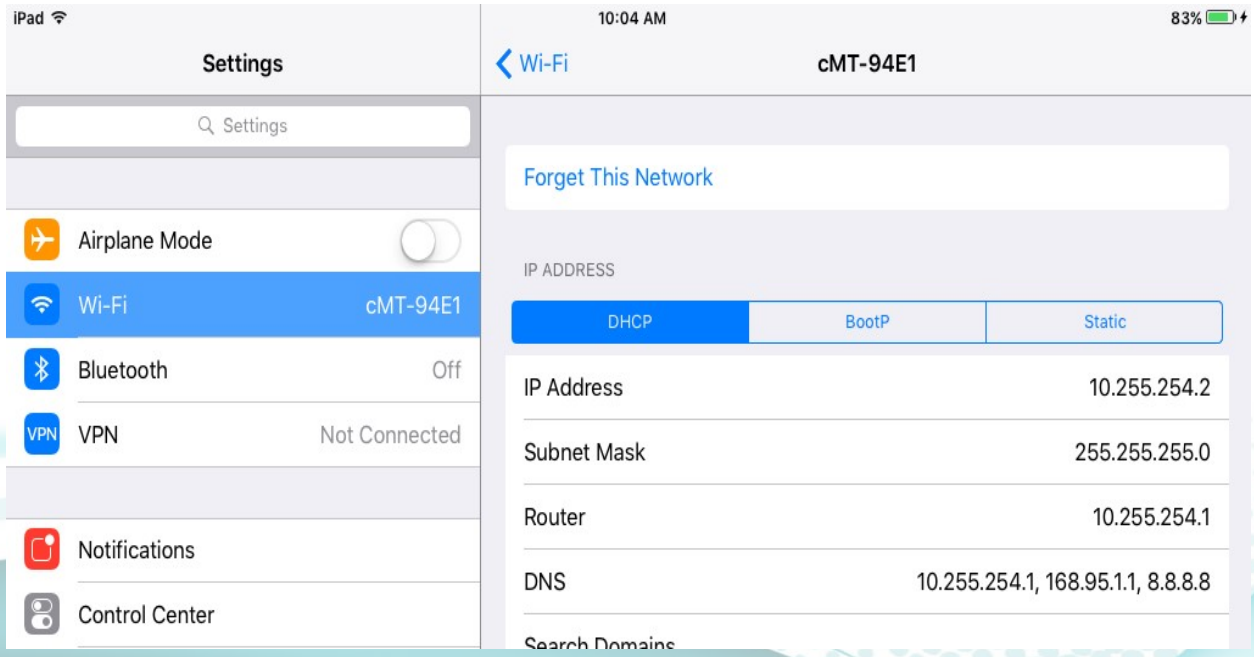


Figure 40

Date/Time

Set time or select [Sync with host.] to synchronize cMT-SVR time with PC time. Daylight saving is enabled to occur March second Sunday at 2AM and end November first Sunday at 3am.

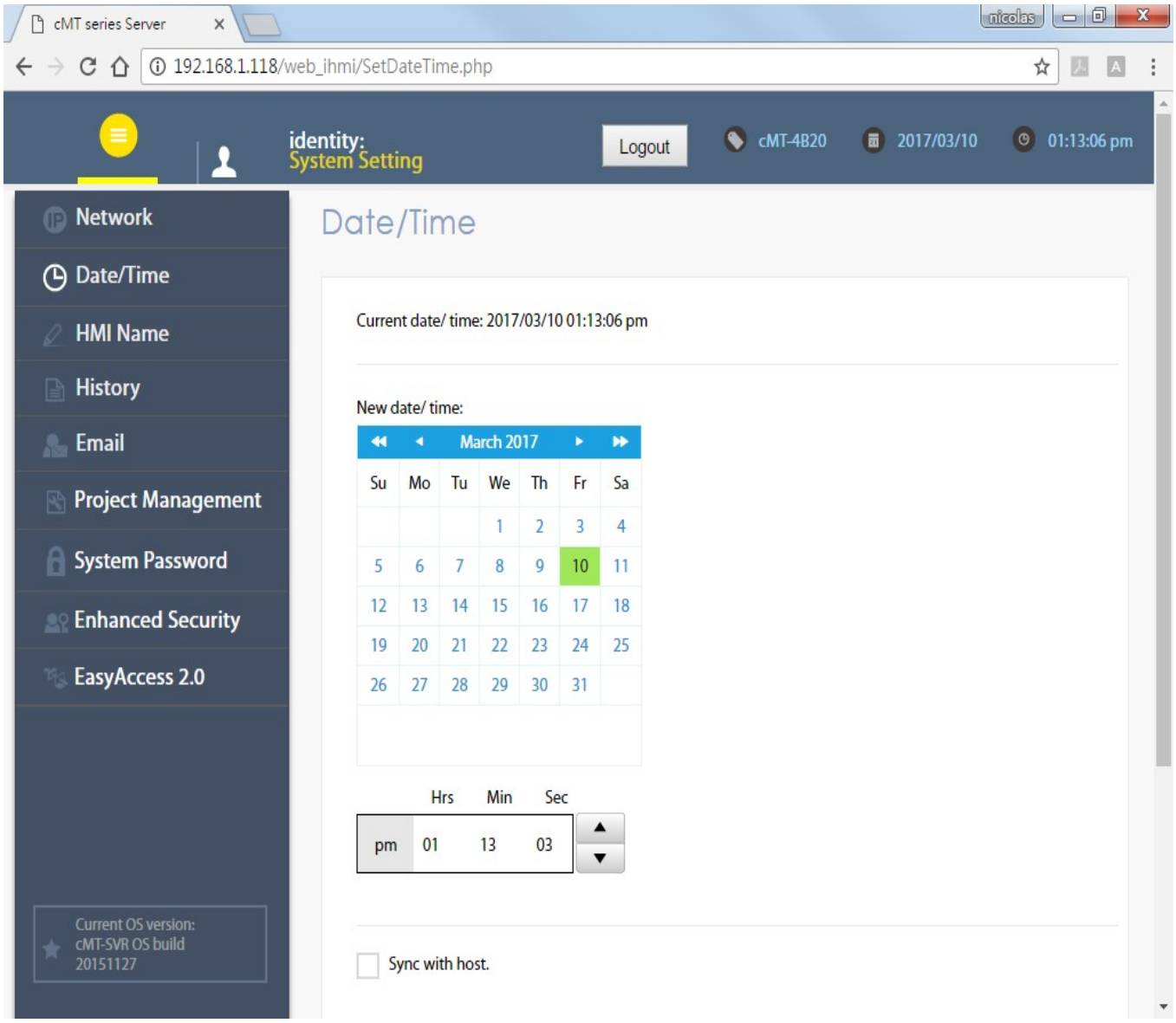


Figure 41

HMI Name

Enter a cMT-SVR name to identify the unit. This saves the trouble of remembering the IP address of each unit. The HMI name will also be used in the email from name for the email account address. Click [Identification light] button to turn on the CPU light of the unit. The light flashes 3 times to aid in finding the unit.

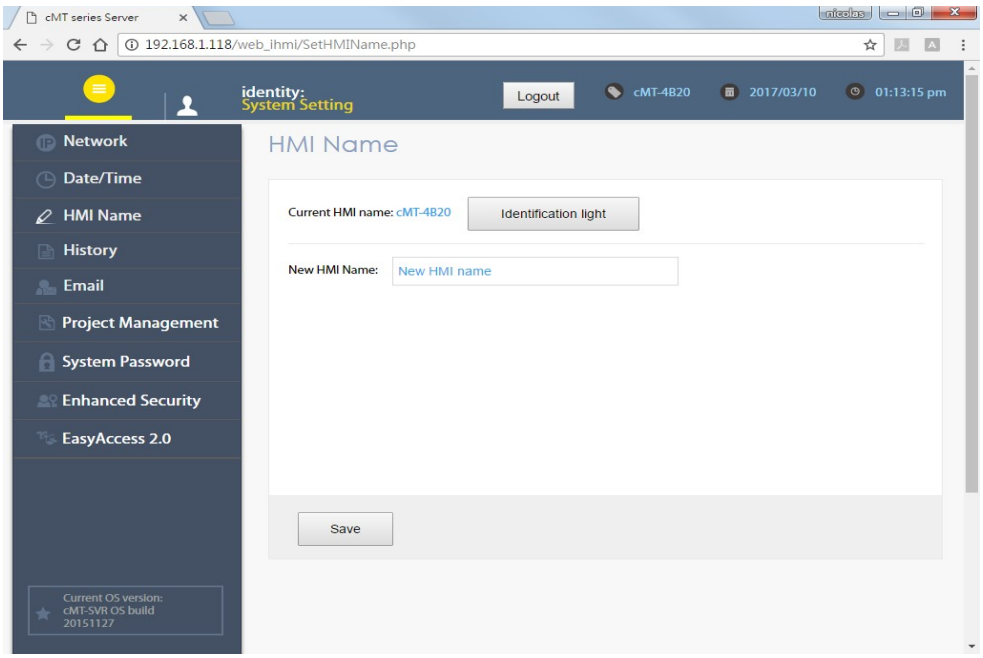


Figure 42

History

Clear or backup history data in cMT-SVR.

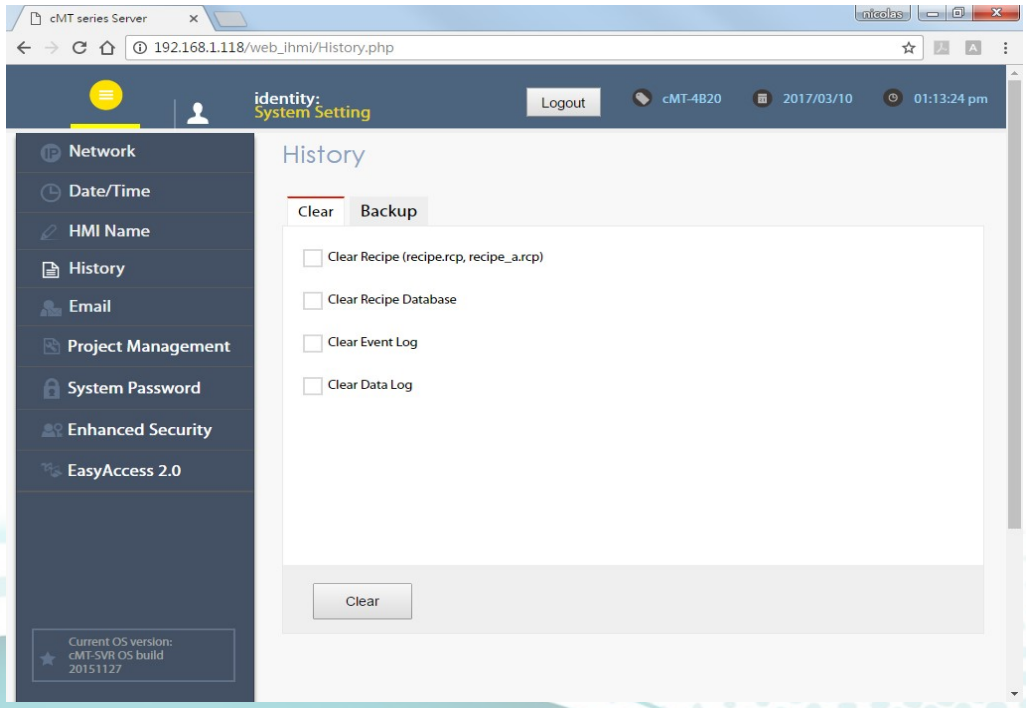


Figure 43

Email

Set the mail address and contact group. The email settings that come with the chamber are for testing only with a known good email account. Please see your email administrator to setup correct email credentials for your email accounts. Darwin reserves the right to update these credentials without notification to any end user using this account.

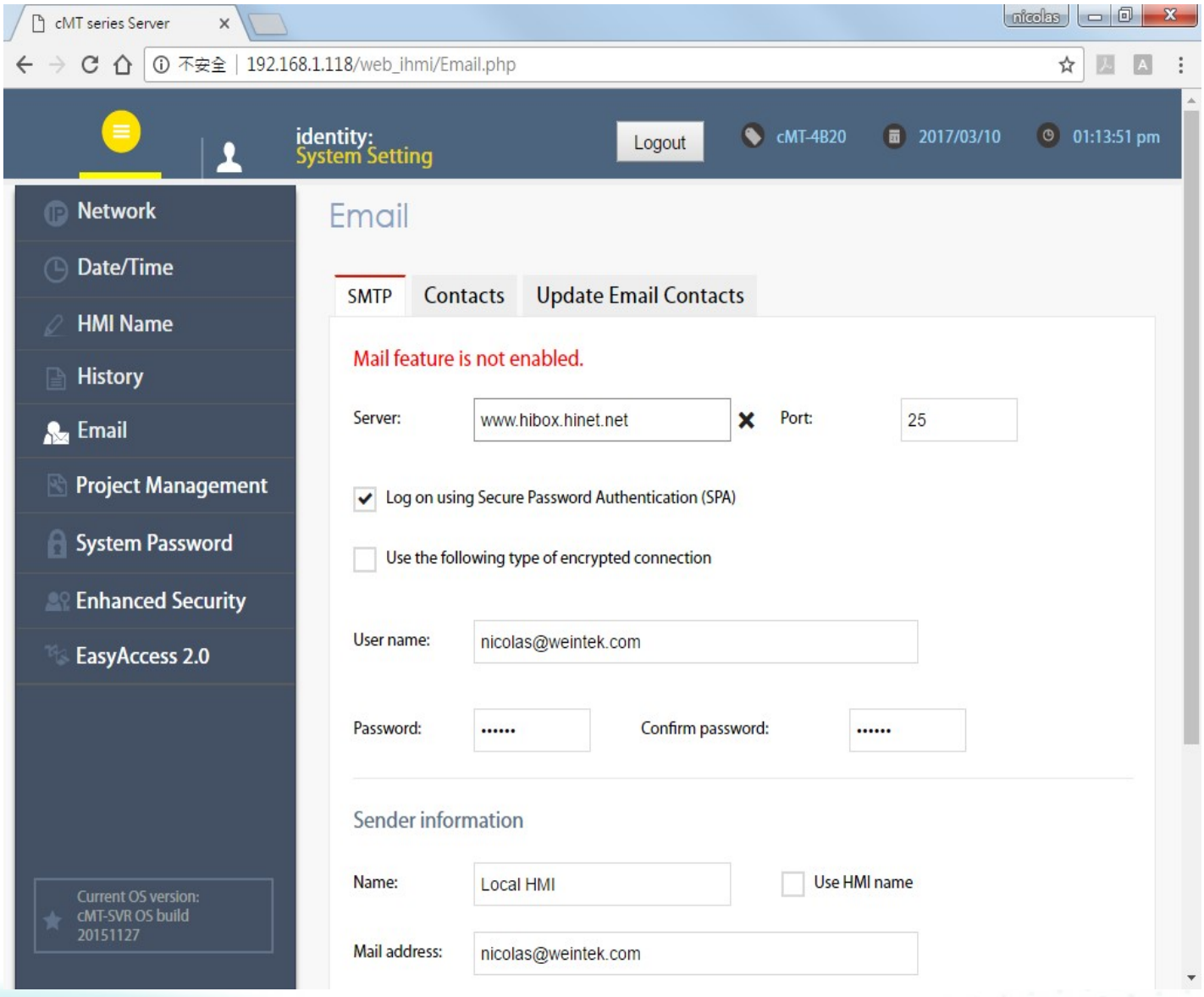


Figure 44

Restart, update, or backup project file. Can be used to restore factory default program saved on the SD card under default folder. Contact technical support before attempting.

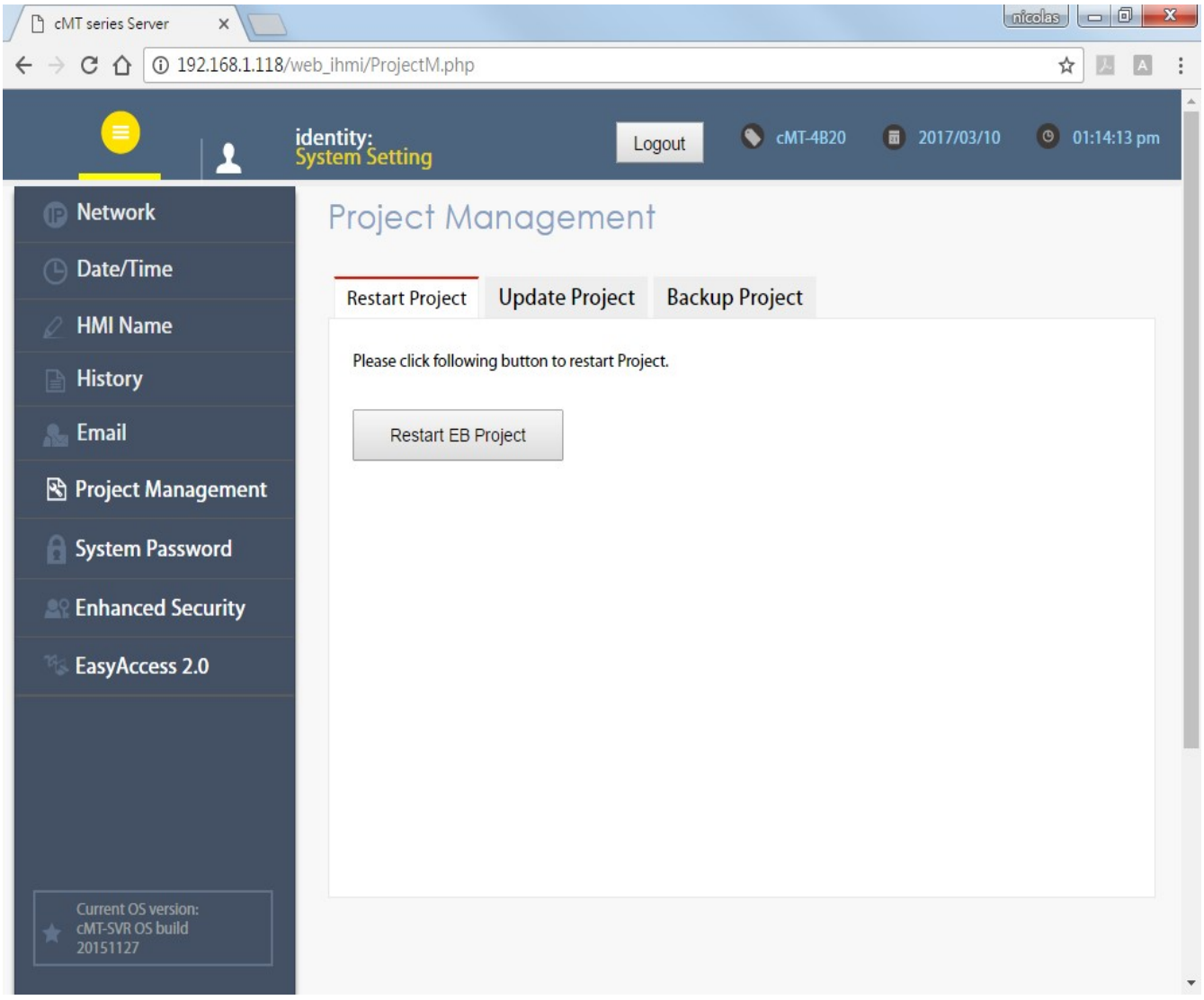


Figure 45

System Password

Set the password for System Settings login, and the password for transferring project file and history data.

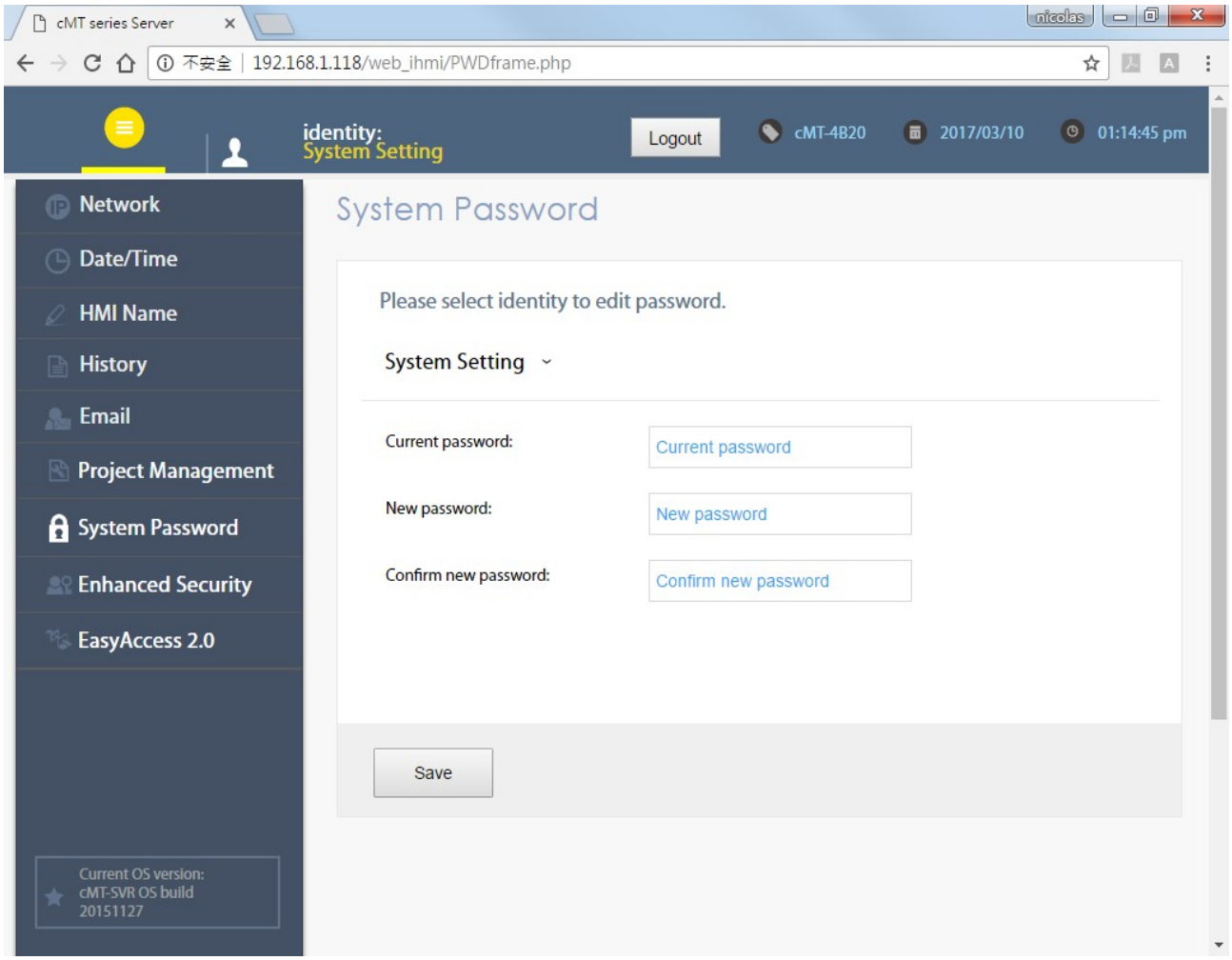


Figure 46

Enhanced Security

Set the privilege and password of the account on the HMI. This is for user who will regularly login to the chamber. Users can also be setup on the security section on the chamber screens. Default / example accounts listed below.

Username	Password	Class
user1	1	A
user2	2	AB
Maintenance	3	C
Supervisor	4	ABCD

Table 17

Note: *When entering any data in a text box, press enter to accept the new data. Using touch or mousing over to another text box will result in error.*

Class	Description
Class A	Download Data
Class B	Change settings
Class C	Maintenance – calibration adjustments
Class D	Create and assign users. Setup email and network settings

Table 18

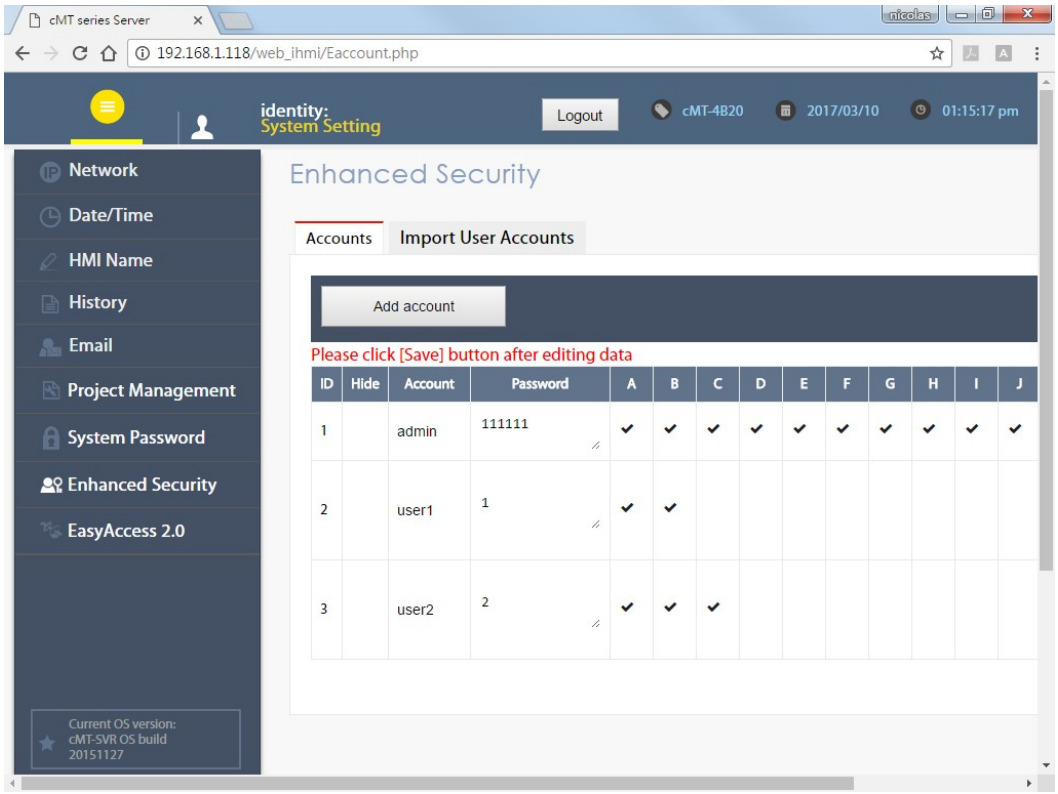


Figure 47

EasyAccess 2.0

Activate EasyAccess 2.0 and configure proxy settings. Easy Access is a VPN connection to the HMI over the internet. Using EasyAccess 2.0 on PC or other internet accessible device with EasyAccess 2.0 installed, will allow access to the chamber anywhere you have internet access. A free EasyAccess account is required. https://account.ihmi.net/domain/index.php

See Getting Started with Easy Access 2.0 for setup with PC and smart devices.

https://support.ihmi.net/ea20/getting-started

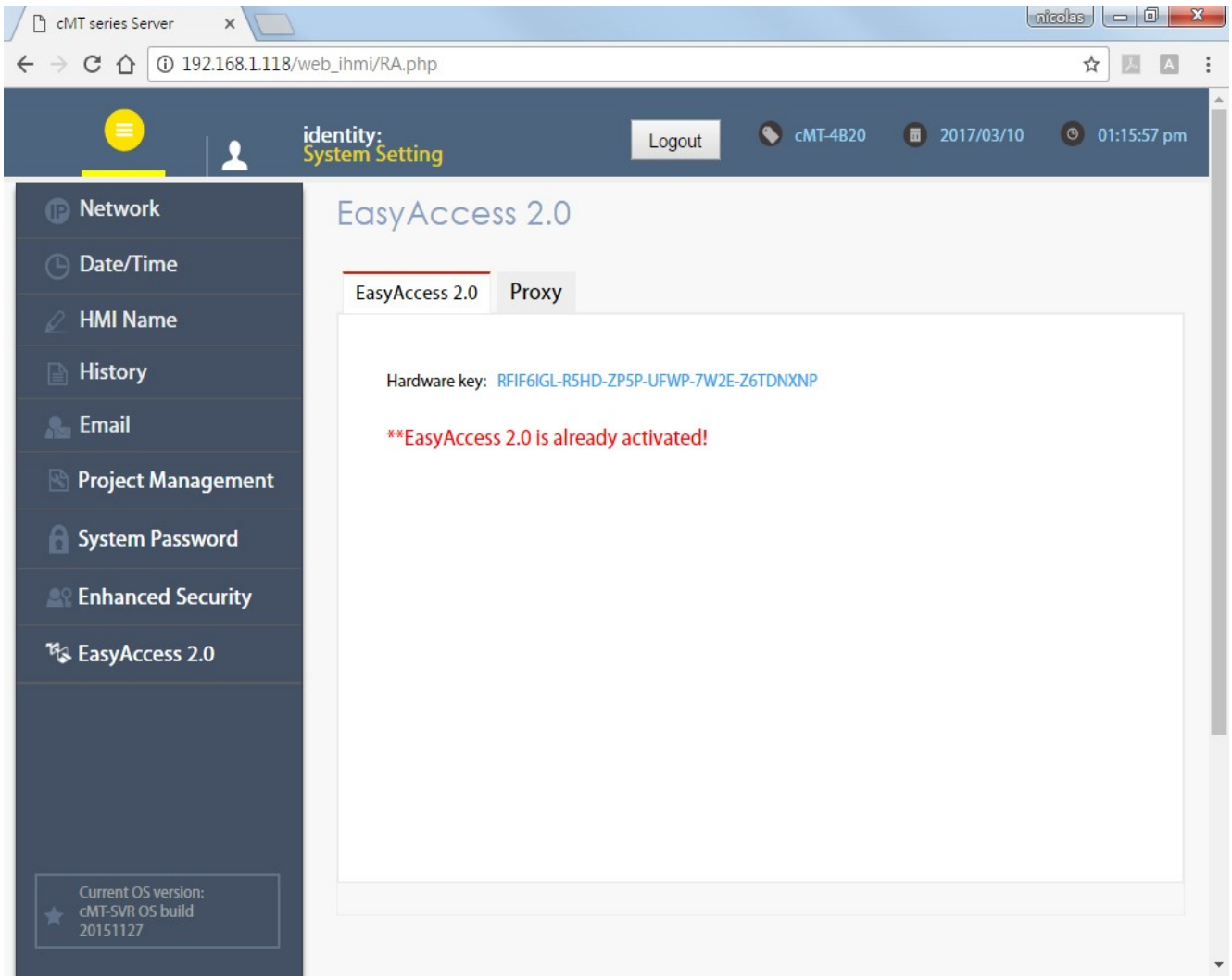


Figure 48

Misc (Miscellaneous)

Miscellaneous settings. FTP client can modify USB/SD data, should be unchecked for CFR 21 part 11. The data is in encrypted format. But this insures the data stays with the chamber.

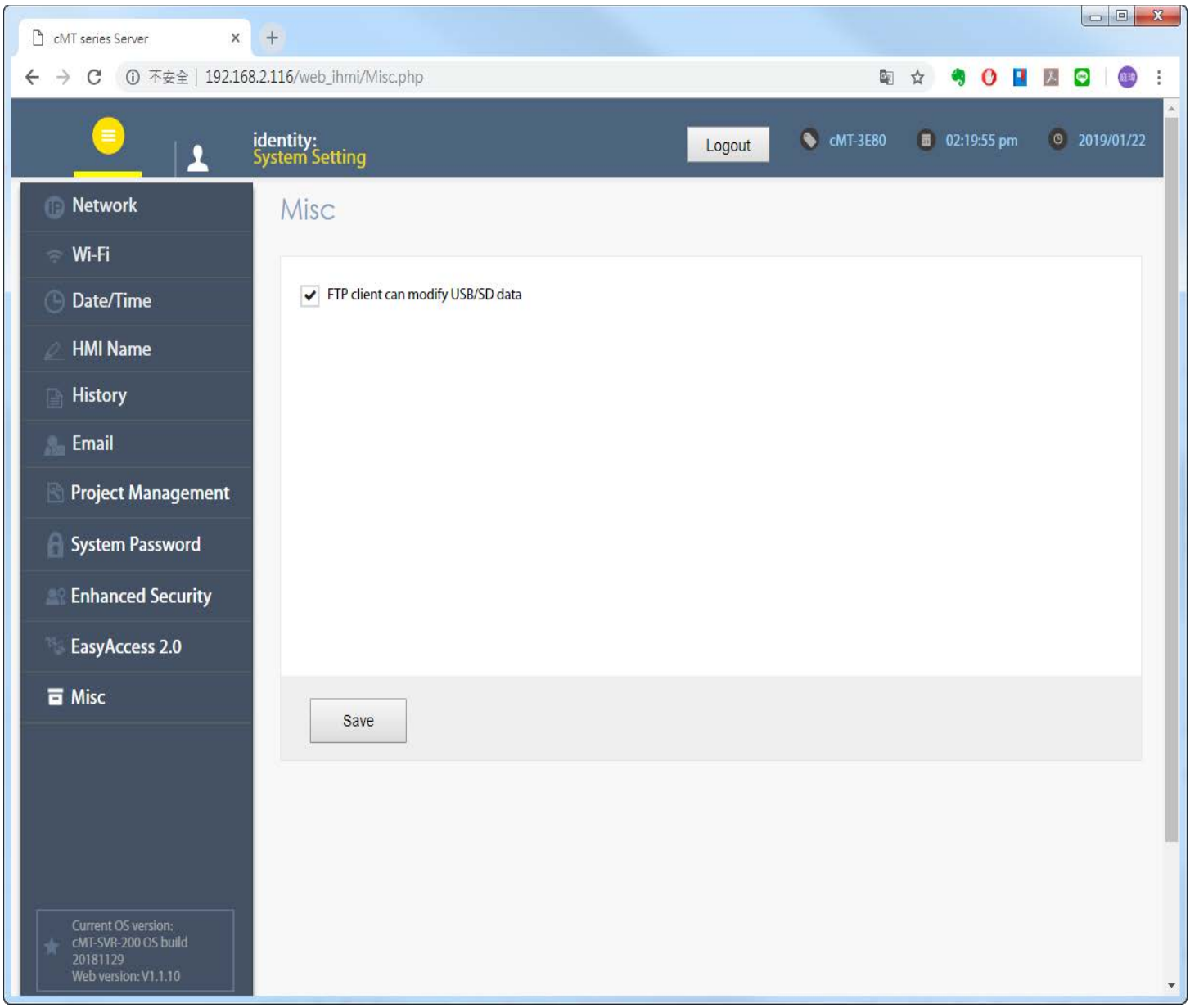


Figure 49

cMT Viewer App

cMT Viewer can connect and control cMT Series HMI models. The devices that support cMT Viewer are: cMT-iV5 (Built-in), iPad/iPhone (Download from iOS® APP Store), Android™ (Download from Google Play), Windows®.

Please note that:

1. Each cMT Viewer device can simultaneously connect with 4 cMT Series models.
2. Each cMT Viewer device can simultaneously monitor 50 cMT Series models (under Monitor Mode).
3. Each cMT Series model can simultaneously connect with 3 cMT Viewer devices.

4.1 Introduction of icons

Icon	Description
	Tap this icon to run cMT Viewer App.
	Tap the Start Button when running the project to return to cMT Viewer home screen.
	Tap this icon to configure cMT Viewer.
	Tap this icon to change screen layout in Monitor Mode.
	Tap this icon to search for all cMT Series HMIs on the same network.

Table 19

How to load project file to cMT Viewer

Step 1. Launch cMT Viewer App and tap the + button as shown below.

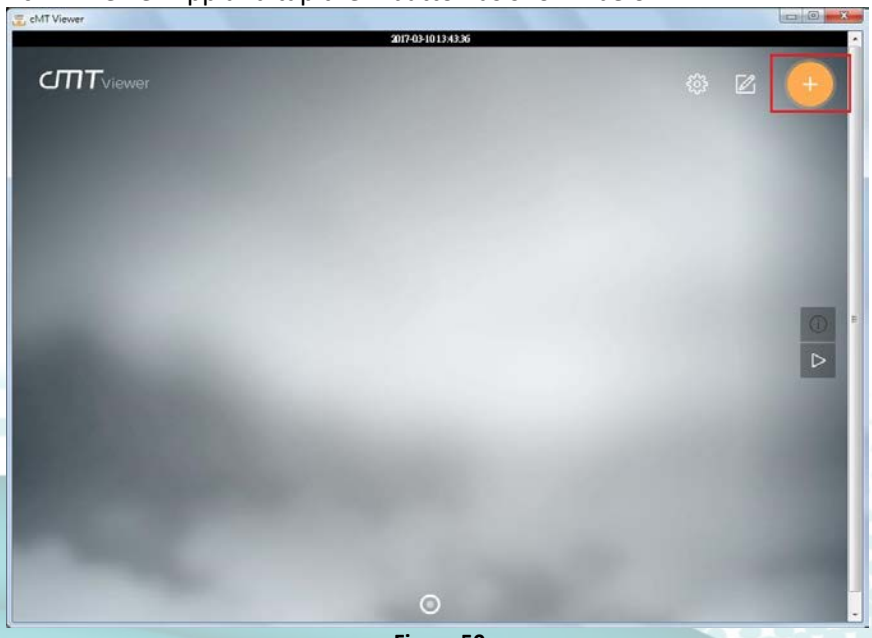


Figure 50

Step 2. Search for all the cMT Series HMI on the same network.

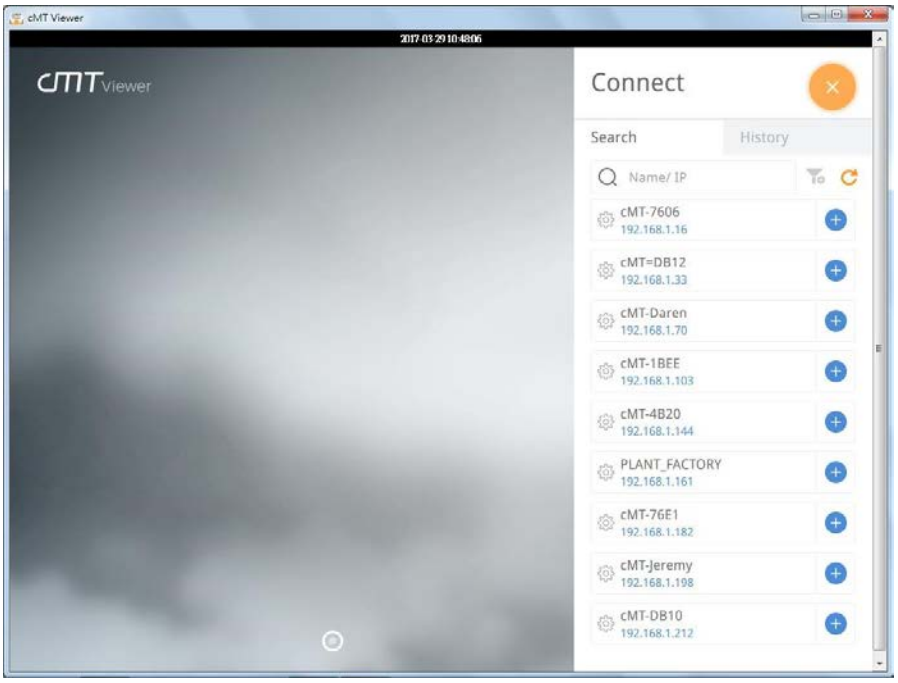


Figure 51

Step 3. Select a cMT Series HMI, tap  and then enter password. If [Use the same password for other machines] checkbox is selected, entering password will not be necessary when adding other cMT Seires HMI that use the same password.

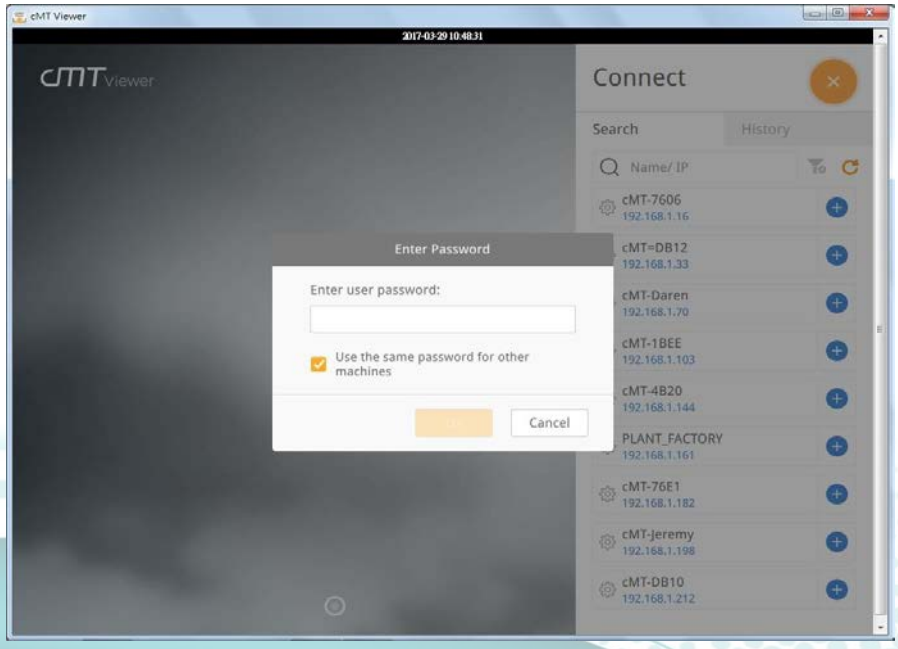


Figure 52

Step 4. When finished, cMT Viewer will display the project.

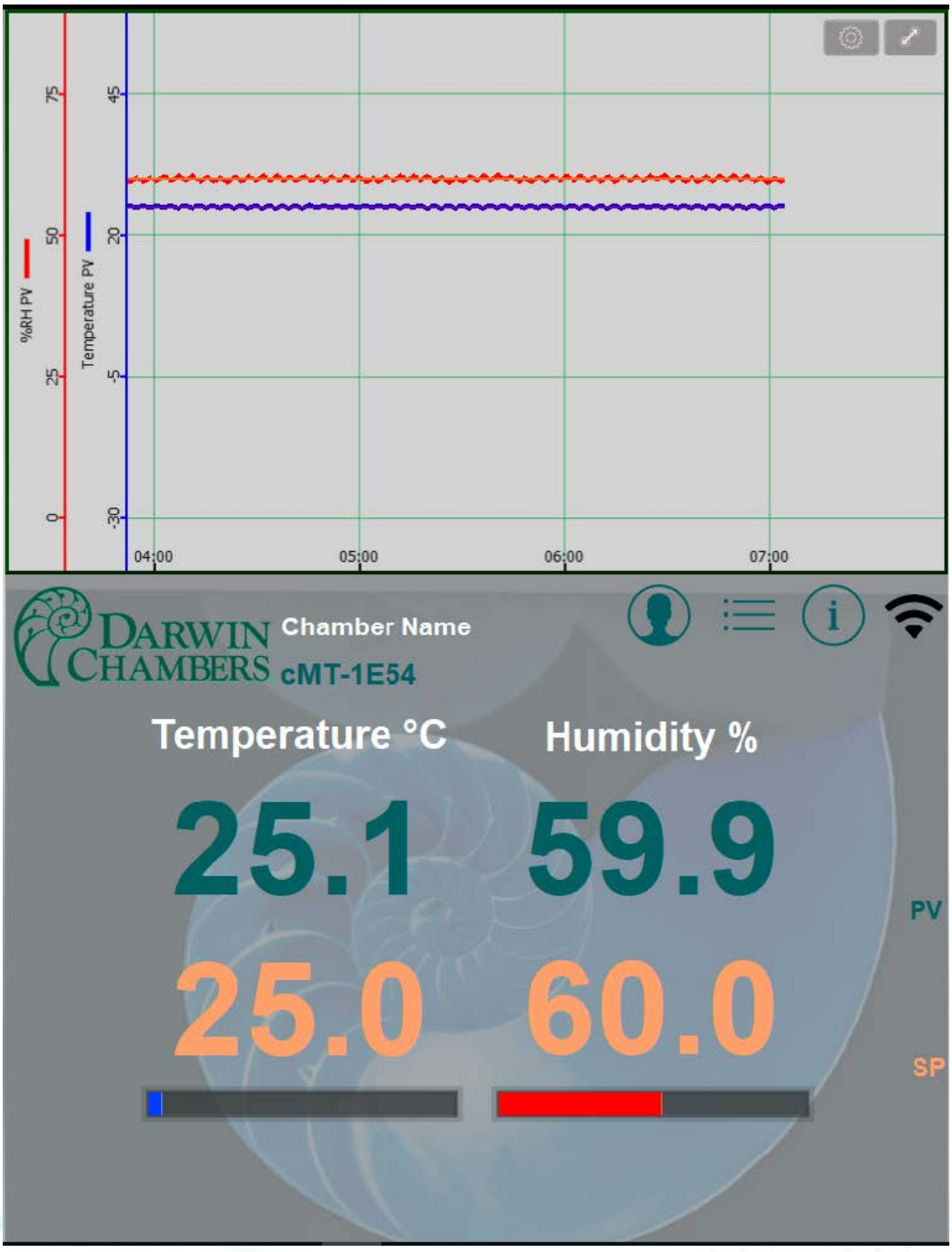


Figure 53

Tap Start Button to return to main screen. To connect another cMT-SVR, follow the preceding steps to search for cMT-SVR and load the project. The + button of the connected cMT Series HMI will turn grey:

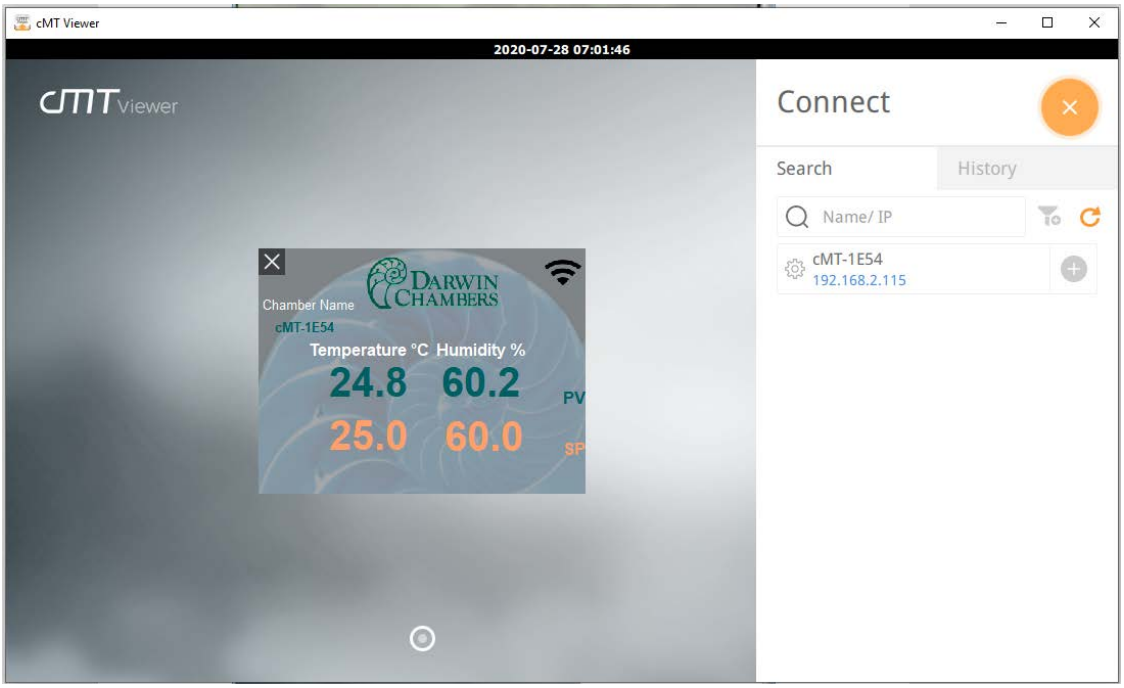


Figure 54

How to open cMT Viewer settings page

Step 1. In cMT Viewer main screen tap  icon.

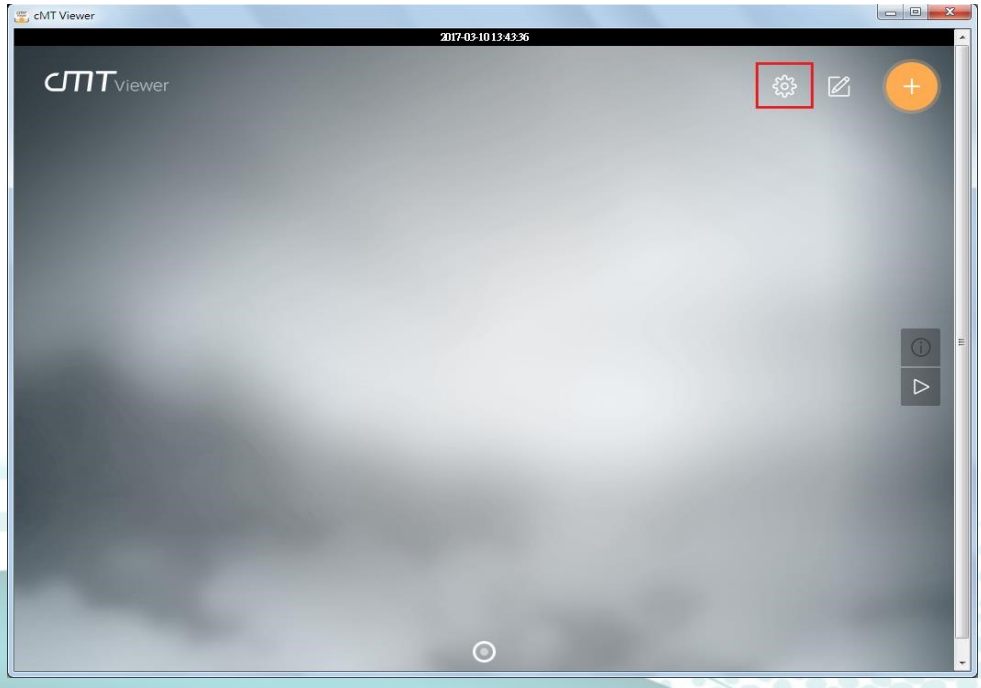


Figure 55

Step 2. Enter password to open [more settings].

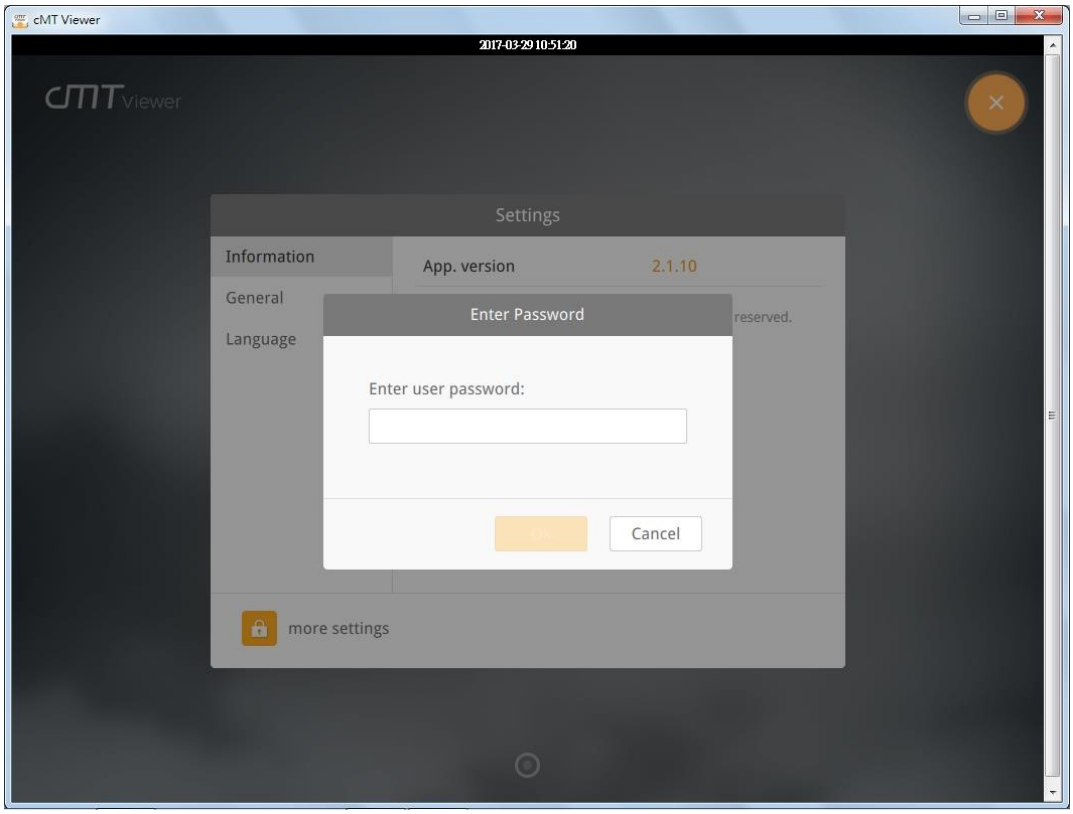


Figure 56

Information

cMT Viewer version information.

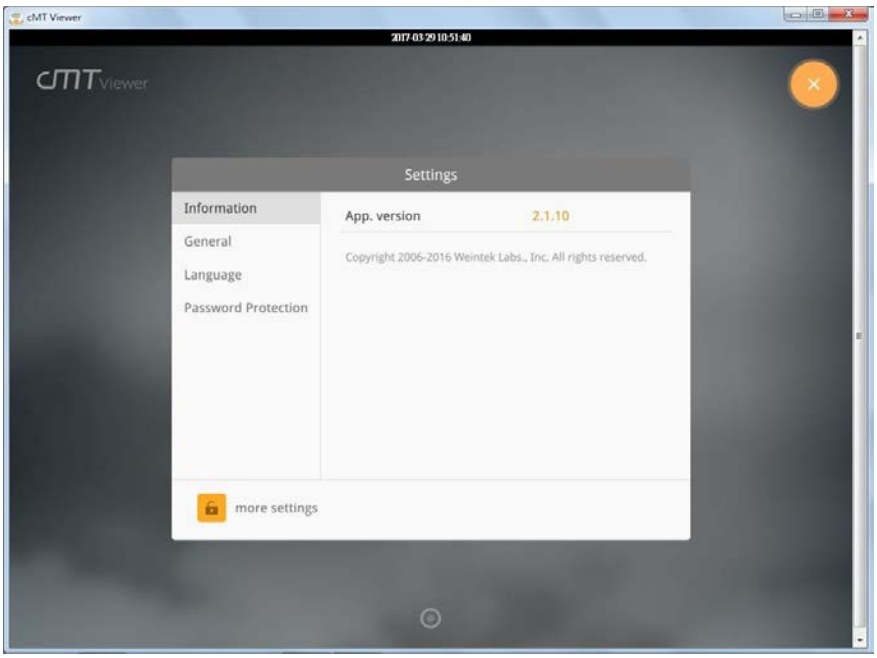


Figure 57

General

cMT Viewer display settings.

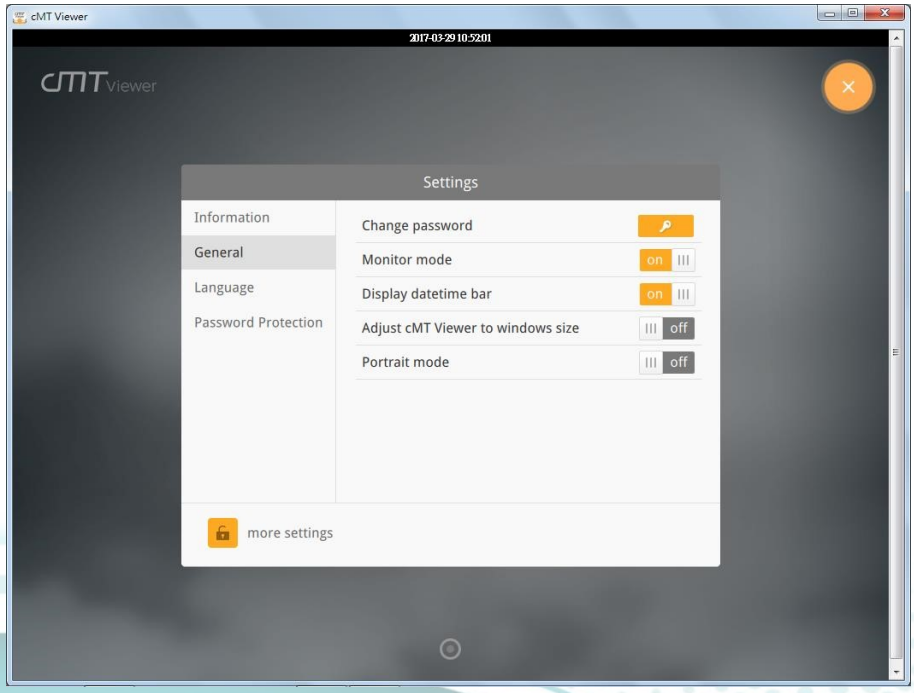


Figure 58

Language

cMT Viewer interface language menu.

Figure 59

Password Protection

After setting, entering password will be necessary for using these functions.

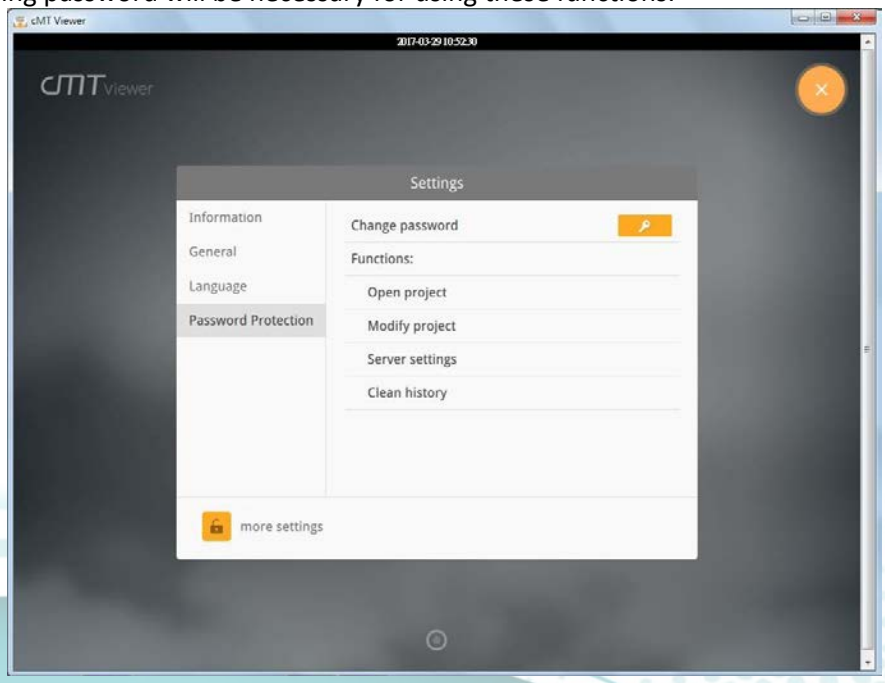


Figure 60

Open project

If this function is protected by password, adding new cMT Series HMI will require password.

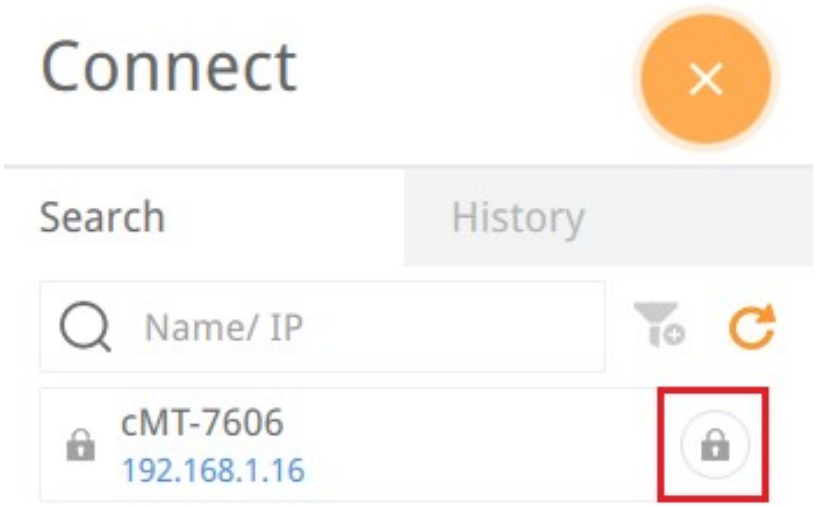


Figure 61

Modify project

If this function is protected by password, changing layout of Monitor Mode will require password.

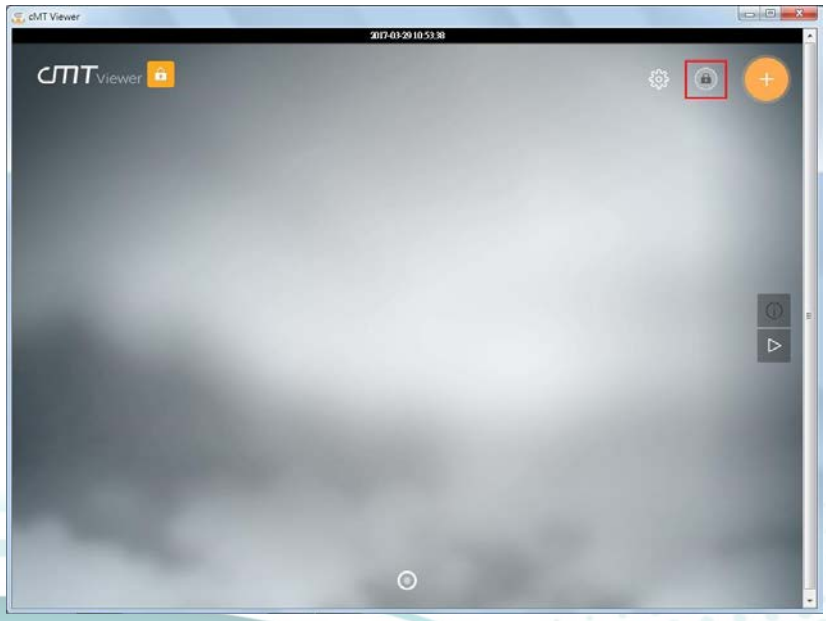


Figure 62

Server settings

If this function is protected by password, entering cMT system settings using cMT Viewer will require password.

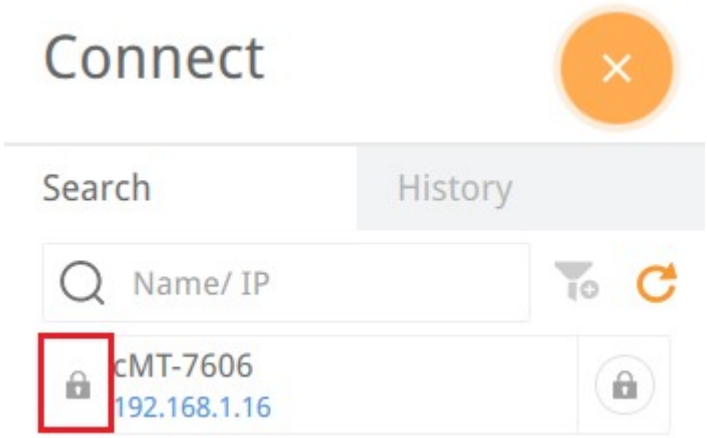


Figure 63

Clear history

If this function is protected by password, clearing connection history in History page will require password.

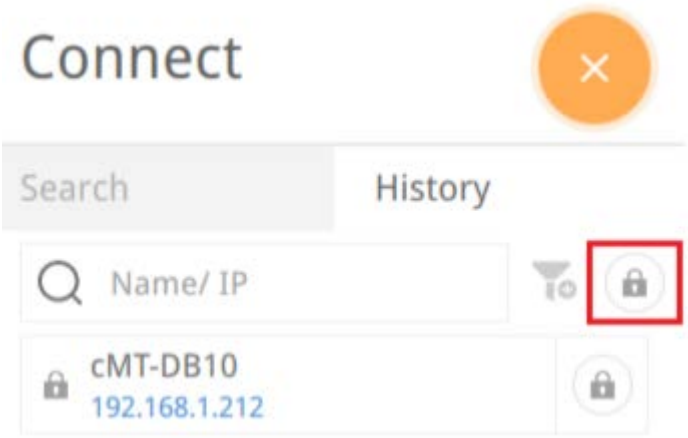


Figure 64

To use password protected functions, tap the lock icon  in the upper left corner and enter password.

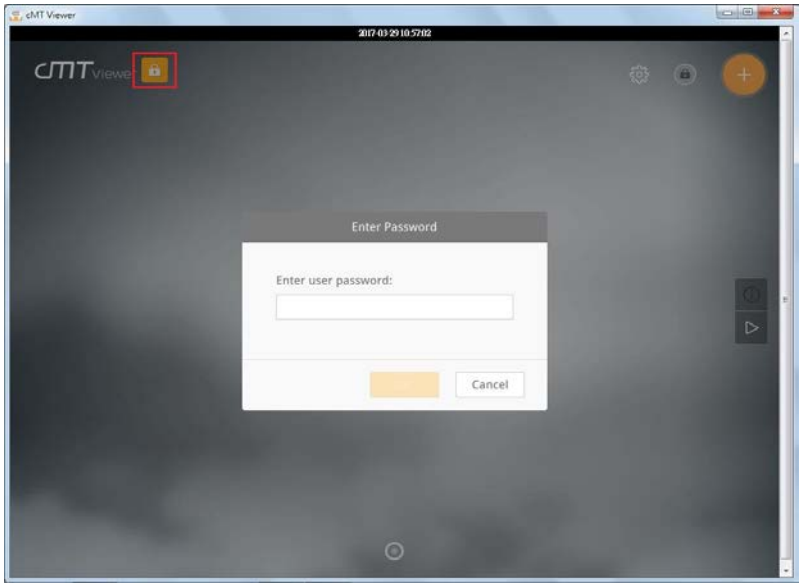


Figure 65

After entering password, cMT Viewer will start a countdown timer of 10 minutes, when it is over, the functions protected by password will be locked again. The countdown timer can be reset by tapping any button in cMT Viewer. To reset the timer to zero, tap  .

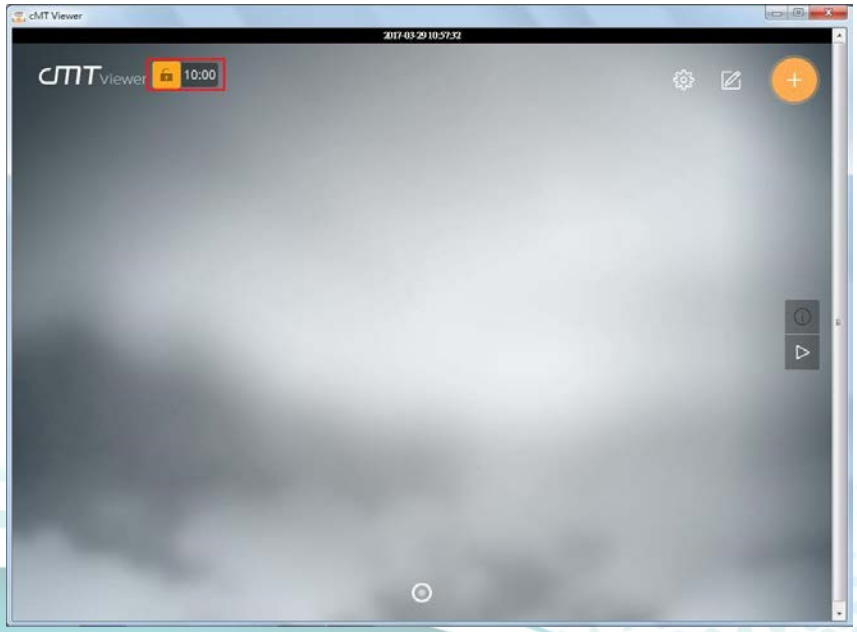


Figure 66

Monitor Mode

cMT Viewer supports Monitor Mode. In Monitor Mode, the user can select up to 50 HMIs (chambers) to monitor simultaneously, without the need for accessing each cMT.

Step 1. Open [more settings] in cMT Viewer, go to General page and enable [Monitor mode].

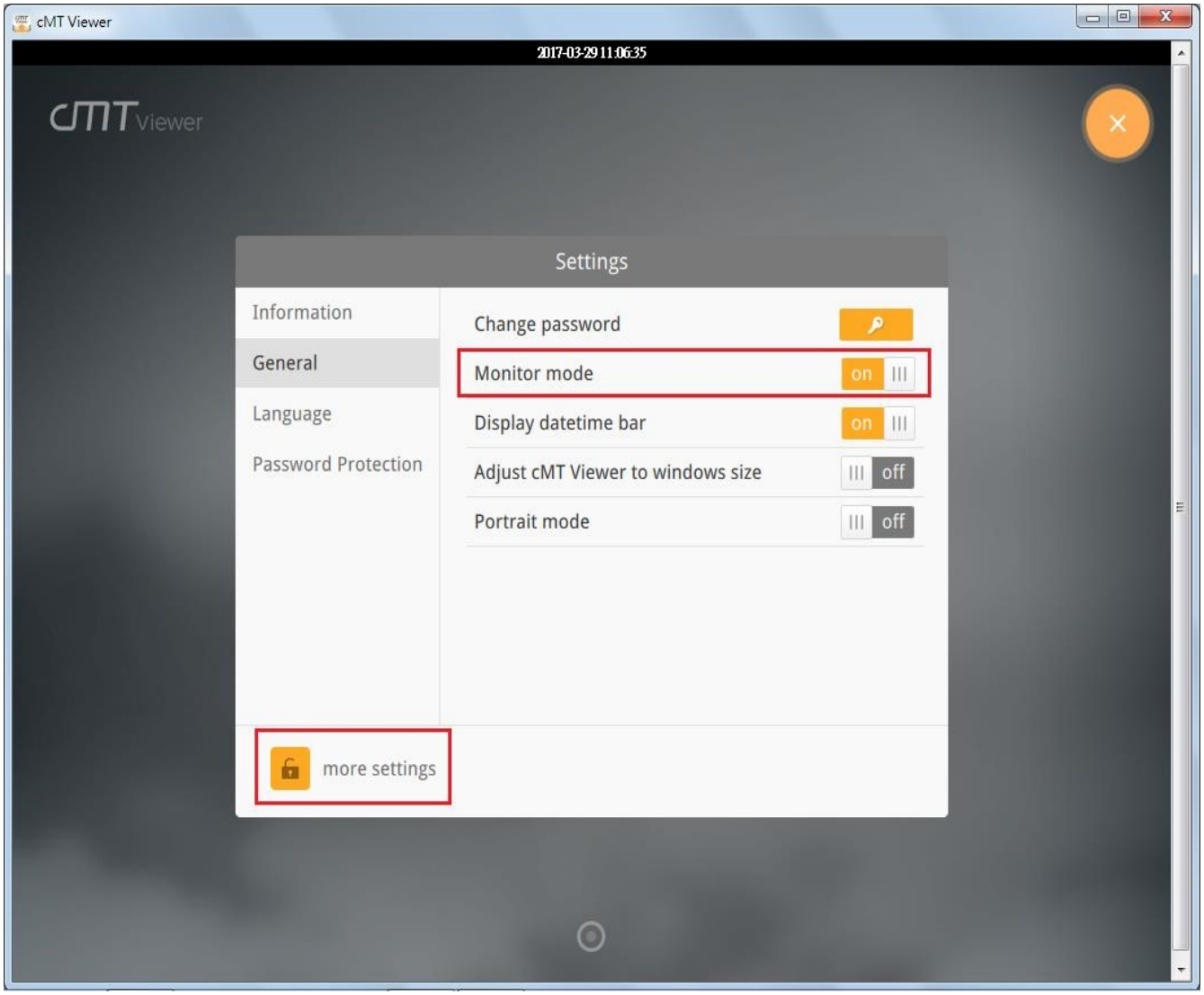


Figure 67

Step 2. Download the project file to cMT Series HMI using cMT Viewer, the Monitor Mode window appears. Alarm message will scroll on the bottom. The process values will flash when in warning and in alarm state. Wi Fi signal strength in upper right-hand corner. When using ramp / soak feature and enable on home screen is selected, the status of the program will appear on the bottom of the screen.

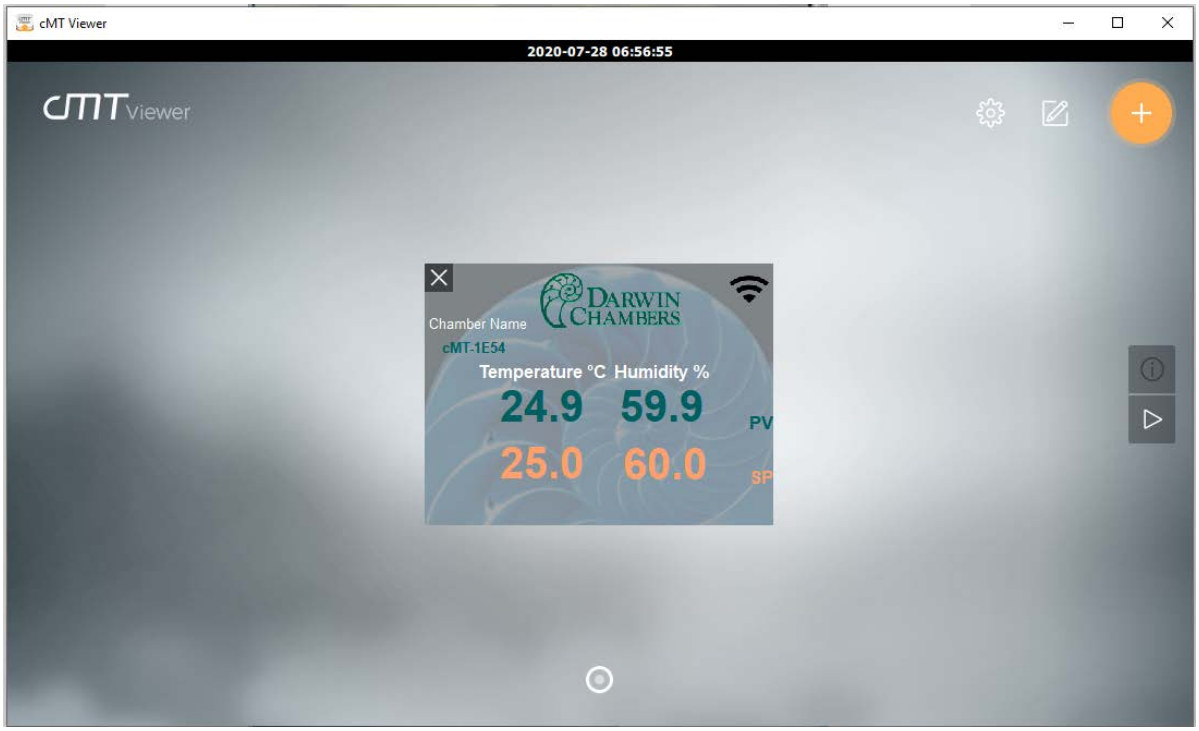


Figure 68

HMI SCREENS

The following screens may have screens that are not found on your chamber. This manual covers multiple chamber series and options they have.

Main Screen

The Main Screen shows the trending data of the process value and setpoints of temperature, Humidity, and lights when applicable.

Icons on the main screen and top of each following screen.

Chamber is in Alarm. This will silence alarm on the HMI. Then navigate to the alarm screen. If alarms are configured to the same as the output alarms the chamber will still have audible alarm that can be silence at push of button at chamber.

This icon is used as the login of the user to change settings. Login icon can be found on every page to prevent navigating back to login screen to make a change.

The Setting icon is used to navigate to gateway of all the settings for the HMI and chamber.

The information icon is used to highlight function of the current screen you are on.

The Wi Fi icon is an indicator for signal strength. When Wi Fi is used as an Access Point the Icon will be black.

In AP Mode or Signal Strength: Weak < -70 dBm	Signal Strength: Fair -60 to -70 dBm	Signal Strength: Good -50 to -60 dBm	Signal Strength: Excellent >-50 dBm
			

Table 20

The Chamber name can be changed by a user with supervisor privilege. The name can have letters and numbers, limited to 32 characters. The Chamber Name will be in the Header of the emails to help segregate emails from multiple chambers.

The trending Chart can be adjusted as needed.

Use this icon to search for a certain day. Day, Month, Year format. i.e., 4 July 2020 would be 040720

Use this icon to resize the chart or return to default setting.

Table 21

Trend Display settings

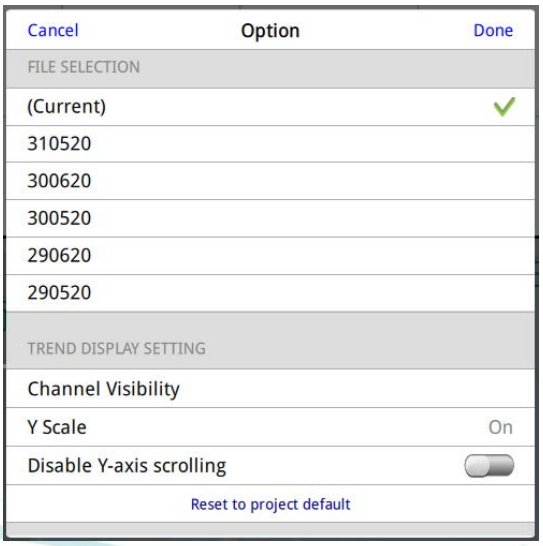


Figure 69

Figure 70

The **Process values (PV)**will stay a dark green under normal operation. When process value deviates away from set point greater than the value in the alarm screen, the process value will flash and change color. This will also occur on the monitor screen mode. This helps to see what chamber is in alarm when multiple chambers are connected to cMT Viewer. The process value will also appear in monitor mode like above. Then in the header on all screens.

Figure 71

The **Setpoint (SP)** values will stay orange in standard operation. To change setpoint the user must login and be a Class B user. When the setpoint value is "grayed out" the chamber is in a Ramp / Soak program and cannot be changed manually. The setpoint value will also appear in monitor mode as above image. However, it cannot be manipulated from the monitor mode screen.

Figure 72

The **bar graphs** below the set point indicate the duty cycle of the controller. The graphs trending to full left are off, while trending to full right the output is full on.

Figure 73

Below the bar graph a **scrolling message** will appear when the chamber is in alarm. Scrolling message will also appear on the monitor mode screen.

Figure 74

In ramp soak operation the **Program Off, run, hold** button along with the **status** and **timing** indicator can appear at bottom of the screen. Pressing the program button from off to run will start current loaded program. Pressing button again from run to hold will pause the program. Then finally pressing the program button from hold to off will stop the program. The ramp / soak operation indicators when enabled on main screen will also appear on the monitor mode screen. The button cannot be manipulated in the monitor mode screen.

The **Status** indicator reveals what stage the program is at currently. (i.e., The status indicator will change from Off to Ramp1 when started. Once the Ramp1 time has expired Status indicator will change to Soak1 until time is compete. **Note** that when times are set to 0 the ramp or soak will be skipped.)

The **Timing** indicator indicates when the time-of-day start is enabled.

Home Screen

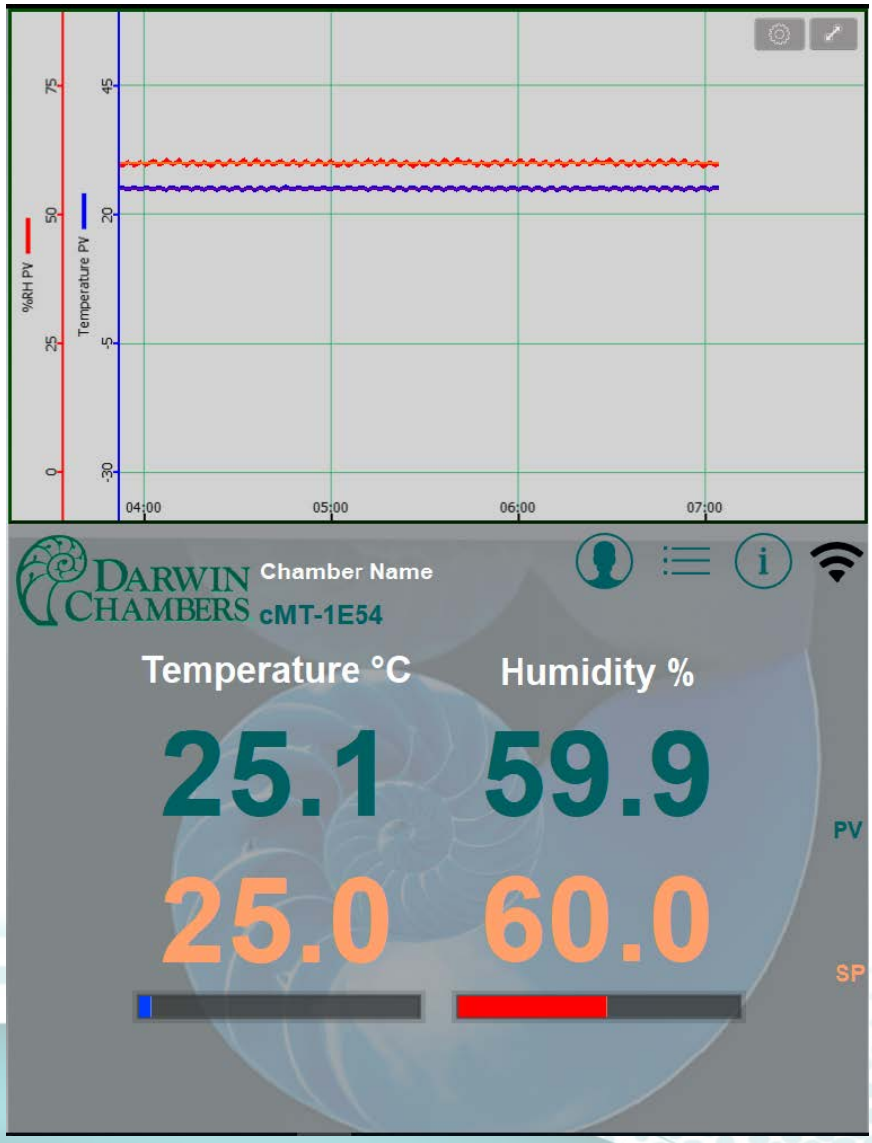


Figure 75

Setting Menu

Setting menu is the root menu screen to navigate to all other screens or operations. Login with the correct Class of user then select icon picture to navigate to that screen.

Figure 76

Historical Data

Historical data is the data log of the process and set point values for Temperature, Humidity, and Light when available. Data is collected every minute.

Use this icon to search for a certain day. Day, Month, Year format. i.e. 4 July 2020 would be 040720

Use this icon to resize the chart or return to default setting.

Expand Y Axis

Narrow Y Axis

Re center to default

Expand X Axis

Narrow X Axis

Table 22

When select any spot on the trending area of the chart an index line will appear. The values below the chart will adjust to that time. Time will appear in the upper left-hand corner.

Press radio button next to the label to turn the trend values on and off.

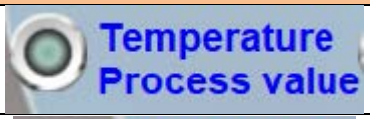
Enabled	Disabled
	
	
	
	

Table 23

Storage Space available is the amount of space on the installed SD card. The HMI is sent out with a 32 GB capacity SD Card. This is the maximum allowed size. This amount of storage should provide years of data log data collected at every minute, with many ramp / soak programs.

USB Installed lets the user know USB flash drive is installed at the chamber and files can be downloaded to it.

Download to CSV to FTP site button converts current file to comma separated value document that can be opened in a spreadsheet program. This can be accessed via browser or setting up an FTP file location on your PC.

Download to CSV to USB Drive converts current file to comma separated value document that can be opened in a spreadsheet program. Be sure USB installed indicator is illuminated before proceeding.

Email .db File sends current file to all users in the group B email list. The file is in an encrypted format that will need to be open by Easy Convertor Tool to open the files.

Email Auto button will send the log files daily to the email group B. Then every Sunday email will be sent for the past seven days. Files will be encrypted and need to use the Easy Convertor Tool to open the files.

Data Table button opens a new screen that shows the current selected file in a spreadsheet format.

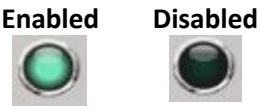


Figure 77

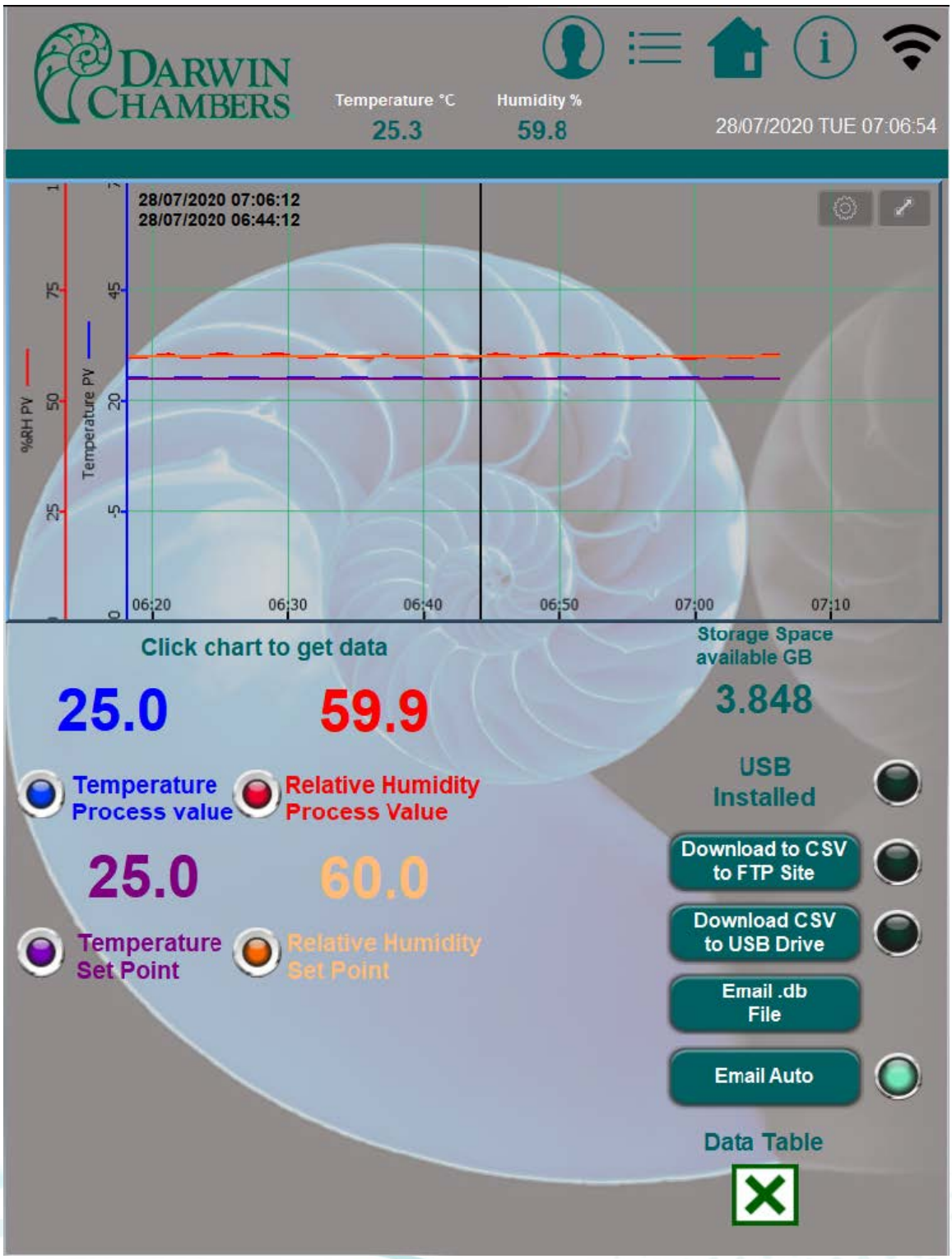
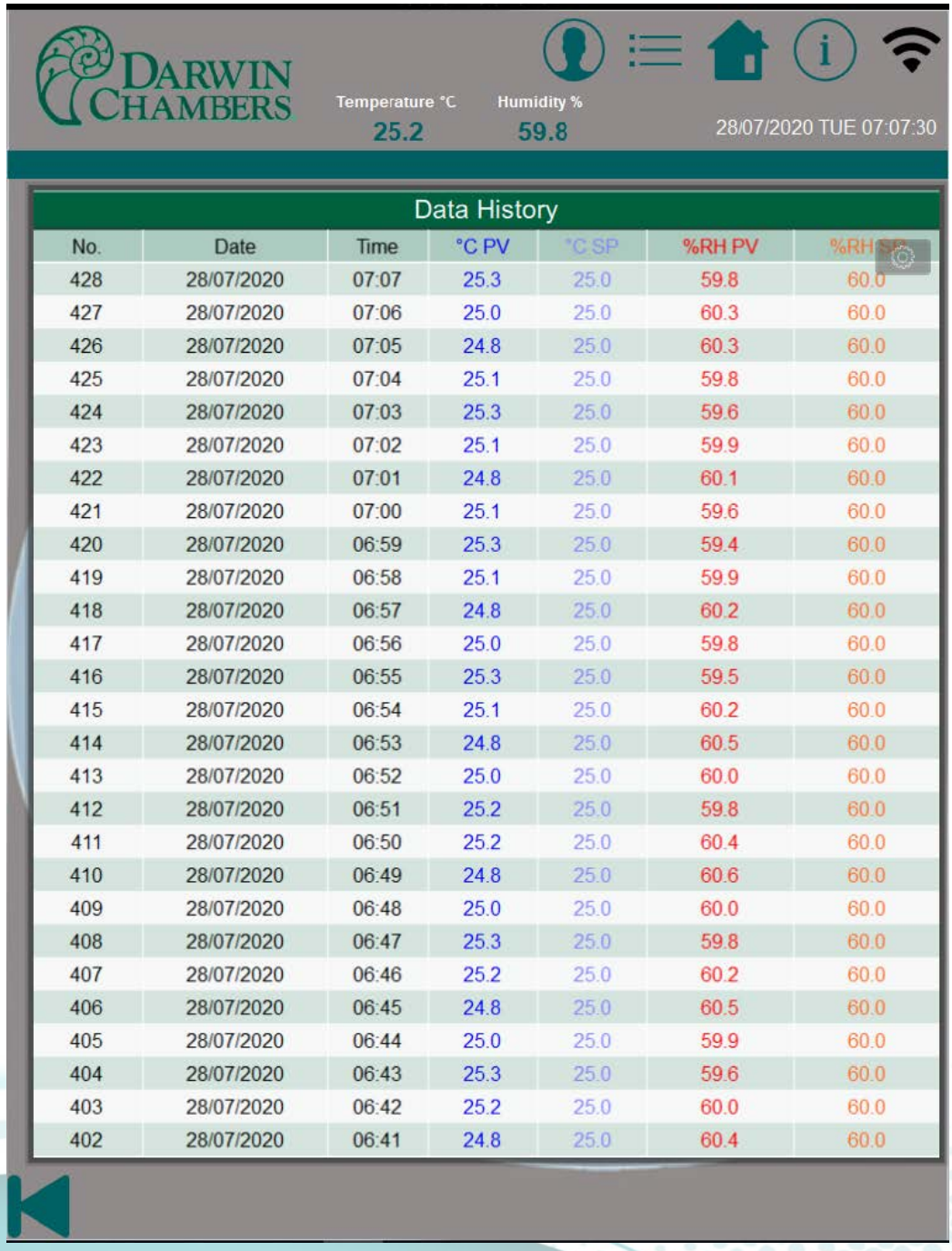

DARWIN CHAMBERS
Temperature °C
25.3
Humidity %
59.8
28/07/2020 TUE 07:06:54
28/07/2020 07:06:12
28/07/2020 06:44:12
%RH PV
Temperature PV
06:20
06:30
06:40
06:50
07:00
07:10
Click chart to get data
Storage Space available GB
3.848
25.0
59.9
Temperature Process value
Relative Humidity Process Value
25.0
60.0
Temperature Set Point
Relative Humidity Set Point
USB Installed
Download to CSV to FTP Site
Download CSV to USB Drive
Email .db File
Email Auto
Data Table

Figure 78

Historical log

Historical log looks and acts like a spreadsheet. User can scroll up and down and scroll right and left. Using the  in the upper right-hand corner the Option list to narrow the search by dates. The date is in day, month, year format. i.e., 4 July 2020 would be 040720



No.	Date	Time	°C PV	°C SP	%RH PV	%RH SP
428	28/07/2020	07:07	25.3	25.0	59.8	60.0
427	28/07/2020	07:06	25.0	25.0	60.3	60.0
426	28/07/2020	07:05	24.8	25.0	60.3	60.0
425	28/07/2020	07:04	25.1	25.0	59.8	60.0
424	28/07/2020	07:03	25.3	25.0	59.6	60.0
423	28/07/2020	07:02	25.1	25.0	59.9	60.0
422	28/07/2020	07:01	24.8	25.0	60.1	60.0
421	28/07/2020	07:00	25.1	25.0	59.6	60.0
420	28/07/2020	06:59	25.3	25.0	59.4	60.0
419	28/07/2020	06:58	25.1	25.0	59.9	60.0
418	28/07/2020	06:57	24.8	25.0	60.2	60.0
417	28/07/2020	06:56	25.0	25.0	59.8	60.0
416	28/07/2020	06:55	25.3	25.0	59.5	60.0
415	28/07/2020	06:54	25.1	25.0	60.2	60.0
414	28/07/2020	06:53	24.8	25.0	60.5	60.0
413	28/07/2020	06:52	25.0	25.0	60.0	60.0
412	28/07/2020	06:51	25.2	25.0	59.8	60.0
411	28/07/2020	06:50	25.2	25.0	60.4	60.0
410	28/07/2020	06:49	24.8	25.0	60.6	60.0
409	28/07/2020	06:48	25.0	25.0	60.0	60.0
408	28/07/2020	06:47	25.3	25.0	59.8	60.0
407	28/07/2020	06:46	25.2	25.0	60.2	60.0
406	28/07/2020	06:45	24.8	25.0	60.5	60.0
405	28/07/2020	06:44	25.0	25.0	59.9	60.0
404	28/07/2020	06:43	25.3	25.0	59.6	60.0
403	28/07/2020	06:42	25.2	25.0	60.0	60.0
402	28/07/2020	06:41	24.8	25.0	60.4	60.0

Figure 79

Option list

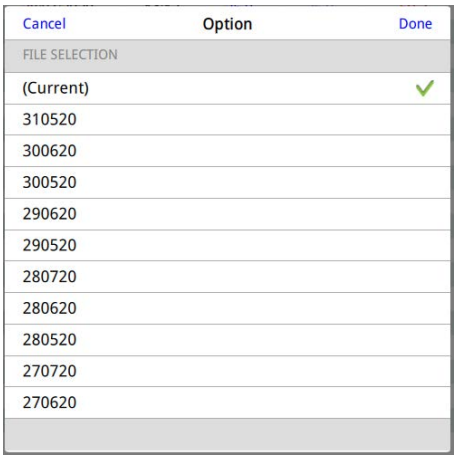


Figure 80

Security

The security screen is used to create new users, see current logged in users, and past logged in users.

The **Auto Logout** time can be adjusted using the drop-down text box.

User list shows all the available users on the HMI and the privilege they have.

The **Security lock** on the controller will lock the controller on the chamber face. A small red key will display on the controller.

Figure 81

This prevents users from changing the settings without logging in to be documented. An email warning will be sent when the controller is unlocked. This will also occur when unlocked and the system is just turned on. Users who are savvy to the Fuji controller may know how to unlock controller at the face. The HMI will still send email to alert group A by email if / when disabled.

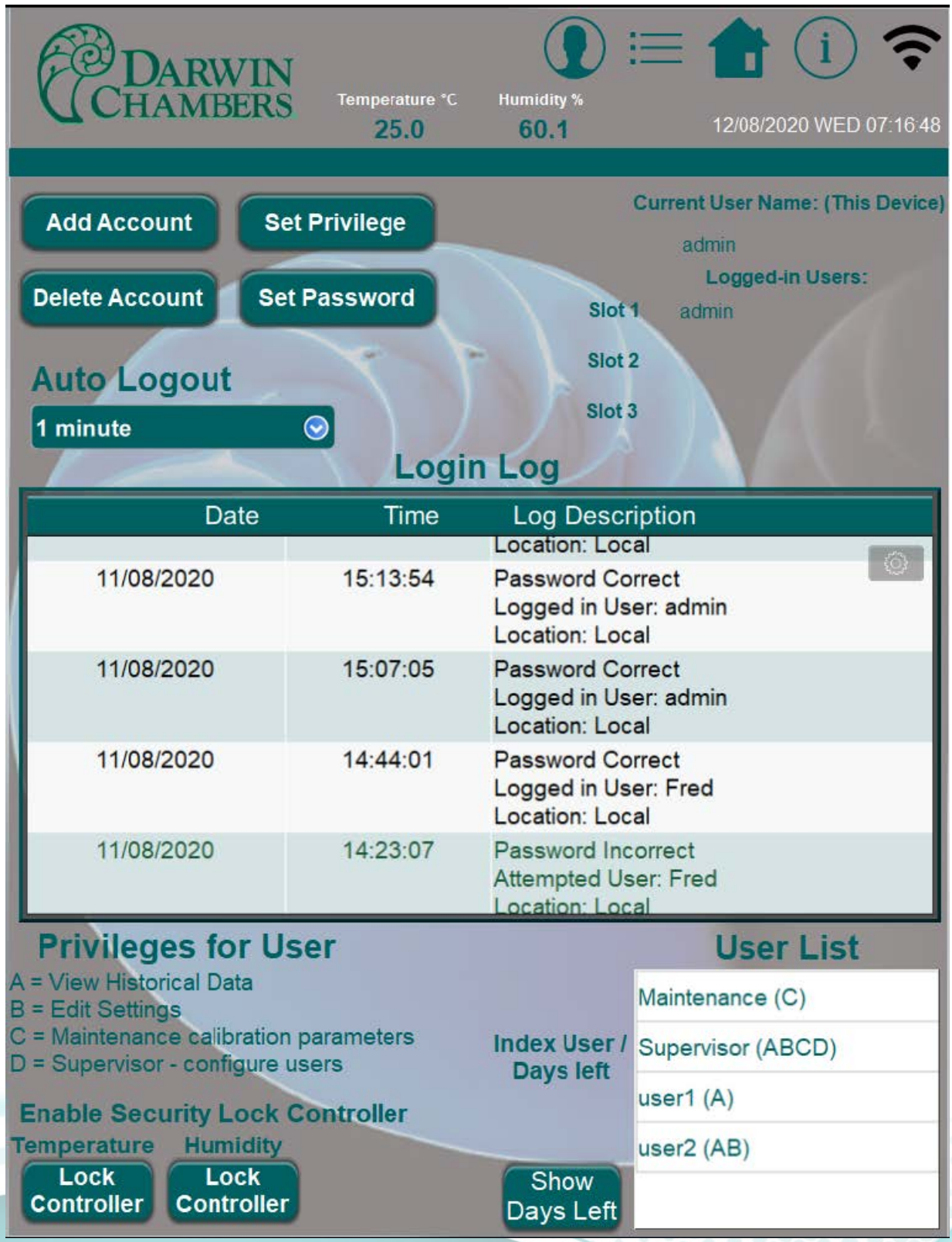

DARWIN CHAMBERS
Temperature °C
25.0
Humidity %
60.1
12/08/2020 WED 07:16:48
Add Account
Set Privilege
Delete Account
Set Password
Current User Name: (This Device)
admin
Logged-in Users:
Slot 1 admin
Slot 2
Slot 3
Auto Logout
1 minute
Login Log
Date
Time
Log Description
Location: Local
11/08/2020 15:13:54 Password Correct Logged in User: admin Location: Local
11/08/2020 15:07:05 Password Correct Logged in User: admin Location: Local
11/08/2020 14:44:01 Password Correct Logged in User: Fred Location: Local
11/08/2020 14:23:07 Password Incorrect Attempted User: Fred Location: Local
Privileges for User
A = View Historical Data
B = Edit Settings
C = Maintenance calibration parameters
D = Supervisor - configure users
Index User / Days left
User List
Maintenance (C)
Supervisor (ABCD)
user1 (A)
user2 (AB)
Enable Security Lock Controller
Temperature
Lock Controller
Humidity
Lock Controller
Show Days Left

Figure 82

Default Users and Password. These are sent preprogrammed as example of users. Highly recommend creating your own users and passwords. Usernames and passwords can have up to 16 alphanumeric characters. Usernames and passwords are both case sensitive.

Username	Password	Class
user1	1	A
user2	2	AB
Maintenance	3	C
Supervisor	4	ABCD

Table 24

Note: *When entering any data in a text box, press enter to accept the new data. Using touch or mousing over to another text box will result in error.*

Class	Description
Class A	Download Data
Class B	Change settings
Class C	Maintenance – calibration adjustments
Class D	Create and assign users. Setup email and network settings

Table 25


Use this Icon on any screen to login. The below image is of the pop-up window that will appear. When typing in the username and/or password, the enter button must be pressed to accept the name or password.

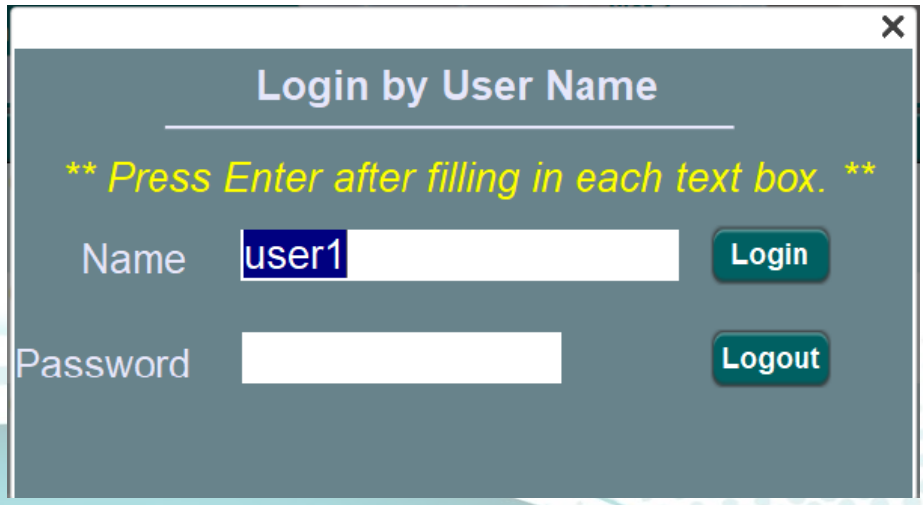


Figure 83

Add account

Used to add a new user to the HMI. Press on the privilege icons to assign the capabilities for that user. Item turns orange when enabled and gray when disabled.

Add Non-Expire User the user stays until deleted.

Add Expiring User will expire when delete once duration has ended. 0 is not excepted.

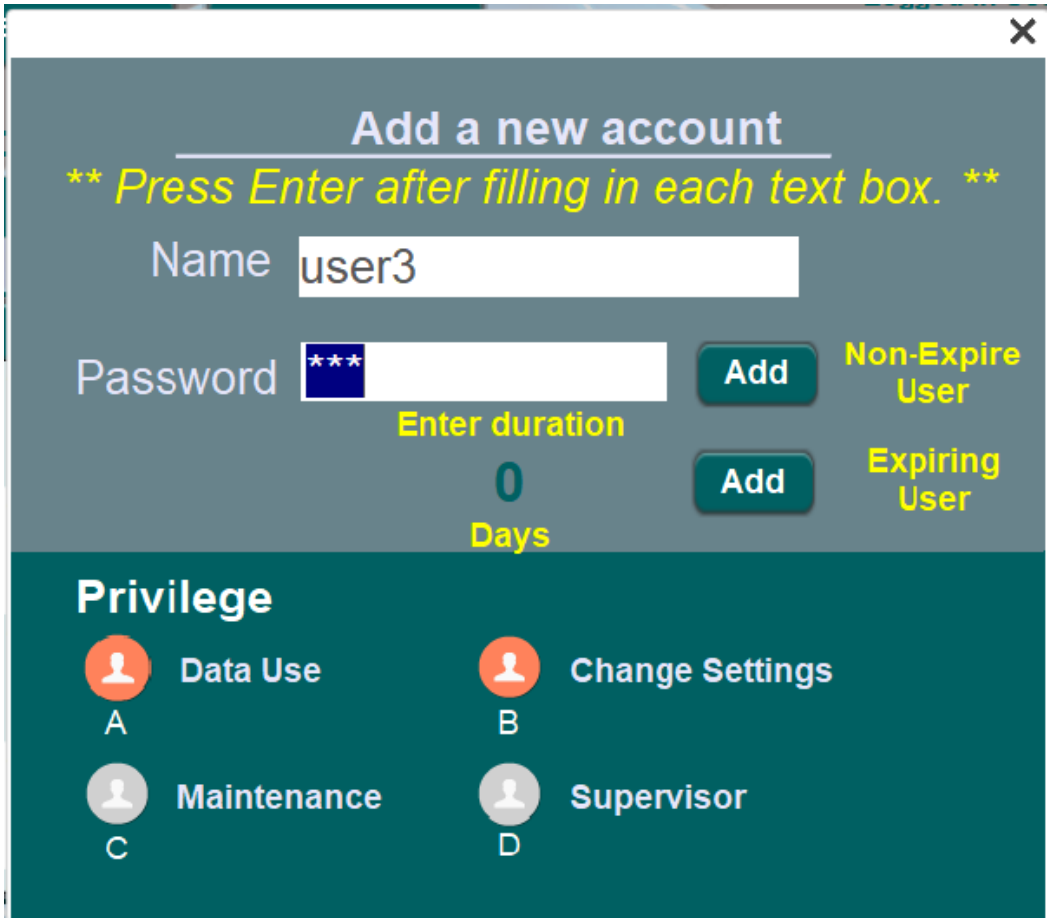


Figure 84

Select a user from the index to delete.

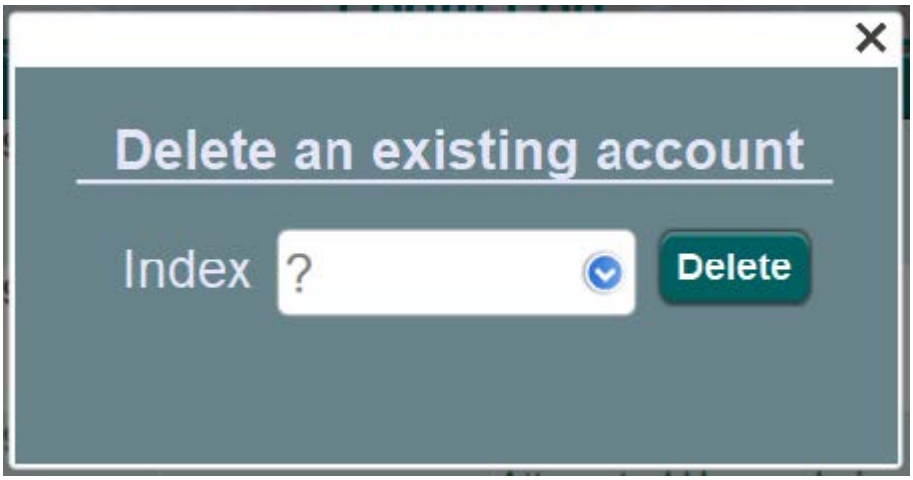


Figure 85

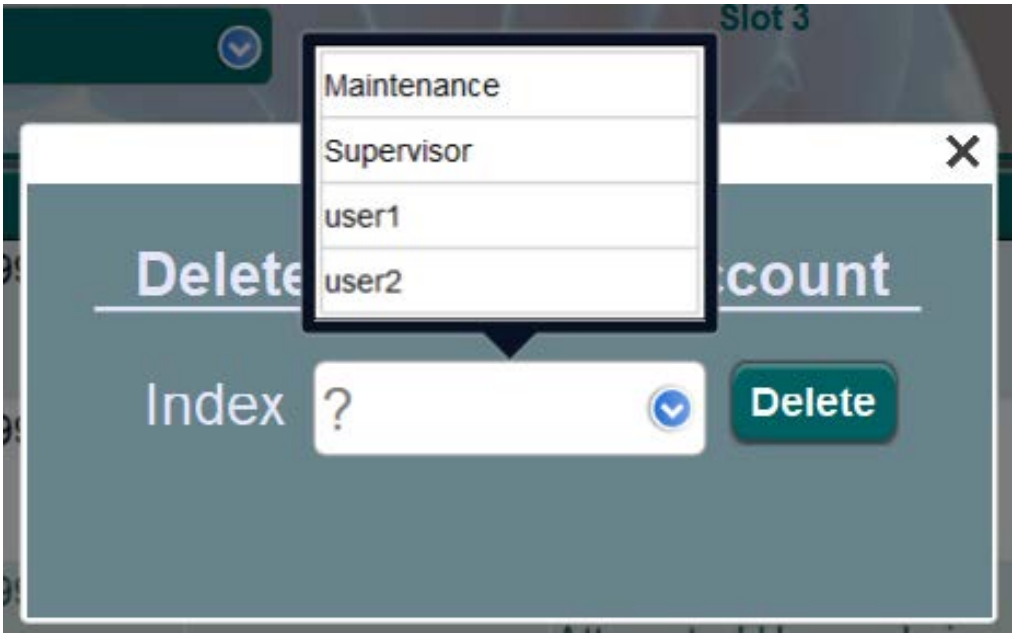


Figure 86

Set Privilege

Select a user from the index, then add or remove privileges for that user.

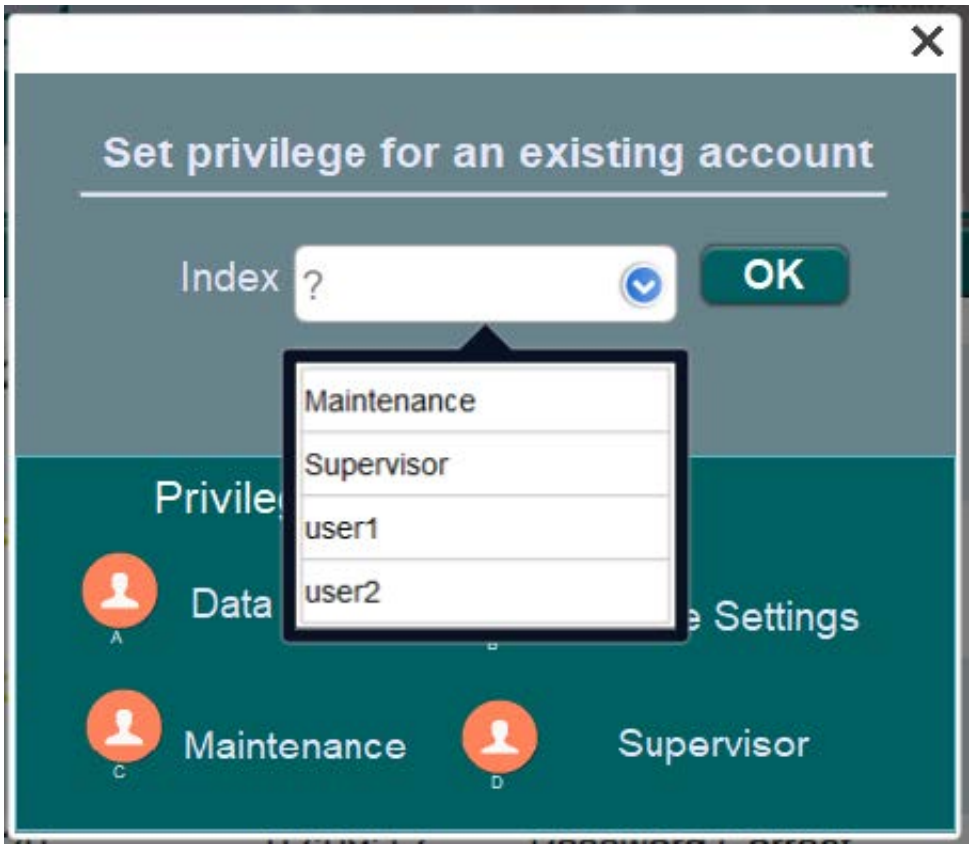


Figure 87

Set Password

Select User from the index. Allow user to change their password.

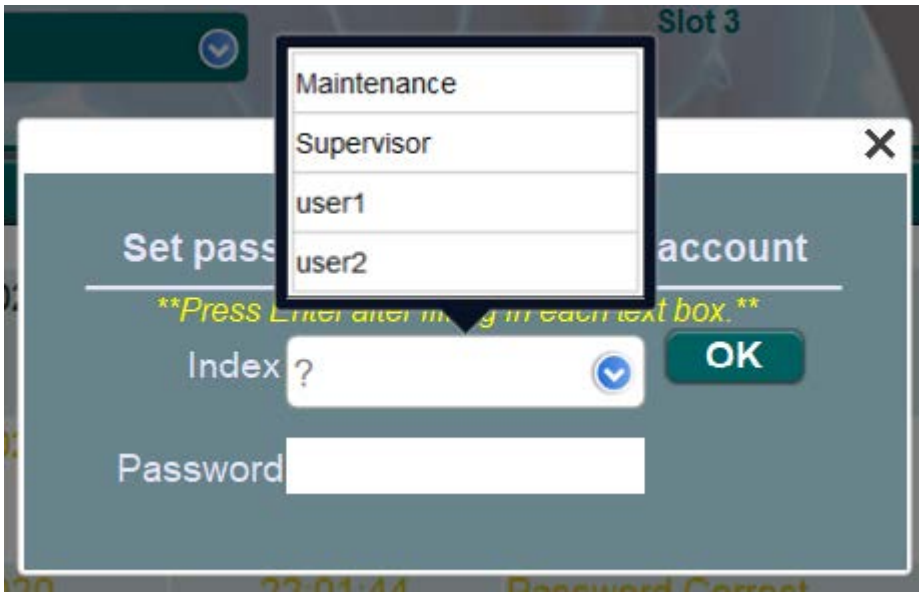


Figure 88

User List

User List is used to show user that have been saved and privilege they have. Select a user and the index number of that user will display to the left. Press **Show Days Left** to show days left on expiring users. If no value is displayed that is a non-expiring user.

Note: *Expiring users will delete upon expiration date.*

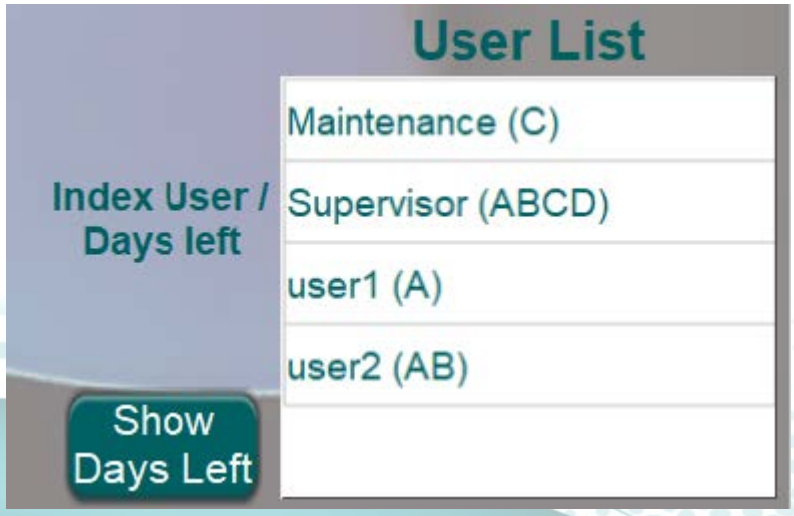


Figure 89

Audit Trail

The Audit trail shows what user pressed a button or changed a setting. Not all buttons are recorded like navigation buttons from screen to screen. The audit file can be copied to a USB flash drive. Indicator next to button will indicate when USB is plugged in, or the Audit file can be emailed to the email group A. The file is in a .db file format. The easy convertor tool must be used to unencrypt the data. See using the Easy Convertor Tool.

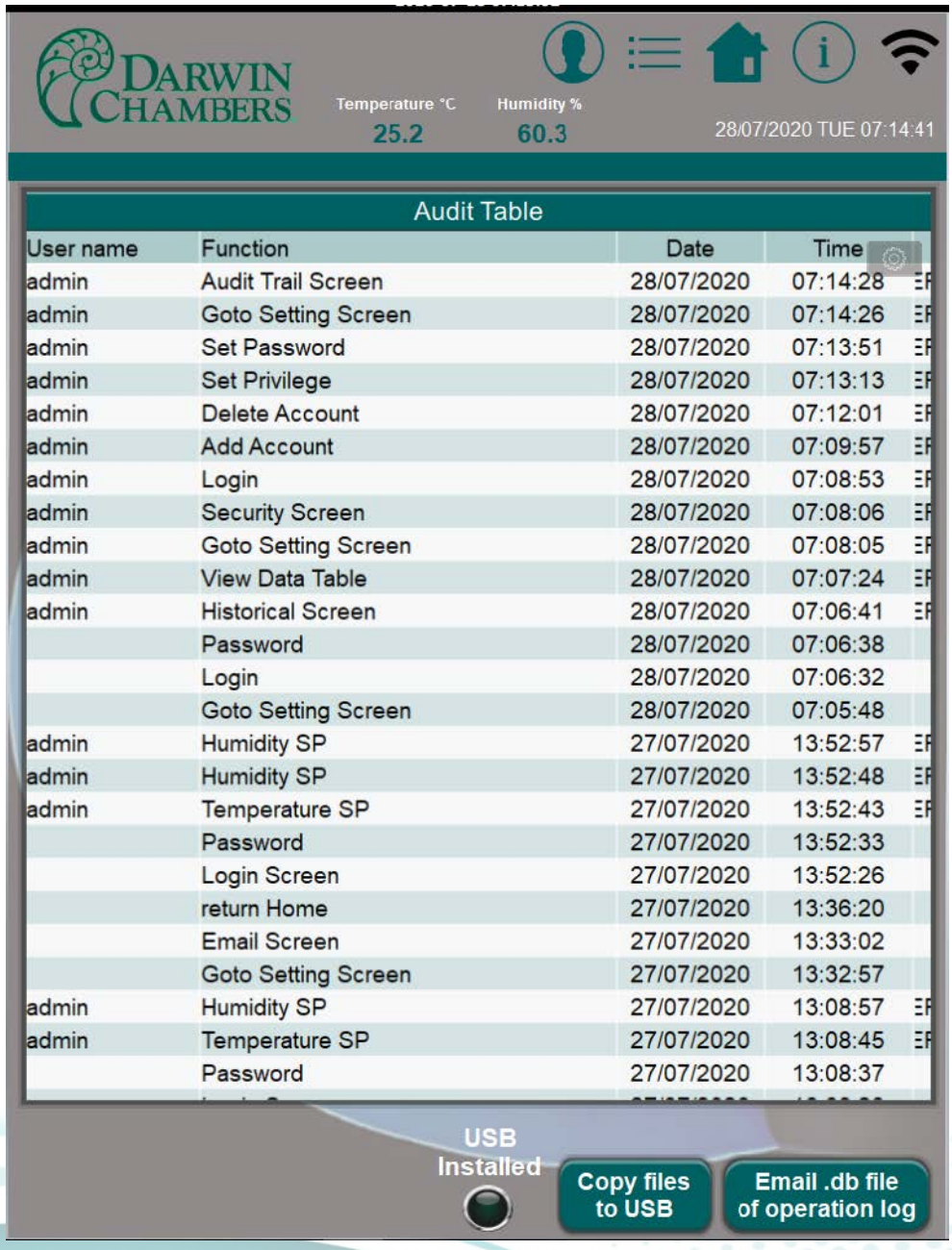


Figure 90

Alarm Screen

The Alarm screen is used to set audible / email alarms to notify when the chamber Process value deviates from the set point. The alarms can be set to go off before the chamber sounds audible and disable components. This can be done by either changing the alarms on the output screen to be wider or narrowing the setting on this screen. This can also be done either by the deviation set point or extending the delay times.

The elapsed time will count when process value has deviated from set point greater than configured here. Once the elapsed time has reached the same time as the delay time, the audible on the HMI will beep and an email notifying chamber alarm will be sent. When conditions have cleared another email will be sent notifying as such.

Use the following icons to navigate to the impacted control loop.

- The **Temperature Output** icon will navigate to the output screen. Here user can see what components have or will be disabled based on how outputs configured.
- The **Humidity Output** icon will navigate to the output screen. Here user can see what components have or will be disabled based on how outputs configured.

The **Alarm History Button** open the Alarm History screen. The alarm history screen appears as a spreadsheet.

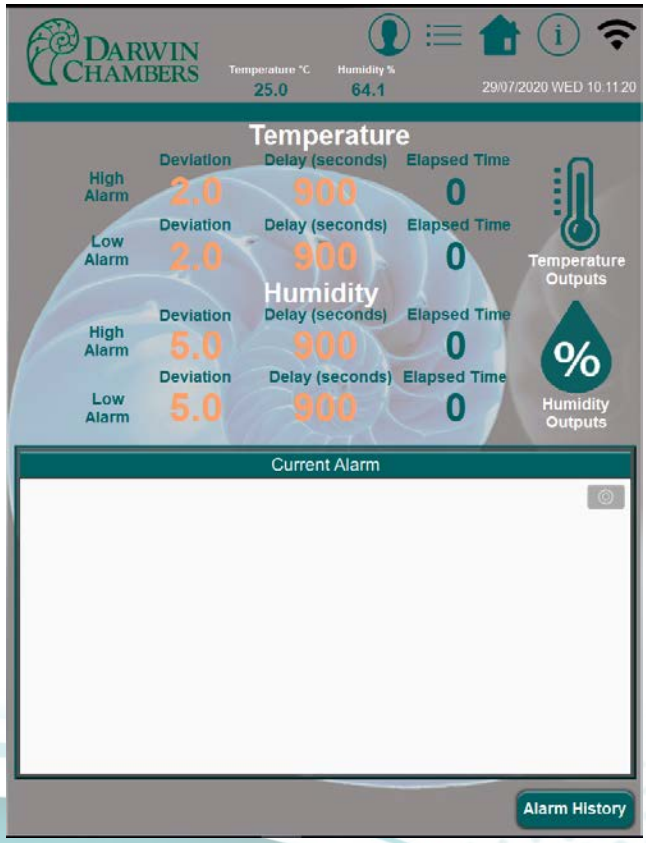


Figure 91

Alarm History

The alarm history screen displays the data in spreadsheet format. The first column is the event message, event trigger time, event trigger date (DD/MM/YYYY), and the elapsed time.

The event will be listed in ascending order.

Events in Red are currently in alarm and have not been acknowledged.

Events in Gold are alarms that have been acknowledged.

Events in Dark Green have returned within specification.

The **Download files to USB** will download the alarm history to USB flash drive. Ensure USB installed indicator is illuminated before pressing button.

USB Drive Installed

NO USB drive

Figure 92

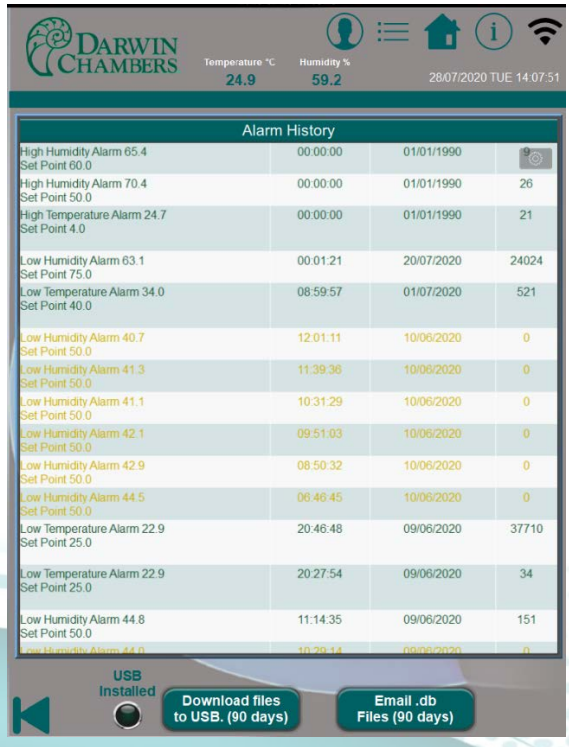


Figure 93

Alarm History Options

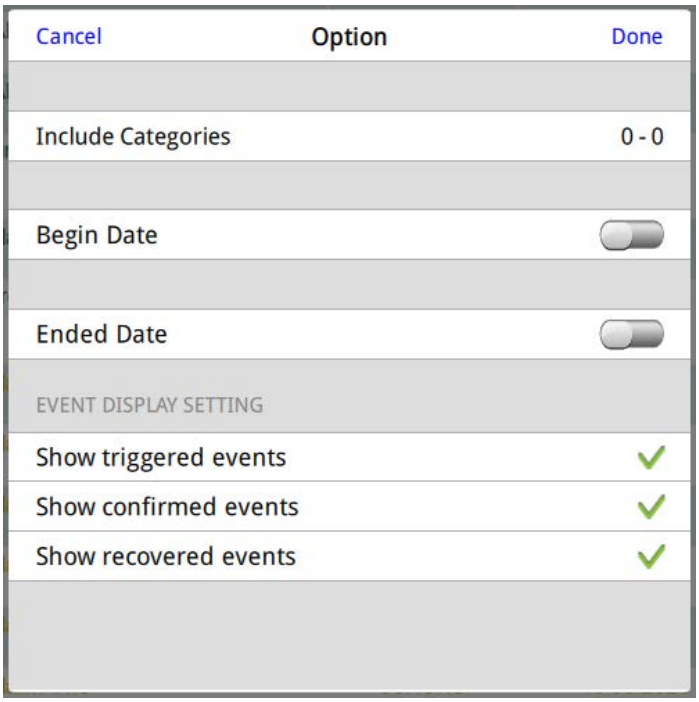


Figure 94

The Alarm History Option list can be used to narrow down a specific alarm event by date, triggered events, confirmed events, and recovered events.

Begin / Ended data Calendar

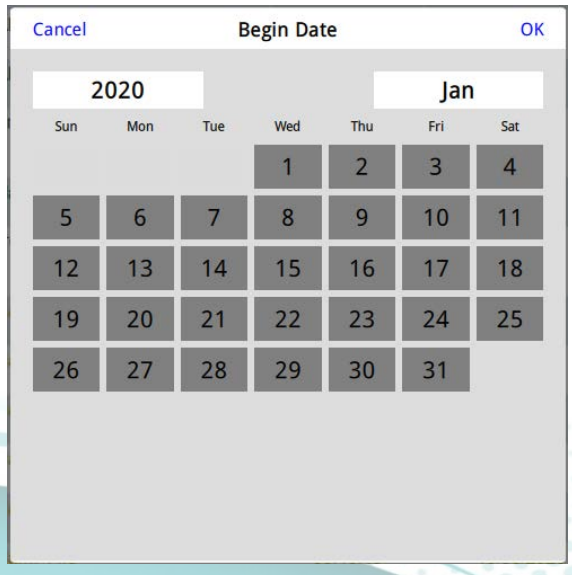


Figure 95

The Begin and End data Calendar can be use by turning on the option then selecting the date.

Figure 96

The days that can be selected will be highlighted in blue.

Temperature Outputs

The temperature output screen shows the control output for the heater and/ or hot gas. (Depends on chamber model for hot gas availability).

The **Duty Cycle** indicates the % call for output.

The **Proportional Band**, **Integration Time**, and **Differential Time** are all used in algorithm for the process control. To improve chamber performance, it is recommended to use the auto tune feature rather than adjust these values manually. **Auto Tune** should be used at initial setup or whenever a new set point is being set. For ramping and soaking function, it is best to auto tune at a temperature in between the minimum and maximum temperatures the chamber will experience. Note when refrigeration / cooling is enabled / disabled.

The **Output Cycle** indicates the amount of time to pass before calculation for demand will be corrected. Chamber with a hot gas will have a minimum of a 7 second Cycle time. This prevents rapid activation of the solenoid. A shorter time will shorten the life of solenoid and refrigeration system.

Figure 97

DO1 is the alarm output for high temperature alarm. This output will enable / disable the heater and sound the audible alarm at the chamber. On the thermoelectric series chambers it will also disable the evaporator fans.

- **Low** – main setpoint for alarm event (can be a high or low alarm, check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.

- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)
- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.
- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**
    - **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
    - **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
    - **Output Invert –** reverse the output from normally open to normally closed.
    - **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

DO2 is the alarm output for low temperature alarm. This output will enable / disable the cooling unit on the chamber and sound the audible alarm at the chamber.

- **Low** – main setpoint for alarm event (can be a high or low Alarm, check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.
- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)
- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.
- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**
    - **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
    - **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
    - **Output Invert –** reverse the output from normally open to normally closed.
    - **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

DO3 is the heat only mode output. This output will enable / disable the cooling unit on the chamber for better performance and efficiency of the chamber. When the process value is lower than set point value by the low value

for longer than the duration in seconds the cooling unit will be disabled. When the process value is higher than the high value for longer than the duration in delay seconds the cooling unit will be disabled.

- **Low** – main setpoint for alarm event (can be a high or low Alarm, check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.
- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)
- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.
- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**
    - **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
    - **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
    - **Output Invert –** reverse the output from normally open to normally closed.
    - **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

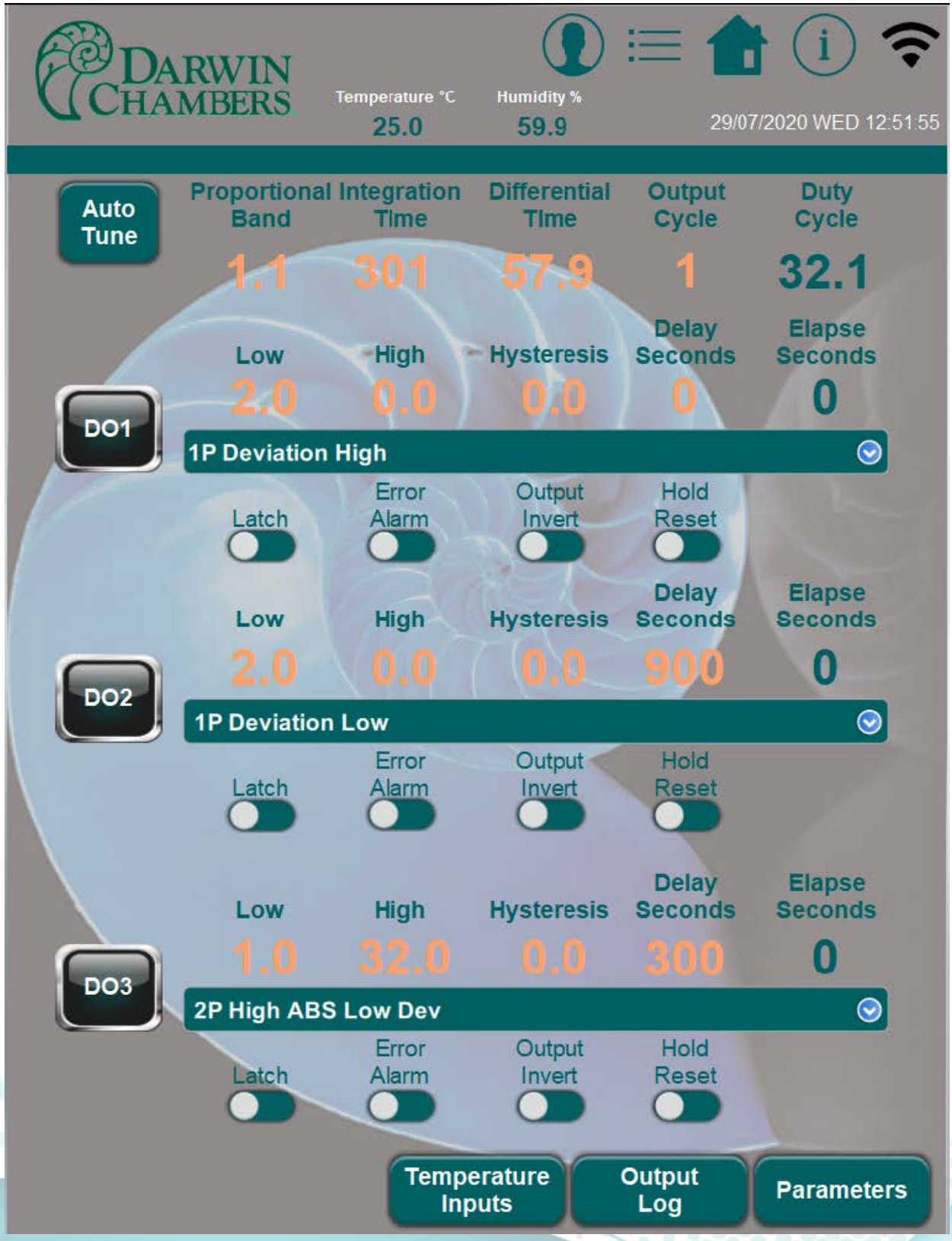

DARWIN CHAMBERS
Temperature °C
25.0
Humidity %
59.9
29/07/2020 WED 12:51:55
Auto Tune
Proportional Band
Integration Time
Differential Time
Output Cycle
Duty Cycle
1.1
301
57.9
1
32.1
DO1
Low
High
Hysteresis
Delay Seconds
Elapse Seconds
2.0
0.0
0.0
0
0
1P Deviation High
Latch
Error Alarm
Output Invert
Hold Reset
DO2
Low
High
Hysteresis
Delay Seconds
Elapse Seconds
2.0
0.0
0.0
900
0
1P Deviation Low
Latch
Error Alarm
Output Invert
Hold Reset
DO3
Low
High
Hysteresis
Delay Seconds
Elapse Seconds
1.0
32.0
0.0
300
0
2P High ABS Low Dev
Latch
Error Alarm
Output Invert
Hold Reset
Temperature Inputs
Output Log
Parameters

Figure 98

Output Log

The output log retains when the output has changed. The data is in a spreadsheet format. First column is the Event message, Trigger time and Trigger date. This is a useful tool to establish if Alarm event occurred disabling the component to cause or be the result of the alarm event. i.e., When the chamber alarms for high temperature, this log can be reviewed to know the chamber was in heat only mode, therefore cooling was disabled. This would mean no mechanical failure. No need for technical assistance.

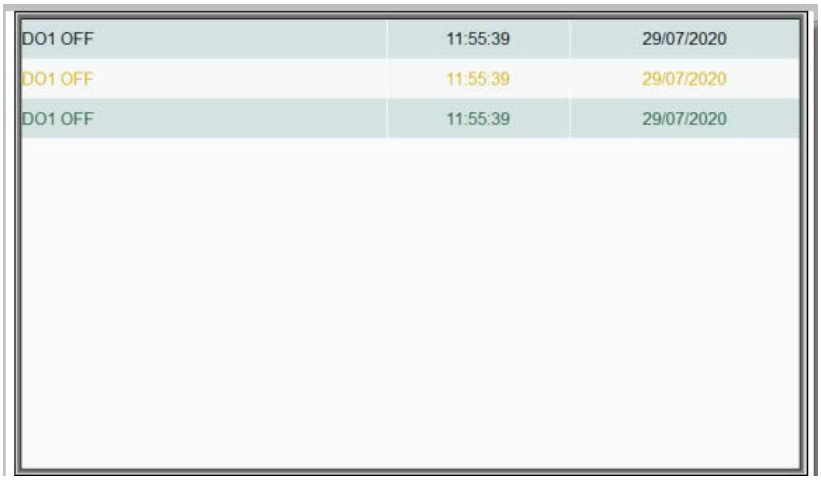


Figure 99

The **Parameter Button** is a masked button reserved for Darwin Administrator.

Temperature Inputs

The temperature input screen is mainly for reference. The control type, Input Type, process and set points can only be adjusted by administrator.

The **calibration input** is used at the lower and upper scale ranges. (-50.0 and 100.0C) Ensures the calibration standard has equal or greater accuracies than the Fuji PXF4 controller. While simulating a low signal use the adjust low for correction. When simulating a high signal use the adjust high for correction. Good calibration practice would be to check a value in the middle. Adjustments should be only made at the lower and upper scale range.

The **PV Offset** is used when mapping a chamber, with multiple sensors arranged throughout the chamber condition space. The average of the temperature sensors could be used as a correction in the Process value to read that average. An example would be 12 temperature sensors show an average of 25.7C when the process value holds at 25.0C. A 0.7 offset can be placed in the process value offset that should now bring the average of the chamber mapping sensors to 25.0C.

PV under range and overrange are indicators for a sensor / scaling failure. Under range the input value is lower than the PV low or not installed / properly terminated. The overrange indicates the input value is higher than the PV high value.

Controller Information is the model, serial number and software version of the controller installed.

 is used to page back to the output screen.

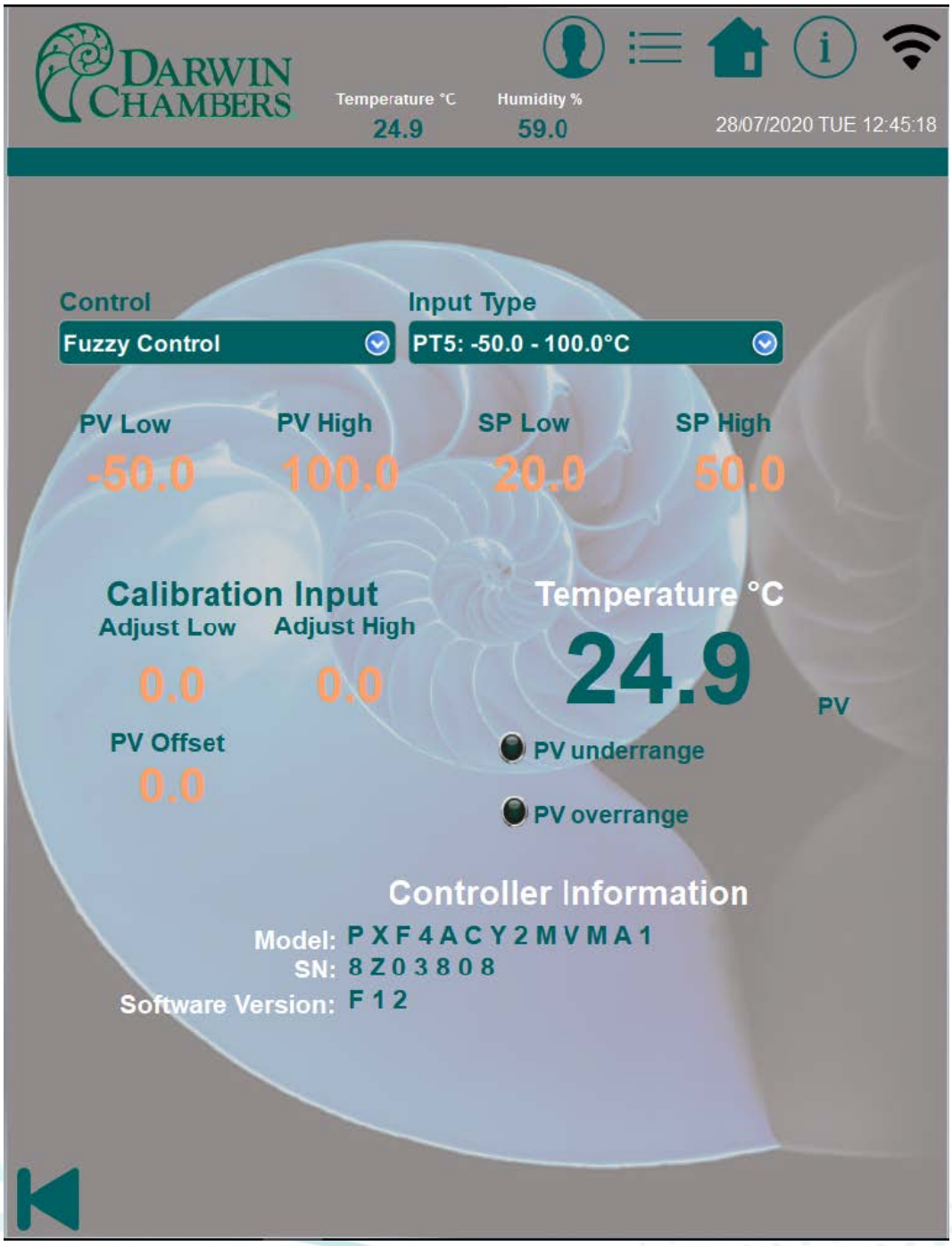


Figure 100

Humidity Outputs

The Humidity output screen shows the control output for the humidifier.

The **Duty Cycle** indicates the % call for output.

The **Proportional Band**, **Integration Time**, and **Differential Time** are all used in algorithm for the process control. To improve chamber performance, it is recommended to use the auto tune feature rather than adjust these values manually. **Auto Tune** should be used at initial setup or whenever a new set point is being set. For ramping and soaking function, it is best to auto tune at a humidity in between the minimum and maximum humidity the chamber will experience.

The **Output Cycle** indicates the amount of time to pass before calculation for demand will be corrected. Humidity output will have a minimum of a 1 second Cycle time.

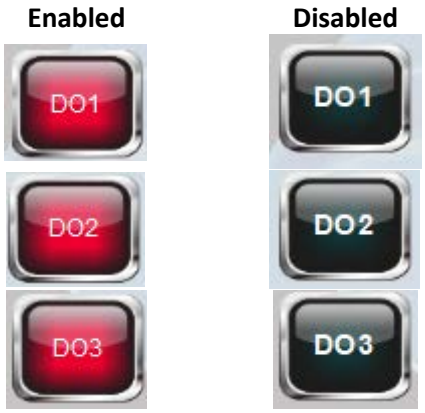


Figure 101

DO1 is the alarm output for high Humidity alarm. This output will enable / disable the humidifier and sound the audible alarm at the chamber.

- **Low** – main setpoint for alarm event (can be a high or low Alarm check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.
- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)
- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.
- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**

- **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
- **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
- **Output Invert –** reverse the output from normally open to normally closed.
- **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

DO2 is the alarm output for low humidity alarm. This output will enable / disable the dehumidifier on the chamber and sound the audible alarm at the chamber.

- **Low** – main setpoint for alarm event (can be a high or low Alarm check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.
- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)
- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.
- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**
  - **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
  - **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
  - **Output Invert –** reverse the output from normally open to normally closed.
  - **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

DO3 enables the dehumidifier output. The dehumidifier can be a dried compress air via Point of use dryer or building supplied dry air, and finally a desiccant wheel dryer. Two different modes of operation can be configured here. First method is recovery mode from an overshoot in humidity. The second is a constant dry air purge. The dryer is kept on to a certain point and the humidifier humidifies against the dry air. This is used when the chamber dew point temperature is below the ambient dew point temperature. See main chamber manual for setup.

- **Low** – main setpoint for alarm event (can be a high or low Alarm check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.
- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)

- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.
- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**
    - **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
    - **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
    - **Output Invert –** reverse the output from normally open to normally closed.
    - **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

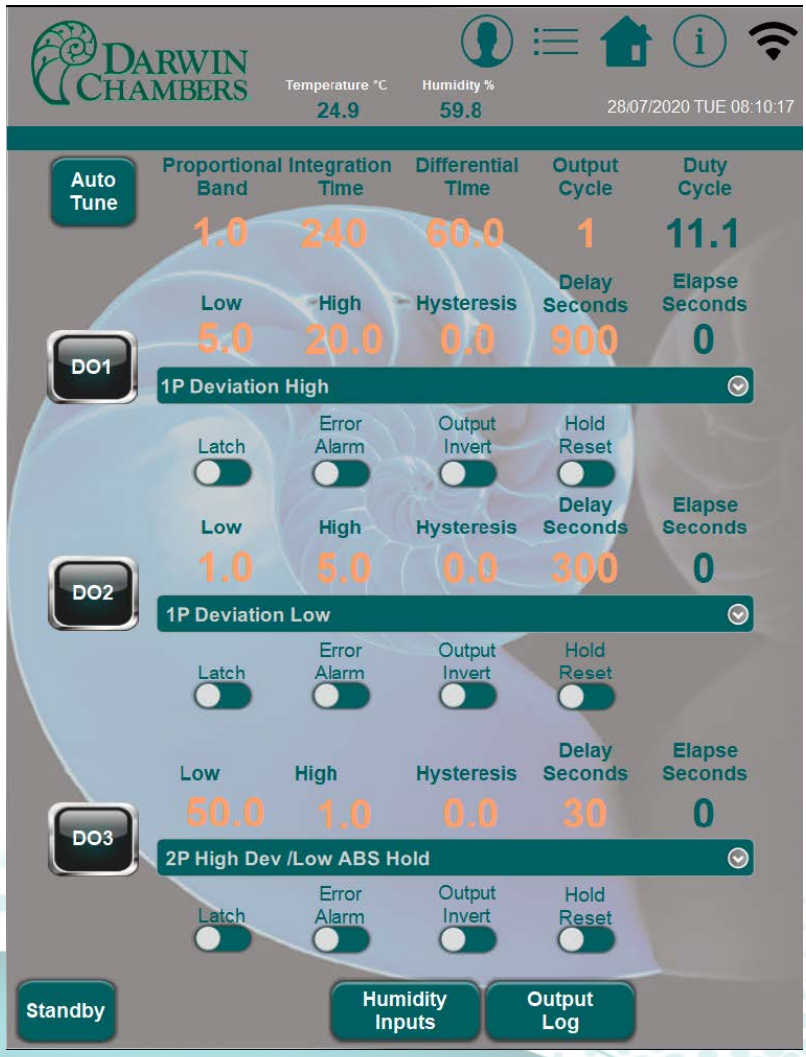


Figure 102

Output Log

The output log retains when the output has changed. The data is in a spreadsheet format. First column is the Event message, Trigger time and Trigger date. This is a useful tool to establish if Alarm event occurred disabling the component to cause or result of the alarm event.

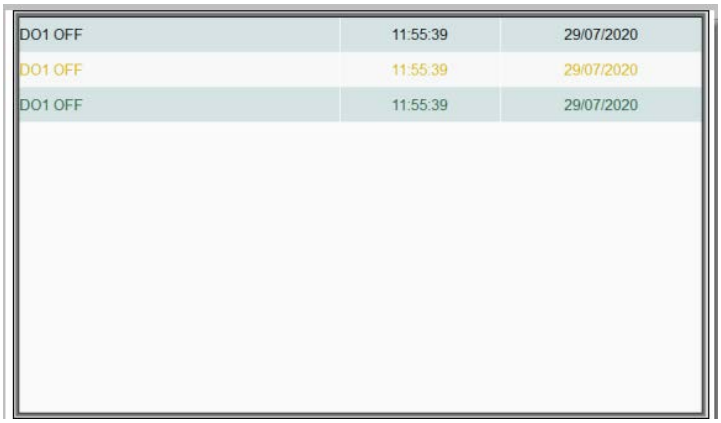


Figure 103

The **Parameter Button** is a masked button reserved for Darwin Administrator.

Humidity Inputs

The Humidity input screen is mainly for reference. The control type, Input Type, process and set points can only be adjusted by Darwin administrator.

The calibration input is used at the lower and upper scale ranges. (0 and 5VDC) Ensure the calibration standard has equal to or has greater accuracies than the Fuji PXF4 controller. While simulating a low signal use the adjust low for correction. When simulating a high signal use the adjust high for correction. Good calibration practice would be to check a value in the middle. Adjustments should be only made at the lower and upper scale range.

The PV Offset is used when mapping a chamber, with multiple sensors arranged throughout the chamber condition space. The average of the Humidity sensors could be used as a correction in the Process value to read that average. An example would be 4 Humidity sensors show an average of 60.7% when the process value holds at 60.0%. A 0.7 offset can be placed in the process value offset that should now bring the average of the chamber mapping sensors to 60.0C.

PV under range and overrange are indicators for a sensor/scaling failure. Under range the input value is lower than the PV low or not installed / properly terminated. The overrange the input value is higher than the PV high value.

Controller Information is the model, serial number and software version of the controller installed.

 is used to page back to the output screen.

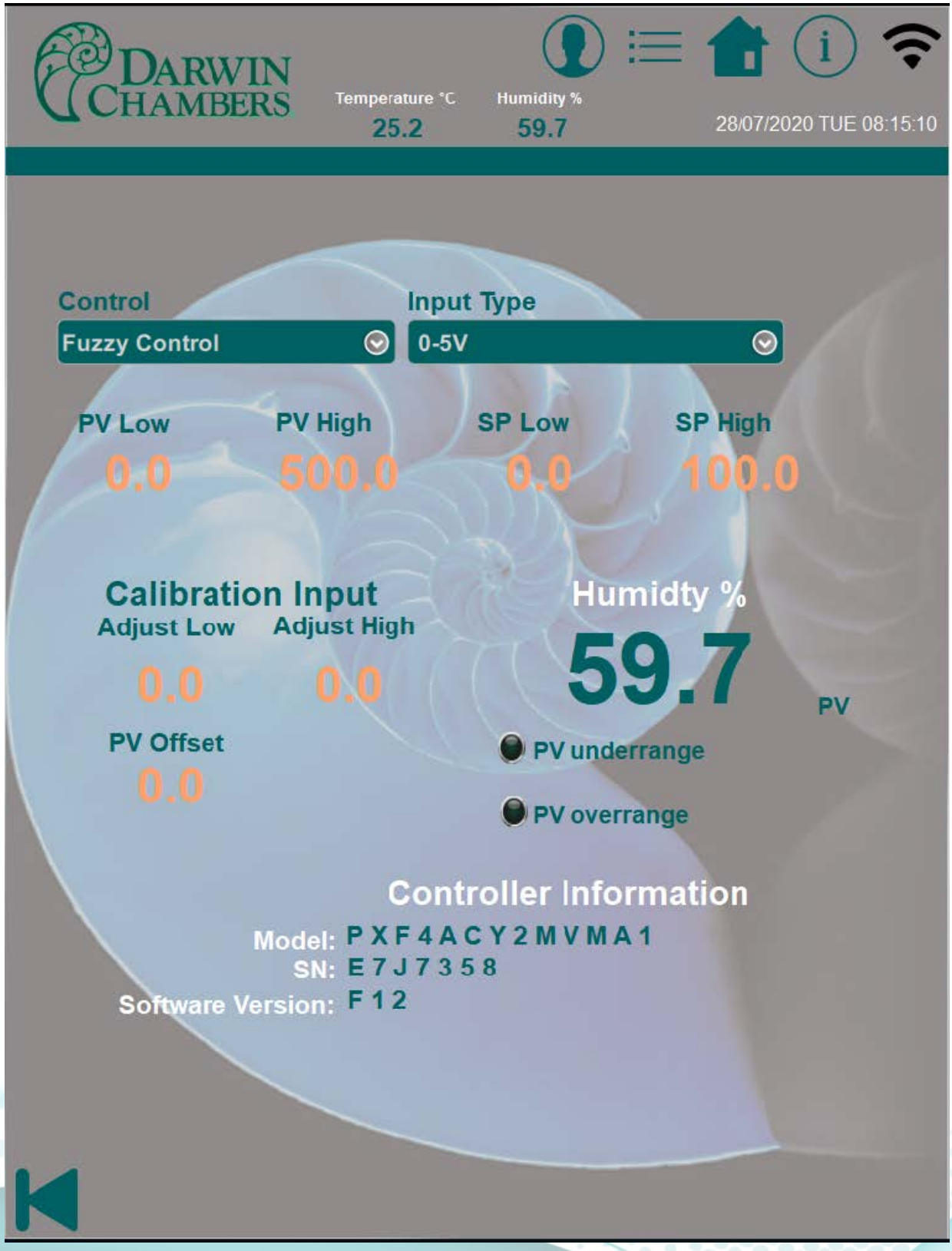

DARWIN CHAMBERS
Temperature °C
25.2
Humidity %
59.7
28/07/2020 TUE 08:15:10
Control
Fuzzy Control
Input Type
0-5V
PV Low
0.0
PV High
500.0
SP Low
0.0
SP High
100.0
Calibration Input
Adjust Low
0.0
Adjust High
0.0
PV Offset
0.0
Humidty %
59.7
PV
PV underrange
PV overrange
Controller Information
Model: P X F 4 A C Y 2 M V M A 1
SN: E 7 J 7 3 5 8
Software Version: F 1 2

Figure 104

Light Outputs

The Light output screen shows the control output for the lights.

The **Duty Cycle** indicates the % call for output.

For Open loop Setup (Standard option.)

Chambers sold without a feedback sensor operate in an open loop. The duty cycle will be the amount of output and used in place of the Process value. The **Proportional Band** value should be set to 100.0, **Integration Time** set to 0.0. and **Differential Time** set to 0.0.

For Closed loop setup (non – standard)

The **Proportional Band**, **Integration Time**, and **Differential Time** are all used in algorithm for the process control when feedback sensor is sold with the chamber. To improve chamber performance, it is recommended to use the auto tune feature rather than adjust these values manually. **Auto Tune** should be used at initial setup.

The **Output Cycle** indicates the amount of time to pass before calculation for demand will be corrected. Light output will have a minimum of a 1 second Cycle time.

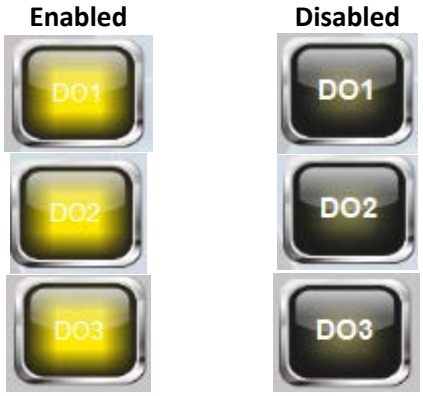


Figure 105

DO1 is the event output for light to be enabled. Some LED drivers or fluorescent light ballast will blink or flicker at low output. DO1 is used to disable the lights to be off. Default setting for this is 5. Therefore, the lights will not be enabled at setpoints below 5.

- **Low** – main setpoint for alarm event (can be a high or low Alarm check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.
- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)
- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.

- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**
    - **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
    - **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
    - **Output Invert –** reverse the output from normally open to normally closed.
    - **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

DO2 is currently not used for lights.

- **Low** – main setpoint for alarm event (can be a high or low Alarm check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.
- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)
- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.
- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**
    - **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
    - **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
    - **Output Invert –** reverse the output from normally open to normally closed.
    - **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

DO3 is currently not used for light output.

- **Low** – main setpoint for alarm event (can be a high or low Alarm check type in drop down text box). For 2P (Two Point) alarms the value is for Low Alarm.
- **High** – is only used when Alarm Type is a 2P (two point) alarm type.
- **Hysteresis**- Used to prevent clearing the alarm at the threshold. i.e. (*If deviation set to 2.0 and hysteresis 1.0 then alarm will stay active until deviation is less than 1. If SP is 25.0, Dev is 2.0 Hyst 1.0 Alarm will clear once value is 26 or less. Leaving at 0.0 alarm clears at 27.0*)

- **Delay Seconds** - The time that has occurred since process has deviated from set point or exceeding an absolute value before activating output.
- **Elapse Seconds** – The time that has occurred since process has deviated from set point or exceeding an absolute value.
- **Drop Down Text box** is used to select Alarm Event type. This can only be changed by a Darwin Administrator User.
- **Dip Switch**
    - **Latch** Turn on to latch Alarm Event. SEL button on fuji controller would need to be used to clear alarm
    - **Error Alarm** can be used when alarm is not configured for Process Alarm. This will trigger output for sensor failure.
    - **Output Invert –** reverse the output from normally open to normally closed.
    - **Hold Reset –** Allows the event to be inhibited until process value is in the window of the alarm from initial startup or set point change. Alarm type selected must have Hold feature. Only Darwin Administrator can change Alarm type.

Lifetime Light in Hours is indicator for how long the lights have been enabled. The amount of time can be adjusted. In a power loss, the active counter will restart from 0 as counter is used in RAM. This prevents the counter from starting where it left off. The accumulated lifetime hours will retain after a power loss. This amount of time should be deducted from the overall time after a power loss. A Seconds counter is used to see where in the count the time on is. This also can be used to deduct from the original time for a more accurate estimate on life of the light in use. (i.e. if 50000 hours is the overall life time of the lights and power loss occurs and the accumulated time is 15234. 50000 – 15234 = 34766. Enter 34,766 as the new lifetime hours.)

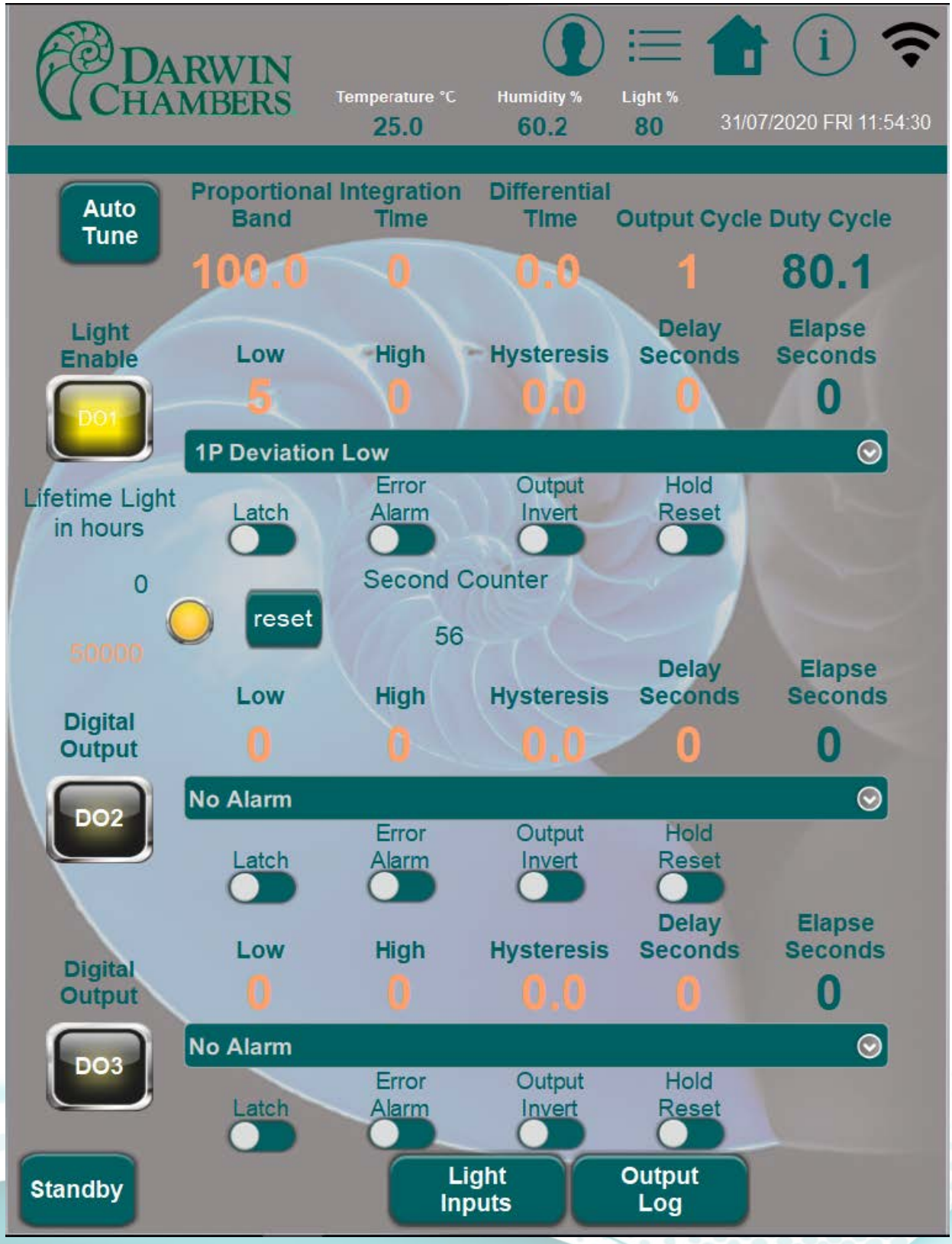

DARWIN CHAMBERS
Temperature °C
25.0
Humidity %
60.2
Light %
80
31/07/2020 FRI 11:54:30
Auto Tune
Proportional Band
100.0
Integration Time
0
Differential Time
0.0
Output Cycle
1
Duty Cycle
80.1
Light Enable
DO1
Low
5
High
0
Hysteresis
0.0
Delay Seconds
0
Elapse Seconds
0
1P Deviation Low
Lifetime Light in hours
0
50000
Latch
Error Alarm
Output Invert
Hold Reset
Second Counter
56
reset
Digital Output
DO2
Low
0
High
0
Hysteresis
0.0
Delay Seconds
0
Elapse Seconds
0
No Alarm
Latch
Error Alarm
Output Invert
Hold Reset
Digital Output
DO3
Low
0
High
0
Hysteresis
0.0
Delay Seconds
0
Elapse Seconds
0
No Alarm
Latch
Error Alarm
Output Invert
Hold Reset
Standby
Light Inputs
Output Log

Figure 106

Light Inputs

The Light input screen is mainly for reference. The control type, Input Type, process and set points can only be adjusted by Darwin administrator.

The calibration input only needs adjusting if using in closed loop control. The calibration input is used at the lower and upper scale ranges. (0 and 5VDC) Ensure the calibration standard has equal to or has greater accuracies than the Fuji PXF4 controller. While simulating a low signal use the adjust low for correction. When simulating a high signal use the adjust high for correction. Good calibration practice would be to check a value in the middle. Adjustments should be only made at the lower and upper scale range.

The PV Offset is used when mapping a chamber. Mapping of the light source is not typically done.

PV under range and overrange are indicators for a sensor/scaling failure. PV Under range means the input value is lower than the PV low or not installed / properly terminated. PV overrange means the input value is higher than the PV high value. For open loop control the input signal is shunted.

Controller Information is the model, serial number and software version of the controller installed.

 is used to page back to the output screen.

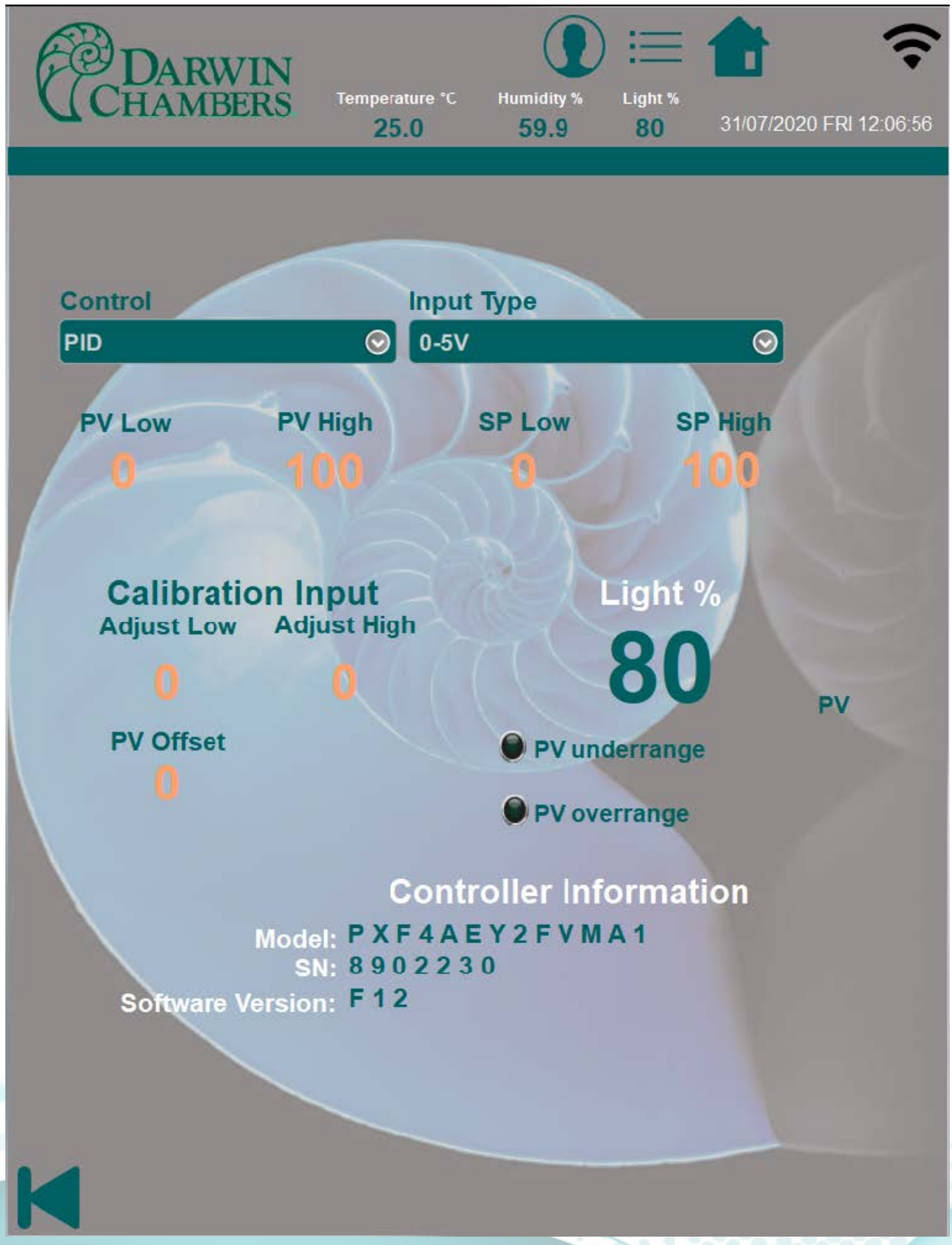

DARWIN CHAMBERS
Temperature °C
25.0
Humidity %
59.9
Light %
80
31/07/2020 FRI 12:06:56
Control
PID
Input Type
0-5V
PV Low
0
PV High
100
SP Low
0
SP High
100
Calibration Input
Adjust Low
0
Adjust High
0
Light %
80
PV
PV Offset
0
PV underrange
PV overrange
Controller Information
Model: P X F 4 A E Y 2 F V M A 1
SN: 8 9 0 2 2 3 0
Software Version: F 1 2

Figure 107

Email

Emails can be sent for transfer of collected data or email alarm alerts. The email screen can be used to setup an email account or assign to an email Group. There are two email groups, A and B. Group A will receive the data files like data log, Audit trail, Alarm history. Group B will get alarm event emails. An email address can be assigned to both groups.

Optional: Check with you email application for filtering emails to a dedicated folder for your chamber.

A Maximum of 256 contacts can be added.

Only two groups. Group A and Group B

UTF-* characters are allowed in contact names.

Use the  button to create a new contact.

Use the button to delete a contact.

Use the drop-down box 

to select the group and assign or remove a user to or from the selected group.

Use the to transfer the selected contact to the selected group.

Use the to remove the selected contact from the selected group.

Figure 108

Failed email light will illuminate when the auto email for log file fails, or when an audit, log, or alarm file is sent manually.

Check failed alarm code when email light is illuminated. Compare the code to the error codes located on the Email code error screen or see Table 26. Check with your network / email administrator for possible solutions to the error.

Code	Cause of Error
0	CSMTP_NO_ERROR
100	WSA_STARTUP = Unable to initialize winsock2
101	WSA_VER = Wrong version of the winsock2
102	WSA_SEND = Function send() failed
103	WSA_RECV = Function recv() failed
104	WSA_CONNECT = Function connect failed
105	WSA_GETHOSTBY_NAME_ADDR = Unable to determine remote server
106	WSA_INVALID_SOCKET = Invalid winsock2 socket
107	WSA_HOSTNAME = Function hostname() failed
108	WSA_IOCTLSOCKET = Function ioctlsocket() failed
109	WSA_SELECT
110	BAD_IPV4_ADDR = Improper IPv4 address
200	UNDEF_MSG_HEADER = Undefined message header
201	UNDEF_MAIL_FROM = Undefined mail sender
202	UNDEF_SUBJECT = Undefined message subject
203	UNDEF_RECIPIENTS = Undefined at least one recipient
204	UNDEF_RECIPIENT_MAIL = Undefined recipient mail
205	UNDEF_LOGIN = Undefined user login
206	UNDEF_PASSWORD = Undefined user password
207	BAD_LOGIN_PASSWORD = Invalid user login or password
208	BAD_DIGEST_RESPONSE = Server returned a bad digest MD5 response
209	BAD_SERVER_NAME = Unable to determine server name for digest MD5 response
300	COMMAND_MAIL_FROM = Server returned error after sending MAIL FROM
301	COMMAND_EHLO = Server returned error after sending EHLO
302	COMMAND_AUTH_PLAIN = Server returned error after sending AUTH PLAIN
303	COMMAND_AUTH_LOGIN = Server returned error after sending AUTH LOGIN
304	COMMAND_AUTH_CRAMMD5 = Server returned error after sending AUTH CRAM-MD5
305	COMMAND_AUTH_DIGESTMD5 = Server returned error after sending AUTH DIGEST-MD5
306	COMMAND_DIGESTMD5 = Server returned error after sending MD5 DIGEST
307	COMMAND_DATA = Server returned error after sending DATA
308	COMMAND_QUIT = Server returned error after sending QUIT
309	COMMAND_RCPT_TO = Server returned error after sending RCPT TO
310	MSG_BODY_ERROR = Error in message body
400	CONNECTION_CLOSED = Server has closed the connection
401	SERVER_NOT_READY = Server is not ready
402	SERVER_NOT_RESPONDING = Server not responding
403	SELECT_TIMEOUT =
404	FILE_NOT_EXIST = File does not exist
405	MSG_TOO_BIG = Message is too big
406	BAD_LOGIN_PASS = Bad login or password
407	UNDEF_XYZ_RESPONSE = Undefined xyz SMTP response
408	LACK_OF_MEMORY = Lack of memory
409	TIME_ERROR = time() error
410	RECVBUF_IS_EMPTY = RecvBuf is empty

Code	Cause of Error
411	SENDBUF_IS_EMPTY = SendBuf is empty
412	OUT_OF_MSG_RANGE = Specified line number is out of message size
413	COMMAND_EHLO_STARTTLS = Server returned error after sending STARTTLS
414	SSL_PROBLEM = SSL problem
415	COMMAND_DATABLOCK = Failed to send data block
416	STARTTLS_NOT_SUPPORTED = The STARTTLS command is not supported by the server
417	LOGIN_NOT_SUPPORTED = AUTH LOGIN is not supported by the server

Table 26

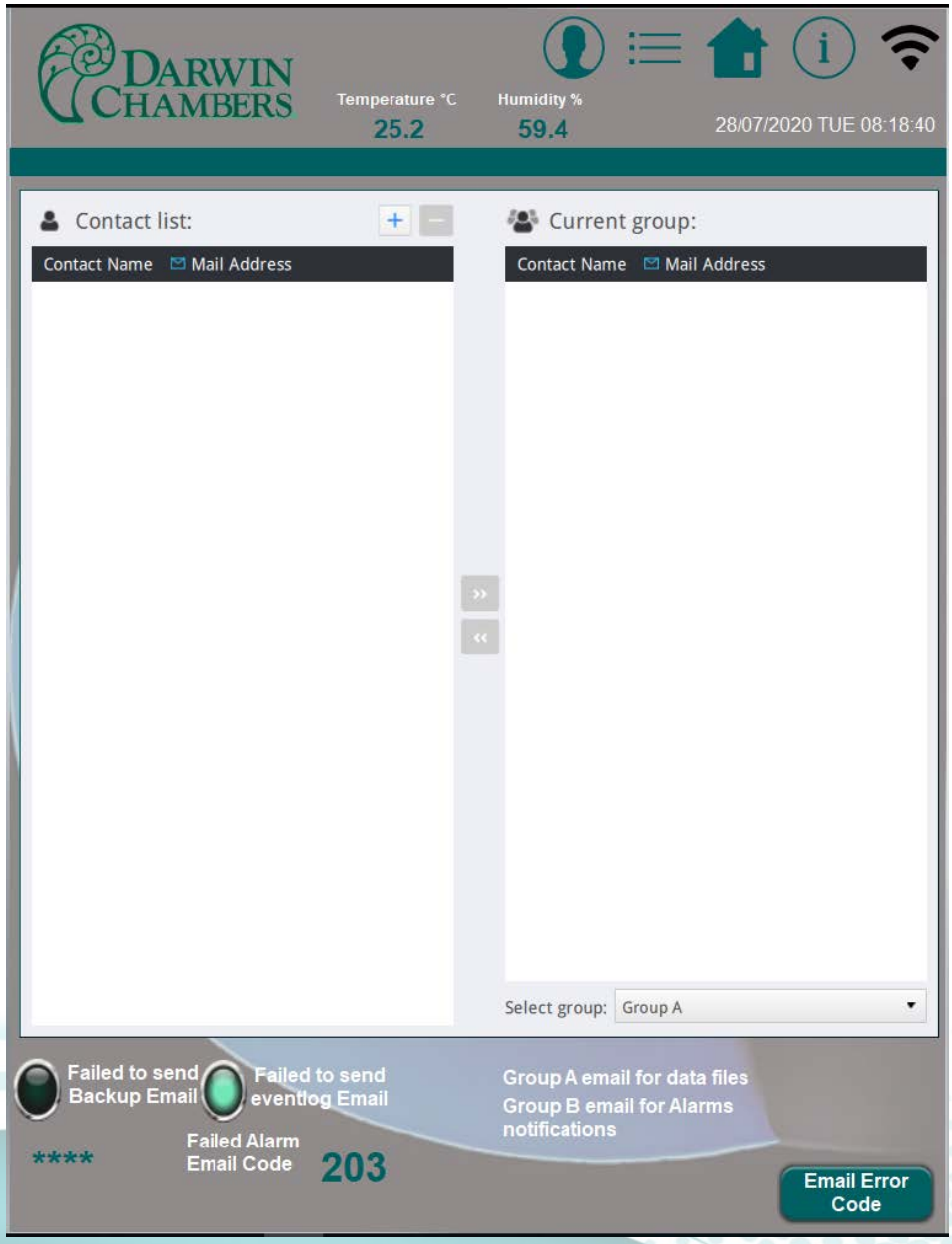


Figure 109

Email can be setup in the browser as well. Login in to the cMT-SVR via a browser. Once logged in select email from the list on the left side. Press Add Contact, a new generic contact name will be added. Select that contact and edit to your new contact information.

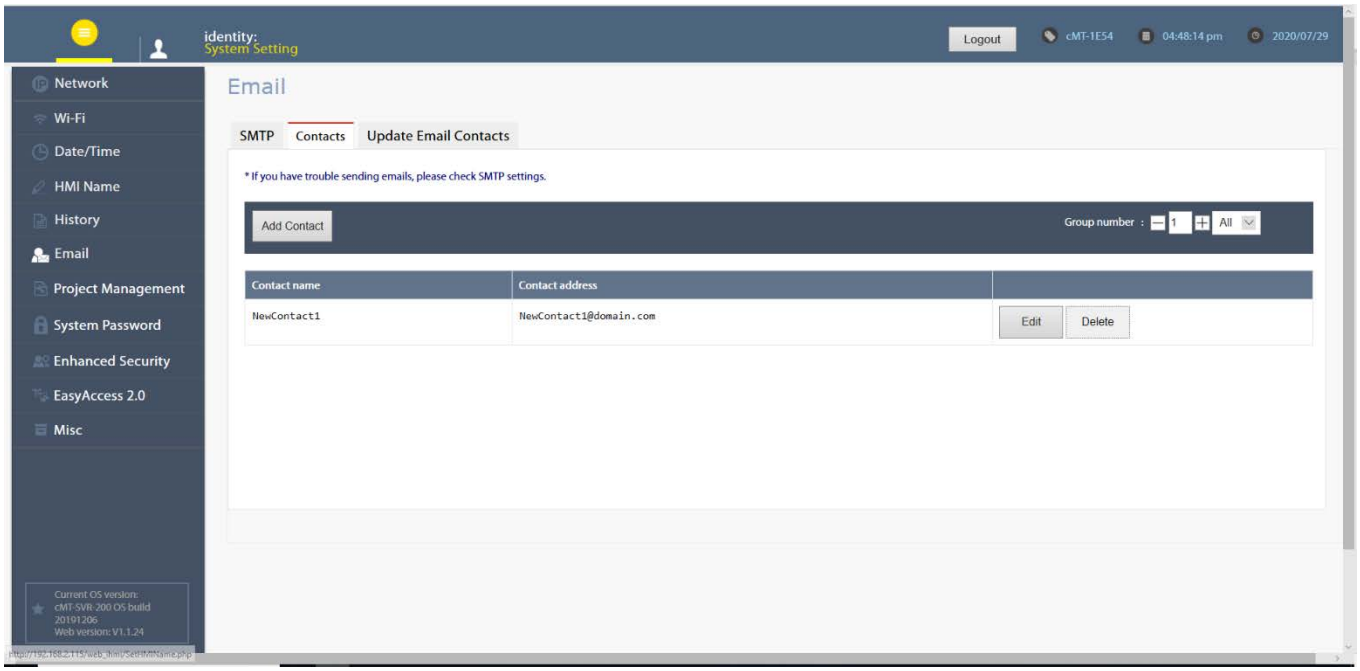


Figure 110

Email Error

The following images show what error codes appear on the HMI. Also see Table 26 for Error codes.

Code	Cause of Error
0	CSMTP_NO_ERROR
100	WSA_STARTUP = Unable to initialise winsock2
101	WSA_VER = Wrong version of the winsock2
102	WSA_SEND = Function send() failed
103	WSA_RECV = Function recv() failed
104	WSA_CONNECT = Function connect failed
105	WSA_GETHOSTBY_NAME_ADDR = Unable to determine remote server
106	WSA_INVALID_SOCKET = Invalid winsock2 socket
107	WSA_HOSTNAME = Function hostname() failed
108	WSA_IOCTLSOCKET = Function ioctlsocket() failed
109	WSA_SELECT
110	BAD_IPV4_ADDR = Improper IPv4 address
200	UNDEF_MSG_HEADER = Undefined message header
201	UNDEF_MAIL_FROM = Undefined mail sender

Figure 111

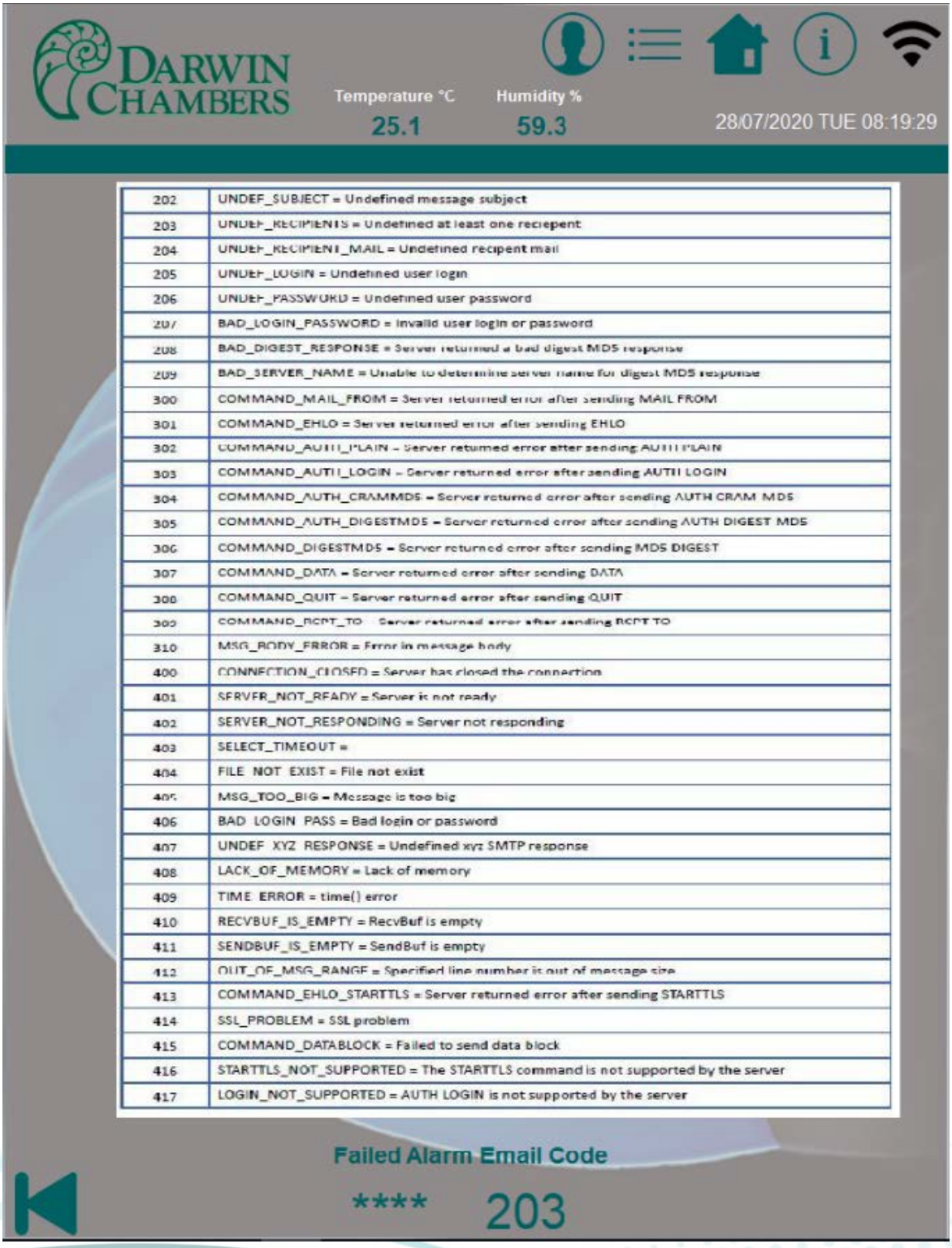

DARWIN CHAMBERS
Temperature °C
25.1
Humidity %
59.3
28/07/2020 TUE 08:19:29
202 UNDEF_SUBJECT = Undefined message subject
203 UNDEF_RECIPIENTS = Undefined at least one reciepent
204 UNDEF_RECIPIENT_MAIL = Undefined recipent mail
205 UNDEF_LOGIN = Undefined user login
206 UNDEF_PASSWORD = Undefined user password
207 BAD_LOGIN_PASSWORD = Invalid user login or password
208 BAD_DIGEST_RESPONSE = Server returned a bad digest MD5 response
209 BAD_SERVER_NAME = Unable to determine server name for digest MD5 response
300 COMMAND_MAIL_FROM = Server returned error after sending MAIL FROM
301 COMMAND_EHLO = Server returned error after sending EHLO
302 COMMAND_AUTH_PLAIN = Server returned error after sending AUTH PLAIN
303 COMMAND_AUTH_LOGIN = Server returned error after sending AUTH LOGIN
304 COMMAND_AUTH_CRAMMD5 = Server returned error after sending AUTH CRAM MD5
305 COMMAND_AUTH_DIGESTMD5 = Server returned error after sending AUTH DIGEST MD5
306 COMMAND_DIGESTMD5 = Server returned error after sending MD5 DIGEST
307 COMMAND_DATA = Server returned error after sending DATA
308 COMMAND_QUIT = Server returned error after sending QUIT
309 COMMAND_RCPT_TO = Server returned error after sending RCPT TO
310 MSG_BODY_ERROR = Error in message body
400 CONNECTION_CLOSED = Server has closed the connection
401 SERVER_NOT_READY = Server is not ready
402 SERVER_NOT_RESPONDING = Server not responding
403 SELECT_TIMEOUT =
404 FILE_NOT_EXIST = File not exist
405 MSG_TOO_BIG = Message is too big
406 BAD_LOGIN_PASS = Bad login or password
407 UNDEF_XYZ_RESPONSE = Undefined xyz SMTP response
408 LACK_OF_MEMORY = Lack of memory
409 TIME_ERROR = time() error
410 RECVBUF_IS_EMPTY = RecvBuf is empty
411 SENDBUF_IS_EMPTY = SendBuf is empty
412 OUT_OF_MSG_RANGE = Specified line number is out of message size
413 COMMAND_EHLO_STARTTLS = Server returned error after sending STARTTLS
414 SSL_PROBLEM = SSL problem
415 COMMAND_DATABLOCK = Failed to send data block
416 STARTTLS_NOT_SUPPORTED = The STARTTLS command is not supported by the server
417 LOGIN_NOT_SUPPORTED = AUTH LOGIN is not supported by the server
Failed Alarm Email Code
**** 203

Figure 112

Communication

The communication screen is mostly for reference for HMI user. For a network system administrator is best to use the browser interface. This screen will also allow the HMI user to give access of the HMI interface to non-personnel to access the chamber interface, without giving them network access by enabling the Access Point (Hot Spot) WI Fi. The need for this could be used for maintenance or service groups. Also, when setting up a network with DHCP disabled, the network administrator can login here or browser preferably to update the network settings.

Default WI FI name (SSID): DCC_WiFi

Default Password: 12345678

It is recommended to rename Wi FI SSID to help segregate chambers when multiple chambers are in the same area. i.e., by serial number.

Note: *If Wi Fi is the only form of network access (no LAN connection), then no emails for alarms or logs can be sent while Hot spot is active.*

Figure 113

Wi Fi and LAN settings will be “grayed out” when DHCP is enabled. Select static to update IP address settings. Consult your network administrator before doing so.

Refresh  will reboot the HMI to update the new network settings. The chamber will continue to run.

Note: *When updating the IP address, the cMT viewer will also need updating by searching for the new address.*


DARWIN CHAMBERS
Temperature °C
25.0
Humidity %
59.5
28/07/2020 TUE 08:20:03
Wi-Fi Setting
Wi-Fi Radio
Off
Connect Status Code
Stopped
Error Code
No Error
SSID
Country Code
US
DHCP
Static
Wi-Fi IP: 000 .000 .000 .000
Mask: 000 .000 .000 .000
Gateway: 000 .000 .000 .000
DNS: 000 .000 .000 .000
Enable/Disable Wi-Fi HotSpot
Wi-Fi HotSpot SSID
MAC: C8 DF 84 70 3C C9
DCC_Wifi
Wi-Fi HotSpot Password
12345678
Refresh Wi-Fi HotSpot Setting
LAN Setting
DHCP
Static
LAN IP: 192 .168 .002 .115
Mask: 255 .255 .255 .000
Gateway: 192 .168 .002 .001
DNS: 192 .168 .002 .212
MAC: 00 0C 26 17 1E 54
Refresh LAN Setting

Figure 114

24 Hour Ramp Soak Screen

The 24-hour ramp soak program has 24 steps, one for each hour. Each step is ramp and soak. Time is in minutes and seconds and can only be entered for ramp time. The soak time is automatically calculated for that hour / step. When the program is initiated the Loop controller will calculate from current process value to the set point set in that first step to start ramp or soak time, if the ramp time is set to 0. Time of day start and end the program is available. This way the user does not need to be there to initiate the program. The end of day program can be used to stop the program, and have program start again the next day. The over run-in time can be due to the Guarantee soak time being enabled, or the accuracy of the internal clock counter on the controller.

The **Loaded Program Number** is the program currently loaded in the loop controller.

The **Program off, run, hold** button along with the **status** and **timing** indicator can appear at bottom of the screen. Pressing the program button from off to run will start current loaded program. Pressing button again from run to hold will pause the program. Then finally pressing the program button from Hold to off will stop the program. The ramp / soak operation indicators when enabled on main screen will also appear on the monitor mode screen. The button cannot be manipulated in the monitor mode screen.

The **status** indicator reveals what stage the program is at currently.

The **Timing** indicator indicates when the time-of-day start is enabled.

Show on the home screen will have the **Program Button**, **Status**, and **Timing indicator** display on the home screen and monitor mode screen. This is for easy access to start a program or see the status of the program and to know the time of day is enabled.

The **Setting Calendar icon**  opens the time of day (Figure 124) pop up window.

The **Step buttons 1 -24** are to quickly navigate to the step for that hour (not time of day). When using multiple loops on the chamber the other loop for the same step / hour will be available to edit.

Program Count: gives the amount of saved or stored programs

Program Number: Gives the index number for the program along with editable name for that program. The name can have up to 10 characters. The name can be shared over multiple programs and the index number used to segregate program with same name.

UP / Down Arrows  **:** used to scroll through the list of saved programs. This will increment or decrement the program Number and name until list end.

Data Base icon  **:** used to open pop up window of all programs (24 Hour and 16 Step) see Figure 126 for preview. Program can also be selected here as well. Scrolling up, down left and right is permitted to see full program.

Program Result: is status indicator to know the program has loaded for editing successfully or if any other errors.

- Command successfully executed
- The selected record does not exist
- Unknown command error
- Record reach limit (10000), no new records can be added.

Add File  **:** used to create a new file. (Previous name will carry over, be sure to update by clicking name. Press the update icon to save.)

Delete File  **:** Delete the current selected file.

Update File  **:** Update current selected file in database.

Upload File  **:** Upload the data base file to the loop controller. Status bar will appear below icon. Once progress bar disappears from the screen program is loaded. If progress bar turns red review program and try to upload again. When program button is pressed this program will run.

Progress Bar:  **:** Progress bar will appear when selected program is being uploaded. When bar vanishes, programming is complete. If progress bar turns red communication error occurred. This could be due to parameter value out of scale or other error.

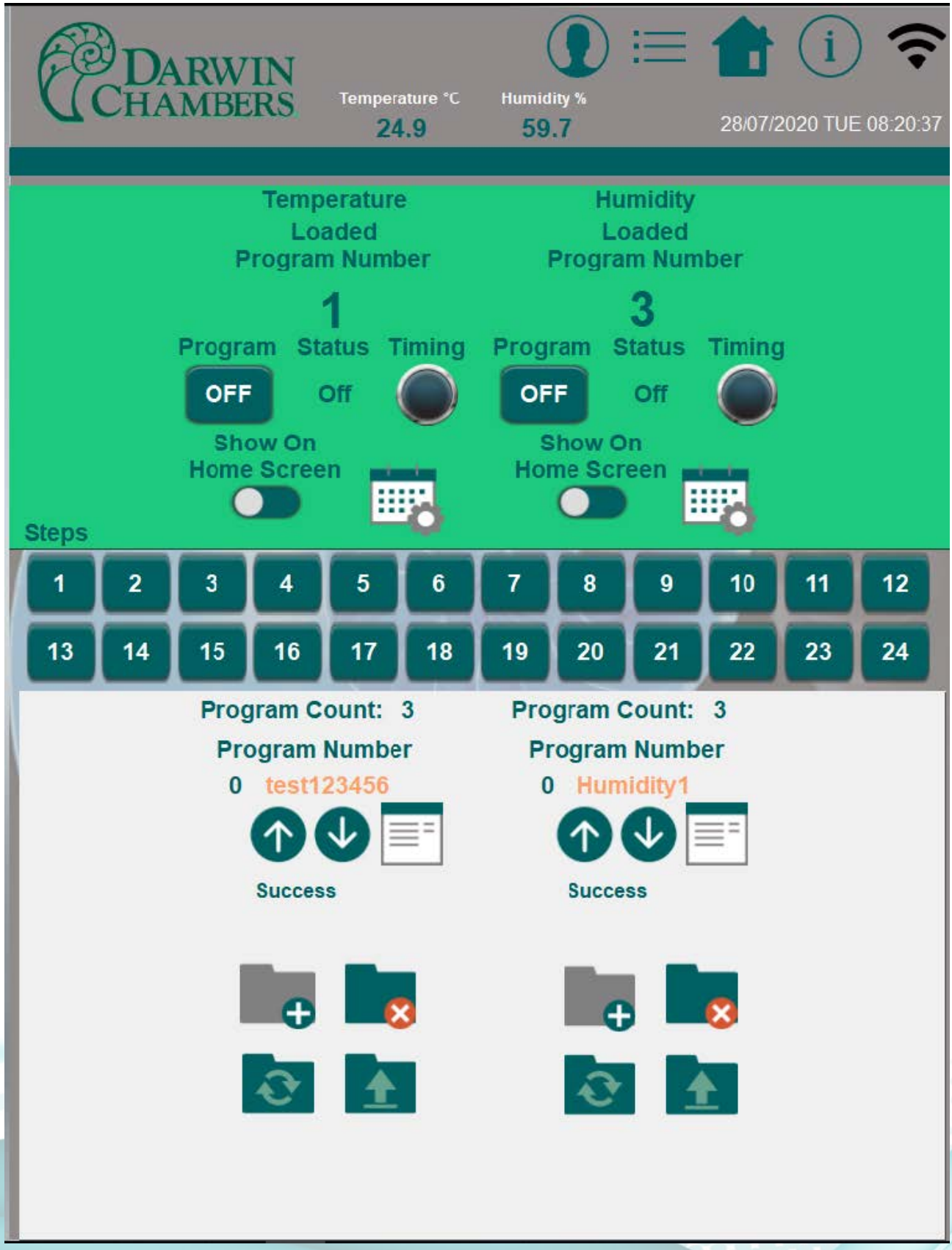

DARWIN CHAMBERS
Temperature °C
24.9
Humidity %
59.7
28/07/2020 TUE 08:20:37
Temperature
Loaded
Program Number
1
Humidity
Loaded
Program Number
3
Program
Status
Timing
OFF
Off
Program
Status
Timing
OFF
Off
Show On
Home Screen
Show On
Home Screen
Steps
1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17 18 19 20 21 22 23 24
Program Count: 3
Program Number
0 test123456
Success
Program Count: 3
Program Number
0 Humidity1
Success

Figure 115

Edit Step in 24 Step

The edit step window appears in bottom of the Ramp / Soak screen for either 24 hour or 16 step programs.

Select the set point and enter the new desired set point.

Select either the minute or second time to edit. The soak time will automatically calculate for the step to equal one hour. Entering 0 in both minute and second will be a soak only, for one hour.

Press the update button for that loop to save the new setting. If upload to is pressed before updating, the wrong parameters will be entered.

Use page back arrow  for previous step or back to main ramp soak screen.

Use page forward arrow  for next step in series or return to main ramp soak screen when reached the last step.

Use the exit  to return to the main ramp soak screen.

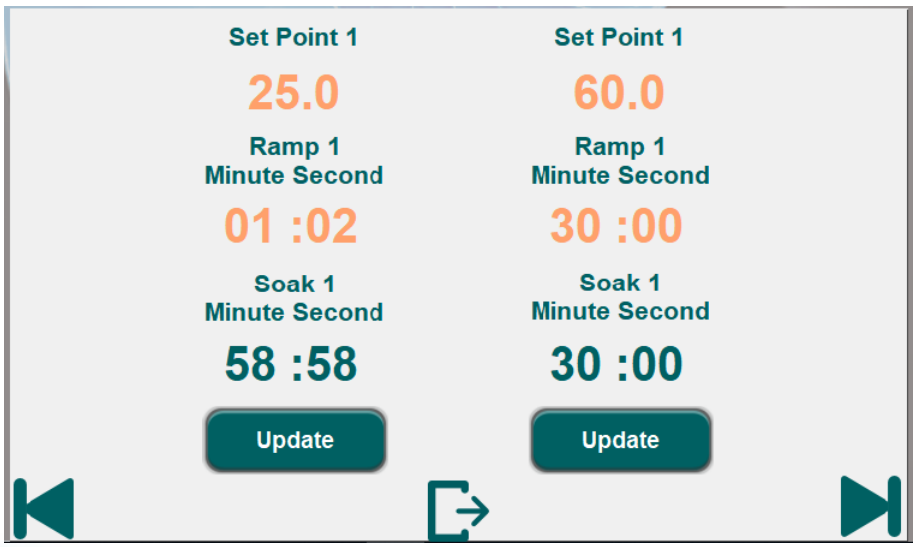


Figure 116

16 Step Ramp / Soak Screen

The 16-step ramp soak program has 16 steps. Each step is ramp and soak. Time is in hours and minutes. When the program is initiated the Loop controller will calculate from current process value to the set point set in that first step to start ramp or soak time, if the ramp time is set to 0. Time of day start and end the program is available.

This way the user does not need to be there to initiate the program. The end of day program can be used to stop the program and, have program start again the next day. The overrun in time can be due to the Guarantee soak time being enabled, or accuracy of the internal clock counter on the controller. Entering the ramp time and soak time to 0 will cause that step to be skipped. Make sure all steps are filled out. This is to prevent a value from previous program not being updated.

The **Loaded Program Number** is the program currently loaded in the loop controller.

The **Program off, run, hold** button along with the **status** and **timing** indicator can appear at bottom of the screen. Pressing the program button from off to run will start current loaded program. Pressing button again from run to hold will pause the program. Then finally pressing the program button from Hold to off will stop the program. The ramp / soak operation indicators when enabled on main screen will also appear on the monitor mode screen. The button cannot be manipulated in the monitor mode screen.

The **Status** indicator reveals what stage the program is at currently

The **Timing** indicator indicates when the time-of-day start is enabled.

Show on the home screen will have the **Program Button**, **Status**, and **Timing indicator** display on the home screen and monitor mode screen. This is for easy access to start a program or see the status of the program and to know the time of day is enabled.

The **Setting Calendar icon**  opens the time of day (Figure 124) pop up window.

The **Step buttons 1 -16** are to quickly navigate to the step. When using multiple loops on the chamber the other loop for the same step will be available to edit.

Program Count: gives the amount of saved or stored programs

Program Number: Gives the index number for the program along with editable name for that program. The name can have up to 10 characters. The name can be shared over multiple programs and the index number used to segregate program with same name.

UP / Down Arrows  **:** used to scroll through the list of saved programs. This will increment or decrement the program Number and name until list end.

Data Base icon  **:** used to open pop up window of all programs (24 Hour and 16 Step) see Figure 126 for preview. Program can also be selected here as well. Scrolling up, down left and right is permitted to see full program.

Program Result: is status indicator to know the program has loaded for editing successfully, or any other errors.

- Command successfully executed
- The selected record does not exist
- Unknown command error
- Record reach limit (10000), no new records can be added.

Add File  **:** used to create a new file. (Previous name will carry over so be sure to update by clicking name. Press the update icon to save.)

Delete File  **:** Delete the current selected file.

Update File  **:** Update current selected file in database.

Upload File  **:** Upload the data base file to the loop controller. Status bar will appear below icon. Once progress bar disappears from the screen program is loaded. If progress bar turns red, review program and try to upload again. When program button is pressed this program will run.

Progress Bar:  **:** Progress bar will appear when selected program is being uploaded. When bar vanishes, programming is complete. If progress bar turns red communication error occurred. This could be due to parameter value out of scale or other error.

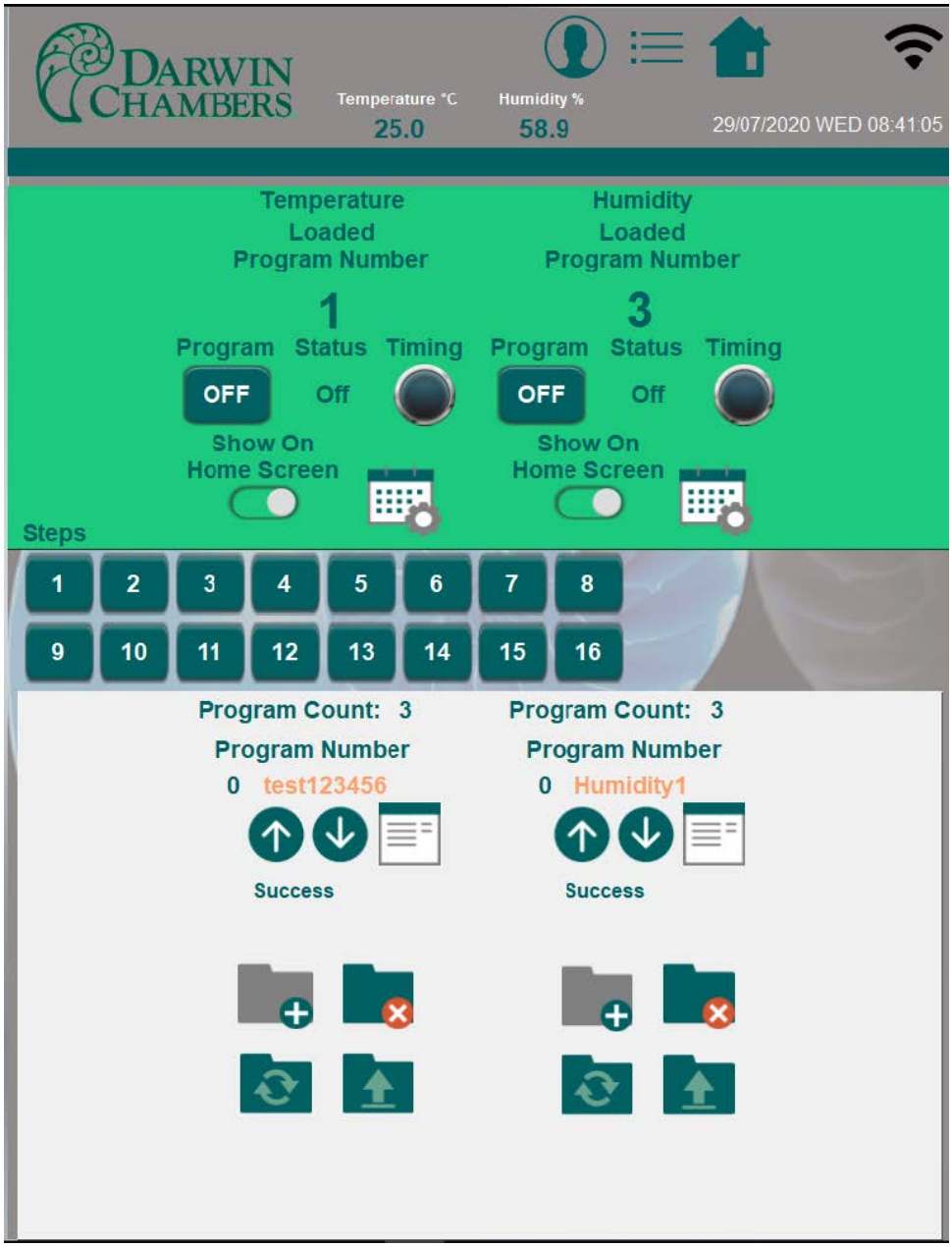


Figure 117

Edit Step

The edit step window appears in bottom of the Ramp / Soak screen for either 24 hour or 16 step programs.

Select the set point and enter the new desired set point.

Select either the Hour or minute time to edit. Enter 0 in the times will skip that step.

Press the update button for that loop to save the new setting. If upload to is pressed before updating, the wrong parameters will be entered.

Use page back arrow  for previous step or back to main ramp soak screen.

Use page forward arrow  for next step in series or return to main ramp soak screen when reached the last step.

Use the exit  to return to the main ramp soak screen.

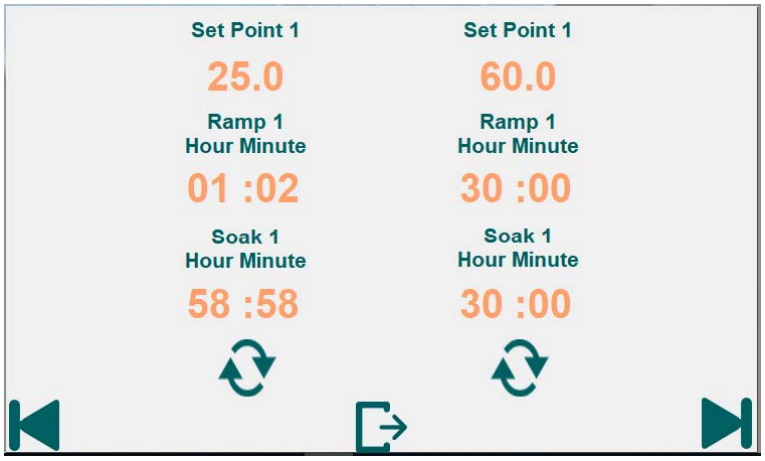


Figure 118

Time of Day Start / End

The time-of-day pop window allows for time of day start and many more ramp soak options. Time of day start will work on the 24 Hour or 16 Step program. Will enable or disable the current loaded program.

Power on Start: Allows for the program to startup when the chamber loop controller is powered on with the current PV.

Ending Output: Maintains the same state as at the end of ramp/soak when ramp/soak is complete. (Maintain Control or Standby)

Off output: Switches to the OFF state when ramp/soak is complete. (Maintain Control or Standby)

Repeat: Will repeat the current loaded program. This uses the internal time counter of the loop controller. This may cause the program to drift from the real time clock. This could mean day one the program started at 7AM.

But loop controller clock has a 5 second daily error. This would have the program starting a minute after 7am when program has repeated for 12 days continuous.

Restore Mode: This tells the loop controller what to do in the event the loop controller loses power while a ramp soak program is running.

- **Restart** Starts the Ramp/Soak from the first step again
- **Restore** Does not operate ramp soak.
- **Continue** Resumes the operation from the status of the time which power is turned off. (It can restore the state to five minutes before maximum.)

Guarantee Soak: This function guarantees the soak time. Soak time is counted down only when PV is in the range window of Lower and upper limit.

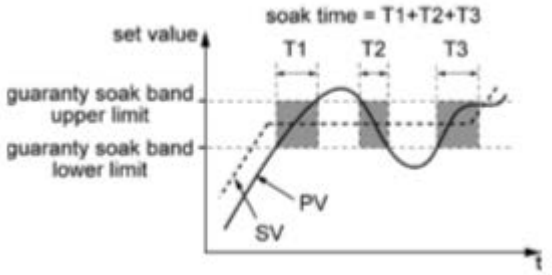


Figure 119

Setting Range:

Figure 120

Use the radio buttons to enable Time of day start, Enable termination Action, and Setting on individual day.

Time of Day Start: Must be the last step when entering a time-of-day start. If Start or End time or day selection edited after Time of day Start button is enabled the change will not take effect.

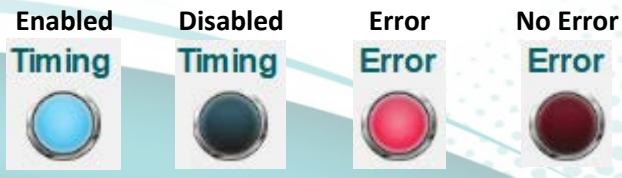


Table 27

Enable Termination Action: This will end the ramp soak program. This can be used to help repeat a 24-hour ramp soak program starting the same time every day, rather than use the repeat function above. This can be used to end program, then a second or two later start programs again. Use with Setting on individual day.

Setting on Individual day: The same start time and end time can be assigned to different days of the week.

Figure 121

To Temp and **From Temp** copies or transfers the Start and End times from Humidity or to Humidity. This helps to reduce repeated data entry. Time of day start must still be selected to enable, however.

Figure 122

To Hum and **From Hum** copies or transfers the Start and End times from Temperature or to Temperature. This helps to reduce repeated data entry. Time of day start must still be selected to enable, however.

Figure 123

Start Time: Enter the time in 24-hour format. For instance, times in the afternoon add 12 to the 12-hour format. For 2PM 12 + 2 for 14 for the hour. Midnight would be hour 0 (zero).

End Time: Enter the time in 24-hour format. For instance, times in the afternoon add 12 to the 12-hour format. For 2PM 12 + 2 for 14 for the hour. Midnight would be hour 0 (zero).

Use the day radio buttons for the days you want the program to start or end.

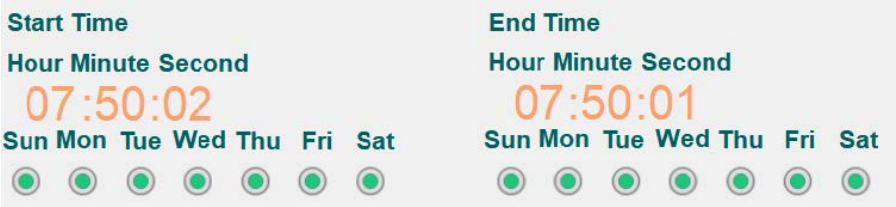


Figure 124

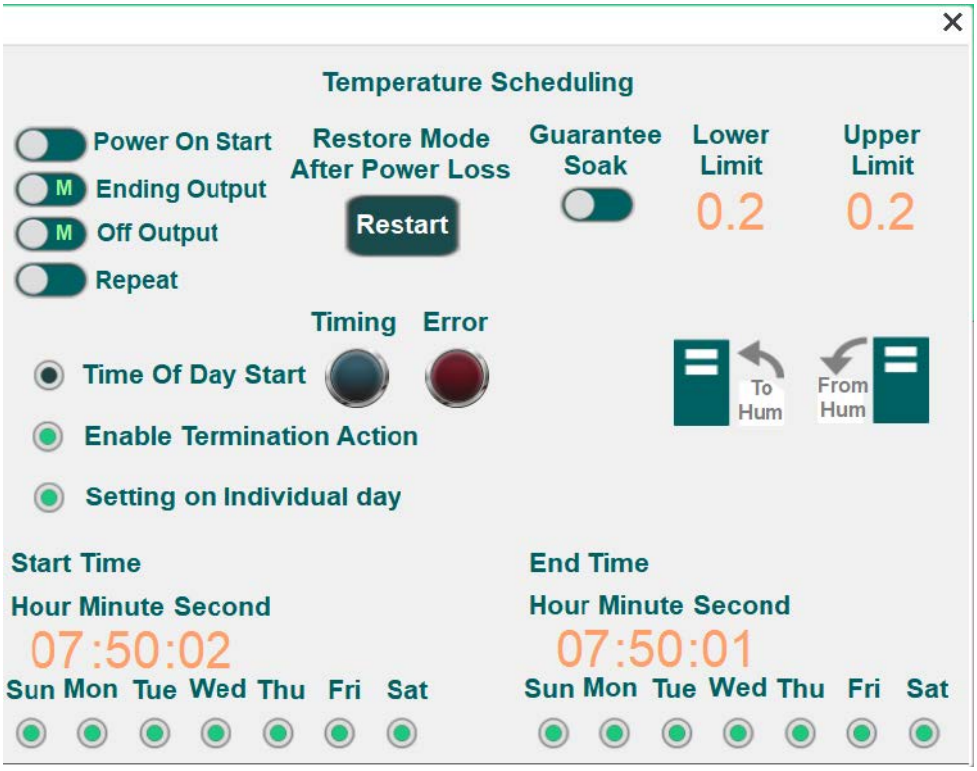


Figure 125

Preview or select program

Use the database icon  to open window to show all stored programs for that loop. Programs can be selected by clicking on that row. Ability to search left, right, up, and down. Database is shared between the 16-Step and 24-hour step program. Make sure proper program is selected for the correct step program to run.

Humidity						
Name	SetPoint1	RampMin1	RampSec1	SoakMin1	SoakSec1	SetPoint2
Humidity2	25.0	1	2	3	4	26.0
Humidity1	25.0	1	2	3	4	26.0
Humidity1	25.0	1	2	3	4	26.0

Figure 126

FTP Viewing:

Apart from saving the history data from an HMI to your PC by using SD card, USB disk, the FTP Server can also do the backup. The FTP Server can be used to backup or update the history data and the recipe data, but not able to delete those data. Please disconnect from FTP before removing an SD card or USB disk, otherwise these external devices may not work when inserted next time.

Optional: Check with your computer operating system about setting up a FTP site as a map Network Drive for convenience.

Steps to log in FTP Server

1. Before logging into FTP Server, please check the HMI IP address. Open an explorer window as shown below.

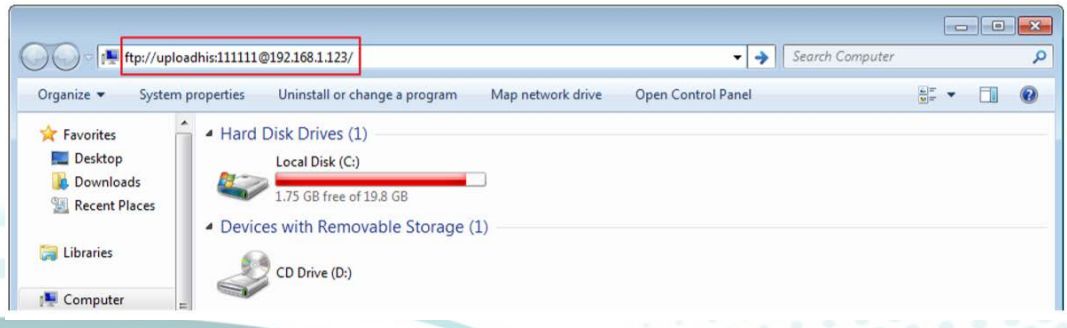


Figure 127

2. On PC, enter the HMI IP address: ftp://192.168.1.123/ (example), then log in by the username: uploadhis, and enter the HMI [history upload password] (if not changed, the default password is 111111). Or directly enter ftp://uploadhis:111111@192.168.1.123/
3. After entering the IP address, the ftp address: ftp://192.168.1.123 and its folders are shown as below:

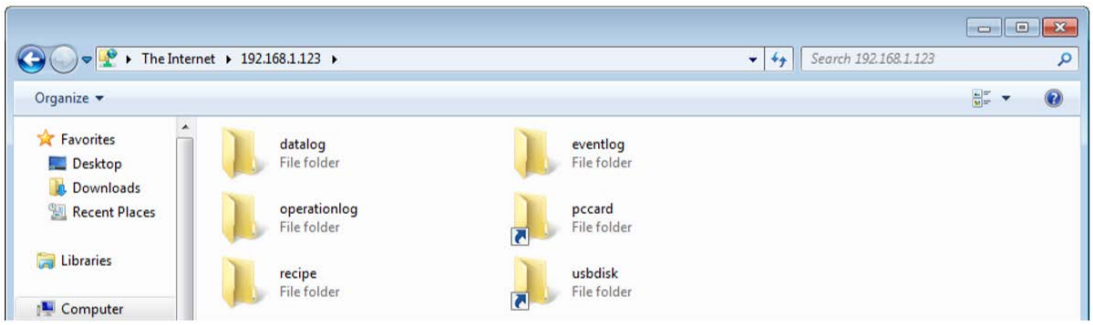


Figure 128

Backup History Data and Update Recipe Data (Ramp/Soak)

- Steps to backup Data Sampling records
  - Click “datalog” folder to view the files
  - Click the file to check the records.
  - Copy and Paste the needed files to your PC.

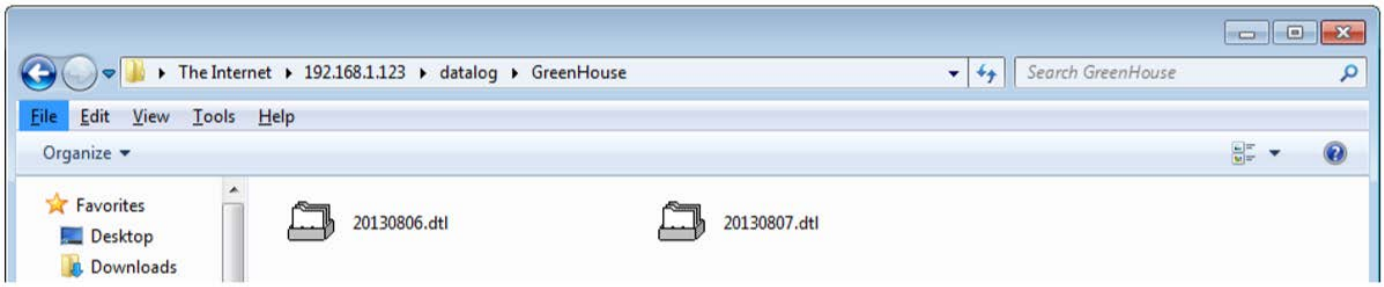


Figure 129

- Steps to backup Event (Alarm) Log records
  - Click “Eventlog” folder to view the files.
  - Copy and Paste the needed files to your PC.

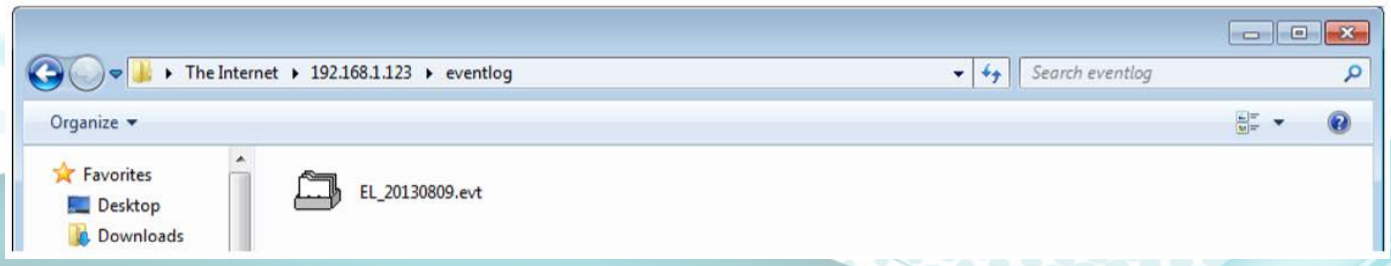


Figure 130

- Steps to backup or update Recipe (Ramp/ Soak) records
  - Click “recipe” folder to view the files.
  - Copy and Paste the needed files to your PC

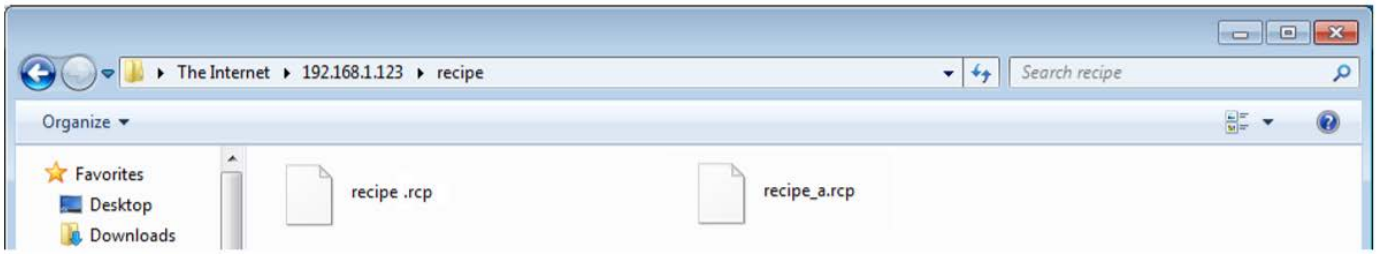


Figure 131

Note: *Since the Recipe data is automatically saved per minute, after updating “recipe.rcp” or “recipe_a.rcp”, the HMI must be rebooted within one minute or the saving will be failed*.

Easy Access 2.0

EasyAccess 2.0 is Remotely monitor and control your Chamber.

Overview

Traditionally, accessing a remote HMI is a convoluted job. Security concerns and tricky network parameters setup makes it difficult for many HMI users. And even with proper setup, access is still quite limited, allowing connection to only one HMI within the remote network. However, with EasyAccess 2.0, this has all changed.

EasyAccess 2.0 provides a new way for accessing an HMI from anywhere in the world. With EasyAccess 2.0, it becomes very easy to monitor and troubleshoot HMI and PLC that are at a remote location if Internet connection is available. As EasyAccess 2.0 already takes care of network settings and addresses security issues, the user can connect easily to the HMIs as if they were on the local network. Moreover, it is possible to have access multiple HMIs within a network.

EasyAccess is also a remote supporting service. Consider the case in which a chamber has a cMT Server HMI installed, and the chamber is nonlocal or even overseas to Darwin Chambers or the end user. The local user is reporting a problem, which may or may not require inspection by an engineer. Darwin Chambers or your maintenance department can remotely connect to the HMI through EasyAccess 2.0 to investigate the problem. The Chamber needs no extra network configuration, just Internet connection. In addition, Darwin Chambers can also update the HMI project, or even update the Fuji Controller program.

Features

- Secure connections
- Little PC setup required; no router setup required
- User friendly administrator and client UI
- Supports pass-through and proxy server
- Mobile support

System Requirement

- PC Operation System: Windows® XP (Last support version: EasyAccess 2.0 version 2.9.15), Windows® 7 (32 / 64bit), Windows® 8 (32 / 64bit), Windows® 10 (32 / 64bit) (Require Administrator privilege)
- Weintek HMI with EasyAccess 2.0 feature activated (Eligible with all Darwin Chambers sold HMI models)
- Internet Connection
- iPad: iOS® 7.0 or above
- AndroidTM: V4.1.2 or above

Specifications

Restrictions	Description
Data Rate and Usage Limit # of Domain an HMI can be registered in	Data rate at 100 kB/s for the first 1GB and 5 kB/s after. Usage count restarts on the 1st day of each calendar month.
# of Domain an HMI can be registered in 1	1
# of users an HMI can be connected by at a time	3. See “Occupied” status in Appendix.
# of HMI a user can connect to at a time 3	3 (Mobile) / 10 (PC)
Service Port	HTTPS port (443)
Ethernet-Ethernet Pass-through	6 IP

Table 28

Getting Started

To get started, follow the steps below:

1. Install EasyAccess 2.0 on PC/Android/iOS (see below)
2. The HMI must be activated. See Activate an HMI, or PC Activator
3. The HMI must be registered in a Domain. See **Add an HMI to a Domain**
4. The user must have a user account which is associated with an HMI. See Manage the Domain
5. EasyAccess 2.0 must be installed.

Installation

1. Download the setup.exe file from EasyAccess 2.0 homepage and open it. Select the language for the installation process, and then click [Next]. If there is a previous version of EasyAccess 2.0 on the PC, please remove it before installation

Figure 132

2. Select a folder for EasyAccess 2.0 installation or use the default folder. Click [Next].

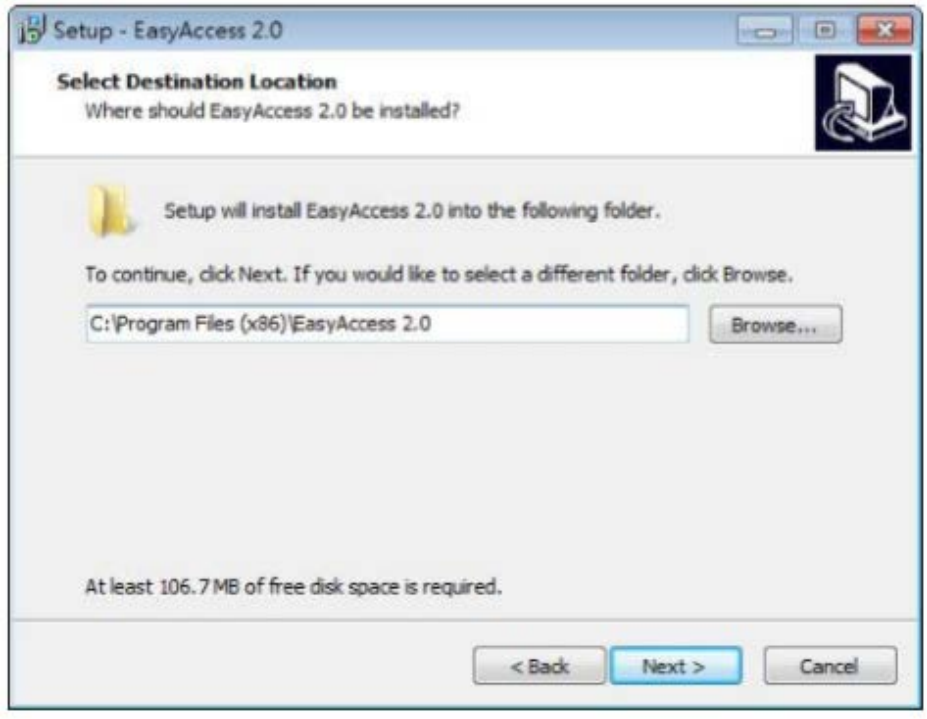


Figure 133

3. Select a start menu folder or use the default folder. Click [Next].

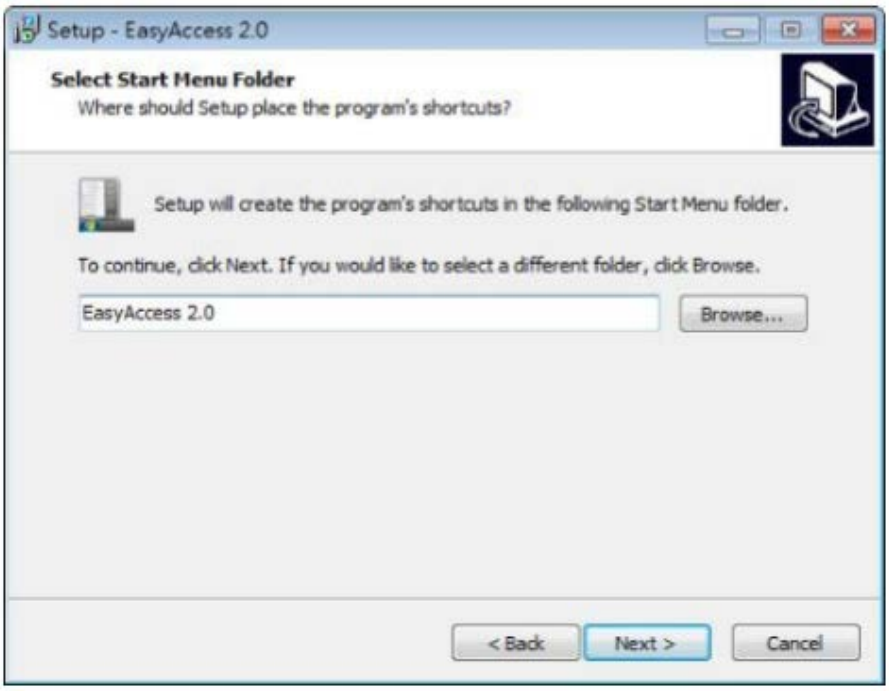


Figure 134

4. Select additional tasks, for example: [Create a desktop icon]. Click [Next].

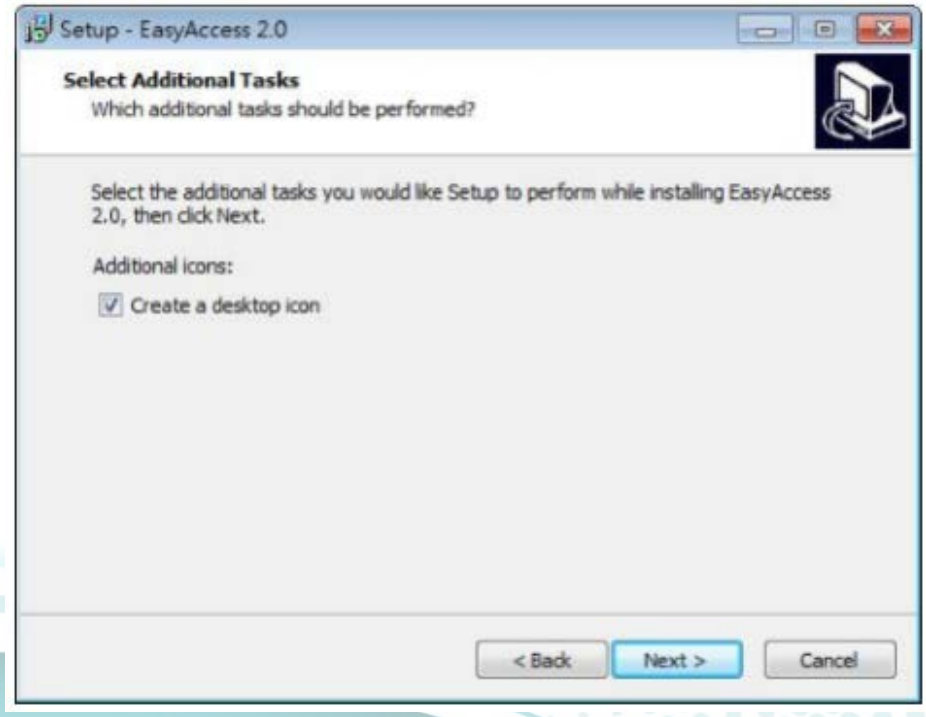


Figure 135

5. Confirm all setting. To change the setting, click [Back]. To start installation, click [Install].

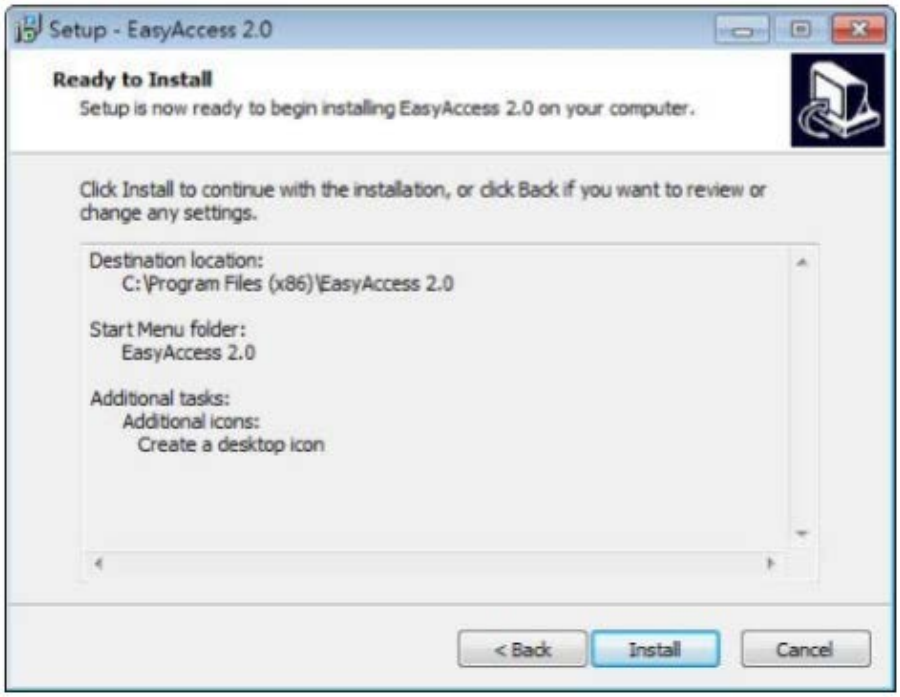


Figure 136

6. Installation progress.

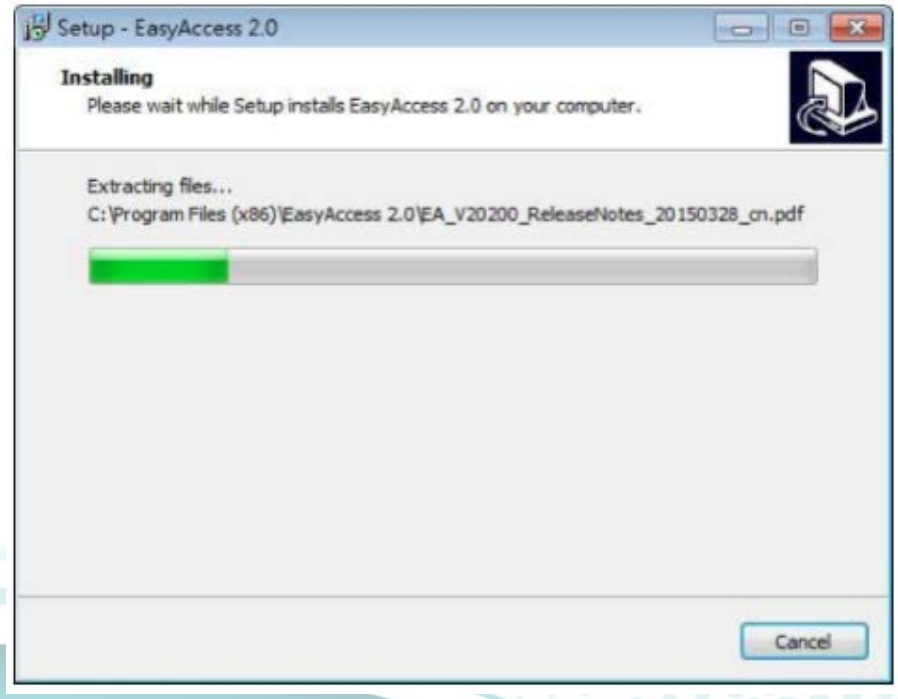


Figure 137

7. Click [Finish] to complete the installation.

Figure 138

Here is a list of notable files in the installation folder:

File Name	Description
cMT Viewer	The PC application for accessing a cMT HMI.
EasyAccess 2.0	The main program used to establish remote connection to an HMI.
gui_30	An essential component when using HMI Viewer to monitor a remote HMI.
PC Activator	Application for activating EasyAccess 2.0 for HMI on the network.

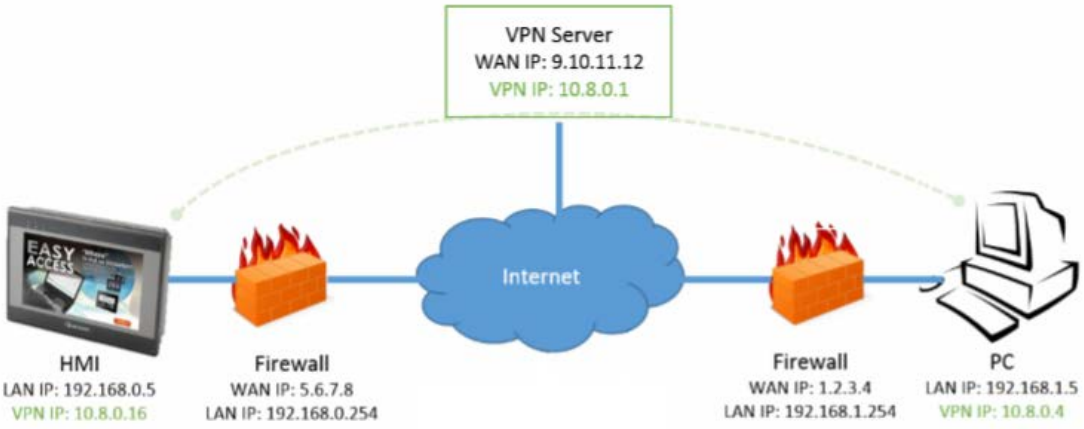
Table 29

Basics

EasyAccess 2.0 access technology is quite different from traditional way of remote access method. Here are some notable points:

Traditional remote connection (blue links)	EasyAccess 2.0 (green dotted links)
Connection traffic must pass through several firewalls, which means there are layers of network settings.	PC and HMI both connect to a dedicated VPN server through which data are exchanged, or by P2P.
Network/Router setting is mandatory; therefore, coordination with the IT department is crucial.	No additional network setting is required.
For one WAN IP, only one device can be connected.	For one WAN IP, multiple devices can be connected
For a device behind two or more routers, connection might not be possible.	Being behind several routers does not affect EasyAccess 2.0 connectivity at all.

Table 30



EasyAccess 2.0 Network Overview

Figure 139

Activation

Chambers come with built-in EasyAccess 2.0 license, must be activated to use the feature. Once an HMI has been activated, its license cannot be transferred to another HMI.

Understanding Domain, HMI Group, and User

The basic management block is Domain, under which HMIs, HMI Groups, and Domain Users exist. An HMI, upon activation, can be added to a domain.

Domain and Domain Admin: The basic block of HMI management. One Domain account may contain several Users, HMIs, and HMI groups. However, each HMI can belong to only one Domain. The Domain Administrator manages all aspects of the domain through the web-based portal at (https://account.ihmi.net). Domain Administrator account can also be used for logging in the EasyAccess 2.0 client program.

HMI Group: A subset of HMIs within a domain. A user in an HMI Group can access all HMI in that group. For the Domain Admin, HMI Groups provide an easy way for management of user access to HMI. An HMI can belong to more than one HMI groups.

User: A user holds the account used to login in to the EasyAccess 2.0 program. They are allowed access to HMIs for which it has direct association, and HMIs within the group it is associated with. User's relationship with HMIs and HMI Groups are managed by the Domain Admin.

The prime principle governing HMI management in EasyAccess 2.0:

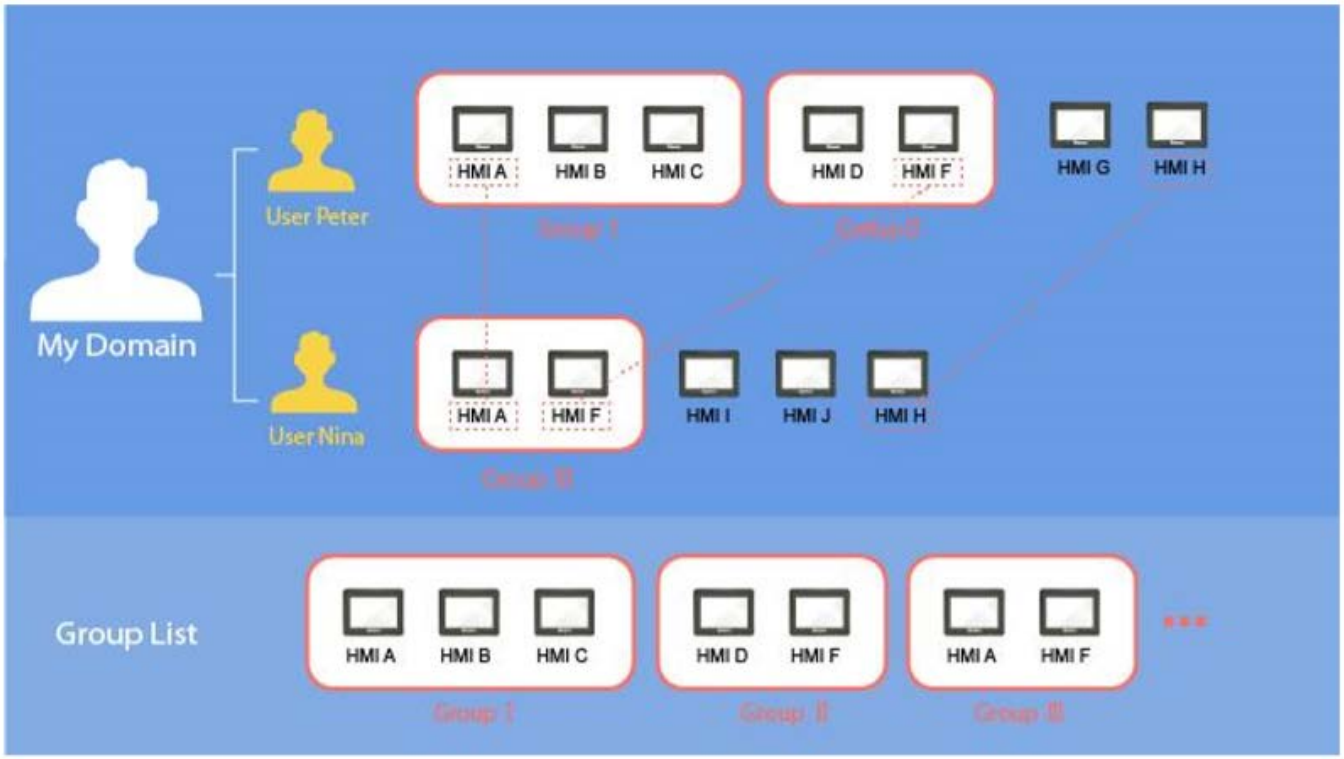
An HMI can belong to one domain only at any given time

Example

Consider the following figure for an illustrative example of a domain.

- In this example, the domain, named "MyDomain" has two users Peter and Nina.
- In this example, HMI are grouped together as Group I, Group II, Group III…etc., and one HMI belong to more than one groups. (HMI A)
- Users can belong to many groups and have access to the HMI in the groups they belong to. (User Peter & Group I)
- Users can be directly associated with HMI and have access to them. (User Nina & HMI J)
- Multiple users can access the same HMI, whether by assignment to groups (HMI A) or by direct association (HMI H).

All of this is done by the Domain Admin. The Domain Admin can exercise large amount of freedom in domain management.



A sample domain "MyDomain"

Figure 140

Activate an HMI

The HMI must have been activated to be connected using EasyAccess 2.0. Check its activation status on HMI in the [EasyAccess 2] tab of the [System settings] page. Activation is permanent, so please make sure that activation is applied to the intended HMI.

Selected models have EasyAccess 2.0 activated by default. If your HMI has not been activated, it can be activated by one of the following means:

- Self-serve activation with activation codes on Domain web page
- Self-serve activation with activation codes on PC Activator
- Activation by Weintek's authorized dealer

Alternatively, new user could test out EasyAccess 2.0 by getting trial activation.

In either case, HMI's Hardware key will be required. Locate it in the [EasyAccess 2] icon on setting screen. Be sure to be logged in as a Class D user

Figure 141

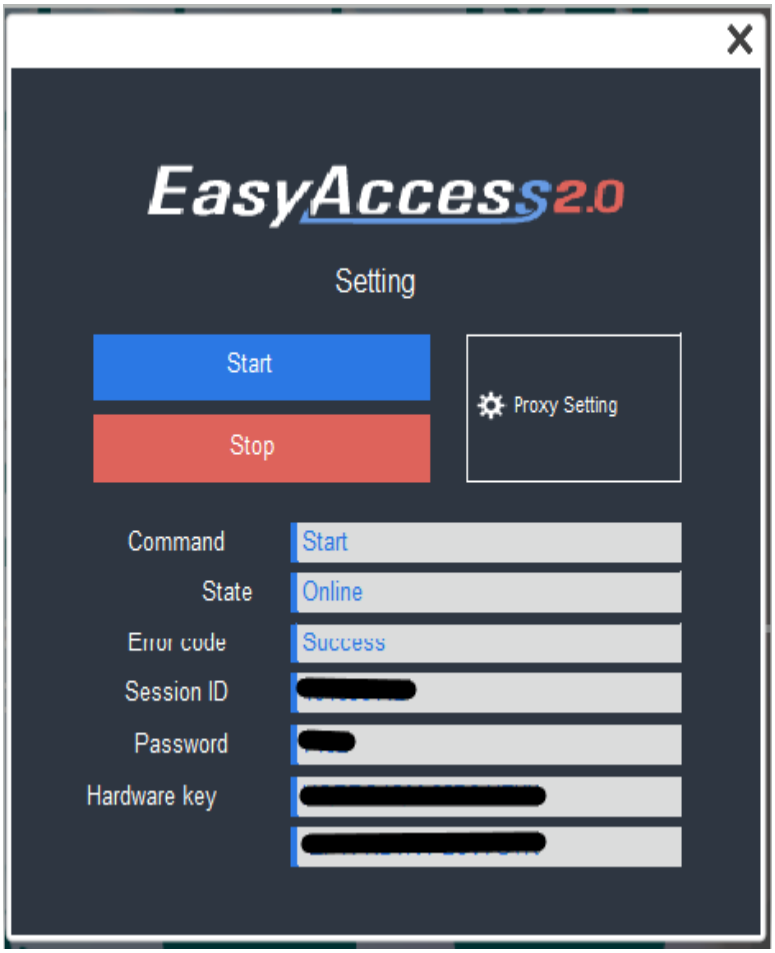


Figure 142

Add an HMI to a Domain

An HMI must belong to a domain to use EasyAccess 2.0.

EasyAccess 2.0 service requires that each HMI belong to only one domain. Therefore, once an HMI is added to one domain, it cannot be added to another one. Another Domain Admin will not be able to add that HMI even with the same Session ID/Password. For an HMI to be transferred to another domain, it needs to be removed from its current domain, and then it can be added to another domain with its new Session ID/Password.

By Session ID/ Password

How to find Session ID/Password?

Session ID/Password are generated uniquely for the HMI by the EasyAccess 2.0 service, the HMI must go online to receive this piece of information.

1. Let HMI go online by pressing Start.
2. Once successfully connected, HMI will display the Session ID/Password.

Review Connect the HMI to EasyAccess 2.0 Server for more information.

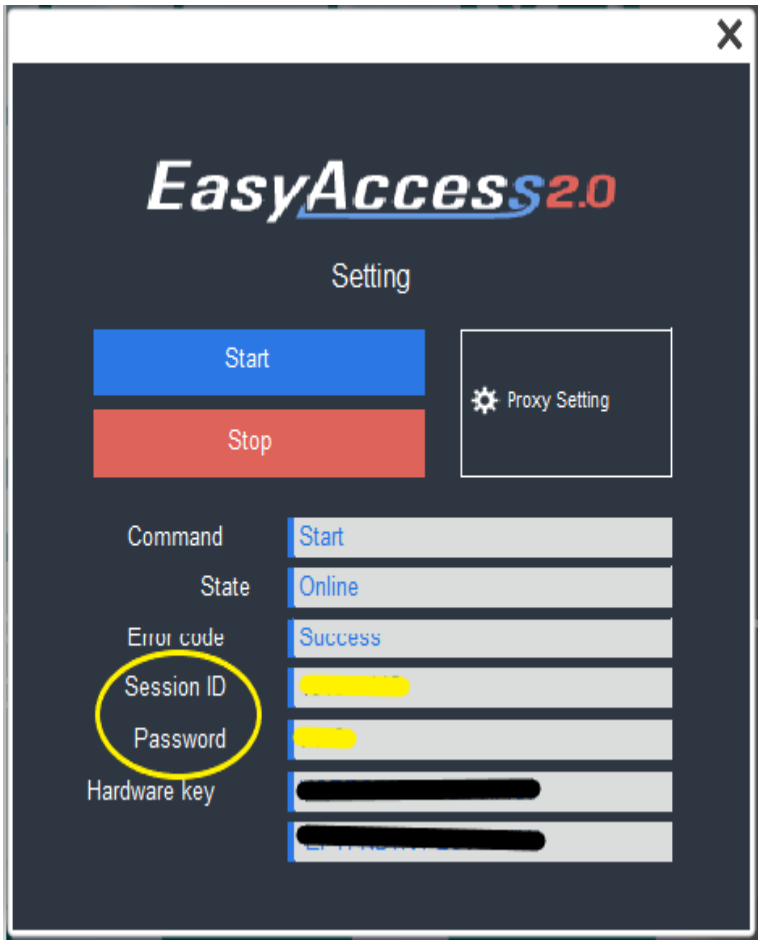
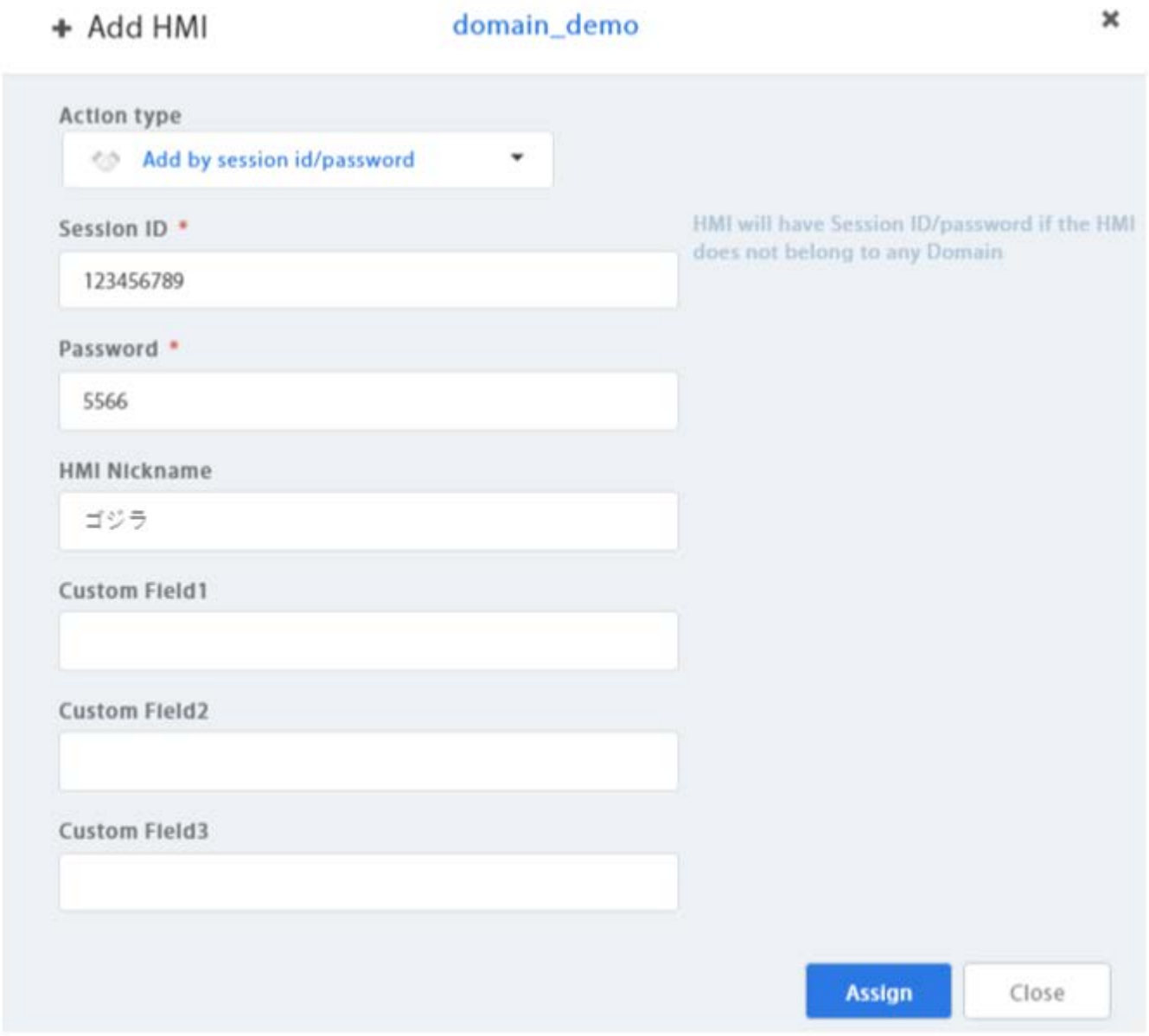


Figure 143

Add to domain by Session ID/Password

In domain page, under the “Devices” tab, click “Add HMI”, and then enter the Session ID/ Password and notes if needed.



Add to Domain by Session ID/Password

Figure 144

HMI Nickname

When you log in as domain admin, you can set "HMI Nickname" in both EasyAccess 2.0 Application or Account web. HMI Nickname can be set in multiple languages.

Figure 145

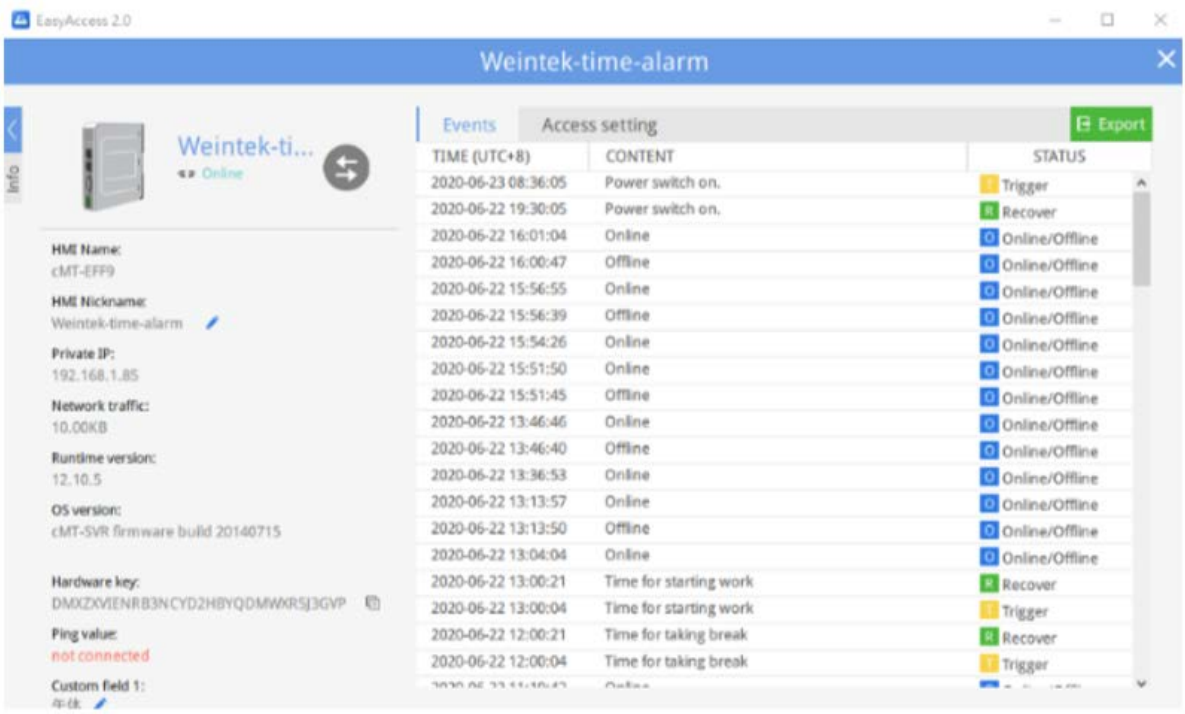


Figure 146

After modification, you can see those nicknames in EasyAccess 2.0 Application, Account web or push notification content.

In PC Activator

PC Activator also facilitates the “Add to Domain” process, without needing access to the Session ID/Password. Refer to PC Activator on how to complete this process in PC Activator

Manage the Domain

To access the domain management system,

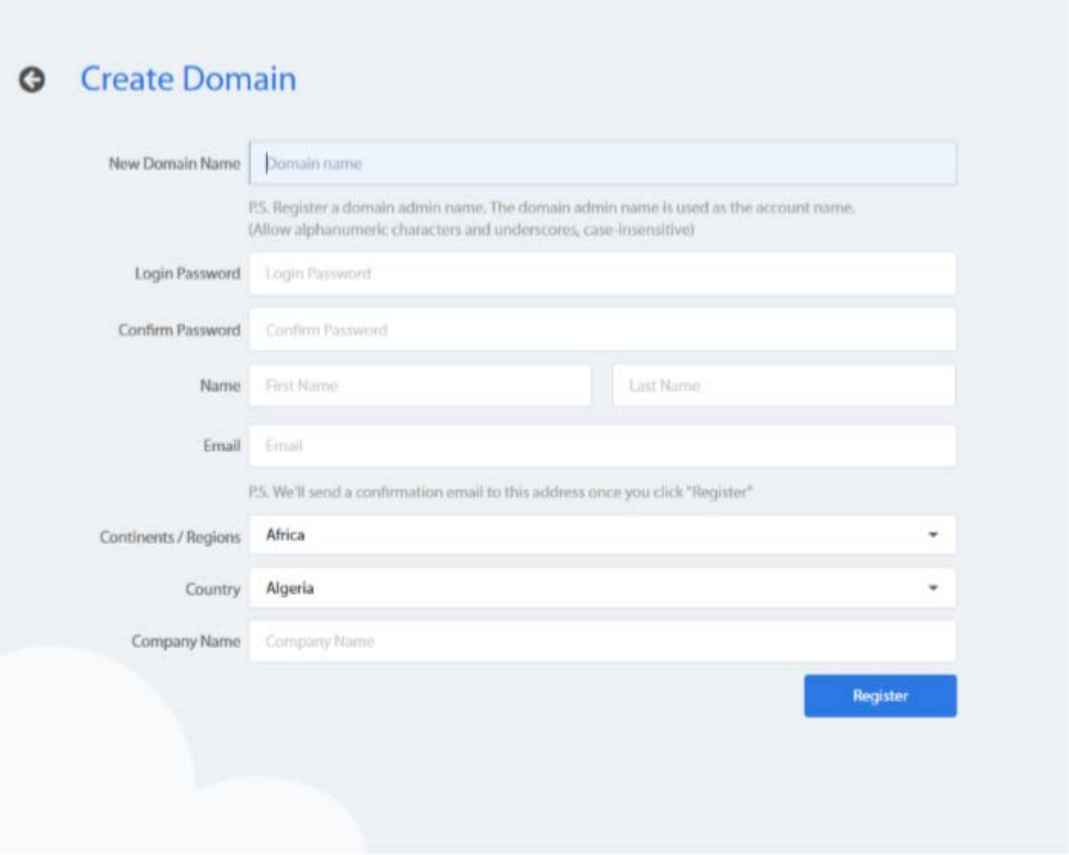
For access of Global server: https://account.ihmi.net

For access of China server: https://www.easyaccess.cn

Note: *your project setting may affect which domain to use. Please be mindful about the choice of server.*

Domain Creation

Anyone can create a new domain for free. A valid e-mail address is required.



Create a Domain

Figure 147

In EasyAccess 2.0 Application, domain can be created from Application side. Click "Sign UP" on the bottom to register new domain account.

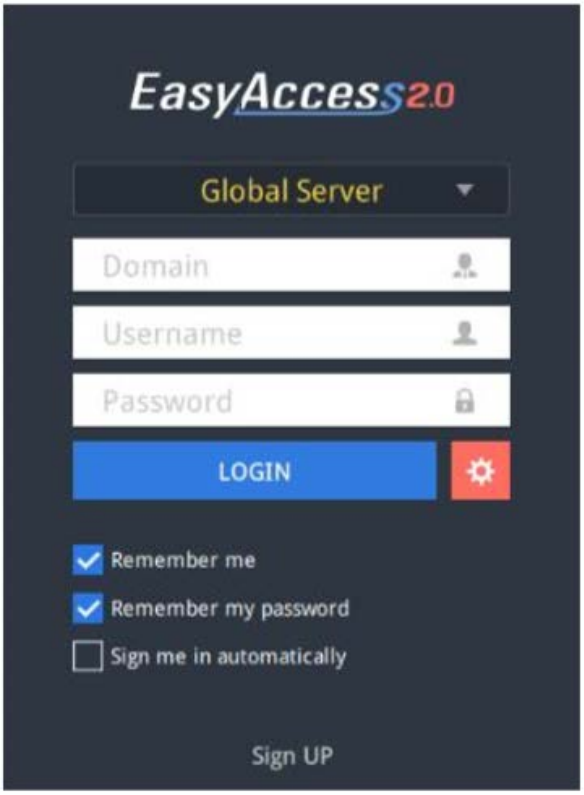


Figure 148

Enter the domain name, admin email address and admin password to register a new domain account. Be sure to read "Terms of Service" and "Privacy Policy" first.

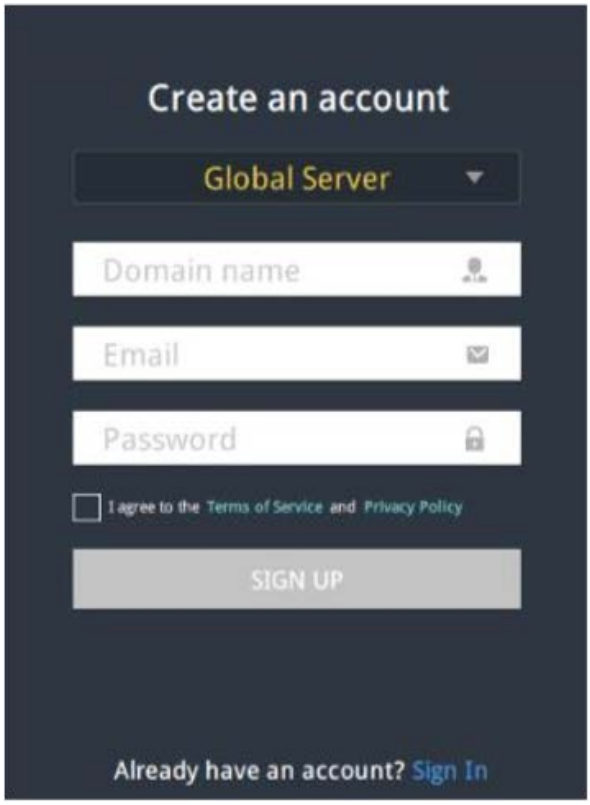


Figure 149

Check you registered email. You will receive an email "EasyAccess 2.0 Domain Registration Confirmation". Please enter "confirm code" in EasyAccess 2.0 application or click the "complete E-mail registration confirmation" link in your email to complete domain registration. If you did not receive any email, try "Resend Email" or contact our customer support service.

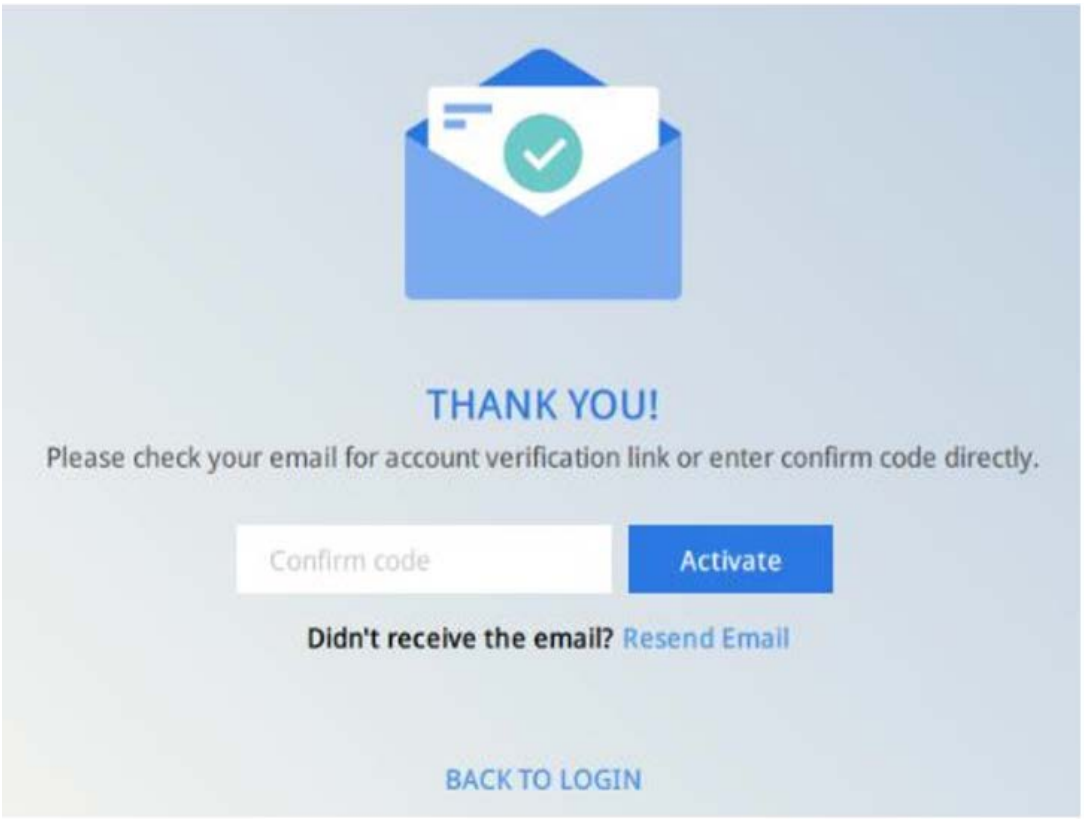


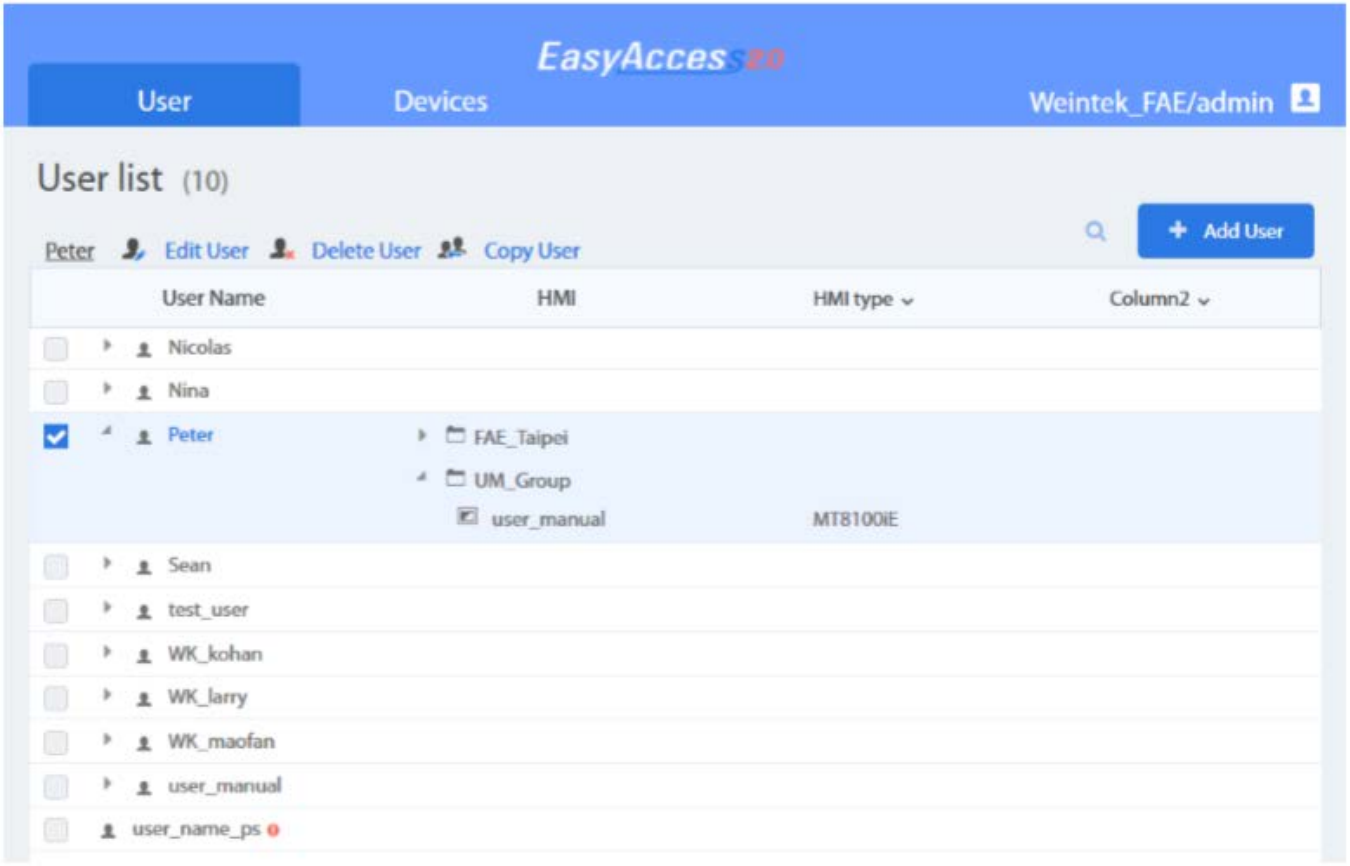
Figure 150

After completing domain registration, EasyAccess 2.0 application will automatically log in your admin account.

User Management

The User list displays all users and their information in the Domain. It shows whether a user is associated with any HMI and if the user belongs to any HMI group. In this page, the Admin can carry out user management actions: Add User, Edit User, Delete User, or Copy User here. For domains with many users, search tool is also available.

Option: You can create a user for Darwin Chambers to give technical support access to the chamber for troubleshooting needs.



List of Users

Figure 151

Icon	Function
	The Admin can create a new user ID in this window by providing an email address. Password information will be sent along with a confirmation email to the address provided. The new user must confirm registration by following the link in the mail to complete registration  *Add New User*
	The Admin can edit the HMI and HMI Group association for the selected user **HMI/HMI Group » HMI** Edit the selected user's association with HMIs. **HMI/HMI Group » Group** Add/Remove the selected user to/from HMI Groups.

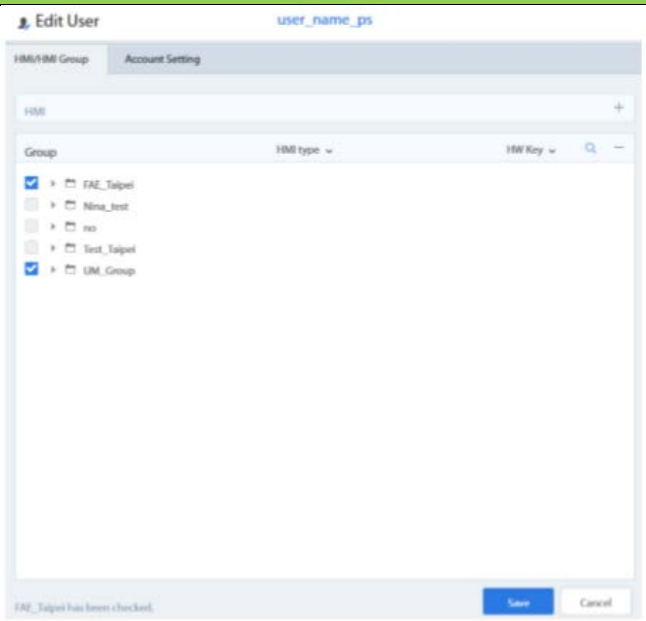
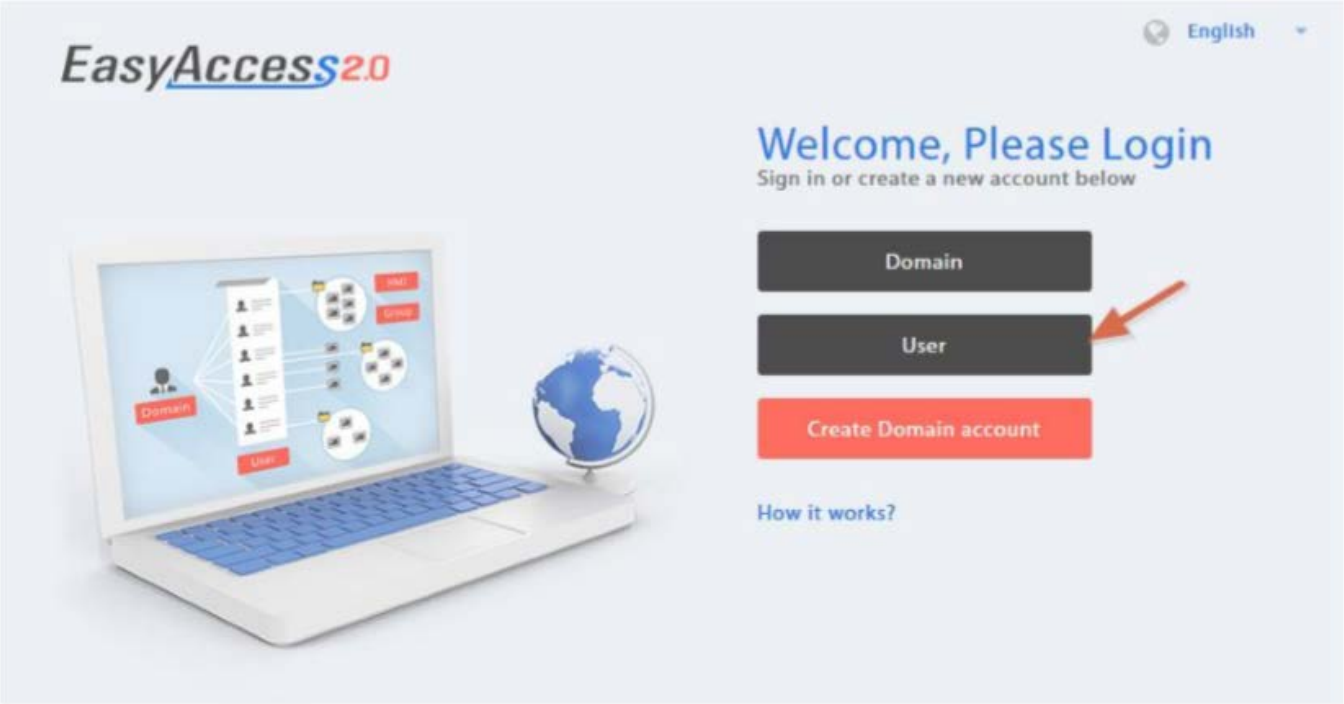
Icon	Function
	 Adding a user to HMI groups **Account Setting** View information about this user account and edit description and email information.
	Delete the selected user from this domain.
	Create a user with the same HMI/HMI Group association.
	Search for a user by name
	A user whose name has an exclamation mark alongside indicates that the user is not assigned to any HMI.

Table 31

Change User Password

When the user account is first created, a default password is mailed to the registered email address. The password can be subsequently changed. To do so, visit the homepage of the domain management system and select User login. Follow the on-screen guidance and change the password.

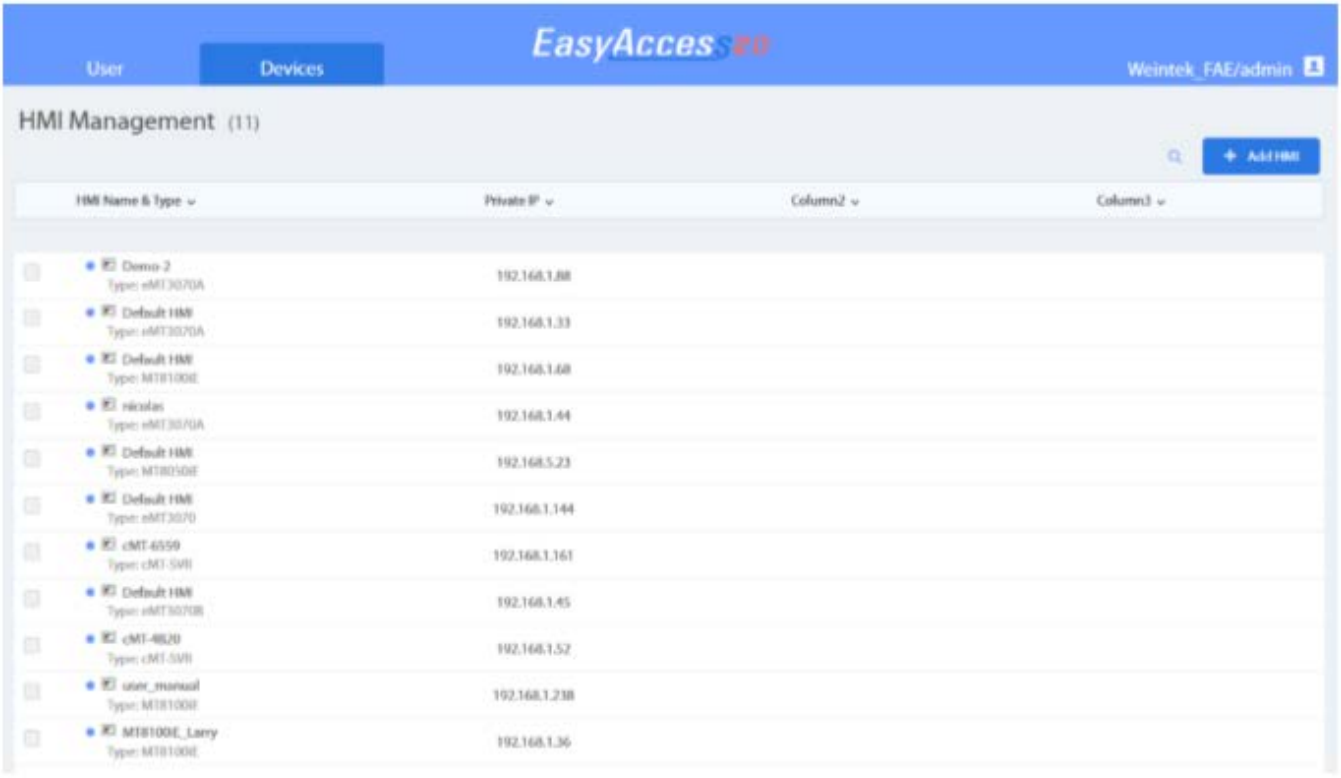


User Login

Figure 152

Device Management

The HMI list shows all HMIs registered in the current domain, and the HMI Group list shows all groups currently existing in this domain. The first column can sort the HMI by name, while the other columns can be set to show the following information: Private IP, Public IP, Activation Date, or Custom Field.



HMI List

Figure 153

HMI Icon	Function
+ Add HMI	Add a new HMI to the domain. **Action type » Using activation card** Activate the HMI and add it to the current domain. Hardware key and activation code are required. **Action type » activate by session id/password** Add the HMI to the current domain by Session ID/Password. Session ID/Password is required. **Action type » 30 days free trial** Activate a 30-day free trial for an HMI. The HMI will be permanently bound to the domain in which the 30 days free trial is activated. Only after the HMI has been activated with an activation code will it be allowed to be deleted from the current domain and added to another one.

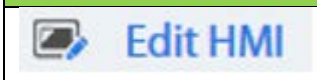
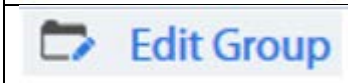
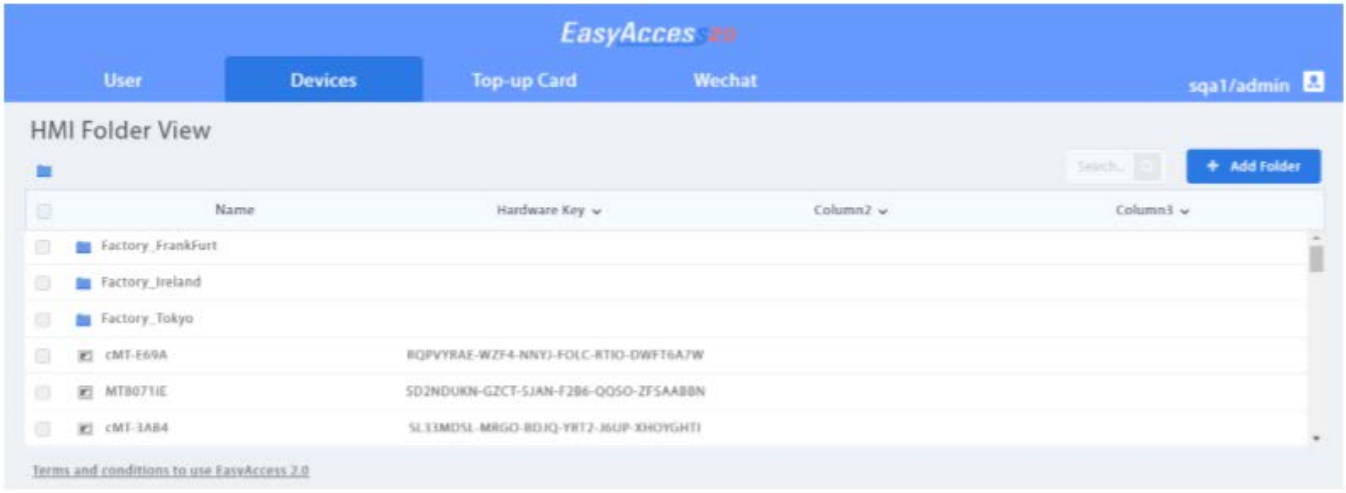
HMI Icon	Function
	Edit the selected HMI **User/HMI Group tab » User** Edit user association with the selected HMI. **User/HMI Group tab » HMI Group** Add/Remove the selected HMI from the HMI groups. **Activation Information** View Hardware key and other information about this HMI.
	Delete the selected HMI from this domain. Once deleted, the HMI can be added to another domain with a new session id/password.
	Search for HMI by name. Enabling filter function will show only assigned / unassigned or all HMI.
	Create a new HMI group.
	Edit the selected HMI group **HMI/User tab » HMI** Add/Remove HMI from the selected group. **HMI/User tab » User** Edit user association with the selected group. **General Setting** View information about this HMI group.
	Delete the selected HMI group.

Table 32

Note: *once an HMI is deleted from current domain, it can then be added to another domain. To add it back again, you will need a new set of session id/password.*

Organize HMI into Folders

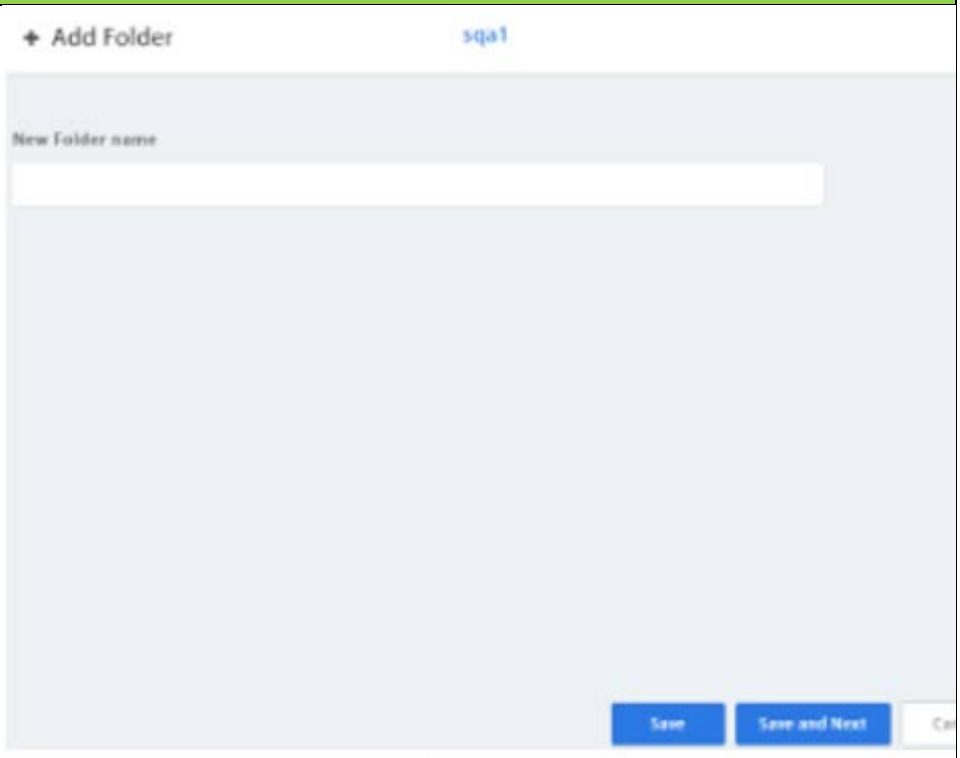
In domain management web page, under the “Devices” tab, click “HMI Folder View”. HMI can be managed easily by creating your own folder/category. In this page, the Domain Admin can: Add/Edit/Delete folders or Move HMI/folder to another folder. For domains with many HMIs, search tool is also available.



List of Folders and HMIs

Figure 154

HMI Folder View Icon	Function
+ Add Folder	The Domain Admin can create a new folder in this domain.

HMI Folder View Icon	Function
	 Add New Folder
>> Factory_FrankFurt >> Lobby	Current folder level is displayed above the table. Click folder name to go to a different level of folder.
Edit Delete Mov	Operation toolbar will be shown via selecting folder.  Select folder to show operation toolbar **Edit** Edit foder name.

HMI Folder View Icon	Function
	 **Delete** Delete selected folders. **Move** Move folders or HMIs to specific folder.  Multiple selection

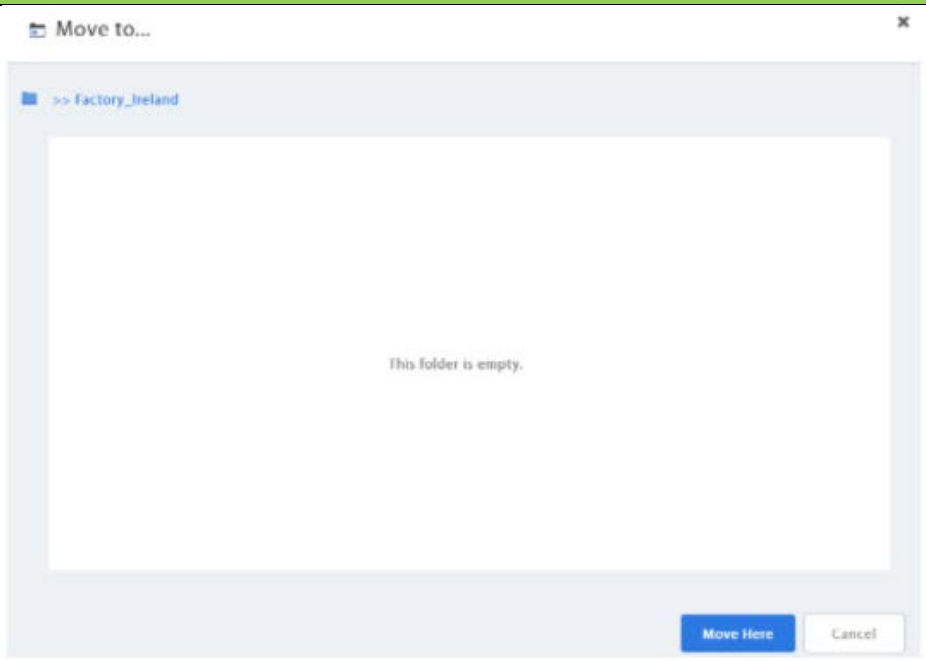
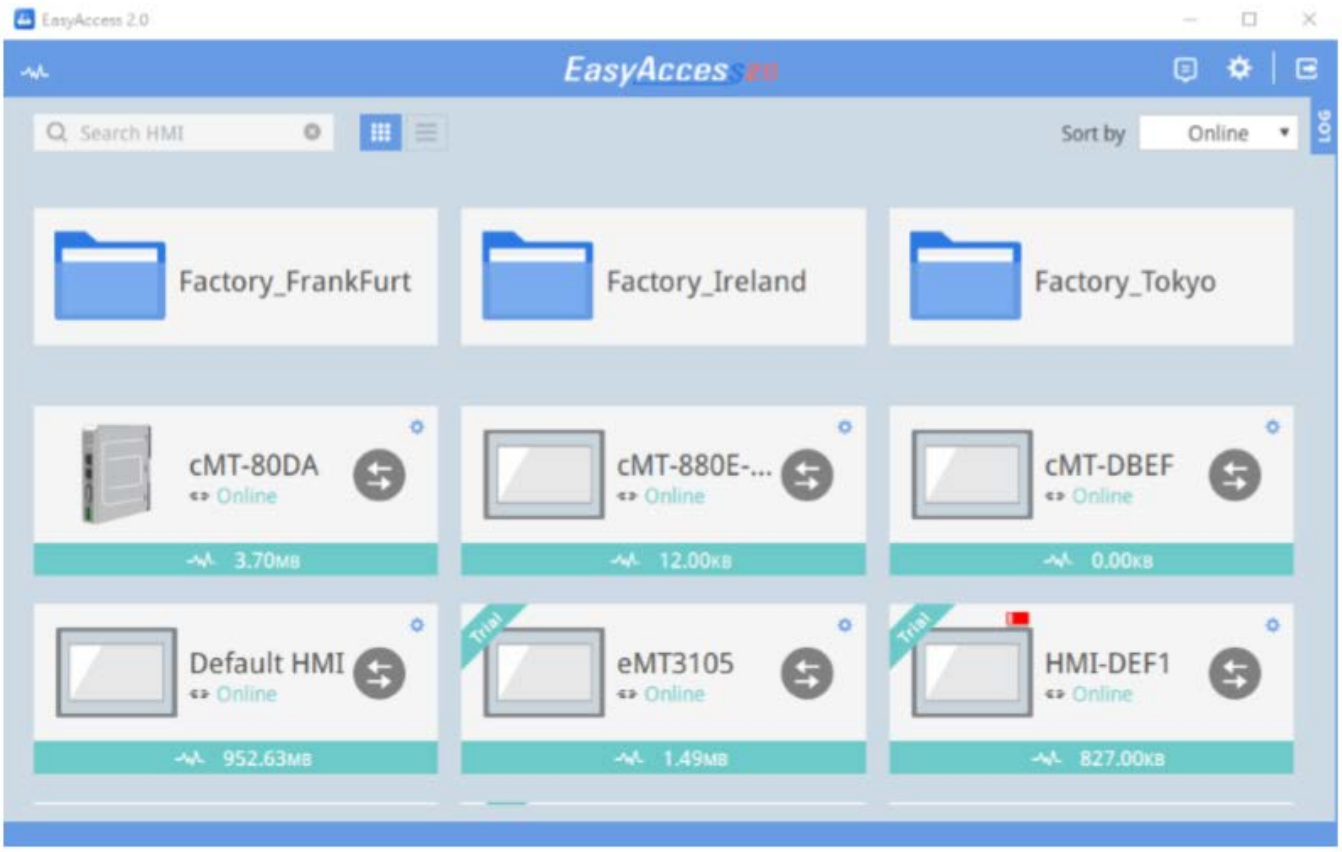
HMI Folder View Icon	Function
	 Move to folder
	Search for a folder or HMI.

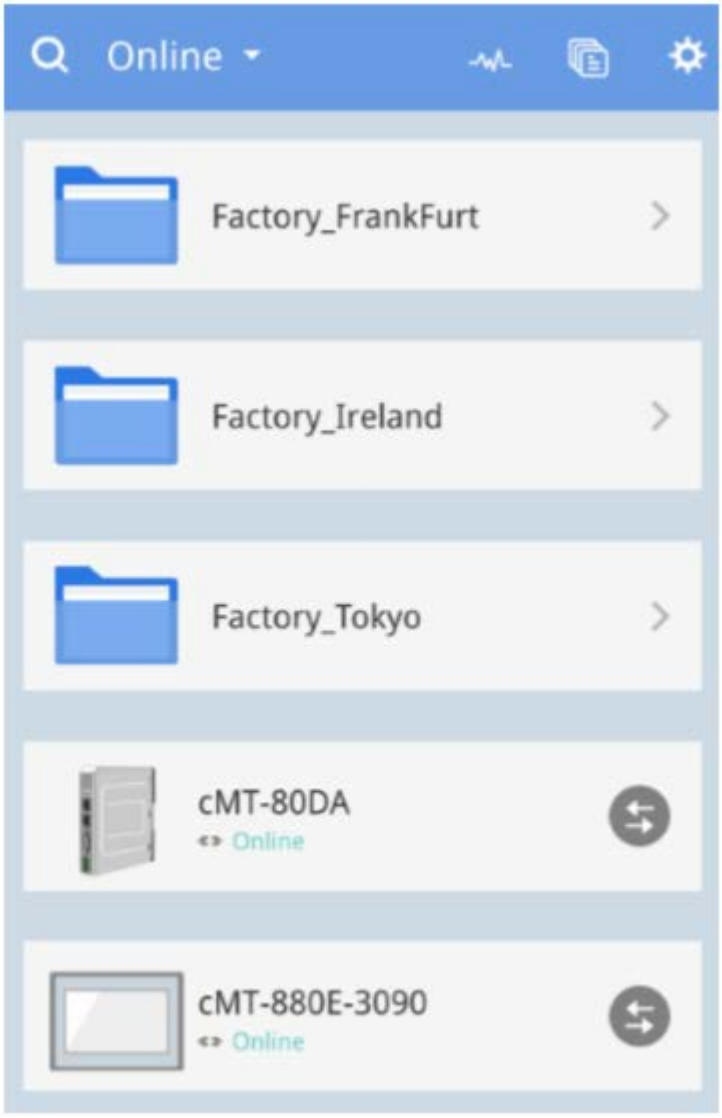
Table 33

The folder structure also displayed on EasyAccess 2.0 Application



Folder Structure on EasyAccess 2.0 (Windows)

Figure 155

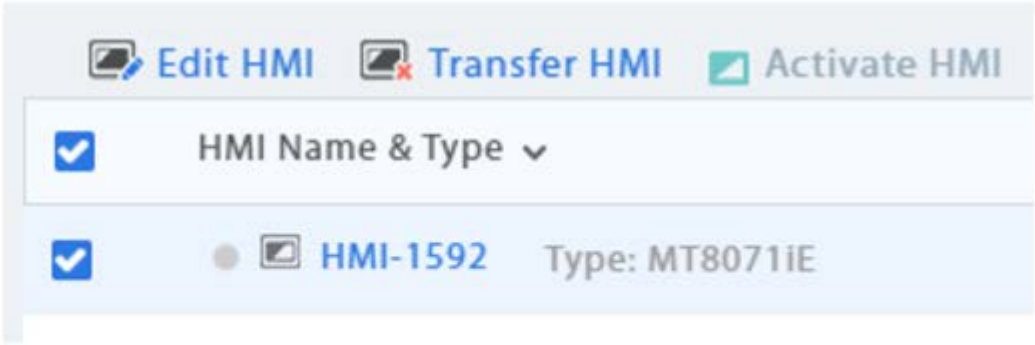


Folder Structure on EasyAccess 2.0 (Mobile)

Figure 156

Transfer HMI

To move an HMI to another domain, click the HMI under the “Devices” tab. Click “Transfer HMI” and a confirm dialog will pop up. Click “Delete” then the HMI will be removed from current domain. You can use Session ID/Password to add this HMI into another domain.



Click an activated HMI to transfer (remove from current domain)

Figure 157

Transfer (delete) HMI from domain

Figure 158

Activity Report

Click the user icon and select [Activity report] to subscribe the report and select a schedule. Once subscribe, the report will be sent to domain admin email according to the schedule (Daily, Weekly, Monthly). You can also send report to other domain users by selecting those users.

To check if it works, a test report can be sent to domain admin by clicking “Send a copy now (1d.)”.

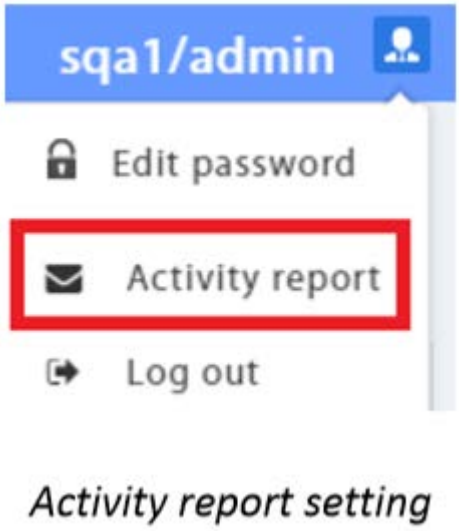
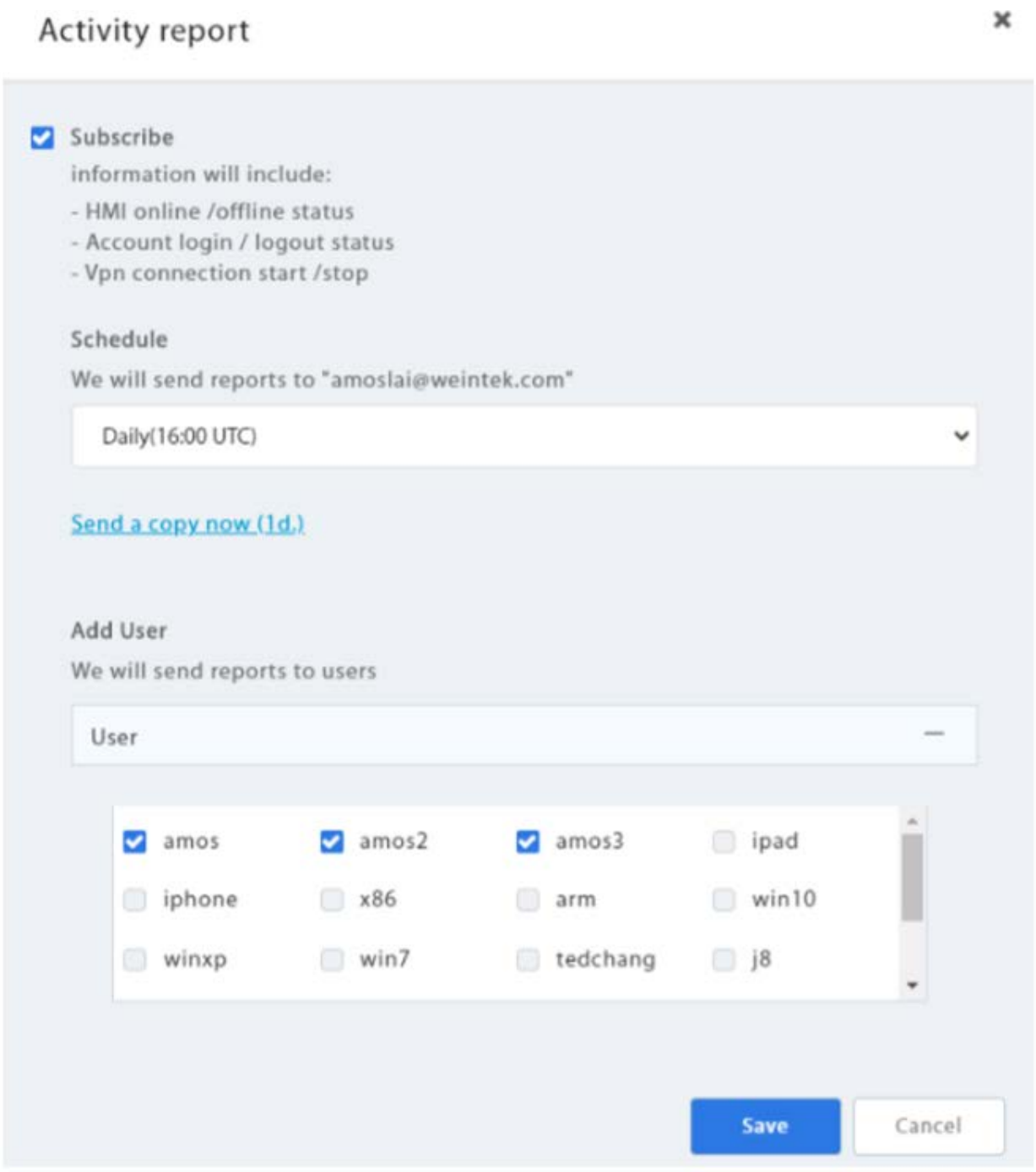

sqa1/admin
Edit password
Activity report
Log out
Activity report setting

Figure 159



Activity report setting

Figure 160

EasyAccess 2.0 on PC

EasyAccess 2.0 is provided as a standalone program that can be installed on the PC. It can be used independent of the EasyBuilder software suite.

Download the software from Weintek's website at:

https://www.weintek.com/globalw/Software/EasyAccess.aspx

Step-by-step for establishing EasyAccess 2.0 connection.

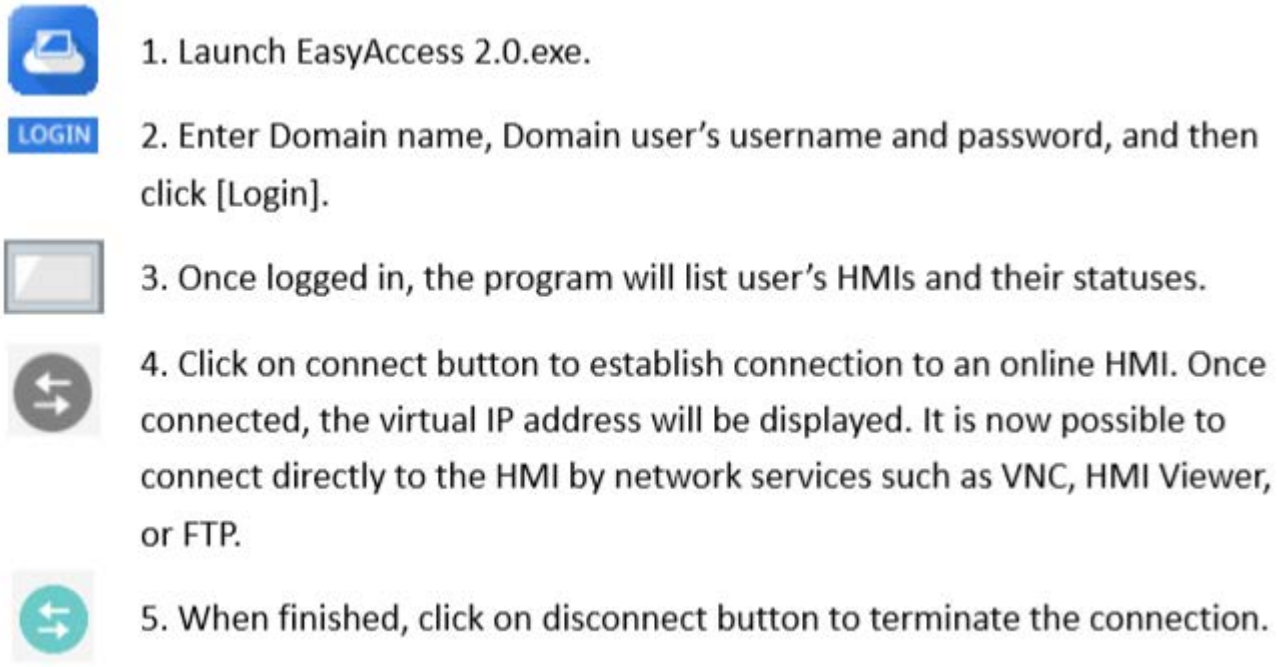


Figure 161

VNC Viewer

For models supporting VNC server, one may use VNC viewer to access the HMI. Please install a VNC Viewer of your choice and provide its executable file (.exe) location to EasyAccess 2.0 application in [Settings] » [Path]. After you have successfully made the connection, should clicking on the VNC icon yields no response, launch VNC viewer separately and use the virtual IP address obtained in EasyAccess 2.0 as the destination IP address.

Please install a VNC Viewer of your choice: TightVNC, RealVNC

HMI Viewer

Non-cMT models support using HMI Viewer to access HMI. Provide a suitable gui_e30.exe location to EasyAccess 2.0 application in [Settings] » [Path]. gui_e30.exe is contained within EasyAccess 2.0 and EasyBuilder Pro installation folder, where the latter always contains the most up-to-date version.

cMT Viewer

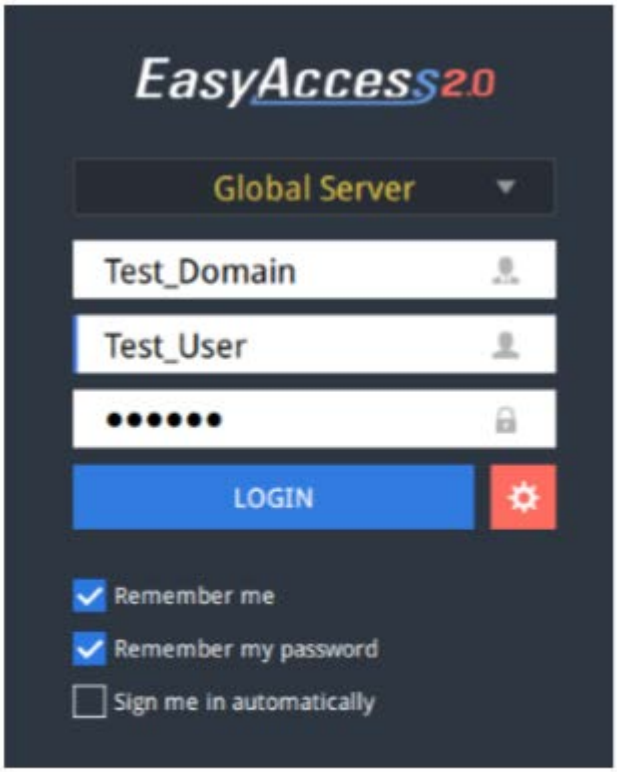
cMT models support using cMT Viewer to access HMI. cMT Viewer is contained within EasyAccess 2.0 and EasyBuilder Pro installation folder, where the latter always contains the most up-to-date version.

Installing adaptors

During the first program run, the software will detect whether necessary adaptors are present. If not, they will be installed automatically.

Log in

Domain name, Domain username and password are required for login.



Login to EasyAccess 2.0

Figure 162

Main screen

Once successfully logged in, the main screen will show all HMIs for the user and their online statuses. HMIs that are online will have a connect button and a setting button. There is no limit on the number of HMIs that can be simultaneously connected from the program. However, once an HMI is connected by a user, it goes into "occupied" state and cannot be connected by another user before the existing connection has been terminated.

EasyAccess 2.0 Main Screen

Figure 163

Functions of icons on Main screen:

Icon	Function
	Domain Traffic Usage(Top-up Card)
	HMI search filter
	Tile view/ List view
	Event Logs
	Settings
	Logout of current user
	Displays connection logs

Figure 164

Tab	Description
General » Network traffic	Options: Show all HMI Network traffic Disable Weintek P2P Enable sending log for debug
Information	Software version and the terms of usage
Language	Select the language Languages available: English, French, Italian, Spanish, Russian, Simplified Chinese, Traditional Chinese, Korean, German, Japanese, Polish
Path » Executable	Select executable (*.exe) path for VNC viewer, HMI Viewer, and cMT Viewer, used to launch the viewers when connections are established.

Tab	Description
	 **VNC executable path** Location of the .exe executable of the VNC viewer. VNC viewer must be installed separately. **HMI Viewer path** Location of the GUI (gui_e30.exe), for use with iE/XE/eMT/mTV series. **cMT Viewer path** Location of the cMT Viewer, for use with cMT series. **EBPro folder** Location of the EasyBuilder Pro folder, where libraries necessary for PC□HMI transfer are located.

Table 34

Note: *Please try to keep GUI updated as it is the necessary executable for running the HMI Viewer. A copy of GUI and cMT Viewer which was most current as of the date of EasyAccess 2.0 release is included in the installation. An update of GUI may be required when programming environment of the HMI was updated; in this case, find it in the latest version of EasyBuilder Pro.*

HMI States and Access Setting

HMI can be in one of the states: Offline, Online, Connected, Occupied.

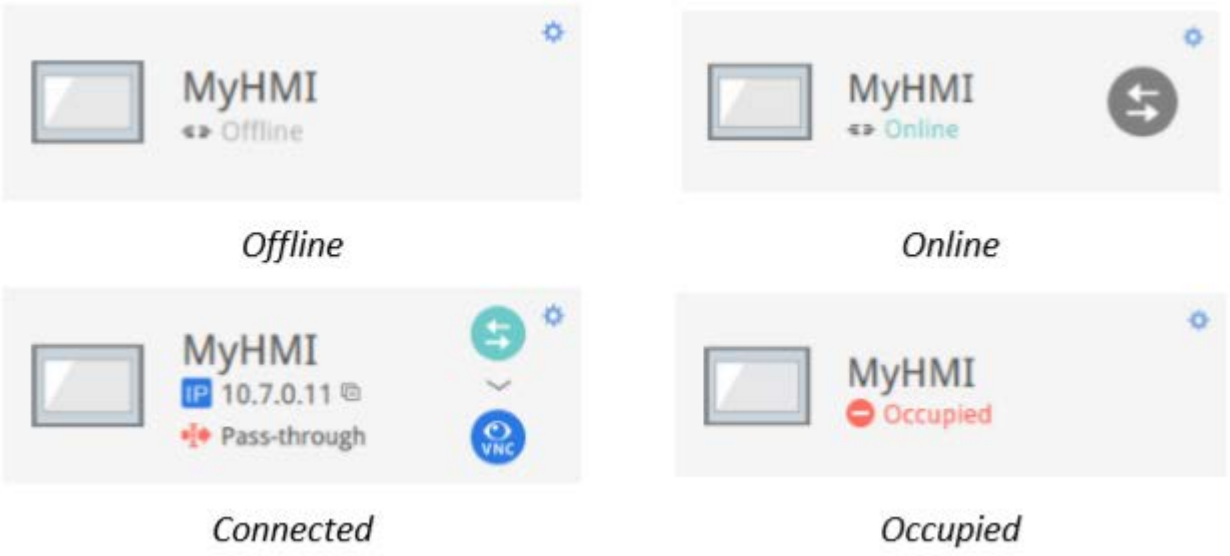
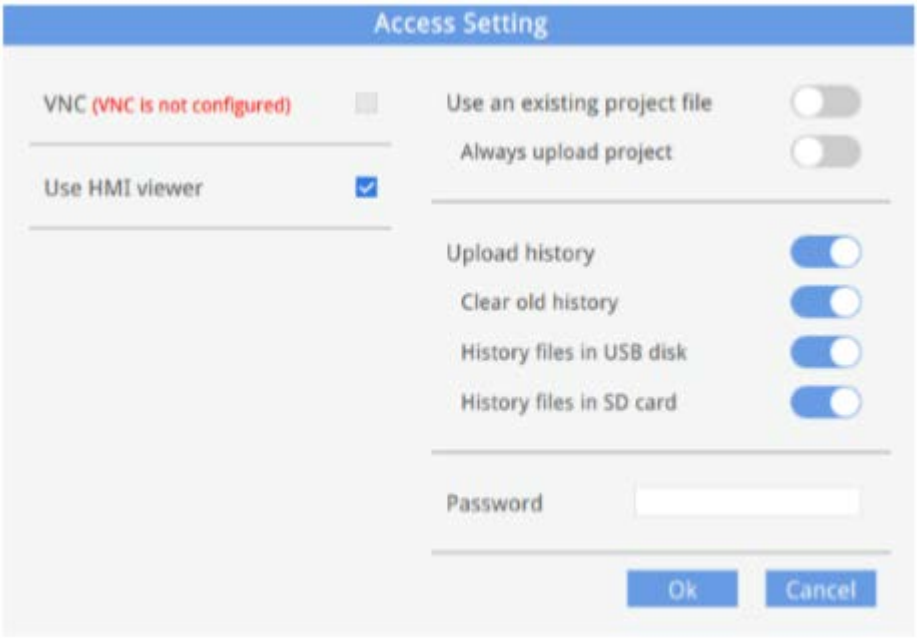
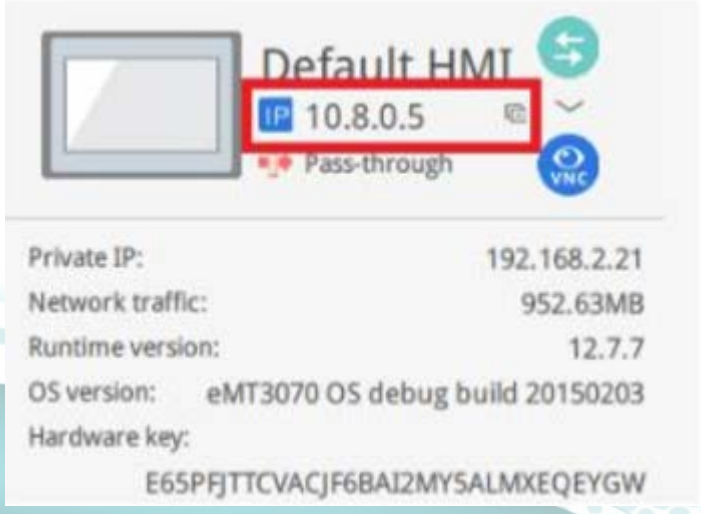


Figure 165

The usage or meaning of each icon:

Icon	Function
MyHMI	HMI name
IP 10.7.0.6	Virtual IP address. Click to copy the IP address to clipboard.
Pass-through	Set up pass-through IP address.
	Connect to the HMI.
	Disconnect from the HMI.
VNC	Access the HMI with VNC viewer (installed separately).
	Access the HMI with HMI Viewer.
	Events When push notification is enabled, the notification of triggered events will be shown here. **Access Setting**

Icon	Function
	Enter Access setting of the HMI, which allows using VNC Viewer or HMI Viewer. To use VNC Viewer, set executable path in Settings page. To use HMI Viewer, set executable path in Settings page. Also, set how project upload and history should be handled.  HMI Viewer setting (only when enabled) **FTP URL with password shortcut** You may enter FTP password beforehand and copy the FTP URL when you long press, right click on the VPN IP, or click the copy button next to “Password in FTP URL”. 

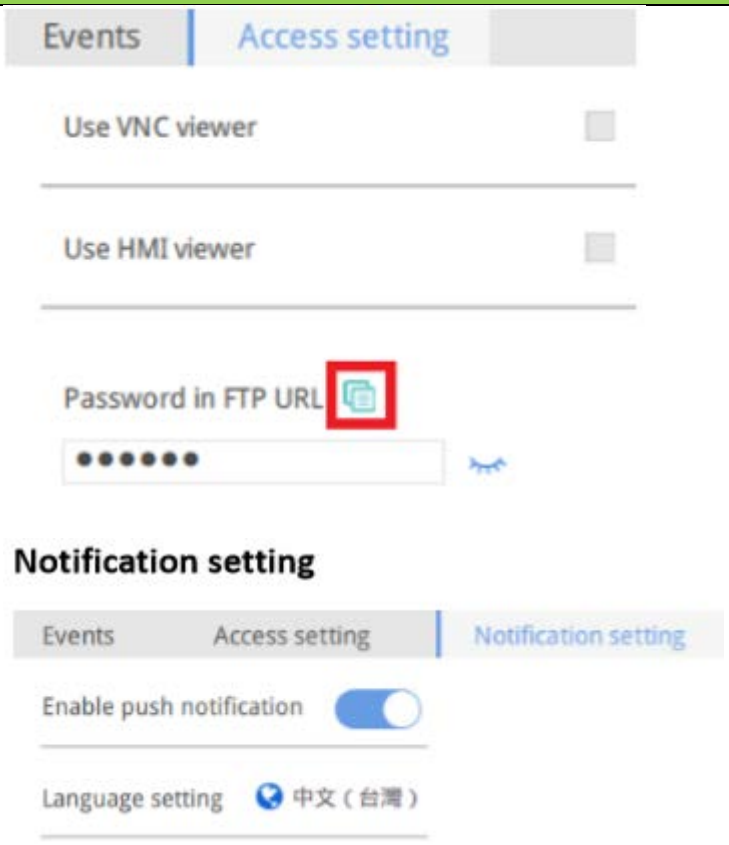
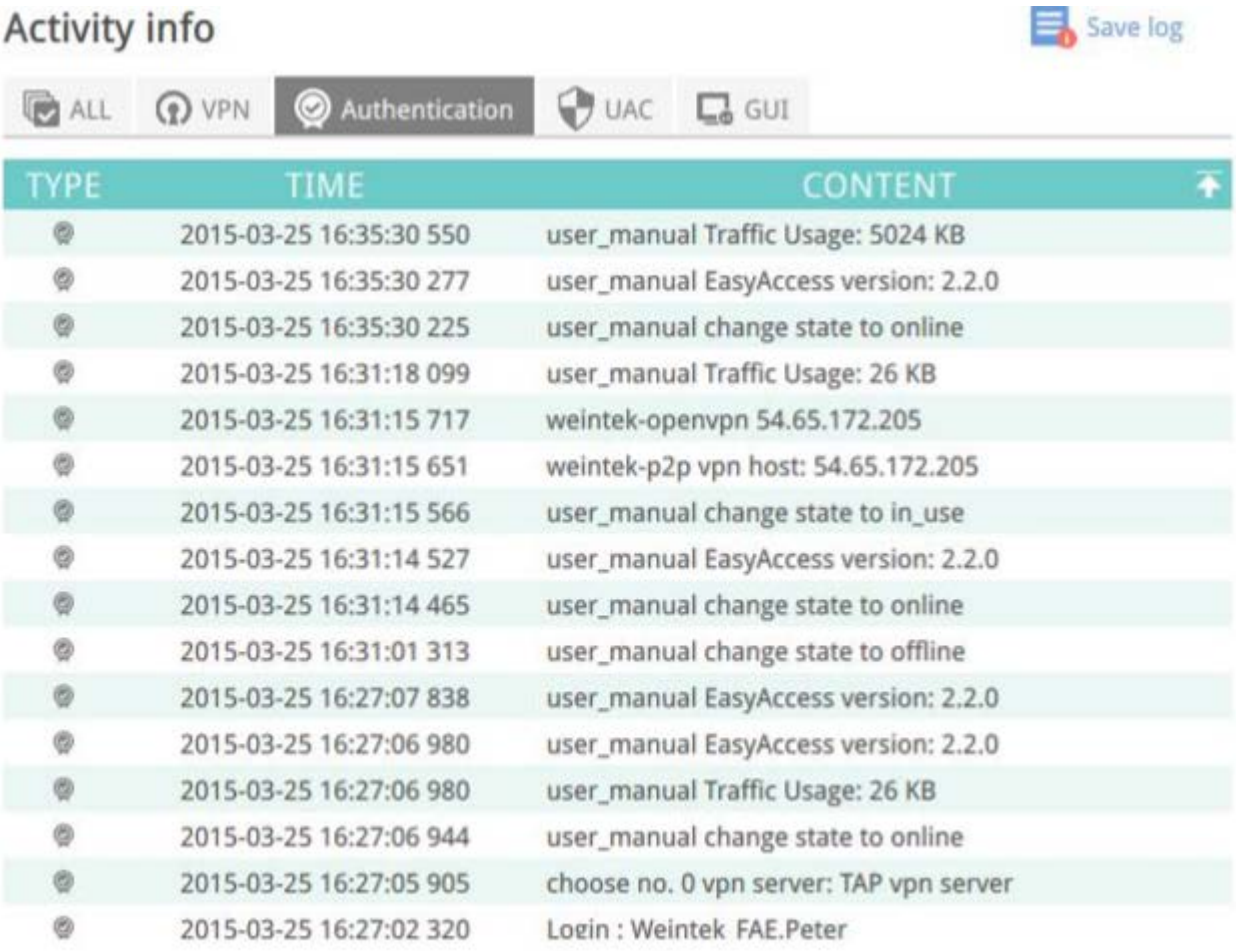
Icon	Function
	 Enable push notification. When an event is triggered on HMI, EasyAccess 2.0 can send push notification about the event. The language used by push notification can be selected in [Language & Font], and Label Tag Library in EasyBuilder Pro can be used to configure multiple languages.

Table 35

Connection Log

Clicking on the LOG icon brings out the detail connection logs with the VPN, Authentication, and UAC server. The GUI tab shows information relevant to the use of HMI Viewer. In additional to viewing them here, it is also possible to save the logs as a file.

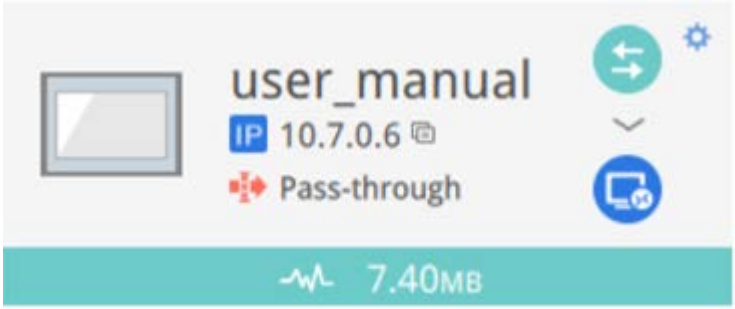


Connection Logs

Figure 166

Usage Display

The HMI's total data usage to date for the current month will be displayed.



Usage Display

Figure 167

Trouble shooting

If connection error happens, click the "Exclamation mark" icon to check the error details.

Error Happens

Figure 168

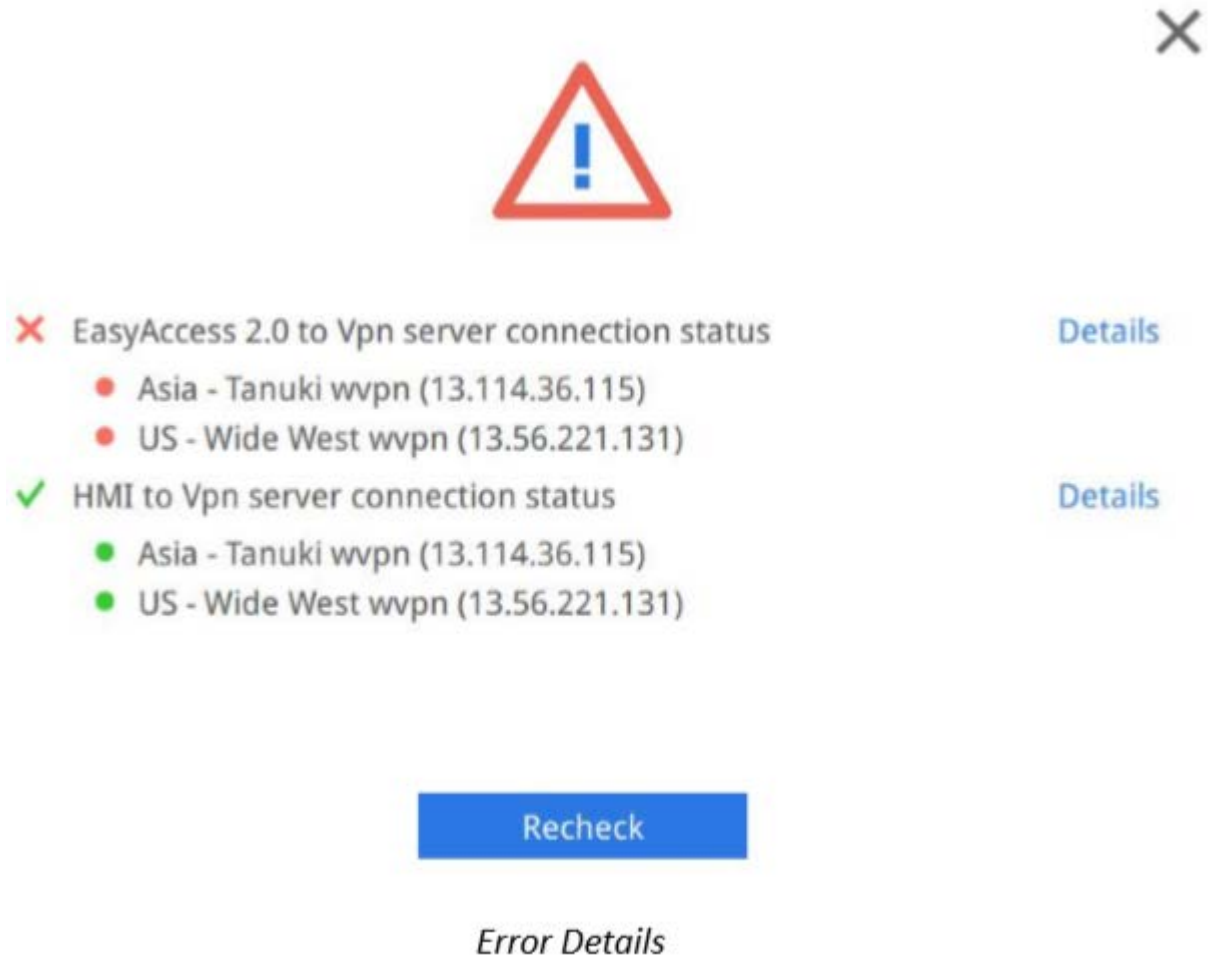


Figure 169

EasyAccess 2.0 on Android

EasyAccess 2.0 is available for Android devices. With EasyAccess 2.0, users can easily use VNC or cMT Viewer to access remote HMI. Even though the UI and available functionalities on an Android device maybe slightly different from PC, the connection steps are as simple and straightforward.

EasyAccess 2.0 on Android requires Android version 4.1.2 or later.

App Download

In addition to the main app EasyAccess 2.0, a helper OpenVPN Connector app is required. Please download the apps from Google Play and install the apps, both of which are free.

	EasyAccess 2.0
	EasyAccess 2.0 OVPN Connector

Table 36

VNC/cMT Viewer Download

- RealVNC VNC Viewer: Google Play
- cMT Viewer: Google Play

Step-by-step connection guide

1. Launch EasyAccess 2.0 app.
2. Enter Domain name, Domain user's username and password, and then click [Login].
3. Once logged in, the app will list user's HMIs and their statuses.
4. Click on the connect button to establish connection to an online HMI."
5. Once connected, the virtual IP address will be displayed. It is now possible to connect directly to the remote HMI by VNC or cMT Viewer.

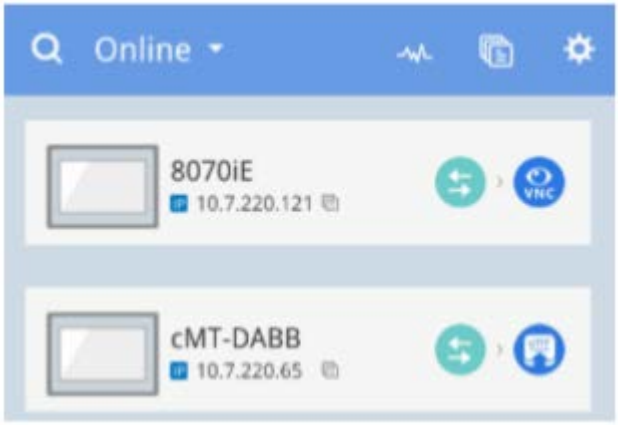


Figure 170

Noted: *You should download VNC viewer and set it to default VNC viewer. For example, download RealVNC Viewer and set to defualt VNC Viewer in Settings => VNC*

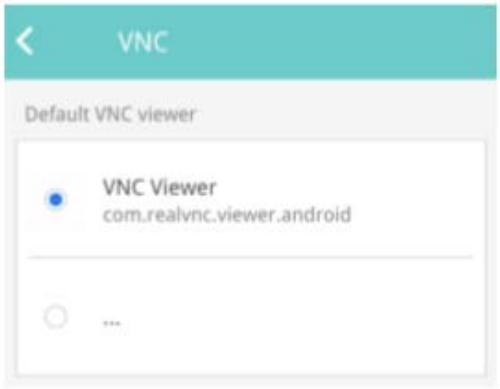


Figure 171

6. When finished, return to EasyAccess 2.0 app and click on the disconnect button to terminate the connection.

VNC Viewer

For models supporting VNC server, one may use VNC viewer to access the HMI. Please install a VNC Viewer of your choice and set it as the default VNC viewer in EasyAccess 2.0 application. Use the virtual IP address obtained in EasyAccess 2.0 as the destination IP address. After you have successfully made the connection, should clicking on the VNC icon yields no response, launch VNC viewer separately and use the virtual IP address obtained in EasyAccess 2.0 as the destination IP address.

cMT Viewer

cMT models support using cMT Viewer to access HMI. cMT Viewer is available for free on Google Play.

EasyAccess 2.0 on iOS

EasyAccess 2.0 is available on iOS devices. With EasyAccess 2.0, users can easily use VNC or cMT Viewer to access remote HMI. However, due to software restrictions, connection steps are slightly different from those on PC or Android.

EasyAccess 2.0 on iOS requires iOS version 7.0 or later.

App Download In addition to the main app EasyAccess 2.0, OpenVPN Connect app is required. lease download the apps from the App store and install the apps, both of which are free.

	EasyAccess 2.0 (Weintek Labs., Inc.)	App Store
	OpenVPN Connect (OpenVPN Technologies)	App Store

Table 37

Step-by-step connection guide

1. Launch EasyAccess 2.0 app
2. Enter Domain name, Domain user's username and password, and then click [Login].
3. Once logged in, the program will list user's HMIs and their statuses.
4. Click on connect button to establish connection to an online HMI. Dialogue will show with action buttons. Click "Open in OpenVPN."

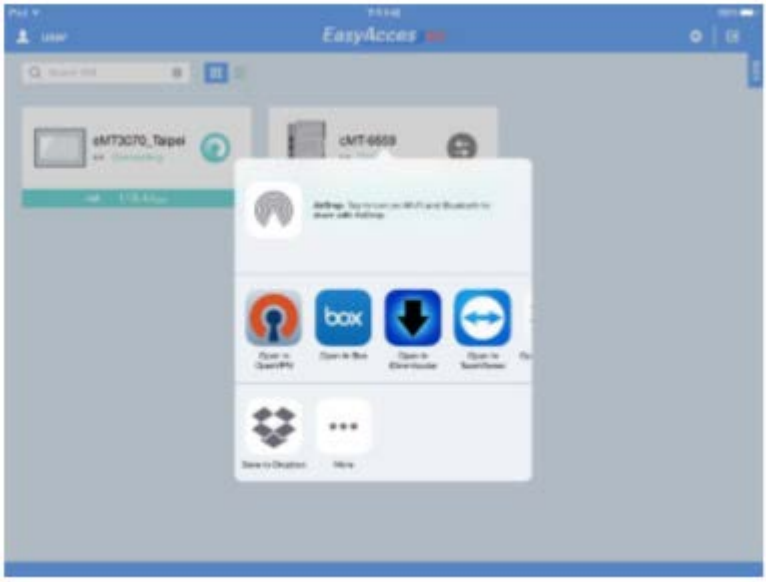


Figure 172

5. In OpenVPN app, add the login profile, and toggle the connection button to initiate connection.

Figure 173

6. Once connected, return to EasyAccess 2.0 app and the virtual IP address will be displayed. The top status bar will also display a VPN icon. It is now possible to connect directly to the remote HMI by VNC or cMT Viewer.

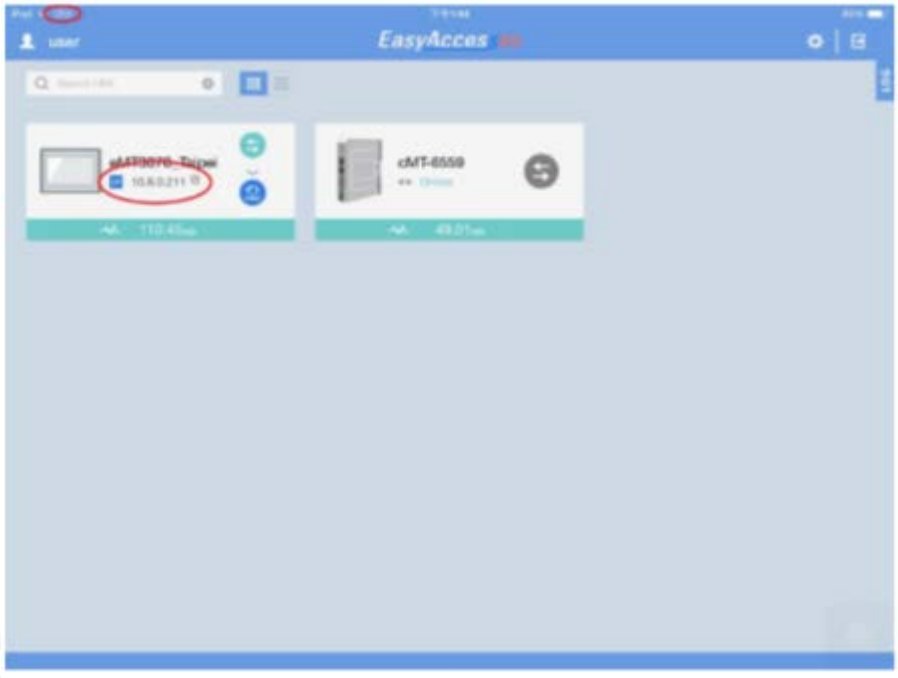


Figure 174

7. When finished, click on disconnect button to terminate the connection.

VNC Viewer

For models supporting VNC server, one may use VNC viewer to access the HMI. Please install a VNC Viewer of your choice and set it as the default VNC viewer in EasyAccess 2.0 application. Use the virtual IP address obtained in EasyAccess 2.0 as the destination IP address. After you have successfully made the connection, should clicking on the VNC icon yields no response, launch VNC viewer separately and use the virtual IP address obtained in EasyAccess 2.0 as the destination IP address.

cMT Viewer

cMT models support using cMT Viewer to access HMI. cMT Viewer is available for free on the App Store.

PC Activator

The PC activator allows the user to quickly perform HMI activations, which would otherwise have to be done through the web interface. Instead of the often-lengthy process of recording and typing hardware keys for activation, with PC Activator, the user now can quickly search for HMI's that are on the network, check their activation statuses, and activate them with the activation code. This is especially useful for bulk activation. In addition, PC Activator also lets users add HMI to a domain without having access to the session ID/ password.

Two main features are supported by the PC Activator

1. HMI activation by activation code.
2. Adding an HMI to a domain.

Activation

1. Enter Domain name, password, and activation code.
2. Select an HMI from the HMI list. It is possible to activate ones with an icon. Its hardware key will be retrieved and shown.

   List of icon:

	HMI is activated and assigned to a domain.
	HMI is activated but not assigned to a domain.
	HMI is not activated. It can be activated in PC Activator.
	HMI's OS version does not support PC Activator. OS upgrade may solve this problem.
	HMI is in trial period.
no icon	HMI does not support PC Activator.

Figure 175

3. Click the Activate button.

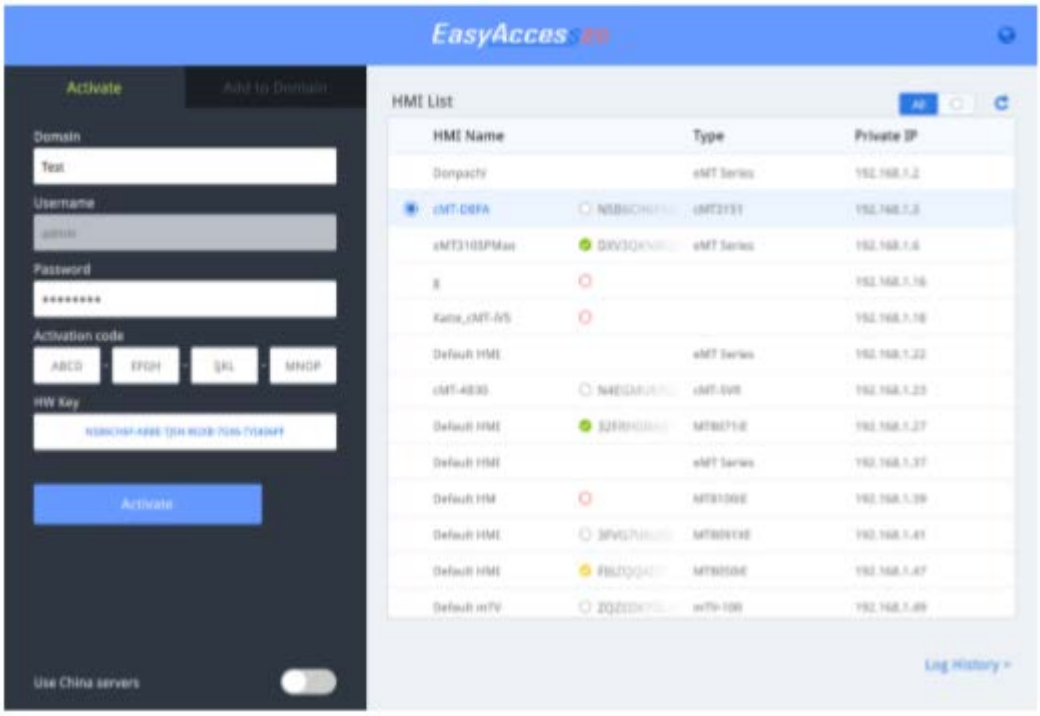


Figure 176

By toggling the option “Use China servers”, PC Activator will check the activation status and perform activation with China servers (https://www.easyaccess.cn). Global and China servers are independent entities, so account information registered on global servers cannot be used on China servers, and vice versa.

Add to Domain PC Activator also allows the user to add an HMI to Domain directly without explicitly having gained access to the Session ID/Password. Simply enter the Domain name and admin password, and then select an HMI that can be added.

HMI with a yellow icon, indicating that it has been activated but not assigned to a domain yet can be selected and added to the Domain.

By toggling the option “Use China servers”, PC Activator will check the activation status and perform activation with China servers (https://www.easyaccess.cn). Global and China servers are independent entities, so account information registered on global servers cannot be used on China servers, and vice versa.

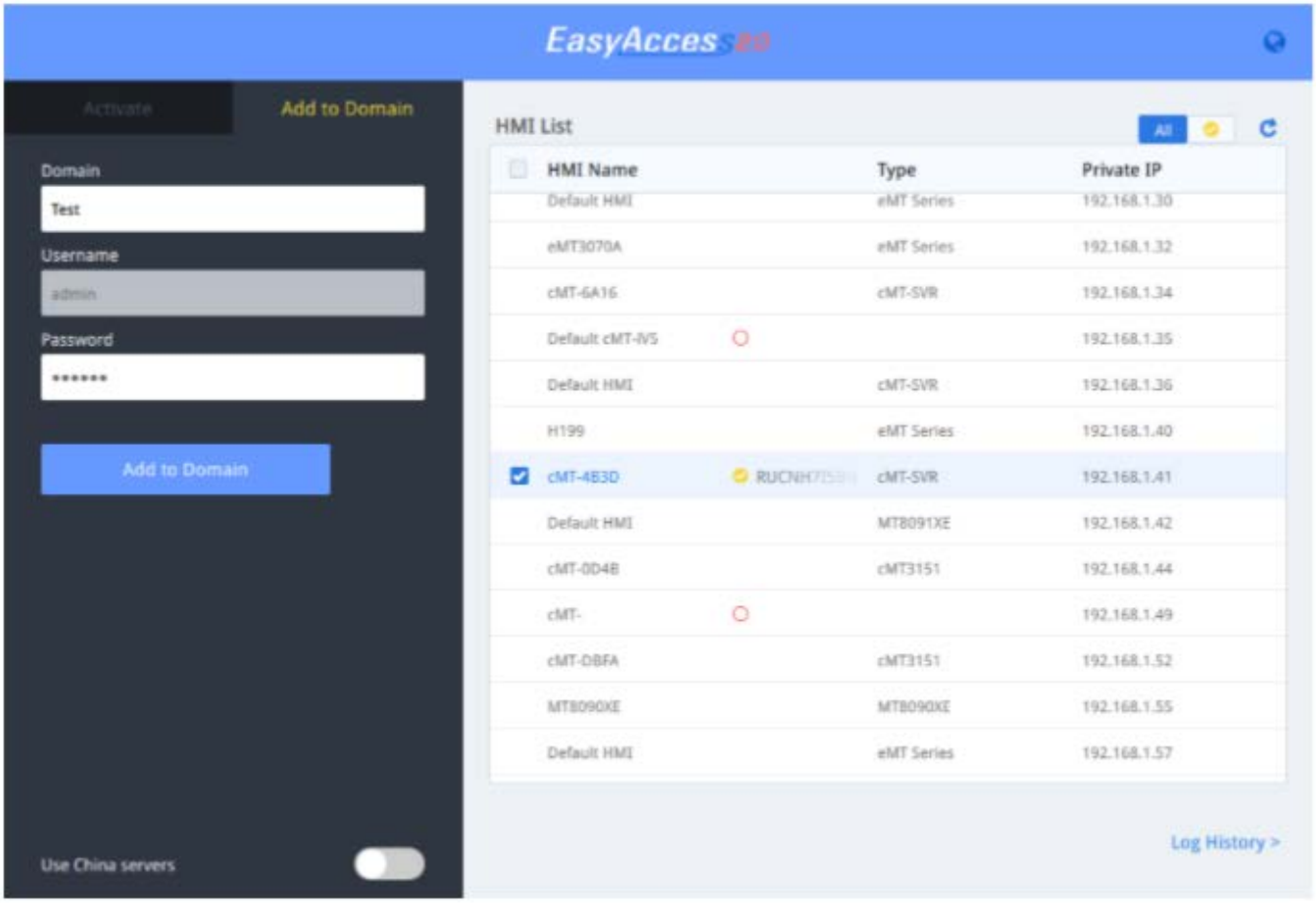


Figure 177

Embedded PC Activator

Search HMIs using embedded PC Activator and add them to your current login domain (Domain admin only). When you log in as domain admin, you can find a "plus button" on lower right corner.

Figure 178

Click to launch a dialog to search for HMIs on your LAN environment. You can activate HMI by using activation card or adding an activated HMI to current login domain.

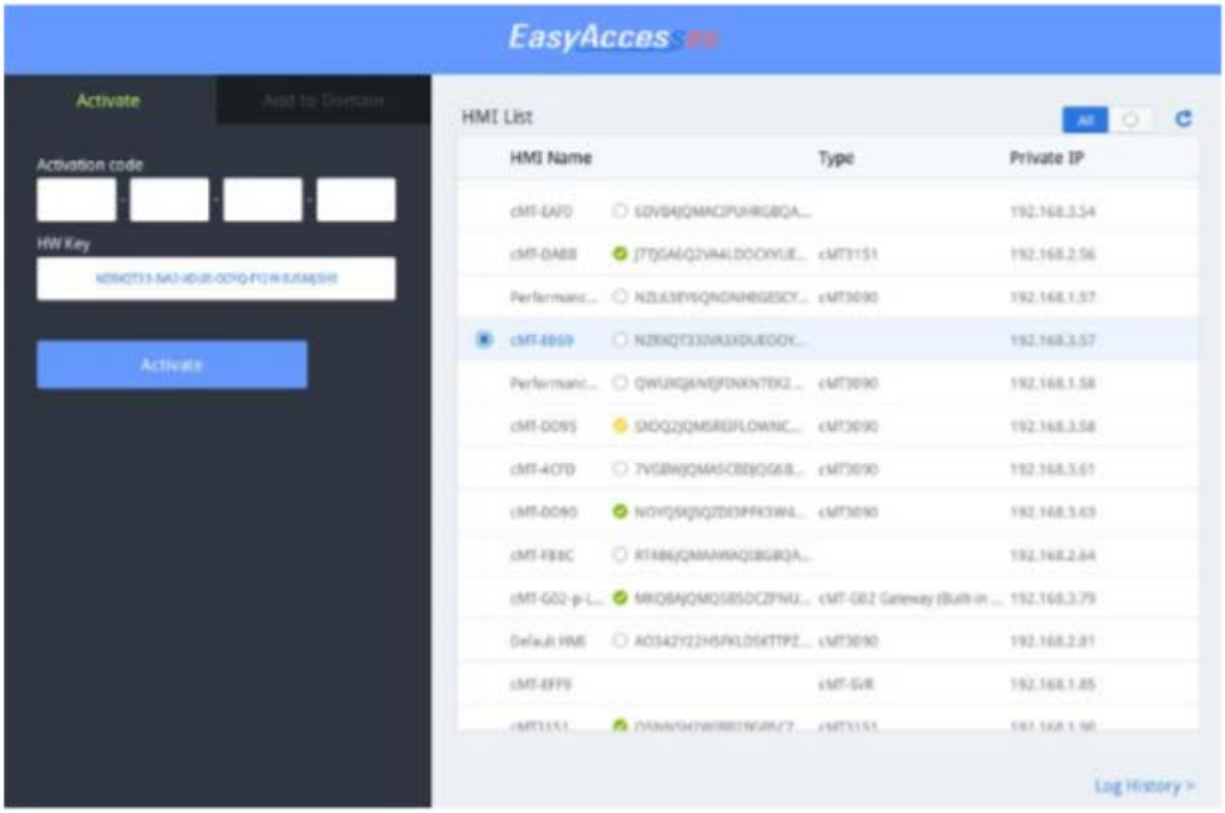

EasyAccess
Activate
Activation code
HW Key
Activate
HMI List
HMI Name
Type
Private IP
Log History

Figure 179

Figure 180

Please be noticed that EasyAccess 2.0 mobile application also supports this feature. Be sure to connect your mobile network to local Wi-Fi environment to find those HMIs under your local environment.

PC Activator HMI OS Support

HMI and OS that supports **PC Activator** (current as of May 2018)

cMT-SVR 20151127

Push Notification

With push notification, HMI sends selected event messages to EasyAccess 2.0 server, which may be viewed in the EasyAccess 2.0 application. In the case of a mobile device, the device will receive the event messages as push notification and be alerted on the standby screen.

Requirements

Using push notification is configured in the HMI and EasyAccess 2.0 application as follows:

1. In the HMI for High and Low Temperature and Humidity Alarms and Controller locked and unlocked push notifications are enabled

2. In EasyAccess 2.0 [Event Logs] => [Push Notification setting], toggle ON the push notification Enable option for each desired HMI.

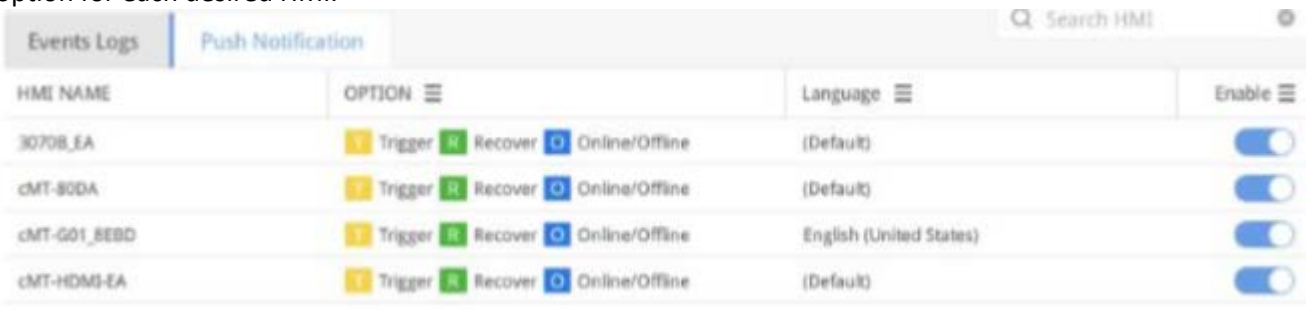


Figure 181

3. Select desired push notification event on OPTION.

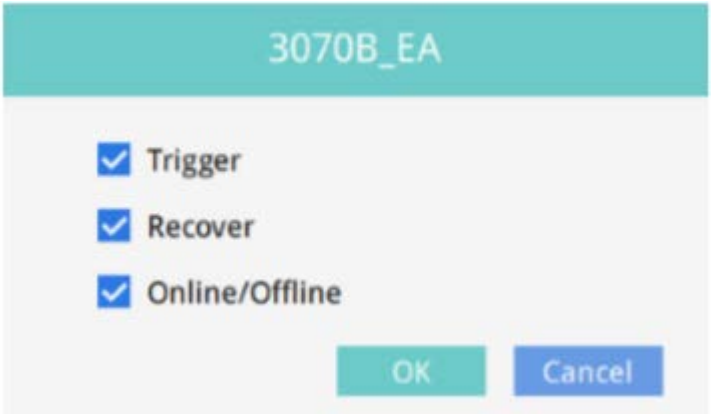


Figure 182

Receiving notification

If EasyAccess 2.0 remains running at least in the background and the user remains logged in, when an event occurs, the device will receive push notification. Nonetheless, the exact device behavior upon receiving push notification depends on each device's setting regarding push notification.

For Apple's iOS device, push notification goes through Apple Push Notification Service, whereas Android devices' goes through Google Cloud Messaging. Note that these services may be unavailable in certain regions, and users in those regions are unable to receive push notification on their devices.

Data Top-up

Currently, an HMI has 1GB of high-speed data per month for free. Once free data cap has been exceeded, speed will be limited to 5kB/s.

For additional high-speed data, data top-up from a top-up card is required. The card comes in 5GB or 10GB, with one-year validity. When an HMI reaches its data cap for the month, top-up data will kick in and the data from the top-up card will be consumed to maintain high-speed data transfer.

Top-up cards are available for purchase through Weintek's dealer; please contact your dealer for purchase details.

Loading top-up data

Load up top-up data with the following simple steps:

1. Obtain a Top-up card. It should come in electronic form, containing License Serial and Activation Code.
2. Go to Top-up card section in domain management system.
3. Click on the "add Top-up card" and then enter the License Serial and Activation Code to add the Top-up card.
4. Once successfully loaded, top-up data will be available within a few minutes.

Double-clicking on any one of the cards will display current usage and use history for the card. Similar "Domain Traffic Usage" information is also visible at the top left corner in the EasyAccess 2.0 application.

Top-up Card List

Figure 183

As Top-up data is associated with domain, all HMI and users in a domain will share the top-up data purchased. Also, adding multiple cards within a domain is allowed, and data from the card with the earliest expiration date will be used first.

Multiple Users Connection

Multiple users can connect to the same HMI at the same time. This function is controlled by domain admin. Configure the settings in account web. When this function is enabled, all domain users can use this functionality (also need to upgrade EasyAccess 2.0 app version to 2.9 or upper).

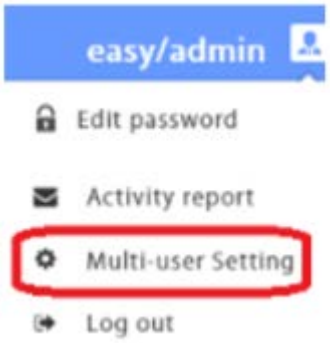


Figure 184

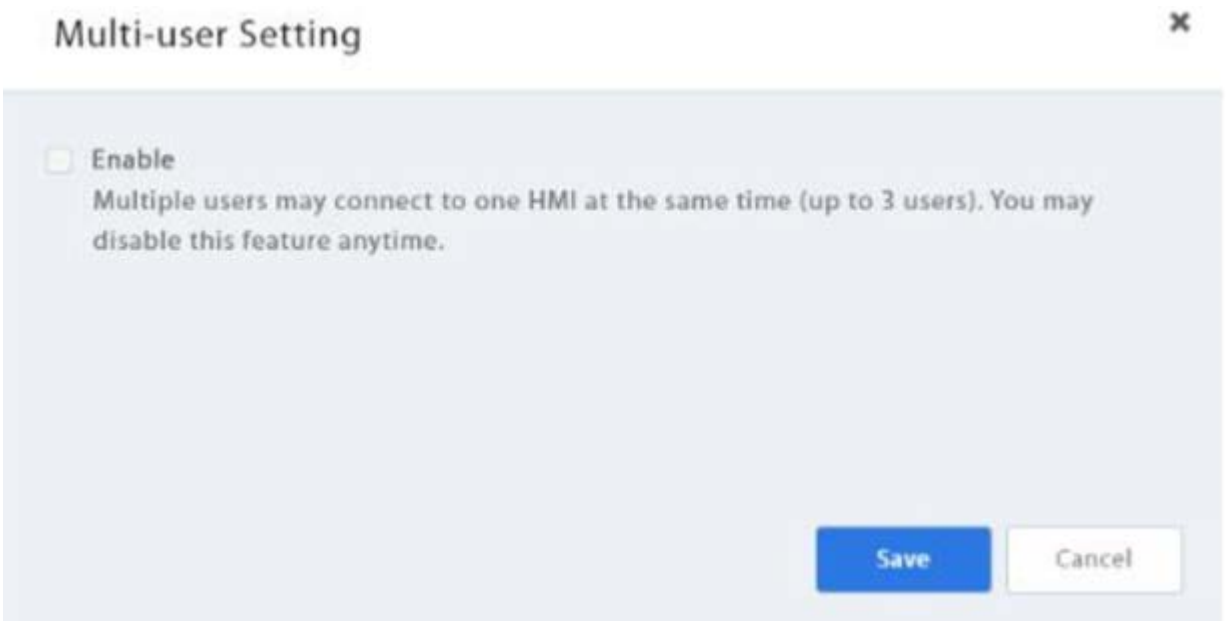
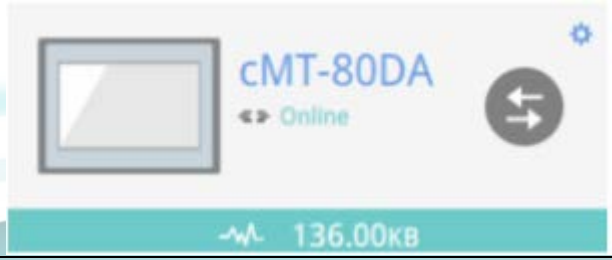


Figure 185

When HMI is already connected by other user, you can still connect the same HMI and see all connected users by clicking Occupied (N) hint. Currently there is a limitation for a maximum of 3 users to connect to same HMI.

Status	Meaning
	Nobody connects the HMI.

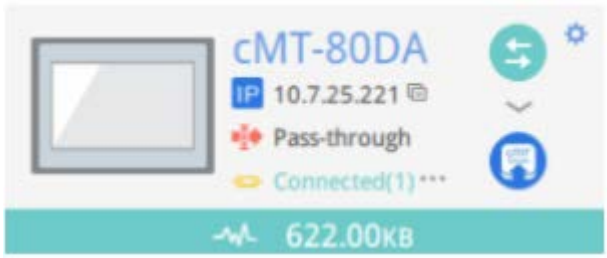
	Somebody connects the HMI. (If multi-user connection is enabled. You can still connect it.). You can check who connect the HMI by clicking Occupied(N).
	Somebody connects the HMI and the maximum connection limit is reached. You can check who connect the HMI by clicking Occupied(N).
	Connected successfully. You can use vpn ip (10.7.X.X) to use cMT-Viewer or VNC Viewer. You can check who connect the HMI by clicking Connected(N).

Table 38

When HMI is connected, you can check who is connecting the HMI by clicking Occupied(N) or Connected(N).

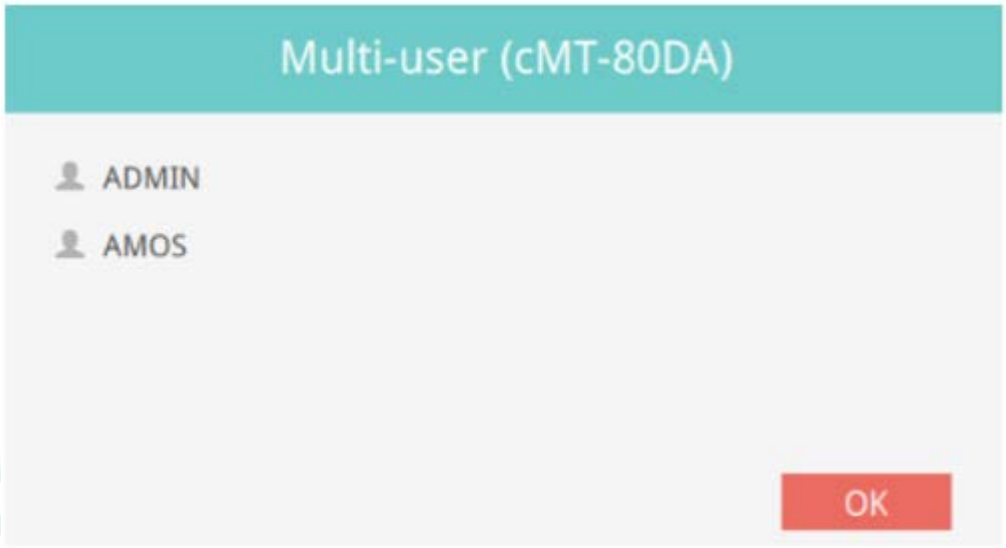


Figure 186

Domain admin can disconnect a currently connected user if necessary. When trying to connect to one HMI that has already been connected, a warning message will pop up.

Figure 187

To avoid the warning message from popping up, you can disable the related setting on Settings page.

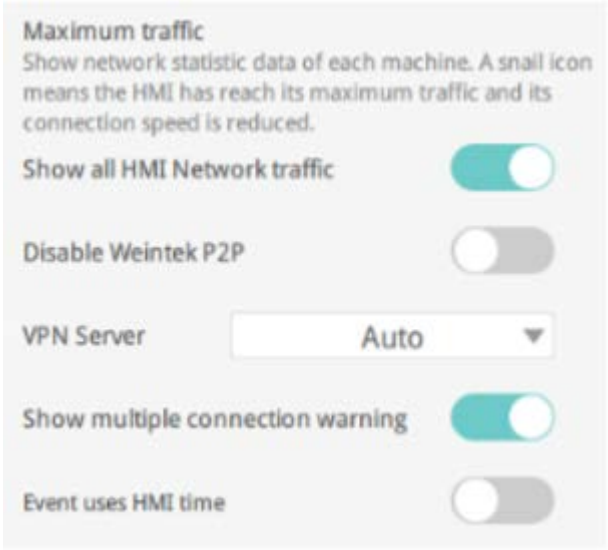


Figure 188

Frequently Asked Questions

Activation/ Domain Registration

Q: I am creating a new domain, but “I Agree” cannot be clicked.

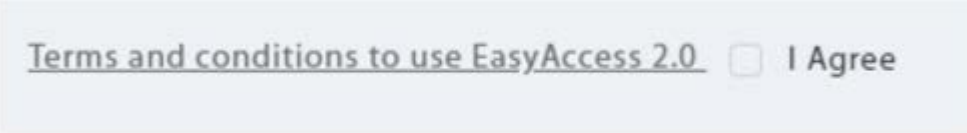


Figure 189

A: Please help check if your browser uses google translation plugin. Disable it and try again.

Q: After registering for a domain account, when trying to log in, it says my registration was incomplete?

A: After initial registration, an email will be sent to the email address. You must click on the link in the email to complete registration.

Q: I cannot activate while using PC Activator. HW Key text field is showing “Not Supported.”

A: Please check the HMI’s OS and refer to PC Activator for the list of PC Activator - supported model and OS version.

Q: I have just updated my OS to the latest release, but my activation disappeared. Do I have to re-activate?

A: In the EasyAccess 2 tab, click on the [Refresh] button. EasyAccess 2.0 will be re-activated if the same HMI was previously activated.

Q: My HMI is broken down and I am sending back my machine for repair. Can I use my old EasyAccess 2.0 license on my replacement machine?

A: Please contact us by service request on our website.

Q: I do not see the EasyAccess 2 tab.

A: Please check the HMI’s OS and refer to Model and OS Support for the list of EasyAccess 2.0 - supported model and OS version.

Q: On the EasyAccess 2 tab, it says “connect to the server fails?” in red.

A: The HMI cannot connect to the internet. Please make sure Internet access is available to the HMI. Check the IP address, Gateway, and DNS address settings.

If the HMI has an OS version prior to 20140814, you might see this message too. This indicates that security certificate on the HMI has expired and cannot work with the EasyAccess 2.0 server. To use EasyAccess 2.0 again, you must update the certificate manually. The update procedure is as follows:

1. With the latest EasyBuilder Pro, download the EasyAccess 2.0 Demo project (or any project which allows LW-10820 to be set to 1) to the HMI. When downloading, make sure EasyAccess 2.0 checkbox is ticked.
2. On the HMI, click the “connect” button (or set LW-10820 to 1); security certificate update will begin.
3. Check the activation status again in the system information page.

EasyAccess 2.0 Application

Q: When I run EasyAccess 2.0 on PC, I see weird graphic display like white dots everywhere and missing words.

A: Your PC may not have full support of graphic rendering method used by EasyAccess 2.0 client program. Run “Display Settings” to select the one that gives the best rendering result.

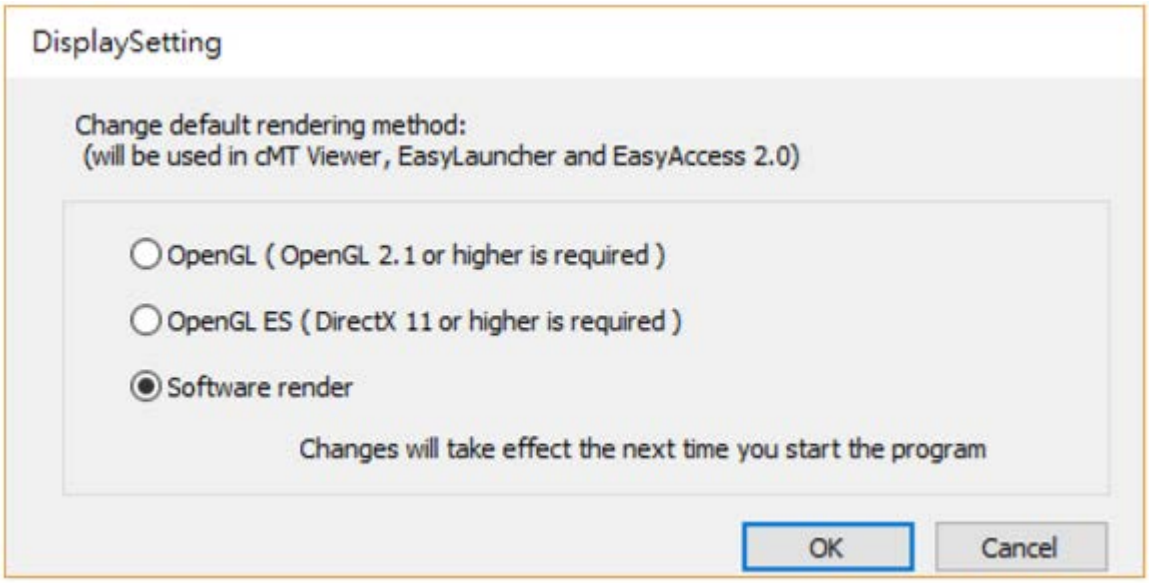


Figure 190

Q: I am using Windows 8 and the SmartScreen warns that running the software may put by PC at risk.

A: If you obtained our software from the official channel, either directly from us or from a trusted dealer, you can be rest assured that the software is safe. Click on “More info”, and then “Run Anyway” to continue.

Q: How do I update EasyAccess 2.0? Do you provide regular updates?

A: Yes, Weintek will provide feature and bug fixing updates on a regular basis. For the latest PC, iOS, Android software, please download from our website, the App Store, and Google Play Store, respectively. HMI’s EasyAccess client program is updated when you download any new program with EasyBuilder Pro. When EasyBuilder Pro detects that HMI has an EasyAccess 2.0 client program older than the one bundled to that EasyBuilder Pro version, it will download and update the one in HMI automatically.

Q: All my settings seem correct, and I see my HMI online in China. However, I just cannot make a connection sometimes! Is EasyAccess 2.0 service available everywhere?

A: Due to possible restriction of VPN traffic imposed by Chinese authorities, EasyAccess 2.0 connection may sometimes fail when network traffic must travel across the “borders”.

Access Location	Server in use	HMI Location	Connection Quality
Outside of China	Global	Outside of China	OK
China	Global	Outside of China	May be Affected
Outside of China	Global	China	May be Affected
China	Global	China	May be Affected
Outside of China	China	Outside of China	May be Affected
China	China	Outside of China	May be Affected
Outside of China	China	China	May be Affected
China	China	China	OK

Figure 191

As a rule of thumb, network traffic that needs to traverse across China’s firewall may be affected. In this case, do not disable Weintek P2P.

Q: I notice that VPN IP address can change between sessions. Is it normal?

A: Yes, it is perfectly normal. EasyAccess 2.0 connections are established on demand, so VPN IP address may change. Also, on PC or Android device, IP address starting with 10.8 denotes a connection made in point-to-point (P2P) mode as opposed to VPN mode. In general, P2P mode allows higher data rate than VPN does. The program will determine the proper mode to use based on current network conditions.

Q: When I try to log in with my user account, I always get incorrect username/password error.

A: Make sure that you are logging in to the right server. Currently there are Global and China servers and they are independent of each other. Their domain management web URL are different, and in EasyAccess 2.0 application, there is an option to choose the server to connect to.

Mobile App

Q: When using EasyAccess 2.0 mobile client, I get “EasyAccess 2.0 OPVN Connector” Error. (Android)

A: Make sure that OVPN is installed. Also, make sure that OVPN is authorized and trusted.

Q: When using EasyAccess 2.0 mobile client, I get “cannot open VNC” related error.

A: Make sure that VNC Viewer is installed and that the correct VNC Viewer app has been designated in the VNC setting page.

Other

Known Model-specific issues

cMT3090 with OS version 20170320 or earlier may experience slower EasyAccess 2.0 connection. We suggest upgrading your cMT3090 OS to a latter version.

Diagnosis

TCP Connection Test

To use EasyAccess 2.0 VPN connection, multiple TCP connection would be made from your HMI or PC to our vpn servers.

On PC, you can download our analyzer tool ea_test.zip to check connections to those servers.

On the HMI, you need to make sure HMI can connect to those VPN servers:

- ireland.wvpn.ihmi.net
- japan.wvpn.ihmi.net
- us.wvpn.ihmi.net

If any error happens, please check your network settings (e.g., firewall). If you still do not know what to do, you can contact our online customer service for help.

For access of Global server: https://account.ihmi.net

For access of China server: https://www.easyaccess.cn

DNS Test

Please run “analyze.bat” and check the result from “analyze_result.txt” in dns_check.zip.

Appendix

Terminology

(Online Status) Online:

When an HMI goes online, it sends keep-alive information to a keep-alive server and lets all EasyAccess 2.0 clients know it is ready for connection. There is still no connection in this state unless one EasyAccess 2.0 client connects to it.

(Online Status) Occupied:

When an EasyAccess 2.0 client connects to the HMI, then the HMI is occupied, and no other EasyAccess 2.0 client can connect to it until it is disconnected.

Easy Convertor Tool

Overview

EasyConverter reads the Data Log file, Event Log file, and Operation Log file in HMI and convert the files to Excel format.

- From Utility ManagerEX click [Data Conversion] » [EasyConverter].
- From EasyBuilder Pro menu select [Tool] » [Data/Event Log Converter].

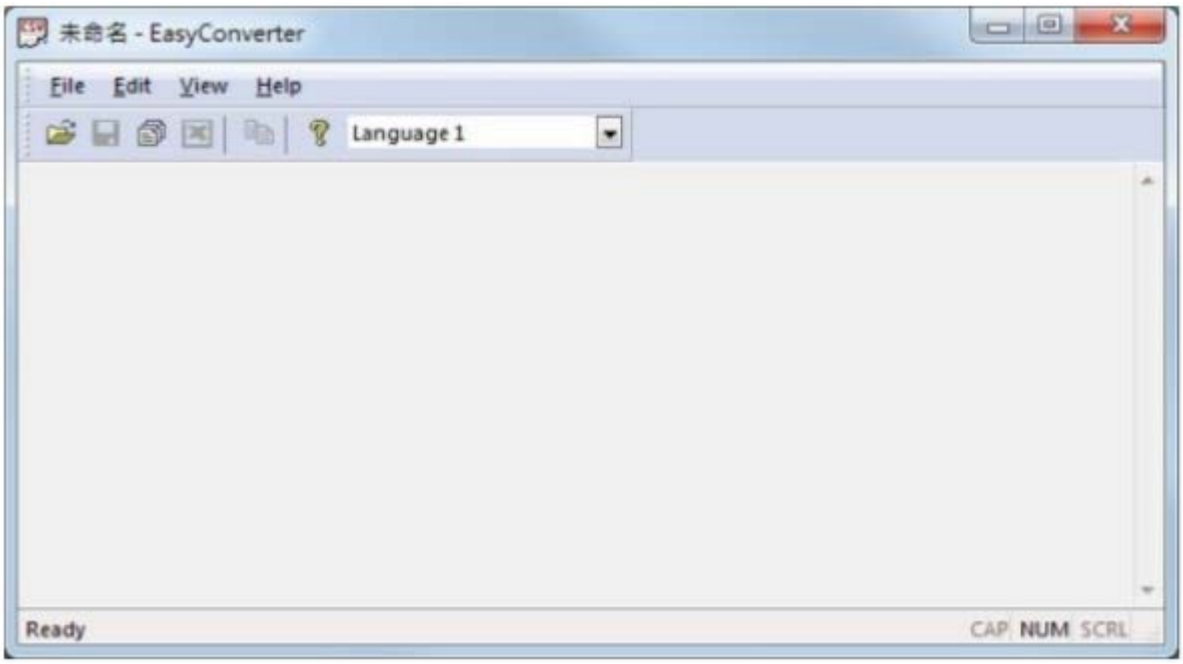


Figure 192

Click the icon to watch the demonstration film. Please confirm your internet connection before playing the film.

Converting Data Log File to Excel File

1. If the Data Log file format is .db, and the file includes data of more than one day, the data to be viewed can be specified by selecting a date range. (If the file format is, .dtl, please skip this step.)

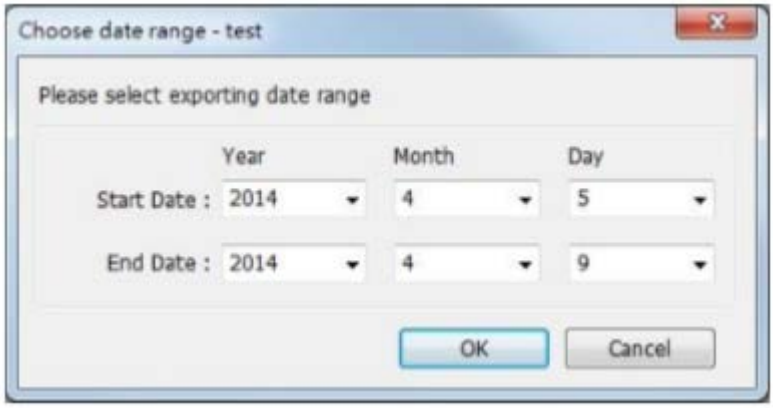


Figure 193

2. The following is the setting dialog box, please set based on actual needs.

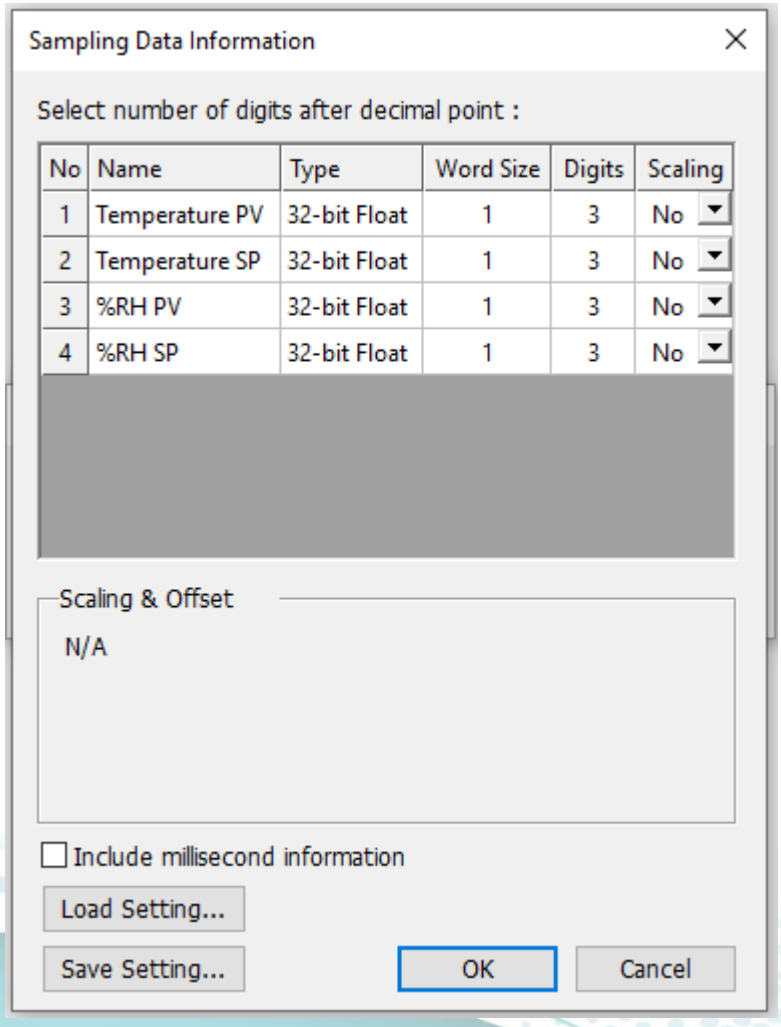


Figure 194

3. Click [OK], the Data Log layout is shown in the following figure. Click [Export to Excel]. The file will be converted to Excel format.

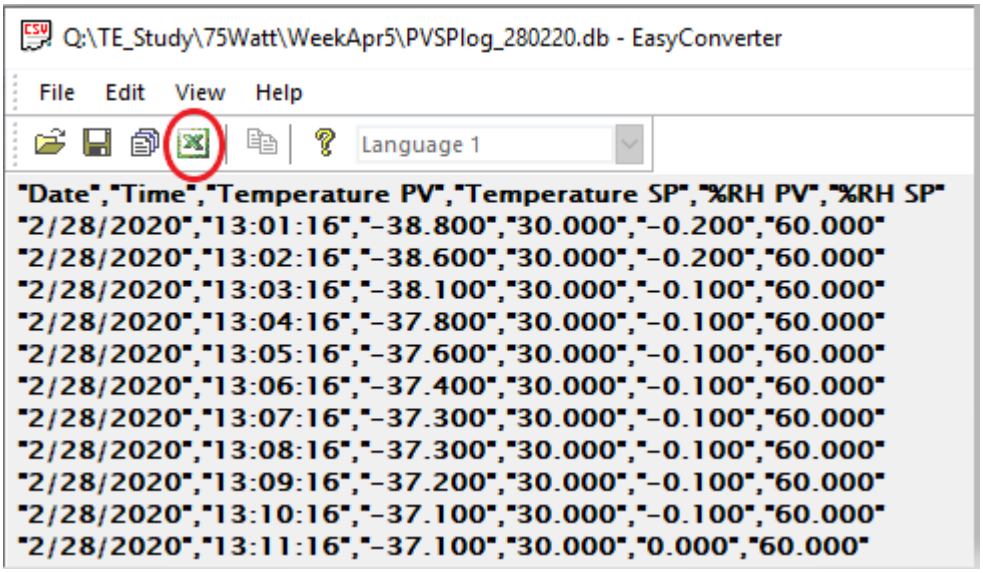


Figure 195

4. The Excel layout is shown in the following figure

	A	B	C	D	E	F
1	Date	Time	Temperature PV	Temperature SP	%RH PV	%RH SP
2	2/28/2020	13:01:16	-38.79999924	30	-0.2	60
3	2/28/2020	13:02:16	-38.59999847	30	-0.2	60
4	2/28/2020	13:03:16	-38.09999847	30	-0.1	60
5	2/28/2020	13:04:16	-37.79999924	30	-0.1	60
6	2/28/2020	13:05:16	-37.59999847	30	-0.1	60
7	2/28/2020	13:06:16	-37.40000153	30	-0.1	60
8	2/28/2020	13:07:16	-37.29999924	30	-0.1	60
9	2/28/2020	13:08:16	-37.29999924	30	-0.1	60
10	2/28/2020	13:09:16	-37.20000076	30	-0.1	60
11	2/28/2020	13:10:16	-37.09999847	30	-0.1	60
12	2/28/2020	13:11:16	-37.09999847	30	0	60

Figure 196

Note:

- If the file requires over six million cells in Excel format, only partial data will be shown in EasyConverter. (The complete data will still be exported to xls / xlsx file.)
- The file will be automatically separated into different sheets in the xls / xlsx file under these conditions:

- Exceeds 60 thousand rows in a single sheet.
- Exceeds 1.5 million cells in a single sheet.

Converting Event Log File to Excel File

1. If the Event Log file format is .db, and the file includes data of more than one day, the data to be viewed can be specified by selecting a date range. (If the file format is, .evt, please skip this step.)

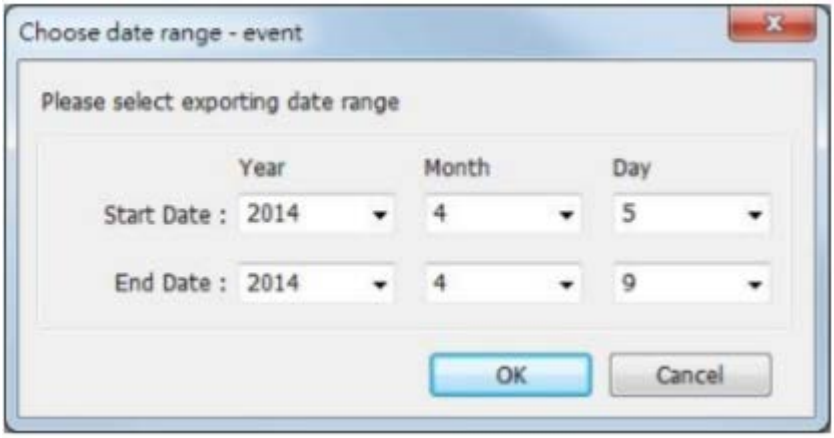


Figure 197

2. If the, .db file of Event Log contains multiple languages, the language to be viewed can be specified. (If the file format is, .evt, please skip this step.)

Figure 198

3. Click [OK], the Event Log layout is shown in the following figure. Click [Export to Excel]. The file will be converted to Excel format.

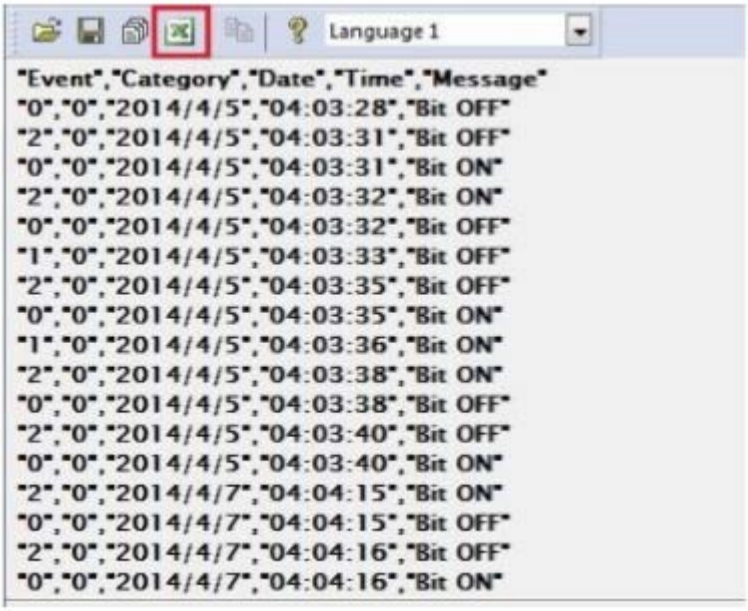


Figure 199

4. The Excel layout is shown in the following figure.

	A	B	C	D	E	F
1	Event	Category	Date	Time	Message	
2	0	0	2014/4/5	4:03:28	Bit OFF	
3	2	0	2014/4/5	4:03:31	Bit OFF	
4	0	0	2014/4/5	4:03:31	Bit ON	
5	2	0	2014/4/5	4:03:32	Bit ON	
6	0	0	2014/4/5	4:03:32	Bit OFF	
7	1	0	2014/4/5	4:03:33	Bit OFF	
8	2	0	2014/4/5	4:03:35	Bit OFF	
9	0	0	2014/4/5	4:03:35	Bit ON	
10	1	0	2014/4/5	4:03:36	Bit ON	
11	2	0	2014/4/5	4:03:38	Bit ON	
12	0	0	2014/4/5	4:03:38	Bit OFF	
13	2	0	2014/4/5	4:03:40	Bit OFF	
14	0	0	2014/4/5	4:03:40	Bit ON	
15	2	0	2014/4/7	4:04:15	Bit ON	

event

Figure 200

Note

- The "Event" column can be found. 0-> Event triggered; 1-> Event acknowledged; 2-> Event returns to normal.
- If the file requires over six million cells in Excel format, opening the file in EasyCoverter only partially shows the data. (The complete data will be exported to xls / xlsx file.)

- The file will be automatically separated into different sheets in the xls / xlsx file under these conditions:
  - Exceeds 60 thousand rows in a single sheet.
  - Exceeds 1.5 million cells in a single sheet.

Converting Operation Log File to Excel File

1. If the Operation Log file includes data of more than one day, the data to be viewed can be specified by selecting a date range.

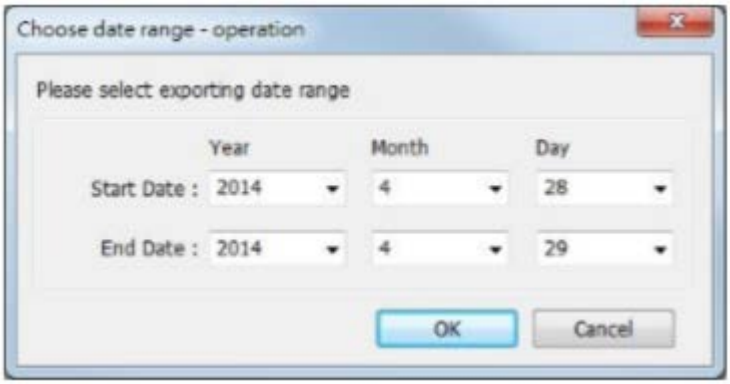


Figure 201

2. Click [OK], the Operation Log layout is shown in the following figure. Click [Export to Excel]. The file will be converted to Excel format.

Figure 202

3. The Excel layout is shown in the following figure.

	ID	Date	Time	User_Name	Class	Window	Object_Name	Comment	Action	Address	Information
1	1	2014/4/28	6:47:57			10	NE_9	month	Set word	LW-9220 (32bit) : password	write 111
2	2	2014/4/28	6:47:59	noname	ADEF	10	NE_4	day	Set word	LW-9020 (16bit) : local day	write 29
3	3	2014/4/29	6:48:02	noname	ADEF	10	NE_5	hour	Set word	LW-9019 (16bit) : local hour	write 9
4	4	2014/4/29	9:48:10	noname	ADEF	10	NE_2	year	Set word	LW-9022 (16bit) : local year	write 2014
5	5	2014/4/29	9:48:13	noname	ADEF	10	NE_2	year	Set word	LW-9022 (16bit) : local year	write 2014
6	6	2014/4/29	9:48:16	noname	ADEF	10	NE_6	minute	Set word	LW-9018 (16bit) : local minute	write 50
7	7	2014/4/29	9:50:20	noname	ADEF	10	NE_8	month	Set word	LW-9219 (16bit) : user no. (1~12)	write 2
8	8	2014/4/29	9:50:22	noname	ADEF	10	NE_9	month	Set word	LW-9220 (32bit) : password	write 222
9	9	2014/4/29	9:50:26	noname	B	10	NE_3	month	Set word	LW-9021 (16bit) : local month	write 6
10											
11											

Figure 203

Note

- If the file requires over six million cells in Excel format, opening the file in EasyCoverter only partially shows the data. (The complete data will be exported to xls / xlsx file.)
- The file will be automatically separated into different sheets in the xls / xlsx file under these conditions:
  - Exceeds 60 thousand rows in a single sheet.
  - Exceeds 1.5 million cells in a single sheet.

Converting Multiple Files

1. Click [Multi-File] to open the following dialog box.

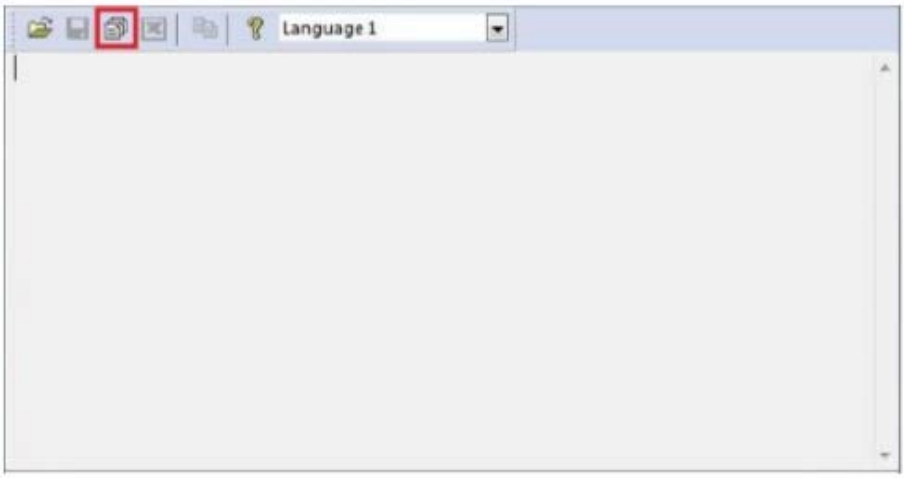


Figure 204

2. Click [Add File…] to add the files to be converted. If click [OK] without selecting [Combine to a file], the files will be exported to separate Excel files.

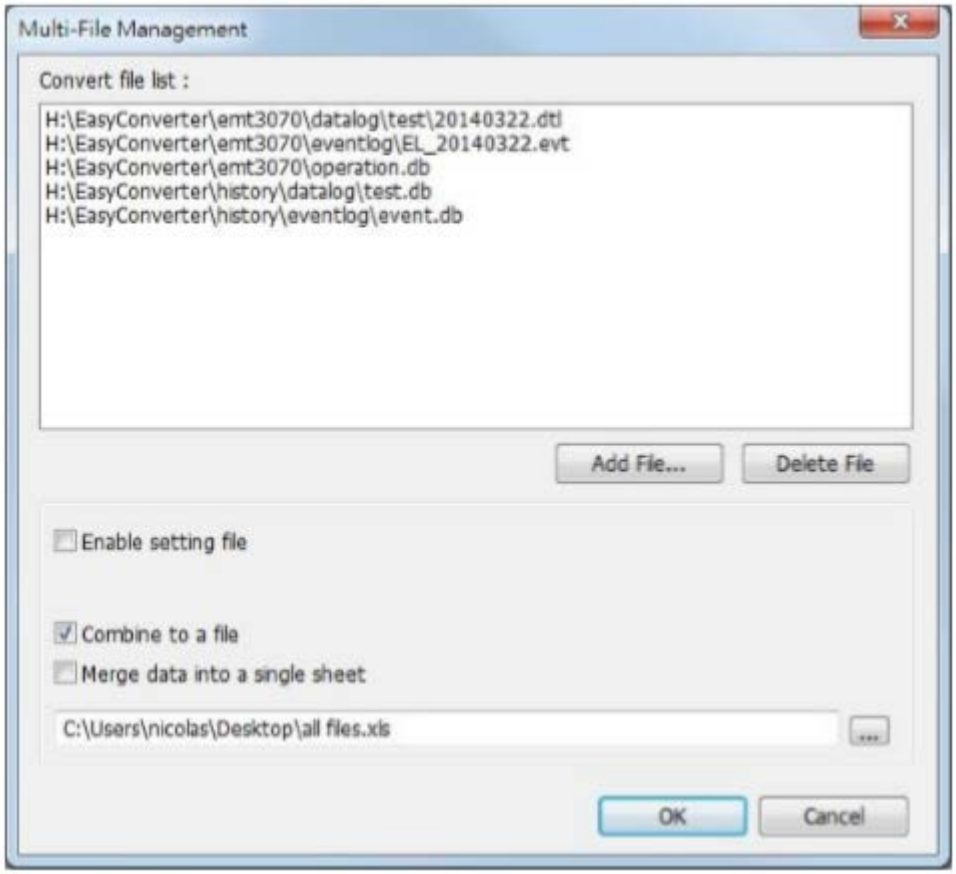


Figure 205

3. If [Combine to a file] is selected, the files will be separated into different sheets of one Excel file as shown in the following figure.

	A	B	C	D	E	F	G
1	Date	Time	Millisecond	temperature	humidity		
2	2014/3/22	6:36:52	260	2	1		
3	2014/3/22	6:36:55	250	6	3		
4	2014/3/22	6:36:58	250	10	6		
5	2014/3/22	6:37:01	300	13	8		
6	2014/3/22	6:37:04	280	17	10		
7	2014/3/22	6:37:07	250	21	13		
8							
9							
10							
11							
12							
13							
14							
15							

20140322 / EL_20140322 / operation / test / event /

Figure 206

Note The files cannot be combined when the total size of the files exceeds 32MB.

Scaling Function

When opening a Data Log file, the scaling function can be set.

The equation of scaling new value = [(value + A) x B] + C, and users can set the values of A, B, and C.

A -> lower limit of the value; B -> [(scaled max) - (scaled min) / (upper limit) - (lower limit)]; C -> scaled min.

For example, here is a voltage data with a format of 16-bit unsigned (range: 0 ~ 4096). To convert the data to volt, range form -5V to +5V, the new value = [(value + 0) x 0.0024] + (-5).

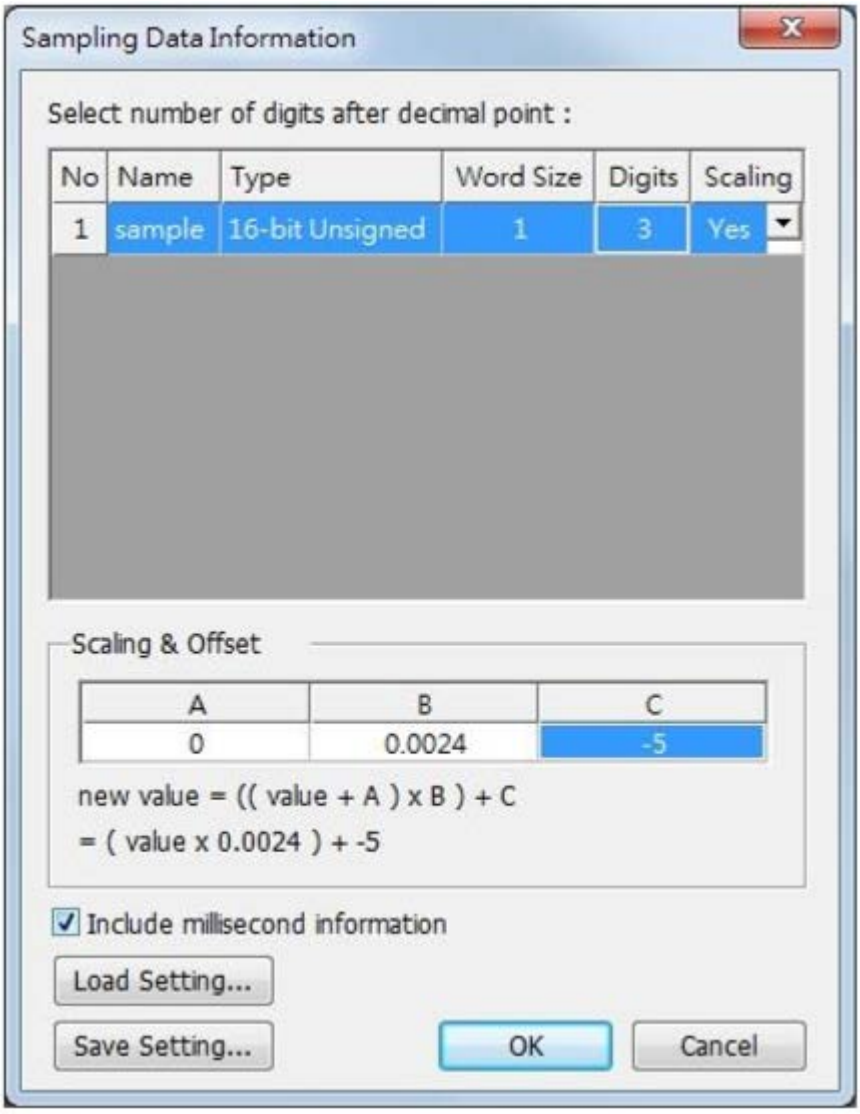
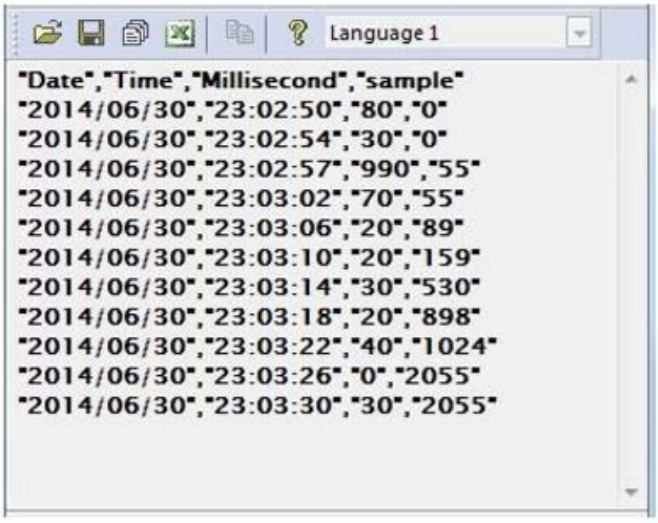


Figure 207

Before scaling:



After scaling:

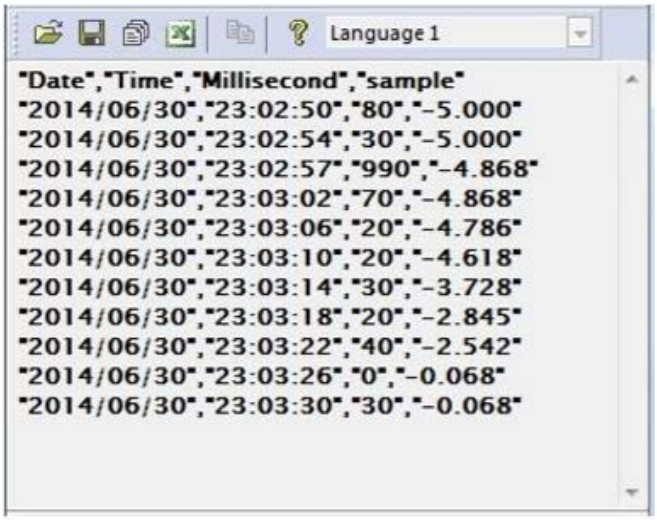


Figure 208

The settings described above can be saved as a settings file in *.lgs format, and then loaded next time if needed.

Batch File

EasyConverter command line can execute batch file (.bat) and convert. dtl or .evt files into .xls or .csv files for export. In the batch file, the user can define the format of the exported file (ex: ASCII, Unicode, or UTF-8), and decide whether to include millisecond information or load settings file.

The following explains how to create batch file (.bat) and provides some relevant notes.

Parameters:

[/c{a,8, u}] [/t{0,1}] [/s "Format file"] ["Src file"] ["Dest file"]

Example:

EasyConverter.exe /ca /t1 /s "C:\Format.lgs" "C:\Src.dtl" "C:\Dest.csv" EasyConverter.exe /t1 /s "C:\Format.lgs" "C:\Src.dtl" "C:\Dest.xls"

Parameter	Description
/c {a,8, u}	Optional, specifies encoding method, only required when exporting a .csv file. /ca: ASCII (Default) /c8: UTF-8

Parameter	Description
	/cu: Unicode
/t {0,1}	Optional, specifies whether to include millisecond information /t0: Excludes millisecond information. /t1: Includes millisecond information. (Default)
/s	Optional, specifies whether to import settings file. To import settings file, specify the path of .lgs file following /s. For example: /s "C:\Format.lgs"
"Src file"	Specifies the source file path, and the file format should be: .dtl, .evt, or .db
"Dest file"	Specifies the destination file path, and the file format can be: .xls or .csv. See Note.

Table 39

Note If the file name and path of "Dest file" is not specified in command line, the system will export the file to the same path as "Src file".

You can also find the commands above by entering the file path of EasyConverter.exe in Windows cmd.exe as shown in the following window. Example: Enter “D:\EasyBuilder\EB Pro>EasyConverter.exe –h”

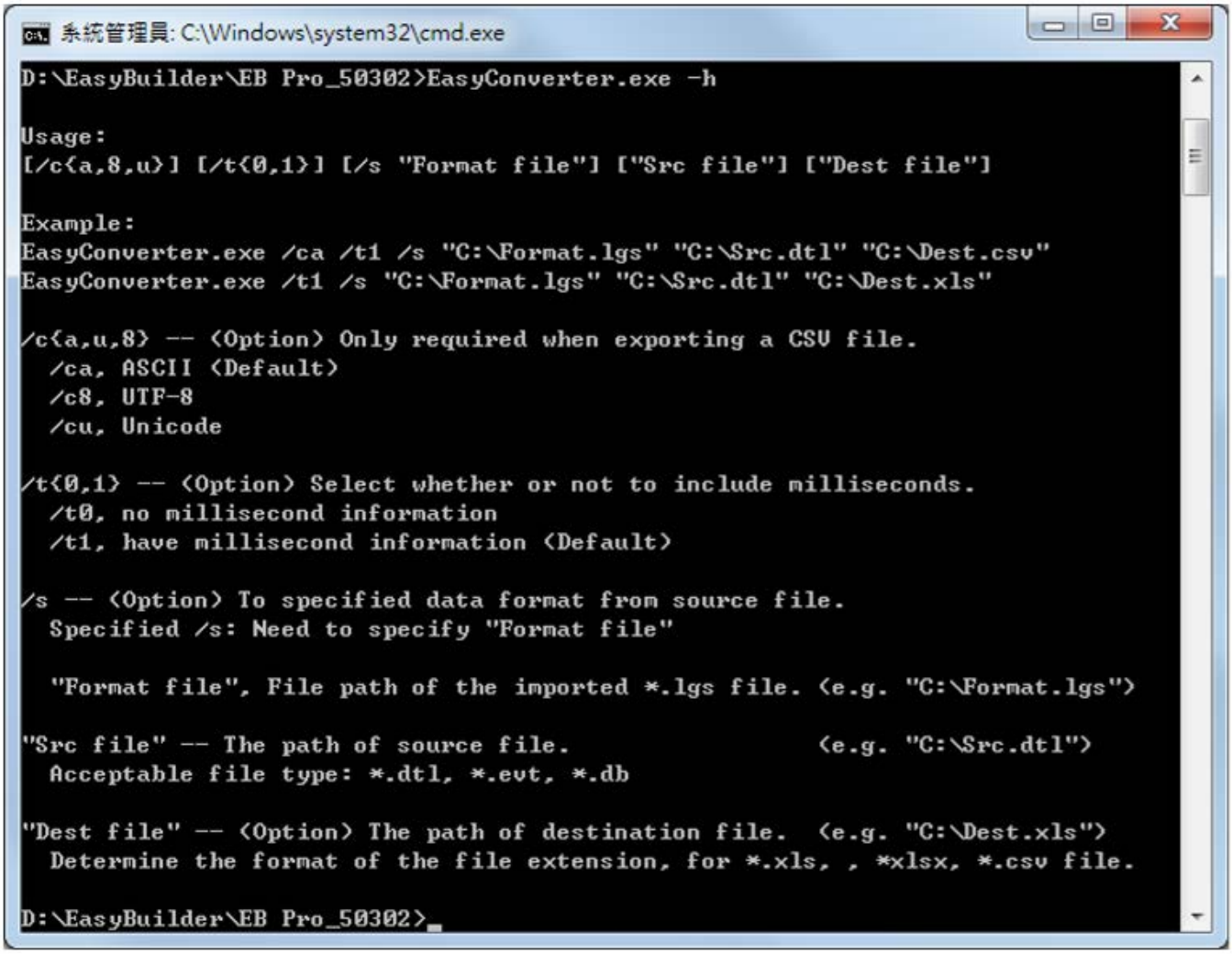


Figure 209

Example

To convert the file 20150919 stored in “D:\EasyBuilder\EB Pro\HMI_memory” from. dtl to .xls, and then save the file to the desktop, you can use the following command lines.

Scene 1: If the .bat file is placed in the same directory as EasyConverter, then the command line is:

EasyConverter.exe "D:\EasyBuilder\EB Pro\HMI_memory\20150919.dtl" "C:\Users\Desktop\20150919.xls"

Scene 2: If the .bat file is placed in a different directory from EasyConverter, the directory to store EasyConverter.exe. must be specified, and the command line will be:

"D:\EasyBuilder\EB Pro\EasyConverter.exe" "D:\EasyBuilder\EB Pro\HMI_memory\20150919.dtl" "C:\Users\Desktop\20150919.xls"

Error Codes:

Email Error Codes

See Email Error

Loop Controller communication Error

Error Code Cause of Communication Error

0 Normal
1 The device is busy and not yet ready to process a command.
2 Communication error due to unexpected reason.
3 The device does not exist.
4 The device using the specified station number does not exist.
5 Incorrect address format.
6 Read/Write unsupported address.
7 The driver of the device does not exist.
8 The COM port does not exist.
9 Incorrect IP address or unable to connect the device.
10 Checksum error.
11 Unidentified command.
12 Ignore
20 The USB device is improperly connected.
21 The CAN Bus device is improperly connected.
22 No reply from the device.
23 Insufficient data read from the device before timeout.
24 The Conversion Tag used by the object does not exist or the content is incorrect.
25 HMI is not accepting any commands from a remote HMI.
251 Read/Write exceeding number of words from/to the register of the MODBUS device.
252 MODBUS device replies incorrect data format.
253 MODBUS device checksum error.

Add on Feature

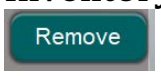
Add-on features do not come standard with the VTS. The feature maybe downloaded to the VTS as an upgrade by end user or Darwin technician. If the VTS is setup on EasyAccess then Darwin chambers setup as an administrator to the account would allow over the air upgrade to the VTS. However, some features may require extra hardware. Speak to your sales representative for interest in a feature or recommendation for an added feature.

Bar Code reader

The bar code reader can be used to check in and check out inventory in the chamber. The end user is required to have a device with an Android based camera. The feature is not supported on IOS. The user can specify location and qty then scan the bar code. The user must be logged in to use the feature. Once Check In or Check Out is pressed the information is recorded in a database format along with the user name who checked in or out the

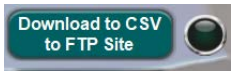
item. The files are saved to the SD card and can be transferred to USB or emailed in a .db file format that can be open using the easy convertor tool. Also included is a QR code generator. This will allow user to create codes if user does not have the tool already. Use the snippet tool on a PC to take screen shot image to print out to label product.

Inventory Screen



Removes the entire database. Class C user is only allowed to use this feature.

Emails the data base file.



Downloads the file to a CSV file format that can be accessed on the FTP site of the HMI.

Downloads the file to a CSV file format and to the installed USB flash Drive.

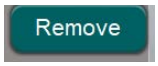
Informs the User know a USB flash drive is installed.

Changes screen to the removed items from the chamber.

Changes screen to the scan screen. To scan must be on a Android device with camera.

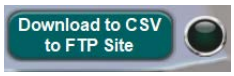

DARWIN CHAMBERS
Temperature °C
25.2
Humidity %
59.7
Light %
80
13/08/2020 THU 08:26:11
Check IN
Current Inventory
No. Time Date Location Qty Item User
6 07:01 13/08/2020 Shelf 4 3 500431 user2
5 07:00 13/08/2020 Shelf 4 3 0028995067006 user2
4 15:03 12/08/2020 Shelf 1 456 Sinjin user2
3 15:01 12/08/2020 Shelf 1 456 2345Fred Supervisor
2 14:56 12/08/2020 Shelf1 23 0028995067006 admin
1 14:54 12/08/2020 Shelf1 23 牆搗 admin
Scan
1234567
Removed Inventory
USB Installed
Download to CSV to FTP Site
Email .db File
Download CSV to USB Drive
Remove

REMOVED INVENTORY



Removes the entire database. Class C user is only allowed to use this feature.

Emails the data base file.

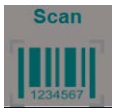


Downloads the file to a CSV file format that can be accessed on the FTP site of the HMI.

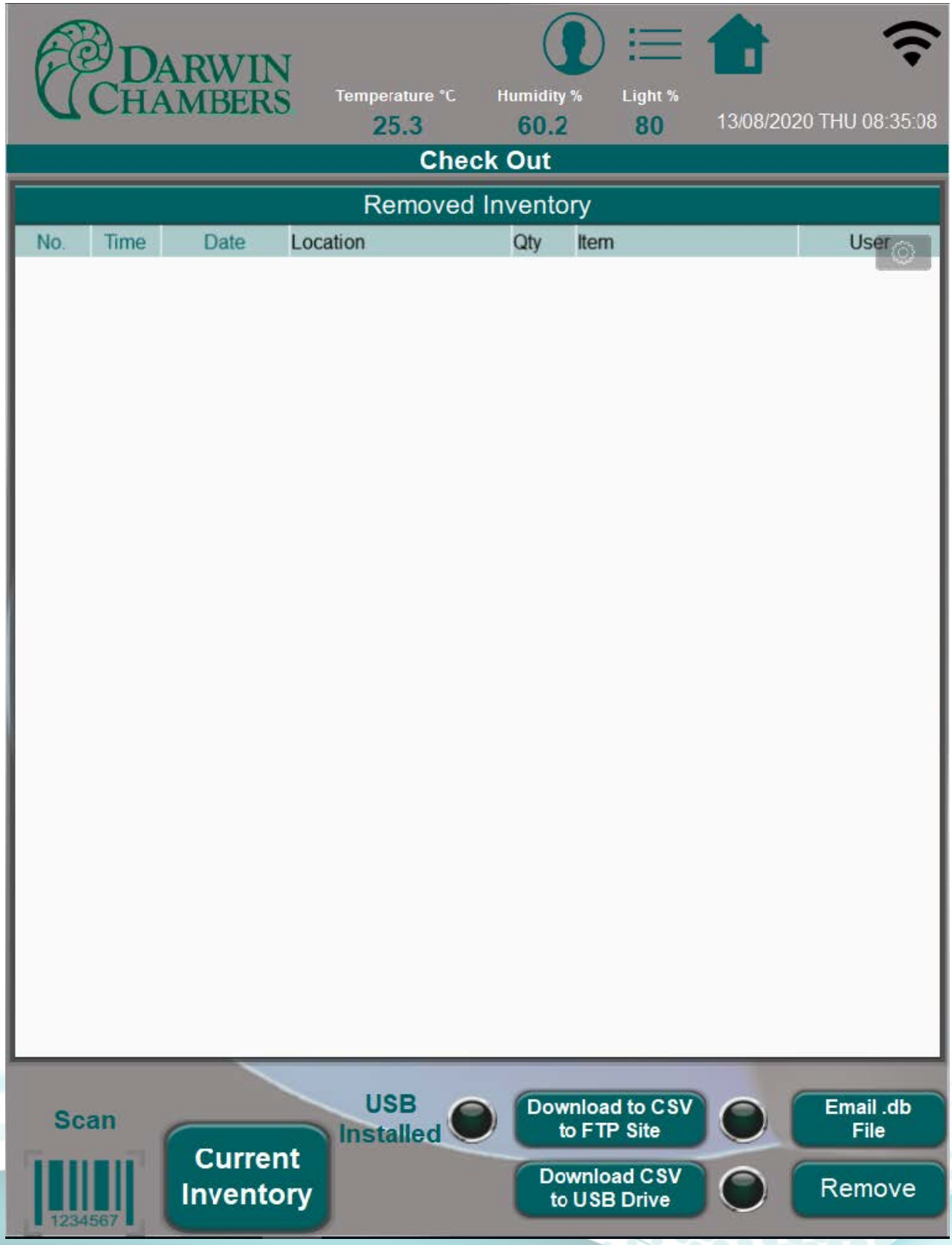
Downloads the file to a CSV file format and to the installed USB flash Drive.

Informs the User know a USB flash drive is installed.

Changes screen to the removed items from the chamber.



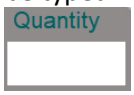
Changes screen to the scan screen. To scan must be on an Android device with camera.


DARWIN CHAMBERS
Temperature °C
25.3
Humidity %
60.2
Light %
80
13/08/2020 THU 08:35:08
Check Out
Removed Inventory
No.
Time
Date
Location
Qty
Item
User
Scan
1234567
Current Inventory
USB Installed
Download to CSV to FTP Site
Download CSV to USB Drive
Email .db File
Remove

SCAN SCREEN

Found is the scanned data from the bar code.

Location is for describing where placed in the chamber. Up to 32 characters can be typed in.



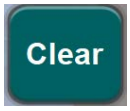
For items with the same bar code a qty amount can be entered. Up tp 8 characters can be typed in.

Changes screen back to inventory screen.

Changes back to removed inventory screen.

Starts and clears the Scanning for bar code on the Android Device.

Stops the Scanning for bar code on the Android Device.

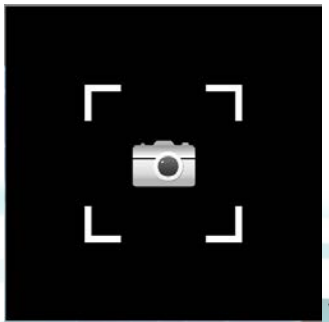


Clears the Scanning for bar code on the Android Device.

Puts the found data in the Current inventory database.

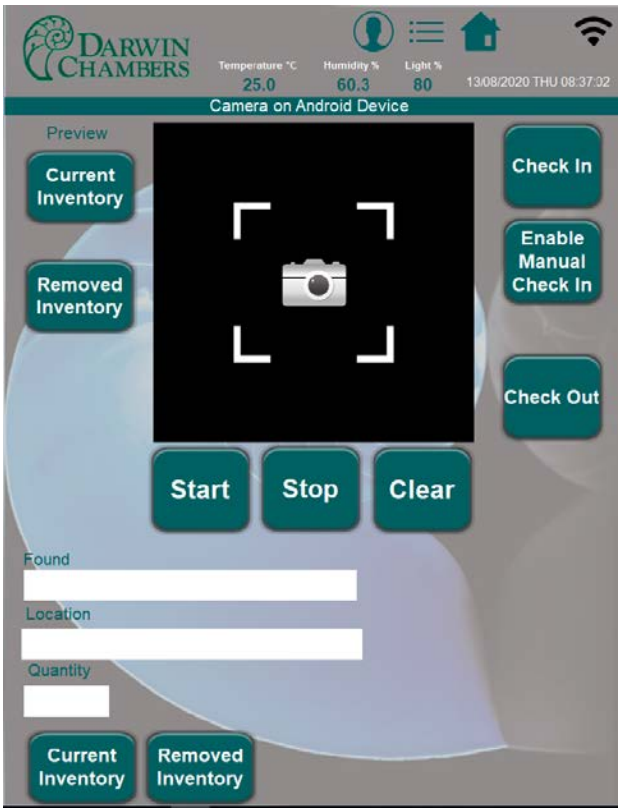
Allows to type in the found data. This helps if reader cannot detect code. Must be a class C user.

Puts the found data in the removed inventory database.


Where image will appear on Android device for scanning barcode. Adjust barcode to fit within the white square like shape.

Preview Current Inventory or Removed Inventory opens a smaller version of that data base screen. This helps when scanning multiple items that the data is being recorded on the database.

Scan Screen on a PC.



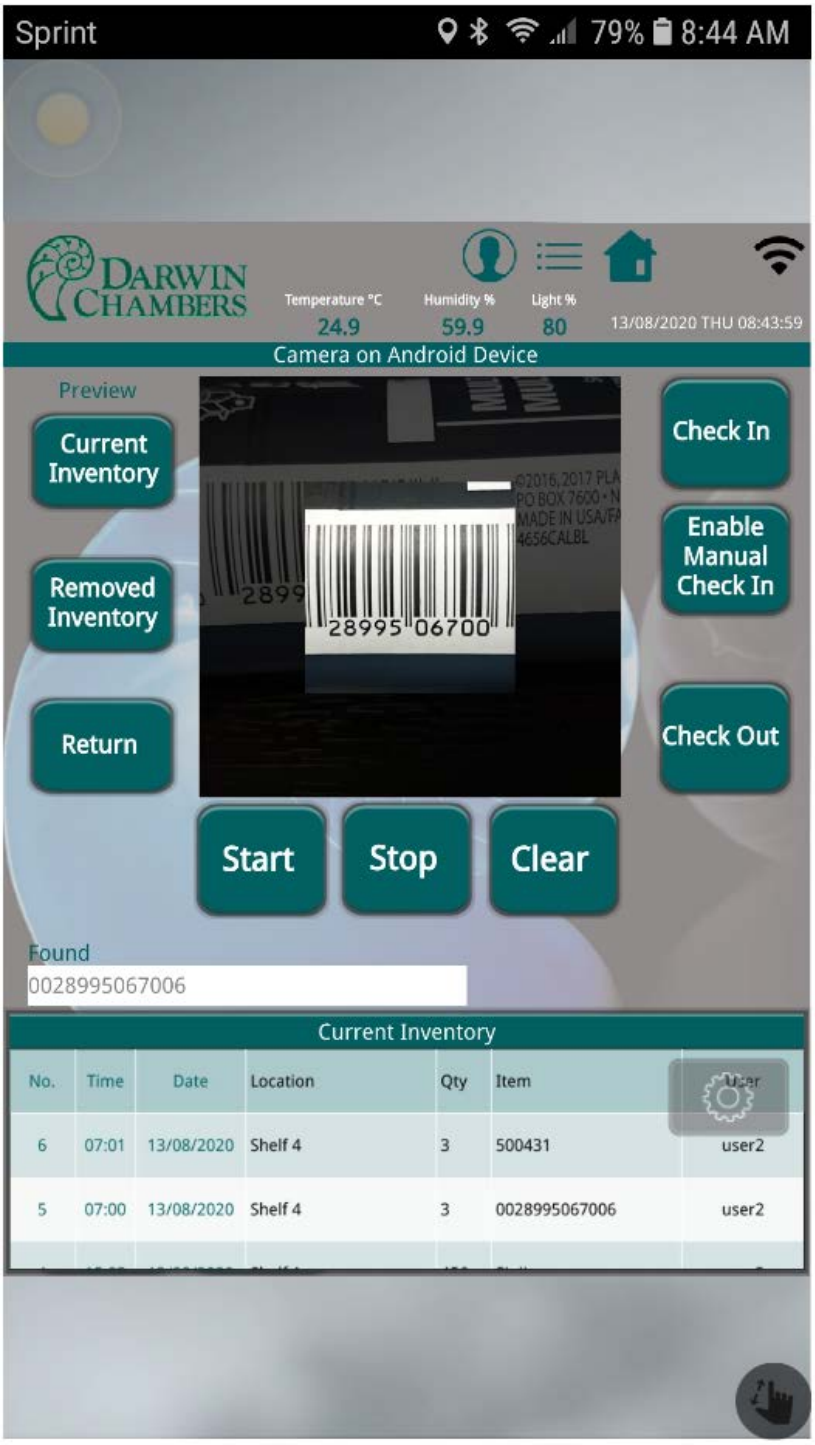
Scan screen on an Android Device. This is how appears before scanning with darken image view.


92% 7:22 AM
DARWIN CHAMBERS
Temperature °C
25.2
Humidity %
59.6
Light %
80
13/08/2020 THU 07:22:20
Camera on Android Device
Preview
Current Inventory
Removed Inventory
Check In
Enable Manual Check In
Check Out
Start
Stop
Clear
Found
Location
Shelf 4
Quantity
3
Current Inventory
Removed Inventory

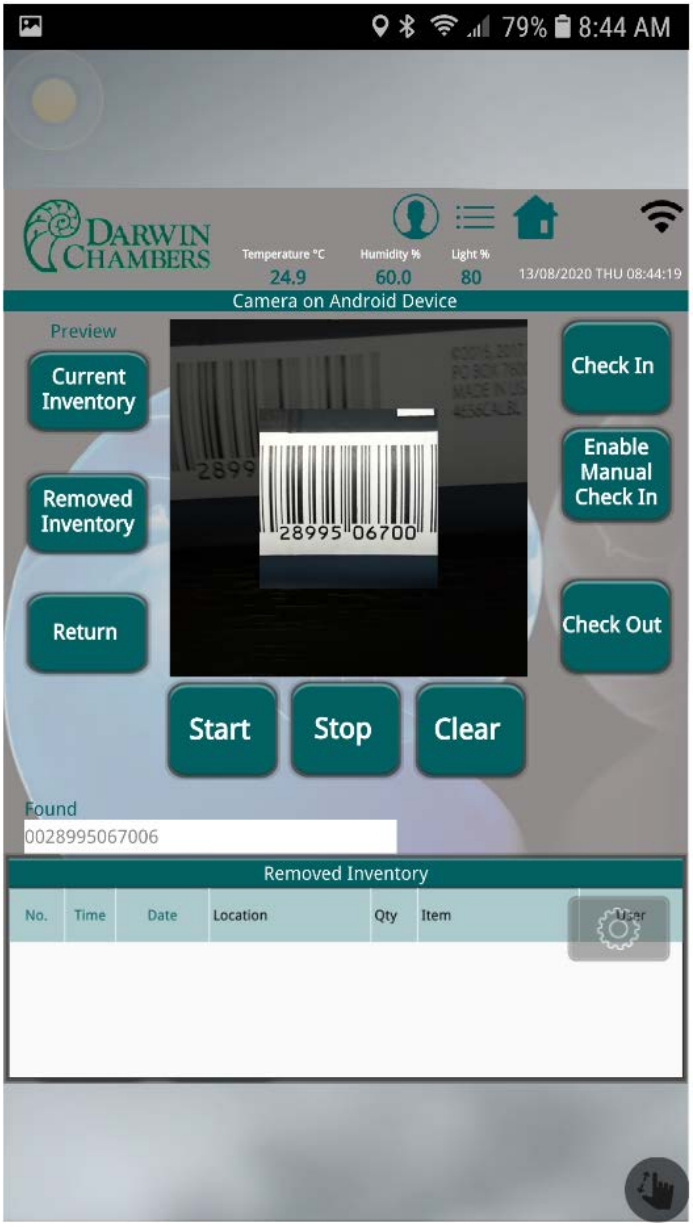
Searching for bar or QR code. The image brightens to help find the code.

Scan Code Detected. Once code is found image of code will be taken. And the code will be put in the found location. Then if Location and Qty are filled to user desire. The Check In or Check out can be pressed to record the data.

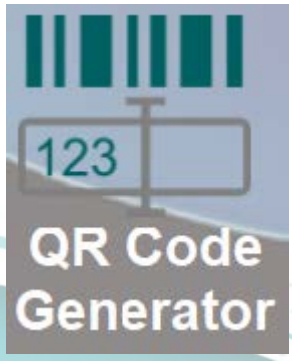
Preview Screen Current Inventory. Shows how the data base file appears to show data was recorded.

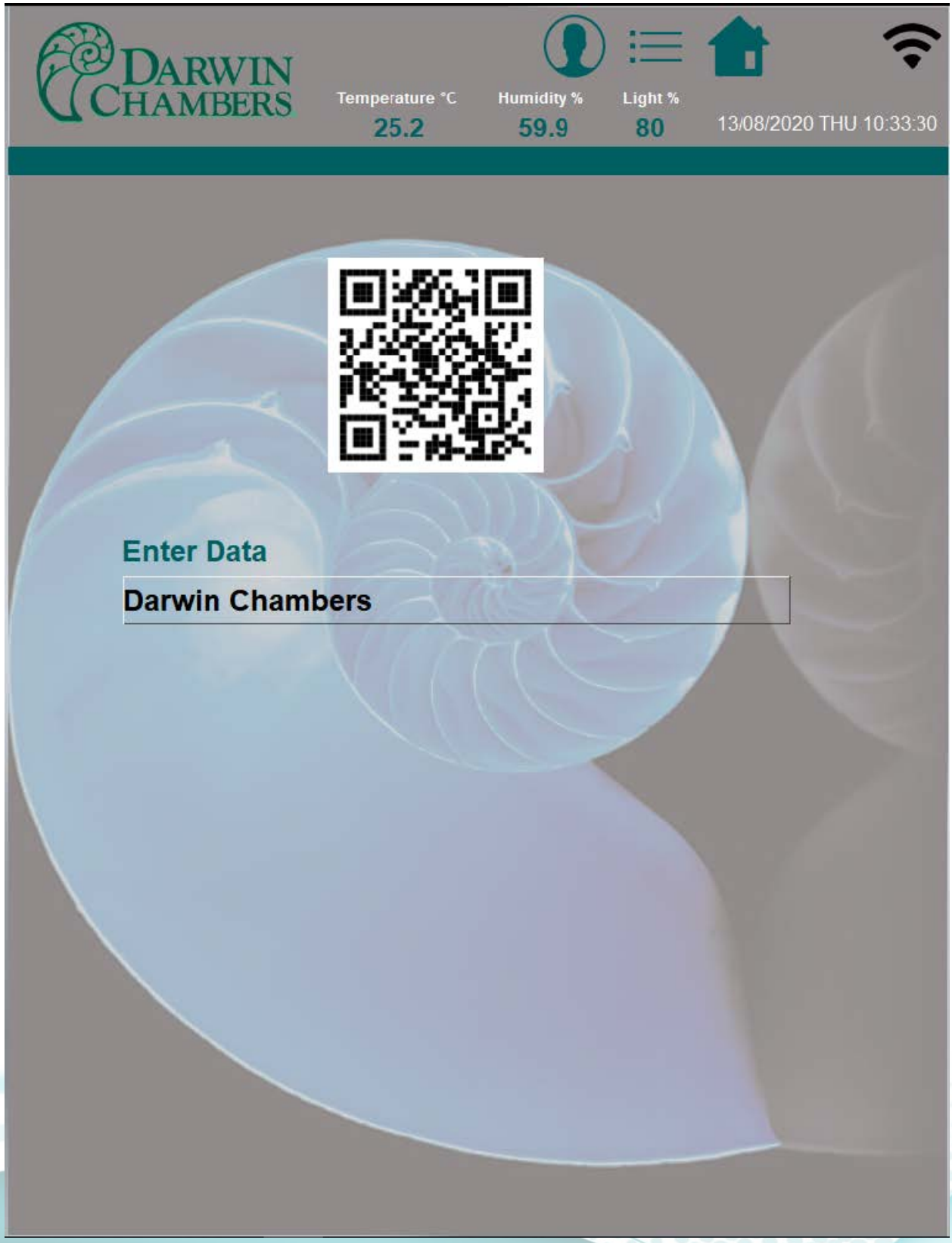


Preview Screen Removed inventory. Shows how the data base file appears to show data was recorded.



BAR CODE GENERATOR





Enter data for code in text box. Press Enter. Using snippet tool on a PC to select code and copy to print a label.

WEST EC44 CONTROLLER

Changing the Setpoint (SP)

Press the < or > buttons until Control Loop 1 Setpoint (Temp) or Control Loop 2 (%RH) is displayed. Then press the ˅and ^ arrows buttons to adjust the SP to the desired value. Press the < or > buttons to cycle back to the dual loop display.

Figure 210

Navigating the Menu

The West Pro-EC44 Micro Controller offers a large range of customizable settings that have been preprogrammed from the factory to best suit the chambers intended operation. To adjust any parameters, the user is required to navigate the controller's menu. To enter the controller's Main Menu, press the ^+ > keys one time. Once inside the menu, utilize the > button to enter additional submenus or to advance to the next

parameter. Press < button to go to the previous parameter. Use the ˅and ^ buttons to select options within the menu or adjust a parameter value. To exit the menu, press ^+ > multiple times until the dual loop screen is displayed.

NOTE: *Each submenu within the Main Menu requires an Unlock Code to view and edit the parameters. To enter the submenus, use the ^ button to insert the Unlock Code (default 0010) and then press >.*

Figure 211

Automatic Tuning

The Automatic Tuning menu is utilized to initiate a Pre-tune and/or Self-tune to configure the controller's P.I.D. parameters. A Pre-tune should be used to allow the chamber to approximate the necessary values. A Self-tune should be utilized for fine tune adjustments. The Automatic-Tuning feature will not "fix" a chamber with a problem—it only fine-tunes an already controlling chamber. Do this if the SP or some other important variable (load, outside temperature, etc.) has changed and the control is less than desirable.

TECH TIP If an If an Automatic tune is required, a Pre-tune should be performed if the chamber has not yet stabilized to get the chamber approximately where it is needed. A Self-tune (if necessary) should be performed after the process variable (PV) has stabilized at the desired setpoint (SP).

To enter the Automatic-tune mode(s), press ^+ > to enter the main menu. Utilize the ˅and ^ buttons to scroll to select Automatic tuning. Once Automatic tuning has been selected, press the > button to advance to the Unlock Code: screen. Enter the unlock code (factory default is 0010) and then press > to enter the Automatic-tune submenu. The controller will ask to perform a Pre-tune now. Using the ˅and ^ select either yes/no and then press >. If no is selected to performing a Pre-tune, the controller will ask whether to perform a Self-tune. Using the ˅and ^ select either yes/no and then press >.

NOTE: *Do not open the door(s) or make any changes while the chamber is tuning. Automatic-tuning times may vary upon the chamber size, ambient condition, chamber setpoint, and chamber load. A typical Automatic tune will take anywhere from approximately 5 minutes to an hour. In addition, the Pre-tune option will be disabled if the PV is less than 5% of the span from the setpoint.*

Changing Alarm Parameters

The controller has both a high and low alarm (HALRM and LALRM respectively). Alarms are triggered when the process variable exceeds the set alarm parameters/limits. For example, if an alarm is set at ±2.0 and the SV of a chamber is 30.0, when either 27.9 or 32.1 are reached, the associated alarm will be activated. Although most chambers ship with alarms preset to a value of ±2.0, actual alarm presets may vary depending upon the chamber type. Please refer to table 4 for the standard chamber specific factory alarm presets.

EXAMPLE: *A controller with deviation alarms set at ±2.0ºC and ±5.0% is programmed to control at 25.0ºC 60.0%RH. In this configuration, Alarm 1 the temperature high alarm would be equivalent to 25.0ºC + 2.0ºC (or 27.0ºC). Alarm 2 the temperature low alarm would equal 25.0ºC - 2.0ºC (or 23.0ºC). Alarm 3 the %RH high alarm would be equivalent to 60.0%+5.0% (65.0%). And Alarm 4 the %RH low alarm equals 60.0%-5.0% (55.0%RH). With these alarms, if a chamber door were opened and the chamber's process variables fell to 20.1°C 38.0%, Alarms 2 and 4 would start the alarm delay process. If both the temperature and %RH do not recover within the set alarm tolerances of ±2.0°C and 5.0% within 900 seconds, then Alarm 2 and Alarm 4 would trigger. If the same chamber reached 28.6ºC and 77.0 %RH, then Alarms 1 and 3 would begin the alarm delay periods and enter an alarm state if the delay expires prior to returning into the preset alarm tolerances.*

When the process variable reaches the set limits dictated by the alarms and the delay time has elapsed, an alarm condition is triggered and an audible will be begin to sound and the associated components would be disabled to protect the chamber. This delay allows access to the chamber without the alarm going off every time the chamber deviates from the controlling setpoint. The delay times are configured through the Alarm Configuration submenu of the Configuration Menu.

The Refrigerated Series chamber controller may feature a switching alarm(s) (Alarm 5 and Alarm 6). Alarms 5 and 6 are designed as a designated control switchover points. Alarm 5 when triggered will automatically switch from cooling to heating control (places the chamber in a "Heat Only Mode"). Alarm 5 is set as Process High Alarm. By factory default, Alarm 5 is preset to a value of 32.0ºC with a 300 second delay. Alarm 5 will not be disabled until the PV reaches or falls below 32.0ºC.

NOTE: *The availability of switching alarms may vary from chamber to chamber and is solely dependent upon the chamber's intended operation range and the presence of humidification and/or dehumidification.*

EXAMPLE*: If a chamber that is controlling at 25.0ºC has its SP raised to 40.0ºC the chamber will warm up normally until it reaches the preset value of Alarm 5 (32.0°C). Alarm 5 is triggered when the chamber reaches 32.0ºC or above in temperature. Once active, Alarm 5 will disable the chamber's cooling components and allow the chamber to operate utilizing electric heat only. This is referred to as Heat Only Mode. If the same chamber's door is opened and the PV fell to 35.0ºC, the chamber will remain in "Heat Only Mode" due to the PV still being greater than 32.0°C. If the chamber is turned off, and upon startup the PV was 33.0°C the chamber's cooling components will enable but start the 300 seconds delay time. Upon the expiration of the Alarm 5 delay, the alarm will trigger placing the chamber back into "Heat Only Mode."*

It is not recommended to make any adjustments to the Alarm 5 parameter values unless the chamber's setpoint is equal to the alarm setpoint upon which the alarm value should be decreased to 30.0ºC. Depending upon the chamber's setpoint and/or the desire for tighter dehumidification control at low %RH setpoints, adjustments to or Alarm 6 maybe required.

On chambers with humidification control, Alarm 6 is utilized to enable the chamber's dehumidification system. Alarm 6 is set as a PV-SP (process variable-setpoint) deviation alarm. Alarm 6 is preset from the factory at 1.0%RH. With these pre-programmed settings, Alarm 6 will trigger enabling the chambers dehumidification when the humidity reaches or exceeds 1.0% RH greater than the setpoint. The alarm parameter also includes a 1.000 hysteresis which can be adjusted to ensure the dehumidification system cannot short cycle.

Example*: A chamber that is controlling at 40.0ºC and a low %RH of 20.0% shows a 1.0% humidity fluctuation throughout the testing. Alarm 6 is set to the factory configuration of a PV-SP Deviation alarm at 1.0% with a hysteresis of 1.000%. To avoid continuous dehumidification system cycling and to produce a steady PV the alarm parameter can be changed to a -1.0%RH setpoint. A negative alarm parameter ensures the dehumidification system remains active unless the dehumidification system overpowers the humidification system resulting in a PV that is to low.*

When the PV goes lower than -1.0% of the setpoint the dehumidification system will disable. This method should not be utilized at relative humidity levels greater than 50.0% RH.

Alarm Condition

Once the high and low alarms have been set and the process variable has passed the set alarm parameters, the chamber will initiate the alarm delay. Upon the expiration of the alarm delay, a LED corresponding to HALRM or the LALRM indicator on the Pro-EC44 will illuminate indicating an active alarm. In addition, when in an alarm the chamber will produce an audible siren to alert the user. If the alarm was silenced by pressing the red button on the control panel, this audible will not be present.

NOTE: *If the alarm condition is not cleared the chamber may not be able to come back into specification or function as designed.*

NOTE: *The HALRM indicator on the West Pro-EC44 will illuminate when Alarm 1 and/or Alarm 3 has been triggered. The LALRM indicator will illuminate when either Alarm 2 and/or Alarm 4 is active.*

To clear the alarm condition, you first must recognize whether the chamber is in high or low alarm and either in a temperature or relative humidity alarm. To determine the active alarm, press the < button one time to display the Alarm Status screen. Please refer to the table below for a list preset controller alarms and the required action.

Alarm Name	Alarm Type	Required Action
Alarm 1	Temperature High Alarm – PV-SP Deviation Alarm	Increase Alarm 1
Alarm 2	Temperature Low Alarm – PV-SP Deviation Alarm	Decrease Alarm 2
Alarm 3*	%RH High Alarm – PV-SP Deviation Alarm	Increase Alarm 3
Alarm 4*	%RH Low Alarm – PV-SP Deviation Alarm	Decrease Alarm 4
Alarm 5**	Heat Only Mode – Process High Alarm	No Action
Alarm 6*	Dehumidification – PV-SP Deviation Alarm	No Action

*Denotes only being applicable to chambers with humidification.

**Applicable only to chamber with electric heat.

During an alarm event, once the alarm has been identified the user is required to enter the Alarm Configuration Menu that is located within the Pro-EC44's Configuration Menu. Enter the controller's menu by pressing the ^+ > buttons together. Utilizing the ˅and ^ buttons scroll until Configuration Menu is highlighted. Enter the Configuration Menu by pressing the > one time. The controller will request the access code. Enter 0010 into the display and then press > to proceed to the Configuration Menu. Once inside the Configuration Menu utilizing the ˅and ^ buttons select Alarm Configuration and then press > to enter the Alarm Configuration Menu. The Alarm Configuration Menu will list the available alarms. Select the active Alarm by utilizing the ˅and ^ keys. To view the selected alarm configuration, press the > button one time. Utilize the > to scroll to the Alarm Value screen. Utilize the arrow keys to widen out the proper alarm. Increase the values for HALRMs and decrease (further negative) values for LALRM's.

EXAMPLE: *If your chamber is in low alarm and the process variable is at 15.0ºC while the setpoint is 25.0ºC, Alarm 2 needs to be decreased to -10.0°C or lower (15.0°C (PV) – 25.0°C (SP) = -10.0°C) to clear the alarm. If the chamber is in high alarm and hypothetically had a process variable of*

33.0ºC and the setpoint was 25.0ºC, Alarm 1 requires an adjustment of 8.0°C or greater (33.0°C (PV) – 25.0°C (SP) = 8.0°C) to clear the alarm. Once the appropriate value has been increased, press the SEL button one last time to confirm the changes. Press the □+□ buttons together several times until the dual loop screen returns.

Once the chamber has returned to its normal operating range, remember to return the alarms to their original settings.

Silencing the Alarm

Figure 212

During an alarm condition, the chamber will trigger an audible warning. The warning is also indicated by the by the illumination of the HALRM and LALRM indicator(s) on the controller. In the event of an alarm, and the expiration of the alarm delay, the associated component will be disabled, and an audible alarm will sound. Located upon the controller's faceplate, the alarm silence button provides a simplified means to mute the alarm until the associated alarm has been cleared. To make use of the alarm silence, simply press the button and the audible will cease.

NOTE: *The alarm silence button only provides a means to mute/disable the audible warning. To ensure that the chamber functions as designed it is strongly recommended that once an alarm has been silenced that the alarm condition is cleared within the controller. Failure to clear the alarm may result in the chamber not returning to specification and/or damage to the chamber.*

Profile Operation

Chambers that incorporate the West Pro-EC44 have the ability run a program that operates the chamber at a specific setpoint for a determined length of time and then methodically changes the set point. This process is known as a Profile Operation. The Profile Operation consists of steps called segments. A profile segment consists of the following:

Start Trigger: is an instruction programmed into the first segment that determines the means the profile starts. A start trigger can start a profile immediately, after a delay, or from the timer.

Ramp: refers to the changing of the setpoint over a given interval or rate. The success of the chamber's ramping ability is dependent upon the chamber's heating abilities, refrigeration/cooling system, the ambient conditions, and chamber load. To avoid an unnecessary alarm condition, it is recommended that ramp times/rates do not exceed 1.0°C per two minutes.

NOTE: *Due to Alarm 5 and "Heat Only Mode" ramping from a high temperature to a temperature lower than 32.0ºC will be solely dependent upon the ambient and chamber load conditions.*

Dwell: maintains the process variable for a specified length of time.

Hold: is the profile stopping and remaining at setpoint until a specific condition is satisfied (e.g., specific time of day or specific PV tolerance is satisfied). Each segment can utilize an Auto-hold that will ensure the PV is within a specified range above the SP, below the SP, or a band (either side of the setpoint).

Join: is utilized at the end of a segment to initiate another profile consecutively.

Step: jumps the setpoint to the new target setpoint without a ramp.

Loops: goes back to a specified segment. This will be repeated for the required number of times before continuing onto the following segment. There also can be more than one loop per profile if the loops do not cross.

End: terminates/end the profile sequence. An end segment must be inserted to save the profile.

To setup a profile, follow the ensuing steps:

1. Enter the Main Menu by pressing the ^+ > buttons simultaneously.

2. Use the ˅and ^ buttons to scroll down until Profile Setup is highlighted and then push the > key to advance to the Unlock Code screen.

Figure 213

3. Insert the Unlock Code by using the ˅and ^ buttons and then press > to advance to the Profile Setup menu.

Figure 214

4. Select and enter the General Configuration menu by pressing the > key. There are only two parameters within this menu, “Control in Operator Mode” (the factory default is Yes) and Enable Edit While Running (factory default is Yes).

NOTE: *Operator Mode is the basic menu that includes the PV-SP Display, Alarm Status, Recorder Status, and Profile Status screens. Entering the Main Menu is not necessary.*

5. Exit the General Configuration menu by pressing the ^+ > buttons simultaneously.

6. Select and then enter the Create a Profile menu. The controller then forwards to the “Enter a Profile Name” screen.

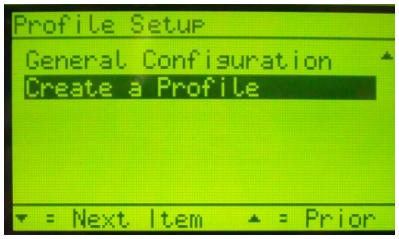


Figure 215

7. Utilizing the ˅, ^, and > keys enter a profile name. The < button can be used to back up the cursor. To forward to the next parameter press > to advance the cursor through each provided space.

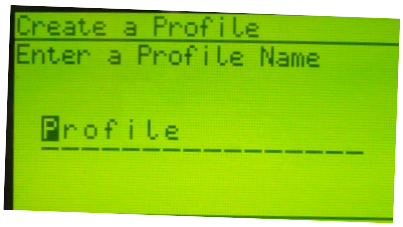


Figure 216

8. Profile Starting Setpoint is then displayed on the LCD. Choose “Current Setpoint” or “Current Process Variable” (factory default) by highlighting the desired value and then press > to advance to the next parameter.

9. The controller then prompts the user for a Profile Start Trigger with the options: None (factory default), After Delay, and Day and Time. Push the > to move to the next screen once the desired option has been selected.

10. Choose the Profile Recovery Method. The factory default Profile Recovery Method is to Continue Profile

11. Then set the Profile Recovery Time by utilizing the ˅and ^ buttons.

12. Next, set the Profile Abort Action. The factory default is Go to Controller’s Setpoint.

13. Select How Many Times to Cycle Program.

14. The controller then prompts the user to choose a segment type for segment 1. The options are Ramp Time, Ramp Rate, Step, Dwell, Hold, Join, End, and Repeat Sequence and End. To start a profile, it is recommended that the first segment is a Ramp Time, Ramp Rate, Step, or a Dwell.

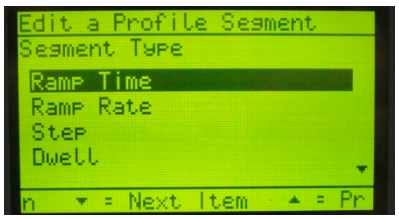


Figure 217

15. With a Ramp Time, Ramp Rate, and Step the controller will prompt the user for a Target Setpoint. Enter a Target Setpoint and then advance to the next screen.

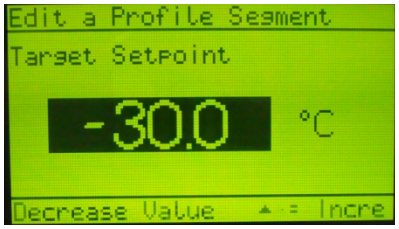


Figure 218

16. Enter a Ramp Time, Rate, or a Dwell Time and then advance to the next screen with the > button.

17. On the next screen if a Ramp or a Dwell is being performed enter an Auto-Hold Type. The options here are None, Above Set point, Below Set point, or Band. After selecting the Auto-Hold Type and if an Auto-Hold was chosen, the controller will prompt the user for the desired range.

18. Next, the controller will prompt the user for Events. Please see the Pro-EC44 product manual included upon the product manual CDROM for more information on Events. For simplicity simply leave the events Inactive and press > to advance.

19. Segment 2 will begin. Repeat steps 14 – 18 until all the desired steps are entered within the controller.

20. To complete the profile, an End, Join, or Repeat and End segment must be selected as the last segment. Once the profile has an End, is Joined with another profile, or selected to Repeat and End the controller will save the profile.

21. Exit the Profile Configuration Menu by pressing the ^+ > to exit each menu until the PV/SP screen is displayed.

22. Start the profile. By factory default a profile can be started from the Main Display by cycling to the Profile Status screen with the > key. Once on the Profile Status screen select Run to begin the profile. If this option is unavailable, go to the Configuration Menu and then Profile Configuration Menu to start the profile.

Data Recorder Operation

The West Pro-EC44 incorporates an internal data recorder option that allows the user to record the operation of the chamber and download the data in CSV format to a USB Drive.

Setting Up the Recorder

To setup the recorder function the user is required to enter the Recorder Configuration Menu that is located within the Configuration Menu.

1. To Reach the Recorder Configuration Menu the user first must enter the Main Menu by pressing down the ^+ > keys simultaneously.
2. Using the arrows, scroll down until Configuration Menu is highlighted. Press > to enter the Unlock Screen.
3. Enter the password 0010 (factory default) and then press > to proceed into the Configuration Menu.
4. Using the arrows scroll down until Recorder configuration is highlighted and then press >.
5. Within the Recorder Configuration Menu, the user will have to select the Recording Mode, Recorder Trigger, Values to Record, Events to Record, and Profiler Events to Record. Please refer to the West Pro-EC44 Product Manual located on the CDROM for additional details.

Utilizing the Recorder

By factory default the recorder has been setup to allow the user to start/stop a recording from the Operation Mode. To start/stop a recording utilize the > key to scroll to the Start/Stop Data Recording Screen. Utilize the arrow keys to select the appropriate option and then the > to advance to the Recorder Status screen. The Recorder Status screen provides a summary of how the recorder was setup (Recording Mode, Sample Size, Memory Remaining, and Time Remaining). If > is pressed one last time, chart is displayed. The user can press the arrow keys to scroll through the chart data.

If the ability to start/stop a recording is unavailable within the Operation Mode, the user will be required to utilize the Recorder Control Menu that is located within the Main Menu. From the Recorder Control Menu, the recording can be started or stopped.

Obtaining the Recorder Data

To get the data from the recorder a USB Flash Drive is required.

Controller Parameter Settings

The factory preset controller parameter values should be included with the owner's documentation. If this information is missing, or if it has been lost or misplaced, please contact Darwin Chambers Company at 877-783-6774, you can also send an email to technicalsupport@darwinchambers.com.

FUTURE DESIGN CONTROLS MCT4 CONTROLLER (TOUCHSCREEN)

WHAT IS THE MCT4?

The MCT4 system combines all the features of a loop controller, high-limit control, video/chart recorder and data logging system into a single/intuitive display device. Email (supporting SSL/TLS), SMS (text messaging), FTP, FileWeb, DataWeb (file transfer protocols for automated data backup and web database interface) and remote viewing/control (via Web server/VNC server) are standard with the MCT4 and can be accessed via LAN/WAN using a PC, tablet, or smart phone device.

Future Design Controls' MCT4 provides a 4.3" color touch screen interface with standard "Smart Device" user interface features for multi-loop control applications. All loop configuration and runtime user access is configurable at the device with no PC software required. Darwin Chambers can configure runtime features (screen availability, menus, language, etc...) to easily customize the system for their requirements. These configurations can be imported/exported to any other MCT4 device for setup (from scratch) within minutes.

Individual, high performance board level PID loop controls (one for each loop up to a maximum of three) offer up to four control outputs each, powerful profiling capabilities with up to three events and full auto tune functionality with high resolution universal process inputs.

Features

Each of the MCT4 loop control boards provide a single digital input that can be programmed as an automatic program control input, input alarm or input status (visual loop status indication).

Each of the loop control boards also provide up to four control outputs which can be used as PID control outputs for heat/cool, direct outputs for controlling external equipment related to the application through software switches called events or be programmed to act as system alarm outputs. When single or dual loop control is used, the HLM high-limit control board can be installed, providing a single interface for all loop control and limit functions from one display.

The MCT4 can be operated in single set point or automatic program control mode. Program entry is made easy using slide list selections and menu items on a single screen. Programs can be copied to the external USB memory stick and then imported to another MCT4 controller which eliminates the need to enter duplicate programs on multiple systems.

Data file analysis tools make looking at historical data a simple task. Any control variable saved to the data file can be plotted on the historical data chart for any time frame within the data file's total time range.

The built in Ethernet functionality includes a Web Server to provides access to all MCT4 data (view only), a VNC interface for remote control and monitoring and an NTS clock, all available via a local Intranet connection (wired or wireless), or the World Wide Web using standard software like Microsoft's Internet Explorer.

The MCT4 provides a rich set of tools for control interaction and process monitoring. The interface provides various loop, chart, alarm, automated program status as well as historical data, alarm log and audit trail views. The menu driven interface eliminates screen "clutter" by providing an easy to use "Smart Device" interface for interaction between the user and MCT4.

The MCT4 can store over a year's worth of data on its SD memory card. Data logging can be enabled manually or automatically during program operation. Data backup is provided via a USB memory stick for plug and play transfer of files to any PC and through the included FTP back-up utility.

The MCT4 protects system access with a four-level security system (user rights based), including audit trail capability that documents all user activity and ensures data integrity by digitally signing all data files and audit trails to meet regulatory requirements.

The MCT4 controller includes the following features:

ACCESSIBILITY

- Touch screen, "Smart Device" user interface (UI) with 30,000-hour LED display
- Built in configuration software; no external software or PC required
- Email, SMS, FTP, FileWeb, DataWeb, VNC and Web functionality standard
- Remote View/Control using PC, Tablet or Smartphone.
- National time server connectivity with daylight savings.

COMMAND BAR ICONS

NAVIGATION, HELP & HOME

The Master Command Bar located on the top of the display provides easy & intuitive 1-touch access from anywhere in the system to Navigation, Help and configured Home view.

Home brings the user back to the system "Home" view. The Home icon can be configured for the following standard views:

- Loop view: includes PV & SP digital display, PV min/max, PID % Output, Auto-Manual, event, profile access and more.
- Overview: all loops, profile, and event status
- Chart view: (trend up to the last 24 hours from system RAM) supporting 4 trends with up to 6 values per trend
- Alarm view or Alarm File

Help offers content sensitive text for every view / page in one of 11 supported languages chosen by the user.

Navigation provides access to the configured menu system, traditional drop down or icon.

ALARMS

- Up to 19 alarms, 10 soft configurable to PCM & HLM, up to 3 alarm outputs per PCM and HLM up to 2 alarm outputs.
- Loop* Alarm Types: Process High & Low, Deviation High & Low, Deviation Band, Event Input and End of Profile.

* PCM configured as Monitor Input (no PID control) configurable only with Process alarms.

Alarm Mode:

Normal or Hold (on start-up Hold mode will not activate if in alarm condition and arm once out of alarm condition).

Silent Alarm, activation does not indicate alarm or write to alarm log file.

Alarm outputs configurable as latching or non-latching.

DATA ACQUISITION

- Data log PV, SP and PID percent output.
- File name: Free form 16 character appended by time/date or the profile name if started with a profile.
- File Start/Stop: user on-demand, on system boot or profile ramp-soak start/end.
- Data Log interval: configurable 1 second to 31 minutes.
- File Interval: configurable to set time in days (1 to 31) to end and start a new file. This allows syncing files to match product cycles as well as keeping file size manageable.
- ID#1 and ID#2 fields allow user to enter specific information such as a batch and/or lot information that is associated with the data file.

SECURITY AND AUDIT TRAIL

- Supports up to 30 users over four user groups with access to 40+ functions restricted by user group.
- Supports password aging and verification.
- Operator Audit Trail provides history for all user activity that includes date, time, username and action, i.e., Loop SP change from 55.2 to 103.5.

PROFILE RAMP/SOAK

- **Loop 1 and/or 2; ***Loop 3 always static
- Start: via touch screen or Event input
- Profile Name: 16-character naming convention
- Global Profile Configuration:
  - Start from PV or static SP
  - Guaranteed Soak & Ramp band
  - Power Fail / Recovery: Continue from last SP value, PV, or static mode.
- Profile Segments: (maximum of 64)
- Guaranteed Soak & Ramp per step
- Events: up to 3 or 6 events per step (1 or 2 loop).
- Jump-To Step: configurable per step
- Profile End Alarm
- Configurable Profile End Logic:
  - Current (Static) Control SP: Set Point & Event status prior to Profile Start is loaded at end of the Profile.
  - Final SP of Profile with all Events off
- Operator Comments/Events: Unlimited operator comments/events linked to each file
- File Type: Data Log fi les are saved in .csv format.
- Digital Signatures: Automatic system as well as user entered signatures.
- Historical Data Viewer: View data log fi les on the display. Chart is auto scaled on an X & Y axis for time and units.
- Meets the requirements for:
  - CFR21 Part 11
  - AMS2750E

EVENT INPUTS

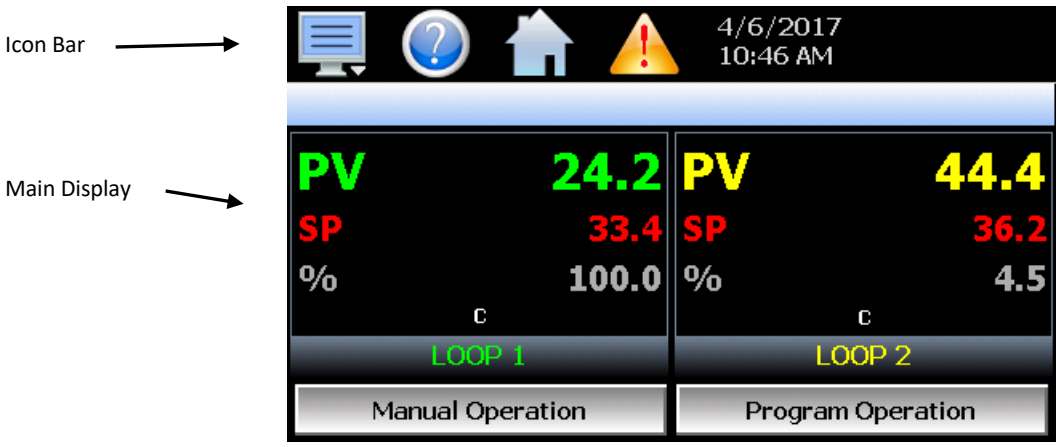
- PCM / HLM each have 1 event input configurable for one of the following functions.
  - PCM: Profile Run, Hold, Run/Hold, Abort, Step Advance, Failure Transfer (Outputs), Alarm Input (indication only) and Loop Status Input
  - HLM: Remote Reset

BASIC OPERATION

This section is designed to help guide the user through the MCT4 touch screen interface and menu structure to navigate through the various operation, monitor and setup screens and gain an understanding of how to use them. Subsequent sections of this manual are tailored to the special features and functions of MCT4. Consult those sections of Darwin Chambers manual for further information and specifics on how to set up and operate them.

Touch Screen Interface

The MCT4 display is split into two sections: the icon bar and main display area. **Loop 1 will be temperature and ***Loop 2 can either be Humidity or Lights. ***Loop 3 when used will be for dimmable lights. (Lights will have a PV of 0.0 as no feedback sensor for lights.)



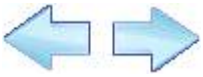
Loop View Screen

The menu icon will open the main menu for navigating to the different control and monitoring screens. Menu items will dynamically appear providing available options based on the system area the user is in, i.e., security, data logging, setup, etc.

The information (help) icon will display text-based help associated with the current screen. Help is available in 10 languages based on the user selection in the offline setup of section of MCT4.

The home icon will return the user to the main view from anywhere in the MCT4 application. The main view is set by Darwin Chambers in the MCT4 configuration and can be the single or dual loop, chart, alarm, alarm history, event, or digital IO view.

The alarm icon will appear and flash when a new system alarm occurs. Pressing the alarm icon will take the user directly to the alarm monitor screen to view and /or reset the active alarm condition



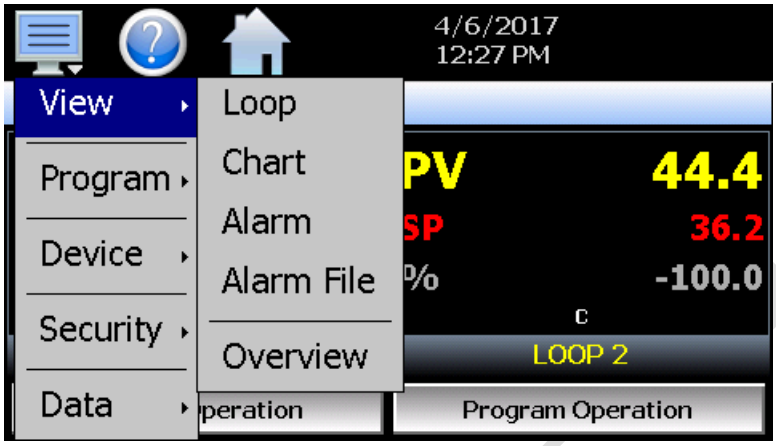
The left and right navigation arrows will appear on screens that provide additional information that the user can scroll to such as the loop view screens, charts or program entry screen to cycle through each step of a ramp/soak program.

NOTE: *A single press of the left or right arrows will scroll program steps to the next step or screens to the next available screen option (i.e., chart number). Pressing and holding the arrow keys will continue the item scrolling until the last step of the program is reached or the button is released.*

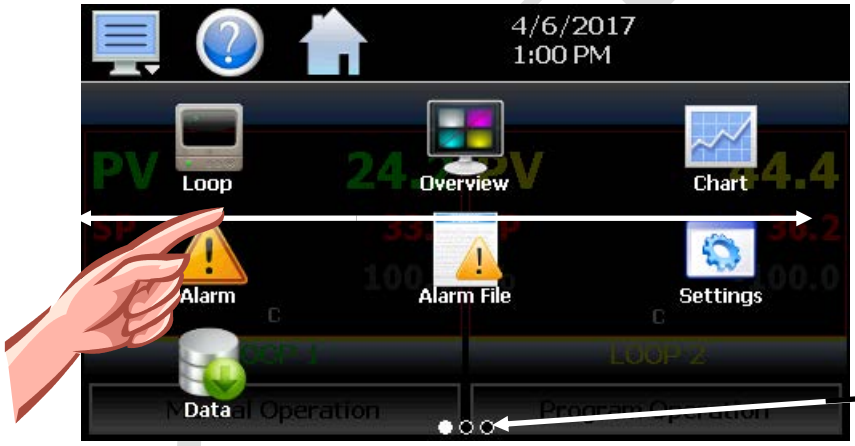
IMPORTANT: *Do not use any sharp or metal objects on the touch screen as they may damage the surface. Also, be sure that hands and fingers are free from oils or chemicals which may mar the surface of the touch screen.*

Menu Navigation

The MCT4 provides the user with the ability to select text-based menu navigation, much like the typical file menu system of a PC, as well as an icon-based navigation system like that of a "smart" device. The user can switch back and forth between the two from the Setup menu.



Text Based Navigation



Touch and drag finger across screen to switch between menu pages.

Active Page Indicator (1 of 3)

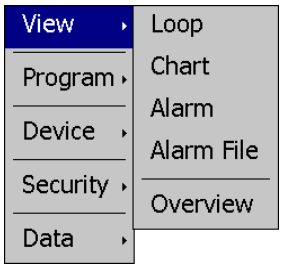
Icon Based/Slide Page Navigation

The available menu items are dependent upon Darwin Chambers configuration of MCT4. Not all the menu items shown may be available on your system. The following information is provided as an overview of the full navigational menus for the MCT4.

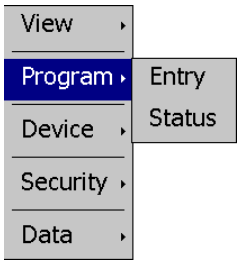
Home Menu

The home menu is the top level, default menu provided when MCT4 first powers on. Pressing the menu (monitor) icon will display the main menu offering the selections shown below.

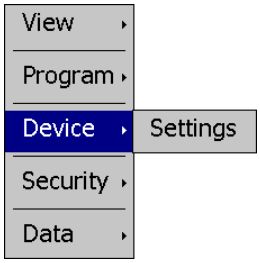
Text Based Home Menu



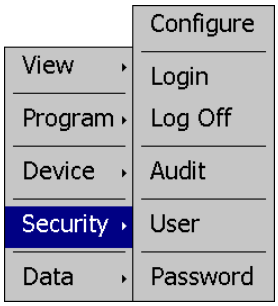
*The **View** menu provides navigation to all standard view screens. These include the Loop view, real time Chart, Alarm monitor, Alarm File and Overview control screens.*



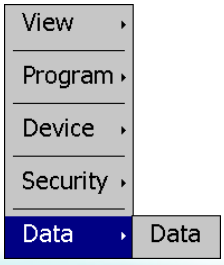
*The **Program** menu provides access to the automatic ramp/soak program actions, Entry and Status views.*



*The **Device** menu provides access to the MCT4 controller settings. These include, loop set point entry limits, alarm set points, communication settings, email setup as well as access to offline settings for date/time, etc.*



*The **Security** menu provides access for user login, security settings and audit trail viewing if the security system is enabled.*



*The **Data** menu provides access to data log functions, file utilities, FTP\WAN back-up settings as well as the historical data viewer.*

Icon/Slide Page Based Home Menu

Slide page 1 provides navigation to all standard view screens. These include the Loop and Overview, Chart, Alarm monitor, and Alarm File.

It also provides quick access to the MCT4 Settings and Data file functions which include file utilities, FTP\WAN back-up settings as well as the historical data viewer.

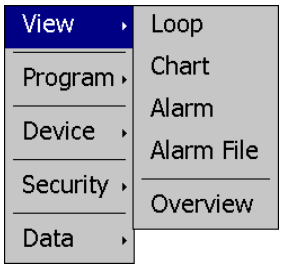
Slide page 2 provides access to program Entry and Status views.

Slide page 3 provides access to Configure security settings, Audit trail viewing, current User information, user Password editing and user Login and Log Off functions.

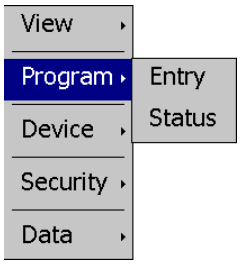
Automatic Ramp/Soak Program Menu

The automatic ramp/soak program menu is identical to the “Home” screen menus for ease of operation. See section 6 on Automatic Ramp/Soak Program Operation for detailed information on how to create and run programs.

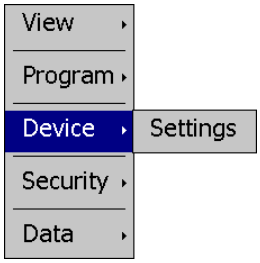
Text Based Program Menu



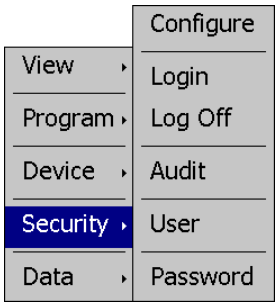
The **View** menu provides navigation to all standard view screens. These include the Loop view, real time Chart, Alarm monitor, Alarm File and Overview control screens.



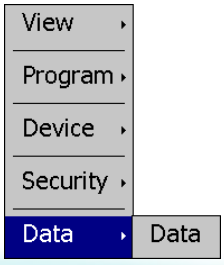
The **Program** menu provides access to the automatic ramp/soak program actions, Entry and Status views.



The **Device** menu provides access to the MCT4 controller settings. These include, loop set point entry limits, alarm set points, communication settings, email setup as well as access to offline settings for date/time, etc.



The **Security** menu provides access for user login, security settings and audit trail viewing if the security system is enabled.



The **Data** menu provides access to data log functions, file utilities, FTP\WAN back-up settings as well as the historical data viewer.

Icon/Slide Page Based Program Menu

Slide page 1 provides navigation to all standard view screens. These include the Loop and Overview, Chart, Alarm monitor, and Alarm File.

It also provides quick access to the MCT4 Settings and Data file functions which include file utilities, FTP\WAN back-up settings as well as the historical data viewer.

Slide page 2 provides access to program Entry and Status views.

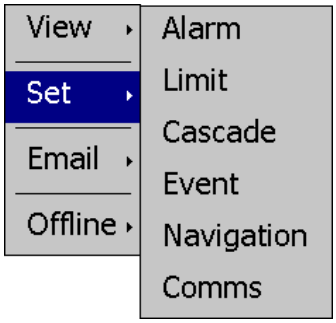
Slide page 3 provides access to Configure security settings, Audit trail viewing, current User information, user Password editing and user Login and Log Off functions.

Device Settings Menu

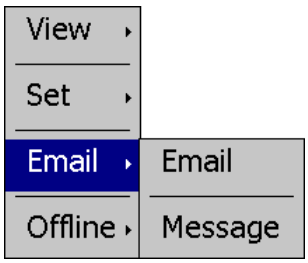
The device settings menu is provided when the user selects “Settings” from the main “Device” menu. See section 9 on Device Settings for detailed information on these settings and their use.

Text Based System Setup Menu

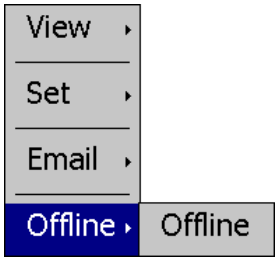
*The **View** menu provides navigation to the manual loop Tuning screen.*



*The **Set** menu provides access to settings Alarm set points, control loop set point Limits, Cascade control settings, Event tagnames, Navigation type selection and Communications options.*



*The **Email** menu provides settings for the email server to send SMS text messages and/or emails on alarm and allows the user to compose and send a Message to any user configured in the system.*



*The **Offline** menu provides access to the MCT4 offline setup which provides the user with the ability to adjust the date/time, calibrate the touch screen, configure profile power recovery options, etc.*

Icon/Slide Page Based Device Settings Menu

Slide page 1 provides access to Navigation type, control loop set point Limits, Alarm set points, loop Tuning, Event tagname entry and Email server settings and Messaging.

It also includes access to the communications settings for the web page, VNC server and Modbus user communications.

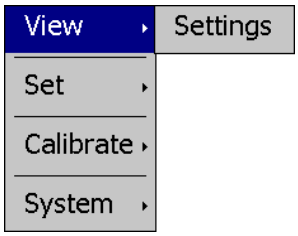
Slide page 2 provides access to Cascade control settings.

Offline Menu

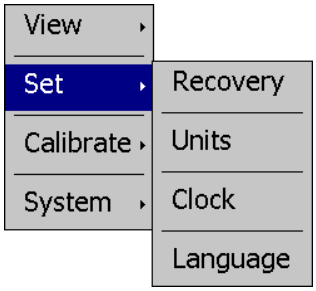
The offline menu is provided when the user selects “Offline” from the device settings “Offline” menu. See section 10 on Offline Settings for information on these settings and their use.

NOTE: Offline settings can only be accessed when an automatic ramp/soak program is not running, and data logging is turned off.

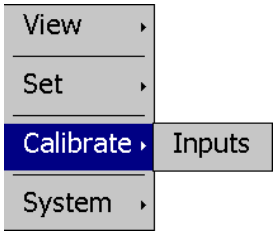
Text Based Offline Setup Menu



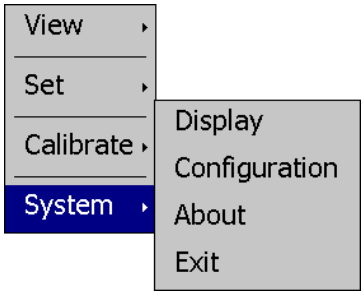
*The **View** menu provides navigation back to the MCT4 device settings menu.*



*The **Set** menu provides access to the profile power Recovery options, temperature Unit's selection, NTS Clock, and Language settings.*

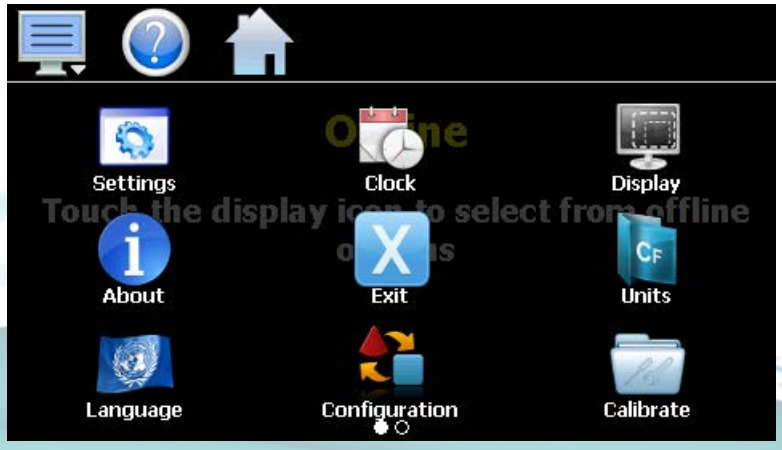


*The **Calibrate** menu provides access to the user input calibration for the control loop/limit inputs.*

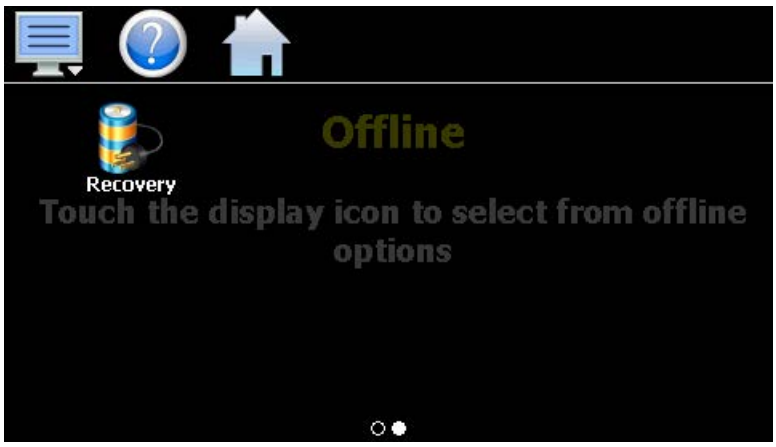


*The **System** menu provides access to the MCT4 Display settings, import/export Configuration utility, About screen and Exit application screen.*

Icon/Slide Page Based Offline Menu



Slide page 1 provides navigation back to the device Settings menu, Clock, Display settings, About MCT4 and Exit application screens, temperature Unit's selection, Language, import/export Configuration utility and input Offset calibration.

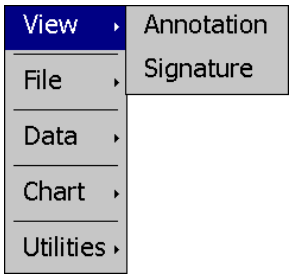


Slide page 2 provides access to the automated program power Recovery options.

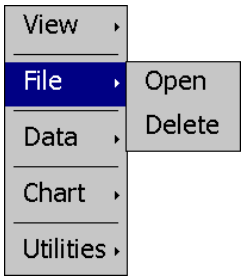
Data Menu

The data log menu is provided when the user selects “Data” from the main “Data” menu. See section 8 on Data Logging for information on these settings and their use.

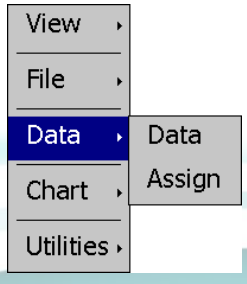
Text Based Data Logging Menu



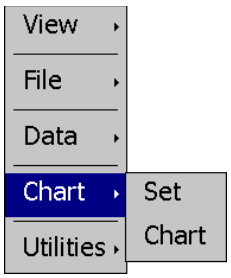
The **View** menu provides access to the data file Annotation and digital Signature screens.



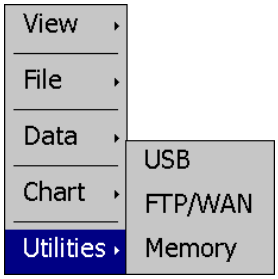
The **File** menu provides functions for opening and deleting historical data log files.



The **Data** menu provides access to the main Data screen for starting and stopping data logging and to the log point Assignment screen where the user can select which items are to be logged to the history file.

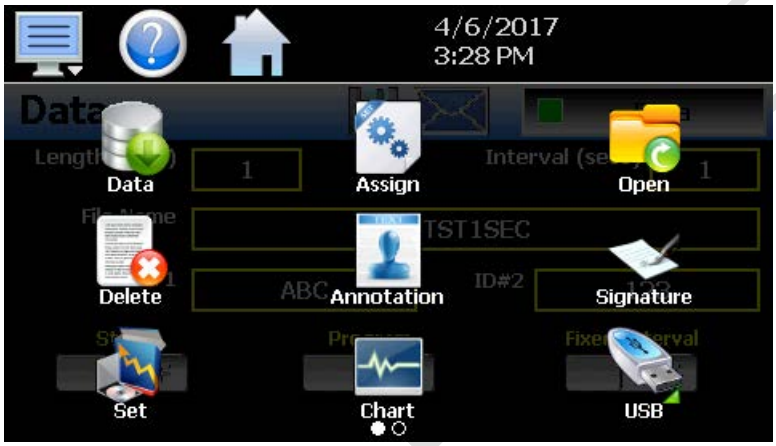


The **Chart** menu provides functions for viewing historical data files in graphical format.



The **Utilities** menu provides access to the MCT4 file management utilities including USB file transfer and FTP/WAN back-up.

Icon/Slide Page Based Log Menu



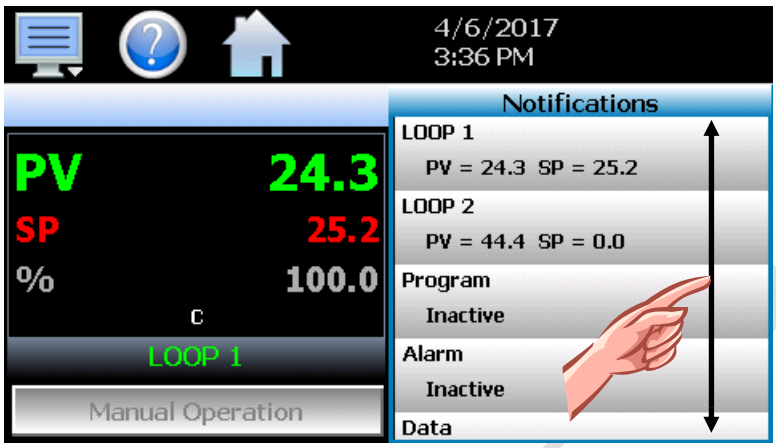
Slide page 1 provides access to the main Data log screen and to the log point Assignment screen where the user can select which items are to be logged.

Historical data file functions are provided for Opening and Deleting historical files and viewing/setting data file Annotations and digital Signatures.

The plot Set and Chart icons provide access to the historical data viewer options.
Slide page 2 provides access to the FTP/WAN back-up settings and the memory check utility for viewing available system/storage memory space.

Notifications

The notification window is a feature that can be accessed by pressing the date/time field in the icon bar. This window provides a snapshot of current MCT4 activity. The notification window can be closed by pressing the date/time field again or is automatically closed if the Menu Home or a navigation arrow icon is pressed.



A user can view all notifications by touching the screen and dragging their finger up or down on the list to scroll through all items like other lists in MCT4. The notifications include the following:

- Loop PV and SP for each loop configured.
- Automatic program status including name of running profile.
- Active alarm status including the most recent alarm.
- Data logging status including active file name and the length and logging rate set.
- Security status including the current user.
- Audit trail active/inactive status.
- Web server active/inactive status.
- VNC server active/inactive status.
- MCT4 IP address.
- Available SD storage memory remaining.

The appearance of the items is based on the configuration of the MCT4. If data logging or security functions are disabled in the Configurator for example, their status items will be removed from the list as well.

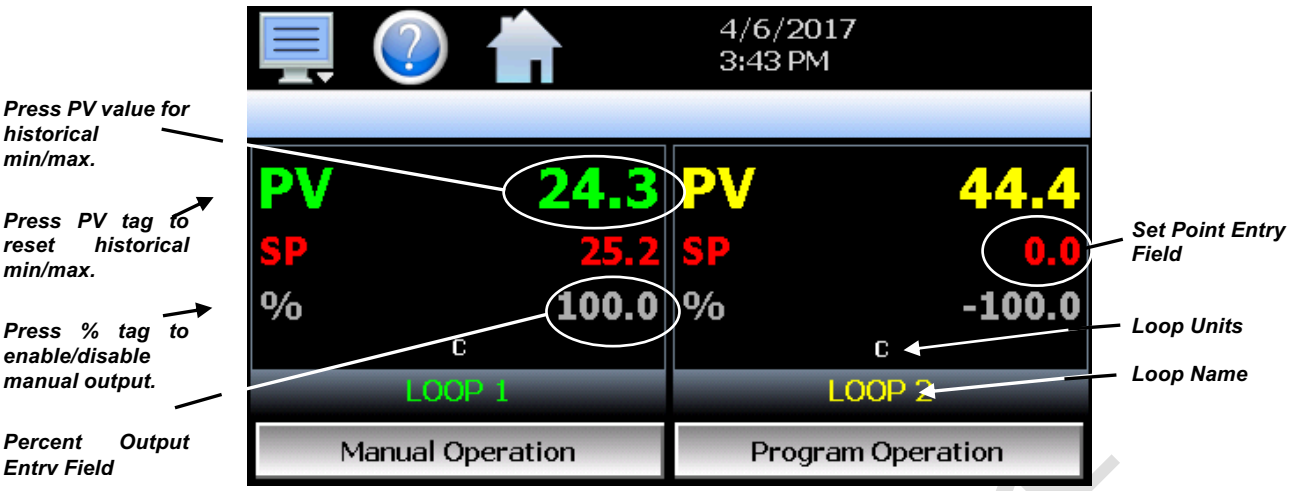
NOTE: *The notification items do not update while the list is shown. The information shown in the list is a snapshot of the data at the time the window was shown. Therefore, the PV or SP shown for a loop may not be the actual values for the loop if the notification window is left open for extended periods of time. The notification window is not available in the offline setup.*

Control Loops (Single Set point Operation)

The Loop view screen provide direct viewing options for the control and monitoring of the MCT4 control loops and limit control (if configured). The Loop screen allows the user to adjust the current loop set point (SP) and view the process variables (PV) and percentages of output (%) for each loop.

Loop View

The Loop screen is accessed from the home “View” menu. It automatically configures itself to display from one to three loops or up to two loops and limit control based on the configuration of the MCT4.



The **set point entry field** is the area where the screen can be touched to bring up the keypad entry window. Using the numeric entry keypad, a new set point can be entered. Once entered, the new set point will be shown in the set point entry field. Adjustment of the set point is locked out if an automated ramp/soak program is running.

IMPORTANT: *When operating in single set point mode, the set point is saved in the loop control board's memory once every 6 minutes. If the set point is changed and power is removed prior to the 6-minute time, when power is re-applied, the loop set point will return to the previous value.*

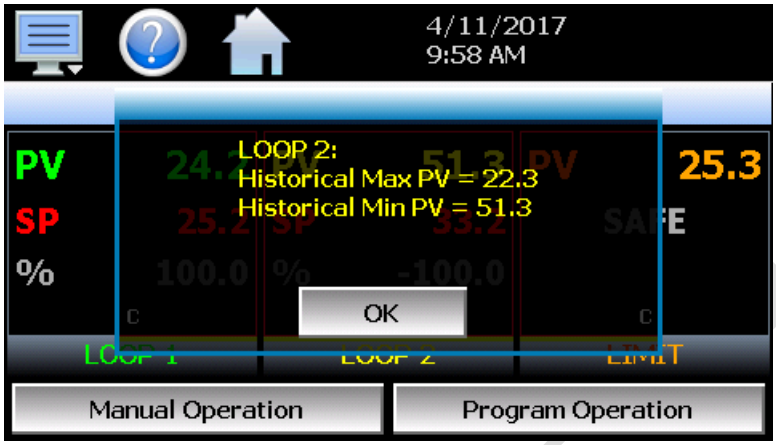
Ensure that power remains on the unit for 6 minutes after a set point change to have it power-up with the desired set point the next time power is applied.

The **percent output entry field** is the area where the screen can be touched to bring up the keypad entry window. Using the numeric keypad, a new fixed percentage of output can be set for the loop. To be able to enter a fixed output percentage, the loop must first be placed in manual output mode. This is done by pressing the "%" tag on the screen. This feature can be removed by turning off the "Loop Manual Mode" function in the Configurator.

The **loop name and loop units**, shown at the bottom of each loop (or limit), will display the tag name and units as entered in the Configurator.

Historical Minimum and Maximum

The MCT4 monitors and stores the minimum and maximum process value reached during operation for each loop in the system as well as the limit if configured. The current historical values can be viewed by pressing the process value display field for the desired loop or limit.



Pressing the “OK” button will close the dialog window and return to the Loop view screen. The historical values are reset each time the runtime application is started and can also be manually cleared by pressing the “PV” tag on the Loop view screen.

Pressing the “Yes” button in the dialog window will reset historical minimum and maximum values and default them both to the current process value. Pressing “No” will simply close the dialog.

Manual Operation

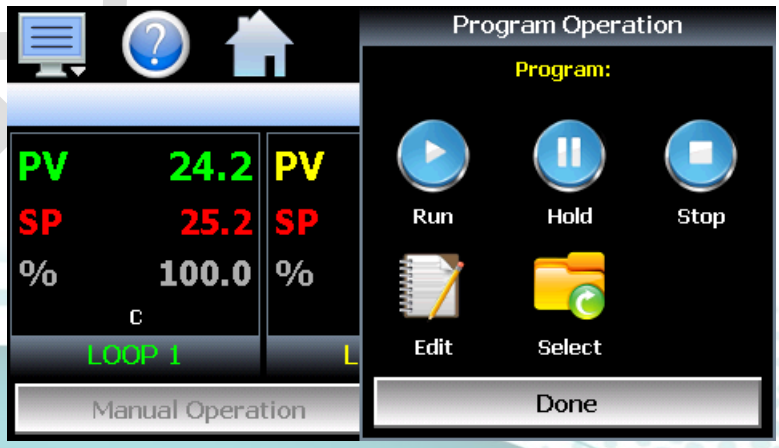
The Manual Operation button displays a “slide out” window providing access to all events programmed for the system. To turn each event and its corresponding output on or off, simply press the button associated with the event. Slide the list up or down as necessary to view additional events if more are programmed than can be displayed in the window at one time.

NOTE: *The MCT4 loop controls can provide up to 3 event outputs each (for a total of 9 events). Depending upon the configuration of MCT4, some outputs may perform specific control or alarm functions. The use of each output, and what it controls, is determined by the system designer. If there are questions or concerns about the configuration and operation of your MCT4 controller, contact Darwin Chambers for further information. Only Darwin Chambers can address equipment related issues.*

The names of events are also determined by the system designer. The screen shot above is an example.

Program Operation

The Program Operation button displays a “slide out” window with all automated program operations included. Press the desired icon for quick access to any program operation. The “Select” icon can be used to select any program stored for quick run operations.



Overview Screen

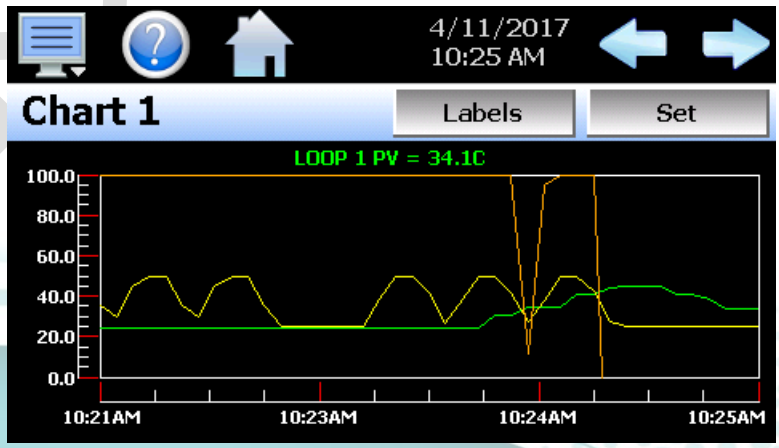
The Overview screen displays all loops, the limit, and events on a single screen for quick access to all system parameters. Press any loop to access the “slide out” keypad for set point entry. Press an event button to turn the output on and off. The Program Operation button displays the “slide out” window to access all automated program operations. Fields located at the bottom of the Overview screen will display the current program loaded as well as a scrolling alarm field which will cycle through all alarms that are active in the system.

Process Monitoring

The Loop and Overview screens provide the current process values of the MCT4. To view the process inputs over time, the MCT4 provides real-time charts. Four user configurable charts are provided with up to six plot points per chart.

Charts

The Chart screen is accessed from the home “View” menu. The real-time charts can be configured to display the process variable (PV), set point (SP) and percentage of output (%) of each control loop over a selectable period. The vertical axis determines the range of displayed data while the horizontal axis determines the history period. The maximum time that can be shown in a chart is 24 hours. The MCT4 comes standard with 4 configurable charts. Each chart includes up to 6 trend lines configurable by the user.



The rate at which the chart plots a new point is based on the time to be shown. Each buffer can hold a total of 720 readings for each of the selected channels to plot. The update rate can be calculated by the formula: time (in minutes) * 60 / 720. Note that for time periods less than 72 minutes, the update rate will be held to a minimum of 6 seconds. Thus, the update rate will vary from a minimum of 6 seconds (for time periods of 72 minutes or less) up to a maximum of 120 seconds for 1440 minutes (24 hours).

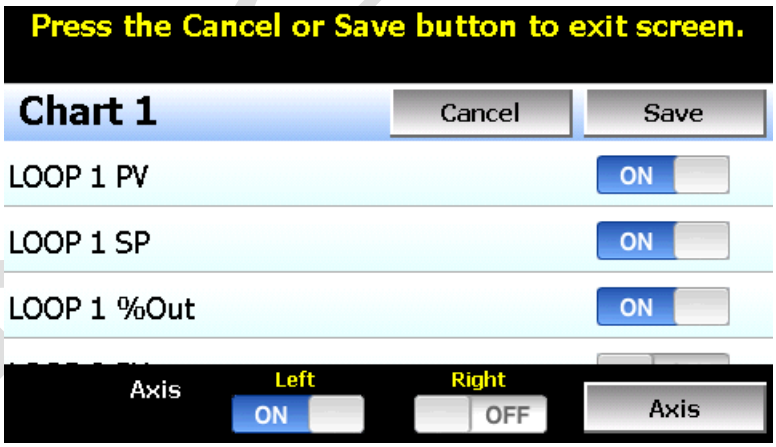
The **Labels** button allows the user to cycle through each of the configured plot channels to determine what each colored plot represents as well as view the current value without having to return to the Single or Dual view screens. The left and right scroll buttons at the upper right of the screen allow the user to cycle through each of the four available charts.

The charts also allow you to "zoom in" on an area to have a more detailed look at current data. By using your finger to select an area on the screen, the chart will zoom in on that area. To select a portion of the plot, touch and hold the screen with your finger. Drag your finger across the graph and a box will be drawn around the selected area. Removing your finger from the screen will cause the chart to redraw with only the selected plot area. To return to the normal view, touch the 'X' or 'Y' axis and select zoom out to return to the previous zoom setting or zoom normal to return to the full display.

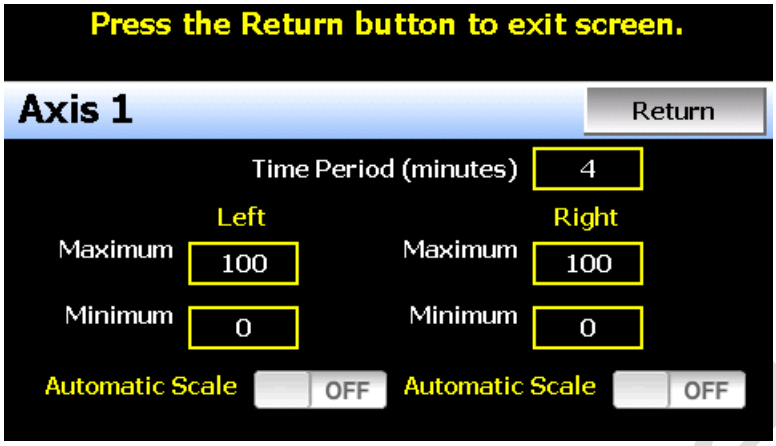
NOTE: *When a chart is zoomed in, it will not update with new information. The chart must be in normal view mode to update at each time interval. The chart will return to normal automatically when selecting a different screen to view.*

Chart Setup

To configure a chart, press the "Set" button in the upper right corner of the display. The setup screen will be shown. To assign channels to the chart, simply touch the on/off button for the desired items in the list to select them. Select the left or right vertical axis for each item by selecting the item in the list and press the button for the desired "Left" or "Right" axis. The left axis is the default axis selection. If none of the channels are assigned to the right axis, the axis will not be shown on the chart.



Once the channel selections have been made, press the “Axis” button to adjust the time period and vertical axis ranges of the graph.



Time Period Adjusts the displayed time for the graph. The allowable range is from 4 to 1440 minutes (24 hours).

Maximum The maximum value sets the maximum range of the vertical access with a minimum value of -32,760 and a maximum of 32,760.

Minimum The minimum value sets the minimum range of the vertical access with a minimum value of -32,760 and a maximum of 32,760.

Automatic Scale When on, the vertical axis will automatically adjust its zero and span as needed to display the selected plot channels.

Once all settings have been made, press the “Return” button to return to the channel selection screen. Press the “Save” button to store the current channel and axis entries or the “Cancel” button to exit chart setup without altering the current chart settings. If channel selections or the time for the chart has changed, all current chart data will be cleared when the new entries are saved. The chart will then begin plotting new data according to the new settings.

System Alarms

When an alarm condition occurs, the alarm icon flashes in the MCT4 icon bar to provide a visual indication of an alarm condition. An audible alarm will also sound if the alarm requires immediate operator attention such as a loop communications failure or a process alarm set point has been exceeded. For more information on adjusting the audible alarm volume, see Section 10.12.3, Alarm Volume.

NOTE: *The MCT4 loop controls can provide up to 3 alarm outputs each (for a total of 9 alarms). Depending upon the configuration of the MCT4, some outputs may perform specific control or event functions. The use of each output, and what it controls, is determined by the system designer. If there are questions or concerns about the configuration and operation of your MCT4 controller, Darwin Chambers for further information. Only Darwin Chambers can address equipment related issues.*

For information on alarm operation, see Sequence of Operation / Alarm Output Functions.

Alarm Monitor

The Alarm screen is accessed from the home “View” menu. It can also be displayed by pressing the alarm icon whenever a new alarm occurs. It displays all current and/or previously acknowledged alarms according

to time and date of occurrence. Once the alarm is reset, the alarm icon will be hidden; however, the alarm condition may still be present.

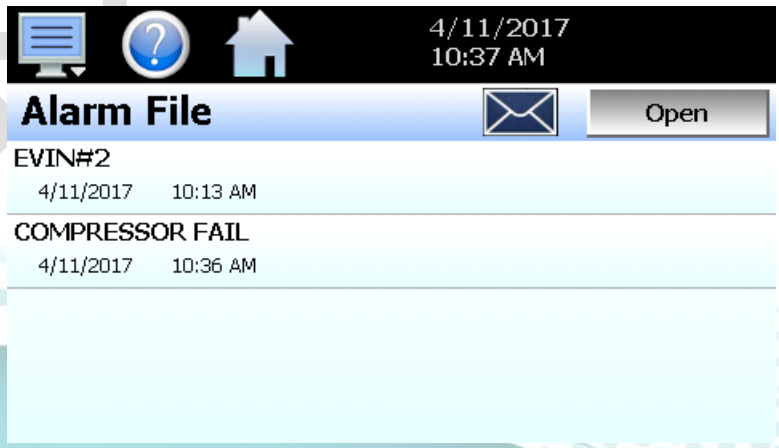
The alarm will be removed from the list when cleared by the operator by pressing the "Clear" button. Only alarms that are not currently active in the system can be cleared from the alarm list.

IMPORTANT: *If a loop control is in manual mode or in automatic tune and the reset button is preset, the alarm reset will terminate automatic tune or manual mode and place the loop back into normal operation.*

Upon alarm reset, if the process no longer exceeds the alarm set point, but the loop control alarm output has not yet reset due to the alarm hysteresis, the alarm reset will ignore the alarm hysteresis and the alarm output will immediately go to the non-alarm output state.

Alarm File

The Alarm File screen is accessed from the home "View" menu. It displays all alarms for any given day. The MCT4 can store daily alarm files for a period of a year or longer (time based on storage usage for data history). Each time an alarm occurs on the MCT4, the alarm is written to a file. Alarm file names are listed as MMDDYYYY (where MM = month, DD = day, YYYY = year. The "Open" file button will display a dialog box where the user can select any alarm file to view.



The send email icon allows the user to send a copy of the currently opened alarm file to any user configured in MCT4. When the email icon is pressed, an "Add Recipients" window will be displayed where the user can select recipients for the file from any of the email addresses configured under the MCT4 email settings. For information on how to add email recipients to MCT4, see the section 8.9, Email.

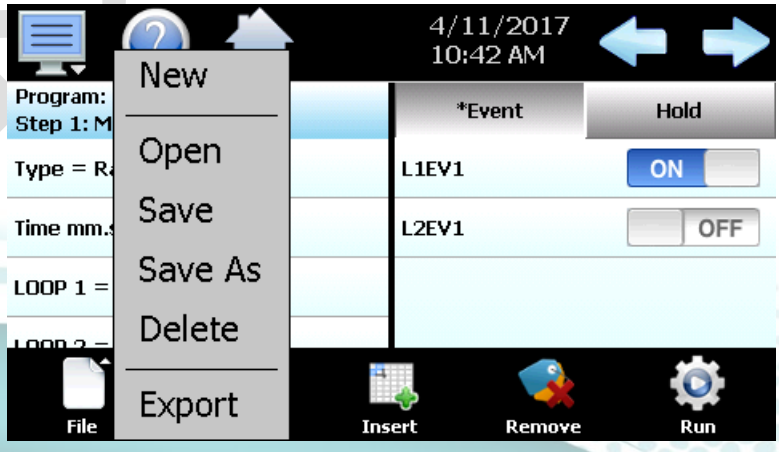
NOTE: *If no alarms occurred on a given day, an alarm file will not be created for that day. The alarm list will display up to 650 alarm files. If more than 650 alarm files are present, the alarm files cannot be shown in the list and the files will have to be exported from the MCT4 to view them. This can be done either via USB file utilities (see section 8.4) or FTP (see section 8.5).*

Automatic Ramp/Soak Program Operation

A ramp/soak program is a set of instructions (set points and events) programmed as a timed sequence of steps. When a program is run, the MCT4 executes each step of the program automatically, in sequence, based on the time duration and settings for each step. The MCT4 can store hundreds of programs (depending on storage usage for data history) with up to 64 steps in each. All program step entry is located on a single screen so even the most complex program is easy to create and edit.

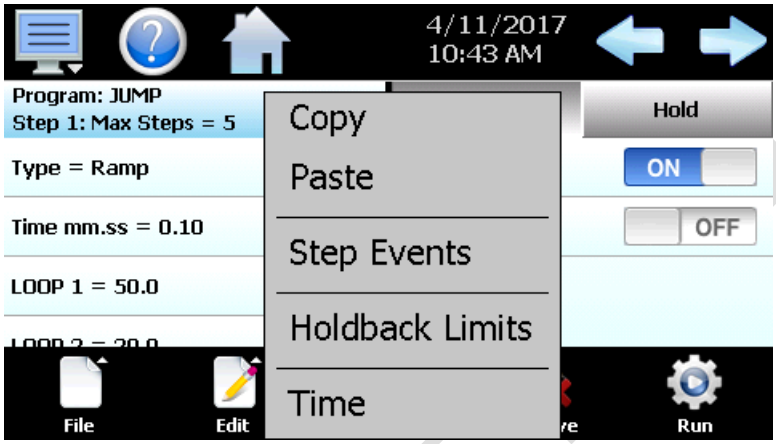
Program Entry Screen

The pop-up "File" icon menu provides the following functions:



New	Clears all current program entries.
Open	Provides file open dialog to select a program from memory.
Save	Saves the current program being edited.
Save As	Saves the program being edited under a new name.
Delete	Deletes the current program from internal memory.
Export	Export the current program to USB memory device.

The pop-up “Edit” icon menu provides the following functions:



Copy	Copies current step data including events.
Paste	Pastes previously copied step data to the current step.
Step Events	Copies and pastes current step events to all following steps.
Holdback Limits	Sets holdback limit values for each loop (set once only per program).
Time	Sets time for program in hh:mm or mm:ss (set once only per program).

Entering a Ramp/Soak Program

Ramp/Soak programs are created and edited from the program Entry screen. The program Entry screen can also be accessed directly from the “Program” menu or “Program Operation” button on Loop and Overview screens. To create an automatic ramp/soak program:

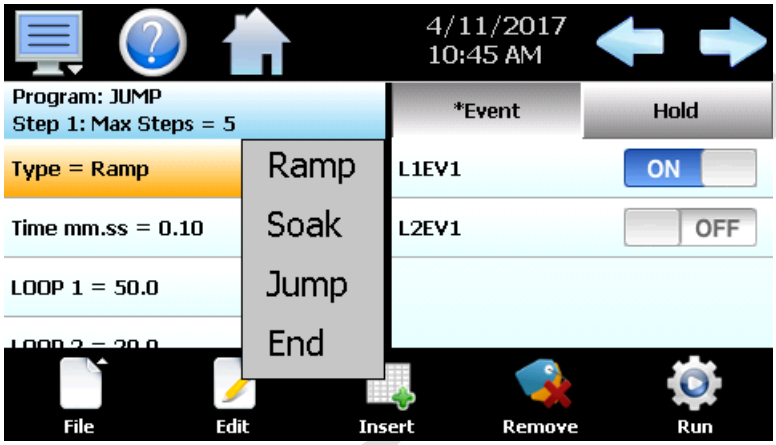
1. From the File pop-up menu, select “New” to create a new program.
2. Enter or delete steps by pressing the “Insert” or “Remove” icons. Steps can be added or deleted “on the fly” as required. Inserting steps anywhere within the program will not affect steps already programmed.
3. For each step, press any row in the loop list view to set the step type, time or loop set point. Entry is dynamic and the interface will display a pop-up menu or slide out numeric keypad to match the type of entry pressed in the list. Slide the list up or down to view more data like any standard smart device. Press any button in the “Event” list to turn the event output on or off for the program step. If holdback for any loop step is required (and programmed in holdback screen), press the “Hold” button and select the loop the step holdback.
4. From the File menu, select “Save” to save the program.

NOTE: *Programs can be saved with names of up to 16 characters long. However, the MCT4 only uses the first 14 characters of the program name for display updates and record keeping. When naming programs, try to keep the name limited to 14 characters to have the full program name shown, or use the first 14 characters as a means of more clearly identifying the program when more than 14 characters are used.*

Setting Step Type

Programs are entered as a sequence of steps which define the set point and length of time that a loop should take to reach the set point (ramp) or remain at a set point (soak). The ramp and soak units can both be set for hours/minutes or minutes/seconds or one can be set for hours/minutes while the other is set for minutes/seconds. To begin editing a program step, first select the type of step by pressing the first row in the list and make the desired selection from the step type pop-up menu.

NOTE: *As the step type selection is changed, the list will update to include only the items specific to the selected step type. This simplifies step entry by only requesting user entry for the items necessary for proper step operation.*



The **Ramp** selection allows the user to program each loop to ramp to a set point in a specific period. Simply select ramp from the pop-up menu and then enter the loop set point(s) and time.

The **Soak** selection allows the user to program each loop to maintain its set point for a specific period. Simply select soak from the pop-up menu and then enter the time desired to maintain the set point.

The **Jump** selection allows the user to jump to a previous step in the program and set the number of times the program should execute the jump before continuing to the following step of the program.

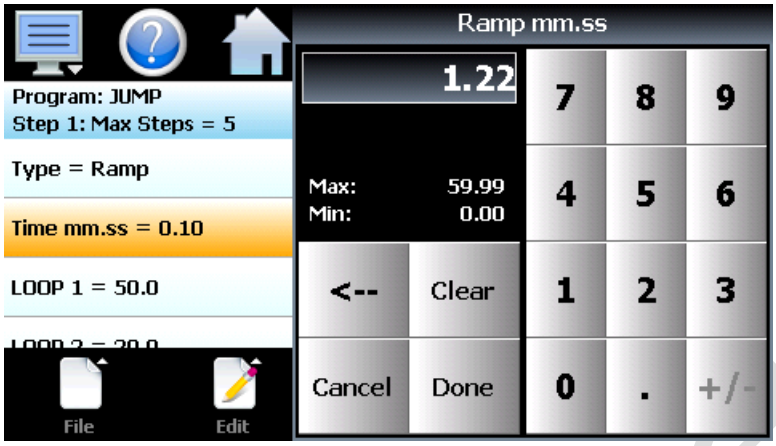
The **End** selection allows the user to program the last step of the program. The end step type includes final set points (if configured) and a cycle count entry to allow the user to enter the number of cycles the program should repeat itself if desired.

Setting Step Set Points and Time

Set point entry is only provided when entering a ramp step. If “soak” is selected for the step type, the loop(s) will remain at the previous set point for time entered for the step. The set point entered for each control loop is used as the target set point for the step, i.e., the set point the loop control will arrive at by the end of the step. Each set point will change independently of the other to arrive at the target set point when the time left in the step reaches zero.

To enter the set point for a loop, touch the set point field for the loop and enter the desired set point. To enter the step time, touch the time field to enter in the desired time duration. Time is entered as HH.MM or MM. SS depending upon the selection made on the Time setup screen under the Edit icon pop-up menu. Thus, to enter a time of 1 hour for example, you would enter a value of 1.00 for one hour and zero minutes. To enter a

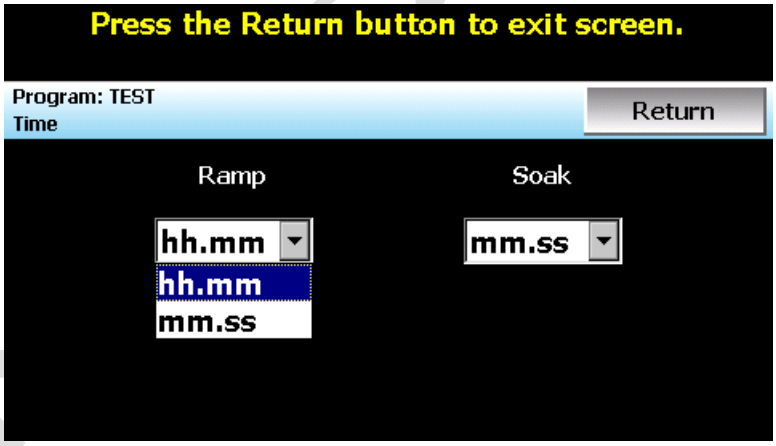
step time of 30 minutes, the time entry would be made as 0.30 for 30 minutes. If the time selection was in minutes and seconds, an entry of 1 minute and 30 seconds would be made as 1.30.



NOTE: *A step time of zero can be entered for a step to implement an immediate set point change when programmed for ramp. If holdback is enabled on a step, a minimum step time of 10 seconds 0.10 (mm:ss) or 1 minute 0.01 (hh:mm) is required to ensure that the holdback condition can recognize the process change in order for holdback to operate.*

Ramp/Soak Time Units Selection

The Time selection screen is accessed by selecting the "Time" menu item from the Edit pop-up menu.



For dual loop and three loop systems, the ramp and soak time selections both provide the option of hours and minutes (hh.mm) and minutes and seconds (mm.ss). The selections apply to all steps of the program. The time units can be changed at any time during program entry; however, the time entry of each step is not scaled to the new unit selection when the change is made.

If program steps were entered in the previous selection of "mm.ss" for example, a time of one minute and thirty seconds (1.30) will become a time entry of one hour and thirty minutes (1.30). If the time unit's selection is changed, all steps must be reviewed to make sure the actual time length for each step is set to the desired length.

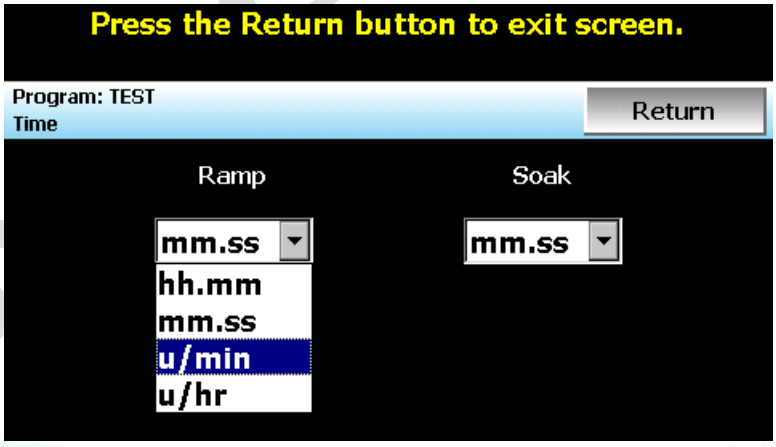
Setting Step Set Point and Ramp Rate (single loop only)

For single loop systems, the time units for ramp steps on the Time setup screen under the Edit icon pop-up menu can be set for units/hour or units/minute. If the ramp units are set for units/hour or units/minute, ramp steps are entered as a rate of change in process units/time. If a set point is entered for the step that matches the set point of the previous step, the step will be skipped since the loop is already at set point.

NOTE: *A ramp rate entry is only available for single loop MCT4 systems because the length of time for the step to complete is based upon the change in set point and the rate at which the set point is to ramp. Ramp units of time are still available for selection on single loop systems if time entry is preferred over rate.*

Ramp Rate/Soak Time Units Selection

The Time selection screen is accessed by selecting the "Time" menu item from the Edit pop-up menu.



For single loop systems, the ramp and soak time selections both provide the option of hours and minutes (hh.mm) and minutes and seconds (mm.ss). In addition, the ramp time selections include units/minute (u/min) and units/hour (u/hr). The selections apply to all steps of the program. The time units can be changed at any time during program entry; however, the time entry of each step is not scaled to the new unit selection when the change is made.

If a ramp step was entered in the previous selection of “u/hr” for example, a ramp rate entry of 10 degrees per hour will become 10 degrees per minute if the ramp selection is changes to “u/min”. When time units’ selections are changed, all steps must be reviewed in order to make sure the actual ramp rate or time length for each step is set to the desired length.

Setting Step Events

For each step of the program, the user can select which events are to be on during the step. To edit step events, press the “Event” button on the program Entry screen. This will display the Event list for the program step.

When at least one event is turned on in a step, an asterisk ‘*’ will appear before the word “Event” on the list selection button. This indicates that at least one event is turned on without having to press the “Event” button, or if the events that are turned on are not currently shown in the list due to the scroll position of the list.

The desired event state for the step can then be set by pressing the on/off button for each event to toggle them on and off. Sliding the list up or down will display additional events if more events are program than can be shown in the list at one time.

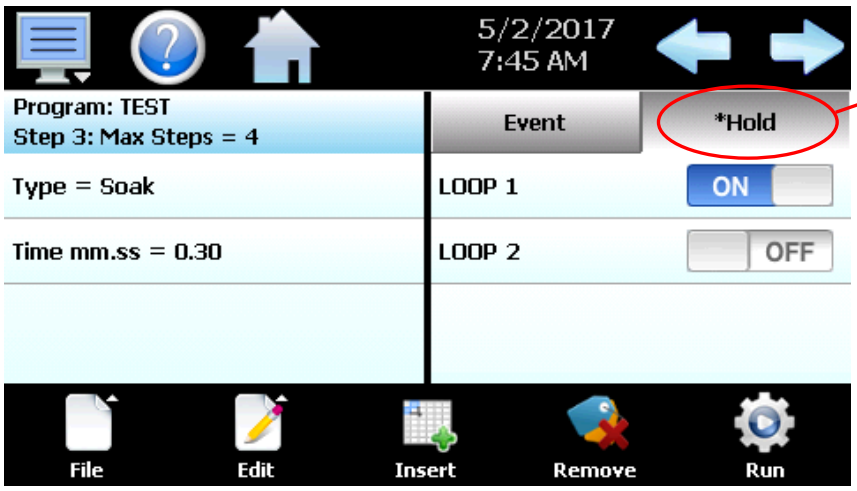
Events cannot be set for the End step. During program operation, when the End step is reached, the event outputs will return to their previous static setting (prior to starting program operation). If the loop controls are configured for “Final Setpoint” at end of program operation, the program will remain in the end step state and all event outputs will turn off until the user halts program operation. Upon stopping the program, the event outputs will then return to their static settings.

NOTE: *The step events must be set individually for each step. Even though a ramp/soak program may be in operation, if the events are not set, the associated loop control output will not turn on. To make setting step events quick and easy, the MCT4 provides the “Step Events” function from the “Edit” menu. When selected, all event selections of the current step will be copied to all following steps.*

This requires the user to only enter event selections for one step (step 1 for example), and if all following steps use the same event selections, selecting “Step Events” from the “Edit” icon pop-up menu will then copy the selections to all other steps of the program. This feature can be used on any step of the program, so if event selections then change on step 5, the function can be used again and all steps after step 5 will then have event selections of step 5 copied to them leaving steps 1-4 with the previous selections.

Setting Hold Events

The hold events are used to turn on the holdback option for each loop control. To edit hold events, press the “Hold” button on the program Entry screen. This will display the Hold list for the program step.



When at least one event is turned on in a step, an asterisk '*' will appear before the word "Hold" on the list selection button.

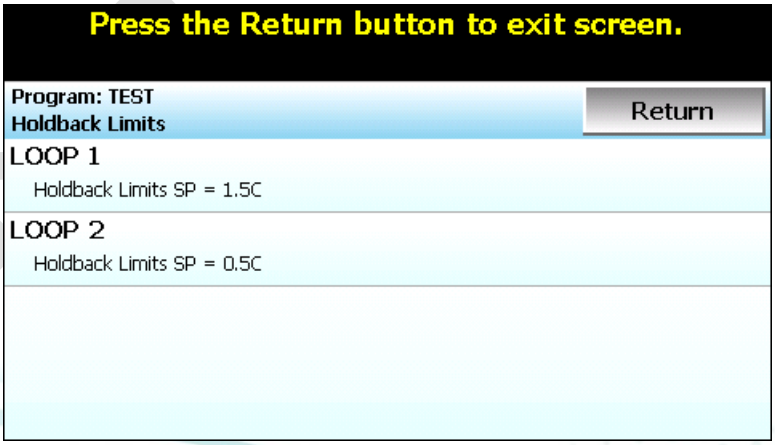
This indicates that holdback is enabled on at least one loop without having to press the "Hold" button.

Pressing the on/off button for each event will toggle holdback on and off for the loop. When the hold event is enabled, the program will automatically enter a hold condition during the step if the loop's process value deviates from its set point by more than the holdback limit setting for the loop.

NOTE: *For proper holdback operation, a minimum step time of 10 seconds 0.10 (mm:ss) or 1 minute 0.01 (hh:mm) is required to ensure that the holdback condition can recognize the process change in order for holdback to operate. If the step time is less than 10 seconds, the holdback condition may not be triggered.*

HoldBack Limits

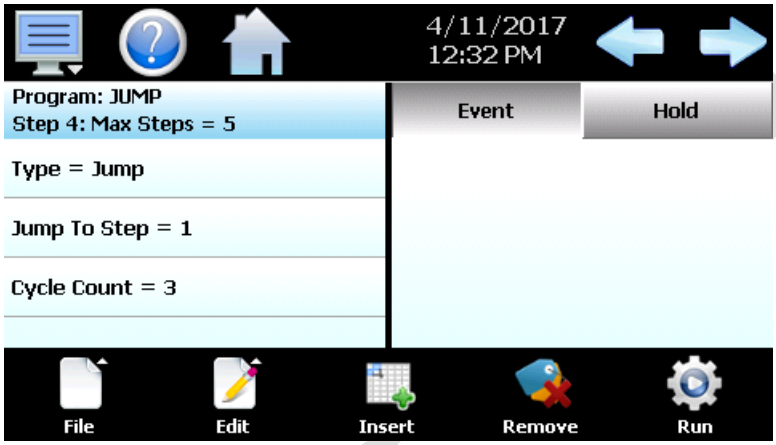
The holdback limit settings are used to set the control tolerance for each loop during steps that have hold back enabled. When the loop process variable deviates from its set point by more than the band value (above or below set point), the program timer will stop until the process variable re-enters the hold back band. The Holdback Limits are accessed from the Edit pop-up menu. The entries apply to every step in the program and only need to be entered once for the program.



The MCT4 uses "band" type holdback operations. This means the MCT4 will be in hold mode when the loop process value is above or below the loop set point by the entered holdback limit value during step operation. Holdback steps must have a minimum value of .10 (mm:ss) or .01 (hh:mm) for holdback to engage during the step. A time value of 0 in a holdback step will cause the automated program to continue to the next step and skip the holdback step.

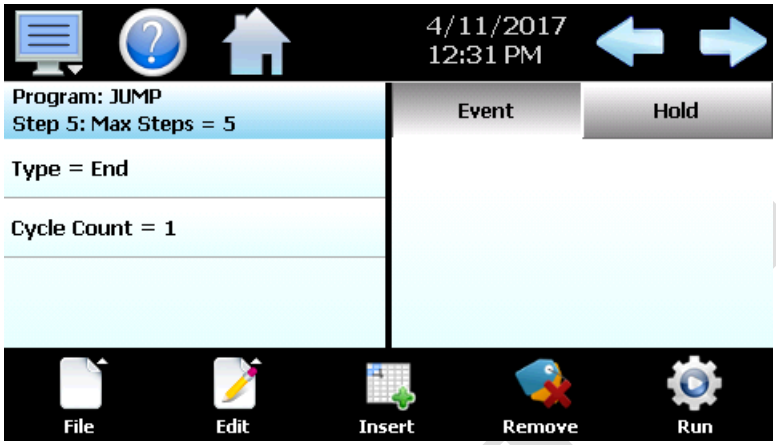
This feature allows the program to jump back to a previous step to repeat certain sections of a program. When a jump step is entered, the program will jump to the specified “jump step” rather than continuing to the next step in the program. After all the programmed jump cycles have been completed, the program will then continue to the following step without making any further jumps.

NOTE: *The MCT4 can do nested looping, i.e., allowing multiple jump steps to be programmed throughout a program in which one jump cycle is repeated within another jump cycle. The program Status screen will display the current cycle count; however, this is for the outer most jump step. If nested jump loops are programmed, the cycle count of the inner jump loops is not displayed.*



To program a jump step, select jump for the step type and enter the step number that you want the program to jump back to along with the total number of times the jump is to be made (by pressing each row in the list). A cycle count of one indicates that no jump will be made since one cycle is completed upon reaching the jump step.

All programs require that the last step be entered as an “End” step type regardless of the length (2 to 64 steps) of the program. The end step type provides a cycle count entry which makes it easy for the operator to repeat an entire program without having to enter a jump step. The end step cycle count can be set from 1 to 9999 cycles. An entry of 10,000 can also be made which signifies infinite looping, i.e., the program will keep repeating itself until manually stopped by the user. Press each row in the list to make the desired entry.



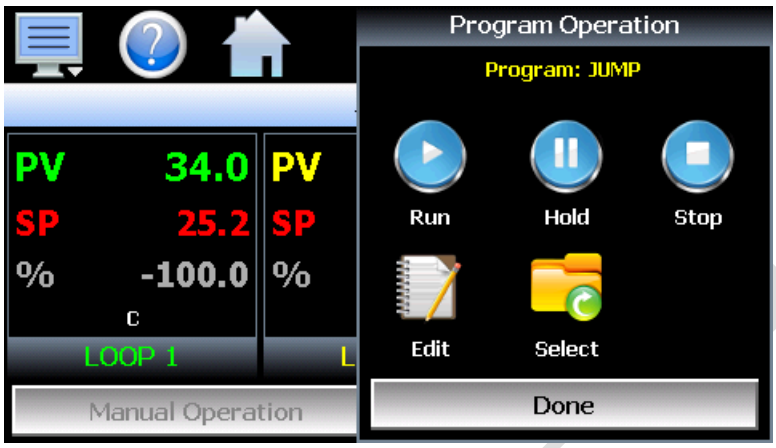
If the MCT4 is configured for automatic program final set point entry, the loop set point for each loop also will be displayed in the list. When the program ends, the set point entered on the end step will be used as the loop set point. The loop control will then remain at that set point until the user halts the program. Once the program is stopped, the loop control will then return to the previous static set point (prior to the start of the program).

The MCT4 configuration also provides the option for having the loop controls return to the static mode of operation when the program is completed. When configured to use the last control set point, the loop controls will automatically return to the previous static set point (prior to the start of the program) when the program ends. If there are questions or concerns about the configuration and operation of your MCT4 controller, contact Darwin Chambers for further information. Only Darwin Chambers can address equipment related issues.

NOTE: *When configured for automatic program final set point entry, MCT4 will remain in the end step until the user manually stops the program. If any loop control outputs are configured as events, they will remain in the off state and cannot be turned back on until the program is stopped.*

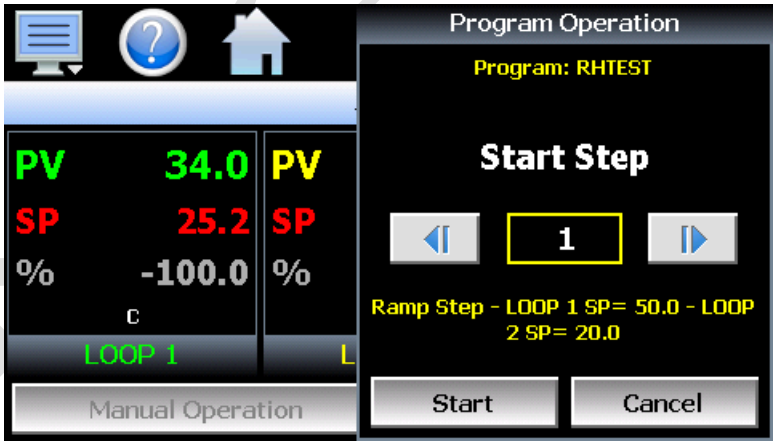
Starting an Automatic Ramp/Soak Program

All automated program operating functions are accessed via the Program Operation screen. This screen can be accessed by pressing the “Program Operation” button on the Loop view or Overview screens or by pressing the “Run” button on the program Entry screen.



The program operation allows an operator to run, hold, stop, edit, and select automatic programs. The Program operation window will display the program loaded in the MCT4 which is ready for operation by pressing the Run, Hold or Stop buttons. If a program is already loaded, the user can start the program without entering a start step. This offers a quick start/stop of programs for repetitive test operations. In this case, the program will always start from step 1.

If entering a Start Step is required (to start the program on a specific step), press the “Select” button and choose the program from the list, then press the run button. This will display the **Start Step** entry.



The **start step** can be adjusted up and down by pressing the right/left arrow buttons or by pressing the step number field and directly entering the desired start step via the numeric keypad. Once the desired start step number is entered, press the “Start” button. The program will then be transferred to the loop control(s) and started once the transfer is complete.

To stop a program, select “Stop” from the Program Operation window. When a program is stopped, the loop set points and events will revert to the single set point (static mode) values that were entered prior to the

program being started. The Edit button will navigate directly to the program Entry screen so a program can be created, edited, and stored.

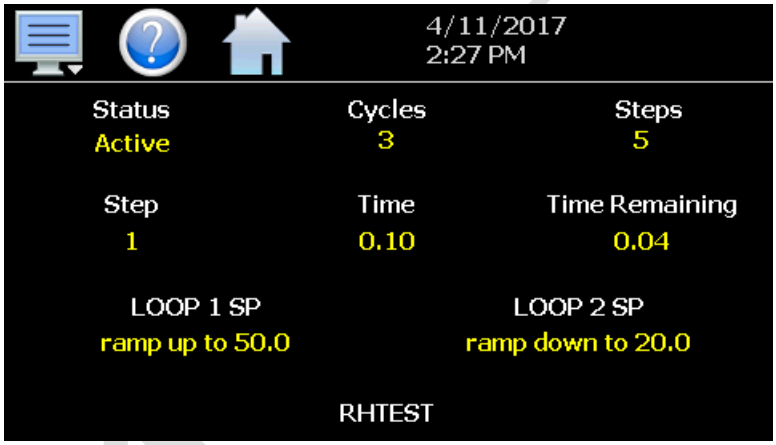
Hold/Resume Ramp/Soak Program Operation

At any time during the operation of a program, it can be manually placed into hold. This stops the program timer; however, the MCT4 continues operation under the current step settings at the time the program was put into hold. To pause a program, select “Hold” from the Program menu. To resume the program from the point in which it was paused, select “Start” from the Program menu.

NOTE: *The program will automatically be placed in hold if holdback is enabled for the step and the process value of the selected loop deviates from set point by more than the holdback band. When the program is in holdback, it cannot be resumed by pressing the Run button. The program will automatically resume once the process value of the selected “hold loop(s)” is within the holdback band from set point.*

Monitoring Automated Ramp/Soak Program Operation

The program Status view provides all information regarding the operation of the current program.



The **Status** field indicates the current operating mode of the program, i.e., On, In Hold and Off.
The **Cycles** field indicates the number of cycles left to be completed for the current jump loop.
The **Steps** field indicates the total number of steps in the current program.
The **Step** field indicates the step number currently being executed.
The **Time** field indicates the total length of time programmed for the current step.
Time Remaining is the time remaining in the current step.

The set point for each loop indicates the programmed set point for the loop that will be achieved by the end of the step. The fields will indicate the current ramp or soak status for the loop based on the set point of the step. If the target set point of the step is greater than the loop set point, “ramp up to” will be displayed. If the set point is lower than the current loop set point, “ramping down to” will be displayed. If the step is a soak step or the target set point is the same as the current loop set point, “soak at” will be displayed.

The name of the running program, or current program loaded to the MCT4 loop controls, will be shown at the bottom center of the screen. If no program has been loaded, the field will be empty.

IMPORTANT: *If the set point does not match the set point programmed for the step, check the lower and upper set point limits for the loop (see Section 9.3 Setpoint Limits). The lower and upper limits*

define the allowed operating range. If a step set point exceeds a limit, it will be coerced to the lower or upper limit that it exceeds. This is done automatically without altering the original program.

Common Questions About Ramp/Soak Program Operation

1. **How do I start or run a ramp/soak program?**

   To select and start a program, use the Program Operation window which can be accessed from the Loop, Overview, or program Entry screens. All start, stop, hold, edit and program select operations are available from this window.

2. **How do I know which program is running?**

   When a program is running, the name is displayed on program Status view screen as well as the Loop and Overview screens. It is also shown on the Program Operation window. The MCT4 will indicate that the program is running when it is in operation. If a program is not running, the MCT4 will display the name of the currently loaded program, i.e., present in memory and ready to be run.

3 **Why is the program not running to the set point entered for the step?**

   Automatic ramp/soak program operation is limited by the lower and upper set point limits (see section 9.3 Setpoint Limits). If a program step has a set point that exceeds the lower or upper limit, the set point will be automatically coerced to the limit it exceeds. This prevents damage to equipment or product by ensuring that the system only operates to the range entered by the user. If a program step has a set point of 100 for example, but the upper limit is 90, when the program is run the set point will be coerced to the maximum allowed upper limit of 90 during operation of the step.

   The original program remains unaltered, so if the user then changes the lower and upper limits to match the range of set points within the program, the program will then operate to the programmed set points. This ensures that the operating range of the system cannot be exceeded even if a user accidentally copies a program from another system with a greater operating range.

4 **Why is Holdback not working?**

   For holdback to function, it must compare the loop process value to the loop set point. When entering a step with a hold event on for a loop, the step time must be long enough in order for the MCT4 to compare the loop process value to the set point to determine if it is within the holdback limit and then issue the command to the loop control to hold the program. This process can take several seconds. If the step time is less than 10 seconds, the program can proceed to the following step prior to the MCT4 issuing the hold command. To ensure proper holdback operation, make sure the step time is minimum of 10 seconds (for minute/second time entry) or 1 minute (for hour/minute time entry).

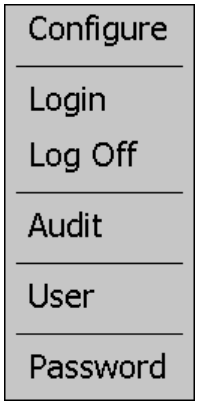
SECURITY

The MCT4 security model provides an administrator with the tools to add up to 30 users to the system. Each user must have a unique ID, full name, and password. Four user levels are provided which include system, user, supervisor, and administrator levels. Specific access rights can be assigned to each user level and password aging can be implemented. Verification is provided (if enabled) for any parameters that will change a control parameter, which could upset the process (i.e., loop set point, start/stop automated ramp/soak programs, etc.).

Verification requires that the logged in user must log in again before the process value (at the controller) will be changed. This feature is provided for extra security. The following example will make re-authentication clearer:

A supervisor logs on the system. The supervisor then steps away from the system to take a phone call but does not log out before leaving. If another user tries to change the control set point on any loop, the system will require another login (by an authorized user for that level) before the control set point is changed. This provides an extra level of protection to make the system more "tamper proof".

The Security menu is accessed from the home menu and provides access to the security section of the MCT4.

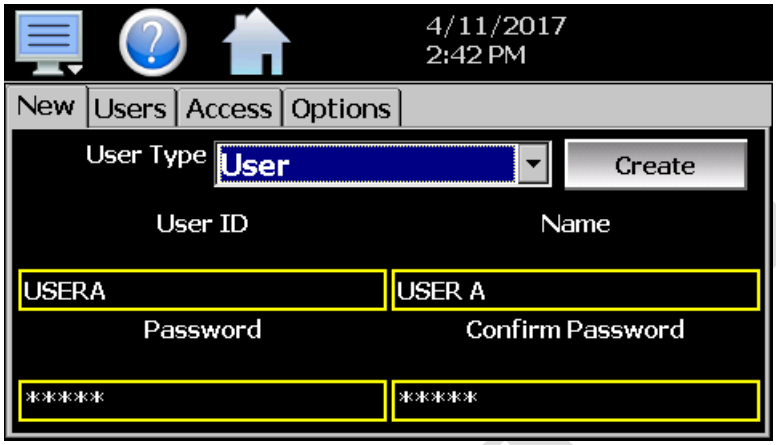


The Security menu provides the following functions:

Configure	Provides access to security setup to add users, set rights and options.
Login	Log on a user if security is enabled.
Log Off	Log off a user if security is enabled.
Audit	Allows the user to view any of the saved audit trail files.
User	Shows the current user logged into the system.
Password	Allows the current user to change their password.

Adding Users

The “New” user tab provides the ability to add up to 30 users to the system. Select the type of user from the drop-down list (System, User, Supervisor or Administrator). Press each field to add the user ID, full name, and password (no spaces allowed 5 characters minimum and 16 characters maximum). Press the “Create” button to add the user to the system. If the passwords do not match or the user ID is already used, the MCT4 will alert the user and not accept the entry.



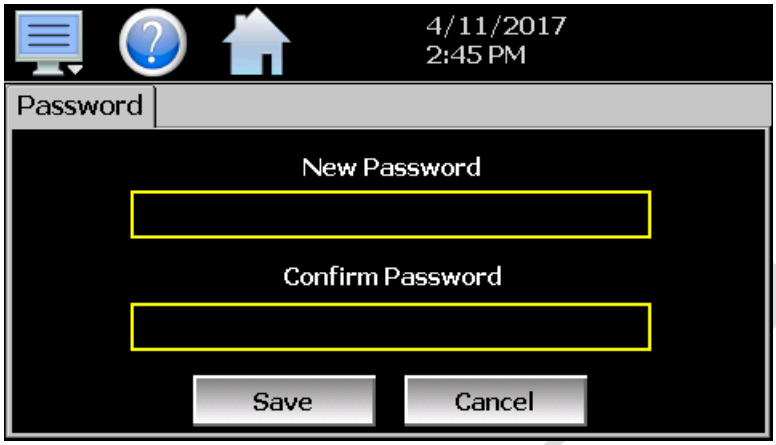
Viewing Users

The “Users” tab provides the administrator with the ability to view information on each user entered the system. Password information is not available. The user can be deleted from this tab and a new password for each user can also be entered from this area.

To delete a user, select the user from the list and press the “Delete” button. Likewise, to change the password for a user, select the user from the list and press the “Password” button.

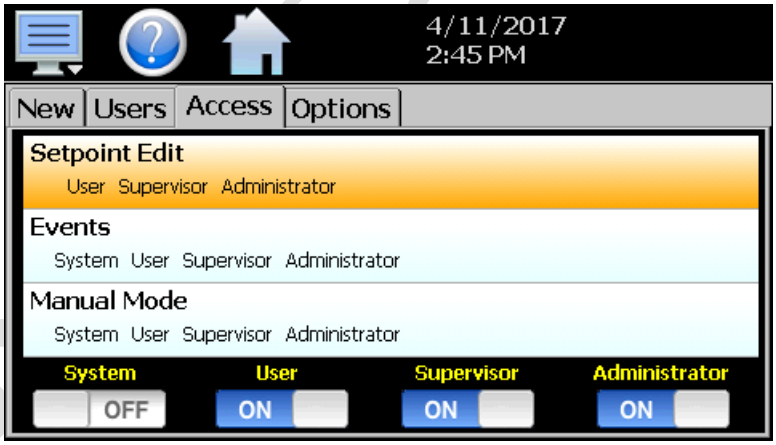
New Password Entry

To change a password, select the desired user by touching the User ID in the list box and press the 'New Password' button. Enter the new password and confirm the password. Press the "Accept" button to change the password (no spaces allowed 5 characters minimum and 16 characters maximum).



Setting User Access

The "Access" tab provides the administrator the ability to assign rights to each user level (System, User, Supervisor and Administrator). To enable or disable specific program functions (user rights) for each user level, select the user right from the list and press the corresponding on/off button for the user level you want to change access rights for. If the button is set to on, user access will be enabled for the user group.



User access for "Security" cannot be disabled for the administrator group. This is a safety feature to make sure that any administrator with the proper user ID and password can access security. If the administrator losses his/her ID or password, there is no "back door" to the system, and it will have to be reset and reprogrammed to return to normal operation.

Security System User Access

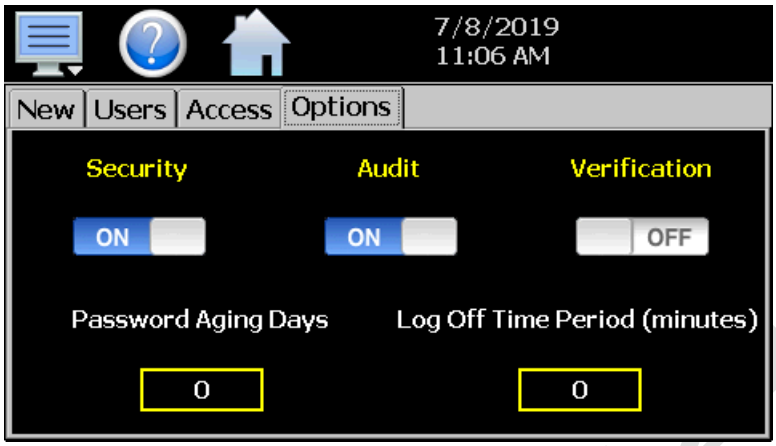
Shown below is a list of the available user rights, where to find the menu item(s) applicable to the user right and a description of what it applies to. Note that Darwin Chambers configuration allows many menu items to be disabled; in which case the menu for a specific user right may not be shown.

User Right	Menu Location	Description
Setpoint Edit	View/Loop, Overview	applies to loop controls when not running an automatic ramp/soak program (does not apply to loop alarms)
Events	View/Events	applies to enable or disable manual events
Manual Mode	View/Single	enable or disable loop control Manual mode button
Automatic Tune	View/Single	enable or disable loop control Automatic Tune button
Program Operate	Program/Run, Hold, Stop actions	applies to all program control menu selections; does not affect digital Inputs configured for same action
Recovery	Device/Settings/Offline/Set/Recovery	logic when running an automated ramp/soak program when power lost & recovery:
Reset Alarms	View/Alarm	alarm Reset button
Clear Alarms	View/Alarm; Clear button	prevents alarm list view from being cleared
Chart Settings	View/Chart	configure plot channels, scale & time for charts
Data	Data/Data	applies to all data logging actions & settings
Annotation	Data/View/Annotation	access to add operator messages to active log file
Signature	Data/View/Signature	access to add digital signature to active historical data file
Open	see description	alarm, automatic program, audit & data files
Save	see description	program “save” and “save as”; note files may be copied from system with USB file transfer utilities
Delete	see description	data files & automatic programs; note files may be deleted with File Utilities
Program Edit	Program/Entry	no data entry or access to Events or Step SP/Time fields; cannot insert/delete/copy/paste step.
USB	Data/Utilities/USB	allows USB memory stick to copy/delete data, alarm, program & audit trail files & to import programs
FTP/WAN	Data/Utilities/FTP/WAN	configure FTP client settings
Communications	Device/Settings/Set/Comms	configure web page, Modbus address & VNC settings
Tuning	Device/Settings/View/Tuning	manual adjustment of loop tuning parameters
Setpoint Limits	Device/Settings/Set/Limit	applies to loop controls (does not apply to loop/monitor alarms)
Adjust Alarms	Device/Settings/Set/Alarm	applies to all loop and monitor point alarms
Event Names	Device/Settings/Set/Event	configure event tagnames (seen in manual Events & program step Events)
Email Settings	Device/Settings/Email/Email Settings	configure email settings and addresses
Email Message	Device/Settings/Email/Message	access to compose & send email message

User Right	Menu Location	Description
Offline	Device/Settings/Offline	access to Off-Line menu system: Units, set Clock, Calibrate Touch, Language, Exit to Application, input Offset, Configuration
Calibrate Touch	Device/Settings/Offline/System/Display	access to the touch screen calibration utility
Backlight	Device/Settings/Offline/System/Display	access to edit backlight settings for brightness and off delay time
Alarm Volume	Device/Settings/Offline/System/Display	allows edit of MCT4 alarm beeper volume
Units	Device/Settings//Offline/Set/Units	loop/monitor point temperature unit's configuration - C\F
Clock	Device/Settings/Offline/Set/Clock	Set Date/Time, Time Zone, DST and NTS connection
NTP	Device/Settings/Offline/Set/Clock	enable & choose National Time Server location
Daylight Savings	Device/Settings/Offline/Set/Clock	enable Daylight Savings Time (DST)
Language	Device/Settings/Offline/Set/Language	Select help language
Security	View/Security/Configure	applies to Security Setup
Configuration	Device/Settings/Offline/System/ Configuration	access to import/export setup files of MCT4
Default Configuration	Device/Settings/Offline/System/ Configuration; Reset Default Configuration button	function to clear system configuration and reset all to blank (default) state for reconfiguring
Exit (run mode)	Device/Settings /Offline/System/Exit; "Exit application. (Automatic mode startup)." button	prevents MCT4 application from being stopped
Exit to Configurator	Device/Settings /Offline/System/Exit; "Exit Application. (Configuration mode startup)." button	prevents MCT4 application from being stopped and access to the MCT4 configurator application
Cascade	Device/Settings //Cascade	Set cascade settings when cascade control enabled.
Calibrate Inputs	Device/Settings /Offline/Calibrate	Provides user offset calibration or full calibration of all MCT4 inputs.

Setting Security Options

The security “Options” tab provides the administrator the ability to set the global security options.



Security is the global setting that turns the MCT4 security system on or off. The security system must be enabled for the audit trail to be enabled.

Audit is a global setting that turns the audit trail on or off. When the audit trail is turned on, all user actions are written to a daily log.

When enabled, **Verification** requires that the logged in user must log in again before the entry value will be changed.

The **Password Aging Days** field is a global for all users. Password aging starts from the day the user is entered into the system. The value can be set from 0 to 365 days. A value of zero disables password aging.

NOTE: *When using password aging and the password expires for a user, the user will be required to change their password before access to the system is permitted. A user can change their password at any time (even if aging is not used) by selecting “Password” from the main security menu.*

The **Log Off Time Period (minutes)** field is a global for all users. The log off time begins once a user logs into the system. If the user does not perform any actions within the specified time, the system will automatically log the user out. User actions are defined as any action that requires a process change, i.e., changing a SP, changing an alarm description, etc. Any field protected by security settings of the MCT4 are user action fields. The log off time can be set from 0 to 1440 minutes (24 hours). A value of zero disables the auto log off feature.

NOTE: *If a user begins an action such as changing a set point but does not complete the task and leaves the numeric keypad shown, the system will log the user out if the log off time elapses. However, since the keypad is still shown, the set point change can still be completed as the task had already begun. In this case, if a user then enters a new set point, the audit trail will record the change under the user that was previously logged in, but since the user was automatically logged out while the keypad was shown, the user will be required to log in to access the set point again.*

Audit Trail

The audit trail viewer is accessed by selecting “Audit” from the Security menu. It displays all user actions that affected the system for any given day. The MCT4 can store daily audit files for a period of a year or longer (time based on storage usage for data history).

Each time a user takes an action that affect the operation of the system (changing a set point, start/stop data logging, changes an alarm set point, etc.), the action is written to a file. Audit trail file names are listed as MMDDYYYY (where MM = month, DD = day, YYYY = year. The “Open” file button will display a dialog box where the user can select any audit file to view.

NOTE: *If no actions occurred on a given day, an audit file will not be created for that day.*

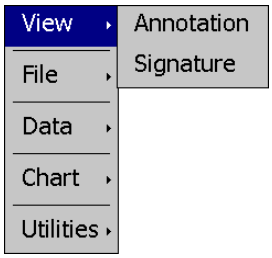
Each action recorded to the file includes the date/time it occurred as well as the user (if logged in) that made the change. If no user is logged in, the user will be listed as “Device Manager”, which is the default user account for the MCT4 system.

The send email icon allows the user to send a copy of the currently opened audit trail file to any user configured in the MCT4. When the email icon is pressed, an “Add Recipients” window will be displayed where the user can select recipients for the file from any of the email addresses configured under the MCT4 email settings. For information on how to add email recipients to the MCT4, see the section 9.9, Email.

DATA LOGGING

The MCT4 data logging features are accessed via the home ‘Data” menu item. The system data logging provides the ability to select individual points for logging, view data log files and start/stop logging operations. The logging ability of MCT4 provides an easy-to-use, convenient method to obtain electronic data without the need for additional data acquisition equipment.

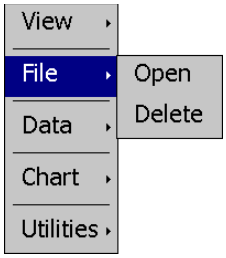
The Data Log menu provides navigation to the following functions:



View menu

Annotation: Allows the user to insert a notification into the currently running log file or view all annotations associated with the currently loaded historical data file.

Signature: Allows the user to digitally sign a file to prevent data tampering and view all digital signatures associated with the currently loaded historical data file.

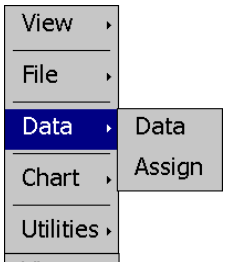


File menu

Open: Opens a history file for review.

Delete: Allows the user to delete the currently loaded history file.

NOTE: *The "Delete" log file function does not affect data from a file that is running, only the current data log file loaded for review.*



Data menu

Data: Displays main data log screen with status of logger.

Assign: Allows the user to select what variables are to be logged.

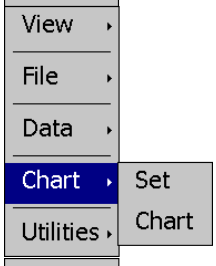
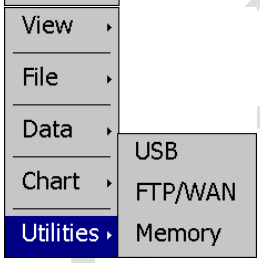


Chart menu

Set: Selection of data file points and time period for history review.

Chart: Plots historical data after time and points are selected.



Utilities menu

USB: Allows the user to access file utility functions.

FTP/WAN: Provides access to the automatic file back-up settings.

Memory: Displays memory capacity remaining on MCT4.

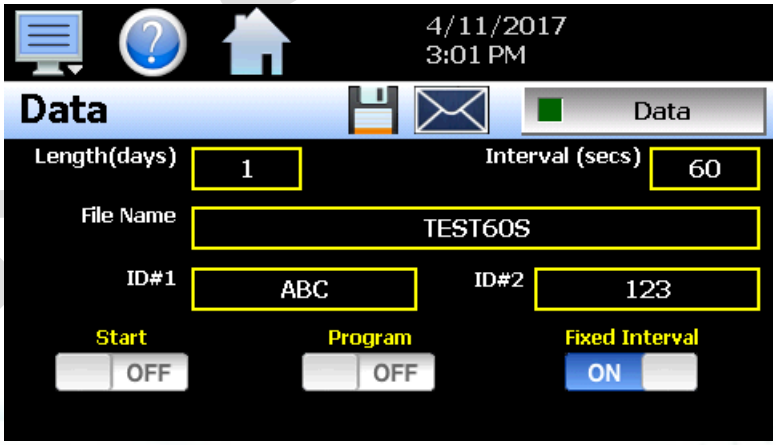
Selecting Points for Logging

For the data logging function of the MCT4 to operate, the user must first select what variables are to be logged to the data file. To choose which points are to be logged, select “Assign” from the Data menu.

Press the on/off button for each item to toggle it on/off. When on, the variable will be logged to the data file. When selections are completed, press the “Save” button to save the point selection to memory. New selections will not take effect until the Save button is pressed.

Starting/Stopping Data Logging

The MCT4 logs data to its SD card. Current data for each variable is written to the log at a fixed interval based on the settings entered in the “Length” and “Interval” fields. File names are automatically generated using MMDDYYYY-HHMMSS format (where MM = month, DD= day, YYYY = year, HH = hour, MM = minutes, SS = seconds). To use a specific file name, touch the “File Name” field and enter the desired name (up to 16 characters). When a file name is entered, the file will be saved as FileName_MMDDYYYY-HHMMSS.



The data logger also provides two entry fields, **ID#1** and **ID#2**, which allow the user to enter in information specific to the file such as a batch and/or lot number to identify product that may be associated with the new data file. These entries will be saved with the data log file for later identification.

The ID#1 and ID#2 fields are also used to identify the MCT4 when DataWeb is active (see section 8.5 FTP/FileWeb/DataWeb Interface). When the DataWeb feature is in use, the ID#1 and/or ID#2 entries are

used to identify a specific MCT4 from many units that may be sending data to the same database. The ID#1 and ID#2 fields also allow the user to search for only the data specific to a single unit in the remote database. The entries in these fields should be unique to each MCT4 connected to the server.

If more than one MCT4 utilizes the same entries, the data from all units with the same ID's will be combined under the one ID in the database. This will render the data unusable as there will be no way to split the data between the different units and know which data points are from each unit. If this does occur; however, the MCT4 will still have a local copy of the data stored to the local data log file(s). This provides a backup copy of the data just in case the ID numbers of more than one unit are identical.

The **Length (days)** field sets the length of a data file in number of days. It can be set for 1 to 31 days. Once the selected number of days has elapsed, a new data file will be created, and logging will continue in the new file.

The **Interval (secs)** field is used to set the rate at which points are written to the log file which equates to the sample rate in seconds. When the "Fixed Interval" option is turned on, the logging interval will be automatically set to record at minute intervals based on the number of days set for the file. If the file is set for 1 day in length, the logging rate will be at 1-minute intervals. If the file is set for 7 days, then the logging rate will be every 7 minutes. This keeps the data file size manageable and able to be viewed by the MCT4 data viewer.

The log interval can be manually set to any rate between 1 and 1860 seconds in any combination with the number of days before a new file is started. To do this, turn off the "Fixed Interval" option and enter in the desired logging rate in seconds.

NOTE: *Logging at shorter intervals allows the MCT4 to capture fast changing processes, but the data files can become extremely large. Files that exceed the capability of the MCT4 data viewer (>520KB in size) will have to be extracted from the MCT4 using a USB memory stick or FTP file transfer to be viewed remotely on a PC.*

Files larger than the 520KB limit will not be automatically, digitally signed by the MCT4. If the files are to be digitally signed, this must be done manually by extracting the files and using the FDC data viewer program running on a remote PC.

To manually start data logging, press the "Data" button. Any time logging is enabled, the indicator on the Data button will be illuminated. To stop data logging, press the Data button again. Data logging can also be started automatically by turning on the "Start" or "Program" option.

The **Start** option automatically turns data logging on whenever the MCT4 is first powered on. This action simulates that of a standard chart recorder.

The **Program** option is a convenient method for gathering information that pertains only to the operation of an automatic ramp/soak program. When selected, the MCT4 will turn the data logger on at the beginning of a program and off once the program is completed. This eliminates the need to scan through extensive data records to find the specific information you are looking for from a time.

NOTE: *The MCT4 will automatically use the program name as the filename for the log file (up to 14 characters). This provides a simple identifier for log files that pertain only to automatic program operation. Any entry made in the File Name field will be ignored.*

The **Email** icon next to the data log on/off button allows the user to select the currently open data file and email the file to any user that has been setup to receive emails from the MCT4.

The **Disk** icon next to the **Email** icon allows the user to save the currently opened data file to a USB memory device connected to the MCT4.

Calculating Log File Size

The MCT4 saves the log file in a text-based format (.csv), so the amount of memory consumed for each reading is dependent upon the number of digits required to accurately display the value (1 byte per character). This optimizes memory usage but also makes calculating an exact file size difficult. To obtain a worst-case approximation of the resultant file size, use the following formula:

File Size (Bytes) = (64 + LD) * number of readings in the file

Where:

LD (loop data) = 7 * number of points selected for logging

Example

MCT4 with three loops of controller data (PV, SP, %Out selected) for each loop (total of nine points).

Logging set at one second interval running for a duration of one day.

LD: 7 * 9 = 63

number of readings in file: 60 secs/min * 60 mins/hr * 24 hrs/day = 86400

File Size (Bytes) = (64 + 63) * 86400 = 10,972,800

An MCT4 logging nine points of data at a one second interval will consume a maximum of 11MB of memory per day. With an SD memory card size of 8GB, the MCT4 can log data for approximately two years before the SD memory card is full.

8GB = 8,000MB (total memory card space) / 11MB (per day) = 727 days (1.9 years)

NOTE: *Available memory space on the SD card is also affected by the number of ramp/soak programs, alarm files and audit trail files that are stored. The quantity and size of these files will reduce the memory space available for logging. Regular file maintenance is recommended to ensure adequate space remains available for the logging of data.*

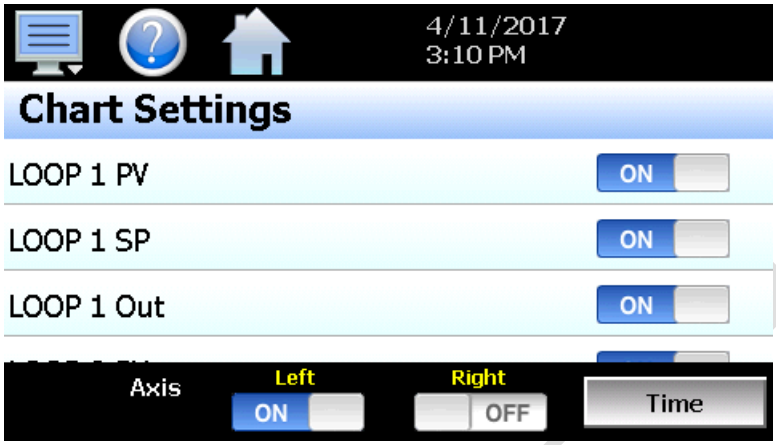
Reviewing Historical Data

Historical files can be opened and viewed using the historical viewer. To view a historical data file, it must first be opened by selecting “Open” from the File menu. Once the file has been opened, the MCT4 can automatically plot the first eight channels of the historical data file, or the user can choose to cancel the plot and select which channels should be plotted as well as adjust the specific time to plot.

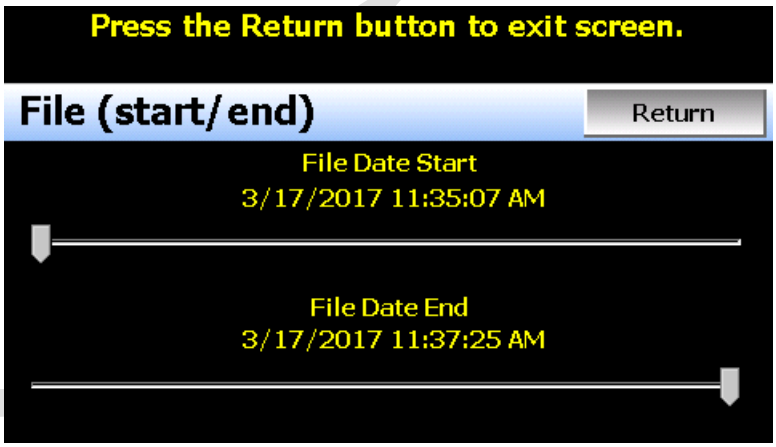
NOTE: *The open historical data file list will display up to 650 files. If more than 650 log files are present, the files cannot be shown in the list and the files will have to be exported from the MCT4 to view them. This can be done either via USB file utilities (see section 8.4) or FTP (see section 8.5).*

History Plot Setup

The history plot setup allows the user to select any time frame (zoom in/out) from the historical data file as well as select up to six channels of data to plot. To edit the settings for the historical plot, select “Set” from the Chart menu.



Any point from the data file can be selected along with the vertical axis to be used for each channel to be plotted. Select channels from the list by turning them on or off and use the “Left” and “Right” axis buttons to assign the selected item to the left or right axis for the plot range. To adjust the period to plot from the data file, press the “Time” button.

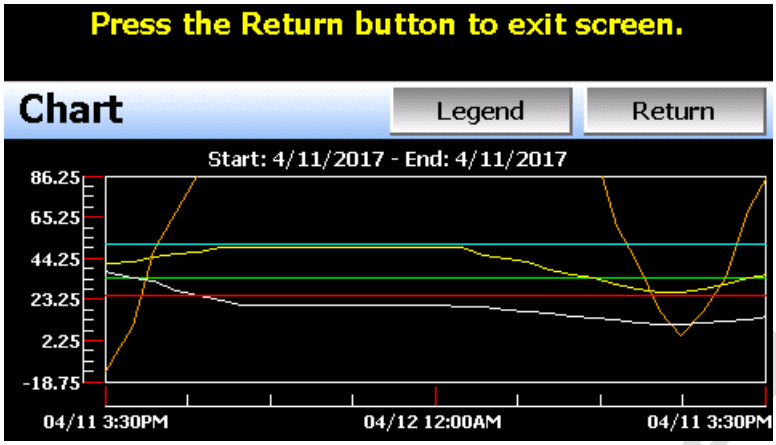


The start and end dates for the currently loaded file will be shown with time in hours, minutes, and seconds. The “File Date Start” and “File Date End” sliders are used to select a time span for historical viewing. Once the desired start and end times have been set, press the “Return” button to return to the Chart Settings screen.

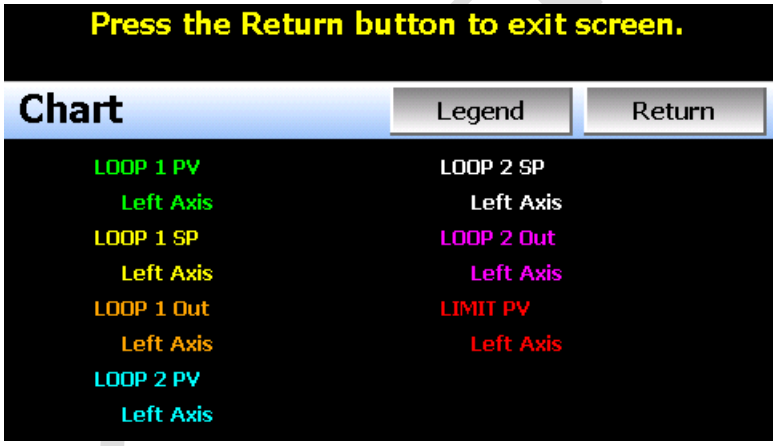
Plotting Historical Data

The history Chart plots the data from the currently opened history file according to the selections made under chart setup. If a file has not been opened or data points have not been assigned to a plot, the MCT4 will alert the user to correct the problem. The ‘X’ and ‘Y’ axis scales are set to auto scale based on current values for each plot channel, so no user action is required.

The historical graph provides the same zoom feature as the real-time charts so the user can zoom in on an area of the historical plot by dragging their finger across the screen to draw a rectangle around the desired plot area.



Pressing the “Legend” button will provide the user with channel information by displaying the names of the selected plot channels, which axis they are associated with, and the color used to display the plot channel. Pressing the button again will toggle the display back to the historical chart.



NOTE: *When pressing the Legend button to toggle between the historical chart and the legend screen, it may take several seconds for the chart to become visible depending on the size of the data file and number of channels selected to plot.*

When finished viewing the historical chart, you must press the “Return” button to exit the historical data viewer and return to the main data log screen.

USB File Transfer

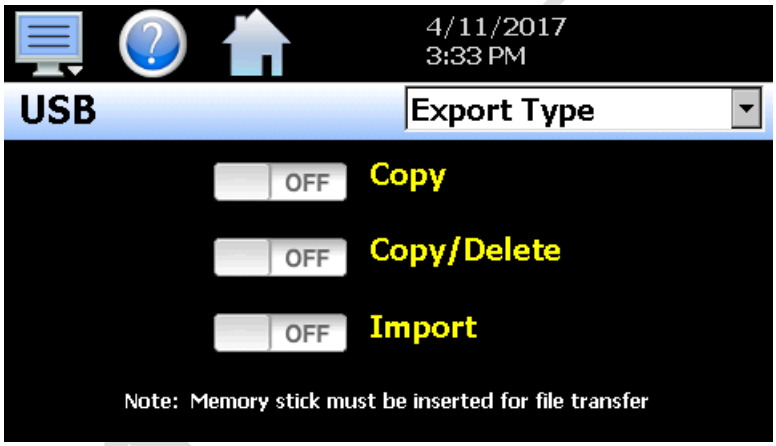
The “Utilities” section of the MCT4 interface provides all the functionality required for retrieving files and maintaining the internal SD memory card. The internal SD card should not be removed from the MCT4 interface. Any change to SD directory structure (moving or deleting files with a PC) may cause the MCT4 interface to stop operating and a new SD card will need to be ordered. Never move or delete the directories unless using the provided MCT4 file utilities functions.

NOTE: *The data log files, programs, alarm log and audit trail directories are saved to the internal SD card (not the USB memory stick device) plugged into the MCT4 interface. Never unplug the SD card when MCT4 is powered up or loss of data may result.*

The USB file transfer screen allows the user to copy or erase files from the internal SD card. Complete file directories for all MCT4 file types can be copied to the USB memory stick and erased from the internal SD card. The status for file functions is displayed for the operator during copy/delete operations. The MCT4 also allows automatic programs to be imported from the USB memory stick. Programs must be exported from another MCT4 device to the memory stick first before this function can be used. The MCT4 will look for "Program" directories on the memory stick for import and alert the user if none exist.

NOTE: *All file transfer functions can be used while data logging is running. If the operator needs to back up or delete files from the system, many files could take considerable time to backup and delete from memory. The file transfer screen will be locked during file transfer so plan the timing appropriately when access to other screen functions is not required.*

When data logging is running, the current data log file will not be copied or deleted while using the file transfer functions. This protects the current file and makes sure that the data file is complete before being copied and cannot be deleted from memory while it is still in operation.



To **Copy** files, insert the USB memory stick into the USB port. Select the file type you wish to copy from the "Export Type" drop down menu. Available file selections are Program, Alarm, Audit and Data files. Once the selection is made, press the "Copy" button. All related files will be copied to the USB memory stick with progress status displayed to user.

To **Copy/Delete** files from internal memory, insert the USB memory stick into the USB port. Select the file type you wish to copy and erase from the MCT4 internal memory by selecting it from the "Export Type" drop down menu. Available file selections are Program files, Alarm files, Audit trail files and Data files. Once the selection is made, press the "Copy/Delete" button. All related files will be copied to the USB memory stick and then deleted from the MCT4 with progress status displayed to user.

The **Import** file function allows automatic ramp/soak program files to be copied from the USB memory device to the MCT4. A dialog box will appear listing the available program directories on the USB memory stick. Program directory names exported from the MCT4 are in the format 'Programs_mm-dd-yyyy-hh-mm-ss'.

NOTE: *The USB memory stick must be inserted into the USB port for any of the file utility operations to function. It is recommended to only use memory sticks certified by Future Design Controls for use with*

the MCT4. Future Design Controls has tested and validated these memory devices for proper operation and performance.

Due to manufacturing variations in the USB memory sticks, it may take a few seconds up to 30 seconds for the MCT4 to recognize the device when it is plugged in. Allow enough time for the device to be recognized before attempting any file utility operations or the MCT4 will indicate a file transfer/memory stick error.

When files are being copied to the USB storage device, a directory for each file type will be created to store the copied files. The directory structure is as follows:

Program files directory:	Programs_mm-dd-yyyy-hh-mm-ss
Alarm files directory:	Alarm Files_mm-dd-yyyy-hh-mm-ss
Audit files directory:	Audit Files_mm-dd-yyyy-hh-mm-ss
Data files directory:	Data Files_mm-dd-yyyy-hh-mm-ss

The purpose for using the date and time as part of the directory name, is to make sure the user can track the date and time of the file transfer. If a user transfers a file type more than once in a single day, the files will be grouped logically by time.

When accessing the data files saved to the USB memory stick, the data files will be in ".csv" format. These files can be opened directly with Microsoft Excel or any program that opens a comma separated file format. You can copy or empty the "Data Files"' directory by simply plugging the USB device into a PC's USB port. The device then becomes like any removable disk attached to the computer and can be manipulated once plugged into the PC.

The FDC Data Viewer program is a free Windows accessory program that allows users to view, plot and print data files and is available from Future Design Controls or any manufacturer that markets the MCT4 product. It is required when using the digital signature feature of MCT4.

IMPORTANT: *Once files are deleted from the MCT4 storage devices, they are gone and cannot be retrieved. DO NOT edit, move, or delete any other files from the internal SD memory card unless using the MCT4 file utilities. The MCT4 will not operate properly if the file/directory structure is altered.*

Recommend File Maintenance

A quick note about file storage; data and setup files (programs, data files, alarm log and audit trail files) need some maintenance every now and then. After a period, storage devices fill up and files require backup or file deletion when no longer needed. The Microsoft WinCE platform allows for a maximum of 999 files per directory when all the files begin with the same 8 characters. Alarm and audit files are recorded by date (one per day) with the format of MMDDYYYY (where MM = month, DD = day, YYYY = year) so there is essentially no limit to the number of files other than available storage area.

Data log files, however, could reach the maximum based on the number of files created per day and if the logging on Program is enabled or a file name is specified by the user. If data logging is manually started or activated on system Startup and only 1 file is created per day, there will be no effective file limit since the first 8 characters of the file name are the date, like that of alarm and audit files.

If a file name is specified or logging on Program operation is enabled, each file will begin with the same prefix. Thus, multiple files can begin with the same 8 characters this limiting the maximum number of files that can be stored. At a frequency of 3 per day, 7 days a week for example, the maximum 999 files would be reached within one year. It is recommended that a quarterly maintenance schedule be adopted to copy and delete all

data files from the MCT4 through either the USB file transfer or FTP backup utilities to prevent the maximum file number from being reached.

If the maximum number of files is reached, the MCT4 will display the alarm message “Data file error. SD card full or missing.” and data logging will be disabled. Note that there is still enough memory space on the SD card; however, due to the maximum number of files being reached, no more files can be placed in the data log folder. Regular backup and removal of files from the MCT4 will prevent this from occurring.

It is also highly recommended to backup and delete alarm and audit files as well. While it is possible to store years of files, the time it will take to copy the files once the time has come, could take hours due to the large number of files. The MCT4 file browser is also limited to a total of 650 files. If the number of alarm files or audit files exceeds the 650-file limit, you will be unable to open and view alarm or audit files on the MCT4. They will have to be exported via USB or FTP to be viewed.

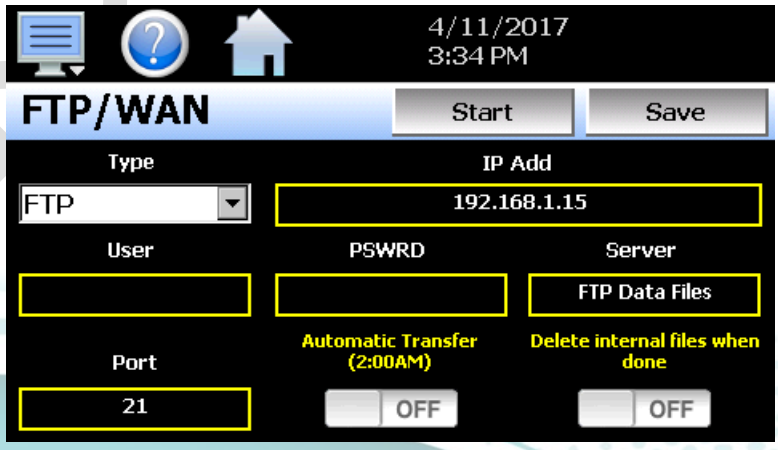
More frequent backups will also require less time to perform. The speed at which files can be transferred is more dependent on the number of files than the size of the files. A fewer number of large files takes less time than many small files.

FTP/FileWeb/DataWeb Interface

The FTP/WAN screen allows the user to configure automatic back-up of all data files contained in the MCT4 memory to a user designated FTP or secure FileWeb site (https://). When enabled, the MCT4 will automatically back up all data log files, alarm files and audit trail files at 2:00AM each day. With the optional delete files selection, the MCT4 will then automatically delete the files from its internal memory after backing up. This will maintain MCT4 memory automatically, so that continuous data logging can be performed without filling up the available memory space.

The MCT4 also offers a DataWeb LAN/WAN/Cloud interface. This allows the MCT4 to transfer data directly into a server’s data base rather than using file-based data solutions. The DataWeb interface provides the transfer of secure (https://), real time data which can be shared and viewed across networks for real time manufacturing data systems interface.

NOTE: *Setting up an FTP site on your network may require authorization and/or assistance from your network administrator. Contact your network administrator for proper settings and authorization from your network server (if required) to allow the MCT4 to connect to the designated FTP site.*



The **Type** drop down is used to select the FTP/WAN interface. Choices are FTP, FileWeb and DataWeb.

The **IP Add** field is used to enter the IP address of the FTP/FileWeb/DataWeb site that MCT4 is to interface with.

The **User** field allows you to enter a username for site access. When the MCT4 connects to the FTP/FileWeb/DataWeb site, the username will be used to identify the connection. If a security login is required (FileWeb/DataWeb always require security credentials), the proper username will have to be entered in this field. If security is not used (FTP only), this field can be left blank (blank for anonymous login using FTP only).

The **PSWRD** (password) field is used in conjunction with the username field and is for entering a password so the MCT4 can access the site. If security is not used (FTP only), this field can be left blank (blank for anonymous login using FTP only).

The **Server** field is used to enter the directory information where the files are to be backed during FTP/FileWeb operation. This field is not used during DataWeb interface selection. When the connection occurs, the MCT4 will place the historical data files in the "Sever" field directory structure when using FTP/FileWeb interfaces. The MCT4 will automatically create an "Alarms" directory and an "Audit" directory within the specified server directory for backup of the alarm files and audit trail files. The "Sever" field for FTP and FileWeb must match the directory structure setup at the server.

For example, if FTP is used and the "root" path at the server is "Files", for the MCT4 files to be transferred to this directory, the "Sever" field must contain the text "Files". If there is a directory inside of the server root "Files" directory named "unit1775" and the files are to be transferred to this directory, the "Server field must contain the text "Files/unit1775". The FTP operation will error, and the transfer will not be completed if the "Server" field is not entered properly or does not match the FTP server configuration.

NOTE: *For FileWeb operation, the Server field is optional and can be left blank. It can be used to enter additional directory information (if desired) on where the files are to be stored. By default, the MCT4 is hard coded to store files on the specified server in the "\Files\user name\" directory. If an entry is made in the Server field, the resulting path would be "\Files\user name\server\".*

When the **Automatic Transfer (2:00AM)** option is turned on, the MCT4 will perform an automatic backup of all historical data files, alarm files and audit trail files contained in its internal memory to the designated FTP/FileWeb site. Note that if data logging is currently active, the active file will not be copied. When the **DataWeb** interface is used, real time data is transferred to a database rather than transferring actual files so this option is not used and is disabled.

When the **Delete internal files when done** option is turned on, the MCT4 will delete all data log files, alarm files and audit trail files within its memory after completing the backup to the FTP site. Note that if data logging is currently active, the active file will not be deleted. When the DataWeb interface is used, real time data is transferred to a database rather than transferring actual files so this option is not used and is disabled.

Once all settings have been made, press the "Save" button to save the settings so that on the next power-up, the entries will be maintained. The "Start" button can be used at any time to perform a manual data backup using FTP or FileWeb interfaces. If the files already exist on the FTP/FileWeb site, they will be overwritten on each subsequent backup. If the FTP/FileWeb site is down, or the MCT4 is not connected to the network, a local alarm message on the Alarm screen will indicate a transmission failure.

NOTE: *Typically, FTP/FileWeb Server connections use case sensitive alpha-numeric characters for the Username, Password and Server directory. Contact your network administrator for proper settings.*

FTP servers (File Transfer Protocol) have been around for many years and can be installed on local or network machines. The FTP server allows a client (MCT4) to transfer files to the FTP server once installed. This allows for manual and automatic backup of data from the MCT4.

MCT4 Field Setup	FTP Server Setup
Type = FTP	FTP server setup for passive operation (see Appendix section A.2 FTP, FileWeb, DataWeb Requirements/Installation for additional information).
IP Add = xxx.xxx.xxx.xxx	Actual IP address of FTP server
User = userName	Actual user name for login if authentication used.
Password = userPassword	Actual password for login if authentication used.
Server = myFTP	FTP server setup with a root directory named “myFTP”. The FTP server directory path must exist and match the MCT4 setup for proper operation. If there is an additional directory within the “myFTP” root directory, its name would be appended to the path. (i.e., myFTP/Files if a “Files” directory inside the myFTP server root directory is the target for transfer).
Port = 21	Port used at MCT4 and open at FTP server.

NOTE: *Make sure proper permissions are set at the FTP server for access/creation of directories and read/write access. Also check root directory structure at Server to identify the actual root that was created for the files since there can be additional layers created by the server and displayed in the path.*

The FileWeb interface allows the MCT4 to transfer its files to a web site for download which can then be viewed using a standard web browser. This interface provides the user the ability to setup a web site to store files for local or global access without installing an FTP server. The MCT4 supports https:// (secure) transfer of files.

MCT4 Field Setup	FileWeb Server Setup
Type = FileWeb	FileWeb server setup (see Appendix section A.2 FTP, FileWeb, DataWeb Requirements/Installation for additional information).
IP Add = https://fdctuil.com/FDDataService.svc	Actual named address of FileWeb server/service.
User = userName	Actual user name for login at FileWeb server (required).
Password = userPassword	Actual password for login at FileWeb server (required).

Server = optional path	The FileWeb server/service must be configured with a root "\files\" directory to use the MCT4 FileWeb feature. The MCT4 is hard coded to transfer files to the "files" directory in the root of the server. If the Server field also contains an entry (i.e optionalPath), the resulting path would be "\files\optionalPath\". If the directory does not exist, it will be created at the server by the MCT4 based on the permissions settings at the server.
Port = not used	

NOTE: *Make sure proper permissions are set at the FileWeb server for access/creation of directories and read/write access. Also check root directory structure at Server to identify the actual root that was created for the files since there can be additional layers created by the server and displayed in the path.*

The DataWeb interface allows the MCT4 to transfer data to a web data base service using MySQL and Microsoft IIS as a web platform. The MCT4 can interface directly to a local or Web data base (Cloud) thereby allowing access to any system globally without any special "client" applications required to view the data. This allows the MCT4 to share data with local or global manufacturing systems by storing data directly to a manufacturing database. The MCT4 supports https:// (secure) transfer of data.

MCT4 Field Setup	DataWeb Server Setup
Type = DataWeb	FileWeb server setup (see Appendix section A.2 FTP, FileWeb, DataWeb Requirements/Installation for additional information).
IP Add = https://fdctuil.com/FDDataService.svc	Actual named address of DataWeb server/service.
User = userName	Actual user name for login at FileWeb server (required). This is the directory where the database structure will reside on the server. The MCT4 will use this directory path for sending data to the database.
Password = userPassword	Actual password for login at DataWeb server (required).
Server = not used	The directory where the database exists uses the userName as the default location for data storage.
Port = not used	
Data logging screen entries: ID#1 = unit specific identifier ID#2 = unit specific identifier (See section 8.2 Starting/Stopping Logging)	Used as the unit identifiers by the remote database to store the data sent from the MCT4. At least one field must contain an entry and should be unique to any other MCT4's that connect to the same server database.

NOTE: *An IT professional with experience is required for DataWeb server setup. Future Design Controls does not support server-side programming or setup but can offer 3rd party resources to assist with or handle complete server-side projects.*

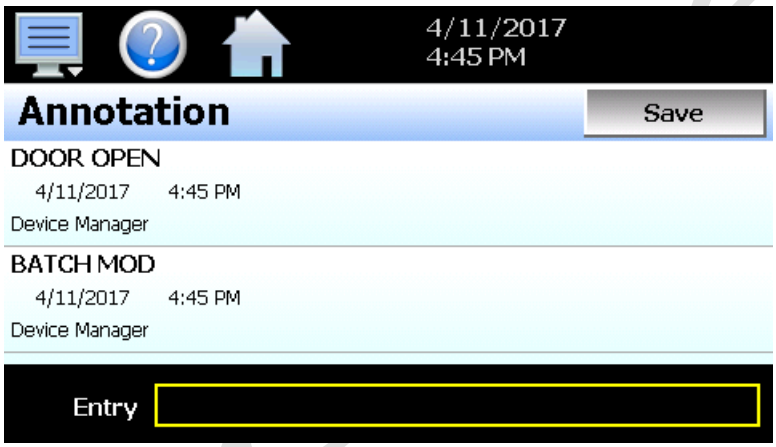
The DataWeb interface does not transfer complete files for backup like the FTP and FileWeb interfaces. The DataWeb interface transfers records in real time based on the log setup interval at the MCT4. When logging is started at the MCT4, data will begin transfer to the server-side site. Data will be transferred to the server at

the beginning of logging (one record) with additional records transferred based on the rate that the MCT4 data log interval is set for.

If the data log interval rate is set for 60 seconds, the MCT4 will populate the database with a single set of records (PV, SP, %Out determined by data log/server setup) once every 60 seconds. If the data log interval rate is set for 120 seconds, the MCT4 will populate the database with a single set of records (PV, SP, %Out determined by data log/server setup) once every 120 seconds. Data log intervals can be set as fast a 1 second since buffering is used at the MCT4 for faster data log rates, but in this case the database would receive a total of 60 records once per minute (one record per second). Buffering for rates faster than 1 minute is used to reduce access/overhead at the server side while still maintaining 1 second date/time stamps for database record keeping.

Annotation

The Annotation screen allows the user to add messages to the running data file and view any messages currently associated with a loaded historical data file.

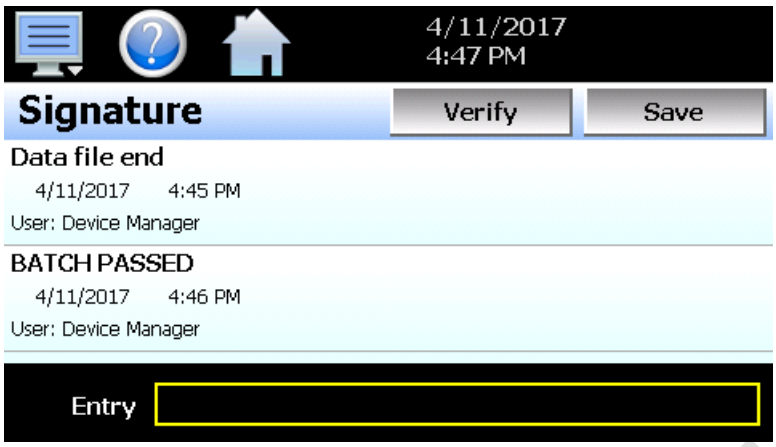


When a historical data file is loaded, the Annotation screen will display any messages that were written to the file. The date, time, username, and description of the data file annotation is shown. Note that the currently running data log file can be opened as a historical data file, and the current annotations for the running file will be shown.

To add an annotation to the running log file, touch the “Entry” field at the bottom of the screen and enter the message (up to 16 characters maximum). Press the “Add” button and the message will be added to the current log file. If the running log file was opened as the historical log file, the annotation will be shown immediately on the screen as it is added. If logging is not currently running, the entry field will be disabled.

Add\View Digital Signatures

The Signature screen allows the user to add digital signatures to historical data log files and view any digital signatures currently associated with the loaded historical log file.



When a historical data file is loaded, the Signature screen will display any signatures currently associated with the file. To verify a digital signature and ensure that the data file has not been altered, touch the signature in the list box and press the "Verify" button. The MCT4 will compare the signature to the log file to see if any alterations to the data have been made. The MCT4 will then indicate if the signature is valid or not.

If the signature is valid, the historical data file is intact and has not been altered. If the signature is invalid, the data has been altered at some time after the signature was assigned to the file. For data integrity, the MCT4 automatically signs a data file when logging is stopped; however, this only occurs if the "Auto Interval" is selected on the Log screen. If a different logging interval is used, the MCT4 will not automatically sign the file and it must be signed by a user.

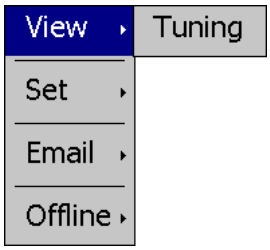
To add a digital signature to the historical log file, touch the "Entry" field at the bottom of the screen and enter in the comment line for the signature (up to 16 characters maximum). Press the "Add" button and the signature will be added to the log file. The signature includes the date and time of the signature, the username and comment line. If a user is not logged into the system, the default username "Device Manager" will be entered as the user.

NOTE: *The Signature screen is not available if security is disabled. The MCT4 security module must be enabled to digitally sign data log files. See Section 7, Security.*

DEVICE SETTINGS

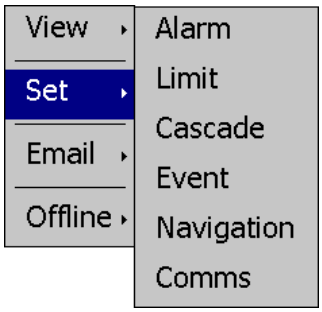
This section covers the use of extended controller features that enhance the functionality of the system. To gain access to the MCT4 setup options, select "Settings" from the home Device menu.

The Device Settings menu provides navigation to the following functions:



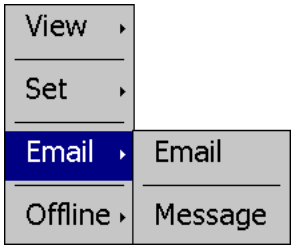
View menu

Tuning: Provides access to manual loop tuning.



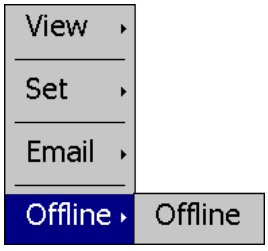
Setup menu

Alarm: Provides access to the alarm set points/message entry.
Limit: Sets minimum/maximum set points allowed for each loop.
Cascade: Provides access to the cascade control set points.
Event: Allows the user to edit names used to describe events.
Navigation: Allows the user to choose text based or icon based/slide page navigation menus.
Comms: Allows user to set MCT4 communication settings.



Email menu

Email: Provides access to the MCT4 email system manager.
Message: Allows the user to send an email message to users entered in the system.

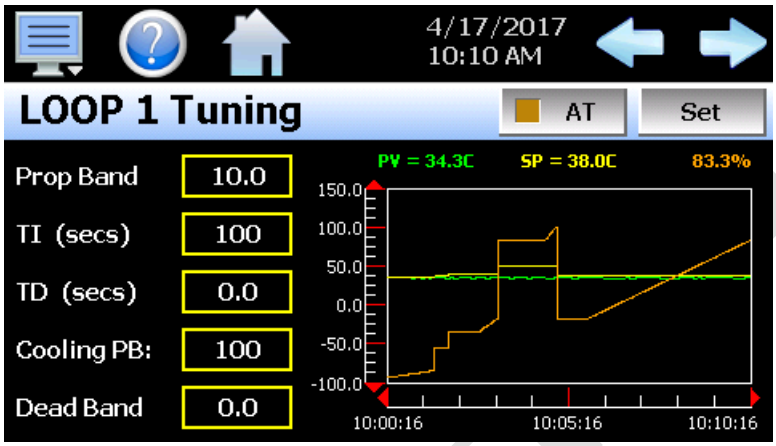


Offline menu

Offline: Provides access to offline system settings.

Tuning

The loop Tuning screen allows for manual and automatic tuning of the MCT4 control loops. Tuning parameters should only be manually adjusted by skilled users familiar with proportional control. Improper settings can result in control loop instability and equipment damage. The loop automatic tune function is the recommended method of loop tuning. If the control response achieved after performing an auto tune does not provide the desired control response, then minor adjustment of the tuning parameters may be done manually to obtain the desired response.



The available tuning parameters are dependent upon the loop configuration. If programmed for heat or cool only control, then the available parameters will be PB (proportional band), TI (integral time) and TD (derivative time). If the loop is configured for heat/cool operation, then two additional parameters for Cooling PB (cooling proportional band) and Dead Band (heat/cool dead band) will be provided.

The tune screen also provides a live real time chart for monitoring the control response of the control loop while adjusting tuning parameters. The chart is fixed at a 10-minute time and updates once per second.

Pressing the **Set** button allows the user to adjust the loop set point without having to leave the tuning screen to observe the control response.

Pressing the **AT** button allows the user to activate/deactivate the loop auto tuning feature. When auto tune is active, the indicator on the button will be illuminated. In addition, the process value of the loop on the Loop view screen will flash while auto tune is active. This allows the user to activate auto tune and then return to the main Loop view screen to observe system operation while being informed of the loop auto tune status.

Heat or Cool only P (or PD) Control

When a loop is programmed for heat or cool only control, it is possible to set the integral time to zero to eliminate reset action. A “PB Offset” field will then be shown for entering a manual reset value to correct for the control offset that will occur once the loop has stabilized. The offset entry is measured in percent with a range of 0-100%.

Once the process has stabilized, if the process value is lower than the set point by 5° for example, and 20.0 is used for the proportional band, that is equal to an offset of 25%. Thus, the PB offset would be increased by 25% to compensate for the set point offset in the process. Note that automatic tune is disabled for P or PD control. To perform an auto tune, the integral time would have to be set to a value greater than zero. P or PD control is not precise for processes with changing load conditions and will require frequent adjustments of the offset. The PID control mode should be used because it automatically does this.

When a loop is programmed for heat/cool operation, the values of the Cooling PB and Dead Band affect the way the heat and cool outputs work together to control the process.

The **Cooling PB** is measured in % of the proportional band with a range 50-300. Set cooling PB to 100% to

begin and examine the cooling effect. If cooling action should be enhanced, then decrease the cooling band. If cooling action is too strong then increase the cooling band. The value of the cooling proportional band is related to the heating proportional band and its value remains unchanged throughout any auto tuning procedures.

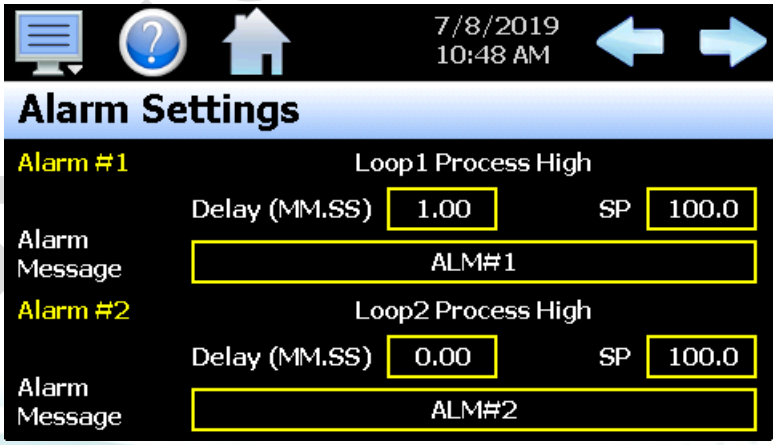
NOTE: *The adjustment of the Cooling PB is also related to the cooling media used. When air is used as the cooling media, it is recommended that the Cooling PB be set to 100%. For oil, a typical setting to use for the Cooling PB is 125%. If water is used as the cooling media, then adjust the Cooling PB to 250%.*

The adjustment of **Dead Band** is more dependent upon system requirements. If more positive values of dead band (greater dead band) are used, an unwanted cooling action can be avoided but an excessive overshoot may occur. If more negative values of dead band (greater overlap) are used, an excessive overshoot can be minimized but an unwanted cooling action may occur.

Dead band is adjustable in the range of -36.0% to 36.0 % of the heating proportional band. A negative dead band value provides an overlap between heating and cooling action in which both outputs can be active at the same time. A positive dead band value provides a dead band area in which neither output is active around set point.

Alarms

The alarm screen allows the user to edit the alarm set points and alarm messages that will be displayed on the alarm screen should the alarm be activated.



The alarm numbers, **Alarm #**, identify the alarms currently shown on the screen along with the alarm description which contains the loop name that the alarm is assigned to as well as the alarm type. The left and right scroll buttons at the upper right of the screen will be shown if more than two alarms are available so that the user can access each alarm by pressing left or right to go to the previous or next alarm.

The alarm **Delay (MM. SS)** and **SP** (set point) fields allow the user to enter the alarm delay (in minutes and seconds) and the set point at which the alarm is to activate. The alarm type and alarm hysteresis are defined by Darwin Chambers in the MCT4 configuration and cannot be changed. Only the alarm delay and set point can be changed by the user.

NOTE: *The End of Program alarm type does not have a set point; however, a delay can be set to delay the activation of the alarm for a specified time after the program ends.*

Alarm delays are only on PCM models beginning with V.17 firmware. If the PCM does not support alarm delays, the alarm delay field will not be shown.

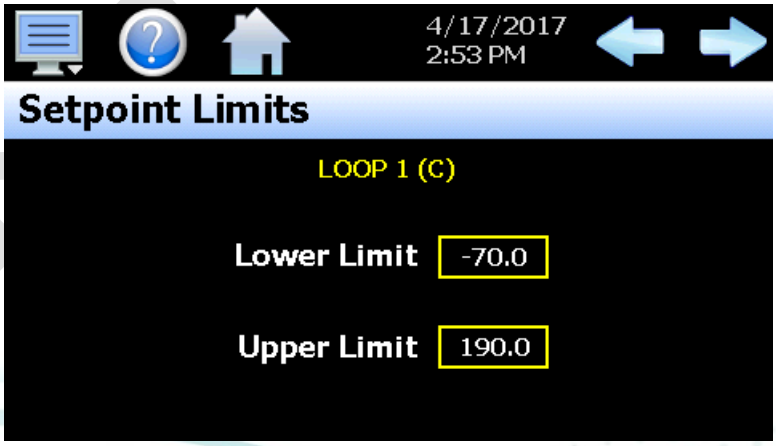
The **Alarm Message** is the text notification that appears on the Alarm screen when the alarm activates. This message can be edited (up to 25 characters maximum) so that the alarm message more accurately describes what the alarm means.

NOTE: *The MCT4 supports a total of 9 hardware + 10 software alarms for a total of 19 alarms. The MCT4 loop control boards can provide up to 3 alarm outputs each for a total of 9 alarms (when three PCM's used or two PCM's and HLM limit control). Software alarms activate no hardware electrical outputs when energized and are for display only including audible alarm and email operation.*

Depending upon the configuration of the MCT4, some PCM board outputs may perform specific control or event functions. The use of each output, and what it controls, is determined by the system designer. If there are questions or concerns about the configuration and operation of your MCT4 controller, contact Darwin Chambers for further information. Only Darwin Chambers can address equipment related issues.

Setpoint Limits

The set point Limit screen allows for the adjustment of the minimum and maximum operating set points allowed to be entered for the control loops. These limits can be used to prevent operators from entering a value that exceeds the survivability limits of equipment or product being manufactured, reducing the risk of property damage.



Enter the desired set point limits by touching the "Lower Limit" and "Upper Limit" entry fields and enter the desired values using the numeric keypad.

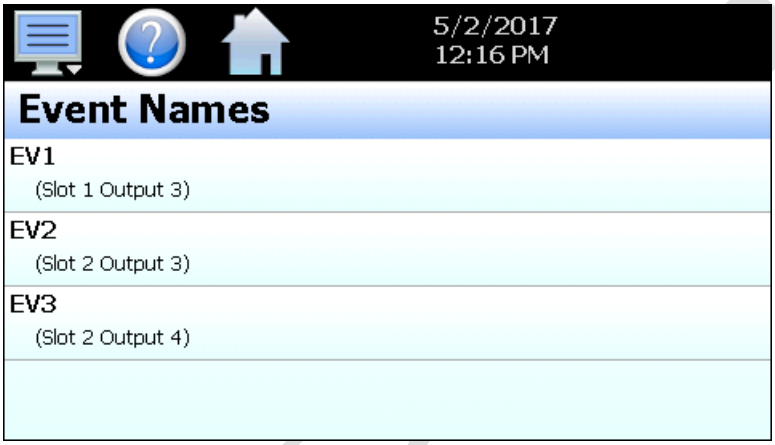
IMPORTANT: *The operation of automatic ramp/soak programs is limited by the lower and upper limits. If a program was created or imported from another MCT4 system with set points that exceed the*

current lower and/or upper limits, when the program is run, the program step set points will be coerced to the lower or upper limit that it exceeds. This protects the equipment or product being manufactured from being subjected to values that exceed current set point limits.

The minimum and maximum values for the lower and upper limits are defined by Darwin Chambers limits set in the MCT4 configuration. The MCT4 prevents the user from entering set point limits outside of these configuration values. Consult Darwin Chambers or equipment installer regarding the maximum set point limits permitted for your system.

Event Names

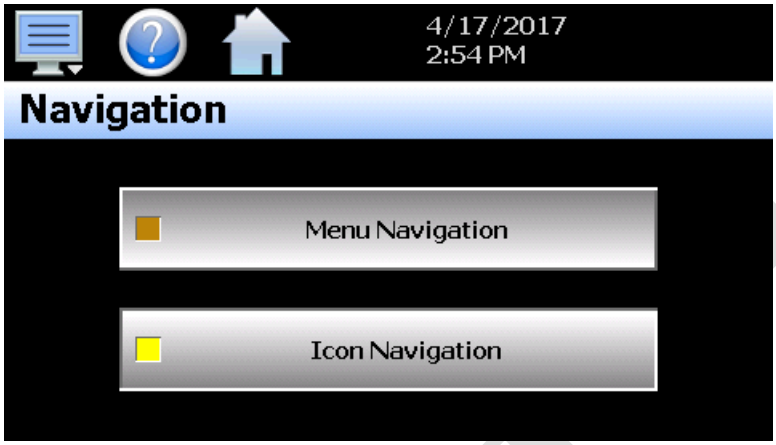
The Event names screen allows the user to change the names of the system events to describe what function they perform. The event names are limited to nine alphanumeric characters.



To change the name of the event, select the event by touching its current tag name in the list. Press the "Edit" button and enter the new tag name using the alpha-numeric keypad and press "Done" when finished. The new name will then appear in the event name list box and will be used throughout all MCT4 screens wherever the event is shown.

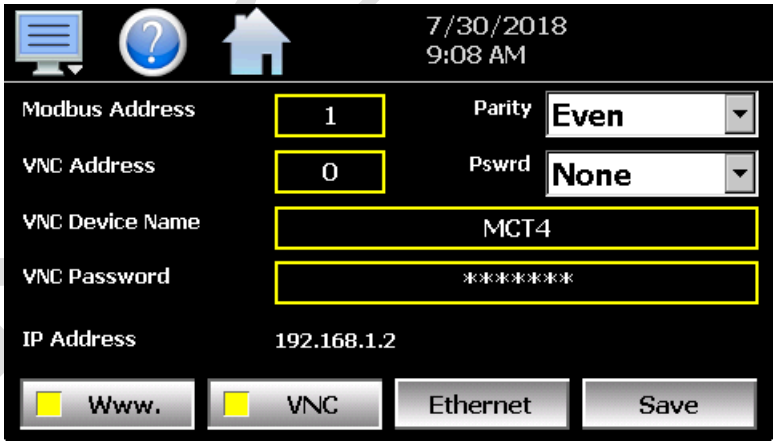
Navigation

The MCT4 provides both text-based PC style menus and icon based/slide page navigation menus like today's "smart" devices. The user can select either type at any time from the Navigation screen. Press the button for the desired menu type to make the selection. The choices are mutually exclusive, so when one selection is made, the other will be de-selected. The button indicator for the active selection will illuminate to show the current selection.



Communication Settings

The "Comms" screen provides settings for the Modbus serial and TCP interfaces as well as the web server and VNC interfaces. It also provides the MCT4 IP address, which is required for using the Modbus TCP, VNC and web server interfaces. For more information regarding the use of the MCT4 data communications interfaces, see Section 11, Communications.



The **Modbus Address and Parity** settings are used to configure the serial interface for user communications. Valid addresses are 1 to 247. The parity setting is only available for the standard MCT4 interface and allows the serial port to be set for Even, Odd or no parity (None). If the MCT4 is configured to provide the simulated Watlow F4S/D communications interface, the parity selection will not be provided.

The Modbus Address is also used to specify the unit ID for Modbus TCP communications. Modbus TCP communications is provided over the Ethernet interface on port 502.

The **VNC Address and Password** set access rights to the MCT4 VNC server. Valid addresses are from 0 to 255. The VNC password selection defines the connection mode for the server. The selections are “None” and “VncAuth” which requires users to enter the password when connecting to the MCT4 over the VNC interface.

IMPORTANT: *When multiple MCT4 controllers are connected to a single router (DHCP server), it is imperative that each MCT4 have a different VNC address. If multiple MCT4 controllers have the same VNC address, network errors may result causing the VNC server to shut down or cause the MCT4 to “lock-up” and become non-responsive requiring the unit to be power cycled to return to normal operation.*

The **VNC Device Name** field is used to enter a name (up to 35 characters) that can better identify the MCT4 to users logged into the VNC interface. The name entered here will be used on the VNC header window on a PC, so that if multiple VNC clients are open to different systems, each one can be identified.

The **VNC Password** field is used to enter the password (up to 20 characters) that a user must enter for the VNC interface to connect to MCT4 if the VNC password is enabled.

The **IP Address** field is a static field that provides the IP address of the MCT4 which is required for connecting over the VNC, web and Modbus TCP server interfaces. See the following section 9.7.1 Ethernet Settings for more information on how to adjust the device IP and other LAN information.

The **WWW.** (web server) pushbutton is used to enable or disable the web server interface.

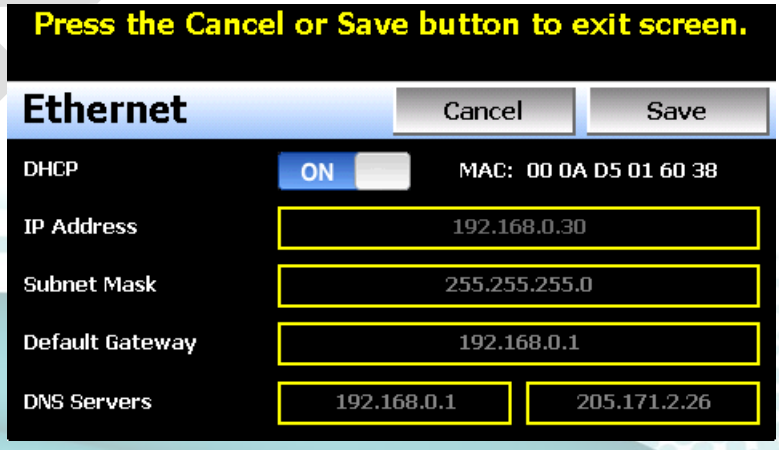
The **VNC** server pushbutton is used to enable or disable the VNC server interface.

The **Ethernet** button is used to access the Ethernet settings screen.

NOTE: *Any changes made to the above settings must be saved for them to take effect. When changes are completed, press the “Save” button. For any changes to the VNC server to take effect, power must also be cycled to the MCT4. The new VNC settings will only take effect when MCT4 first boots up. Serial communication and web server settings take effect immediately upon save.*

Ethernet Settings

The “Ethernet” screen provides settings for the network interface of the MCT4. It is accessed by pressing the Ethernet button on the Communications screen.



The **MAC** address field displays the media access control address (physical address) of the MCT4. This is a unique identifier for the network hardware of the MCT4 and cannot be changed. It is for informational purposes and may be required by your network administrator when connecting the MCT4 to your network.

The **DHCP** button is used to turn automatic addressing on and off. By default, the MCT4 is shipped with the DHCP setting on. This means the MCT4 will be assigned an IP address by the network router. When on, the entry fields will be disabled, but will display current connection information used by the MCT4. To enter a static address, press the button to turn it off.

To set the static network address, enter a valid **IP Address**, **Subnet Mask** and **Default Gateway**. The **DNS Servers** are not required, but typically the IP address of the network router is entered to provide one. Consult your network administrator for the proper values. The IP address must not be a duplicate of any other address on the network, or the interface will not operate correctly. The entry fields except IPV4 addressing format only. The MCT4 does not except IPV6 addressing.

NOTE: *When DHCP is on and the MCT4 is disconnected from the network, the entry fields on the Ethernet screen will continue to display connection information based on its last valid connection for diagnostic purposes. The IP address on the main Communications screen (or shown in the notifications list) always displays the current address used by the MCT4. If the IP address on the Communications screen displays the loop-back address of "127.0.0.1" then no connection is present.*

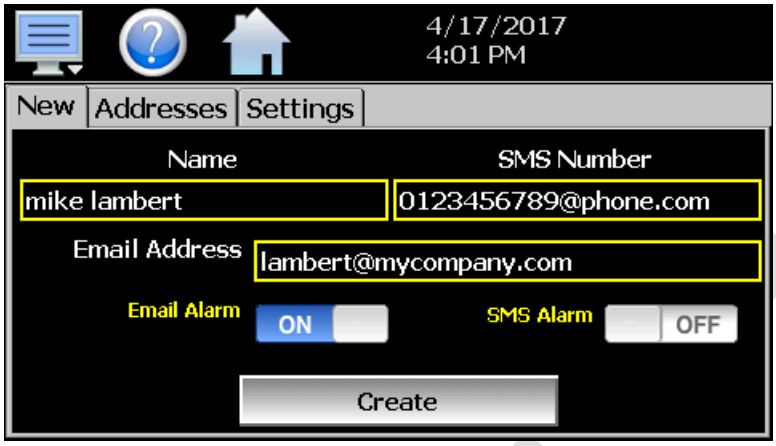
When DHCP is off, the IP address on the Communications screen will always display the user entered static IP address regardless of connection status. It does not indicate whether a valid network connection is present or not.

Email

The MCT4 email server can send alarm messages to email and SMS addresses. Up to 30 addresses can be programmed into the system. Each one can be configured to receive emails, SMS text messages or both. When an alarm occurs, MCT4 will send an alert to the specified address for each user in the list. The email settings are accessed by selecting "Email" from the setup "Email" menu.

Email Address Entry

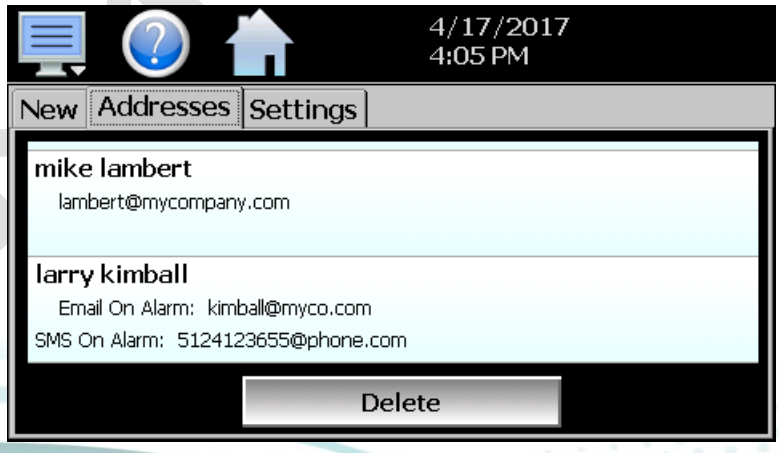
Select the “New” tab to add new email addresses to the system. For each entry, enter the recipient’s Name, Email Address and/or SMS Number (up to 50 characters each). Turn on the Email Alarm and/or SMS Alarm options to specify which addresses the alarm messages are to be sent to. Press the “Create” button to add the user to the list.



NOTE: *The SMS address is specific to the service provider. Each service provider has their own unique address; however, the phone number is always the “name” for the address entry. There are internet sites with this information that cover most of the providers, or when in doubt, contact your service provider for the proper address format.*

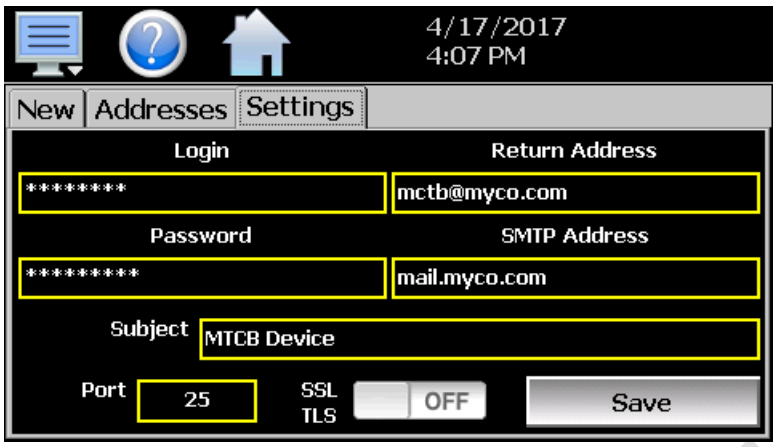
Email Addresses

Selecting the “Addresses” tab allows the user to view the list of email addresses entered in the MCT4. Each entry will be shown with the notification method and address associated with it (email/SMS). To delete a user, touch the name of the user in the list box and press the “Delete” button. This will permanently remove the user from the list.



Email Settings

The “Settings” tab provides access to the email server configuration, which is how the MCT4 can connect and send email messages over its Ethernet connection. Each field may have up to 50 characters.



The **Login** field is used to enter the login name required by the MCT4 to log in to your company's mail server. You can use your login if one is not set up specifically for the MCT4 on your network. Contact your network administrator for assistance.

The **Return Address** is the address given for the MCT4 on your company's mail server. The MCT4 does not accept email messages; however, this field is required for proper email delivery for security/anti-spam purposes. If using your personal login name, you can also use your personal email address if one is not set up specifically for the MCT4 on your network. Contact your network administrator for assistance.

The **Password** field is used for entering a password, if required by your network server, to send email. Contact your system administrator for assistance.

This **SMTP Address** field is for entering the address of the email server used for sending emails. This must be a valid mail server for which the above settings allow MCT4 access. Contact your system administrator for assistance.

This **Subject** field is used to enter a subject line for emails and/or SMS text messages. It can be used to provide an identifier to the recipients of the alarm message to know which chamber it is coming from.

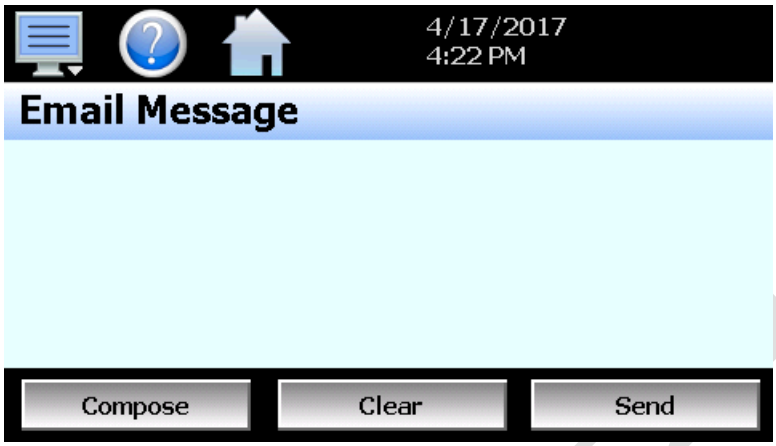
NOTE: *It is recommended to put some form of entry in this field. It can be left blank; however, many firewalls and spam filters will filter out messages without subject lines. That may prevent recipients from receiving the email. It can also be useful for identifying a unit on the factory floor.*

The **Port** field is used to set the port number that will be used on the device for email operations. For non-secure connections (no SSL/TLS) port 25 is the default. If SSL/TLS is used, port 587 is usually the standard port selected.

The **SSL/TLS** button is used to enable or disable **Secure Socket Layer (SSL)** and **Transport Security Layer** (TLS) functionality. These protocols are used to provide an authenticated connection between servers and clients as well as encrypt information between the two. This provides a more secure environment for email information with many public email services only allowing SSL/TLS connectivity.

Once all settings have been made, be sure to press the "Save" button to begin using the new values and store them, so that on the next power up, the settings will be retained. The body of the email/SMS text message will contain the description of the alarm condition as it would appear on the alarm screen. If the mail server is down, or the MCT4 is not connected to the network, the message will not be sent and a local alarm message on the Alarm screen will indicate a transmission failure.

MCT4 provides the user with the ability to send short email messages to users configured in the MCT4 email server. To send a message, select “Message” from the device settings, Email menu.



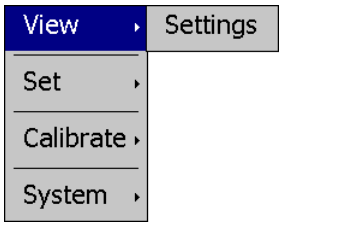
Press the “Compose” button to create a brief message using the keypad (up to 100 characters). When you are finished entering the message, press the “Done” button. The completed message will then be shown in the message window. Press the “Send” button to select the email recipients you wish to receive the message and send the message.

OFFLINE

The Offline settings do not include Darwin Chambers setup of the MCT4. Refer to the documentation provided by Darwin Chambers regarding the MCT4 configuration. To enter offline setup, automated ramp/soak program operation and data logging must be manually stopped.

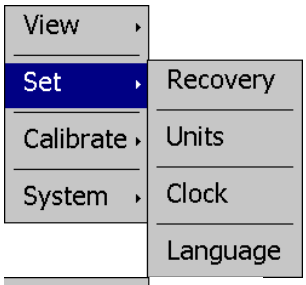
NOTE: *Upon entering offline setup, all loop control outputs, event outputs and alarm outputs will be set to their corresponding OFF state. Power supply and retransmission outputs will continue to operate normally. Upon returning to the online mode, the outputs will be returned to normal operation. Limit outputs are not affected.*

The offline menu provides navigation to the following functions:



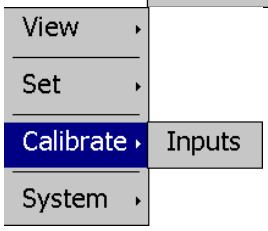
View menu

Settings: Navigation back to the device settings menu.



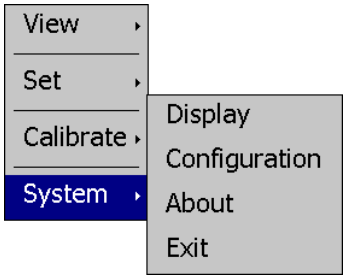
Set menu

Recovery: Settings for profile power recovery action.
Units: Setting for temperature units.
Clock: Settings for system date and time
Language: Settings for menu and help language text.



Calibrate menu

Offset: Settings for loop input offset calibration.

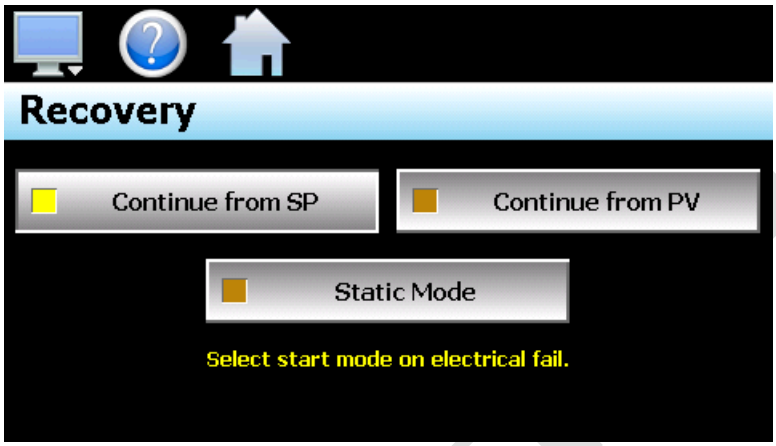


System menu

Display: Access to display calibration and backlight settings.
Configuration: Access to MCT4 import/export utility.
About: View current firmware/software version numbers.
Exit: Exit MCT4 application and access to the MCT4 configurator.

Power Recovery

The Power Recovery setting allows the user to select how the system should restart in the event of a power failure while an automatic ramp/soak program was running. When power is restored, the MCT4 will perform the selected recovery action. To set the power recovery action, push the recovery mode button for the desired setting to select it as the power-up state. The selections are mutually exclusive to one another, i.e., only one can be selected at a time. As a new selection is made, the previous setting will be automatically turned off.



Select **Continue from SP** to have the MCT4 resume the program from where it left off on loss of power. The set point ramp will continue from the set point value at the time of power interruption.

Select **Continue from PV** to have the MCT4 resume the program from where it left off on loss of power. The set point ramp will continue from the current process value of the loop and not the last set point value.

Select **Static Mode** to have the MCT4 default to single set point operation on power-up. The program will be stopped, and the loops will control to the last static set point entry.

NOTE: *When a program is NOT running and a power down/up sequence occurs, the MCT4 will return with the same set points and system events active as when the power was lost.*

See Appendix section Profile Recovery Detail ***for a more detailed explanation and examples of program recovery operation.***

Recovery Interval

During program operation, the current program progress is stored in memory on each step change and at 6-minute intervals during step operation. During static set point operation, the current control set point is also stored in memory every 6 minutes.

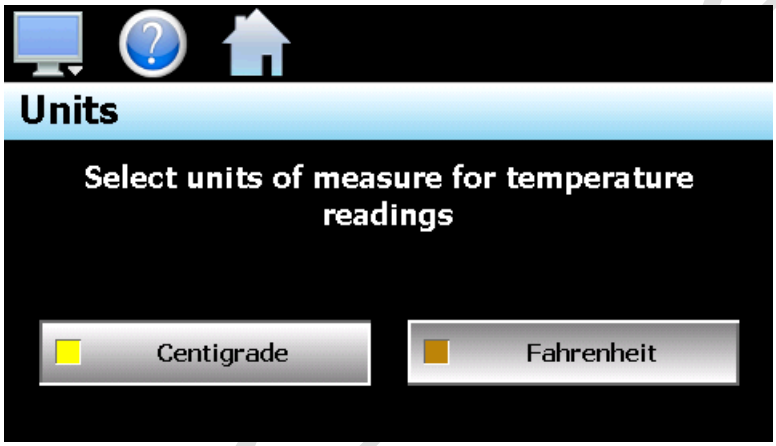
For program operation, this results in a possible recovery error of up to 6 minutes. For example, a program is running and enters step 2 which is a ramp step from 0 to 100 degrees in 10 minutes. If power is lost at 5 minutes into the step and "Continue from SP" is the selected recovery mode, when power is restored, the program will begin operation from the beginning of step 2 with a set point of 0. It will not resume operation from 50 degrees at 5 minutes into the step.

If the power is lost at 8 minutes into the step (2 minutes remaining), the program will continue from the last save point which was 6 minutes into the step (4 minutes remaining) with a set point of 60 degrees. For soak steps the set point remains a constant and time remaining is the only variable. So as with the ramp step, the time remaining in the step will continue from the last save point.

When in static set point operation, if the set point is changed and power is immediately cycled, the loop control will resume operation when power is restored from the previous set point, not the one just entered. The save interval is from power up, so when a new set point is entered, it could be saved within seconds or take up to 6 minutes for it to be saved. To ensure that the system powers up with the desired set point, maintain power to the MCT4 after a set point change for at least 6 minutes before removing power.

Degrees C/F Units Selection

The MCT4 can display temperatures in either degrees Centigrade or Fahrenheit. To change the temperature display units, select "Units" from the offline Set menu.



Press the button for the desired temperature units to make the selection. The choices are mutually exclusive so when one selection is made, the other will be de-selected.

NOTE: *When changing display units, ramp/soak program set points will not be converted between units. Separate programs are required for each temperature range. Operating the MCT4 with programs that have been written using alternate units could cause property damage or personal injury.*

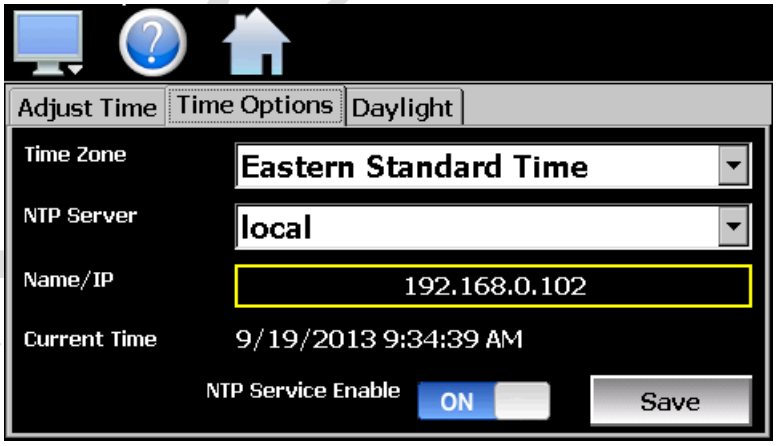
Clock Settings

The system date and time is adjusted from the “Adjust Time” tab under the Set/Clock menu. The current date and time will be displayed in the thumb wheels as shown below.

To adjust, scroll each time wheel to adjust the month, day, year, hour, minutes, seconds, and AM/PM selection. Once all adjustments have been made, press the “Save” button to set the system clock to the date and time entered.

Time Options

Select the “Time Options” tab to configure the time zone and national time server clock settings. If the MCT4 is connected to the internet, these settings can be used to have the MCT4 automatically synchronize its time with one of the nationally provided time servers.



To enable the national time server, select your time zone and which time server you wish to use from the drop-down menu selections. Turn on the “NTP Service Enable” option and press the “Save” button. The MCT4 will then synchronize its time with the selected national time server at 2:00AM each day.

If the MCT4 is not connected to the internet, a local alarm message will be shown on the alarm screen; “NTP Failure. Check cable and server” to indicate that the time server could not be located.

Local Time Server Settings

If an active internet connection is not available, or company policy prohibits internet access, the MCT4 can be configured to use a local time server instead of one of the national time servers. To configure the use of a local time server, select “local” from the NTP server list. When selected, the “Name/IP” entry field will be shown. The computer name or IP address of the computer running the local timer server on the LAN can then be entered. The MCT4 will then contact the local computer to synchronize time.

NOTE: *The steps required to configure and provide NTP service from a computer on the LAN is outside the scope of this manual. Contact your network administrator for assistance.*

Daylight Savings

Select the “Daylight” tab to configure daylight saving time options. The daylight savings time options allow the user to set the start date and end date for daylight savings time.

NOTE: *If the NTS time server setting is enabled, and the selected time zone uses daylight savings time, daylight savings must be properly configured and enabled, or the clock will not show the correct time.*

If your locale utilizes daylight savings time, set the start, and stop dates for daylight savings and turn on the “Daylight Savings Enable” option. Press the “Save” button to store the settings. MCT4 will then automatically update its clock for daylight savings time.

Language

The Language screen is used to select the language for all the online help, menus, and most static display fields. Note that the keypad will remain in English, so all user text entry will still be in the English language.

Available language selections include:

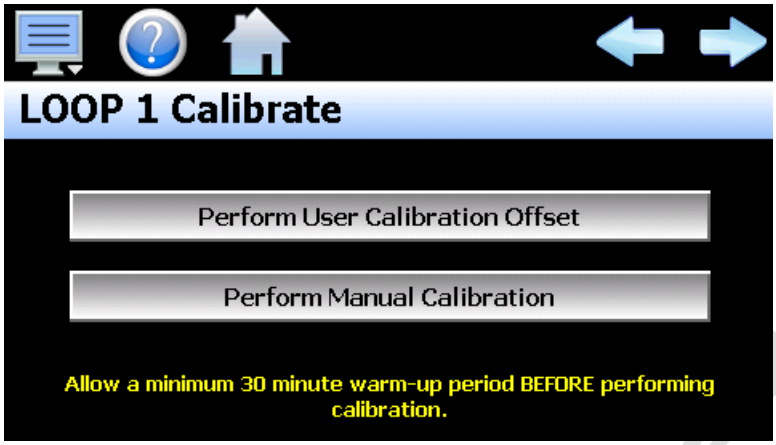
- ✓ Chinese Simplified
- ✓ Chinese Traditional
- ✓ English
- ✓ French
- ✓ German
- ✓ Italian
- ✓ Japanese
- ✓ Korean
- ✓ Portuguese
- ✓ Russian
- ✓ Spanish

DISCLAIMER: English is the default language for the MCT4 control system. All other language selections provided through translation from the English language. FDC does not guarantee the accuracy or validity of alternative language selections and shall not be liable for any damages or losses, whether direct, indirect, incidental, special, consequential or any other damages for misinterpretation of other languages. FDC offers a free, PC based application which allows the end user or Darwin Chambers to create the translation files for the desired language selection. The translation files can then be copied to the MCT4 control system to provide a more accurate or desired translation.

Calibration

Each MCT4 loop control and limit control is calibrated at the factory before shipment; however, they can be recalibrated in the field with the use of proper calibration equipment. The user calibration offset provides the means for the end user and Darwin Chambers to simply apply an offset to the factory calibration. Typical reasons for applying this offset may include the need to match a reference standard, to match the calibration to a transducer or sensor or to remove long term drift in the factory set calibration.

To access calibration, select “Inputs” from the Calibrate menu. When more than one loop and/or the limit control is installed, the left/right navigation arrows will be provided at the top right of the screen. This allows the user to scroll through each available loop and limit if installed.



Press the **Perform User Calibration Offset** button to access the settings for applying an offset to the loop or limit factory calibration. This is the recommended method of calibrating the inputs for users without special calibration equipment and is suitable for most applications.

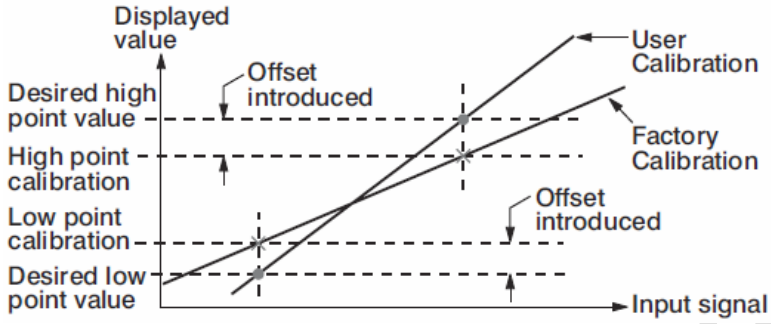
Press the **Perform Manual Calibration** button to begin the factory calibration procedure for the selected loop or limit input. This option is NOT recommended for users with limited calibration experience. Special high accuracy equipment is required to properly calibrate the inputs to factory standards. Improper calibration could render the device inoperable and require it to be sent back to the factory for repair.

Prior to performing any calibration procedure, read the documentation carefully and understand the steps required to perform calibration. The loop and limit controls must be powered for a minimum of 30 minutes prior to performing calibration to ensure that they have warmed up and are at normal operating temperature.

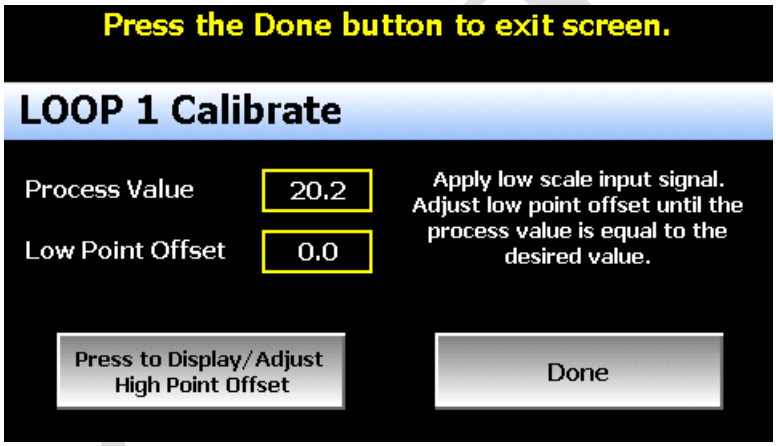
Required calibration sources:

RTD Input:	0 – 300ohm source ± 0.005% accuracy
Voltage Input:	0 – 10VDC source ± 0.005% accuracy
Milliamp Input:	0 – 20mA source ± 0.005% accuracy

The calibration offset provides a two-point offset, a low point offset and a high point offset. The two-point offset constructs a straight line (linear calibration) between the two points. To ensure greatest accuracy, it is best to calibrate with the two points at the minimum and maximum operating ranges for the system.



To begin calibration, send the low signal input to the loop control. If the process value does not match the reference signal, adjust the low point offset so that the process value matches the reference input signal. Press the button to switch to the high point offset and then apply the high signal input to the loop control. Adjust the high point offset, if necessary, to make the process value match the reference signal.



Once the high point offset has been adjusted, press the button to switch to the low point offset and again apply the low signal input to the loop control input. If the process value does not match the reference signal, adjust the low point offset again so that the process value matches the reference input signal. Again, press the button to return to the high point offset and apply the high signal input to the loop control. Adjust the high point offset, if necessary, to get the process value to match the high reference signal. This process may have to be repeated several times depending upon the amount of offset applied. Each time the low or high offset is adjusted, it can affect the opposite end of the calibration curve.

If the known calibration error of the loop input is the same at both the minimum and maximum operating range of the system, i.e., a linear offset, you can simply enter the difference between the reference signal and process value for both the low point offset value and high point offset value. If both the low and high point offsets match, it shifts the calibration curve thus applying the value of the low/high point offset equally across the entire range.

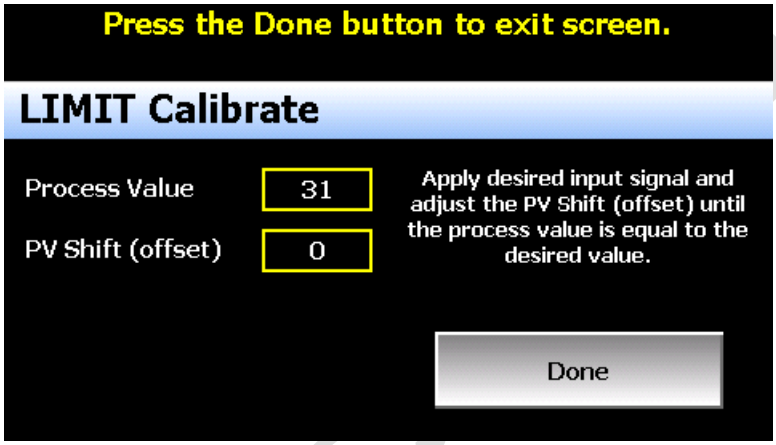
For example, if the range of operation is -50.0 to 350.0 degrees and the error between the reference signal and the process value is 0.7 at both the low and high-range resulting in process values of -49.3 and 350.7,

simply enter the value of -0.7 for both the low and high point offset. This will shift the curve equally at both ends of the curve so the resulting process values will be -50.0 and 350.0.

Once the calibration offset is complete, press the “Done” button to return to the main Calibration screen.

Limit Calibration Offset

The calibration offset provides a single point shift. If the limit control is used for high/low operation and the error differs from one end of the calibration curve to the other, the shift value can be used to split the difference between the two. This will make the error equal at both ends of the curve or it can be used to shift it to reduce error at one end of the curve; however, it will also increase the error at the opposite end of the curve.



To begin calibration, apply the desired reference signal to the limit control input. Adjust the PV Shift value to achieve the desired process value. Once the calibration offset is complete, press the “Done” button to return to the main Calibration screen.

Manual (Factory) Calibration

The manual calibration procedure is a two-step process for RTD and linear inputs and a three-step process for thermocouple inputs. Each step of the calibration procedure can be skipped which provides the user with a means to exit manual calibration without altering the calibration coefficients of the loop or limit control.

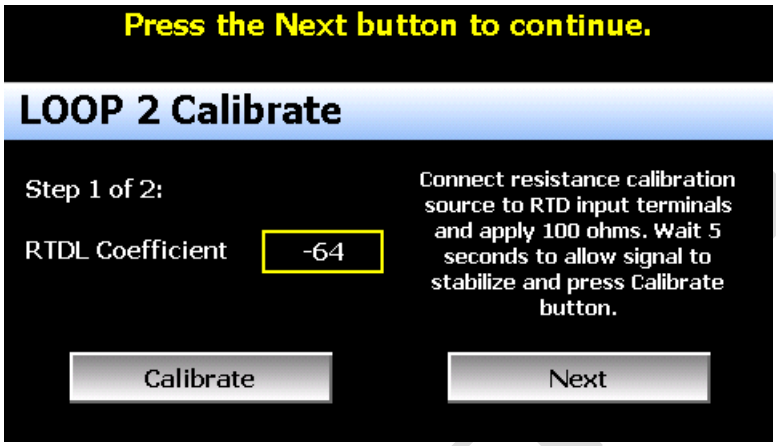
CAUTION: *Performing manual calibration will replace the factory calibration coefficients with new values. If calibration is performed incorrectly, it could introduce a large input error resulting in dangerous operating conditions if not detected or render the device inoperable requiring that it be sent back to the factory for repair. Prior to calibrating, each coefficient, it is recommended that the current value be recorded. The calibration coefficients can be manually entered so if the calibration process fails, the previous values can be re-entered returning the unit to its previous operational state.*

RTD and Linear Input Calibration

When the loop or limit control input is configured with an RTD or linear input, pressing the “Perform Manual Calibration” button on the main Calibration screen will begin the calibration procedure for the configured input type. The procedure is a two-step process and begins by calibrating the zero of the A to D converter.

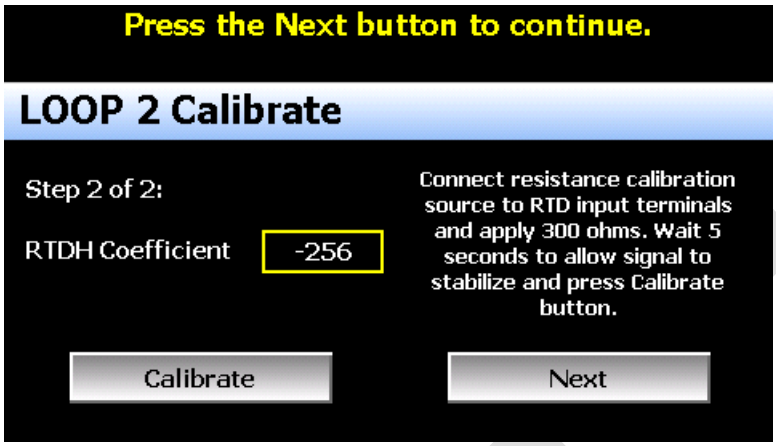
To calibrate the input low coefficient, connect the resistance source (for RTD input), voltage source (for voltage input) or milliamp source (for current input) to the input terminals of the loop or limit control. Adjust the source signal to 100 ohms (for RTD input), 0VDC (for linear voltage input) or 0mA (for current input) and allow several seconds for the source signal to stabilize. Record the current calibration coefficient value.

Press the “Calibrate” button to calibrate the input low coefficient. A dialog will be shown indicating the new coefficient is being calculated. DO NOT alter the source signal during the process. Once complete, the dialog will close, and the new coefficient value will be shown.



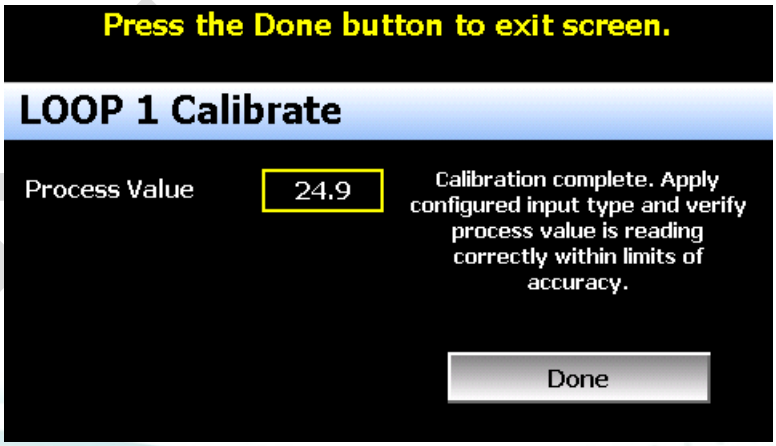
If the new coefficient value is -1999 or 1999, the calibration failed. Check the source connections and ensure the proper signal is applied. Press the Calibrate button to repeat the process or press the coefficient display/entry field and enter the previous coefficient value recorded to return the loop/limit back to its previous state. To skip the input low coefficient calibration or to proceed to the next step after calibration has been performed, press the “Next” button.

Step 2 of the procedure is calibrating the span of the A to D converter. To calibrate the input high coefficient, adjust the resistance source to 300 ohms (for RTD input) or 20mA (for current input). If calibrating a voltage input, adjust the voltage source to 60mV for 0-60mV input, 1VDC for 0-1VDC input, 5VDC for 0-5/1-5VDC input or 10VDC for 0-10VDC input. Allow several seconds for the source signal to stabilize. Record the current calibration coefficient value and press the "Calibrate" button. A dialog will be shown indicating the new coefficient is being calculated. DO NOT alter the source signal during the process. Once complete, the dialog will close, and the new coefficient value will be shown.



If the new coefficient value is -1999 or 1999, the calibration failed. Check the source connections and ensure the proper signal is applied. Press the Calibrate button to repeat the process or press the coefficient display/entry field and enter the previous coefficient value recorded to return the loop/limit back to its previous state. To skip the input high coefficient calibration or to complete the calibration procedure, press the "Next" button.

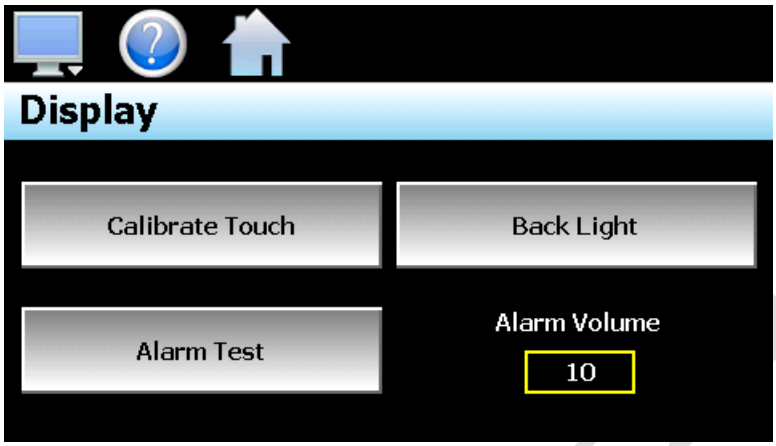
Once the calibration steps have been completed, adjust the reference signal to the low and high end of the operational range to verify that the process value matches the reference signal within the accuracy limits for the input type.



Once the input has been verified to display the proper value according to the input reference signal, reconnect the control sensor to the loop/limit control and press the "Done" button. This will return to the main Calibration screen.

Display Settings

The Display screen provides access to the touch screen calibration utility, back light settings, and alarm volume adjustment.

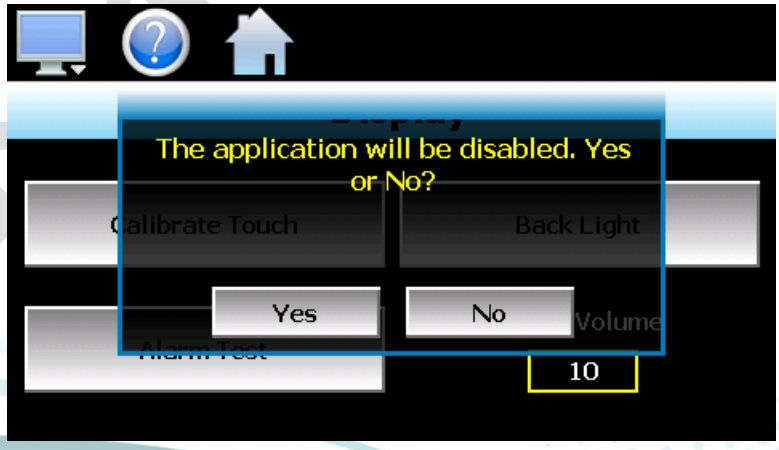


The **Alarm Volume** adjusts how loud the internal alarm buzzer of the MCT4 will be when activated under an alarm condition. The volume can be set from 0 (off) to 100. To edit the alarm volume, touch the entry field and enter the desired volume level. To test the buzzer, press the "Alarm Test" button.

Calibrate Touch

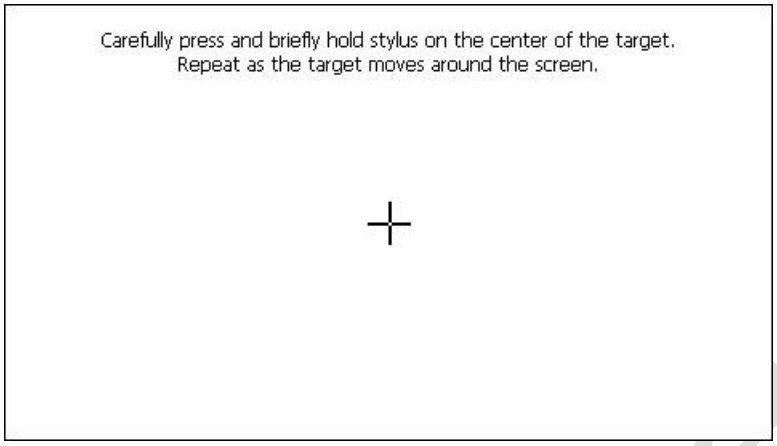
After extended use and many hours of operation, it may be necessary to recalibrate the touch screen of the MCT4. A typical sign that the screen may be out of adjustment, is inaccurate responses when attempting to press buttons, check boxes or adjust fields on the display. The calibration utility is provided to re-adjust the screen when this happens.

To begin the calibration process, press the "Calibrate Touch" button. An alert message will appear stating that the application will be disabled to perform the calibration procedure. Press "Yes" to continue.

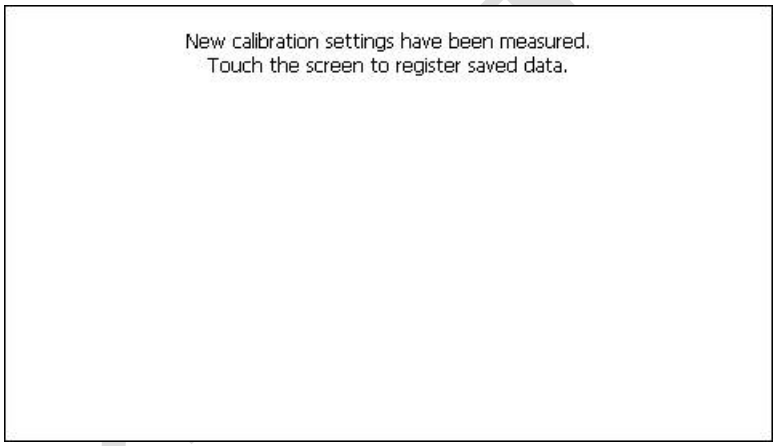


The calibration utility will start, and crosshairs will appear on the screen. At each crosshair position, touch the screen at the center of the crosshairs. Repeat this for each position to set the calibration. The calibration requires five points, the center and four corners.

NOTE: *It is recommended that you use your finger rather than a stylus when calibrating the screen. The touch response will be more fluid after calibrating it with your finger.*



Once complete, the calibration utility will provide a notification message that the new calibration settings have been measured and to touch the screen to register the new calibration data; just touch anywhere on the screen to close the window and return to the MCT4 application to resume normal operation.

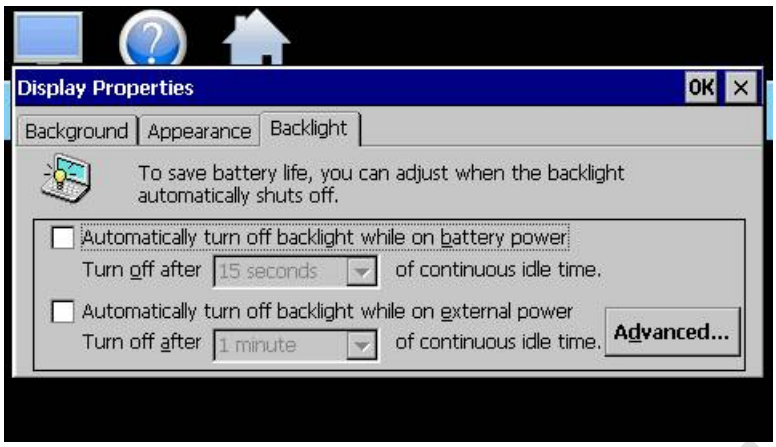


Backlight Settings

The backlight settings allow the user to adjust the screen brightness as well as set a time for dimming the backlight after a period of inactivity which can extend the life of the display. To adjust the backlight settings, press the “Back Light” button. An alert message will appear stating that the application will be disabled to enter the backlight settings, press “Yes” to continue.

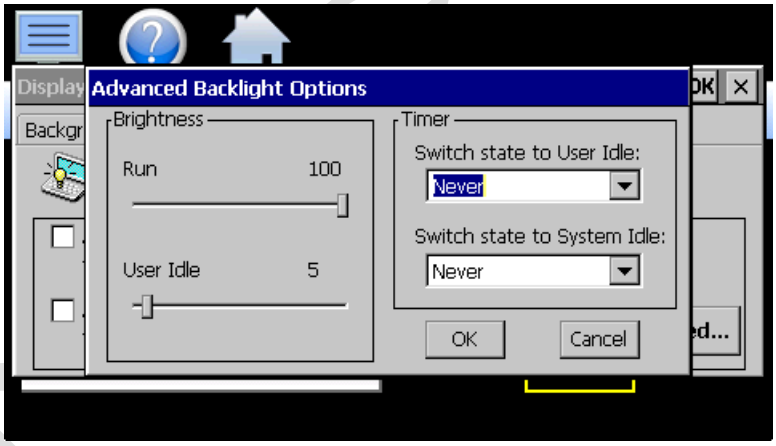
Select the “Backlight” tab from on the Display Properties window. Press the “Advanced…” button to access the settings for the backlight.

NOTE: *The checkboxes on the Backlight tab for “Automatically turn off backlight while on battery power” and “Automatically turn off backlight while on external power” have no effect on backlight operation and should be left unchecked.*



The brightness of the display during operation is set by adjusting the “Run” slider. The default setting is 100. The “User Idle” slider is used to adjust the brightness of the display during periods of inactivity. The default setting is 5. Use caution when adjusting the “Run” slider. It is possible to set the brightness to zero (0), in which case the screen will go black, and you will be no longer able to see the settings. Should this occur, it is possible to tap the screen in the general area of the run slider. If you tap the screen in the proper position of the slider, it can set the slider to make the screen visible again. It is recommended that the slider not be adjusted below 20.

When adjusting the “User Idle” slider, the screen will temporarily adjust to the setting of the slider as you move it. If you choose a value of zero (0), the screen will go black. However, once you lift your finger, the screen will return to the “run” brightness level after a couple seconds.



To enable the backlight dimming function, use the “Switch state to User Idle” drop-down menu and select a time for no activity at which the screen should dim. The delay time can be set at fixed intervals from 1 minute up to 30 minutes. To disable the dimming feature, select “Never”.

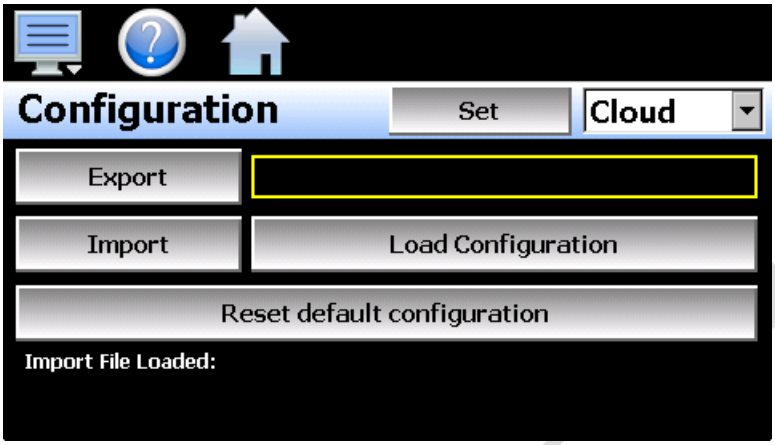
Once all settings are complete, press the “OK” button and then press the “OK” button at the top right of the “Display Properties” window to return to the MCT4 application and begin normal operation.

Configuration

The Configuration utility allows the user to back up the entire configuration of the MCT4 and save it to a file for “safe keeping” in case of system damage due to a lightning strike, etc. The utility also allows the MCT4 to

be configured with a push of a button by selecting from a list of preconfigured setups that could be created and saved on a USB memory device or remote server for loading a configuration to a new MCT4 system.

IMPORTANT:Do not import configuration files that are not intended for use with the current hardware configuration of the MCT4 as unexpected operation may result.



By default, the import/export procedure is set to operate via USB. To perform import/export operations from a remote server, use the drop-down menu to select "Cloud". When "Cloud" is selected, a "Set" button will appear to the left of the drop-down menu. Pressing the button will display the Cloud setup screen where the remote server settings can be entered (See section 10.7.1 Cloud Server Settings). The settings only need to be entered once as they can be saved and used for any future import/export operations.

When the **Export** button is pressed, the MCT4 configuration data will be written to the USB memory device or remote server. The export file function will use the name entered in the text field to the right of the export button and create a directory on the memory stick with that name, to contain the configuration data. The filename can be entered with up to 10 characters which permits multiple configurations to be identified and saved for later retrieval. The export files will be saved to a directory with a name format of "MCT4_filename_mm-dd-yyyy-hh-mm-ss" to identify the configuration according to the date and time it was created. This prevents multiple configuration files with the same name from overwriting previous files. It also allows the user to identify a backup of the MCT4 so that it could be reconfigured to a previous date if multiple back-ups are created.

If the export is being sent to a remote server, a single file is created with the format of "MCT4_filename_mm-dd-yyyy-hh-mm-ss.ccg". The file is encrypted and automatically signed with a digital signature to protect it and prevent alteration of the file. Should a file be tampered with, it would fail the import, thus protecting the MCT4 from accepting a bad configuration file.

The **Import** button is used to configure the MCT4 according to the currently loaded configuration file. To load a configuration file, the USB memory device must first be inserted into the USB port (or the remote server must be properly configured and the MCT4 connected to the internet when Cloud is selected). When the **Load Configuration** button is pressed, a list of available configuration files from the memory stick (or remote server) will be shown. Select the desired file from the list and press "Open" to load the file. Once the file is loaded, the import process can be started. Pressing the "Import" button will begin the process. When the import is complete, you must cycle power to the MCT4 for the new configuration data to be loaded into runtime memory for proper operation.

The **Reset default configuration** button can be used to clear the current MCT4 configuration and reset the system back to default values. This function clears all user and/or Darwin Chambers configuration values and returns the system to an "as new" factory state allowing the system to be configured from scratch. This

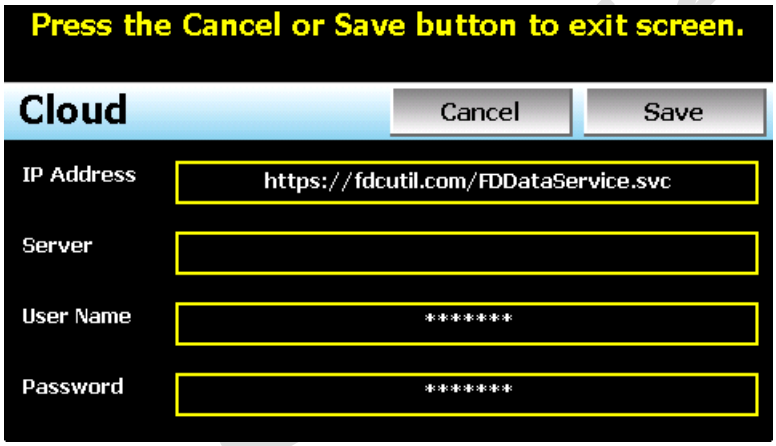
function is provided to start over if the system configuration has been altered to an unknown state and is not operating properly, and a known good configuration is not available to import. Rather than go through every setting of every feature to try and determine where the configuration error exists, this allows the system to be cleared so that it can be reconfigured from a clean slate.

NOTE: *The configuration functions do not affect the VNC server configuration. The enable state, VNC address, device name and password fields must be manually changed as these settings are specific to each device and must be set independently for proper VNC server operation over a network.*

The network settings, i.e., DHCP/ Static IP address settings and control loop set points are also not saved to the configuration file. These settings must be done manually.

Cloud Server Settings

The "Cloud" screen provides settings for the remote configuration FileWeb server. The screen is accessed by pressing the "Set" button on the Configuration screen. Note that the "Set" button is only shown when "Cloud" is selected for the import/export configuration location.



The **IP Address** field is used to enter the IP address of the remote server site that MCT4 is to interface with.

The **User Name** field allows you to enter a user name for site access. When the MCT4 connects to the site, the username will be used to identify the connection. The username is required for FileWeb access.

The **Password** field is used in conjunction with the username field and is for entering a password, so the MCT4 can access the site. A password is required for FileWeb access.

The **Server** field is used to enter additional directory information for the server (if desired) where the files are to be stored during import/export operation. The field can be left blank. By default, the MCT4 is hard coded to store files on the specified server in the "\configs\user name\" directory. If an entry is made in the Server field, the path would be "\configs\user name\server\".

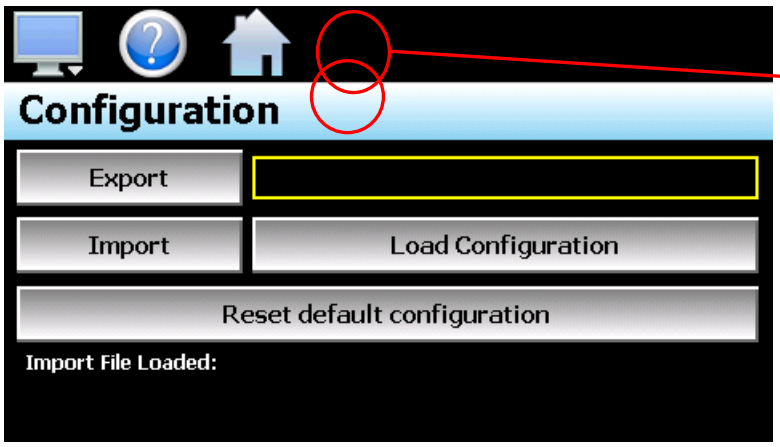
MCT4 Field Setup	FileWeb Server Setup
IP Address = https://fdctuil.com/FDDataService.svc	Actual named address of FileWeb server/service.
Server = optional path	The FileWeb server/service must be configured with a root "\configs\" directory to use the MCT4 cloud import/export feature. The MCT4 is hard coded to transfer configuration files to the "configs" directory in the root of the server. This results in a typical file path of "\configs\userName\". If the Server field also contains an entry, the resulting path would be "\configs\userName\Server\". It is recommended that this field be left blank for the majority of users to ensure all configuration files are stored in the base "configs" directory. When loading a configuration for import, only the files in the specified directory will be available for selection. If a configuration file was stored to a location specified by the Server field and the proper entry is not known, the user will be unable to select the proper configuration file for import.
User Name = userName	Actual user name for login at FileWeb server (required).
Password = userPassword	Actual password for login at FileWeb server (required).

NOTE: *Make sure proper permissions are set at the server for access/creation of directories and read/write access. Also check root directory structure at the server to identify the actual root that was created for the files since there can be additional layers created by the server field and displayed in the path (see Appendix section A.2 FTP, FileWeb, DataWeb Requirements/Installation for additional information).*

Importing a Darwin Chambers Default Configuration

The "Reset default configuration" button loads a predefined configuration stored in memory on the MCT4. The factory configuration is "blank" meaning it will reset all attached loop control boards and limit control to the FDC factory defaults. All user and/or EOM configuration settings will be cleared which will require the user to reconfigure the entire device for the intended application.

For OEM manufacturers, the MCT4 provides a means of importing a default factory configuration. If an end user happens to make configuration changes that affect operation, or to ensure the system is configured properly to Darwin Chambers specifications while providing customer support, Darwin Chambers configuration can be stored in the MCT4 and will be installed when the "Reset default configuration" button is pressed.



Hidden Import Factory Defaults Button

To import a factory default configuration, insert the USB memory device containing the desired configuration file. Next to the "Home" icon is a hidden button. Tap the location repeatedly 10 times within a period of 4 seconds. A dialog will be shown prompting to copy a configuration as factory defaults. When "Yes" is selected, the open file screen will be shown. Select the desired configuration file and press the "Open" button to import the file as factory defaults.

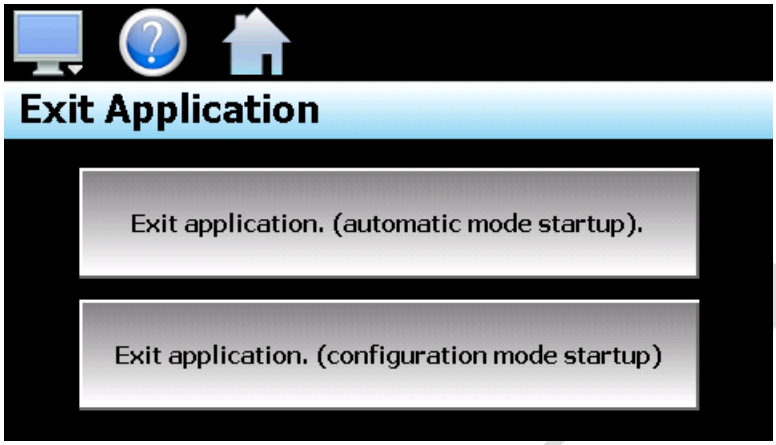
NOTE: *Importing a factory defaults file does not affect the current configuration of the unit. This only imports a configuration file as the factory defaults file.*

About MCT4

The "About" MCT4 screen provides operating system version numbers for the currently installed firmware and software of both the MCT4 HMI and loop control boards and limit device. This information should be recorded prior to any service request so that proper assistance can be provided for your control model.

Exit Application

The “Exit” Application screen allows the user to quit the MCT4 runtime software and return to the CE.Net operating system. This operation is NOT recommended except for users who oversee system configuration due to the danger of editing or removing files by accident.



The **automatic mode startup** option will return the MCT4 to normal operation on the next power up.

The **configuration mode startup** option will start the MCT4 Configurator program on the next power up so that the user can access control loop and MCT4 configuration settings.

COMMUNICATIONS

This section provides instructions on how to use the MCT4 communication interfaces. As a standard, the MCT4 is equipped with both an Ethernet interface and an RS232/485 serial interface for user communications.

Ethernet Communications

The MCT4 provides several options for remote control and monitoring over the Ethernet communications interface. The web server interface provides a monitor only connection, while the VNC server and Modbus TCP interfaces allow a user to manipulate and control the MCT4 remotely. The VNC interface allows the user to view and observe operation of the MCT4 display directly on their PC screen while the Modbus TCP interface allows the user to manipulate MCT4 operation via other devices and/or software capable of Modbus TCP communications.

NOTE: *To use Ethernet communications, the MCT4 must be properly connected to a network. To connect the MCT4 to a network, connect the touch screen’s Ethernet port to your network using a standard CAT5 cable connection. Note that after connecting the network cable, it may be necessary to cycle power to the MCT4 for it to obtain a valid IP address.*

Guide to Smart Networking Practices

The expansion of Ethernet onto the industrial floor has brought forth a new realm of possibilities from the gathering of information to the inherent control of equipment from anywhere around the world. The flexibility and convenience that this provides makes it a very desirable feature for new equipment. The MCT4 provides this ability, but there are considerations that must be taken by the end user to protect their equipment and investment.

Just like placing a personal computer on the internet opens it up to outside attack, placing your MCT4 on a network poses the same risk. The first thing to remember is this: The most likely cause of problems is not a hacker trying to sabotage your equipment, but more often to be related to the ubiquity of PCs with Ethernet cards, the ease with which your own co-workers can "hang stuff on the network", and careless or nonexistent internal security measures. Accidental problems are more common than deliberate ones.

Allowing anyone access to the MCT4 by placing it on the office LAN, also opens the door for accidental shutdown, damage to equipment, loss of data, lost time, etc. This is possible even by the most well-intentioned co-workers. Thus, there are several steps that should be taken to minimize this risk.

The first is to never mix your office LAN with your control LAN. The control LAN should be a separate network that consists of your MCT4 controller(s) and possibly any other equipment that you may have that is related to the operation of the system. It should be separated from your office LAN by a firewall, or at minimum, a bridge or router. A control network and a business network have two entirely different purposes and their interaction should be closely controlled.

It is also unwise to assume that any Ethernet capable devices themselves have any security features at all. The MCT4 VNC server only provides minimal single password-based security access. Separating the control LAN from the office LAN using a firewall would increase security and only allow control access that is based on a combination of IP source address, destination address, and port number. This is by no means completely "hacker-proof", but it should keep the well-meaning co-workers out.

Another hazard is connecting consumer "plug and play" devices to your control LAN. A printer for example, might flood the network with traffic in a "broadcast storm" as it tries to self-configure or advertise its presence to all nodes on the network. Faulty devices, for example defective NIC cards, can transmit large amounts of bad packets (i.e., runts, which are abnormally short Ethernet frames) into your network. Using switches instead of hubs will limit the effect of such problems.

The most overlooked source of problems is cabling. Not all cables are created equal. Electrical noise generated by factory equipment or other electrical equipment in the area, could easily corrupt transmitted data over the network and cause devices to "lock up" or shut down the VNC server, both of which then require the MCT4 to be shut down and restarted to clear the problem.

Select the right cable for the environment. Shielded twisted pair (STP) cable is naturally more noise immune and is preferable to unshielded twisted pair or UTP in noisy situations. STP should have at least 40dB CMRR and less than 0.1pF capacitance unbalance per foot. Ground STP cable, making sure the ground is connected only at one end. CAT5 STP patch panels normally provide a grounding strip or bar. Hubs and switches do not provide grounding, use cables.

It is wise to be pessimistic about a cable's ability to reject noise from 230 VAC and 460 VAC power lines and electrically "noisy" equipment in the area. Capacitance imbalance in cables greater than 70pF per 100m can introduce harmonic distortion resulting in bit errors. The cost of cable is quite small compared to total equipment cost, so if you are looking to save money, this is not a place to do it. Choose a well-designed cable to minimize bit-error rate after installation, and that will give faster throughput with fewer glitches.

The MCT4 and Network Security

When most people think of security, they think of anti-virus programs and continuous operating system updates to ensure their system is running with the "latest-and-greatest" software. For consumer devices, this is well and good, but when it comes to industrial devices not so much. How many times has an update to the OS caused an issue with an existing program that for now some reason is not working correctly or crashes inexplicably. How about an anti-virus program updating its threat definitions and now sees an application as a

potential threat and blocking it from operating? To have this occur on a control device could be catastrophic to a process. So how does the MCT4 address these concerns while still providing threat protection?

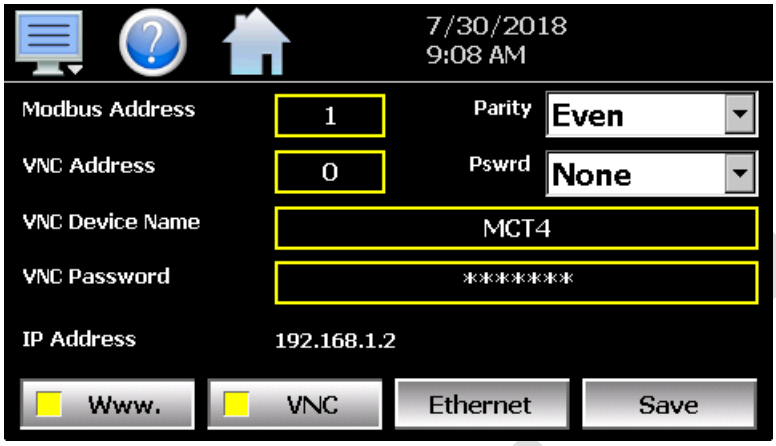
The MCT4 software validation uses a specific OS version and revision number as part of the validation process. WinCE is not the same as Win7, 10, etc. and does not support automatic updates since the OS must be installed in a specific portion of memory using a cable or SD with the device present. The OS layout is also specific to the hardware on the device. FDC has never had an update to the OS unless the hardware changed on our units which required a driver (mostly third party) for the new hardware. This also provides stability since this is an industrial device that provides specific functionality without most of the "overhead" of the OS's that full PC's run.

Most security issues arise from browsing or opening an email attachment that carries harmful code. The MCT4 does not support the addition of anti-virus software: however, the MCT4 does not have a browser or an email server to receive emails or attachments. The FTP, FileWeb and DataWeb interfaces are also client based only. They transmit files and data to remote servers, but do not receive.

The MCT4 writes data to a web page in memory that can be accessed by an external browser. This is a read only web page (from the remote browser) that contains process values, set points, event, and current program data only. The internal web page data is written over with real time data every 30 seconds. The MCT4 does not read any data from its internal web page so any corruption of the web page would not affect MCT4 display/control operations. There are no passwords or sensitive data sent from the remote browser to the "read only" web page.

A virus to attack Windows CE would be difficult, but not impossible. Every Windows CE device is different (by manufacturer), so not an easy standard to write the virus against. The virus would need to be built for Windows CE and the CPU that the MCT4 runs, and the storage device does not have a standard name. There might be industrial devices that run anti-virus on their CE devices; however, FDC is not aware of any. As the saying goes, the best defense is a good offense. It is best to design a "smart network" to prevent intruders from gaining access in the first place than to try and defend them off once they are already in the door.

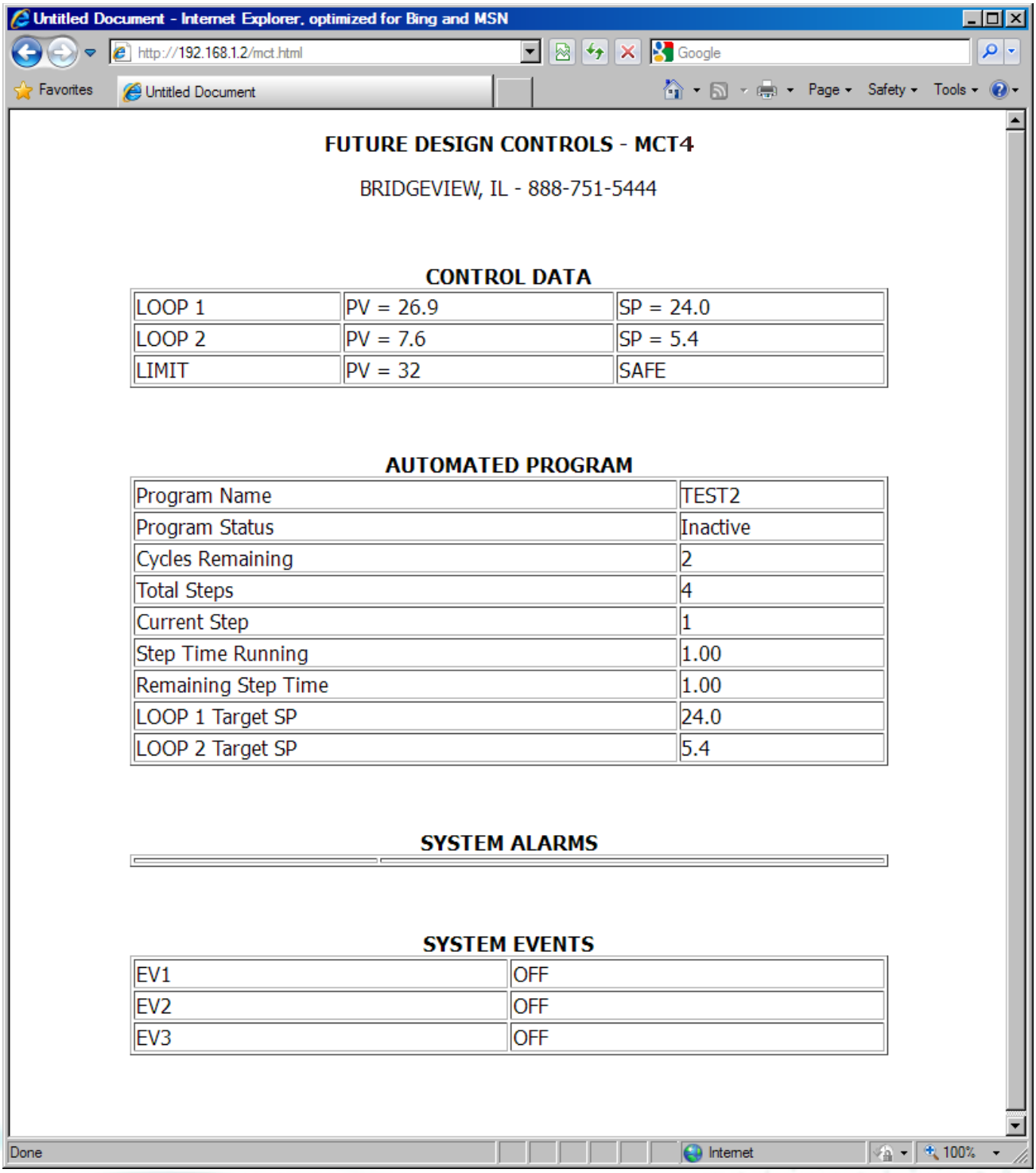
The MCT4 web server allows a user to remotely monitor operations anywhere via a PC's standard web browser. When enabled, the web server provides a detailed status page of the current operating conditions. The web server can be enabled and disabled by pressing the web server (Www.) button on the communications screen (select "Comms" from the Device\Settings\Set menu).



You must use the assigned IP address to access the MCT4. The IP address is shown on the communications screen and is also included in the notifications list. Write down the IP address so you will have it later to enter in your web browser.

NOTE: *Contact your network administrator prior to enabling the web server of the MCT4. Company policy may prohibit the use of web servers for security reasons. Future Design Controls is not responsible for the use of, nor makes any claims as to the security of the web server interface over your network. The use of the web server is the responsibility of the end user.*

To access and view the MCT4 web page, enter the following link in your PC's browser address window: **Error! Hyperlink reference not valid.**. Using the IP address from the sample screen, the entry would be: http://192.168.1.2/MCT.html. The following example is typical of the MCT4 web page appearance. The web page updates automatically every 30 seconds and provides information on each individual control loop, ramp/soak program status, alarm status and system event status.



Using the VNC Server

The MCT4 VNC server allows a user to remotely monitor and control MCT4 by directly viewing and manipulating the touch screen over the network. You must use the assigned IP address and VNC port number to access MCT4. The IP address is shown on the communications screen and is also included in the notifications list. Write down the IP address and port number so you will have it to enter your VNC viewer.

There are many VNC viewers available for both PC and tablet use. Due to the ever-changing market and availability of such applications, it is not possible to test them all for compatibility or help with their use with the MCT4. It is the responsibility of the end user to test the chosen VNC client for compatibility with the MCT4 prior to putting the unit into service. If the VNC client viewer has compatibility issues with the MCT4, it can cause the VNC server to stop responding and/or shut down requiring power to be cycled to the MCT4 to reboot the system and restart the server.

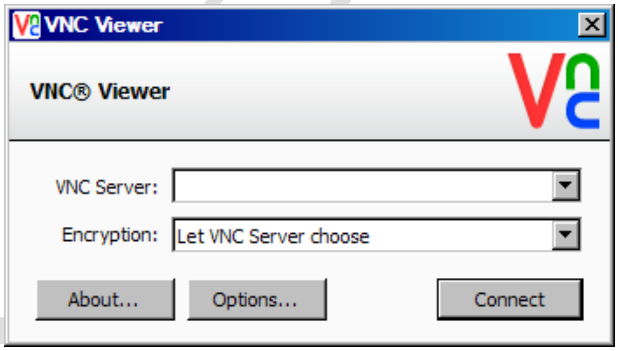
Future Design Controls has tested and recommends the use of RealVNC's viewer. It has been tested for compatibility with the MCT4 and a free version can be obtained from http://www.realvnc.com/ for PC/MAC use. RealVNC does offer a version for the iPad that can be obtained through the App Store for a small fee. The App Store also offers a free VNC client called Remotix for the iPad. It has also been tested for compatibility with the MCT4.

NOTE: *Contact your network administrator prior to enabling the VNC server of the MCT4. Company policy may prohibit the use of VNC servers and/or viewers for security reasons. Future Design Controls is not responsible for the use of, nor makes any claims as to the security of the VNC server interface over your network. The use of the VNC server is the responsibility of the end user.*

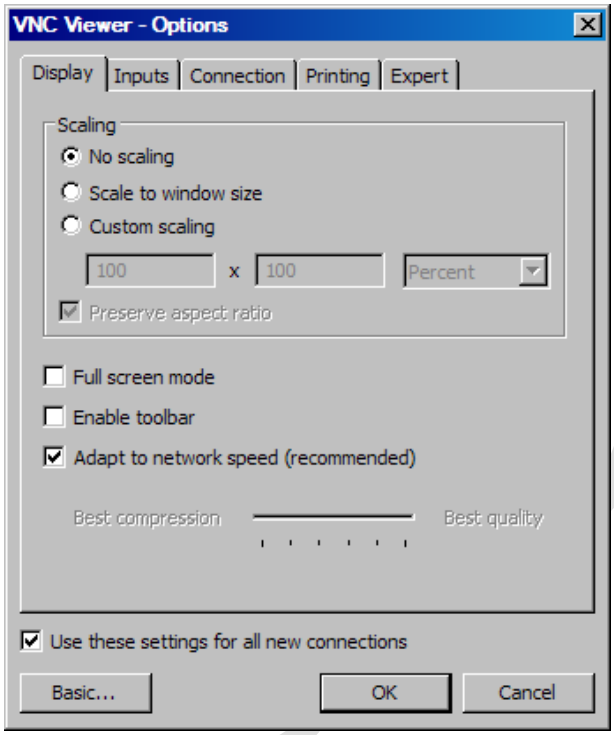
Recommended VNC Viewer Settings (PC/MAC)

This section applies to setup of the recommended RealVNC viewer for PC/MAC. These settings have been tested and evaluated to provide the best performance and quickest response to user input when using the VNC viewer with the MCT4. After installing the VNC viewer software, it is recommended that the following changes be made to the default viewer settings.

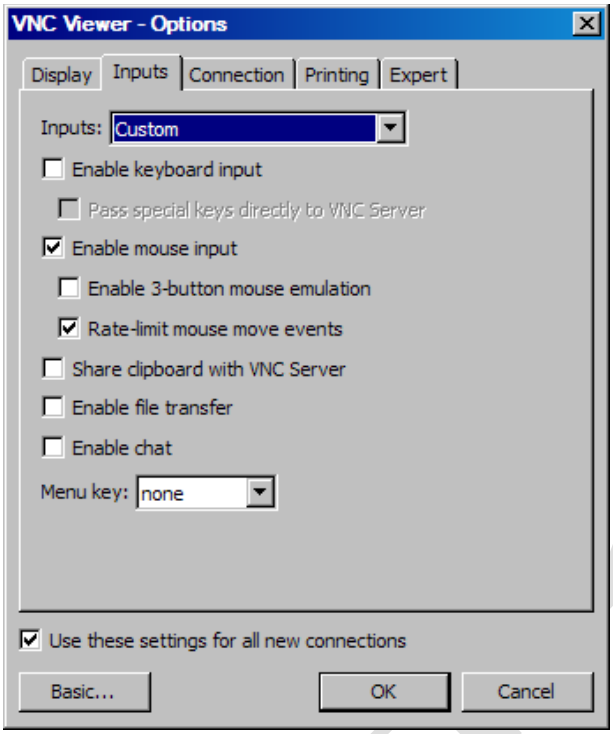
To begin, start the VNC viewer. Click on the "Options" button to open the VNC Viewer - Options window. Click on the "Advanced" button at the bottom left of the window to show the advanced setup options.



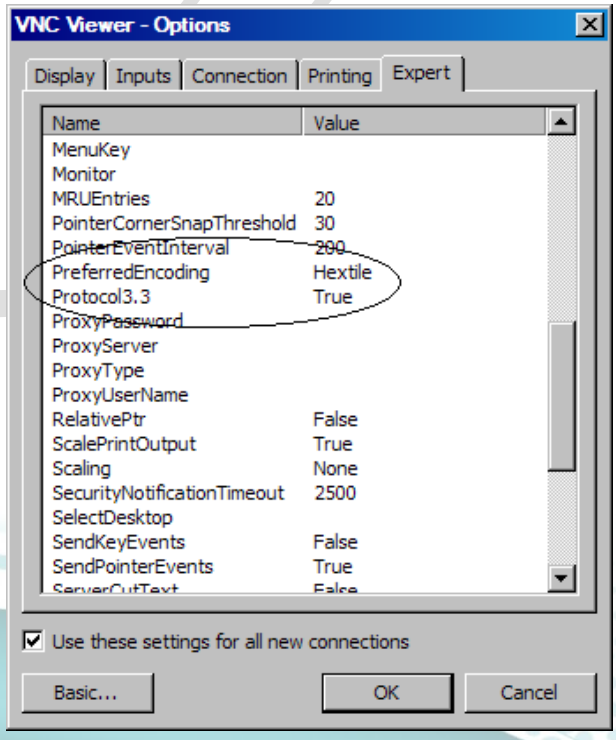
On the Display tab, make sure the scaling is set to “No scaling” and the checkbox for “Adapt to network speed (recommended)” is checked.



Next, select the Inputs tab and deselect all entries except for “Enable mouse input” and “Rate-limit mouse move events”. The “Inputs:” drop down selection box will automatically change to “Custom” when the settings are made.



Proceed to the Expert tab. Scroll down the list of settings until you find the “PreferredEncoding” and “Protocol3.3” options. Set the preferred encoding to Hextile and the Protocol 3.3 option to true. Verify that the “Use these settings for all new connections” checkbox at the bottom of the window is checked and click the OK button. This will set the selections to the default start settings for the VNC viewer.



Recommended VNC Viewer Settings for Tablets

The VNC clients for tablets have been found to offer limited flexibility for use with the MCT4. Most clients have default settings requiring security to be enabled on the server to connect. If you have trouble connecting with a VNC viewer through an iPad, iPhone or even an Android based phone, start by enabling the security on the MCT4 VNC server and be sure to enter those settings in the client viewer.

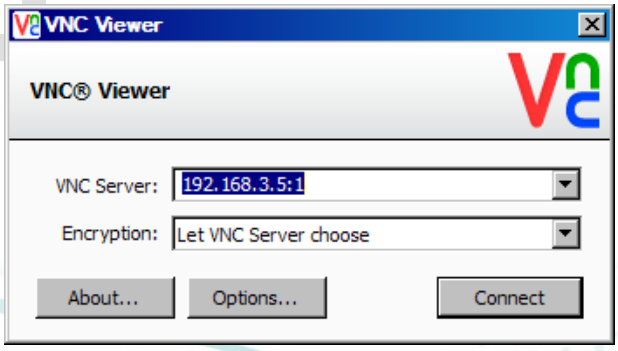
Color and encoding options can also affect the connectivity. If the client offers the option, leave color and encoding options to "automatically detect" or "server decides". If the client is still unable to connect, try default encoding of Hextile and set the color option to limited colors such as 256-bit color. Future Design Controls does not write or create VNC clients (3rd party software), so final selection of client and testing is the end user responsibility. The following settings are provided as an example for the Remotix client for the iPad. When adding an MCT4 server to the Remotix client, use the following settings. Note that the VNC server in the MCT4 must have security enabled for this client to connect.

Connection Type:	VNC
Host/IP:	IP address of MCT4
Port:	VNC address of MCT4 (5900 = 0, 5901 = 1, etc.…)
Use SSH Tunnel:	Off
VNC Authentication:	VNC Password
VNC Password:	VNC password of MCT4
VNC Server Type:	AutoDetect
Operating System:	Windows
Preferred Encodings:	Hextile
Color Depth:	16 bits

Accessing the MCT4 through a VNC Viewer

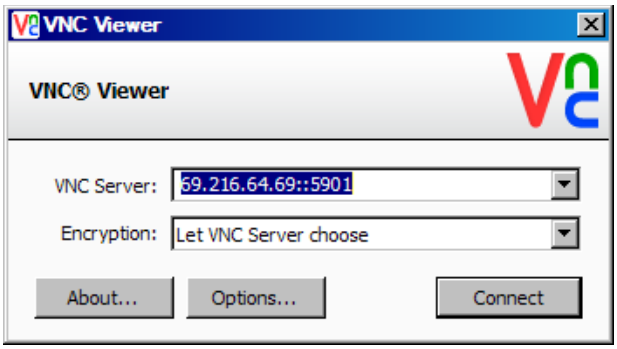
The following examples are based on the use of the RealVNC viewer for PC/MAC. Once the default settings have been entered, just enter the IP address and port number for the MCT4 and click the "Connect" button to access the MCT4 over the network.

Intranet Example: If the IP address assigned is 192.168.3.5 and the configured VNC Address is 1, from the PC's VNC Viewer address field, enter '192.168.3.5:1' to access the device (address 1 relates to port 5901, address 2 to port 5902, etc., which is the port opened by the VNC server to allow communications with the MCT4 over the network).



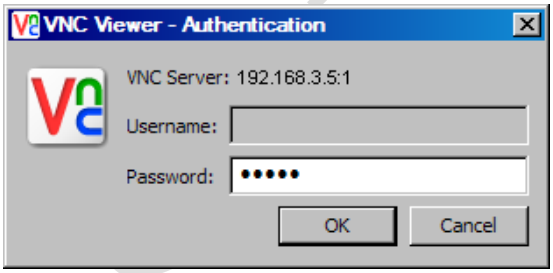
Internet Example: Internet connection usually requires a qualified network System Administrator. Typically, a permanent IP address and specific port address are assigned to the MCT4; support on this action is beyond the scope of this guide. Consult your network system administrator for assistance in setting up an Internet connection.

If the IP address of the LAN is 69.216.64.69 and the configured VNC Address is 1 (port 5901 has been opened and assigned to this specific MCT4 controller), from the remote PC (outside of the site Servers LAN), in the VNC Viewer address field enter '69.216.64.69::5901' to access the device (5901 relates to address 1, 5902 to address 2, 5903 to address 3, etc., note the double colon).

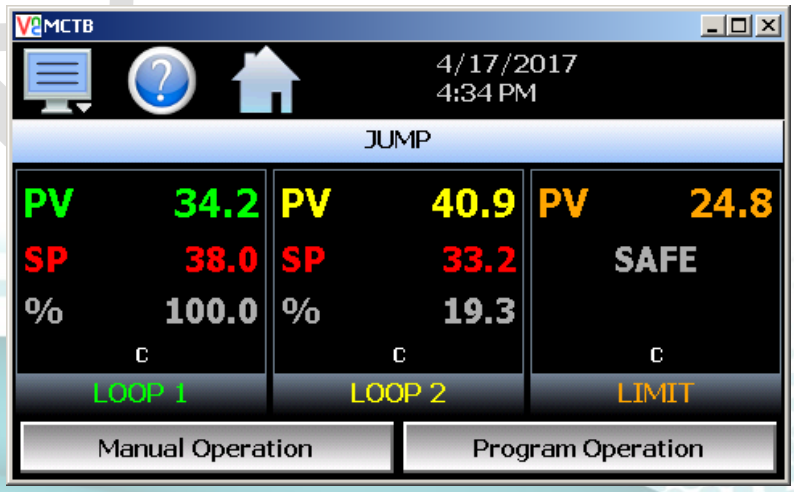


NOTE: *The IP address shown on the communications screen of the MCT4 is the local LAN address and would not typically be used for an Internet connection.*

Security Example: If the VNC server password is enabled on the MCT4 for either example above, upon pressing the "Connect" button to make the connection, the VNC viewer will prompt for the proper password. The connection will only be established once a valid password is entered.



Once the connection is established, the current MCT4 display will be shown on your desktop. The image will be a duplicate of what is on the MCT4. As you manipulate the screen, the display of the MCT4 will also be manipulated so that any local operator will be able to see what is happening and vice versa.



Multiple instances of the VNC viewer can be started on your PC. By running multiple viewers, you can have access to multiple MCT4 controllers right from your desktop. The heading of each VNC viewer window will use the "VNC Device Name" entry for the header. By entering a unique name for each MCT4, you can identify each VNC connection and know which system you are accessing.

The VNC viewer is meant to be used for short term control access to the MCT4. It is not meant for long term monitoring of system operation. If long term monitoring access is desired, use the built-in web server of the MCT4 or a PC with FDC software to monitor and control the MCT4 over its serial communications port. The web server interface and PC software is designed for long term monitoring and status updates.

Due to the nature of VNC operation, and for security reasons, the VNC viewer connection should not be left open on your desktop. The viewer connection should be opened to perform the necessary control and/or status check of system operation, and then closed once the task is complete. Accidental manipulation of the control or erroneous network activity could cause connection problems over the VNC interface and result in the VNC server shutting down and requiring the MCT4 to be restarted to regain access.

NOTE: *Some viewers may also contain additional features for file transfer and other high-level functions. These functions are NOT compatible with the MCT4. Any attempt to use them may cause the MCT4 VNC server to malfunction and require power to be cycled to reboot the system. All viewers should be used ONLY to monitor and manipulate the MCT4 as if you were standing directly in front of the unit and touching the screen.*

Using Modbus TCP/IP Communications

The MCT4 Modbus TCP server interface allows a user to remotely monitor and control the MCT4 via another device or software application compatible with Modbus TCP/IP protocol. The acronym TCP stands for Transmission Control Protocol while IP stands for Internet Protocol. These protocols are used together and handle the transfer of data over the internet. When Modbus information is sent using these protocols, the data is passed to the TCP layer where additional information is attached and then passed to the IP layer. The IP layer then places the data in a packet (or datagram) and transmits it.

Like the MCT4 Modbus serial interface, the TCP interface is always active; however, rather than using the Modbus Address on the communications screen as the slave address, the MCT4 IP address is used as the slave address. For Modbus TCP communications to function, the Master (or Client in Modbus TCP) establishes a connection with the Slave (or Server) using the IP address. In this case, the server is the MCT4. The MCT4 waits for an incoming connection from the client, and once a connection is established, the MCT4 then responds to queries from the client until the client closes the connection.

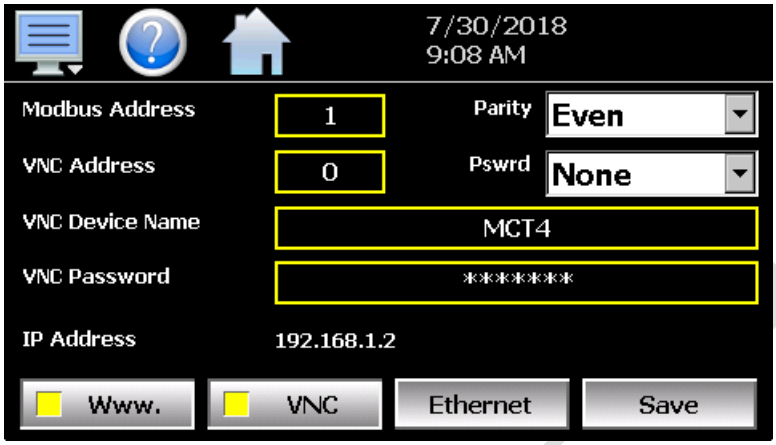
For a client to establish a connection with the MCT4, the following settings must be used by the client:

IP address (of slave) =	MCT4 IP address as displayed on the Communications screen
Unit Identifier =	MCT4 Modbus Address as displayed on the Communications screen.
Port Number =	502

NOTE: *The implementation and/or use of a Modbus TCP client is outside the scope of this manual. For additional information regarding Modbus TCP/IP protocol there are many resources available online (http://www.modbus.org/specs.php) or consult the documentation provided with your client software application.*

For a list of supported functions and data available over the Modbus TCP interface, see Appendix section A.1 Modbus Communications.

The MCT4 serial interface uses Modbus RTU protocol. Any device used to communicate with the MCT4 over the serial interface must use this protocol. The interface can be configured to operate in either standard MCT4 mode or a simulated Watlow F4S/D mode.



When configured for the standard MCT4 interface, the communication address and parity can be set on the Web/Modbus/VNC. All other communication settings are fixed. The port settings of the device used to communicate with MCT4 must be set to match for the communications to take place.

Address:	1-247 (user selectable)
Baud Rate:	9600
Data Bits:	8
Stop Bits:	1
Parity:	None, Odd, Even (user selectable)

When configured for the simulated Watlow F4S/D interface, only the communications address can be set. The parity setting is hidden and defaulted to “None” to be compatible with WatView software or other devices used to communicate with a Watlow F4S/D controller. The port settings of the device used to communicate with MCT4 must be set to match the standard F4 settings as follows:

Address:	1-247 (user selectable)
Baud Rate:	19200
Data Bits:	8
Stop Bits:	1
Parity:	None

The Modbus address is used to identify the MCT4 on the serial link. When a multi-drop connection is used, each controller on the link must have a different address so that each one can be identified separately. If two or more MCT4 controllers have duplicate addresses, communications with those controllers will fail because they will each try to respond to the same message. For single MCT4 connections, the address only needs to match that of the commands being sent from the host device.

IMPORTANT: *See Appendix section A.1 Modbus Communications for details on the available data and functions supported when using either the MCT4 or simulated Watlow F4S/D interface as functionality of the Watlow F4S/D interface is limited to features compatible with the MCT4 controller.*

ALARM CODES AND TROUBLESHOOTING

This section provides explanations of standard MCT4 alarms to help in diagnosing and resolving the alarm conditions. Note that the information provided here covers standard alarms only, and not alarms configured by Darwin Chambers. If you are unable to diagnose a problem using this guide, contact Darwin Chambers for further assistance.

Some of the troubleshooting procedures may require access to live circuitry. Dangerous accidental contact with line voltage may be possible. Only qualified service personnel should be allowed to perform these procedures.

Alarm Monitor Description	Explanation/Corrective Action
"tagname" A to D converter failure	(error code 40) Indicates that the analog to digital converter in the loop or limit control indicated by "tagname" has failed. Return to factory for repair or replace. If the MCT4 is running a ramp/soak program when this alarm occurs, the program will be terminated if it occurs on either **Loop 1 or ***Loop 2. If the alarm occurs on ***Loop 3, the program will continue operation.
Auto tune failed for "tagname".	(error code 26) Indicates that auto tune was unable to execute properly for the loop control indicated by "tagname". Verify that PB >0 and TI>0 before starting auto tune. Try manual tuning instead of auto tuning if the process has a very slow response.
"tagname" cold junction failure	(error code 30) Indicates that the cold junction compensation in the loop or limit control indicated by "tagname" has failed. Return to factory for repair or replace.
Communications error with "tagname". Check cable.	Communication error occurred between the MCT4 base unit and installed PCM/HLM indicated by "tagname". Verify that the PCM/HLM is properly installed in the base unit. Replace PCM/HLM card.
Data file error. SD card full or missing.	Indicates that data logging could not be started or has been stopped due to an issue in accessing the SD memory card. This will occur if the memory card does not have any remaining memory space available or the maximum number of files has been reached in the data log directory. Use the USB file utilities or FTP to backup (copy) and delete data files from the MCT4 to free up memory. Verify that an SD card is properly inserted into the MCT4. Replace SD card.
"tagname" EEPROM failure	(error code 29) Indicates that the memory in the loop or limit control indicated by "tagname" has failed. Return to factory for repair or replace.
Email Error! Check cable or server down.	Indicates that the MCT4 was unable to send an alarm message through the mail server. Verify that the MCT4 is properly connected to the network and that the email settings and addresses are valid.
FTP! Check cable or server down.	Indicates that the FTP back-up attempt of the data files failed. Verify that the MCT4 is properly connected to the network and that the FTP settings are valid. If the MCT4 is not connected to a network, disable the FTP data back-up to prevent this alarm from occurring.

Alarm Monitor Description	Explanation/Corrective Action
Memory Error Please check SD card.	Indicates that the SD card cannot be accessed when checking available memory space. Verify that an SD card is properly inserted into the MCT4. Replace SD card.
NTP Ping Failed. Check Cable.	Indicates that the MCT4 was unable to synchronize its clock with the selected time server. Verify that the MCT4 is properly connected to the network and the selected time server is accessible. If the MCT4 is not connected to a network, disable the NTS clock to prevent this alarm from occurring.
"tagname" outputs 1 and 2 incorrectly configured.	(error code 4) Indicates that the control loop configuration for the loop control indicated by "tagname" is not valid and must be corrected to clear the alarm. Check and correct setup values of output 2, PB, TI and output 1. If output 2 is required for cooling control, the control should use PID mode (PB > 0, TI > 0) and output 1 should use reverse mode (heat action), otherwise, do not use output 2 for cooling control.
Program run error. "**Loop 1" and "***Loop 2" are not synchronized.	Alarm applies to dual and triple loop MCT4 systems only and indicates that the running program (in each loop control) is operating with a difference of more than 1 minute between the programmed steps. **NOTE:** This alarm does not affect program operation. To clear the alarm, the program will have to be stopped. If the alarm will not clear, but the program indicates it is off, select "Stop" from the Program menu and then try to clear the alarm again. The timing accuracy of the MCT4 loop controls is ±30 seconds per month. This may cause one loop control to execute the program slightly faster than the other. For programs with long term operation, weeks, or months, one loop may get significantly ahead of the other causing it to begin its next ramp or soak step ahead of the other affecting product or test results. Verify that the program end set point configuration for each loop is set to the same function. Verify that the event input functions (if used) are configured for the same function when program control functions are used.
SD card damaged or missing.	Indicates that the SD card cannot be accessed for USB file transfer. Verify that an SD card is properly inserted into the MCT4. Replace SD card.
SD card filled. Please use USB file transfer.	Indicates that a file was unable to be written due to lack of available free space on the memory card. Use the USB file utilities or FTP to backup (copy) and delete alarm, audit, and data files from the MCT4 to free up memory. Can also occur if the SD card is missing/not properly inserted.

Alarm Monitor Description	Explanation/Corrective Action
"tagname" sensor break	Check sensor wiring for the loop or limit control indicated by "tagname". Verify lead connections. If sensor requires power, verify power to sensor. If the MCT4 is running a ramp/soak program when this alarm occurs, the program will be terminated if it occurs on either **Loop 1 or ***Loop 2. If the alarm occurs on ***Loop 3, the program will continue operation.

Appendix

A.1 Modbus Communications

The MCT4 utilizes Modbus as its standard protocol and offers both Modbus RTU serial and Modbus TCP forms. This section provides information on the supported functions and data available over the Modbus interface. It is assumed that the user is already familiar with Modbus protocol and has a basic understanding of its implementation and use. For additional information and support, modbus.org (http://modbus.org/tech.php) provides an abundance of technical documents, standards, and support applications.

Listed below are a few of the more common software packages that claim to support Modbus protocol. This list is provided as informational only. Contact the software manufacturer for more information on applying their software.

LabView by National Instruments
11500 N Mopac Expwy
Austin, TX 78759-3504
Phone 800-683-8411
http://www.natinst.com

Wonderware by Wonderware
26561 Rancho Pkwy. South
Lake Forest, CA 92630
Phone 949-727-3200
http://www.wonderware.com

SpecView by SpecView Corporation
13409 53rd Ave NW
Gig Harbor, WA 98332
Phone 253-853-3199
http://www.specview.com

A.1.1 Supported Function Codes

Modbus bases its data model on a series of tables, each of which defines a particular range of values. In the case of the MCT4, all data is contained within the Holding Register data table. This means that all communication transactions between the MCT4 and the master (client) are performed using three command types. These include Read Holding Registers, Write Single Register and Write Multiple Registers.

		Function Codes	
		code	(hex)
16 bits access (word)	Read Holding Registers	03	03
	Write Single Register	06	06
	Write Multiple Registers	16	10

Function code 03 (read holding registers) is used to read the contents of a contiguous block of data registers from the MCT4. The request from the master specifies the starting register address and the number of

registers. The response message from the MCT4 contains the value of each register requested (two bytes per register).

Function code 06 (write holding register) is used to write to a single data register in the MCT4. The request from the master specifies the address of the register to be written and the value. The response message from the MCT4 is an exact duplicate of the sent message (if completed successfully).

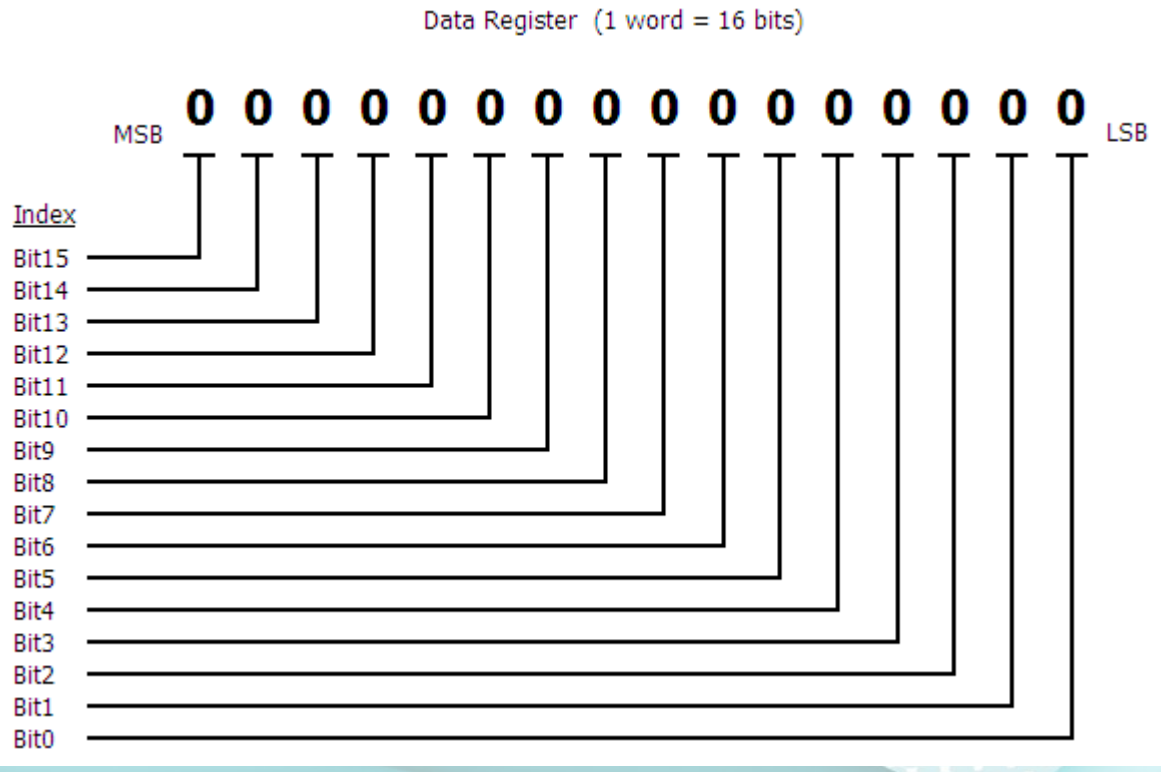
Function code 16 (write multiple registers) is used to write to a contiguous block of data registers in the MCT4. The request from the master specifies the starting register address to be written, the number of registers to write and two bytes of data for each register. The normal response message from the MCT4 returns the function code, starting address and quantity of data registers written.

A.1.2 MCT4 Data Registers (Standard Interface)

Some of the values contained in the MCT4 register base contain bit-oriented values. This means that each bit of the word indicates an on/off status for a specific setting or condition. When handling these values, it is recommended that the word be converted to its binary equivalent.

By converting the value to its binary equivalent, it produces a Boolean array of true [bit on (1)] and false [bit off (0)] values. This allows each bit to be examined individually. In the same manner, creating a Boolean array of 16 bits produces an equivalent hexadecimal value that can be sent to the MCT4 to set a control register.

For this manual, parameters defined as bit oriented will have the function of each bit associated with the bit's index number in the data word. The index number is equal to that of a typical array function. Thus, an index number of zero, selects the first bit in the word (LSB). An index number of 1 selects the second bit in the word, and so on. This helps eliminate offset selection errors that may occur when coding software and using array functions to select which bit in the word that is required for examination.



Adhere to the following lists of registers and their allowable data ranges. DO NOT attempt to write to any other register number than those listed. DO NOT write to registers that are for options your controller does not have. Failure to adhere to this requirement can result in erratic control and/or damage to equipment.

All register numbers are listed in relative values. To convert to absolute values, add 400001.

A.1.2.1 Control Registers

Register Address		Parameter Description	Data*A	Range *B		*C
			Type	Low	High	Unit
0	**(0x0000)**	System Offline/Busy Status	R	*B1	*B1	-
1	**(0x0001)**	Alarm Reset	R/W	0	1	-
2	**(0x0002)**	Automatic Program Out of Sync Alarm	R	0	1	-
3	**(0x0003)**	Loop Communication Alarm Status	R	*B2	*B2	-
4	**(0x0004)**	Loop Control Error Status	R	*B3	*B3	-
5	**(0x0005)**	Process Alarm Status	R	*B4	*B4	-
6	**(0x0006)**	Process Alarm Status	R	*B4	*B4	-
7	**(0x0007)**					
8	**(0x0008)**					
9	**(0x0009)**	Control Loop Manual Override	R/W	*B5	*B5	-
10	**(0x000A)**	Control Loop Autotune Activation	R/W	*B6	*B6	-
11	**(0x000B)**	**RESERVED** – DO NOT write to register				
12	**(0x000C)**	System Events	R/W	*B7	*B7	-
13	**(0x000D)**					
14	**(0x000E)**	Automatic Program Start Step Number	R/W	1	64	-
15	**(0x000F)**	Automatic Program Operating Status	R/W	*B8	*B8	-
16	**(0x0010)**	Program Name Characters 1 & 2	R	*B9	*B9	-
17	**(0x0011)**	Program Name Characters 3 & 4	R	*B9	*B9	-
18	**(0x0012)**	Program Name Characters 5 & 6	R	*B9	*B9	-
19	**(0x0013)**	Program Name Characters 7 & 8	R	*B9	*B9	-
20	**(0x0014)**	Program Name Characters 9 & 10	R	*B9	*B9	-
21	**(0x0015)**	Program Name Characters 11 & 12	R	*B9	*B9	-
22	**(0x0016)**	Program Name Characters 13 & 14	R	*B9	*B9	-
23	**(0x0017)**	Current Program Step	R	1	64	-
24	**(0x0018)**	Total Number of Steps	R	1	64	-
25	**(0x0019)**	Total Time of Step	R	0	99.59	-
26	**(0x001A)**	Time Remaining in Step	R	0	99.59	-
27	**(0x001B)**	Cycles Remaining for Current Jump Loop	R	1	10000	-

Register Address		Parameter Description	Data*A	Range *B		*C
			Type	Low	High	Unit
28	**(0x001C)**					
29	**(0x001D)**					
30	**(0x001E)**					
31	**(0x001F)**	**Loop 1 Target Setpoint for Current Step	R	-32768	32767	*C1
32	**(0x0020)**	***Loop 2 Target Setpoint for Current Step	R	-32768	32767	*C1
33	**(0x0021)**					
34	**(0x0022)**					
35	**(0x0023)**	**Loop 1 Process Variable (PV)	R	-32768	32767	*C1
36	**(0x0024)**	**Loop 1 Setpoint (SP)	R/W	-32768	32767	*C1
37	**(0x0025)**	**Loop 1 Percent Output (%Out)	R/W	-100.00	100.00	%
38	**(0x0026)**	**Loop 1 Operational Status	R	*B10	*B10	-
39	**(0x0027)**	**Loop 1 Error Code	R	*B11	*B11	-
40	**(0x0028)**	***Loop 2 / Limit Process Variable (PV)	R	*B12	*B12	*C1
41	**(0x0029)**	***Loop 2 Setpoint (SP)	R/W	-32768	32767	*C1
42	**(0x002A)**	***Loop 2 Percent Output (%Out)	R/W	-100.00	100.00	%
43	**(0x002B)**	***Loop 2 / Limit Operational Status	R	*B10	*B10	-
44	**(0x002C)**	***Loop 2 / Limit Error Code	R	*B11	*B11	-
45	**(0x002D)**	***Loop 3 / Limit Process Variable (PV)	R	*B12	*B12	*C1
46	**(0x002E)**	***Loop 3 Setpoint (SP)	R/W	-32768	32767	*C1
47	**(0x002F)**	***Loop 3 Percent Output (%Out)	R/W	-100.00	100.00	%
48	**(0x0030)**	***Loop 3 / Limit Operational Status	R	*B10	*B10	-
49	**(0x0031)**	***Loop 3 / Limit Error Code	R	*B11	*B11	-
50	**(0x0032)**					
51	**(0x0033)**	Alarm 1 Setpoint	R/W	*B13	*B13	*C1
52	**(0x0034)**	Alarm 2 Setpoint	R/W	*B13	*B13	*C1
53	**(0x0035)**	Alarm 3 Setpoint	R/W	*B13	*B13	*C1
54	**(0x0036)**	Alarm 4 Setpoint	R/W	*B13	*B13	*C1
55	**(0x0037)**	Alarm 5 Setpoint	R/W	*B13	*B13	*C1
56	**(0x0038)**	Alarm 6 Setpoint	R/W	*B13	*B13	*C1
57	**(0x0039)**	Alarm 7 Setpoint	R/W	*B13	*B13	*C1
58	**(0x003A)**	Alarm 8 Setpoint	R/W	*B13	*B13	*C1
59	**(0x003B)**	Alarm 9 Setpoint	R/W	*B13	*B13	*C1
60	**(0x003C)**	Alarm 10 Setpoint	R/W	*B13	*B13	*C1
61	**(0x003D)**	Alarm 11 Setpoint	R/W	*B13	*B13	*C1
62	**(0x003E)**	Alarm 12 Setpoint	R/W	*B13	*B13	*C1
63	**(0x003F)**	Alarm 13 Setpoint	R/W	*B13	*B13	*C1

Register Address	Parameter Description	Data*A	Range *B		*C
		Type	Low	High	Unit
64 **(0x0040)**	Alarm 14 Setpoint	R/W	*B13	*B13	*C1
65 **(0x0041)**	Alarm 15 Setpoint	R/W	*B13	*B13	*C1
66 **(0x0042)**	Alarm 16 Setpoint	R/W	*B13	*B13	*C1
67 **(0x0043)**	Alarm 17 Setpoint	R/W	*B13	*B13	*C1
68 **(0x0044)**	Alarm 18 Setpoint	R/W	*B13	*B13	*C1
69 **(0x0045)**	Alarm 19 Setpoint	R/W	*B13	*B13	*C1
70 **(0x0046)**					
71 **(0x0047)**	**Loop 1 Input Units	R	*B14	*B14	-
72 **(0x0048)**	***Loop 2 / Limit Input Units	R	*B14	*B14	-
73 **(0x0049)**	***Loop 3 / Limit Input Units	R	*B14	*B14	-

Notes:

*A R/W Specifies readable / writable data, R specifies read only data and W specifies a write only control value.

*B The range of certain parameters are dependent upon system options. Consult the following range tables for information regarding the use of these parameters.

Reading bit-oriented parameters

The value contained in these parameters is dependent upon the combination of "on" bits (1). Therefore, only the individual status of each bit has meaning, not the value of the parameter.

Setting bit-oriented parameters

The value that must be written to these parameters is dependent upon the combination of "on" bits. Therefore, it is necessary to know the current value of the parameter before setting it so that only the bit status you want to update is changed. Otherwise, sending a value derived from only the bit you wish to set will turn off all other functions related to the other bits in the parameter.

*B1

Parameter Value	Description
0	MCT4 is Online
1	Offline/Program Download in Progress

The status of this register should be used for information only, as a means of determining if the system is ready for operation.

*B2

Parameter Value	Description

Note: *If a bit is on, check the corresponding loop / limit communication wiring/settings to determine the cause for the alarm.*

For Bit1 and Bit2, the device associated with the error is dependent upon the system configuration. If the MCT4 is a single loop control with the limit installed, Bit1 will represent an error code on the limit control. If the MCT4 has two control loops configured, Bit1 will represent an error on loop 2 while Bit2 represents an error on the limit control.

Bit0	**Loop 1 Communications Error
Bit1	***Loop 2 / Limit Communications Error
Bit2	***Loop 3 / Limit Communications Error
Bit3 – Bit15	Not Assigned

*B3

Parameter Value	Description
Bit0	**Loop 1 Control Error
Bit1	***Loop 2 / Limit Control Error
Bit2	***Loop 3 / Limit Control Error
Bit3 – Bit15	Not Assigned

Note: *If a bit is on, check the corresponding loop / limit operational status register to determine the cause for the alarm.*

For Bit1 and Bit2, the device associated with the error is dependent upon the system configuration. If the MCT4 is a single loop control with the limit installed, Bit1 will represent an error code on the limit control. If the MCT4 has two control loops configured, Bit1 will represent an error on loop 2 while Bit2 represents an error on the limit control.

*B4

Parameter Value	Description
Bit0	Alarm 1 Active
Bit1	Alarm 2 Active
Bit2	Alarm 3 Active
Bit3	Alarm 4 Active
Bit4	Alarm 5 Active
Bit5	Alarm 6 Active
Bit6	Alarm 7 Active
Bit7	Alarm 8 Active
Bit8	Alarm 9 Active
Bit9	Alarm 10 Active
Bit10	Alarm 11 Active
Bit11	Alarm 12 Active
Bit12	Alarm 13 Active
Bit13	Alarm 14 Active
Bit14	Alarm 15 Active
Bit15	Alarm 16 Active

Note: *Alarms 1 through 16 are indicated in register 5. The number of alarms available in the system is dependent upon the configuration.*

Parameter Value	Description
Bit0	Alarm 17 Active
Bit1	Alarm 18 Active

Note: *Alarms 17 through 19 are indicated in register 6. The register will be used to indicate alarm active status only when more than 16 alarms are configured.*

Bit2	Alarm 19 Active
Bit3 – Bit15	Not Assigned

*B5

Note: *When loop is in manual mode, the loop percentage of output can be set by writing to the corresponding loop percent output register.*

Parameter Value	Description
Bit0	**Loop 1 Manual Mode
Bit1	***Loop 2 Manual Mode
Bit2	***Loop 3 Manual Mode
Bit3 – Bit15	Not Assigned

*B6

Note: *Auto tune may not be available depending upon the loop configuration. If auto tune operation is not available, the bit for the loop will automatically turn off after being set.*

When auto tune completes normally, the bit for the loop will automatically turn off indicating that tune is complete. To terminate an auto tune in progress, turn off the bit for the desired loop.

Parameter Value	Description
Bit0	**Loop 1 in Auto Tune
Bit1	***Loop 2 in Auto Tune
Bit2	***Loop 3 in Auto Tune
Bit3 – Bit15	Not Assigned

*B7

Note: *Not all system events may be available on your system. Event names and functions are defined by system configuration. Consult your system documentation or contact Darwin Chambers for information on event use.*

Parameter Value	Description
Bit0	Event 1
Bit1	Event 2
Bit2	Event 3
Bit3	Event 4
Bit4	Event 5
Bit5	Event 6
Bit6	Event 7
Bit7	Event 8
Bit8	Event 9
Bit9 – Bit15	Not Assigned

*B8

Parameter Value	Description
0	Automatic Program Start (On)
1	Automatic Program Hold
2	Automatic Program Halt (Off)

*B9

Parameter Value	High Order Byte	Low Order Byte	Description
Range Low	32	32	Program Name Character (ASCII Table)
Range High	126	126	Program Name Character (ASCII Table)

See the ASCII character chart in Section 3.1 for the character representation of these values.

Example

Read command of registers 16 to 22 from the MCT4 returns the following values:

Register Values:	0x74	53	0x72	6F	0x20	65	0x65	54	0x74	73	0x20	20	0x20	20
ASCII Equivalent:	t	S	r	o		e	e	T	t	s				

Assemble the ASCII characters in order from low to high byte starting with register 16 to assemble the automatic program name: “Store Test”. Note that null characters are not used in the program name. A space (0x20) will be used is used in place of a null character to maintain the 14-character name length if the program name is not 14 characters long.

*B10

Parameter Value	Description
Bit0	Program Run Mode / Limit Ou1
Bit1	Program Hold Mode / Limit Out2
Bit2	Static Mode
Bit3	Auto Tune Mode
Bit4	Manual Mode
Bit5	Off Mode
Bit6	Failure Transfer
Bit7	Automatic Program Ramp Up
Bit8	Automatic Program Ramp Down
Bit9	Automatic Program Soak
Bit10	Alarm 1 Active
Bit11	Alarm 2 Active
Bit12	Alarm 3 Active
Bit13	Event 1 On
Bit14	Event 2 On
Bit15	Event 3 On

*B11

Parameter Value	Description
0	No Error
4	Illegal Setup Values
10	Comm Error – Bad Function Code
11	Comm Error – Register Out of Range
14	Comm Error – Write Read Only Data
15	Comm Error – Out of Range Data
25	Holdback Time Out
26	Auto Tune Error
27	Input Type Requires Calibration
29	EEPROM Error
30	Cold Junction Failure
39	Sensor Break
40	A to D Failure

Note: *The "alarm active" and "event on" status bits cannot be used for determining alarm or event status. The alarm and event activation are based upon loop configuration. To monitor alarm and event status, use registers 5 and 12 respectively.*

*For **limit controls**, only Bit0 and Bit1 are used. The bits represent the active state of the limit output. When the bit is on (1), the output is on. When the bit is off (0), the output is off. Under normal conditions Bit0 will be on indicating a non-limit condition. The status of Bit1 is dependent upon the alarm configuration of output 2.*

Note: *The process value for loop controls is read directly as a short, i.e., a 16-bit signed integer with the range of -32768 to 32767.*

*For the **limit control**, the process value is read as an unsigned integer, i.e., a 16-bit unsigned integer with a range of 0 to 65535. In order to convert the value, read to the actual process value, subtract 19999 from the value read from the limit control. This results in a value of -19999 to 45536.*

*B12

Parameter Value	Range Low	Range High
Loop PV	-32768	32767
Limit PV	-19999	45536

*B13

Parameter Value	Input Units	Range Low	Range High
Loop Alarm SP	Deg C	-18000	18000
	Deg F	-32768	32767
	Process	-32768	32767
Limit Alarm SP	Deg C	-11280	25120
	Deg F	-19999	45536
	Process	-19999	45536

Note: *The alarm set point value for loop controls is read/written directly as a short, i.e., a 16-bit signed integer with the range of -32768 to 32767.*

*For the **limit control**, the alarm set point value is read/written as an unsigned integer, i.e., a 16-bit unsigned integer with a range of 0 to 65535. In order to convert the value, read/written to the limit control to the proper display value, subtract 19999 from the value read or add 19999 to the value prior to writing it. This results in a value within the overall range of -19999 to 45536.*

Note: *When the loop or limit input type is linear (process units), the units of measure are based on the OEM configuration.*

*B14

Parameter Value	Description
0	Centigrade
1	Fahrenheit
2	Process Units

*C1 The units of measure and range of a loop or limit control is dependent upon the configuration of the input and/or the units of temperature selection (Celsius or Fahrenheit) of the MCT4. The decimal point position for the loop or limit input is an implied value based on the configuration of the input. Thus, a register value of 345 can represent an actual process value of 345, 34.5, 3.45 or 0.345 depending upon the decimal point configuration of the loop or monitor input.

A.1.2.2 Automatic Program Registers

The automatic program parameters are a separate group of registers that are used to load programs into the MCT4. The way the program steps are configured and sent to the MCT4 is specific and must be followed exactly.

Each program step consists of 14 data registers. The program must be written one step at a time, using a multiple write command (0x10) to write the data for all 14 registers at once. This allows programs to be stored as two-dimensional arrays, of which code can be written to simply index through the array step-by-step and transmit the program file to the MCT4.

The first 14 registers of the program contain specific settings related to the program. These include hold back limits, ramp units, dwell units, the program name, and the length of the program (number of steps).

Register Address		Parameter Description	Data *D	Range *E		*F
			Type	Low	High	Unit
100	**(0x0064)**	Hold Back Limit **Loop 1	W	*E1	*E1	PV
101	**(0x0065)**					
102	**(0x0066)**	Ramp Units	W	*E2	*E2	-
103	**(0x0067)**	Dwell Units	W	*E3	*E3	-
104	**(0x0068)**	Hold Back Limit ***Loop 2	W	*E1	*E1	PV
105	**(0x0069)**					
106	**(0x006A)**	Total Number of Steps	W	1	64	-
107	**(0x006B)**	Program Name (Chars 1 & 2)	W	*E4	*E4	-
108	**(0x006C)**	Program Name (Chars 3 & 4)	W	*E4	*E4	-
109	**(0x006D)**	Program Name (Chars 5 & 6)	W	*E4	*E4	-
110	**(0x006E)**	Program Name (Chars 7 & 8)	W	*E4	*E4	-
111	**(0x006F)**	Program Name (Chars 9 & 10)	W	*E4	*E4	-
112	**(0x0070)**	Program Name (Chars 11 & 12)	W	*E4	*E4	-
113	**(0x0071)**	Program Name (Chars 13 & 14)	W	*E4	*E4	-

The following 14 registers of the automatic program contain the data for step 1 of the program.

Register Address		Parameter Description	Data *D	Range *E		*F
			Type	Low	High	Unit
114	**(0x0072)**	Step Number*	W	0	63	-
115	**(0x0073)**	Step Type	W	*E5	*E5	-
116	**(0x0074)**	Ramp Target Setpoint **Loop 1	W	-32768	32767	PV
117	**(0x0075)**	Ramp Time or Ramp Rate	W	0	5999	-
118	**(0x0076)**	Event Selections 1, 2, 3	W	*E6	*E6	-
119	**(0x0077)**	Holdback Type **Loop 1	W	*E7	*E7	-
120	**(0x0078)**	Dwell Time	W	0	9999	-
121	**(0x0079)**	Jump Step	W	0	63	-
122	**(0x007A)**	Jump Cycles	W	1	9999	-
123	**(0x007B)**	Final Setpoint **Loop 1	W	-32768	32767	PV
124	**(0x007C)**	Ramp Target Setpoint ***Loop 2	W	-32768	32767	PV
125	**(0x007D)**	Event Selections 4, 5, 6	W	*E8	*E8	-
126	**(0x007E)**	Holdback Type ***Loop 2	W	*E7	*E7	-
127	**(0x007F)**	Final Setpoint ***Loop 2	W	-32768	32767	PV

*The **Step Number** must be offset by 1 when writing step data to the MCT4. Steps 1-64 will be sent with the step number as a value of 0-63 (-1 offset).

All remaining steps of the program follow the same format and data structure as is represented for step one above. Up to the following 882 registers are used to contain the additional step data of the program as required for steps 2 through 64. Since few if any programs will contain the maximum of 64 steps, it is only necessary to write the step data for the number steps used in the automatic program.

128 (0x0080) – 141 (0x008D) Program Step 2 Data Registers
142 (0x008E) – 155 (0x009B) Program Step 3 Data Registers
156 (0x009C) – 169 (0x00A9) Program Step 4 Data Registers
170 (0x00AA) – 183 (0x00B7) Program Step 5 Data Registers
184 (0x00B8) – 197 (0x00C5) Program Step 6 Data Registers
198 (0x00C6) – 211 (0x00D3) Program Step 7 Data Registers
212 (0x00D4) – 225 (0x00E1) Program Step 8 Data Registers
226 (0x00E2) – 239 (0x00EF) Program Step 9 Data Registers

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through

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996 (0x03E4) – 1009 (0x03F1) Program Step 64 Data Registers

Notes:

*D W Specifies write only data.

*E1

Parameter Value	Temperature Units °C	Temperature Units °F	Process Units
Range Low	0	0	0
Range High	555	999	999

*E2

Parameter Value	Description
0	Hours and Minutes
1	Minutes and Seconds
2	Units/Minute
3	Units/Hour

Note: *DO NOT use ramp units of units/minute or units/hour on a dual loop system. Since step time is defined by the ramp rate and the change in set point, the program will get out of sync between each loop causing an automatic program run error.*

*E3

Parameter Value	Description
0	Hours and Minutes
1	Minutes and Seconds

*E4 See note *B9 in Section 5.1 for information on the range of this parameters.

*E5

Note: *The last step of an automatic program must be an end step. If the last step is not an end step, the program will not run correctly and/or a program download error will occur and the program will not operate.*

Parameter Value	Description
0	Ramp
1	Soak
2	Jump
3	End

*E6

Parameter Value	Description
Bit0	Event 1
Bit1	Event 2
Bit2	Event 3
Bit3 – Bit15	Not Assigned

Note: *The available system events are based on the configuration of the MCT4. Only event outputs configured on loops 1 and 2 can be controlled via the program. Any events configured to loop 3 outputs will not function during program operation.*

*E7

Parameter Value	Description
0	Holdback Disabled
3	Deviation Band Holdback

*E8

Parameter Value	Description
Bit0	Event 4
Bit1	Event 5
Bit2	Event 6
Bit3 – Bit15	Not Assigned

Note: *The available system events are based on the configuration of the MCT4. Only event outputs configured on loops 1 and 2 can be controlled via the program. Any events configured to loop 3 outputs will not function during program operation.*

*F The unit PV means that the unit of the parameter is the same as the unit of PV (the loop configuration).

Use caution when loading an automatic program to the MCT4. You must ensure that the decimal point scaling and units of measurement in the program match the loop configuration. Loading a program with a temperature set point of 80 will result in a control temperature of 8.0°F if the MCT4 control is in degrees Fahrenheit with a decimal resolution of 1 for the loop control. However, if the MCT4 is set for degrees Centigrade with a decimal resolution of 0 for the loop control, it will result in a control temperature of 80°C (176°F).

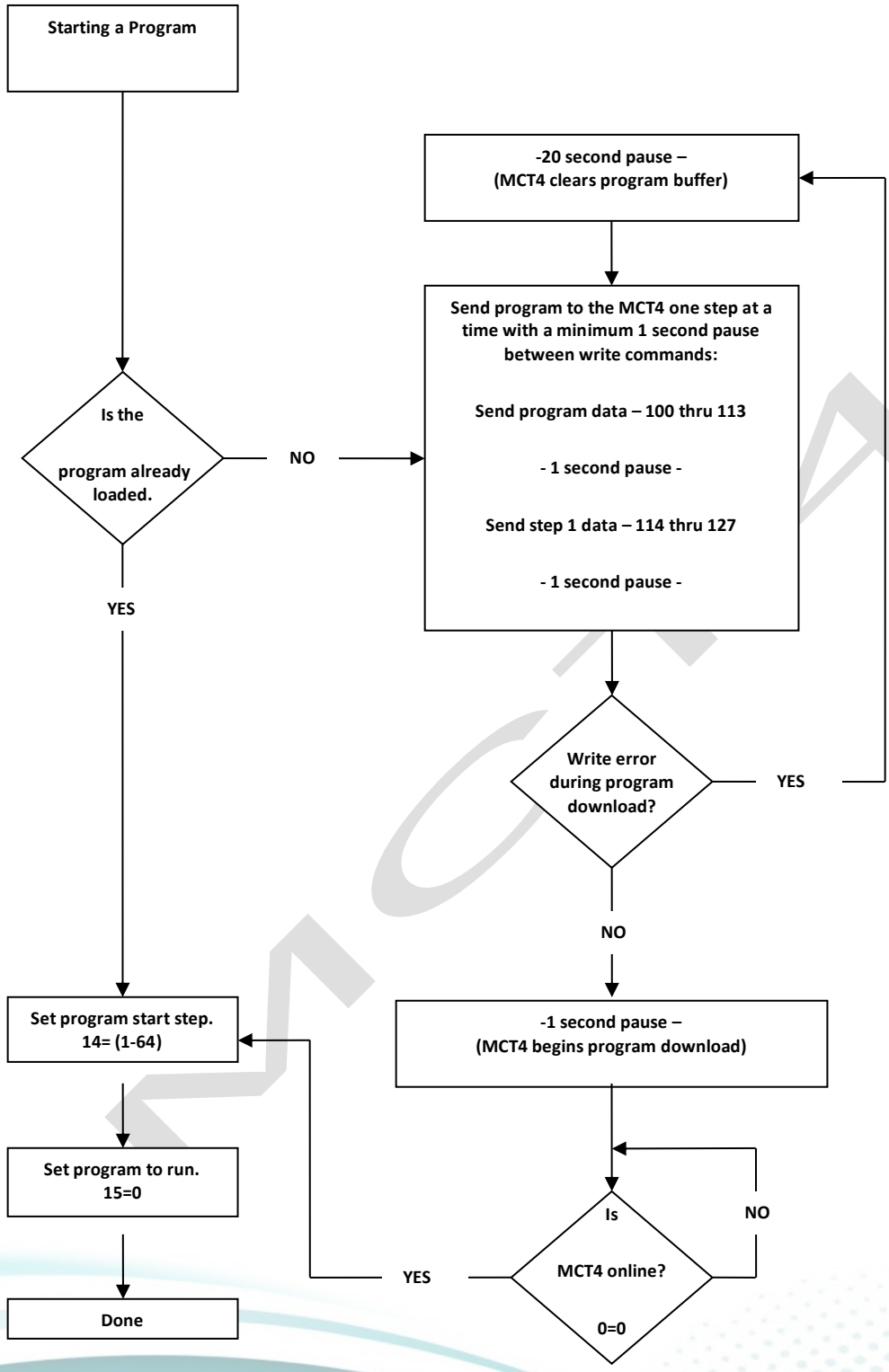
A.1.2.3 Starting an Automatic Program

Automatic programs are sent to the MCT4 in a step-by-step process. The download sequence must be followed in proper order and must complete without errors to be valid. If a write error is detected during the

transfer of a program from a PC to the MCT4 (no response from MCT4 or NACK returned), the program download must be aborted and restarted.

The MCT4 is automatically placed into program transfer mode when the first group of registers containing the program specific data is sent (registers 100-113). The MCT4 then begins looking for the number of steps of the program to be sent as was set in register 106. As each step is received, it increments the count. Once all steps have been received, the MCT4 downloads the program to the loop control program memory. During this transfer, register 0 will be set to 1 to indicate that the process is taking place. Once the register value returns to zero, the automatic program is ready to be started.

If an error occurs during the transfer process from the PC to the MCT4, the program transfer process should be stopped at the PC. The data sent to the MCT4 was either corrupted in transmission or not received properly. It is not possible to resend the failed step because it is not known if any of the previous data was received by the MCT4 properly. On the transmission error, the MCT4 will enter a 15 second timeout process. At the end of the timeout period, the buffer will be cleared, and the program can be resent. To ensure that the new download begins properly, induce a 20 second wait period on the host PC after the failed transmission attempt to ensure that enough time has elapsed.


Starting a Program
-20 second pause –
(MCT4 clears program buffer)
Send program to the MCT4 one step at a time with a minimum 1 second pause between write commands:
Send program data – 100 thru 113
- 1 second pause -
Send step 1 data – 114 thru 127
- 1 second pause -
Is the
program already loaded.
NO
YES
Write error during program download?
YES
NO
Set program start step.
14= (1-64)
-1 second pause –
(MCT4 begins program download)
Set program to run.
15=0
Is
MCT4 online?
0=0
NO
YES
Done

A.2 FTP, FileWeb, DataWeb Requirements/Installation

A.2.1 Introduction

The following describes the system requirements and components for the FDC Cloud service and website. The FDC cloud service provides the ability to upload data from FDC devices to cloud storage for backup and/or further analysis. The website provides the ability to verify data, uploads, and to manage users.

A.2.2 System Overview

There are four server components: the data transfer service (FDDataService), the website (FDDataWeb), the FTP server, and a MySQL database. FDDataService and FDDataWeb are Microsoft .Net services and use Microsoft Internet Information Services (IIS) as a web platform. The MySQL (Can be SQL, Oracle, etc.) database stores user configuration information as well as providing cloud data storage if desired.

A.2.3 System Requirements

A Microsoft Windows server is required, with the following minimum capabilities:

- Windows Server 2008 or greater
- 2 GB RAM or greater
- 2 Cores or greater
- 40GB Storage or greater (this will vary depending on the user's expected uploads)
- .Net framework version 4.5 or greater
- MySQL 5.6 or greater

The server should be setup to provide the web server role.

A.2.4 FDC Cloud "Server" Services

Future Design Controls does not provide direct support or hosting services; however, third party support is available from our partner ***Mooseworks Software*** which can provide:

1. Complete site and installation without hosting charges (includes FDC site with custom banner, site setup, all code/data model definitions and manual). User provides the server and hosting credentials including domain name and https certificate.
2. Purchase of #1 above with hosting using Amazon Web Services (AWS). AWS T2 small server with 30GB storage. User provides the domain name and https certificate. Support cost on a yearly basis.
3. Purchase of #1 above with no hosting but support of client server at customer facility or customer selected location. Support cost on a yearly basis for web service and application.
4. DIY documentation – interface/data model definitions and server setup directions. DIY experience recommendations include installation and configuration of web servers, web services, SQL language and HTML/.NET code. Support packages for DIY documentation can be purchased in 5-, 10- and 25-hour increments.
    - Custom development services:
        - Fixed pricing available for well-defined systems.
        - Time and material options available for less defined, continuous engagements.

For more information, please see the MCT Cloud Services document or contact FDC support for assistance.

A.3 Profile Recovery Detail

The following will provide a detailed explanation of program recovery operation for the MCT4.

Program Power Recovery

1. Static Mode

When power is cycled the program will be terminated. The current control set point and manual events will return to the previous static set point and event activation that were used prior to the program being started.

2. Continue From SP

When power is cycled the program will resume operation in the same step with the same event activation and step time that were present at the time of power interruption. The accuracy of time recovery will be from the beginning of each step and every 6 minutes into the step. The set point; however, is dependent upon step type.

a. When recovery occurs on a ramp step, the set point and time remaining in the step will return to the values at the last save interval. If less than 6 minutes into the step, the step will resume from the beginning of the step. If more than 6 minutes into the step, the step will return to the last 6-minute interval that elapsed (from the beginning of the step) and resume from the set point and time remaining at that moment the save occurred.
b. When recovery occurs on a soak step, the time remaining in the step will return to the last save interval. If less than 6 minutes into the step, the step will resume from the beginning of the step. If more than 6 minutes into the step, the step will return to the last 6-minute interval that elapsed (from the beginning of the step) and resume from the time remaining at that moment the save occurred.

   The set point will return to the programmed soak set point, i.e., the set point of the previous ramp step in the program. If a program is started on a soak step, the set point is defined by the "setpoint at start of automatic program setting." However, on recovery, the set point is defined by the programmed set point which may be different from the original soak set point at the start of the program.

   Example: A program is started on step 2 which is a soak step. The "current control setpoint" (static set point) is chosen as the starting program set point. If the static set point is 25, the program will begin and soak at the set point of 25. On power recovery, the set point will go to the set point defined by the program, so if step 1 of the program is a ramp to 50, the set point will be 50 on power recovery and the program will finish the remainder of the soak time with a set point of 50.

3. Continue From PV

When power is cycled the program will resume operation in the same step with the same event activation that was present at the time of power interruption. The set point and time remaining; however, are dependent upon step type.

a. When recovery occurs on a ramp step, the program will resume with the control set point equal to the current process value.
   i. If the process value has not exceeded the target set point for the ramp step, the time remaining will be dependent upon the programmed ramp rate and the difference between

the process value and the target set point of the step. If ramp time units are used, i.e., MM. SS or HH.MM, the ramp rate is calculated by using the difference between the set point of the previous step and the set point of the current ramp step divided by the step time to get a rate of change in units/time.

Example: A program is started on step 3 which is a ramp step to -50 in 10 minutes. The "current control setpoint" (static set point) is chosen as the starting program set point. If the static set point is 25, the program will begin and start ramping the set point from 25 to the target set point of -50 over a period of 10 minutes (a ramp rate of 7.5/minute). On power recovery, if the process value is -3, the control set point will be set to -3.

The program will then begin ramping from -3 to the target set point of -50. The time remaining for the ramp is then be determined by the programmed ramp rate. If step 1 of the program is a ramp to 50, and step 2 is a soak at 50, the programmed ramp rate was from step 2 at 50 to step 3 of -50 in 10 minutes. That is a total of 100 over a period of 10 minutes which is a ramp rate of 10/minute. Since the difference between the process value and target set point is 47, the time remaining will be 4 minutes and 42 seconds. Thus, the program will continue ramp step 3 from -3 to -50 over a period of 4 minutes and 42 seconds.

Note that when starting on step 1 of a program which is a ramp step, the previous set point will be the set point as defined by the "setpoint at start of automatic program" selection.

ii. If the process value has exceeded the target set point for the programmed ramp step, i.e., the programmed ramp was increasing the set point to 50 and the process value is >50 or the ramp step was decreasing the set point down to -50 and the process value is < -50 on power recovery, the time remaining for the step will be the time remaining at the last save interval. If less than 6 minutes had elapsed into the step at the time of power loss, the step time will be the original time remaining from the beginning of the step. If more than 6 minutes into the step, the step will return to the last 6-minute interval that elapsed (from the beginning of the step) and resume from the time remaining at that moment the save occurred. The program will then ramp from the current process value to the target set point of the step over the remaining time.

b. When recovery occurs on a soak step, the time remaining in the step will return to the last save interval. If less than 6 minutes into the step, the step will resume from the beginning of the step. If more than 6 minutes into the step, the step will return to the last 6-minute interval that elapsed (from the beginning of the step) and resume from the time remaining at that moment the save occurred.

The set point will return to the programmed soak set point, i.e., the set point of the previous ramp step in the program. If a program is started on a soak step, the set point is defined by the "setpoint at start of automatic program setting." However, on recovery, the set point is defined by the programmed set point which may be different from the original soak set point at the start of the program.

Example: A program is started on step 2 which is a soak step. The "current process value" is chosen as the starting program set point. If the process value is 37, the program will begin and soak at the set point of 37 matching the process value. On power recovery, the set point will go to the set point defined by the program, so if step 1 of the program is a ramp to 25, the set point will be 25 on power recovery and the program will finish the remainder of the soak time with a set point of 25.

A.4 MCT4 Base Unit Specifications

Technical Specifications

Description	Details
Size	4.3"
Resolution (W X H in pixels)	480 x 272
Display type	TFT, Wide touch Screen
Colors	65,536
Touch screen Type	Resistive analog
Active display area (W X H mm)	95 X 54
MTBF back light at 25 0C	30,000 hrs.
Backlight	LED
Brightness Adjustment	Yes
Screen Saver	Yes
Language Fonts	Yes

Main Hardware

Description	Details
Processor, CPU speed	ARM Cortex-A8, 1Ghz
Flash Memory (ROM)	128 MB
SDRAM(RAM)	256 MB
Operating system	WinCE 6.0
Real Time Clock	Yes
Buzzer	Yes
SD card slot	Yes

Communication Ports/Interfaces

Description	Details
RS232C / RS485, DB9 Male	1
Ethernet 10/100 Mbps, RJ45	1
USB Host	1
RS485, screw terminal	1

General Specifications

Description	Details
Rated Voltage	110/220 VAC (24 VDC)
Power supply	90-250 VAC (11-26 VDC)
Rated Current	0.8A AC (3.27A DC)
Power Consumption	36VA (15W)
Outer dimensions (W X H X D mm)	122 X 100 X 134
Mounting depth (mm)	123
Panel cut (W X H mm)	91^{+1} X 91^{+1}
Protection	IP66/NEMA 4X front, IP20 housing and terminals
Front bezel, housing	Plastic, plastic
Installation	Panel Mount
Net Weight (Kg)	0.65

Standards, Certificates and Approvals

Description	Details
UL approval	UL 61010-1 and CSA C22.2 No.61010-1-12
Low Voltage Directive	2014/35/EU
EMC Directive	2014/30/EU
Requirements for Emission	EN 61326-1:2013
Tick mark for Australia	AS/NZS CISPR 11:2004
FCC	FCC Part 15, Subpart B, Class A

NOTE: The table above shows the approvals that may be available.

Base Standards for EMC & Safety

Description	Details
Electrostatic discharge	IEC 61000-4-2: 2008
Radiated radio-frequency electromagnetic fields	IEC 61000-4-3: 2006 + A1:2007 + A2:2010
Electrical fast transient/burst	IEC 61000-4-4: 2012
Surge	IEC 61000-4-5: 2014
Conducted disturbances induced by radio-frequency fields	IEC 61000-4-6: 2014
Power frequency magnetic field	IEC 61000-4-8: 2009
Voltage dips, short interruptions, and voltage variations	IEC 61000-4-11: 2004
Emission from Electromagnetic fields	CISPR 11:2009 + A1:2010 Class A
Harmonics Current	IEC61000-3-2:2014
Voltage Fluctuation and Flicks	IEC61000-3-3:2013
Requirements for Safety	EN61010-1:2013

Protective class

Description	Details
Standard enclosures	IP 66/NEMA 4X (Front), IP20 housing and terminals

Operating conditions

Description	Details
Temperature	0C to + 50C
Relative Humidity	10% to 90%, no condensation
Altitude	2000 meters maximum
Pollution	Degree 2
Sinusoidal vibration conforming to IEC 60068-2-6	10 to 58Hz: 0.75mm amplitude 58 to 150Hz: 1g 1oct/min. 10 sweeps
Shock conforming to IEC 60068-2-29	3 shocks per direction 11ms 10g

NOTE:*In temperatures below 0°C, the response time of liquid crystal display becomes slower, and color of the display will be darker than normal. Do not operate in ambient temperature less than 0°C.*

LCD specifications

Description	Details
Touch operations	1,000,000 times using R 0.8 Polyacetal stylus with force 250g
Vibration test	10-55 Hz, Stroke: 1.5mm, 2 hrs. for each direction of X, Y, Z
Shock test	100G, 6ms, +/- X, +/- Y, +/- Z, 3 times for each direction
Typical viewing angle	Vertical (up/down), 50° / 70° Horizontal (left/right), 70° / 70°

Transport & Storage conditions

Description	Details
Temperature	-20C to + 60C
Relative Humidity	10% to 90%, no condensation
Altitude	2000 meters maximum
Sinusoidal vibration conforming to IEC 60068-2-6	5 to 16.8 Hz: 3.5 mm amplitude 16.8 to 150 Hz: 2g 1oct/min. 40 sweeps
Shock conforming to IEC 60068-2-29	3 shocks per direction 11ms 15g

WARNING: Cancer and Reproductive Harm: This warning is intended to address certain Prop 65 chemicals that may be found in Future Design Controls products. These products can expose you to chemicals including lead and lead compounds which are known to the State of California to cause cancer, birth defects or other reproductive harm.

A.5 Support and Warranty Information

SOFTWARE VERSIONS FOR FDC- MCT4 Control System

The software version levels for the MCT4 Control system can be viewed in the offline system setup, from the System menu; select “About”. Both the HMI (Human Machine Interface – color touch screen) and loop/limit control firmware and software versions will be displayed.

When obtaining replacement parts or to get assistance for setup and/or troubleshooting purposes, it is important to have this information available to ensure that your request is processed properly and in a timely manner. It is recommended that this information be written down and kept in a readily accessible location along with this manual, so that it is available when required.

CE Net Version: _____ CE Image Version: _____
HMI Version: _____ CE BSP Version: _____
**Loop 1 Version: _____ Loop2 /Limit Version: _____ Loop3 /Limit Version: _____

The CE Net version of the HMI, and firmware versions of the loop and limit controls of the MCT4 control system are proprietary and only available directly from Future Design Controls.

Using similar or like components obtained from a source other than Future Design Controls will cause unexpected operation and/or malfunction of the MCT4 control system. Any attempts to do so will be at the user’s own risk and void all claims or warranties with Future Design Controls.

In addition, installing Future Design MCT4 software on hardware not obtained directly from Future Design is a violation of the software license agreement. See the Future Design Software License agreement on the following page. By installing and/or using the MCT4 Control System, you are accepting the terms of the software license.

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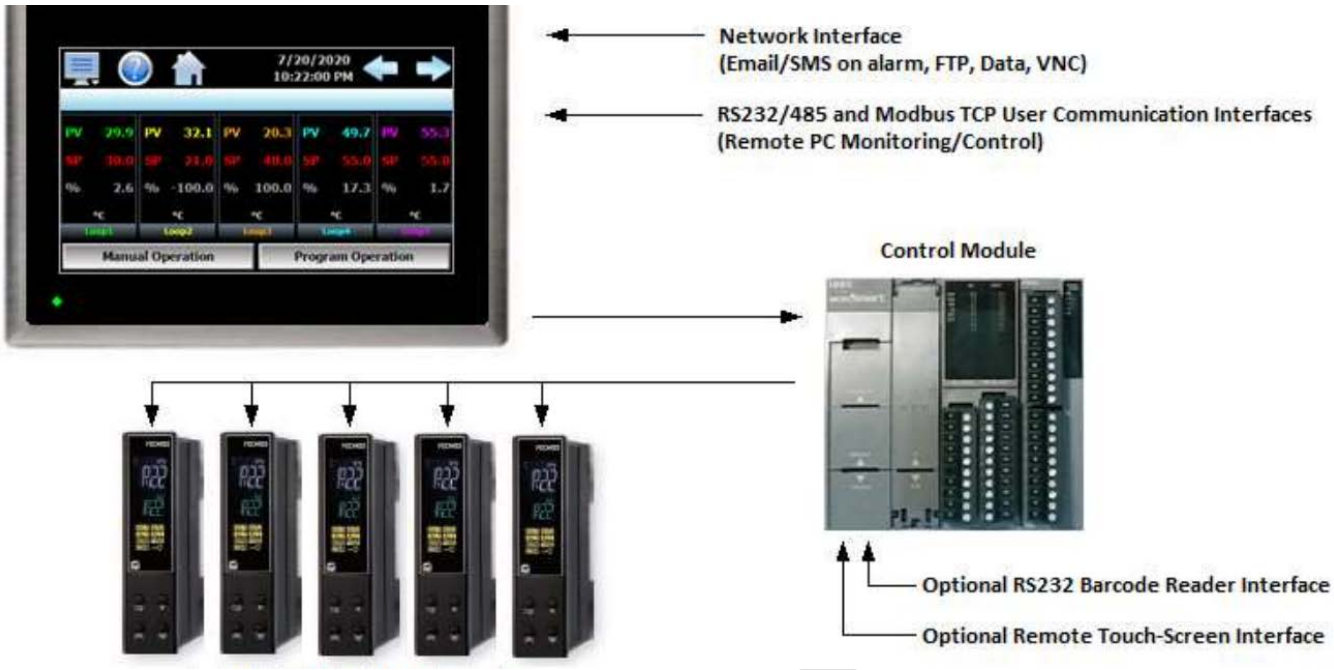
Contact Future Design Controls for Return Material Authorization Number prior to returning any product to our facility:

7524 West 98th Place – Bridgeview, IL 60455 – Phone 888.751.5444 – Fax 888.307.8014

http://www.futuredesigncontrols.com

FUTURE DESIGN CONTROL MCT-CM (TOUCHSCREEN CONTROLLER)



WHAT IS THE MCT-CM?

The MCT system combines all the features of typical loop controllers, video/chart recorders and data logging system into a single/intuitive display device. Email (supporting SSL/TLS), SMS (text messaging), FTP, FileWeb, DataWeb (file transfer protocols for automated data backup and web database interface) and remote viewing/control (via Web server/VNC server) are standard with the MCT and can be accessed via LAN/WAN using a PC, tablet, or smart phone device.

Future Design Controls' "MCT" is offered in either a 4.3" or 7" color touch screen interface with standard "Smart Device" user interface features for multi-loop OEM control applications (up to 10 loops). All loop configuration and runtime user access are configurable at the device with no PC software required. Darwin Chambers configure runtime features (screen availability, menus, language, etc...) to easily customize the system for their requirements. These configurations can be imported/exported to any other MCT device for setup within minutes by the touch of a button.

In addition to a maximum of ten loops of control, the MCT-CM can also provide up to an additional 15 inputs for process monitoring for a total of 25 process inputs. The system is provided with eight digital inputs and 8 digital outputs standard. The MCT-CM can be expanded to a total of 16 digital inputs and 32 digital outputs. The MCT-CM also provides the capability of accepting analog inputs for remote set point control and providing analog outputs capable of retransmitting system variables (PV, SP or %Out) to other devices such as a chart recorder. The 0-10Vdc or 4-20mA user selectable signals are provided through the addition of optional analog expander cards.

Individual process controls, one for each loop in the system, provide reliable, consistent, and accurate control by distributing the process control requirements of the system among multiple processors. Each loop control provides full auto tune functionality with high resolution, universal process inputs. When coupled with the built-in ramping programmer, it allows for automatic, timed control of all processes and outputs of the system.

Features

The MCT digital inputs can be configured as alarm inputs with adjustable delay timers, as control inputs for controlling automatic program operation or for direct control of the system's digital outputs. The digital outputs can be used as direct outputs for controlling external equipment related to the application through software switches, called events, or be programmed to act as system alarm or status outputs. All outputs have adjustable delay times for on, off and cycle times.

The MCT can be operated in single set point or automatic program control mode. Program entry is made easy using copy, paste and delete menu selections. Programs can be copied to the external USB memory stick and then imported to another MCT controller eliminating the need to enter duplicate ramp/soak programs into multiple systems. When running in program mode, the operator can place the system into hold and change any control parameter without modifying the original program giving the operator maximum flexibility over the controlled process.

Data logging can be enabled manually or automatically during program operation. Data backup is provided via a USB memory stick for plug and play transfer of files to any PC and through the included FTP back-up utility. Data file analysis tools make looking at historical data a simple task. Any control variable saved to the data file can be plotted on the historical data chart for any time frame within the data file's total time range.

The built in Ethernet functionality includes a Web Server to provides access to all MCT data (view only), a VNC interface for remote control and monitoring and an NTS clock, all available via a local Intranet connection (wired or wireless), or the World Wide Web using a standard web browser.

System access is protected with a four-level security system (user rights based), including audit trail capability that documents all user activity and ensures data integrity by digitally signing all data files and audit trails to meet regulatory requirements.

The MCT-CM controller includes the following features:

ACCESSIBILITY

- Touch screen, "Smart Device" user interface (UI) with 30,000-hour LED display
- Built in configuration software; no external software or PC required
- Email, SMS, FTP, FileWeb, DataWeb, VNC and Web functionality standard
- Remote View/Control using PC, Tablet or Smartphone.
- Modbus RTU RS232/485 serial and Modbus TCP user communication interfaces for 3rd party software or hardware access.
- National time server connectivity with daylight savings.

COMMAND BAR ICONS

NAVIGATION, HELP & HOME

The Master Command Bar located on the top of the display provides easy & intuitive 1-touch access from anywhere in the system to Navigation, Help and configured Home view.

Home brings the user back to the system "Home" view. The Home icon can be configured for the following standard views:

ALARMS

- Maximum of 30 alarms configurable to any loop/monitor in the system.
- Alarm Types: Process, Deviation and Percent Output low, high or both.
- Alarm Modes: Latching, Silent and Inhibit on startup.
- Alarms can be configured to activate a digital output and/or defeat digital outputs when active.

DATA ACQUISITION

- Data log up to ten control loops (PV, SP and % out) and up to 15 optional monitor points (up to 25 PV inputs total).
- File name: Free form 16 character appended by time/date or the profile name if started with a profile.
- File Start/Stop: user on-demand, on system boot or profile ramp-soak start/end.
- Data Log interval: configurable 2 seconds to 31 minutes.
- File Interval: configurable to set time in days (1 to 31) to end and start a new file.
- ID#1 and ID#2 fields allow user to enter specific information such as a batch and/or lot information that is associated with the data file.
- Operator Comments/Events: Unlimited operator comments/events linked to each file
- File Type: Data Log files are saved in .csv format.

- Loop view: includes PV & SP digital display, PV min/max, PID % Output, manual (event) operation, ramp/soak program access and more.
- Overview: all loops, monitors, program, alarm, and event status
- Chart view: (trend up to the last 24 hours from system RAM) supporting 8 trends with up to 8 values per trend
- Alarm view or Alarm File

Help offers content sensitive text for every view / page in one of 11 supported languages chosen by the user.

Navigation provides access to the configured menu system, traditional drop down or icon.

SECURITY AND AUDIT TRAIL

- Supports up to 30 users over four user groups with access to 50+ functions restricted by user group.
- Supports password aging and verification.
- Operator Audit Trail provides history for all user activity that includes date, time, user name and action; i.e. Loop SP change from 55.2 to 103.5.

PROGRAM RAMP/SOAK

- Up to ten loops
- Start: via touch screen or Event input
- Program Name: 16-character naming convention
- Global Program Configuration:

- Guaranteed Soak & Ramp band

- Power Fail / Recovery: Hold, continue, restart, resume or static mode.

- Program Segments: (maximum of 99)
- Guaranteed Soak & Ramp per step
- Events: up to 32 events per step
- Jump-To Step: configurable per step
- Programmable “wait for” step advance logic includes digital inputs, loops and monitor points.

- Digital Signatures: Automatic system as well as user entered signatures.
- Historical Data Viewer: View data log fi les on the display. Chart is auto scaled on an X & Y axis for time and units.
- Meets the requirements for:

- CFR21 Part 11

- AMS2750E

Configurable Digital IO

Digital Inputs (DI): CPU includes 8 inputs with optional 8 input card for maximum of 16 digital inputs.

- Digital inputs are configurable as a time delay (timers), alarm inputs, program run/stop control, output disable and more.

Digital Outputs (DO): CPU includes 8 outputs with optional 8 or 16 output card for maximum of 24 outputs.

- Digital outputs are configurable as event outputs or system control outputs and include on/off delay times and cycle timers.
- Output “on” times and off/on cycles are tracked and can be used to generate service alerts for hours of operation.

Configurable Analog IO

- Remote Setpoint: Cards accept two 4-20mA or 2-10Vdc inputs to be utilized as a set point value for a specified loop control.
- Retransmission: Cards have one 4-20mA or 0-10VDC signals configurable as PV, Setpoint or % Out values from a specified loop control.

Maximum number of cards is 7: 14 remote set point inputs and 7 retransmitted PV, SP or %Out values.

BASIC OPERATION

This section is designed to help guide the user through the MCT touch screen interface and menu structure to navigate through the various operation, monitor and setup screens and gain an understanding of how to use them. Subsequent sections of this manual are tailored to the special features and functions of the MCT. Consult those sections of the manual for further information and specifics on how to set up and operate them.

Chamber Series Configuration Options

The availability of certain menu items, screens, and the functionality of the MCT are determined by the configuration of the controller. This manual covers all available options, some of which may not be available on your system.

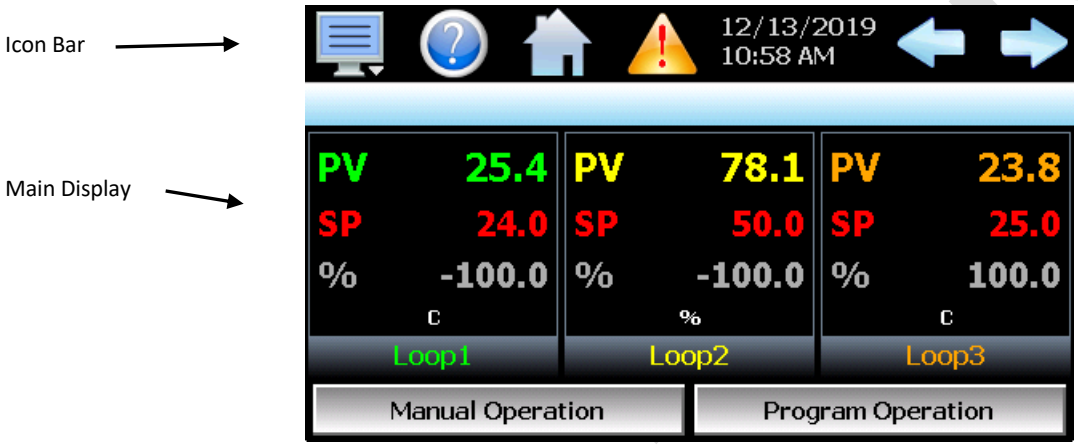
If there are questions or concerns about the operation and available options on your MCT controller, contact your OEM for further information. Only your OEM can address equipment related issues.

Darwin Chambers Control Loop Configuration Options

If a loop is configured for cascade control, it may appear as a normal control loop on the MCT; however, this type of loop is operated by another control loop on the MCT. The set point of the cascade loop cannot be changed by the user. It is a calculated set point generated by the other control loop. If you suspect that there is a problem with your MCT controller if you are unable to change a loop set point, contact your Darwin Chambers and verify the configuration of your system to determine if the loop is operating under cascade control and how that interacts with your equipment.

Touch Screen Interface

The MCT display is split into two sections: the icon bar and main display area.



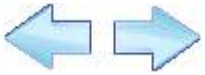
Loop View Screen

The menu icon will open the main menu for navigating to the different control and monitoring screens. Menu items will dynamically appear providing available options based on the system area the user is in, i.e., security, data logging, setup, etc.

The information (help) icon will display text-based help associated with the current screen. Help is available in 28 languages based on the user selection in the offline setup of section of nCompass.

The home icon will return the user to the main view from anywhere in the nCompass application. The main view is set by Darwin Chambers in the nCompass configuration and can be the single or dual loop, chart, alarm, alarm history, event, or digital IO view.

The alarm icon will appear and flash when a new system alarm occurs. Pressing the alarm icon will take the user directly to the alarm monitor screen to view and /or reset the active alarm condition.

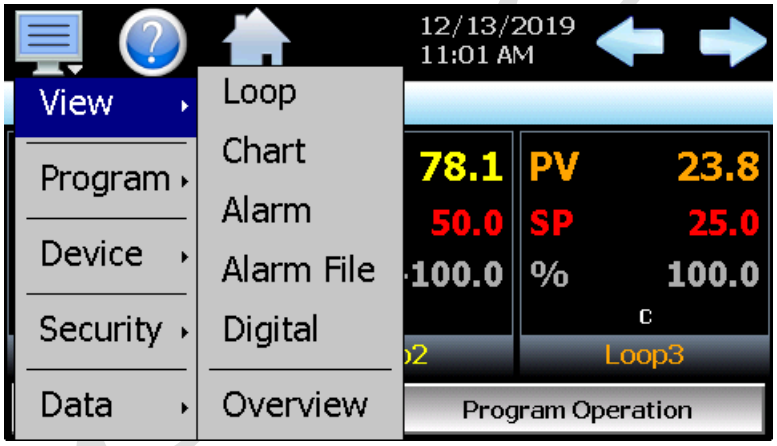


The left and right navigation arrows will appear on screens that provide additional information that the user can scroll to such as the loop view screens, charts or program entry screen to cycle through each step of a ramp/soak program.

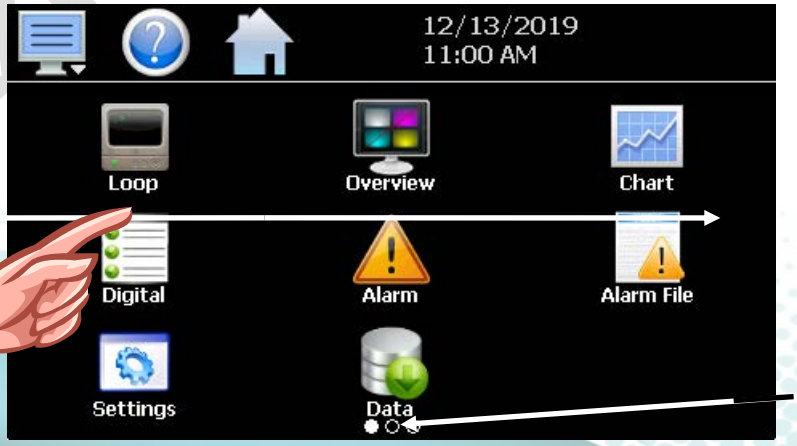
NOTE: *A single press of the left or right arrows will scroll program steps to the next step or screens to the next available screen option (i.e., chart number). Pressing and holding the arrow keys will continue the item scrolling until the last step of the program is reached or the button is released.*

Menu Navigation

The MCT provides the user with the ability to select text-based menu navigation, much like the typical file menu system of a PC, as well as an icon-based navigation system like that of a "smart" device. The user can switch back and forth between the two from the Setup menu.



Text Based Navigation



Touch and drag finger across screen to switch between menu pages.

Active Page Indicator (1 of 3)

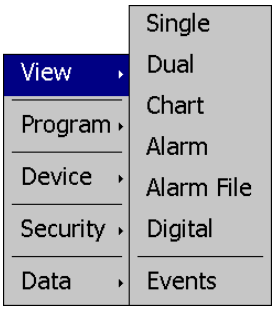
The available menu items are dependent upon the OEM configuration of the MCT. Not all the menu items shown may be available on your system. The following information is provided as an overview of the full navigational menus for the MCT.

IMPORTANT: *Do not use any sharp or metal objects on the touch screen as they may damage the surface. Also, be sure that hands and fingers are free from oils or chemicals which may mar the surface of the touch screen.*

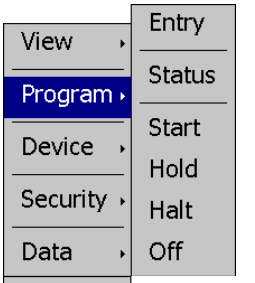
Home Menu

The home menu is the top level, default menu provided when the MCT first powers on. Pressing the menu (monitor) icon will display the main menu offering the selections shown below.

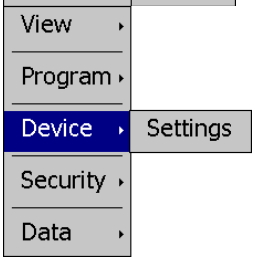
Text Based Home Menu



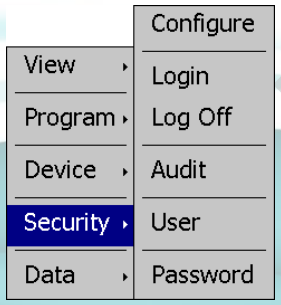
The **View** menu provides navigation to all standard view screens. These include the Single and Dual loops views, real time Charts, Alarm monitor, Alarm File, Digital IO monitor and Events control screen.



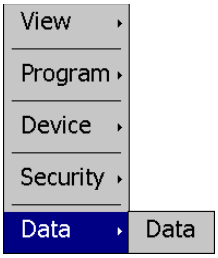
The **Program** menu provides access to the automatic ramp/soak program actions, Entry and Status views. The program Start, Hold, Halt and Off menu items allow quick access to these functions if a program is already downloaded to the nCompass control module.



The **Device** menu provides access to the nCompass controller settings. These include, loop set point entry limits, alarm set points, communication settings, email setup as well as access to offline settings for date/time, etc.

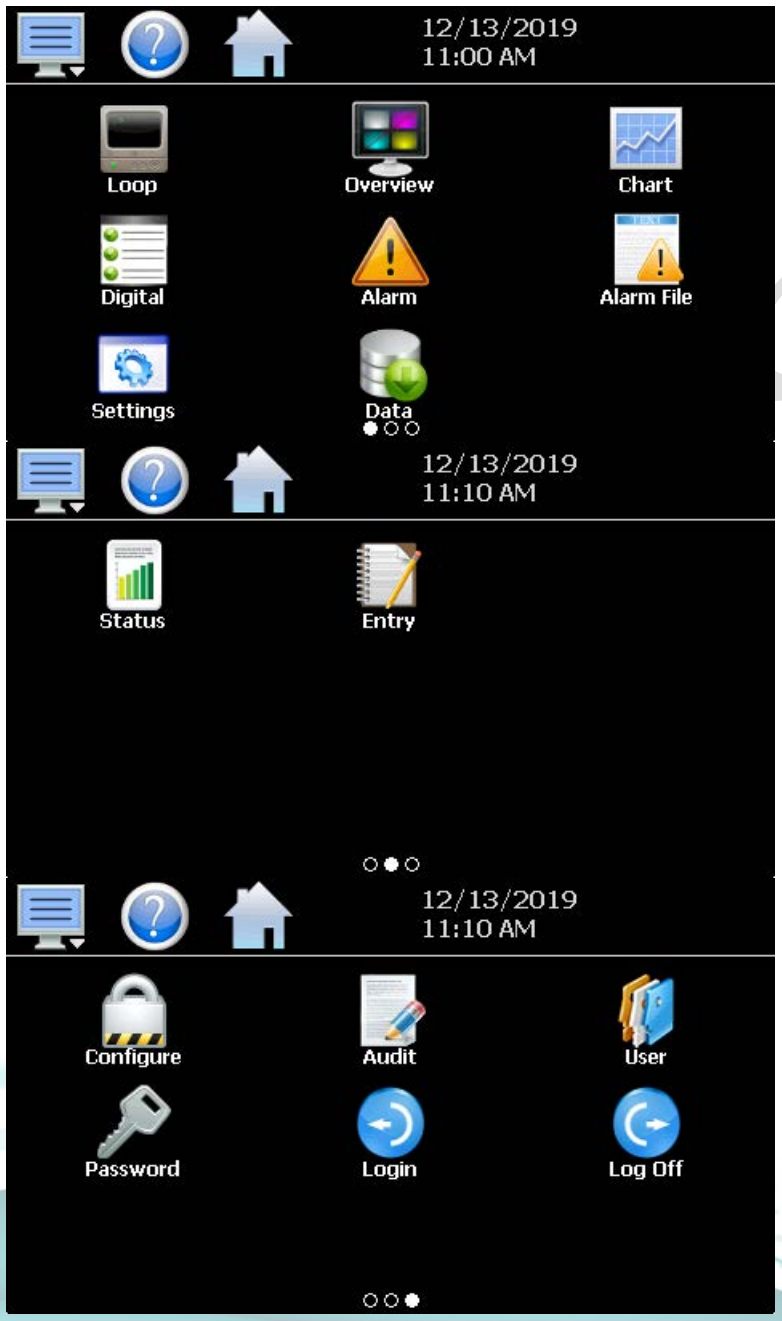


The **Security** menu provides access for user login, security settings and audit trail viewing if the security system is enabled.



The **Data** menu provides access to data log functions, file utilities, FTP\WAN back-up settings as well as the historical data viewer.

Icon/Slide Page Based Home Menu



Slide page 1 provides navigation to all standard view screens. These include the Single and Dual views, Events control, Charts, Digital I/O monitor, Alarms monitor, and Alarm File.

It also provides quick access to the nCompass Settings and Data file functions which include file utilities, FTP\WAN back-up settings as well as the historical data viewer.

Slide page 2 provides access to automatic ramp/soak program actions, Entry and Status views.

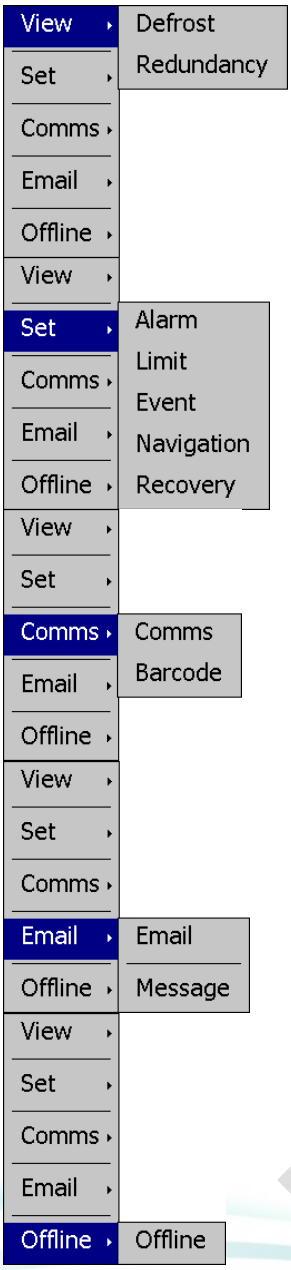
Start, Hold and Halt program menu items allow quick access to these functions if a program is already downloaded to the nCompass control module.

Slide page 3 provides access to security settings, Audit trail viewing, current User information, user Password editing and user Login and Log Off functions.

Device Settings Menu

The device settings menu is provided when the user selects “Settings” from the main “Device” menu. See section _Device Settings for detailed information on these settings and their use.

Text Based System Setup Menu



The **View** menu provides navigation to the Defrost and Redundancy operation/setup screens.

The **Set** menu provides access to the nCompass setup screens for Alarms, power Recovery, control loop setpoint Limits, Event tag names, and Navigation type selection.

The **Comms** menu allows the user to adjust the communications settings for the web page, VNC server and optional Modbus user communications as well as settings for the optional barcode reader.

The **Email** menu provides settings for the email server to send SMS text messages and/or emails on alarm and allows the user to compose and send messages to any user configured in the system.

The **Offline** menu provides access to the nCompass offline setup screens which provide the user with the ability to adjust the date/time, calibrate the touch screen, configure digital and analog IO, etc.

Icon/Slide Page Based Device Settings Menu

Slide page 1 provides access to the primary nCompass setup screens. These include options for Navigation type, control loop setpoint Limits, Alarm setup, Event tag name entry, power Recovery, Defrost operation/setup and email server settings and messaging.

It also includes access to the communications settings for the web page, VNC server and optional Modbus user communications.

Slide page 2 provides access to the nCompass offline setup screens which provide the user with the ability to adjust the date/time, calibrate the touch screen, configure digital and analog IO, etc.

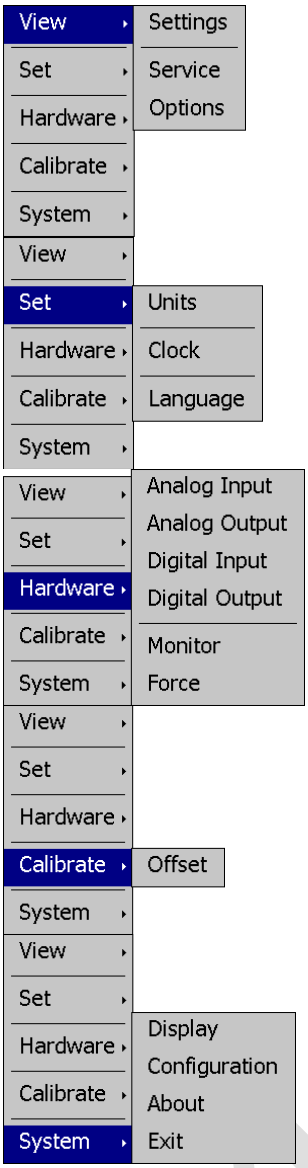
It also includes access to the optional Barcode reader as well as the Redundancy operation/setup screen.

Offline Menu

The offline menu is provided when the user selects “Offline” from the device settings “Offline” menu. See section Offline for information on these settings and their use.

NOTE: *Offline settings can only be accessed when an automatic ramp/soak program is not running, and data logging is turned off. When entering offline setup, the MCT will go offline. This means that all outputs and control functions provided by the control module will stop and be disabled. If the current control process cannot be interrupted, DO NOT enter offline setup until the process can be properly stopped.*

Text Based Offline Setup Menu



The **View** menu provides navigation back to the device settings menu and to the Service items view and Service Options screens.

The **Set** menu provides access to the temperature Units selection, NTS Clock, and Language settings.

The **Hardware** menu provides configuration access to the nCompass digital and analog inputs and outputs (if available on the system). It also provides access to the input Monitor and output Force screens

The **Calibrate** menu provides access for applying an offset to the monitor inputs (if available on the system).

The **System** menu provides access to the nCompass Display settings, import/export Configuration utility, About screen and Exit application screen.

Icon/Slide Page Based Offline Menu

Slide page 1 provides navigation back to the device settings menu, temperature units selection, NTS Clock, Service items and Options, touch screen calibration and language settings.

It also provides access to the About and Exit application screens.

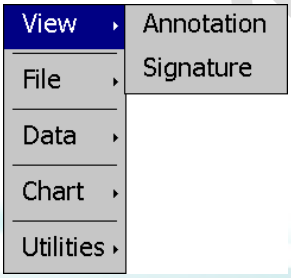
Slide page 2 provides configuration access to the nCompass digital and analog inputs and outputs (if available on the system).

It also provides access to the monitor input offset screen, digital output force and input monitor screens as well as the import/export configuration utility.

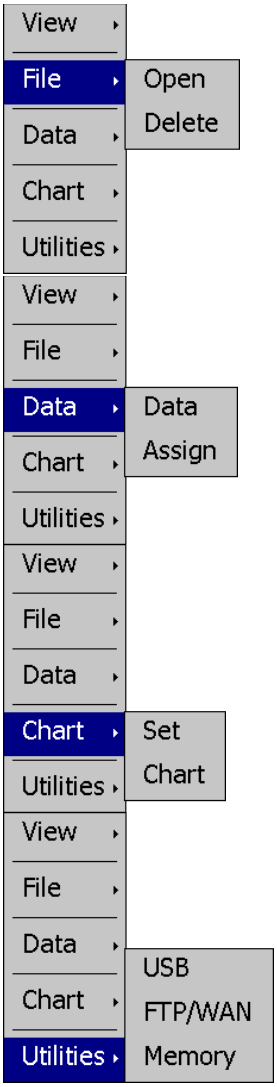
Data Menu

The data log menu is provided when the user selects “Data” from the main “Data” menu. See section 0 Data Logging for information on these settings and their use.

Text Based Data Logging Menu



The **View** menu provides access to the data file Annotation and digital Signature screens.



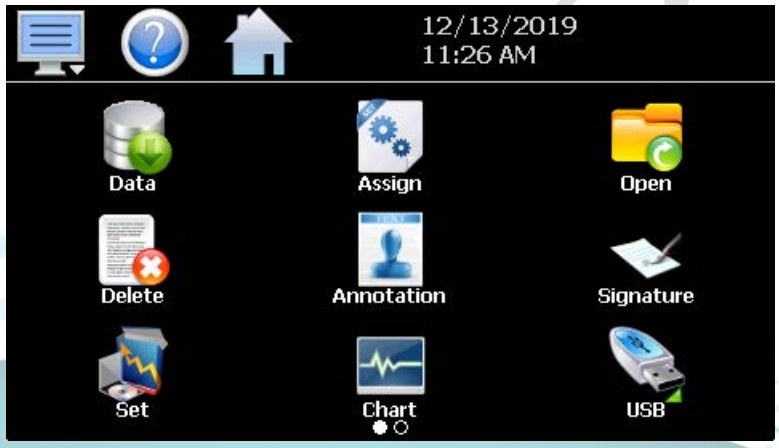
The **File** menu provides functions for opening and deleting historical data log files.

The **Data** menu provides access to the main Data screen for starting and stopping data logging and to the log point Assignment screen where the user can select which items are to be logged to the history file.

The **Chart** menu provides functions for viewing historical data files in graphical format.

The **Utilities** menu provides access to the nCompass file management utilities including USB file transfer and FTP/WAN back-up.

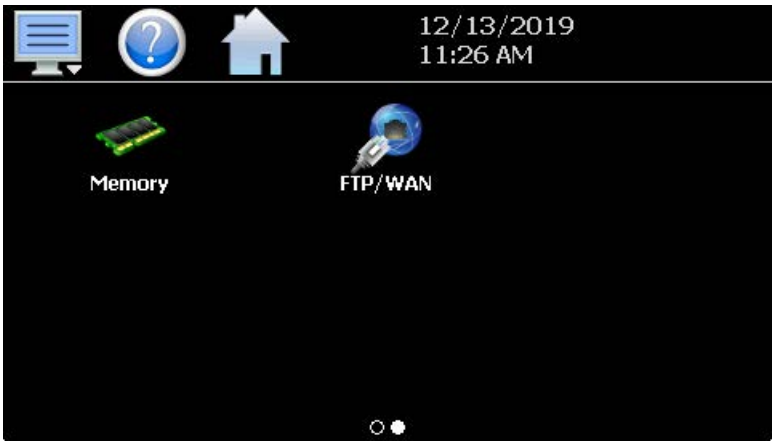
Icon/Slide Page Based Log Menu



Slide page 1 provides access to the main Data log screen and to the log point Assignment screen where the user can select which items are to be logged.

Historical data file functions are provided for Opening and Deleting historical files and viewing/setting data file Annotations and digital Signatures.

The plot Set and Chart icons provide access to the historical data viewer options.

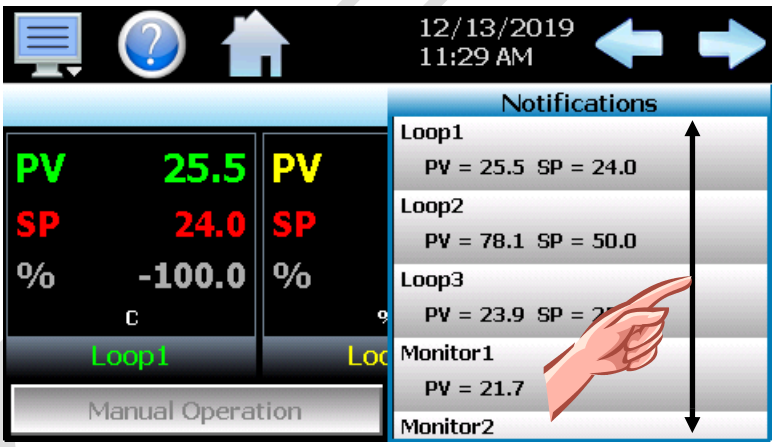


Slide page 2 provides access to the FTP/WAN back-up settings and the memory check utility for viewing available system/storage memory space.

Slide page 2 provides access to t

Notifications

The notification window is a feature that can be accessed by pressing the date/time field in the icon bar. This window provides a snapshot of current MCT activity. The notification window can be closed by pressing the date/time field again, or is automatically closed if the Menu, Home, or a navigation arrow icon is pressed.



A user can view all notifications by touching the screen and dragging their finger up or down on the list to scroll through all items like other lists in MCT. The notifications include the following:

- Loop PV and SP for each loop configured.
- Monitor PV for each monitor point configured.
- Automatic program status including name of running program.
- Defrost operational status.
- Redundancy operational status.
- Active alarm status including the most recent alarm.

- Data logging status including active file name and the length and logging rate set.
- Security status including the current user.
- Audit trail active/inactive status.
- Web server active/inactive status.
- VNC server active/inactive status.
- MCT IP address.
- Available SD storage memory remaining.

The appearance of the items is based on the configuration of MCT. If defrost or redundancy functions are disabled in the configurator for example, their status items will be removed from the list as well.

NOTE: *The notification items do not update while the list is shown. The information shown in the list is a snapshot of the data at the time the window was shown. Therefore, the PV or SP shown for a loop may not be the actual values for the loop if the notification window is left open for extended periods of time. The notification window is not available in the offline setup.*

Control Loops (Single Set point Operation)

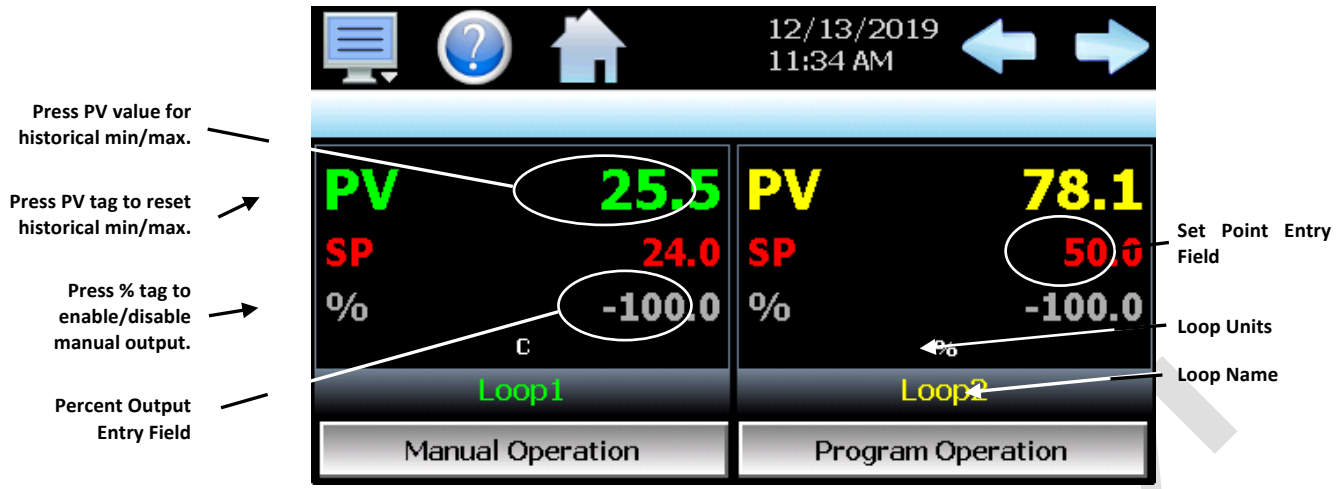
The loop view screens provide direct viewing options for the control and monitoring of the MCT control loops and process monitor inputs. The loop screens allow the user to adjust the current loop set points (SP) and view the process variables (PV) and percentages of output (%) for each loop. If the loop is a process monitor input only, the set point and percentage of output will not be displayed since no control is associated with the input.

NOTE: *The OEM configuration of MCT may allow the operator to change the loop set point, activate manual mode, and initiate an auto tune at the loop control itself. If any of these permissions are active, any change made at the loop control will be indicated on the loop view screens. If these permissions are not enabled, any change made at the loop control will be overridden by the setting from MCT*

If in doubt about which permissions, if any, are allowed from the loop control, contact Darwin Chambers. Any changes made at the loop controls are not logged or protected by MCT security settings. These changes will not appear in the audit trail. If adjustments to control loop settings are to be made only by authorized users with the proper security access, the loop permissions should be disabled in the MCT configuration or other means are necessary to prevent unauthorized users from accessing the loop controls.

Loop View

The Loop screen is accessed from the home “View” menu. The number of loops shown can be from one to five depending upon the setting made for “Number of Loops to View” on the Navigation screen under the Setup menu.



The **left** and **right arrow buttons** will be displayed if the number of loops and monitors configured in the system exceeds the number shown on the screen. They will allow the user to cycle through each loop and monitor point available in the system. When the first or last loop is reached, MCT will automatically wrap around to the beginning or end of the list to show the next loop.

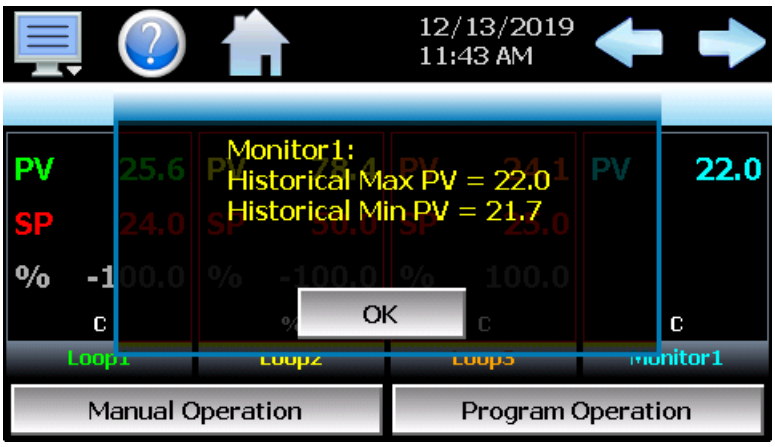
The **set point entry field** is the area where the screen can be touched to bring up the keypad entry window. Using the numeric entry keypad, a new set point can be entered. Once entered, the new set point will be shown in the set point entry field. Adjustment of the set point is locked out if an automated ramp/soak program is running unless the program is first placed into Hold.

The **percent output entry field** is the area where the screen can be touched to bring up the keypad entry window. Using the numeric keypad, a new fixed percentage of output can be set for the loop. To be able to enter a fixed output percentage, the loop must first be placed in manual output mode. This is done by pressing the "%" tag on the screen.

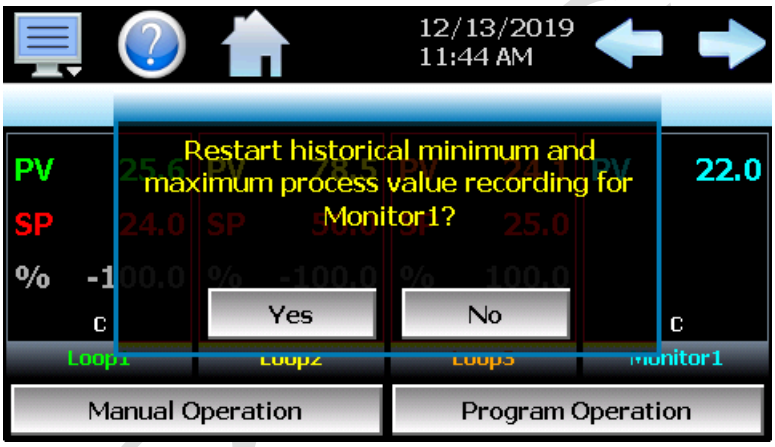
The **loop name and loop units**, shown at the bottom of each loop (or monitor point), will display the tagname and units as entered in the Configurator.

Historical Minimum and Maximum

The MCT monitors and stores the minimum and maximum process value reached during operation for each loop and monitor in the system. The current historical values can be viewed by pressing the process value display field for the desired loop or limit.



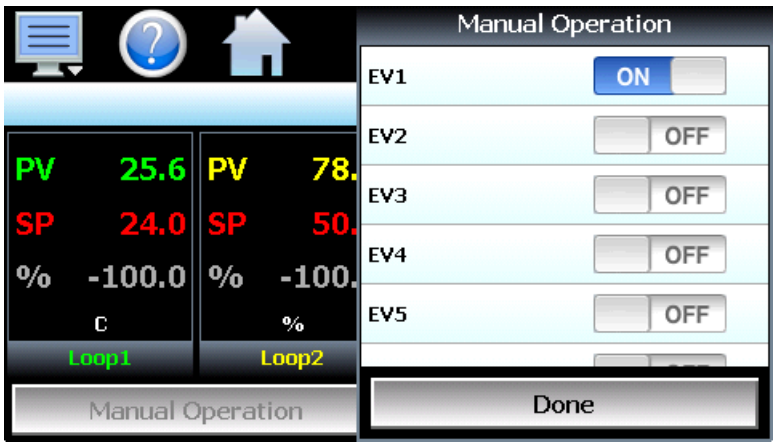
Pressing the “OK” button will close the dialog window and return to the Loop view screen. The historical values are reset each time the runtime application is started and can also be manually cleared by pressing the “PV” tag on the Loop view screen.



Pressing the “Yes” button in the dialog window will reset historical minimum and maximum values and default them both to the current process value. Pressing “No” will simply close the dialog.

Manual Operation

The Manual Operation button displays a “slide out” window providing access to all events programmed for the system. To turn each event and its corresponding output on or off, simply press the button associated with the event. Slide the list up or down as necessary to view additional events if more are programmed than can be displayed in the window at one time.



Program Operation

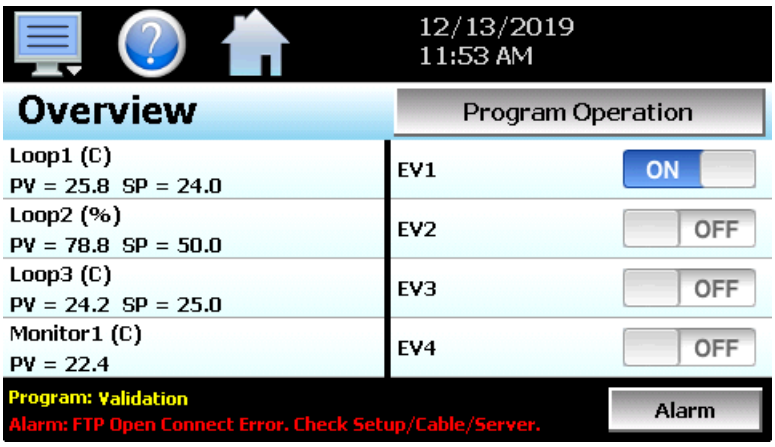
The Program Operation button displays a "slide out" window with all automated program operations included. Press the desired icon for quick access to any program operation. The "Select" icon can be used to select any program stored for quick run operations.

Overview Screen

The Overview screen provides access to the system events as well as a convenient way to monitor and control all loops and monitors configured in the system. Events are the 'switches' used to turn the digital outputs of MCT on and off. These events can be manually turned on and off as well as programmed into automatic ramp/soak programs so that they can be turned on and off at set time intervals.

NOTE: *Not all digital outputs of MCT may be able to be controlled as event outputs. Depending upon the configuration of MCT, some outputs may perform specific control or alarm functions. The use of each output, and what it controls, is determined by the system designer. Consult section Digital Outputs and how to program them as event outputs or any of the other available control functions.*

The names of events are also determined by the system designer. The screen shot below is an example showing factory default event names. Consult section Event Names to see how to change the names of events so that their description in the list matches their function to avoid operator confusion.



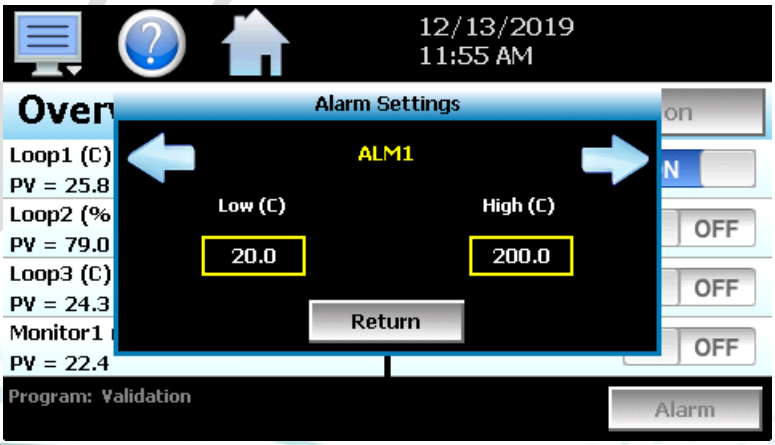
The Overview screen contains two scrolling lists. The list on the left contains all loop and monitor information. To change the set point of a loop, touch the row of the desired loop. The numeric keypad will then be shown allowing a new set point to be entered.

The list on the right contains the system events (if configured). To turn the system events on and off, press the on/off button for the event that you want to turn on or off to toggle the on/off state of the event. When turned on, any digital outputs configured for the event will turn on.

The currently loaded program, or status of a running ramp/soak program will be displayed at the bottom left of the screen. The Overview will also display all current alarms that have not been cleared from the Alarm screen. The alarm field will automatically scroll through each alarm, displaying one at a time every few seconds until all alarms have been cleared.

Alarm Set Points

The 'Alarm' button on the Overview screen provides quick access to the alarm set points for all alarms configured in the system. This allows a user to adjust an alarm set point without having to enter device settings and accessing the main alarm setup.

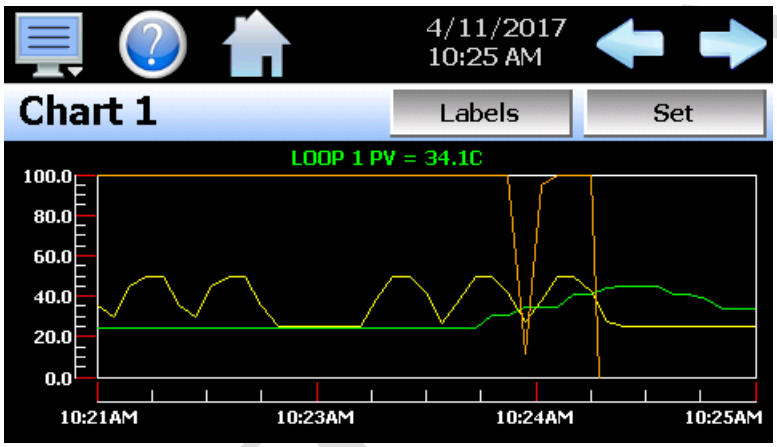


The Alarm Settings window will be displayed upon pressing the Alarm button. It will display the alarm message and provides access to the low and high set points for alarm 1 up to the maximum number of alarms given user set point access in the configurator. To exit the alarm settings, press the Return button. The left and right arrow buttons allow you to cycle through each available alarm.

The Loop and Overview screens provide the current process values of the MCT. To view the process inputs over time, the MCT provides real-time charts. Eight user configurable trends are provided with up to eight plot points per trend. In addition, MCT provides status monitors for all the digital inputs and outputs of the system. This allows an operator to keep track of all inputs and outputs of the control module.

Charts

The Chart screen is accessed from the home "View" menu. The real-time charts can be configured to display the process variable (PV), set point (SP) and percentage of output (%) of each control loop and the process variable of monitor points over a selectable time. The vertical axis determines the range of displayed data while the horizontal axis determines the history period. The maximum time that can be shown in a chart is 24 hours.



The rate at which the chart plots a new point is based on the time to be shown. Each buffer can hold a total of 720 readings for each of the selected channels to plot. The update rate can be calculated by the formula: time (in minutes) * 60 / 720. Note that for time periods less than 72 minutes, the update rate will be held to a minimum of 6 seconds. Thus, the update rate will vary from a minimum of 6 seconds (for time periods of 72 minutes or less) up to a maximum of 120 seconds for 1440 minutes (24 hours).

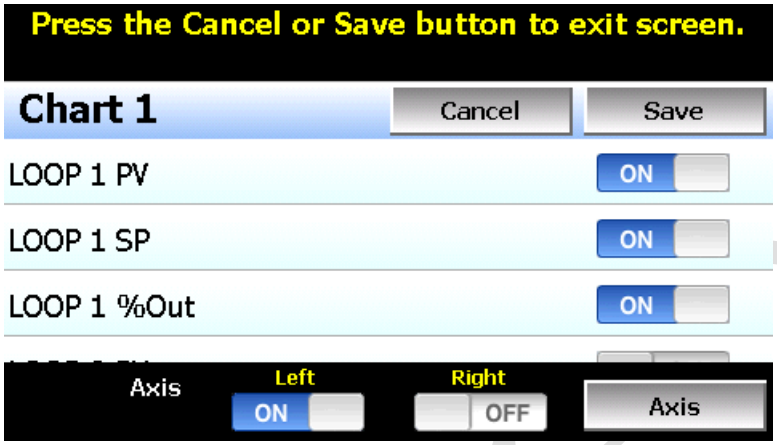
The **Labels** button allows the user to cycle through each of the configured plot channels to determine what each colored plot represents as well as view the current value without having to return to the Single or Dual view screens. The left and right scroll buttons at the upper right of the screen allow the user to cycle through each of the eight available charts.

The charts also allow you to "zoom in" on a particular area to have a more detailed look at current data. By using your finger to select an area on the screen, the chart will zoom in on that area. To select a portion of the plot, touch and hold the screen with your finger. Drag your finger across the graph and a box will be drawn around the selected area. Removing your finger from the screen will cause the chart to redraw with only the selected plot area. To return to the normal view, touch the 'X' or 'Y' axis and select zoom out to return to the previous zoom setting or zoom normal to return to the full display.

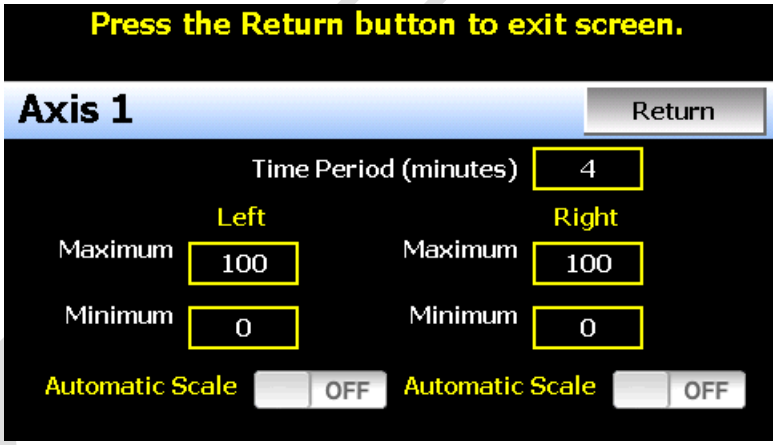
NOTE: *When a chart is zoomed in, it will not update with new information. The chart must be in normal view mode to update at each time interval. The chart will return to normal automatically when selecting a different screen to view.*

Chart Setup

To configure a chart, press the “Set” button in the upper right corner of the display. The setup screen will be shown. To assign channels to the chart, simply touch the on/off button for the desired items in the list to select them. Select the left or right vertical axis for each item by selecting the item in the list and press the button for the desired “Left” or “Right” axis. The left axis is the default axis selection. If none of the channels are assigned to the right axis, the axis will not be shown on the chart.



Once the channel selections have been made, press the “Axis” button to adjust the time and vertical axis ranges of the graph.



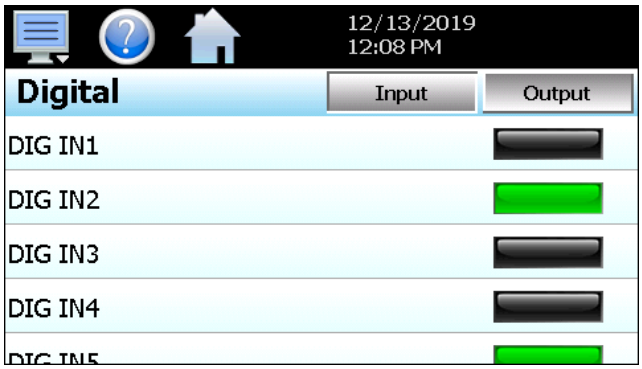
Time Period -	Adjusts the displayed time for the graph. The allowable range is from 4 to 1440 minutes (24 hours).
Maximum -	The maximum value sets the maximum range of the vertical access with a minimum value of -32,760 and a maximum of 32,760.
Minimum -	The minimum value sets the minimum range of the vertical access with a minimum value of -32,760 and a maximum of 32,760.
Automatic Scale -	When on, the vertical axis will automatically adjust its zero and span as needed to display the selected plot channels.

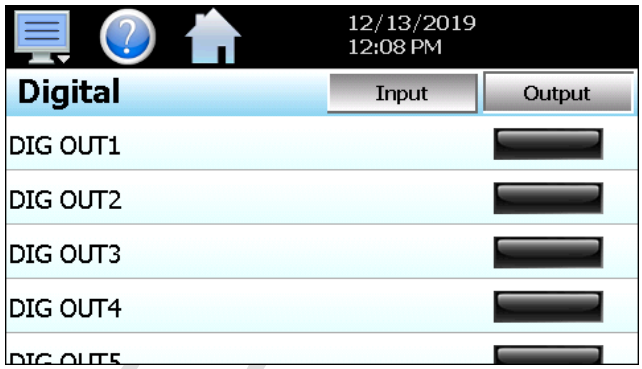
Once all settings have been made, press the “Return” button to return to the channel selection screen. Press the “Save” button to store the current channel and axis entries or the “Cancel” button to exit chart setup without altering the current chart settings. If channel selections or the time for the chart has changed, all current chart

data will be cleared when the new entries are saved. The chart will then begin plotting new data according to the new settings.

Digital IO Monitor

The Digital IO monitor screen is accessed from the home “View”’ menu. It provides simple, at a glance status monitoring of all digital inputs and outputs configured on the MCT control module. To view input status, press the Input button. To view output status, press the Output button.



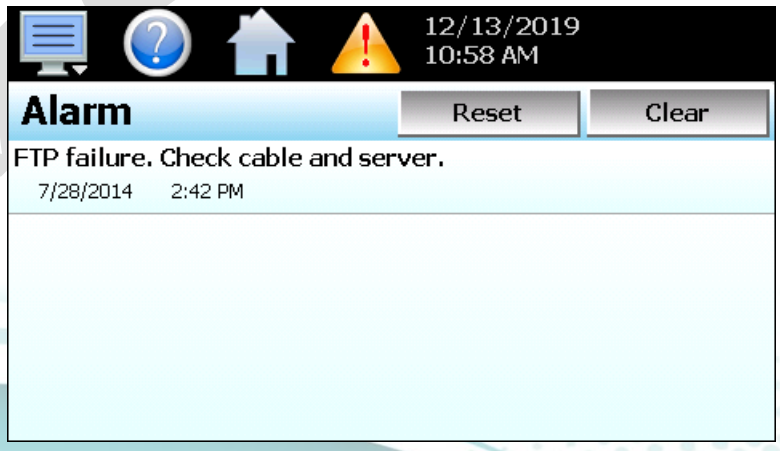


System Alarms

When an alarm condition occurs, the alarm icon flashes in the MCT icon bar to provide a visual indication of an alarm condition. An audible alarm will also sound if the alarm requires immediate operator attention such as a loop communications failure or a process alarm set point has been exceeded. For more information on adjusting the audible alarm volume, see section _Display Settings.

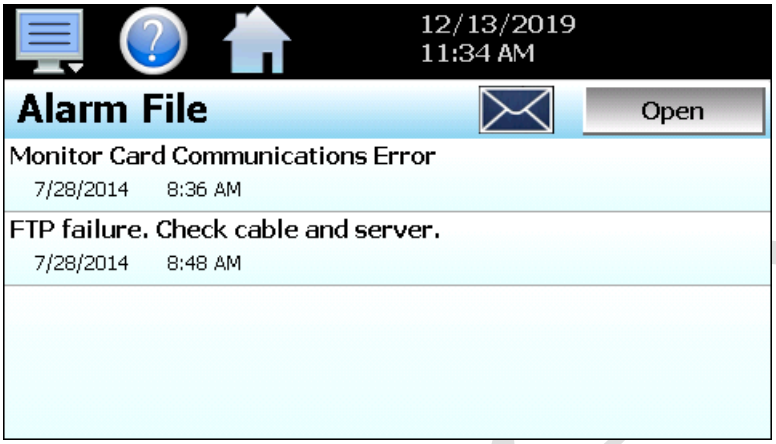
Alarm Monitor

The Alarm screen is accessed from the home “View” menu. It can also be displayed by pressing the alarm icon whenever a new alarm occurs. It displays all current and/or previously acknowledged alarms according to time and date of occurrence. Once the alarm is reset, the alarm icon will be hidden; however, the alarm condition may still be present.



The alarm will be removed from the list when cleared by the operator by pressing the “Clear” button. Only alarms that are not currently active in the system can be cleared from the alarm list.

The Alarm File screen is accessed from the home "View" menu. It displays all alarms for any given day. The MCT can store daily alarm files for a period of a year or longer (time based on storage usage for data history). Each time an alarm occurs on the MCT, the alarm is written to a file. Alarm file names are listed as MMDDYYYY (where MM = month, DD = day, YYYY = year. The "Open" file button will display a dialog box where the user can select any alarm file to view.

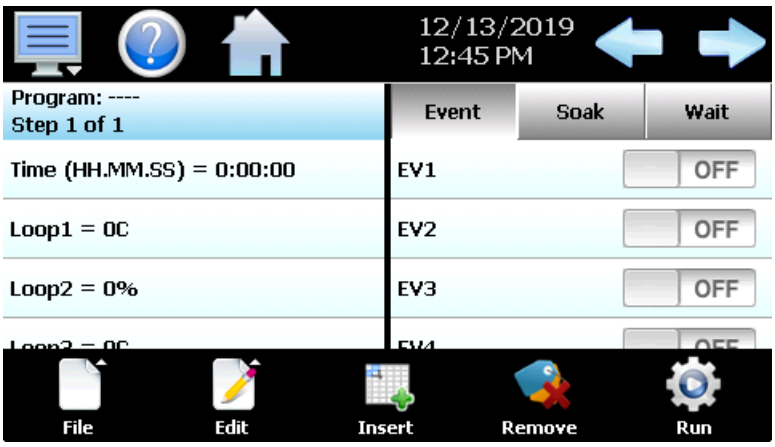


The send email icon allows the user to send a copy of the currently opened alarm file to any user configured in MCT. When the email icon is pressed, an "Add Recipients" window will be displayed where the user can select recipients for the file from any of the email addresses configured under the MCT email settings. For information on how to add email recipients to MCT, see the section Email.

NOTE: *If no alarms occurred on a given day, an alarm file will not be created for that day. The alarm list will display up to 650 alarm files. If more than 650 alarm files are present, the alarm files cannot be shown in the list and the files will have to be exported from the MCT to view them. This can be done either via USB file utilities (see section 0 USB File Transfer) or FTP (see section 0 FTP/FileWeb/DataWeb Interface).*

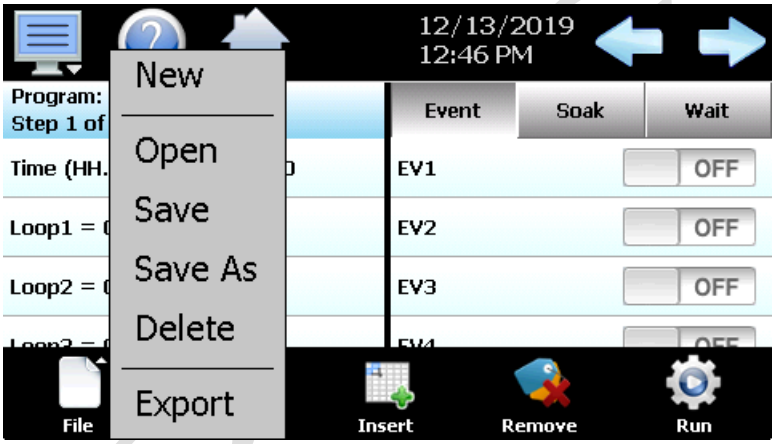
AUTOMATIC RAMP/SOAK PROGRAM OPERATION

A ramp/soak program is a set of instructions (set points and events) programmed as a timed sequence of steps. When a program is run, the MCT executes each step of the program automatically, in sequence, based on the time duration and settings for each step. MCT can store hundreds of programs (depending on storage usage for data history) with up to 99 steps in each.



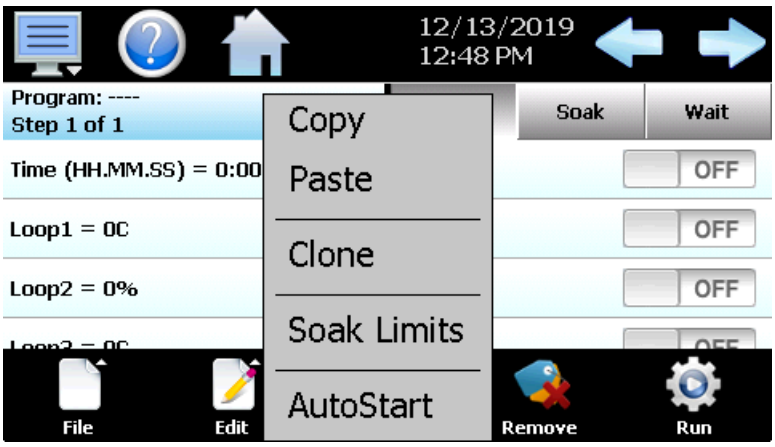
Program Entry Screen

The pop-up "File" icon menu provides the following functions:



New	Clears all current program entries.
Open	Provides file open dialog to select a program from memory.
Save	Saves the current program being edited.
Save As	Saves the program being edited under a new name.
Delete	Deletes the current program from internal memory.
Export	Export the current program to USB memory device.

The pop-up "Edit" icon menu provides the following functions:



Copy	Copies all current step data including events.
Paste	Pastes all previously copied step data to the current step.
Clone	Copies and pastes current step events only to all following steps.
Soak Limits	Displays soak limits screen for soak band entry (set once only per program).
Time	Displays auto start screen for automatic start time entry (set once only per program).

Entering a Ramp/Soak Program

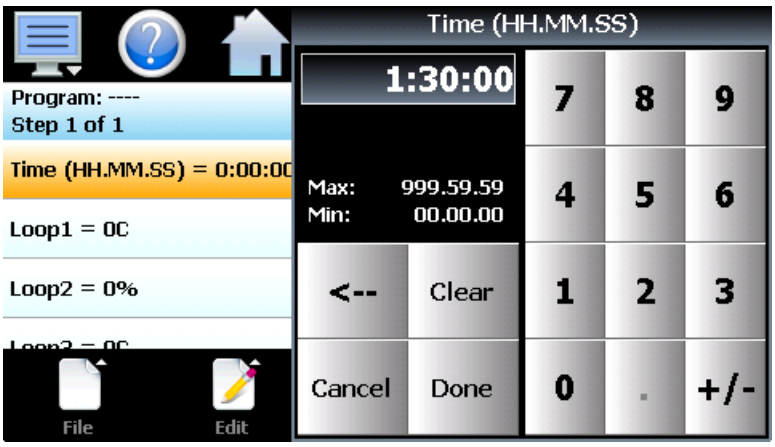
Ramp/Soak programs are created and edited from the program Entry screen. The program Entry screen can also be accessed directly from the "Program" menu or "Program Operation" button on Loop and Overview screens. To create an automatic ramp/soak program:

1.) From the File pop-up menu, select "New" to create a new program.
2.) Enter or delete steps by pressing the "Insert" or "Remove" icons. Steps can be added or deleted "on the fly" as required. Inserting steps anywhere within the program will not affect steps already programmed.
3.) For each step, press any row in the loop list view to set the time, loop set points and jump settings. Simply slide the list up or down to view more data like any standard smart device. Press any button in the "Event" list to turn the event output on or off for the program step. If soak or wait for conditions are required press the button for the desired type and make the necessary entries.
4.) From the File menu, select "Save" to save the program.

NOTE: *Programs can be saved with names of up to 16 characters long. However, MCT only uses the first 10 characters of the program name for display updates and record keeping. When naming programs, try to keep the name limited to 10 characters to have the full program name shown, or use the first 10 characters as a means of more clearly identifying the program when more than 10 characters are used in the name.*

Entering Step Time and Set Points

The length of the step, loop set points and jump steps are entered by touching the corresponding row for the desired entry in the list on the left side of the program entry screen. For example, to enter the time for the step, press the first row in the step data list view that contains the time entry. Upon doing so, the numeric entry keypad will be shown.



The length of each step is entered as a time in hours, minutes, and seconds. To make time entry easy, the entry will automatically be formatted into time as the number keys are pressed. For example, if a step is to be thirty seconds long, just enter a value of 30. If the time for the step is one minute and thirty seconds, enter a value of 130 for 1 minute, 30 seconds. If the step time is one hour and thirty minutes, enter a value of 13000 for 1 hour, 30 minutes and 00 seconds.

Note that one hour and thirty minutes is also a time of 90 minutes, you can also enter a value of 9000 for 90 minutes, 00 seconds. Upon pressing the Done button, the time will be formatted and displayed in the step data list view as 1:30:00.

To enter set points for each control loop, touch the loop in the step data list view and enter the desired set point via the numeric keypad. The loop set points are used as the target set points for the step, i.e., the set point that each control loop will arrive at by the end of the step. Each set point will then change independently of the other set points to arrive at the target set point when the time left in the step reaches zero. Thus, based on the time entered and the set point of the loop from the previous step, the step will either be a “ramp” step or a “soak” step.

Entering a Soak Step

The set point entry for a step defines the target set point, i.e., the set point that will be achieved by the end of the step. Thus, if the set point of the step matches the set point for the control loop from the previous step, the loop will soak, i.e., remain at that set point, for the entire step creating a soak step.

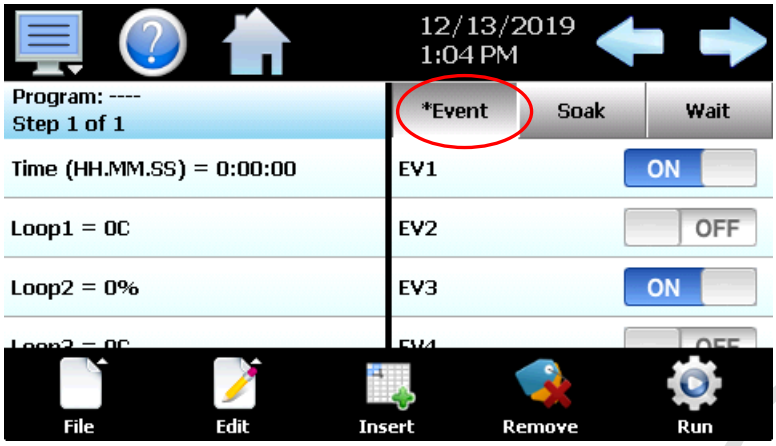
Entering a Ramp Step

A ramp step is merely a step with a set point that is different from the previous step. The loop’s set point will then ramp from the previous set point to the set point of the current step, linearly over the time entered for the step. This creates a ramp step.

NOTE: *A step time of zero can be entered for a step to implement an immediate set point change. When coupled with a wait for condition on the following step, there is no need to know the time it takes for the process to reach set point. The wait condition can be used to trigger the next step, typically a soak, so that the desired soak time is achieved without having to determine how much time may be needed to make sure that the process reaches set point before starting the soak time.*

Setting Step and Soak Events

The **Event** selections are used to select which system events (and corresponding digital outputs) are to be on during the step. To edit step events, press the "Event"' button on the program Entry screen. This will display the list of all events configured in the system. You can then select which events are to be on during the step by touching each event on/off button to toggle the events on or off.



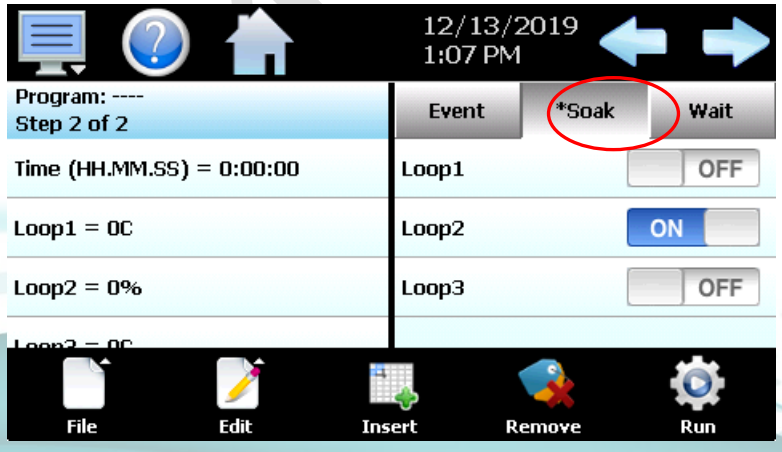
When at least one event is turned on in a step, an asterisk '*' will appear before the word 'Event' on the list selection button.

This lets the user know that events have been turned on without having to press the Event button or if more events are configured than can be shown on the list at one time. Event 15 may be set but will not be visible if the user has scrolled to the top of the list.

NOTE: *The step events must be set individually for each step. Even though a ramp/soak program may be in operation, if the events are not set, any equipment that is required to operate during the program will not turn on. To make setting step events quick and easy, MCT provides the "Clone" function from the "Edit" menu. When selected, all event selections of the current step will be copied to all following steps.*

This requires the user to only enter event selections for one step (step 1 for example), and if all following steps use the same event selections, selecting "Clone" from the "Edit" menu will then copy the selections to all other steps of the program. This feature can be used on any step of the program, so if event selections then change on step 5, the function can be used again and all steps after step 5 will then have event selections of step 5 copied to them leaving steps 1-4 with the previous selections.

The **Soak** selections are used to turn on the guaranteed soak option for one or more of the control loops. To enable guaranteed soak for a loop, first press the "Soak" button above the event list view on the program entry screen. This will display the list of soak selections for each loop configured in the system.



When a soak selection is made on a step, an asterisk '*' will appear before the word 'Soak' on the list selection button.

This lets the user know that soak selections are made without having to press the Soak button or if more loops are configured than can be shown on the list at one time. A soak on loop 10 may be set but will not be visible if the user has scrolled to the top of the list.

Press the on/off button for a loop to toggle the soak selection on and off as desired. When the soak event for a loop is turned on, the program will automatically enter a hold condition during the step if the loop's PV deviates from its set point by more than the soak limit setting for the loop as entered on the Soak limits screen.

NOTE: *Guaranteed soak is typically not used during set point ramping steps as the ramp rate will be affected if any process variable deviates from its soak band because the program will be placed into hold. When the program is in hold, the step length will be extended, and all set points will no longer ramp at the desired rate. They will maintain their current value until the timer starts again. Guaranteed soak is primarily used on soak steps to make sure that the process stays at the desired set point, within the soak band, for the full-time duration of the step.*

Setting Wait Conditions

The "Wait" function is a powerful tool for pausing a program until selected process variables (loops and/or monitors) reach a predefined set point. This differs from the guaranteed soak function by being a single shot monitor. With the guaranteed soak, the process variable is monitored throughout the whole step. If the process exceeds the limit, the program will pause until the process returns to within the limit setting. The wait for function pauses the program and waits for the process to reach a particular value that is set for the step. Once the process reaches this set point value, the program automatically resumes operation.

The program can also be set to wait for a digital input. This allows any of the available inputs on the MCT control module to be selected (input must also be configured as a wait for input). When the step is reached, it will wait for the input to change state before continuing the step. Any combination of loops, monitors and inputs can be set for a step, but all of them must meet the wait for condition of the step for the program to continue.

To enable a wait condition in a step, press the "Wait" button on the Entry screen to display the wait settings screen. The process selections, as shown below, allow you to select which loops and/or monitors (if any) will be used as a wait for condition.

If any analog or digital wait selections or delta selections are made for the current step, an asterisk '*' will appear before the word on the corresponding list selection button.

The 'Wait' button on the Entry screen will also display an asterisk if any wait or delta selection is made. This allows the user to know that a wait condition has been entered for the step without the user having to access the wait screen and check each step of the program.

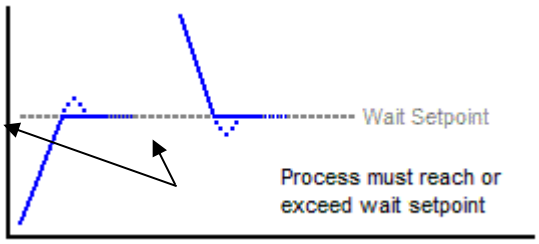
The loop and monitor selections are two common settings, the "Wait Type" and "Wait SP". These settings are used to set the trigger point for the wait condition, i.e., the value that each loop and/or monitor must meet for the program to continue.

The **Wait SP** is the set point value that each selected loop and monitor must reach.

The **Wait Type** setting selects how MCT determines if the loop or monitor input has reached the wait set point. There are three possible selections that can be made from the drop-down list box; Edge, Increase and Decrease.

The default setting is Edge. With this selection, MCT samples each loop and monitor input selected and determines that the wait for condition is met when each input crosses the set point value, either rising or falling. If the selected wait type is Increase or Decrease, each input must be above, or be below the set point for the wait condition to be met.

NOTE: *The set point entry is critical for the step to operate correctly when Edge is selected as the wait type. During the wait state, each selected loop and/or monitor input must arrive at or cross the wait set point for the program to resume operation. Thus, the previous step must ensure that the process values will be moving towards the target wait set point prior to the wait step beginning. If all selected loops and/or monitors do not cross the wait set point after the wait step has started, the program will pause indefinitely on the step until the user acts.*



The digital input selections are made by pressing 'Digital' button on the Wait screen. When using the digital input wait for selection, the digital input must be configured as a 'wait input'. If it is not configured as a 'wait input', the program will wait on the step indefinitely until the user acts since the input is unable to trigger the end of the wait condition. See section Digital Inputs for information on setting the digital input function.

Delta Control Setting

The delta control setting, accessed by pressing the "Delta" button, is a special feature of MCT that works in conjunction with the loop and monitor wait for setting. Typical uses for this function include wood drying or

heat-treating processes (metal, food, etc.) where temperature gradients through the product need to maintain at a minimum.

When enabled for a loop, MCT will use the lowest process value (if a wait type of Increase is selected) or the highest process value (if wait type of Decrease is selected) of all the selected loops and/or monitor inputs programmed for the wait condition, and apply the delta set point offset to that value. The resulting value (lowest loop or monitor input + Delta SP or highest loop or monitor input – Delta SP) will be used as the set point for the loop(s) selected in the list.

To enable delta control, at least one of the available control loops must be selected to have the delta set point applied and a wait type of Increase or Decrease must be selected. If no loops are selected or a wait type of Edge is selected, delta control will not be applied, and the step will be a normal wait step.

NOTE: *Delta control is only active during the wait condition of the step. Once the wait conditions have been met, delta control will be terminated. The loop(s) selected for delta control will then use the set point programmed in the step. Therefore, you must make sure you program the loop set point(s) of the step properly to maintain proper control of the process once the wait condition is met and delta control is no longer active.*

Example:

During manufacturing, a large, steel roller must be tempered in an oven after the hardening process is complete. If heated unevenly or too quickly, the roller could warp. To evenly temper the roller, four thermocouple monitor inputs of MCT are placed evenly across the length of the roller's surface. This allows the operator to monitor the temperature of the roller from one end to the other to insure it is being heated and cooled evenly.

The program must heat the roller to 400 degrees and then hold that temperature for an hour to ensure that the core of the roller is up to temperature. After the one-hour long soak at 400 degrees, the oven temperature is lowered down to 100 degrees to complete the tempering process. To ensure even heating and cooling, the program must limit the maximum temperature difference between the roller and the air temperature within the oven to 50 degrees. If the air temperature rises or falls too quickly, or a temperature gradient between any two points on the roller exceeds 50 degrees, it could cause the roller to warp.

To maintain this 50-degree difference, delta control is used to control the set point of **Loop 1, the oven temperature. A Delta SP of 50 is entered and monitor inputs 1 – 4 are selected as the "wait" inputs, which are the thermocouples placed on the roller's surface. By using these temperature inputs, the delta control function

can add the 50-degree set point to the lowest monitor input for the heating step and subtract it from the highest monitor input for the cooling step. The resulting value is then automatically used as the set point for **Loop 1.

Step 1 **Loop 1 set point = 400

Time = 0
Wait Type (Increase) = monitor inputs 1, 2, 3, 4 selected
Wait set point = 400
Delta Loop = **Loop 1
Delta SP = 50

*When the program is started, it will enter the wait condition and wait for each of the four monitor inputs to rise to 400 degrees. During the wait condition, the Delta SP will be added to the lowest monitor point and the result will be set to **Loop 1 set point. Once the wait condition is met, the delta control function will be turned off and **Loop 1 set point will become the program specified set point, i.e., 400 degrees as set for the step.*

Step 2 **Loop 1 set point = 400

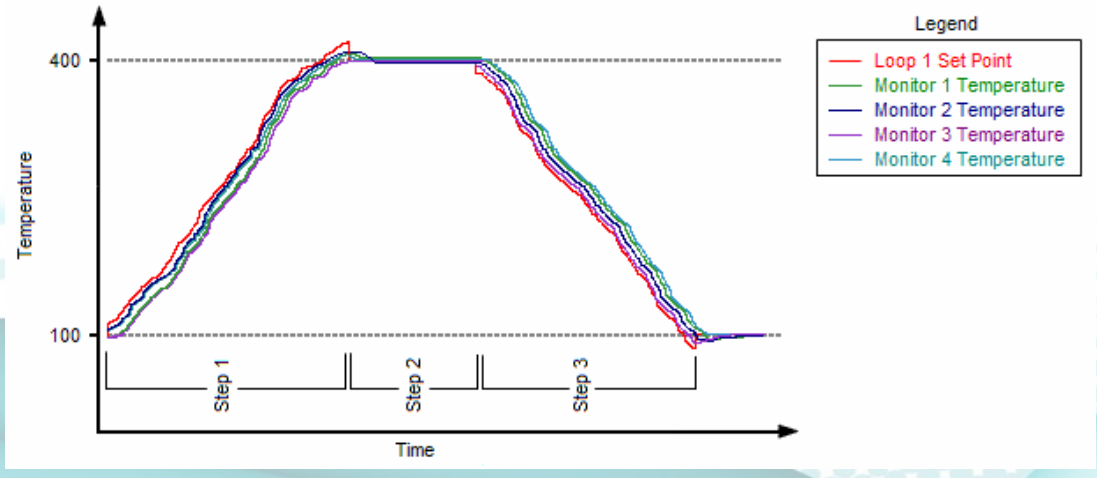
Time = 1 hour

This step is the soak step at 400 degrees for one hour since the set point is the same as the previous step 1. No wait or delta is programmed on this step.

Step 3 **Loop 1 set point = 100

Time = 0
Wait Type (Decrease) = monitor inputs 1, 2, 3, 4 selected
Wait set point = 100
Delta Loop = **Loop 1
Delta SP = 50

*Once the soak step is complete and step 3 is reached, the program will enter the wait condition and wait for each of the four monitor inputs to fall below 100 degrees. During the wait condition, the Delta SP will be subtracted from the highest monitor point and the result will be set to **Loop 1 set point. Once the wait condition is met, the delta control function will be turned off and **Loop 1 set point will become the program specified set point, i.e., 100 degrees which completes the program.*



Setting Jump Steps

This feature allows the program to 'jump' between different steps within itself. When a jump is programmed on a step, the program will first execute the step as a normal step; however, once the step time is complete, the program will jump to the specified 'jump step' rather than continuing to the next step. After all the programmed jumps have been completed, the program will then continue to the next sequential step in the program without making any further jumps.

To program a jump, scroll to the bottom of the step data list on the Entry screen. The jump step and cycle count are listed below the loop set points. Enter the step number that you want the program to jump to when the step is complete along with the total number of times the jump is to be made.

Jump to Step: *Sets* the step number that the program will jump to upon the completion of the step. The jump will only occur if the cycle count is greater than zero. The step number can be a previous step number, to cycle back to a previous portion of the program, or it can be set to make the program skips steps by jumping further ahead in the program.

Cycle Count: Sets the number of jumps that will be made from the step. Once all jumps have been made, the program will continue to the next step in sequential order. Jumps are disabled on the step when the cycle count is zero. MCT will ignore the jump step, so it does not have to be set. It can be left at its default value of one.

NOTE: *The cycle count defines how many jumps will be made. Thus, if you wish to perform 10 cycles within a program, your cycle count will be set to 9, 10 minus the 1 you performed prior to reaching the jump step.*

Example:

A process must cycle between 0 and 55 for 10 cycles during a portion of the program, and then returned to its starting value for following steps.

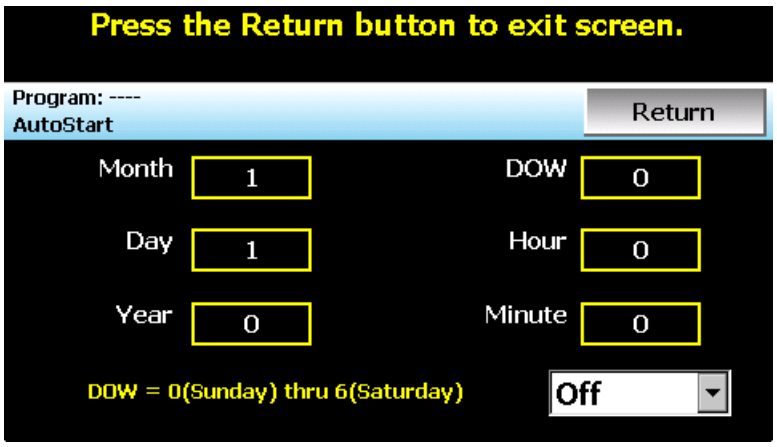
With the jump programmed on step 6, the program will jump from step 6 back to step 1 after the ramp time has completed. The program will then repeat steps 2 through 6. It will continue to do this until all 9 jumps have occurred. Once all 9 jumps have been completed, the program will continue to step 7 after the final ramp to 25. Since 1 cycle is made prior to the first jump at the end of step 6, a total of 10 cycles are completed.

NOTE: *MCT can do nested looping. Jumps can be set on every step throughout the program. It can jump forward, skipping steps, only to allow them later by other jump steps returning to the skipped steps. However, this can become confusing. Use caution with nested loops to prevent product loss. The program may not operate as expected due to multiple jump paths within the program.*

Setting Program Auto Start

Auto Start is a feature that can be used to start a ramp/soak program on a specified date or day, and time (of a 24-hour-clock). The auto start settings are saved with the program. Choose the desired auto start method, by date or by day, from the drop-down menu and enter the start time settings.

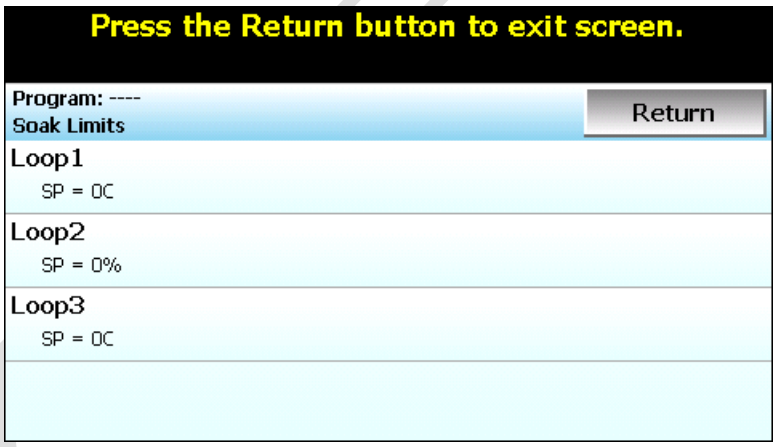
When auto start by date is selected, the exact date and time must be entered. Enter the month, day, year, and time of day in hours and minutes for when the program is to start. The day of week is not required to be set. It is not used for this function. When auto start by day is selected, only the day of week and time is required to be entered. The date settings are ignored. MCT simply looks for the day of week and time to begin the program.



NOTE: *The time is entered in a 24-hour format. To convert time from a 12-hour format (AM/PM) into 24-hour format, add 12 to the hours for PM time. For example, 2pm will be a value of 14 (2 + 12) for hours. A time of 5:30pm will be 17 hours, 30 minutes.*

Setting Guaranteed Soak Limits

The guarantee soak limits are used to set the control tolerance for each loop during guaranteed soak steps when in ramp/soak program operation. When a process variable deviates from its set point by more than its soak limit value, the program timer will stop until the process variable re-enters the soak band. These limits apply to every step in the program and only need to be set once.



To change a limit, touch the desired loop in the list, enter the new limit setting on the numeric keypad and press 'Done' when finished. The new limit value will then be shown in the list view for the selected control loop.

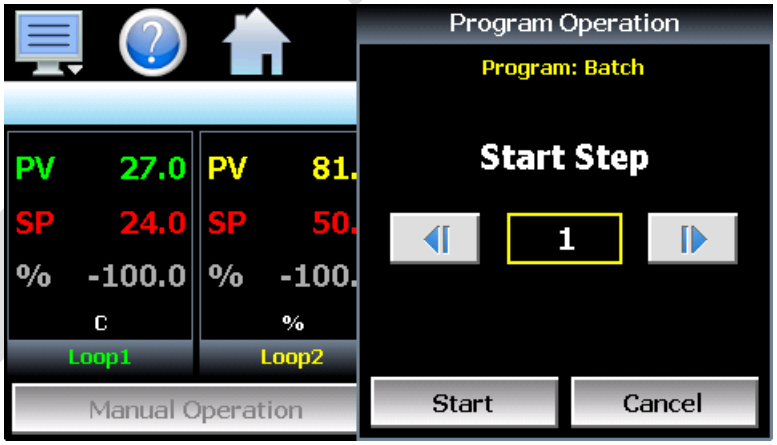
NOTE: *If soak limit is set too tight, i.e., a very small deviation value from set point, it could prevent the program from operating as desired because the process may not be able to be controlled to such a tight limit setting.*

Starting an Automatic Ramp/Soak Program

All automated program operating functions are accessed via the Program Operation screen. This screen can be accessed by pressing the “Program Operation” button on the Loop view or Overview screens or by pressing the “Run” button on the program Entry screen.

The program operation allows an operator to run, hold, stop, edit, and select automatic programs. The Program Operation window will display the program loaded in the MCT which is ready for operation by pressing the Run, Hold Stop or Off buttons. If a program is already loaded, the user can start the program without entering a start step. This offers a quick start/stop of programs for repetitive test operations. In this case, the program will always start from step 1.

If entering a Start Step is required (to start the program on a specific step), press the “Select” button and choose the program from the list, then press the run button. This will display the **Start Step** entry.



The **start step** can be adjusted up and down by pressing the right/left arrow buttons or by pressing the step number field and directly entering the desired start step via the numeric keypad. Once the desired start step number is entered, press the “Start” button. The program will then be transferred to the control module and started once the transfer is complete.

To stop a program, select “Stop” from the Program Operation window. When a program is stopped, the loop set points and events will remain at their current values. Selecting “Off” will also stop the program; however,

this will also turn off all system events at the same time. The Edit button will navigate directly to the program Entry screen so a program can be created, edited, and stored.

NOTE: *If the program was set up with the auto start feature enabled, the program will enter the auto start mode immediately upon start. Once the set date or day and time is reached, the program will begin running. The start date shown on the Status view screen indicates when the program will start based on the auto start settings.*

Hold/Resume Ramp/Soak Program Operation

At any time during the operation of a program, it can be manually placed into hold. This stops the program timer; however, MCT continues operation under the current step settings at the time the program was put into hold. To pause a program, select "Hold" from the Program Operation screen. To resume the program from the point at which it was paused, select "Run" from the Program Operation screen.

NOTE: *When a program is in hold, the set points and system events can be manually changed to make on-the-spot adjustments to system operation in that step, without changing the original program. When program operation is resumed, MCT will continue the step using the adjustments made to the set points and system events.*

Adjusting Step Time

During program operation, the length of time remaining in a step can be adjusted to increase or decrease the time left. The adjust step time function allows you to add or subtract time from the current step; however, the program must be first put into hold. Once in hold, the Adjust Time icon on the Status view screen is enabled.

When selected, the numeric keypad will be shown. Enter the time adjustment in hours and minutes and press Done when finished. The time remaining in the step will be adjusted by the total time entered. Resume the program by selecting "Run"' from the Program Operation screen.

NOTE: *When adjusting the time of a set point ramp step, the ramp rate will be altered for the remainder of the step. The ramp rate will decrease if time is added and increase if time is removed.*

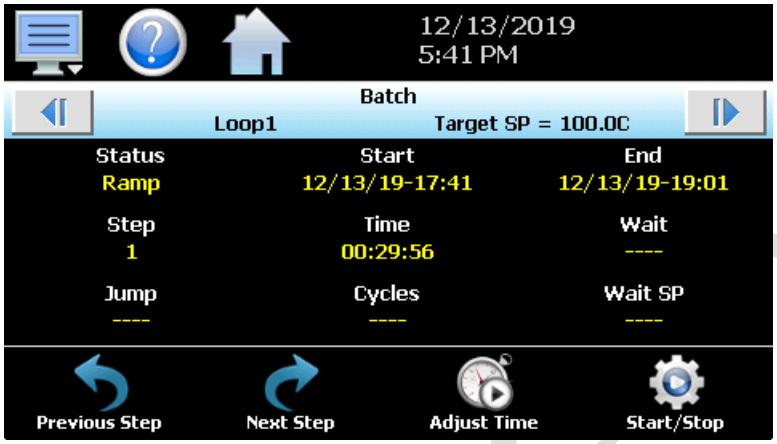
Advance Previous/Next Step

The advance step functions allow you to skip certain program steps or repeat them by advancing to the desired step. To advance to a previous or next step in the program, it must be first put into hold. Once the program is in hold, the advance step icons on the Status view screen are enabled.

Each press of the Previous or Next icon will cause the program to jump back or jump forward by one step. When the program is on the desired step, place it back into run and the program will resume operation from the beginning of the step.

Monitoring Automated Ramp/Soak Program Operation

The program Status view provides all information regarding the operation of the current program.



Status indicates the current operating mode of the program, i.e., active, hold, ramp, steady, waiting, etc.

Start indicates the date and time at which the program was started.

End is the calculated stop date and time for the program.

Step indicates the step number currently being executed.

Time is the time remaining in the current step.

Wait indicates the input(s) being monitored if a wait for condition is present.

Wait SP shows the set point or digital input number for the wait for condition if active.

Jump indicates the step number that program will jump to at the completion of the current step.

Cycles indicates the number of jumps remaining for the step (if any).

The **loop set points** for the current step can be viewed at the top of the screen by pressing the left and right scroll buttons to cycle through each loop configured in the system. Note that the set points shown here are the target set points, not the actual set points the loops are controlling to. To view the actual control set point, see the Single, Dual or Overview screens.

IMPORTANT: *If the set point does not match the set point programmed for the step, the set point may exceed the configured set point range for the loop. If a step set point exceeds a limit, it will be coerced to the lower or upper limit that it exceeds. This is done automatically without altering the original program.*

The set point limits are those defined in the MCT configuration for the loop, not those on the set point Limits screen under the device setup menu. It is not possible to enter set points for a program that exceed the configured set point limits; however, if the program was imported from another MCT system with set point limits exceeding those of the current system, this can occur.

Common Questions About Ramp/Soak Program Operation

1. How do I start or run a ramp/soak program?

To select and start a program, use the Program Operation window which can be accessed from the Loop, Overview, or program Entry screens. All start, stop, hold, edit and program select operations are available from this window.

2. How do I know which program is running?

When a program is running, the name is displayed on the program Status view screen as well as the Loop and Overview screens. It is also shown in the Program Operation window. The MCT will indicate that the program is running when it is in operation. If a program is not running, the MCT will display the name of the currently loaded program, i.e., present in memory and ready to be run.

3. Why is the program name not appearing correctly?

MCT only uses the first ten characters of the program name for display updates and record keeping, even though programs can be saved with names of up to 16 characters long. When naming programs, try to keep the names limited to ten characters if the desire is to have the full program name shown, or use the first ten characters as a means of more clearly identifying the program when more than ten characters are used.

4. How do I enter a jump step?

A jump step is a normal step; however, instead of continuing to the next step of the program when the step is complete, the program jumps to a specified step. To enter a jump, set the step number you want to the program to jump to, and the number of times that the jump is to take place, into the step you want to jump from. When that step is complete, the jump settings will tell the program to jump to the specified step until all jumps have taken place. The next time the jump step is executed (after all jumps have taken place), the program will continue to the next step.

5.Why is the program not coming out of a Wait?

When a wait condition is applied to a step, the step will not begin until the wait condition is met. When using a wait condition to initiate a soak time, be sure to place the wait condition on the soak step. If the wait is applied to the ramp step, the program will not continue because the set point will not change until the wait condition is met, i.e., the ramp cannot take place until the step is executed. Since the set point does not change, the input will not change to meet the wait set point and the program will wait indefinitely.

If the wait condition is a digital input, the selected input must meet its configured transition state after the wait has been initiated. If the input turns on or off before the 'wait' step has been entered, the program will not continue because the change in state of the input must be seen after the wait has been initiated.

6.Why has the program not completed its run by the stop date given when I started it?

The estimated stop date provided by MCT for the program is a calculated value based on the sum of all step times. This time can be affected by any guaranteed soaks or wait for conditions entered steps of the program.

The effects of these times are an unknown and can cause the program to run longer than calculated because they pause the program until their conditions are met.

NOTE: *MCT does update the estimated stop date based on these conditions as they occur; however, it does make the stop date a moving target.*

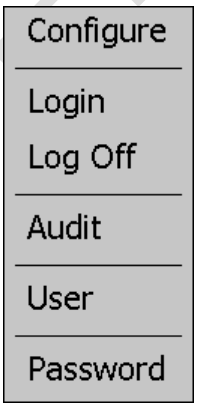
SECURITY

The MCT security model provides an administrator with the tools to add up to 30 users to the system. Each user must have a unique ID, full name, and password. Four user levels are provided which include system, user, supervisor, and administrator levels. Specific access rights can be assigned to each user level and password aging can be implemented. Verification is provided (if enabled) for any parameters that will change a control parameter, which could upset the process (i.e., loop set point, start/stop automated ramp/soak programs, etc.).

Verification requires that the logged in user must log in again before the process value (at the controller) will be changed. This feature is provided for extra security. The following example will make re-authentication clearer:

A supervisor logs on the system. The supervisor then steps away from the system to take a phone call but does not log out before leaving. If another user tries to change the control set point on any loop, the system will require another login (by an authorized user for that level) before the control set point is changed. This provides an extra level of protection to make the system more "tamper proof".

The Security menu is accessed from the home menu and provides access to the security section of the MCT.



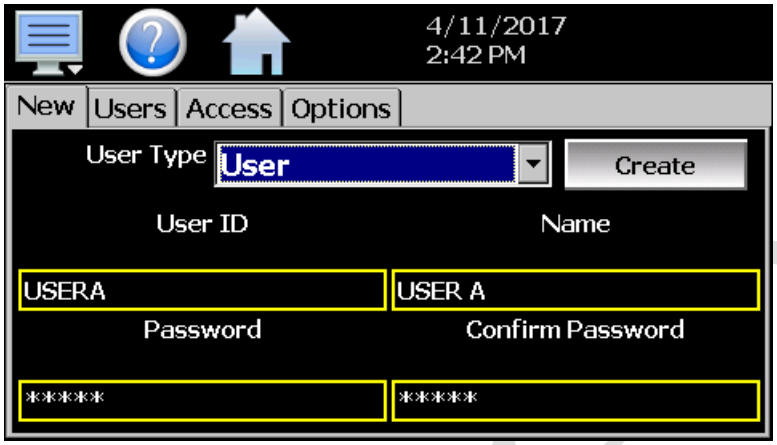
The Security menu provides the following functions:

Configure	Provides access to security setup to add users, set rights and options.
Login	Log on a user if security is enabled.
Log Off	Log off a user if security is enabled.
Audit	Allows the user to view any of the saved audit trail files.
User	Shows the current user logged into the system.
Password	Allows the current user to change their password.

To assist in setup and documentation of MCT, see the "MCT Configuration and Worksheets" Excel file provided on the Future Design Controls website (http://www.futuredesigncontrols.com/MCT.htm). This document provides setup and configuration forms and templates for all the MCT features including Security.

Adding Users

The “New” user tab provides the ability to add up to 30 users to the system. Select the type of user from the drop-down list (System, User, Supervisor or Administrator). Press each field to add the user ID, full name, and password (no spaces allowed 5 characters minimum and 16 characters maximum). Press the “Create” button to add the user to the system. If the passwords do not match or the user ID is already used, the MCT will alert the user and not accept the entry.



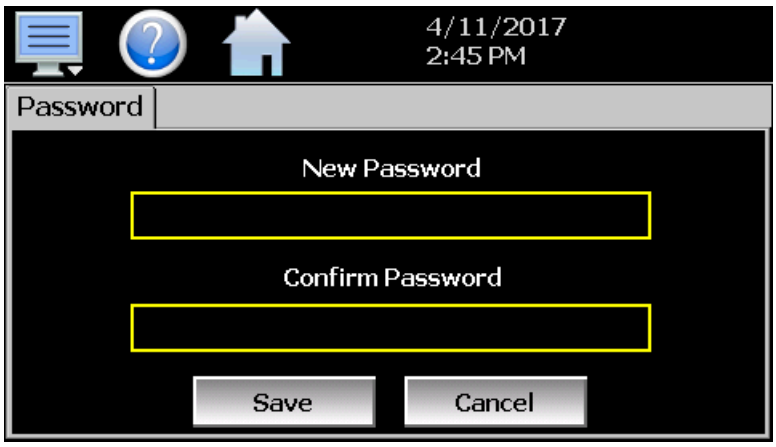
Viewing Users

The “Users” tab provides the administrator with the ability to view information on each user entered the system. Password information is not available. The user can be deleted from this tab and a new password for each user can also be entered from this area.

To delete a user, select the user from the list and press the “Delete” button. Likewise, to change the password for a user, select the user from the list and press the “Password” button.

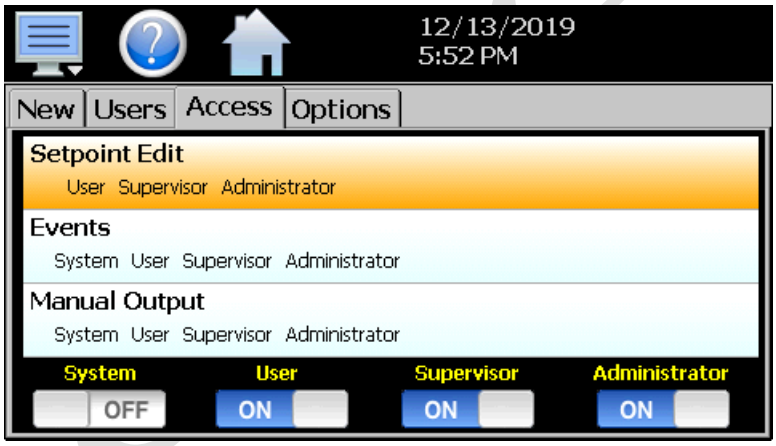
New Password Entry

To change a password, select the desired user by touching the User ID in the list box and press the ‘New Password’ button. Enter the new password and confirm the password. Press the “Accept” button to change the password (no spaces allowed 5 characters minimum and 16 characters maximum).



Setting User Access

The “Access” tab provides the administrator the ability to assign rights to each user level (System, User, Supervisor and Administrator). To enable or disable specific program functions (user rights) for each user level, select the user right from the list and press the corresponding on/off button for the user level you want to change access rights for. If the button is set to on, user access will be enabled for the user group.



User access for “Security” cannot be disabled for the administrator group. This is a safety feature to make sure that any administrator with the proper user ID and password can access security. If the administrator losses his/her ID or password, there is no “back door” to the system, and it will have to be reset and reprogrammed to return to normal operation.

Security System User Access

Shown below is a list of the available user rights, where to find the menu item(s) applicable to the user right and a description of what it applies to. Note that the Darwin Chambers configuration allows many menu items to be disabled; in which case the menu for a specific user right may not be shown.

User Right	Menu Location	Description
Setpoint Edit	View/Loop, Overview	applies to loop controls when not running an automatic ramp/soak

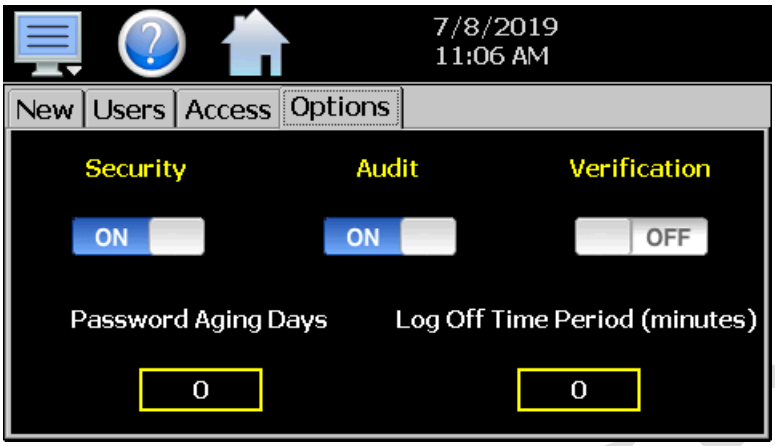
User Right	Menu Location	Description
		program (does not apply to loop/monitor alarms)
Events	View/Overview	applies to enable or disable system events
Manual Output	View/Loop	enable or disable loop control output control
Tuning	Device/Settings/Tuning	enable or disable loop control AT (auto tune) button and manual edit of loop tuning (PID) parameters
Program Operate	Program/Start, Hold, Halt, Off actions	applies to all program control menu selections; does not affect digital Inputs configured for same action
Recovery	Device/Settings/Set/Recovery	logic when running an automated ramp/soak program when power lost & recovery: Off, Hold, Continue, Restart or Resume
Reset Alarms	View/Alarm	does not affect digital input alarm silence function
Clear Alarms	View/Alarm; Clear button	prevents alarm list view from being cleared
Chart Settings	View/Chart	configure plot channels, scale & time for charts
Data	Data/Data	applies to all data logging actions & settings; does not affect digital input functions
Annotation	Data/View/Annotation	access to add operator messages to active log file
Signature	Data/View/Signature	access to add digital signature to active historical data file
Open	see description	alarm, automatic program, audit & data files
Save	see description	program “save” and “save as”; note files may be copied from system with USB file transfer utilities
Delete	see description	data files & automatic programs; note files may be deleted with File Utilities
Program Edit	Program/Entry	no data entry or access to Events or Step SP/Time fields or GS Soak Limits, Auto Start; can't insert/delete/copy/paste step.
USB	Data/Utilities/USB	allows USB memory stick to copy/delete data, alarm, program & audit trail files & to import programs
FTP/WAN	Data/Utilities/FTP/WAN	configure FTP client settings

User Right	Menu Location	Description
Communications	Device/Settings/Comms/Comms	configure web page, Modbus address & VNC settings
Barcode	Device/Settings/Comms/Barcode	applies to all barcode reader settings
Defrost	Device/Settings/View/Defrost	applies to defrost interval, duration and fan delay time settings
Start Thaw	Device/Settings/View/Defrost; Defrost button	access to manually initiate a defrost cycle
Redundancy	Device/Settings/View/Redundancy	applies to primary system selection, redundancy operating mode and alternate/concurrent time settings
Load Timer	Device/Settings/View /Redundancy; Load Timer button	access to active redundancy product load timer
Setpoint Limits	Device/Settings/Set/Limit	applies to loop controls (does not apply to loop/monitor alarms)
Adjust Alarms	Device/Settings/Set/Alarm	applies to all loop and monitor point alarms
Event Names	Device/Settings/Set/Event	configure event tagnames (seen in Overview & program step Events)
Email Settings	Device/Settings/Email/Email Settings	configure email settings and addresses
Email Message	Device/Settings/Email/Message	access to compose & send email message
Offline	Device/Settings/Offline	access to Off-Line menu system: Service items & Options, Units, set Clock, Display settings, Language, Exit To Application, monitor Offset, Configuration, Analog Input & Output Setup, Digital Input & Output Setup, Digital Input Monitor & Digital Output Force
Service	Device/Settings/Offline/View/Service	applies to counter set point entry and clearing counters
Service Options	Device/Settings/Offline/View/Options	service notification enable/disable
Calibrate Touch	Device/Settings/Offline/System/Display	access to the touch screen calibration utility
Backlight	Device/Settings/Offline/System/Display	access to edit backlight settings for brightness and off delay time
Alarm Volume	Device/Settings/Offline/System/Display	allows edit of MCT alarm beeper volume

User Right	Menu Location	Description
Units	Device/Settings//Offline/Set/Units	loop/monitor point temperature units configuration - C\F
Clock	Device/Settings/Offline/Set/Clock	Set Date/Time, Time Zone, DST and NTS connection
NTP	Device/Settings/Offline/Set/Clock	enable & choose National Time Server location
Daylight Savings	Device/Settings/Offline/Set/Clock	enable Daylight Savings Time (DST)
Language	Device/Settings/Offline/Set/Language	Select help language
Offset Calibration	Device/Settings/Offline/Calibrate/Offset	enter bias for monitor points
Analog Inputs	Device/Settings/Offline/Hardware/ Analog Inputs	configure Analog Input(s) to act as remote set points for specific loop controls
Analog Outputs	Device/Settings/Offline/Hardware/ Analog Outputs	configuration of PV, SP or %out retransmission from specific loop controls
Digital Inputs	Device/Settings/Offline/Hardware/ Digital Inputs	configure Digital Inputs
Digital Outputs	Device/Settings/Offline/Hardware/ Digital Outputs	configure Digital Outputs
Force	Device/Settings/Offline/Hardware/Force	access to force digital outputs on/off
Security	View/Security/Configure	applies to Security Setup
Configuration	Device/Settings/Offline/System/ Configuration	access to import/export setup files of MCT
Default Configuration	Device/Settings/Offline/System/ Configuration; Reset Default Configuration button	function to clear system configuration and reset all to blank (default) state for reconfiguring
Exit (run mode)	Device/Settings /Offline/System/Exit; “Exit application. (Automatic mode startup).” button	prevents MCT application from being stopped
Exit to Configurator	Device/Settings /Offline/System/Exit; “Exit Application. (Configuration mode startup).” button	prevents MCT application from being stopped and access to the MCT configurator application

Setting Security Options

The security “Options” tab provides the administrator the ability to set the global security options.



Security is the global setting that turns the MCT security system on or off. The security system must be enabled for the audit trail to be enabled.

Audit is a global setting that turns the audit trail on or off. When the audit trail is turned on, all user actions are written to a daily log.

When enabled, **Verification** requires that the logged in user must log in again before the entry value will be changed.

The **Password Aging Days** field is a global for all users. Password aging starts from the day the user is entered into the system. The value can be set from 0 to 365 days. A value of zero disables password aging.

NOTE: *When using password aging and the password expires for a user, the user will be required to change their password before access to the system is permitted. A user can change their password at any time (even if aging is not used) by selecting “Password” from the main security menu.*

The **Log Off Time Period (minutes)** field is a global for all users. The log off time begins once a user logs into the system. If the user does not perform any actions within the specified time, the system will automatically log the user out. User actions are defined as any action that requires a process change, i.e., changing a SP, changing an alarm description, etc. Any field protected by security settings of the MCT are user action fields. The log off time can be set from 0 to 1440 minutes (24 hours). A value of zero disables the auto log off feature.

NOTE: *If a user begins an action such as changing a set point but does not complete the task and leaves the numeric keypad shown, the system will log the user out if the log off time elapses. However, since the keypad is still shown, the set point change can still be completed as the task had already begun. In this case, if a user then enters a new set point, the audit trail will record the change under the user that was previously logged in, but since the user was automatically logged out while the keypad was shown, the user will be required to log in to access the set point again.*

Audit Trail

The audit trail viewer is accessed by selecting “Audit” from the Security menu. It displays all user actions that affected the system for any given day. The MCT can store daily audit files for a period of a year or longer (time based on storage usage for data history).

Each time a user takes an action that affect the operation of the system (changing a set point, start/stop data logging, changes an alarm set point, etc.), the action is written to a file. Audit trail file names are listed as MMDDYYYY (where MM = month, DD = day, YYYY = year. The "Open" file button will display a dialog box where the user can select any audit file to view.

NOTE: *If no actions occurred on a given day, an audit file will not be created for that day.*

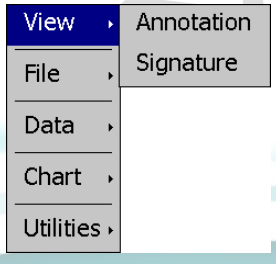
Each action recorded to the file includes the date/time it occurred as well as the user (if logged in) that made the change. If no user is logged in, the user will be listed as "Device Manager", which is the default user account for the MCT system.

The send email icon allows the user to send a copy of the currently opened audit trail file to any user configured in the MCT. When the email icon is pressed, an "Add Recipients" window will be displayed where the user can select recipients for the file from any of the email addresses configured under the MCT email settings. For information on how to add email recipients to the MCT, see the section 0 Email.

DATA LOGGING

The MCT data logging features are accessed via the home "Data" menu item. The system data logging provides the ability to select individual points for logging, view data log files and start/stop logging operations. The logging ability of MCT provides an easy-to-use, convenient method to obtain electronic data without the need for additional data acquisition equipment.

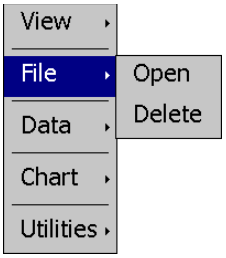
The Data Log menu provides navigation to the following functions:



***View** menu*

Annotation: Allows the user to insert a notification into the currently running log file or view all annotations associated with the currently loaded historical data file.

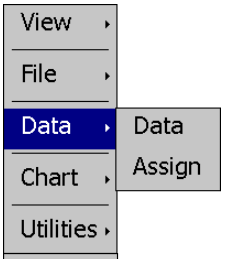
Signature: Allows the user to digitally sign a file to prevent data tampering and view all digital signatures associated with the currently loaded historical data file.



***File** menu*

Open: Opens a history file for review.
Delete: Allows the user to delete the currently loaded history file.

***NOTE:** The "Delete" log file function does not affect data from a file that is running, only the current data log file loaded for review.*



***Data** menu*

Data: Displays main data log screen with status of logger.
Assign: Allows the user to select what variables are to be logged.

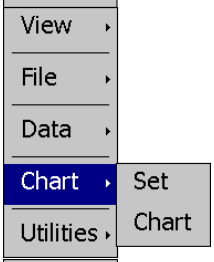
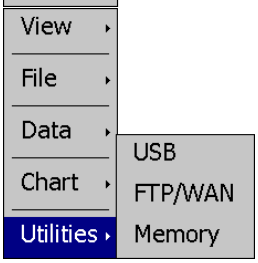


***Chart** menu*

Set: Selection of data file points and time for history review.
Chart: Plots historical data after time and points are selected.

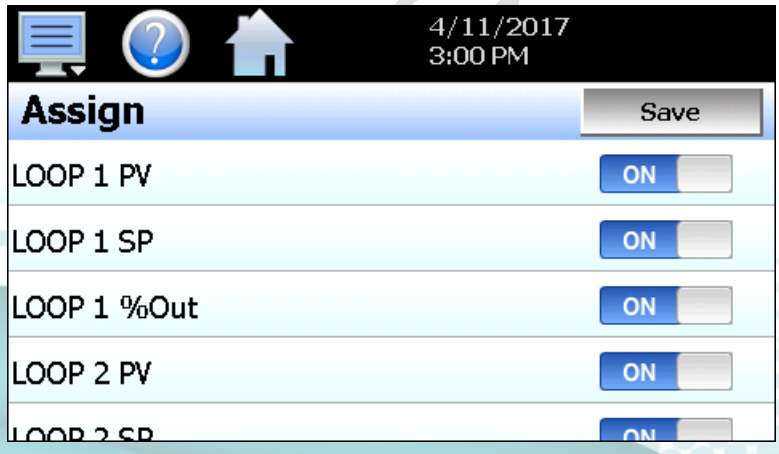


***Utilities** menu*

USB: Allows the user to access file utility functions.
FTP/WAN: Provides access to the automatic file back-up settings.
Memory: Displays memory capacity remaining on nCompass.

Selecting Points for Logging

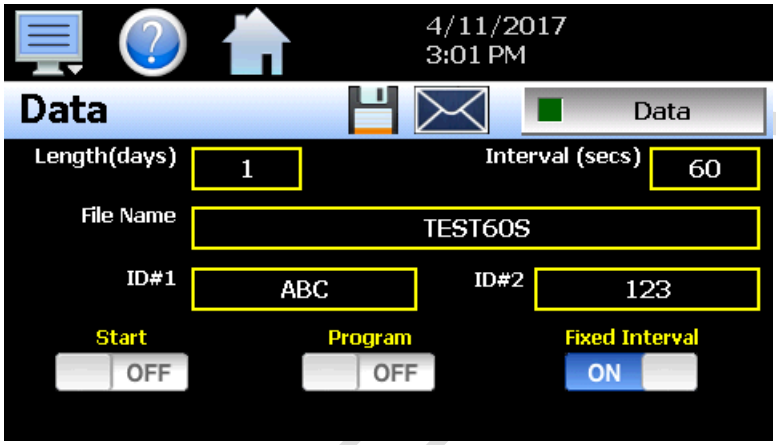
For the data logging function of the MCT to operate, the user must first select what variables are to be logged to the data file. To choose which points are to be logged, select "Assign" from the Data menu.



Press the on/off button for each item to toggle it on/off. When on, the variable will be logged to the data file. When selections are completed, press the "Save" button to save the point selection to memory. New selections will not take effect until the Save button is pressed.

Starting/Stopping Data Logging

The MCT logs data to its SD card. Current data for each variable is written to the log at a fixed interval based on the settings entered in the "Length" and "Interval" fields. File names are automatically generated using MMDDYYYY-HHMMSS format (where MM = month, DD= day, YYYY = year, HH = hour, MM = minutes, SS = seconds). To use a specific file name, touch the "File Name" field and enter the desired name (up to 16 characters). When a file name is entered, the file will be saved as FileName_MMDDYYYY-HHMMSS.



The data logger also provides two entry fields, **ID#1** and **ID#2**, which allow the user to enter in information specific to the file such as a batch and/or lot number to identify product that may be associated with the new data file. These entries will be saved with the data log file for later identification.

The ID#1 and ID#2 fields are also used to identify the MCT when DataWeb is active (see section 0 FTP/FileWeb/DataWeb Interface). When the DataWeb feature is in use, the ID#1 and/or ID#2 entries are used to identify a specific MCT from many units that may be sending data to the same database. The ID#1 and ID#2 fields also allow the user to search for only the data specific to a single unit in the remote database. The entries in these fields should be unique to each MCT connected to the server.

If more than one MCT utilizes the same entries, the data from all units with the same ID's will be combined under the one ID in the database. This will render the data unusable as there will be no way to split the data between the different units and know which data points are from each unit. If this does occur; however, the MCT will still have a local copy of the data stored to the local data log file(s). This provides a backup copy of the data just in case the ID numbers of more than one unit are identical.

The **Length (days)** field sets the length of a data file in number of days. It can be set for 1 to 31 days. Once the selected number of days has elapsed, a new data file will be created, and logging will continue in the new file.

The **Interval (secs)** field is used to set the rate at which points are written to the log file which equates to the sample rate in seconds. When the "Fixed Interval" option is turned on, the logging interval will be automatically set to record at minute intervals based on the number of days set for the file. If the file is set for 1 day in length, the logging rate will be at 1-minute intervals. If the file is set for 7 days, then the logging rate will be every 7 minutes. This keeps the data file size manageable and able to be viewed by the MCT data viewer.

The log interval can be manually set to any rate between 2 and 1860 seconds in any combination with the number of days before a new file is started. To do this, turn off the "Fixed Interval" option and enter in the desired logging rate in seconds.

NOTE: *Logging at shorter intervals allows the MCT to capture fast changing processes, but the data files can become extremely large. Files that exceed the capability of the MCT data viewer (>520KB in size) will have to be extracted from the MCT using a USB memory stick or FTP file transfer to be viewed remotely on a PC.*

Files larger than the 520KB limit will not be automatically, digitally signed by the MCT. If the files are to be digitally signed, this must be done manually by extracting the files and using the FDC data viewer program running on a remote PC.

To manually start data logging, press the "Data" button. Any time logging is enabled, the indicator on the Data button will be illuminated. To stop data logging, press the Data button again. Data logging can also be started automatically by turning on the "Start" or "Program" option.

The **Start** option automatically turns data logging on whenever the MCT is first powered on. This action simulates that of a standard chart recorder.

The **Program** option is a convenient method for gathering information that pertains only to the operation of an automatic ramp/soak program. When selected, the MCT will turn the data logger on at the beginning of a program and off once the program is completed. This eliminates the need to scan through extensive data records to find the specific information you are looking for from a particular time.

NOTE: *The MCT will automatically use the program name as the filename for the log file (up to 10 characters). This provides a simple identifier for log files that pertain only to automatic program operation. Any entry made in the File Name field will be ignored.*

The **Email** icon next to the data log on/off button allows the user to select the currently open data file and email the file to any user that has been setup to receive emails from the MCT.

The **Disk** icon next to the **Email** icon allows the user to save the currently opened data file to a USB memory device connected to the MCT.

Calculating Log File Size

The MCT saves the log file in a text-based format (.csv), so the amount of memory consumed for each reading is dependent upon the number of digits required to accurately display the value (1 byte per character). This optimizes memory usage but also makes calculating an exact file size difficult. To obtain a worst-case approximation of the resultant file size, use the following formula:

File Size (Bytes) = (64 + LD) * number of readings in the file

Where:

LD (loop data) = 7 * number of points selected for logging

Example

MCT with ten loops of controller data (PV, SP, %Out selected) for each loop and 15 monitor points (PV) selected (total of 45 points). Logging set at two second interval running for a duration of one day.

*LD: 7 * 45 = 315*

*number of readings in file: 1 reading/2 secs * 60 secs/min * 60 mins/hr * 24 hrs/day = 86400*

File Size (Bytes) = (64 + 315) * 43200 = 16,372,800

An MCT logging 45 points of data at a two second interval will consume a maximum of ~16MB of memory per day. With an SD memory card size of 8GB, the MCT can log data continuously for over one year before the SD memory card is full.

8GB = 8,000MB (total memory card space) / 16MB (per day) = 500 days (1.3 years)

NOTE: *Available memory space on the SD card is also affected by the number of ramp/soak programs, alarm files and audit trail files that are stored. The quantity and size of these files will reduce the memory space available for logging. Regular file maintenance is recommended to ensure adequate space remains available for the logging of data.*

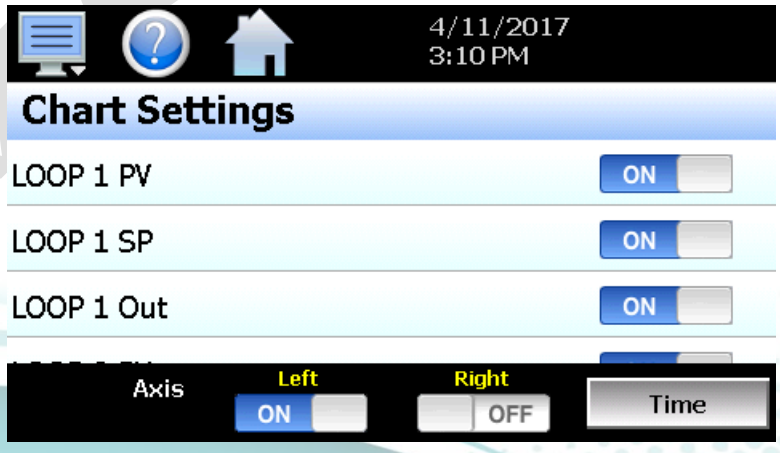
Reviewing Historical Data

Historical files can be opened and viewed using the historical viewer. To view a historical data file, it must first be opened by selecting "Open" from the File menu. Once the file has been opened, the MCT can automatically plot the first eight channels of the historical data file, or the user can choose to cancel the plot and select which channels should be plotted as well as adjust the specific time to plot.

NOTE: *The open historical data file list will display up to 650 files. If more than 650 log files are present, the files cannot be shown in the list and the files will have to be exported from the MCT to view them. This can be done either via USB file utilities (see section 0 USB File Transfer) or FTP (see section 0 FTP/FileWeb/DataWeb Interface).*

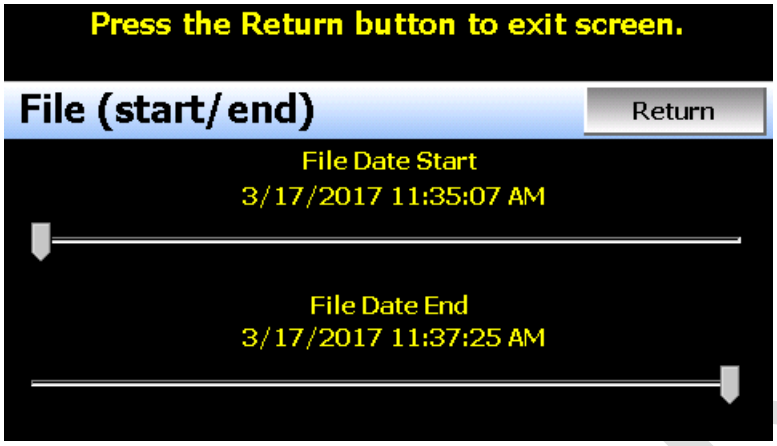
History Plot Setup

The history plot setup allows the user to select any time frame (zoom in/out) from the historical data file as well as select up to six channels of data to plot. To edit the settings for the historical plot, select "Set" from the Chart menu.



Any point from the data file can be selected along with the vertical axis to be used for each channel to be plotted. Select channels from the list by turning them on or off and use the "Left" and "Right" axis buttons to

assign the selected item to the left or right axis for the plot range. To adjust the time to plot from the data file, press the “Time” button.

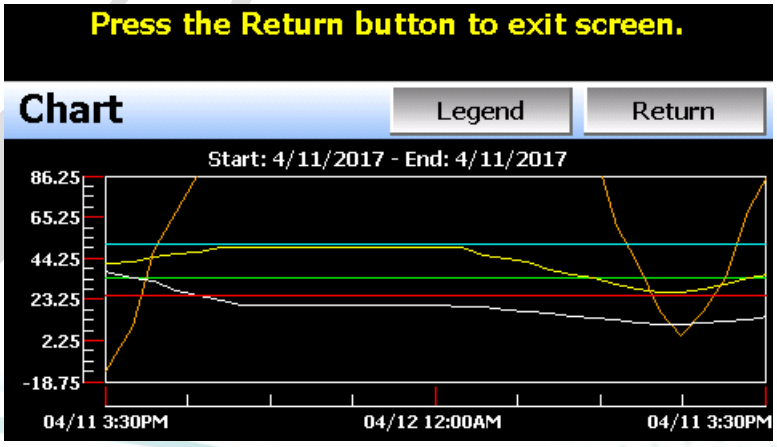


The start and end dates for the currently loaded file will be shown with time in hours, minutes, and seconds. The “File Date Start” and “File Date End” sliders are used to select a time span for historical viewing. Once the desired start and end times have been set, press the “Return” button to return to the Chart Settings screen.

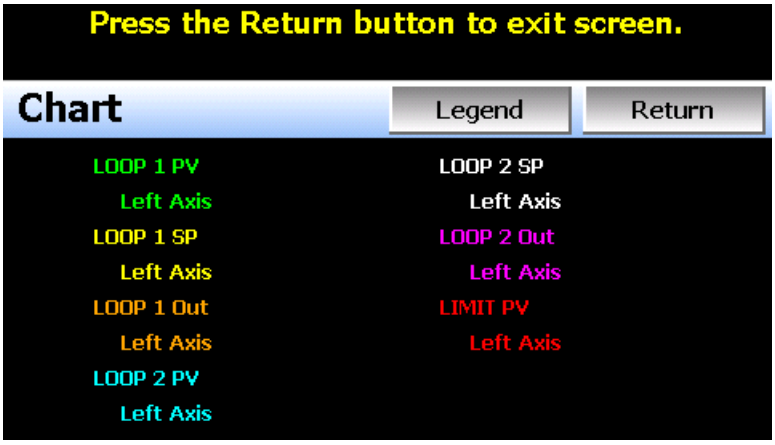
Plotting Historical Data

The history Chart plots the data from the currently opened history file according to the selections made under chart setup. If a file has not been opened or data points have not been assigned to a plot, the MCT will alert the user to correct the problem. The ‘X’ and ‘Y’ axis scales are set to auto scale based on current values for each plot channel, so no user action is required.

The historical graph provides the same zoom feature as the real-time charts so the user can zoom in on a particular area of the historical plot by dragging their finger across the screen to draw a rectangle around the desired plot area.



Pressing the “Legend” button will provide the user with channel information by displaying the names of the selected plot channels, which axis they are associated with, and the color used to display the plot channel. Pressing the button again will toggle the display back to the historical chart.



NOTE: *When pressing the Legend button to toggle between the historical chart and the legend screen, it may take several seconds for the chart to become visible depending on the size of the data file and number of channels selected to plot.*

When finished viewing the historical chart, you must press the "Return" button to exit the historical data viewer and return to the main data log screen.

USB File Transfer

The "Utilities" section of the MCT interface provides all the functionality required for retrieving files and maintaining the internal SD memory card. The internal SD card should not be removed from the MCT interface. Any change to SD directory structure (moving or deleting files with a PC) may cause the MCT interface to stop operating and a new SD card will need to be ordered. Never move or delete the directories unless using the provided MCT file utilities functions.

NOTE: *The data log files, programs, alarm log and audit trail directories are saved to the internal SD card (not the USB memory stick device) plugged into the MCT interface. Never unplug the SD card when MCT is powered up or loss of data may result.*

The USB file transfer screen allows the user to copy or erase files from the internal SD card. Complete file directories for all MCT file types can be copied to the USB memory stick and erased from the internal SD card. The status for file functions is displayed for the operator during copy/delete operations. The MCT also allows automatic programs to be imported from the USB memory stick. Programs must be exported from another MCT device to the memory stick first before this function can be used. The MCT will look for "Program" directories on the memory stick for import and alert the user if none exist.

NOTE: *All file transfer functions can be used while data logging is running. If the operator needs to back up or delete files from the system, many files could take considerable time to backup and delete from memory. The file transfer screen will be locked during file transfer so plan the timing appropriately when access to other screen functions is not required.*

When data logging is running, the current data log file will not be copied or deleted while using the file transfer functions. This protects the current file and makes sure that the data file is complete before being copied and cannot be deleted from memory while it is still in operation.

To **Copy** files, insert the USB memory stick into the USB port. Select the file type you wish to copy from the "Export Type" drop down menu. Available file selections are Program, Alarm, Audit and Data files. Once the selection is made, press the "Copy" button. All related files will be copied to the USB memory stick with progress status displayed to user.

To **Copy/Delete** files from internal memory, insert the USB memory stick into the USB port. Select the file type you wish to copy and erase from the MCT internal memory by selecting it from the "Export Type" drop down menu. Available file selections are Program files, Alarm files, Audit trail files and Data files. Once the selection is made, press the "Copy/Delete" button. All related files will be copied to the USB memory stick and then deleted from the MCT with progress status displayed to user.

The **Import** file function allows automatic ramp/soak program files to be copied from the USB memory device to the MCT. A dialog box will appear listing the available program directories on the USB memory stick. Program directory names exported from the MCT are in the format 'Profiles_mm-dd-yyyy-hh-mm-ss'.

NOTE: *The USB memory stick must be inserted into the USB port for any of the file utility operations to function. It is recommended to only use memory sticks certified by Future Design Controls for use with the MCT. Future Design Controls has tested and validated these memory devices for proper operation and performance.*

Due to manufacturing variations in the USB memory sticks, it may take a few seconds up to 30 seconds for the MCT to recognize the device when it is plugged in. Allow sufficient time for the device to be recognized before attempting any file utility operations or the MCT will indicate a file transfer/memory stick error.

When files are being copied to the USB storage device, a directory for each file type will be created to store the copied files. The directory structure is as follows:

Program files directory:	Profiles_mm-dd-yyyy-hh-mm-ss
Alarm files directory:	Alarm Files_mm-dd-yyyy-hh-mm-ss
Audit files directory:	Audit Files_mm-dd-yyyy-hh-mm-ss
Data files directory	Data Files_mm-dd-yyyy-hh-mm-ss

The purpose for using the date and time as part of the directory name, is to make sure the user can track the date and time of the file transfer. If a user transfers a file type more than once in a single day, the files will be grouped logically by time.

When accessing the data files saved to the USB memory stick, the data files will be in ".csv" format. These files can be opened directly with Microsoft Excel or any program that opens a comma separated file format. You can copy or empty the "Data Files"' directory by simply plugging the USB device into a PC's USB port. The device then becomes like any removable disk attached to the computer and can be manipulated once plugged into the PC.

The FDC Data Viewer program is a free Windows accessory program that allows users to view, plot and print data files and is available from Future Design Controls or any manufacturer that markets the MCT product. It is required when using the digital signature feature of MCT.

IMPORTANT: *Once files are deleted from the MCT storage devices, they are gone and cannot be retrieved. DO NOT edit, move, or delete any other files from the internal SD memory card unless using the MCT file utilities. The MCT will not operate properly if the file/directory structure is altered.*

Recommended File Maintenance

A quick note about file storage; data and setup files (programs, data files, alarm log and audit trail files) need some maintenance every now and then. After a period, storage devices fill up and files require backup or file deletion when no longer needed. The Microsoft WinCE platform allows for a maximum of 999 files per directory when all the files begin with the same 8 characters. Alarm and audit files are recorded by date (one per day) with the format of MMDDYYYY (where MM = month, DD = day, YYYY = year) so there is essentially no limit to the number of files other than available storage area.

Data log files, however, could reach the maximum based on the number of files created per day and if the logging on Program is enabled or a file name is specified by the user. If data logging is manually started or activated on system Startup and only 1 file is created per day, there will be no effective file limit since the first 8 characters of the file name are the date, like that of alarm and audit files.

If a file name is specified or logging on Program operation is enabled, each file will begin with the same prefix. Thus, multiple files can begin with the same 8 characters this limiting the maximum number of files that can be stored. At a frequency of 3 per day, 7 days a week for example, the maximum 999 files would be reached within one year. It is recommended that a quarterly maintenance schedule be adopted to copy and delete all data files from the MCT through either the USB file transfer or FTP backup utilities to prevent the maximum file number from being reached.

If the maximum number of files is reached, the MCT will display the alarm message "Data file error. SD card full or missing." and data logging will be disabled. Note that there is still sufficient memory space on the SD card; however, due to the maximum number of files being reached, no more files can be placed in the data log folder. Regular backup and removal of files from the MCT will prevent this from occurring.

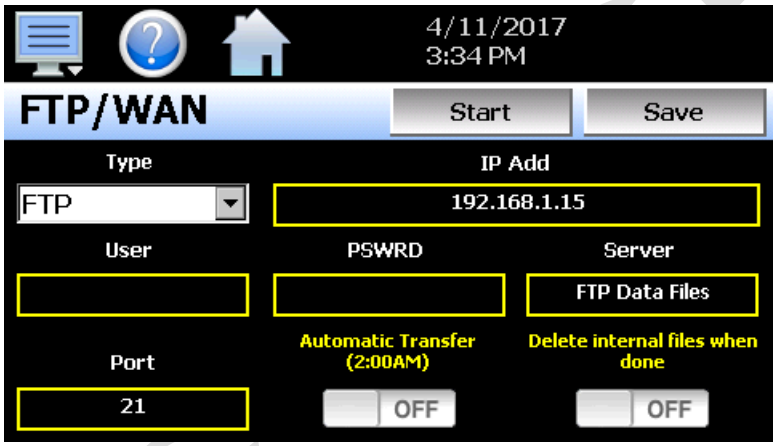
It is also highly recommended to backup and delete alarm and audit files as well. While it is possible to store years of files, the time it will take to copy the files once the time has come, could take hours due to the large number of files. The MCT file browser is also limited to a total of 650 files. If the number of alarm files or audit files exceeds the 650-file limit, you will be unable to open and view alarm or audit files on the MCT. They will have to be exported via USB or FTP to be viewed.

More frequent backups will also require less time to perform. The speed at which files can be transferred is more dependent on the number of files than the size of the files. A fewer number of large files takes less time than many small files.

The FTP/WAN screen allows the user to configure automatic back-up of all data files contained in the MCT memory to a user designated FTP or secure FileWeb site (https://). When enabled, the MCT will automatically back up all data log files, alarm files and audit trail files at 2:00AM each day. With the optional delete files selection, the MCT will then automatically delete the files from its internal memory after back up. This will maintain MCT memory automatically, so that continuous data logging can be performed without filling up the available memory space.

The MCT also offers a DataWeb LAN/WAN/Cloud interface. This allows the MCT to transfer data directly into a server's data base rather than using file-based data solutions. The DataWeb interface provides the transfer of secure (https://), real time data which can be shared and viewed across networks for real time manufacturing data systems interface.

NOTE: *Setting up an FTP site on your network may require authorization and/or assistance from your network administrator. Contact your network administrator for proper settings and authorization from your network server (if required) to allow the MCT to connect to the designated FTP site.*



The **Type** drop down is used to select the FTP/WAN interface. Choices are FTP, FileWeb and DataWeb.

The **IP Add** field is used to enter the IP address of the FTP/FileWeb/DataWeb site that MCT is to interface with.

The **User** field allows you to enter a user name for site access. When the MCT connects to the FTP/FileWeb/DataWeb site, the user name will be used to identify the connection. If a security login is required (FileWeb/DataWeb always require security credentials), the proper user name will have to be entered in this field. If security is not used (FTP only), this field can be left blank (blank for anonymous login using FTP only).

The **PSWRD** (password) field is used in conjunction with the user name field and is for entering a password so the MCT can access the site. If security is not used (FTP only), this field can be left blank (blank for anonymous login using FTP only).

The **Server** field is used to enter the directory information where the files are to be backed during FTP/FileWeb operation. This field is not used during DataWeb interface selection. When the connection occurs, the MCT will place the historical data files in the "Sever" field directory structure when using FTP/FileWeb interfaces. The MCT will automatically create an "Alarms" directory and an "Audit" directory within the specified server directory for backup of the alarm files and audit trail files. The "Sever" field for FTP and FileWeb must match the directory structure setup at the server.

For example, if FTP is used and the "root" path at the server is "Files", for the MCT files to be transferred to this directory, the "Sever" field must contain the text "Files". If there is a directory inside of the server root "Files" directory named "unit1775" and the files are to be transferred to this directory, the "Server field must contain the text "Files/unit1775". The FTP operation will error, and the transfer will not be completed if the "Server" field is not entered properly or does not match the FTP server configuration.

NOTE: *For FileWeb operation, the Server field is optional and can be left blank. It can be used to enter additional directory information (if desired) on where the files are to be stored*. By default, the MCT is hard coded to store files on the specified server in the "\Files*user name*\" directory. If an entry is made in the Server field, the resulting path would be "\Files*user name**server*\".

When the **Automatic Transfer (2:00AM)** option is turned on, the MCT will perform an automatic backup of all historical data files, alarm files and audit trail files contained in its internal memory to the designated FTP/FileWeb site. Note that if data logging is currently active, the active file will not be copied. When the **DataWeb** interface is used, real time data is transferred to a database rather than transferring actual files so this option is not used and is disabled.

When the **Delete internal files when done** option is turned on, the MCT will delete all data log files, alarm files and audit trail files within its memory after completing the backup to the FTP site. Note that if data logging is currently active, the active file will not be deleted. When the DataWeb interface is used, real time data is transferred to a database rather than transferring actual files so this option is not used and is disabled.

Once all settings have been made, press the "Save" button to save the settings so that on the next power-up, the entries will be maintained. The "Start" button can be used at any time to perform a manual data backup using FTP or FileWeb interfaces. If the files already exist on the FTP/FileWeb site, they will be overwritten on each subsequent backup. If the FTP/FileWeb site is down, or the MCT is not connected to the network, a local alarm message on the Alarm screen will indicate a transmission failure.

NOTE: *Typically, FTP/FileWeb Server connections use case sensitive alpha-numeric characters for the User name, Password and Server directory. Contact your network administrator for proper settings.*

More About FTP, FileWeb and DataWeb Interfaces

FTP servers (File Transfer Protocol) have been around for many years and can be installed on local or network machines. The FTP server allows a client (MCT) to transfer files to the FTP server once installed. This allows for manual and automatic backup of data from the MCT.

MCT Field Setup	FTP Server Setup
Type = FTP	FTP server setup for passive operation (see Appendix section A.2 FTP, FileWeb, DataWeb Requirements/Installation for additional information).
IP Add = xxx.xxx.xxx.xxx	Actual IP address of FTP server
User = userName	Actual user name for login if authentication used.
Password = userPassword	Actual password for login if authentication used.
Server = myFTP	FTP server setup with a root directory named "myFTP". The FTP server directory path must exist and match the MCT setup for proper operation. If there is an additional directory within the "myFTP" root directory, its name would be appended to the path. (i.e., myFTP/Files if a "Files"

MCT Field Setup	FTP Server Setup
	directory inside the myFTP server root directory is the target for transfer).
Port = 21	Port used at MCT and open at FTP server.

NOTE: *Make sure proper permissions are set at the FTP server for access/creation of directories and read/write access. Also check root directory structure at Server to identify the actual root that was created for the files since there can be additional layers created by the server and displayed in the path.*

The FileWeb interface allows the MCT to transfer its files to a web site for download which can then be viewed using a standard web browser. This interface provides the user the ability to setup a web site to store files for local or global access without installing an FTP server. The MCT supports https:// (secure) transfer of files.

MCT Field Setup	FileWeb Server Setup
Type = FileWeb	FileWeb server setup (see Appendix section A.2 FTP, FileWeb, DataWeb Requirements/Installation for additional information).
IP Add = https://fdctuil.com/FDDataService.svc	Actual named address of FileWeb server/service.
User = userName	Actual user name for login at FileWeb server (required).
Password = userPassword	Actual password for login at FileWeb server (required).
Server = *optional path*	The FileWeb server/service must be configured with a root "\files\" directory to use the MCT FileWeb feature. The MCT is hard coded to transfer files to the "files" directory in the root of the server. If the Server field also contains an entry (i.e optionalPath), the resulting path would be "\files*optionalPath*\". If the directory does not exist, it will be created at the server by the MCT based on the permissions settings at the server.
Port = not used	

NOTE: *Make sure proper permissions are set at the FileWeb server for access/creation of directories and read/write access. Also check root directory structure at Server to identify the actual root that was created for the files since there can be additional layers created by the server and displayed in the path.*

The DataWeb interface allows the MCT to transfer data to a web data base service using MySQL and Microsoft IIS as a web platform. The MCT can interface directly to a local or Web data base (Cloud) thereby allowing access to any system globally without any special "client" applications required to view the data. This allows

the MCT to share data with local or global manufacturing systems by storing data directly to a manufacturing database. The MCT supports https:// (secure) transfer of data.

MCT Field Setup	DataWeb Server Setup
Type = DataWeb	FileWeb server setup (see Appendix section A.2 FTP, FileWeb, DataWeb Requirements/Installation for additional information).
IP Add = https://fdctuil.com/FDDataService.svc	Actual named address of DataWeb server/service.
User = userName	Actual user name for login at FileWeb server (required). This is the directory where the database structure will reside on the server. The MCT will use this directory path for sending data to the database.
Password = userPassword	Actual password for login at DataWeb server (required).
Server = not used	The directory where the database exists uses the userName as the default location for data storage.
Port = not used	
Data logging screen entries: ID#1 = unit specific identifier ID#2 = unit specific identifier (See section Starting/Stopping Data Logging)	Used as the unit identifiers by the remote database to store the data sent from the MCT. At least one field must contain an entry and should be unique to any other MCT's that connect to the same server database.

NOTE: *An IT professional with experience is required for DataWeb server setup. Future Design Controls does not support server-side programming or setup but can offer 3rd party resources to assist with or handle complete server-side projects.*

The DataWeb interface does not transfer complete files for backup like the FTP and FileWeb interfaces. The DataWeb interface transfers records in real time based on the log setup interval at the MCT. When logging is started at the MCT, data will begin transfer to the server-side site. Data will be transferred to the server at the beginning of logging (one record) with additional records transferred based on the rate that the MCT data log interval is set for.

If the data log interval rate is set for 60 seconds, the MCT will populate the database with a single set of records (PV, SP, %Out determined by data log/server setup) once every 60 seconds. If the data log interval rate is set for 120 seconds, the MCT will populate the database with a single set of records (PV, SP, %Out determined by data log/server setup) once every 120 seconds. Data log intervals can be set as fast as 2 seconds since buffering is used at the MCT for faster data log rates, but in this case the database would receive a total of 30 records once per minute (one record per second). Buffering for rates faster than 1 minute is used to reduce access/overhead at the server side while still maintaining 2 second date/time stamps for database record keeping.

FileWeb/DataWeb Server Components and Requirements.

While the actual server-side development is more involved than this manual will cover, component overview and installation is covered in section A.2 of the Appendix.

Web Development Support:

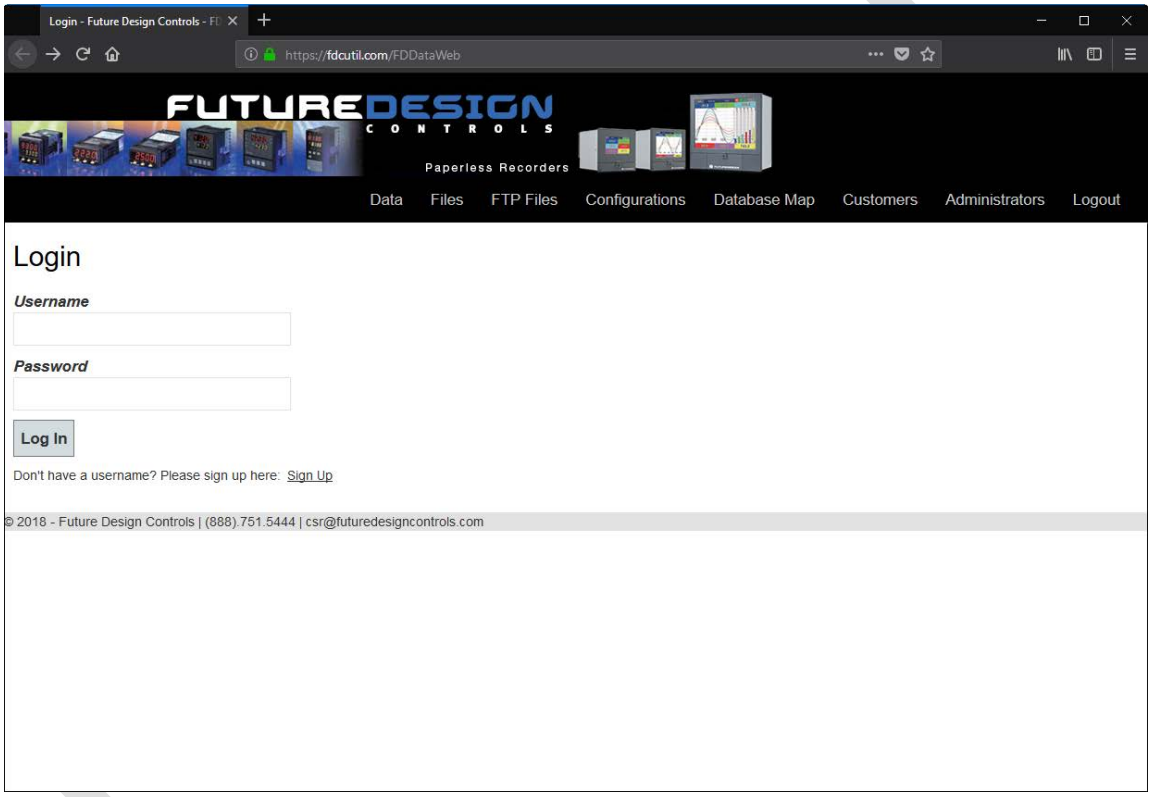
Future Design Controls does not support or develop custom server-side web solutions. We can offer 3rd party resources to assist customers in these development requirements.

FDCUtil.com Web site for FTP, FileWeb and DataWeb Testing

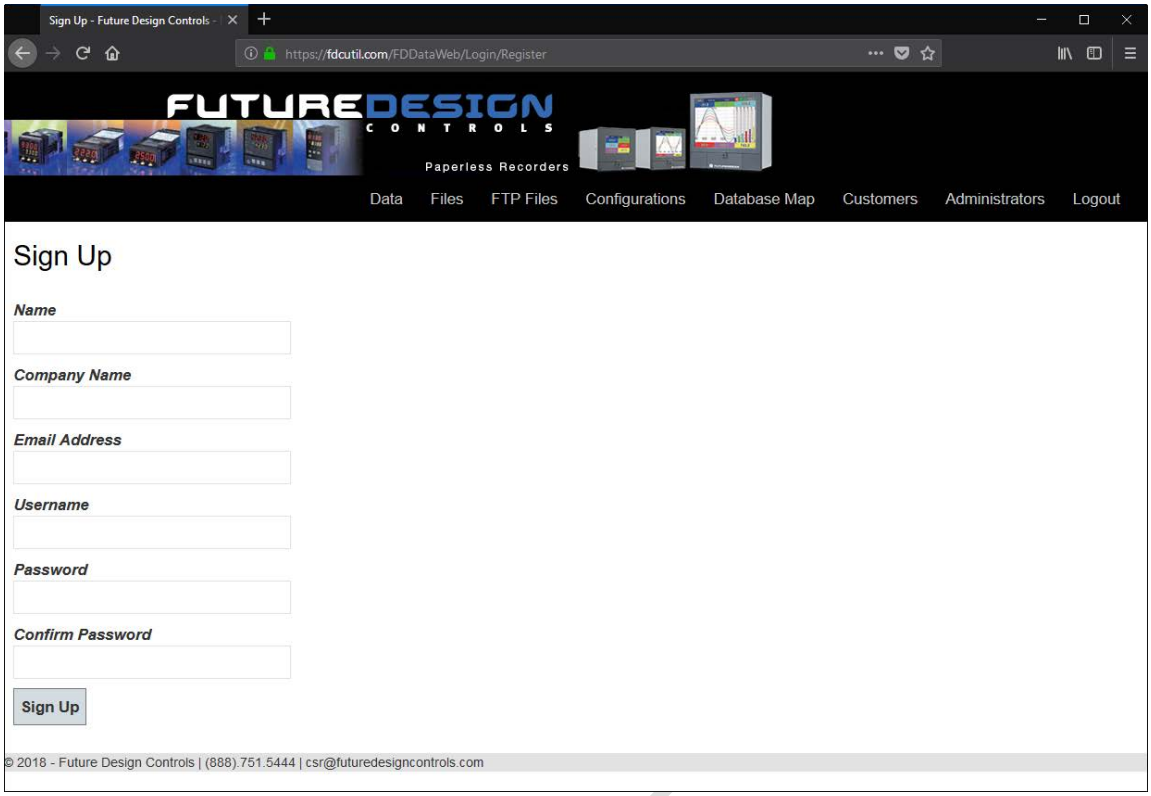
The FDCUtil web site is a Future Design Controls http/https site that allows customers to create a free account and test the FTP, FileWeb and DataWeb interfaces offered on the MCT. The site automatically deletes files every hour since this is a test site only and cannot be used for permanent web storage of files or data. The site allows customers to fully test and verify that data is being transferred properly from the MCT device to the FDCutil site, thereby providing everything needed to test the MCT and the Internet connection without requiring additional software or development. This allows the customer to test the interface and pick which type of data transfer is the best for operations.

Access the Web Site and Create an Account:

To create a free account, go to the following link: https://fdcutil.com/FDDataWeb/



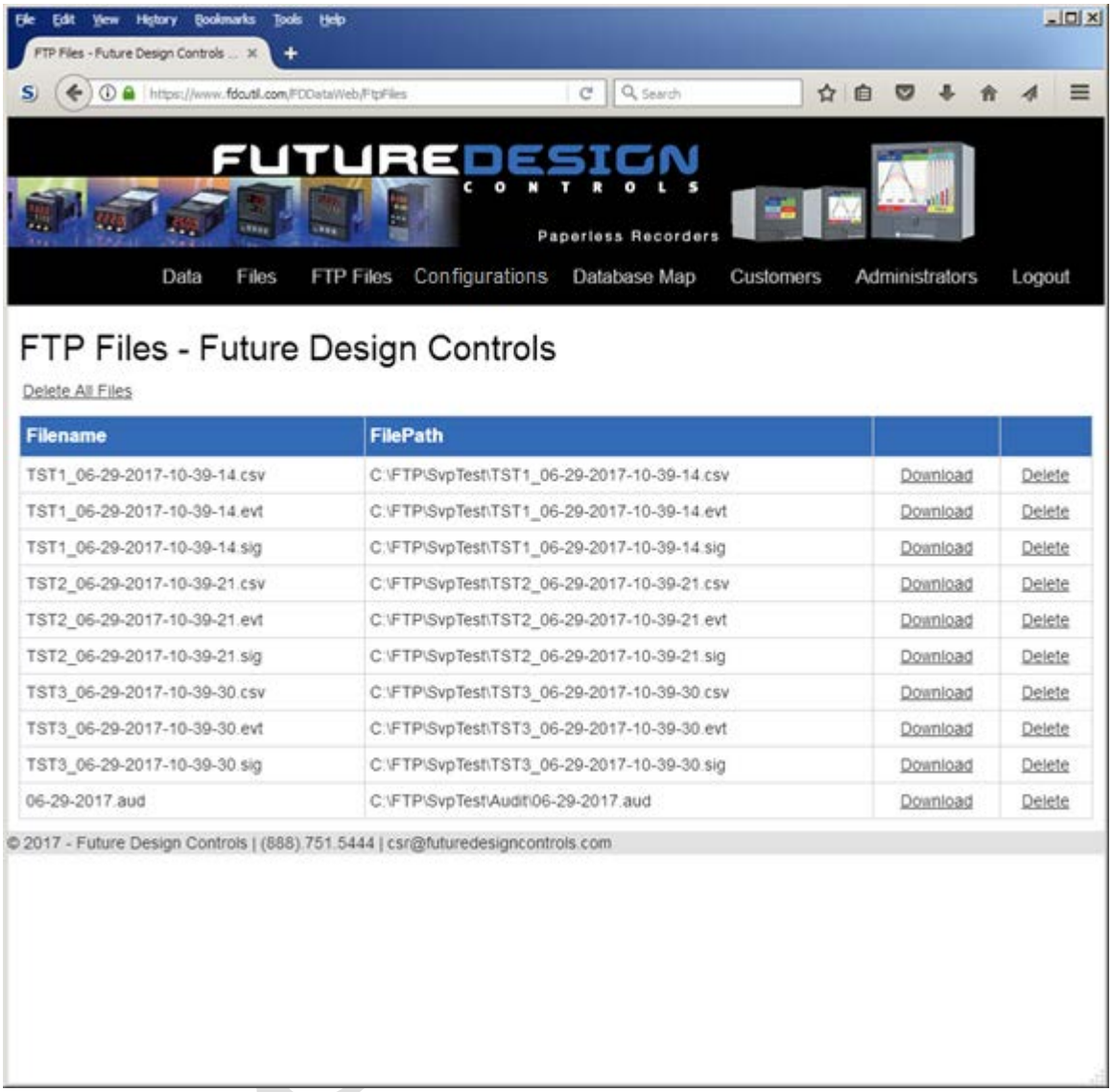
Click on the “Sign Up” link. Enter your name, company name, email address and password. Note that your email address will not be used for solicitation purposes. It is used to send an account verification email. The email sent requires no confirming information; it only verifies that a real user got the email before activating the account. Although FdcUtil.com is a no-charge site, important user data is encrypted for additional protection.



Once you have created and verified your account, you can log in to the website. Once logged in, the main FDCUtil website will be displayed with tabs for Data (DataWeb), Files (FileWeb), FTP Files (FTP) and Configurations. These tabs can be clicked on and will display data after transfer from the MCT device. Every hour, the data will be deleted from each section (except for Configurations) or the data can be manually deleted using the "Delete" link on each page.

FTP Files Page:

The FTP files page, accessible from the "FTP Files" menu item, lists the files in the customer's FTP data directory. These are only the files in the customer's directory, not all uploads. The user can delete the files from this page.



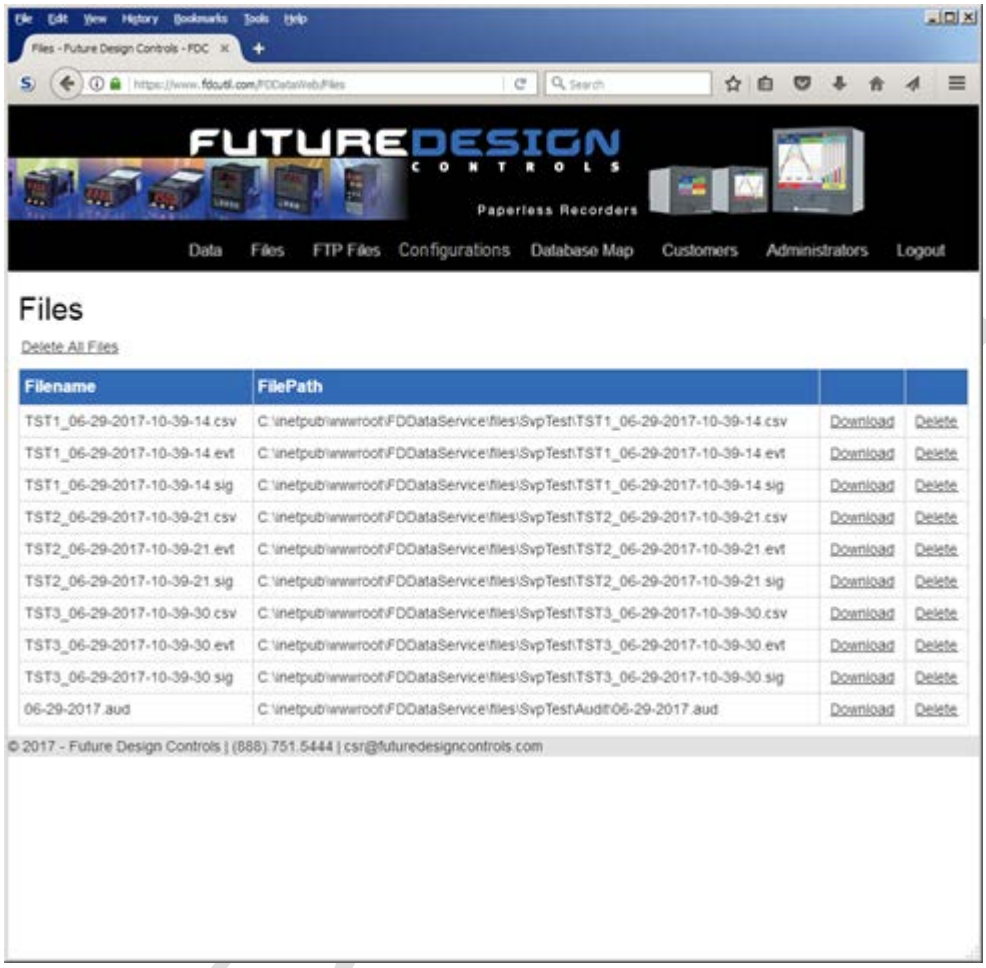
FTP sample setup using FDCutil.com:

To setup the MCT for use with the FDCutil.com FTP server, go to the FTP/WAN screen on the MCT and contact Future Design Controls technical support for FTP access. The FTP section of FDCutil.com is used for tech support (pass/fail) testing only when validation if required at a customer site (customer site not working for some reason). This is due to the user-based security in the FileWeb/DataWeb interfaces not included in the FTP services.

After FTP access is given by FDC technical support, press the “Save” button to complete the setup on the MCT FTP/WAN screen. Press the “Start” button to begin a manual transfer of files from the MCT to the FDCutil.com site. Login to the FDCutil.com site to view the FTP files by pressing on the FTP files link on the page (or press FTP link if already logged into FDCutil.com).

Data Files Page (FileWeb):

The data files page, accessible from the “Files” menu item, lists the files in the customer’s data directory. These are only the files in the customer’s directory, not all uploads. The user can delete the files from this page.



FileWeb sample setup using FDCutil.com:

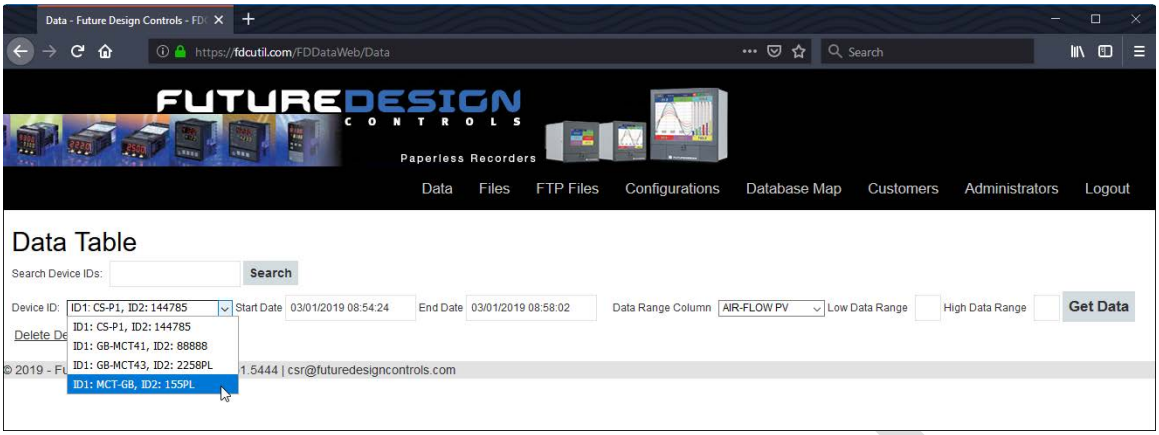
To setup the MCT for use with the FDCutil.com FileWeb server, go to the FTP/WAN screen on the MCT and enter the following data into the screen fields. Make sure to replace the “custName” and “custPassword” text below with the actual user name/password entered during the FDCutil.com signup process.

- Type = FileWeb
- IP Add = https://fdcutil.com/FDDataService.svc
- User = custName
- Password = custPassword
- Server = optional
- Port = not used

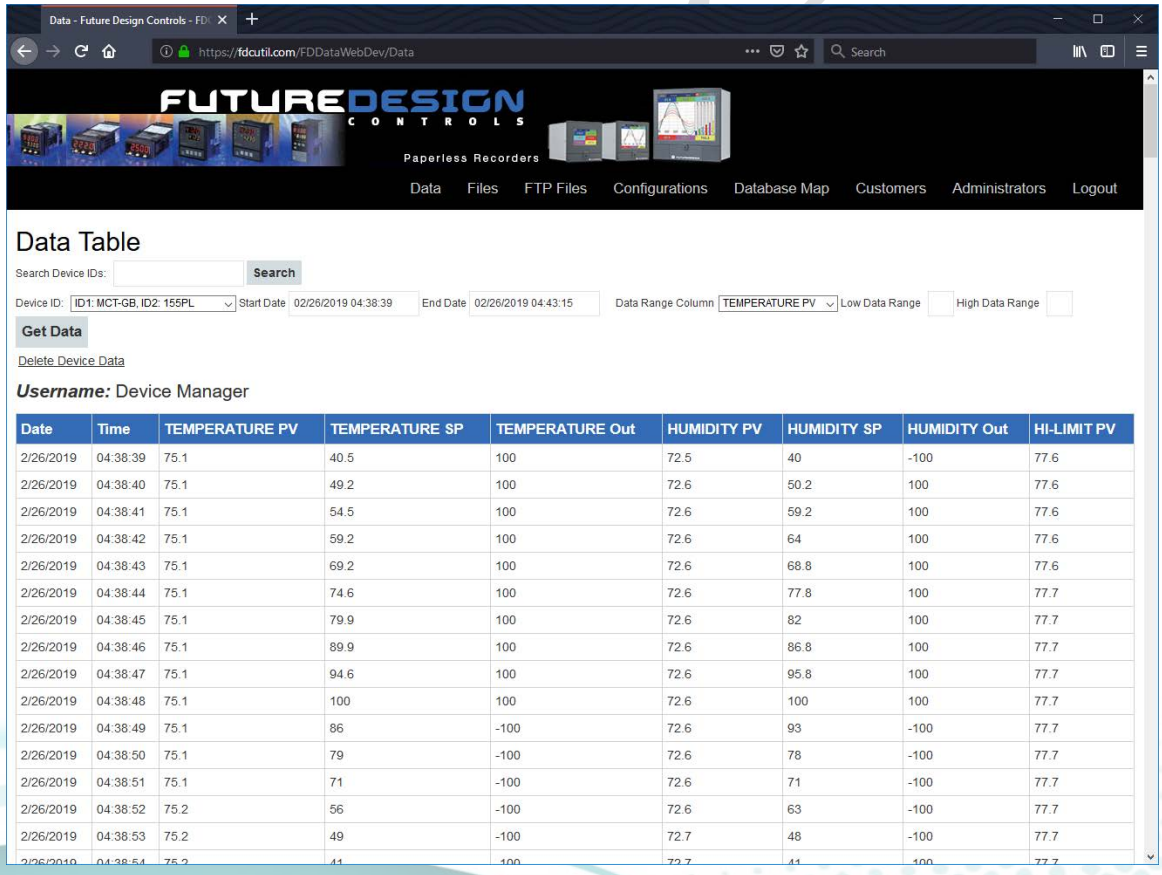
Press the “Save” button to complete the setup on the MCT FTP/WAN screen. Press the “Start” button to begin a manual transfer of files from the MCT to the FDCutil.com site. Login to the FDCutil.com site to view the FTP files by pressing on the Files link on the page (or press Files link if already logged into FDCutil.com)

Database Data Page (DataWeb):

Once logged in, the customer will be shown the Data page. If data has been uploaded to the database, the "Device ID" drop-down menu will contain the list of units (according to the ID#1 and/or ID#2 entries as made on the Data logging screen).



To view the data, select the desired unit from the list and click the "Get Data" button below the Device ID menu. The data available between the Start Date and End Date will be displayed.

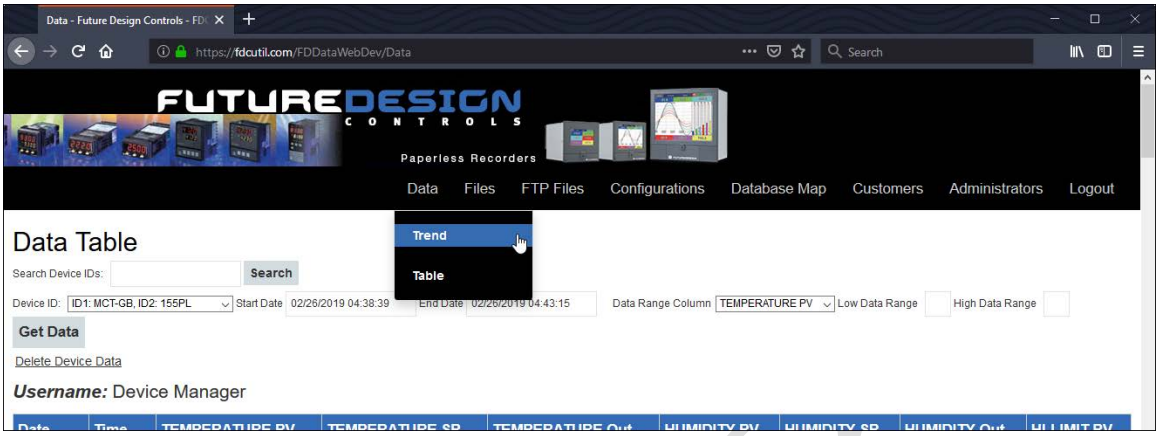


Date	Time	TEMPERATURE PV	TEMPERATURE SP	TEMPERATURE Out	HUMIDITY PV	HUMIDITY SP	HUMIDITY Out	HI-LIMIT PV
2/26/2019	04:38:39	75.1	40.5	100	72.5	40	-100	77.6
2/26/2019	04:38:40	75.1	49.2	100	72.6	50.2	100	77.6
2/26/2019	04:38:41	75.1	54.5	100	72.6	59.2	100	77.6
2/26/2019	04:38:42	75.1	59.2	100	72.6	64	100	77.6
2/26/2019	04:38:43	75.1	69.2	100	72.6	68.8	100	77.6
2/26/2019	04:38:44	75.1	74.6	100	72.6	77.8	100	77.7
2/26/2019	04:38:45	75.1	79.9	100	72.6	82	100	77.7
2/26/2019	04:38:46	75.1	89.9	100	72.6	86.8	100	77.7
2/26/2019	04:38:47	75.1	94.6	100	72.6	95.8	100	77.7
2/26/2019	04:38:48	75.1	100	100	72.6	100	100	77.7
2/26/2019	04:38:49	75.1	86	-100	72.6	93	-100	77.7
2/26/2019	04:38:50	75.1	79	-100	72.6	78	-100	77.7
2/26/2019	04:38:51	75.1	71	-100	72.6	71	-100	77.7
2/26/2019	04:38:52	75.2	56	-100	72.6	63	-100	77.7
2/26/2019	04:38:53	75.2	49	-100	72.7	48	-100	77.7

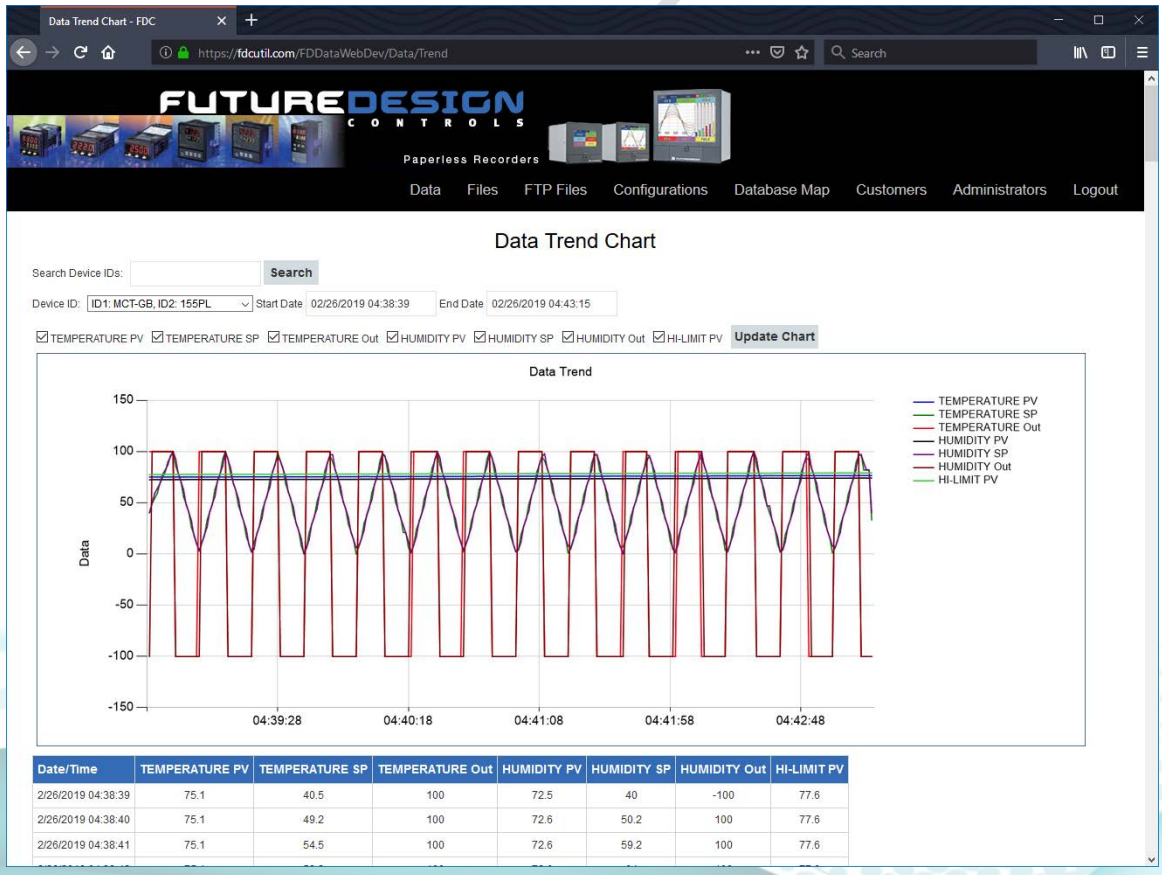
The start and end dates can be altered by simply clicking on the fields to display only data from a specific time frame. When the specified time is entered, press the Get Data button to refresh the data table. The Data

Range Column selection and Low/High Data Range fields can also be used to search for data points that fit within the specified range.

The available data can also be viewed in graph format. Hover the mouse over the Data tab and selections for Trend and Table will be provided.



Once Trend is selected, choose the desired unit from the Device ID menu. Place a check next to each available point you want to plot and click the Update Chart button. A trend plot according to the chosen plot points and time range will be displayed along with the corresponding data table below.



Date/Time	TEMPERATURE PV	TEMPERATURE SP	TEMPERATURE Out	HUMIDITY PV	HUMIDITY SP	HUMIDITY Out	HI-LIMIT PV
2/26/2019 04:38:39	75.1	40.5	100	72.5	40	-100	77.6
2/26/2019 04:38:40	75.1	49.2	100	72.6	50.2	100	77.6
2/26/2019 04:38:41	75.1	54.5	100	72.6	59.2	100	77.6

NOTE: *Once you access the Data Table or Data Trend Chart page, the default start and end times are based on the available data at the server. If an MCT is actively sending data, you must manually set the end time to a future date so that each time you refresh the page via the Get Data or Update Chart buttons, the page is updated with the latest data sent from the MCT.*

DataWeb sample setup using FDCutil.com:

To setup the MCT for use with the FDCutil.com DataWeb server, go to the FTP/WAN screen on the MCT and enter the following data into the screen fields. Make sure to replace the "custName" and "custPassword" text below with the actual user name/password entered during the FDCutil.com signup process.

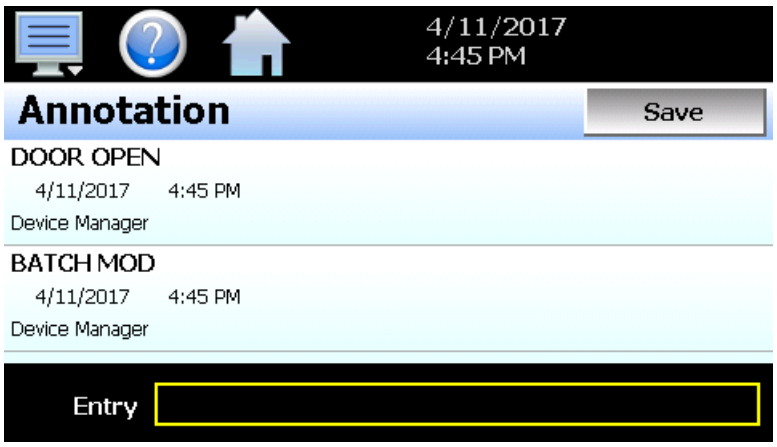
- Type = DataWeb
- IP Add = https://fdcutil.com/FDDataService.svc
- User = custName
- Password = custPassword
- Server = empty (no characters)
- Port = not used
- ID#1 = unique identifier of your choice
- ID#2 = unique identifier of your choice

Press the "Save" button to complete the setup on the MCT FTP/WAN screen. Next, navigate to the Data logging screen. Make entries in the ID#1 and/or ID#2 fields. These entries should be unique to the MCT and not duplicates of any other MCT you may have connected to the site. Once logging is started at the MCT, data will begin transfer to the "Data" section of the server-side site. Data will be transferred to the server at the beginning of logging (one record) with additional records transferred based on the rate that the MCT data log interval is set for.

If the data log interval rate is set for 60 seconds, the MCT will populate the database with a single set of records (PV, SP, %Out determined by data log/server setup) once every 60 seconds. If the data log interval rate is set for 120 seconds, the MCT will populate the database with a single set of records (PV, SP, %Out determined by data log/server setup) once every 120 seconds. Data log intervals can be set as fast a 1 second since buffering is used at the MCT for faster data log rates, but in this case the database would receive a total of 60 records in 1 minute (one record per second). Buffering for rates faster than 1 minute is used to reduce access/overhead at the server side while still maintaining 1 second date/time stamps for database record keeping.

Annotation

The Annotation screen allows the user to add messages to the running data file and view any messages currently associated with a loaded historical data file.

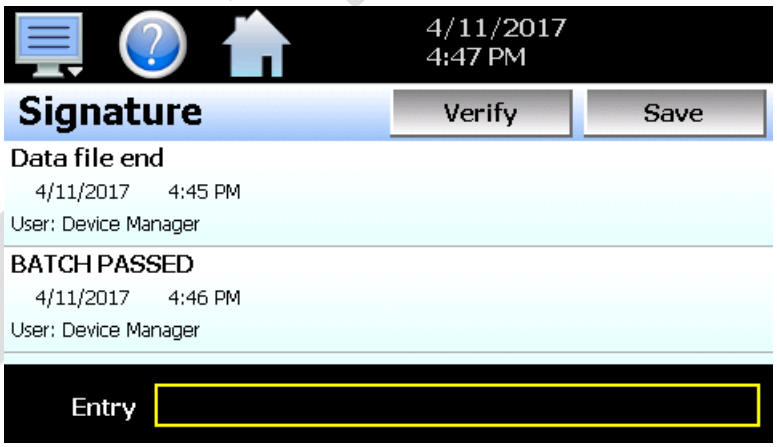


When a historical data file is loaded, the Annotation screen will display any messages that were written to the file. The date, time, user name and description of the data file annotation is shown. Note that the currently running data log file can be opened as a historical data file, and the current annotations for the running file will be shown.

To add an annotation to the running log file, touch the "Entry" field at the bottom of the screen and enter the message (up to 16 characters maximum). Press the "Add" button and the message will be added to the current log file. If the running log file was opened as the historical log file, the annotation will be shown immediately on the screen as it is added. If logging is not currently running, the entry field will be disabled.

Add\View Digital Signatures

The Signature screen allows the user to add digital signatures to historical data log files and view any digital signatures currently associated with the loaded historical log file.



When a historical data file is loaded, the Signature screen will display any signatures currently associated with the file. To verify a digital signature and ensure that the data file has not been altered, touch the signature in the list box and press the "Verify" button. The MCT will compare the signature to the log file to see if any alterations to the data have been made. The MCT will then indicate if the signature is valid or not.

If the signature is valid, the historical data file is intact and has not been altered. If the signature is invalid, the data has been altered at some time after the signature was assigned to the file. For data integrity, the MCT automatically signs a data file when logging is stopped; however, this only occurs if the "Auto Interval" is

selected on the Log screen. If a different logging interval is used, the MCT will not automatically sign the file and it must be signed by a user.

To add a digital signature to the historical log file, touch the "Entry" field at the bottom of the screen and enter in the comment line for the signature (up to 16 characters maximum). Press the "Add" button and the signature will be added to the log file. The signature includes the date and time of the signature, the user name and comment line. If a user is not logged into the system, the default user name "Device Manager" will be entered as the user.

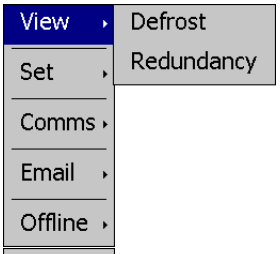
NOTE: *The Signature screen is not available if security is disabled. The MCT security module must be enabled to digitally sign data log files. See section 0 Security.*

DEVICE SETTINGS

This section covers the use of extended controller features that enhance the functionality of the system. To gain access to the MCT setup options, select "Settings" from the home Device menu.

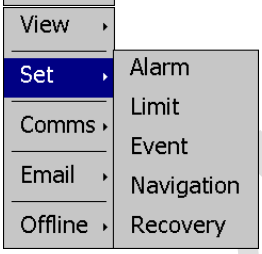
To assist in setup and documentation of the MCT, see the "MCT Configuration and Worksheets" Excel file provided on the Future Design Controls website (http://www.futuredesigncontrols.com/MCT.htm). This document provides setup and configuration forms and templates for all MCT features including those provided under the Setup menu.

The Device Settings menu provides navigation to the following functions:



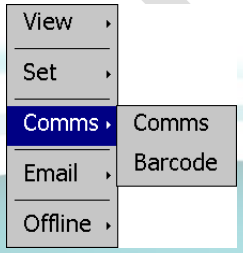
***View** menu*

Defrost: Provides access to defrost settings.
Redundancy: Provides access to redundancy settings.



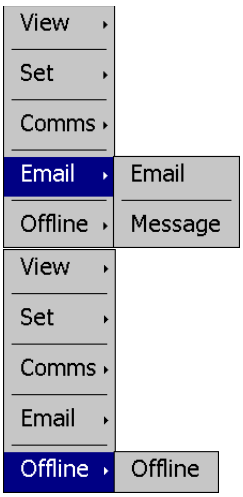
***Set** menu*

Alarms: Provides access to the alarm module.
Limit: Sets minimum/maximum set points allowed for each loop.
Event: Allows the user to edit names used to describe events.
Navigation: Allows the user to choose text based or icon based/slide page navigation menus.
Recovery: Allows user to set program recovery action on power failure.



***Comms** menu*

Comms: Allows user to set nCompass communication settings.
Barcode: Provides access to the barcode reader settings.



***Email** menu*

Email: Provides access to the nCompass email system manager.

Message: Allows the user to send an email message to users entered in the system.

***Offline** menu*

Offline: Provides access to offline system settings.

Defrost

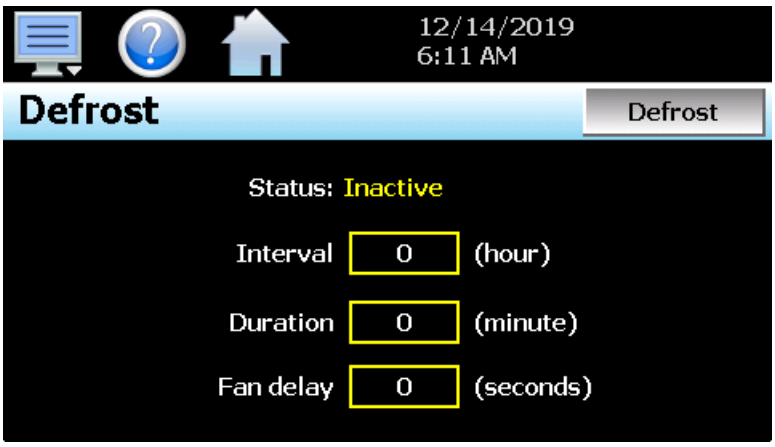
The MCT defrost function was designed for use with refrigeration or other types of cooling systems that may accumulate ice on cooling surfaces such as finned coils and provide a means of pausing operation at preset intervals to remove the build-up of ice to restore efficient operation.

NOTE: *While the defrost function was intended for refrigeration systems, it may also be used as an interval timer to perform a specific operation at preset intervals. Consult you OEM configuration regarding the use and operation of defrost.*

Defrost cycles are intended to keep ice from accumulating excessively on an evaporator coil. Ice accumulation reduces the capacity of the refrigeration system and lowers the evaporator coil's operating temperature. This causes more ice to form and if not controlled, allows liquid refrigerant to flow back to the compressor which can cause permanent damage and failure of the compressor. The control of ice accumulation is the primary function of the defrost operation.

The second goal is to minimize excess use of energy from too frequent defrost cycles. The heat put into the system during the defrost operation must be removed by the refrigeration system to bring the system back to its operating temperature. The shortest defrost period and the minimum number of defrost cycles provides the most efficient operation. These goals are accomplished by the proper setting of the first two parameters (defrost interval and defrost duration).

The third goal is to minimize the increase in temperature during and after the defrost cycle. This is controlled by the fan delay. The fan delay feature allows the refrigeration system to pre-cool the cooling coil before the fan is turned on after a defrost cycle. This is adjusted to give a minimum amount of temperature rise after the defrost cycle has completed.



The defrost settings allow the user to set the interval, duration, and fan delay time for timed defrost sequences. If the MCT is configured for timed defrost only, defrost cycles will take place at the interval set by the user. If the defrost function is configured for 'timed process', the defrost interval for defrost will only be active when the OEM configured loop or monitor point is below the defrost enable set point that is entered in the MCT configurator. Consult your OEM configuration for the defrost type your system uses.

The **Status** field displays the status of defrost operation; Inactive, Active or Fan Delay Active.

The defrost **Interval** field is used to set the defrost interval. The time can be entered in hours from 0-999. If '0' is entered for the defrost interval, defrost will not be initiated automatically. The defrost interval must be set from 1-999 hours to activate defrost. Setting the field to zero allows the user to disable automatic defrost operation for testing purposes or to require manual activation only via the demand 'Defrost' button.

The defrost **Duration** field is used to set the defrost duration. The time can be entered in minutes from 0-999. If '0' is entered for the defrost duration, defrost will not operate. The defrost duration must be set from 1-999 minutes to activate defrost. Setting the field to zero allows the user to disable defrost operation for testing purposes or to prevent it from operating if its use is not required.

The **Fan Delay** field is used to adjust the fan delay. The time can be set from 0-999 seconds.

Pressing **Defrost** while programmed for timed defrost will activate a single defrost cycle. If defrost is configured for timed process, defrost will only activate if the OEM configured loop SP or monitor point PV is below the enable set point that is entered in the MCT configurator.

Defrost Description of Operation

The defrost interval timer is activated when the OEM configured defrost enable output(s) are on for timed defrost. For the interval timer to be activated when defrost is configured for timed process, the OEM configured loop set point or monitor point value must also be below the enable set point. If at any time the enable outputs are turned off, or the loop or monitor point rises above the enable set point, the interval timer will be reset.

NOTE: *When a loop is selected as the enable point, the loop set point must be equal to or below the defrost enable set point. When a monitor point is selected as the enable point, the process value must be equal to or below the defrost enable set point.*

Once the user set interval has elapsed, the defrost cycle begins. When the defrost cycle starts, the OEM configured output defeats will be activated. This will turn off all outputs configured for defeat regardless of any other settings. If a digital output is configured as a Defrost Output, the output will be turned on for the duration

of the defrost cycle. Once the user set defrost duration has elapsed, the defrost cycle will be terminated and the fan delay will be activated.

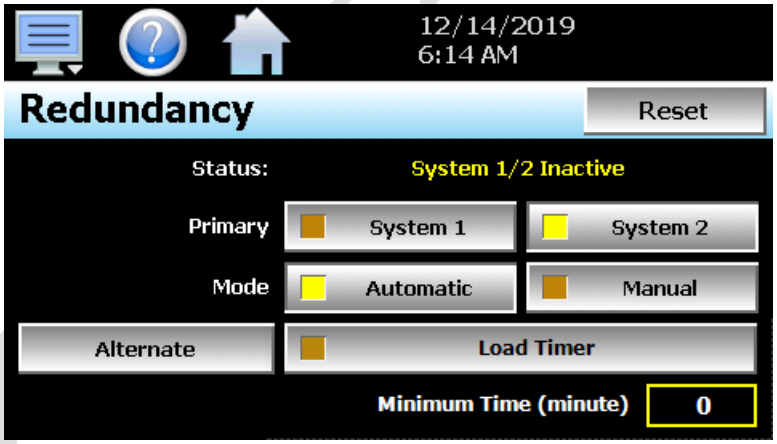
During the fan delay period, the defrost output defeats are removed and the OEM configured precool output defeats are activated. If a digital output is configured as a Defrost Precool Output, the output will be turned on for the fan delay period. Once the fan delay period has expired, the precool output defeats are removed allowing all outputs to return to normal function.

The system will continue to run normally until the interval timer elapses once more, and the cycle begins again. If at any time the user presses the Demand Defrost button, the interval timer will be reset, and a single defrost cycle will be initiated. Note that if defrost is configured for timed process, pressing the Demand Defrost button will only initiate a defrost cycle if the OEM configured loop or monitor point is also below the enable set point that is entered in the MCT configurator.

NOTE: *If redundant systems are also configured, consult the following section Redundancy for additional information on defrost operation in conjunction with redundant system operation.*

Redundancy

The MCT can be configured by the OEM to operate redundant systems. These 'systems' could be pump stations, refrigeration units, etc. This feature would be typically used when two identical systems share a common process and the failure of one system would turn on the back-up system so that the process can continue operation with interruption. The MCT allows the systems to be configured for alternate or concurrent modes operation. Alternate and concurrent mode operation both provide "equal" run time switching for each system when a redundancy alarm (high/low alarm, system failure) does not exist.



The redundancy settings are accessed by selecting 'Redundancy' from the device setting's 'View' menu. They allow the user to set the redundancy mode of operation, select the primary system and adjust the concurrent minimum runtime and/or alternating times. The user can also activate the product Load Timer which enables the alarm to inhibit of the Darwin Chambers configured redundancy alarm. Consult Darwin Chambers for the redundancy type settings.

The redundancy **Status** indicates the current operating condition of redundancy. These include:

System 1/2 Inactive	= Redundancy not operating, control outputs off (system 1 and 2)
System 1 Active (automatic)	= Redundancy operating system 1 as primary system in auto

System 1 Active (manual)	= Redundancy operating system 1 as primary system in manual
System 2 Active (automatic)	= Redundancy operating system 2 as primary system in auto
System 2 Active (manual)	= Redundancy operating system 2 as primary system in manual
System 1 Active (fail Mode)	= Redundancy operating system 1 in auto, primary system 2 failed
System 2 Active (fail Mode)	= Redundancy operating system 2 in auto, primary system 1 failed
System 1/2 Active	= Redundancy operating system 1 and 2 concurrently (alarm activated)
System 1/2 Failed	= Redundancy operating, system 1 and 2 off (dual system failure)

The operational **Mode** selection indicates the redundancy mode and allows the user to place redundancy in auto or manual operation. When in manual mode, only the primary system will operate and equal run time switching will not take place. System failure alarm inputs and the redundancy process alarm are ignored. When in auto mode, systems will perform equal run time switching based on user time settings and alternate automatically upon system failure and redundancy process alarms.

The **Primary** system selection allows the user to select system 1 or system 2 for operation. The primary system selection can only be made when redundancy is placed in manual mode. When in auto mode, the primary system selection will automatically alternate according to the alternating time settings.

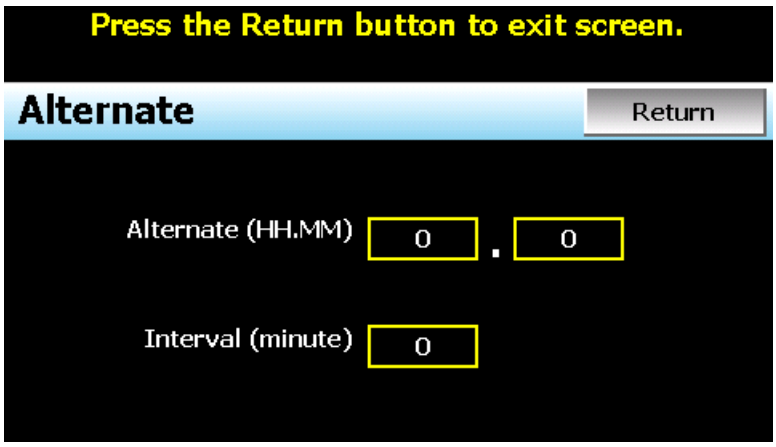
The product **Load Timer** button allows the user to activate the alarm start delay of the OEM configured redundancy process alarm. This alarm is one of the 30 alarms provided by the MCT and can be configured by the user for process high/low, deviation or rate of change (see section Alarms). By activating the product load timer, the alarm will be reset, and the alarm start delay will become active. Once the start delay expires, if the alarm condition is present, the alarm delay will become active and once expired, the redundancy alarm will be activated.

NOTE: *If the product load timer (alarm inhibit) is already active, pressing the Load Timer button will cause the MCT to prompt the user if they wish to reset the timer. This allows the user to reset the start delay each time the button is pressed should more time be required to clear the condition that will cause the redundancy alarm to occur.*

The **Reset** button is used to reset a redundancy system failure; system 1 fail, system 2 fail, system 1/2 fail and reset alternating redundancy upon a redundancy alarm. Normal system switching will only resume once the alarm condition has been reset and cleared on the Alarm screen and the 'Reset' button is pressed.

The concurrent **Minimum Time** is shown when redundancy is configured for concurrent operation. This entry defines the minimum amount of time that the back-up system will operate when a redundancy alarm occurs. This field can be set from 0 to 32767 minutes.

The 'Alternate' button is provided when redundancy is configured to switch after defrosting. It provides access to the Alternate settings screen.



The **Alternating (HH.MM)** fields are used to set the time of day (24-hour clock) at which the equal run time interval will begin. If it is 8AM for example, and the time of day is set for 12:00, the equal run time interval will begin at noon.

NOTE: *If redundancy was operating in manual mode, and not placed into auto until 12:01, the equal run time interval would not begin until the following day at noon. Redundancy must be in auto mode when the time-of-day elapses for the interval timer to begin. Each time redundancy is placed in manual mode, or redundancy is inactive due to the system being turned off, the interval timer will be reset and will not begin again until redundancy is active in auto mode and the time of day is reached.*

The alternating switch **Interval** defines the equal run time duration for each system when redundancy is operating in auto mode. Once the interval timer is activated according to the time-of-day entry, the primary system will alternate back and forth according to the minutes of operation defined by this field. Valid entry is in the range of 0-32767 minutes. If a value of 0 is entered, the alternating timer will not operate. The interval must have a value of 1-32767 for alternate switching to take place.

Concurrent Redundancy Switching

When redundancy is active (Darwin Chambers configured enable output(s) on), any digital outputs configured for “Redundant System 1’ or ‘Redundant System 2’ that correspond with the selected primary system will be turned on. The opposing system then becomes the ‘backup’ system by default.

When the redundancy process alarm exists, the MCT will run the backup system concurrently with the primary system until the minimum concurrent run timer expires, or until the process alarm condition no longer exists. If the redundancy alarm is set for latching, the user must press the alarm reset button on the main alarm screen to acknowledge the alarm for it to clear. The backup system will then shut down automatically after the minimum time (user defined) expires if the process alarm no longer exists. The user can switch from ‘Auto’ to ‘Manual’ at any time and select the primary system or run a single system in manual mode.

Alternating Redundancy Switching

When redundancy is active (OEM configured enable output(s) on), any digital outputs configured for “Redundant System 1’ or ‘Redundant System 2’ that correspond with the selected primary system will be turned on. The opposing system then becomes the ‘backup’ system by default.

When the redundancy process alarm exists, the MCT will switch to the backup system (turn off the primary system output and turn on the backup system output) and operate in fail mode on the backup system until the alarm condition is cleared and the “Reset” button is pressed. If the redundancy alarm is set for latching, the

user must press the alarm reset button on the main alarm screen to acknowledge the alarm for it to clear. Once the alarm condition is cleared and the redundancy "Reset" button is pressed, the backup system becomes the primary system and normal redundancy operation resumes. The user can switch from 'Auto' to 'Manual' at any time to select primary systems or run a single system in manual mode.

Equal Run Time Switching

Equal run time switching (when no redundancy alarms exist) is provided for both alternate and concurrent systems. Equal run time switching is OEM configured for 'Before Defrost' or 'After Defrost' operation.

NOTE: *If defrost is not configured, equal run time switching (if configured) will correspond to the 'After Defrost' mode of operation; however, no defrost action would take place prior to the system switch.*

Before Defrost Switching

Before defrost operation provides equal run time switching at each "timed" defrost cycle. No defrost cycle is performed during system switching in this mode. Since system switching is done at each defrost cycle, the system not running will naturally defrost due to normal ambient conditions between defrost intervals. If a redundancy alarm occurs (process alarm, system 1/2 fail), defrost cycles will be performed under fail mode operation based on timed or timed process defrost settings.

Pressing the demand defrost button while redundancy alarm conditions exist, will perform a single defrost cycle based on timed or timed process defrost settings. Pressing the demand defrost button while no redundancy alarm conditions exist, will switch between system 1 and 2 with no defrost cycle being performed. Primary systems and actual systems digital outputs (1/2) will only switch when no redundancy alarm conditions exist, and concurrent operation is not active.

When a defrost cycle is performed and the system is running in concurrent mode due to a redundancy alarm, the backup system will be turned off and the primary system will go through the defrost cycle. The redundancy alarm will be reset when defrost activates, so that upon completion of the defrost cycle, the redundancy alarm delay (if any) will have to expire again prior to turning on the backup system again. This provides for a 'smart recovery' action if the redundancy alarm was due to a frozen evaporator.

After Defrost Switching

After defrost operation provides equal run time switching based on the user defined alternating switch interval. When OEM configured for 'After Defrost' and no redundancy alarm condition exists, a defrost cycle will be forced at each system switch time when 'timed defrost' is configured. If defrost is configured for timed process, a defrost cycle will be forced at system switch only if required based on the condition of the loop or monitor point configured. Normal defrost cycles will take place based on timed or timed process settings since the 'equal run time' switching is typically longer than the system should run without a defrost cycle.

If a defrost cycle is running and the equal run time switching timer has elapsed, the defrost cycle will be completed, then the primary systems will switch. If a redundancy alarm condition exists (process alarm, system 1/2 fail), defrost cycles will be performed under fail mode operation based on timed or timed process settings.

Pressing the demand Defrost button will perform a single defrost cycle based on defrost settings (during normal switching or fail mode conditions). Primary systems and actual systems digital outputs (1/2) will only switch when no redundancy alarm conditions exist, and concurrent operation is not active.

If a system 1/2 failure occurs on alternating or concurrent systems, the MCT will always operate in fail mode on the system that does not have a system failure. If both 1 and 2 system failures occur, the digital outputs configured for 'Redundant System 1 or 2' will be de-energized. During any system failure (1/2 or 1 and 2), the alarm must be reset from the main alarm screen and the condition cleared that caused the system failure.

Once the alarm condition is acknowledged and cleared, the "Reset" button on the Redundancy screen must be pressed for normal system operation to resume, at which point the backup system will become the primary system. The user can switch from 'Auto' to 'Manual' mode at any time to run system 1 or 2 in manual operation while performing maintenance on the systems.

NOTE: *System 1/2 failures are defined by the OEM configured digital input selections. When the assigned alarm input(s) for the system is active, the system failure occurs. Consult your OEM configuration for information on which inputs are configured for system 1/2 failure (if any).*

Alarms

The Alarm screen provides access to the MCT alarm module which contains up to 30 user configurable alarms. These alarms can be assigned to any loop or monitor input in the system.

NOTE: *After all changes made to any of the following alarm settings, you MUST press the 'Save' button at the lower right of the screen to save the changes to the alarm. If you do not press 'Save' prior to leaving the screen or going to the next alarm, all changes will be lost, and the alarm will maintain its previous configuration.*

The alarm number, **AL#**, in the upper left of the display, shows the current alarm being configured. The left and right scroll buttons at the upper right of the screen allow the user to access each alarm in the system, by pressing left or right to go to the previous or next alarm.

The **Input** selection is used to select the loop or monitor input that will be monitored by the alarm. The same loop or monitor input can be used more than once, for any alarm.

The alarm **Type** selection is used to set the type of alarm. When set to 'Off', the alarm is disabled. Available alarm type selections are as follows:

Absolute: An absolute alarm uses one or two set points to define a specific alarm value. An absolute alarm can be set for high only, low only or both high and low.

%Out: A percent output alarm uses one or two set points to define a specific alarm value. The alarm can be set for high only, low only or both high and low.

NOTE: *The percent output alarm type is not available for the monitor inputs. Monitor inputs do not have control outputs.*

Deviation: A deviation alarm uses one or two set points that are defined relative to the control set point. High and low alarm set points are calculated by adding and/or subtracting offset values from the control set point. If the set point changes, the window defined by the alarm set points automatically changes with it. A deviation alarm can be set for high only, low only or both high and low.

NOTE: *The deviation alarm type is not available for the monitor inputs. The monitor inputs are not associated with a control set point.*

The alarm mode selections are used to select the alarm action. Available selections are as follows:

Latch: When latching is enabled, the alarm will remain active even after the alarm condition has passed until acknowledged by the user. Latched alarms are acknowledged by the user when pressing the 'Reset' button on the Alarm screen or by activating a digital input configured for 'Remote Alarm Reset'. An alarm that does not having latching enabled (self-clearing) will deactivate automatically when the alarm condition has passed.

NOTE: *Latching alarms are acknowledged even when the alarm condition is still present when the user activates the alarm reset. The latched alarm will then automatically clear once the alarm condition is no longer present. If the alarm reset was not activated during the alarm period, the alarm will remain latched until the user activates the alarm reset.*

Reverse: When turned on, the digital output assigned to the alarm will be energized in a non-alarm condition, i.e., fail-safe. When turned off, the digital output assigned to the alarm is normally open and will close in an alarm condition.

Silent: This is used to control the method by which an alarm is reported. When turned off, an alarm condition will trigger the audible alarm and the alarm notification icon will flash to indicate the alarm condition. The buzzer must then be manually silenced by pressing the reset button on the alarm screen.

If silent mode is on, the audible alarm will not sound when the alarm condition occurs. If the alarm latch is turned off, the alarm will not be reported on the alarm screen. If the alarm latch is turned on, which requires manual reset by the operator, the alarm will be reported on the alarm screen to notify the user to reset the alarm; however, the alarm notification icon will not flash. The user must navigate to the alarm screen to determine if a latched alarm is present.

Start Delay: When the start delay is off, the alarm will activate immediately when the input exceeds the alarm set points as programmed. When the start delay is on, the input must first enter the normal operating range (be above the low alarm set point and/or below the high alarm set point) before the alarm can be activated. Upon the next excursion beyond the alarm set points, the alarm will then activate.

The start delay feature is typically used on processes that, when in the off state, are in an alarm condition. This allows the process to be started prior to the alarm(s) being activated and shutting down the process.

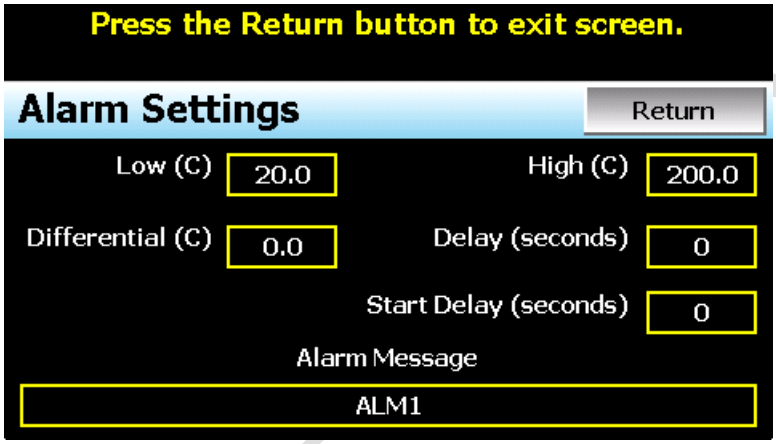
NOTE: *The alarm start delay, when activated, inhibits alarm action from power-up of the MCT, or when entering 'online' mode.*

The **Digital Output** assignment can be used to assign one of the MCT digital outputs to the alarm. When the alarm activates, the output will work in conjunction with the alarm and turn on when the alarm is active and off when the alarm is cleared.

NOTE: *The selected digital output must be configured as a process alarm output. If the digital output selected is not configured to be a process alarm output, it will not function according to the alarm settings. See section Digital Outputs for information on how to configure the digital outputs.*

Set Points and Alarm Message

The alarm set points and alarm message are accessed by pressing the 'Setpoints' button at the lower left of the Alarm screen.

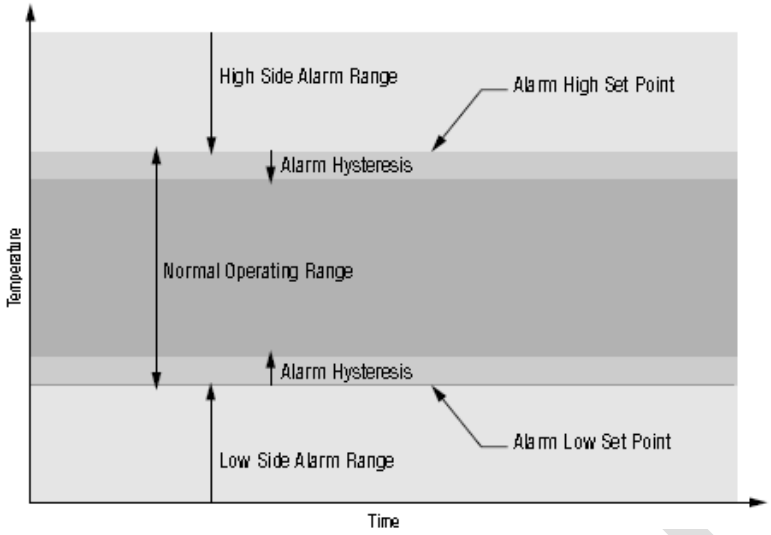


NOTE: *The low and high alarm set point fields are shown for Absolute, Deviation & %Out alarm types. Although both set point fields are shown, only the high SP is used for 'high' alarms, low for all 'low' alarms and both fields are used for Absolute, Deviation & %Out 'both' alarm types.*

The **Low** set point defines the input value that will trigger a low side alarm. It must be lower than the alarm high set point.

The **High** set point defines the input value that will trigger a high side alarm. It must be higher than the alarm low set point.

The **Differential** (often referred to as alarm hysteresis) defines how far the input must return into the normal operating range before the alarm can be cleared.



The alarm on delay time, **Delay (seconds)**, can be used to delay the activation of the alarm. If the input exceeds the alarm setting, but then re-enters the normal operating mode before the alarm delay time expires, the alarm will not be activated. The allowable time setting is from 0 – 32,760 seconds. A value of zero (0) disables the alarm delay and the alarm will activate immediately when the input exceeds the alarm settings.

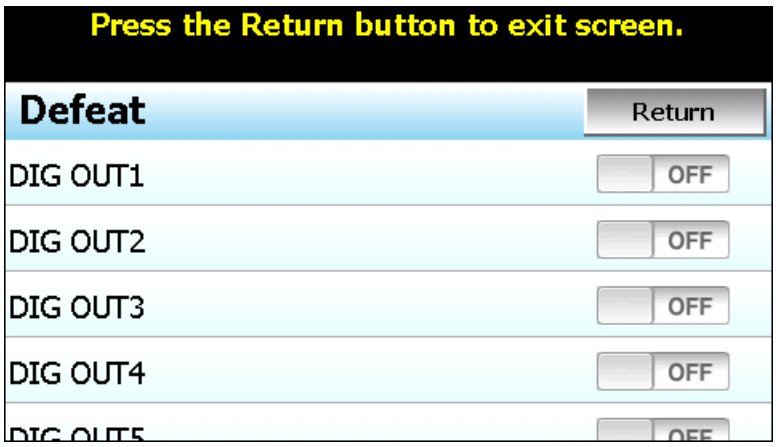
The **Start Delay (seconds)** works in conjunction with the alarm start delay mode selection. If the alarm start delay is enabled, the start delay time can be used to set the maximum length of time the alarm can be inhibited. For example, if a process is started, and the start delay is enabled, what happens if the process never reaches its normal operating mode. The process will operate indefinitely in an alarm condition unless an operator notices it, because the alarm will not activate since it never entered the normal range.

By setting the start delay, the alarm inhibit will be disabled once this time is exceeded from the start-up of the system. The allowable time setting is from 0 – 32,760 seconds. A value of zero (0) disables the alarm start delay timer, so inhibit will be on indefinitely until the alarm input reaches normal operating range.

The **Alarm Message** is the text notification that appears on the Alarm screen when the alarm activates. This message can be edited (up to 25 characters maximum) so that the alarm message more accurately describes what the alarm means.

Output Defeat

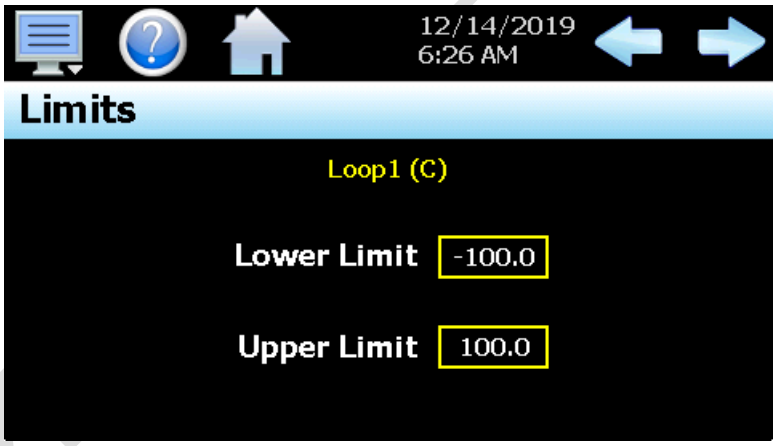
The alarms can be used to disable outputs of the MCT when in an alarm condition. To assign which outputs are to be disabled when the alarm occurs, press the 'Defeat' button on the Alarm screen.



Select which outputs are to be turned off when the alarm is active by pressing the on/off button associated with the desired output(s) and press the 'Return' button when finished.

Limits

The set point Limits screen allows for the adjustment of the minimum and maximum operating set points allowed to be entered for the control loops. These limits can be used to prevent operators from entering a value that exceeds the survivability limits of equipment or product being manufactured, reducing the risk of property damage.

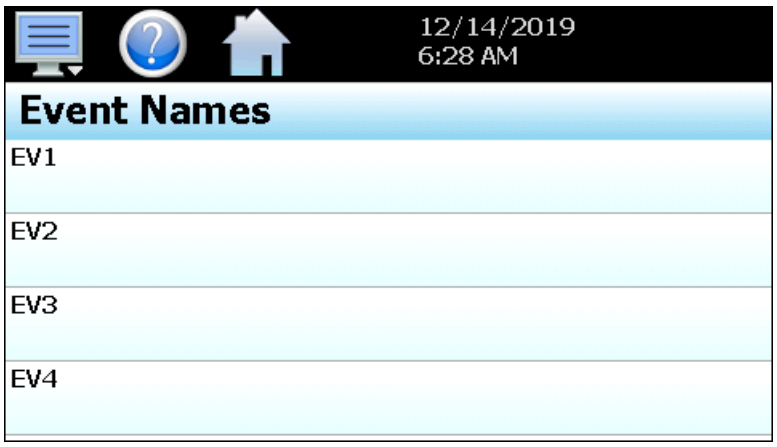


Enter the desired set point limits by touching the "Lower Limit" and "Upper Limit" entry fields and enter the desired values using the numeric keypad.

IMPORTANT: ***The minimum and maximum values for the set point limits are defined by the OEM or equipment installer limits set in the MCT configuration. The MCT prevents the user from entering set point limits outside of these configuration values. Consult your OEM or equipment installer regarding the maximum set point limits permitted for your system.***

Event Names

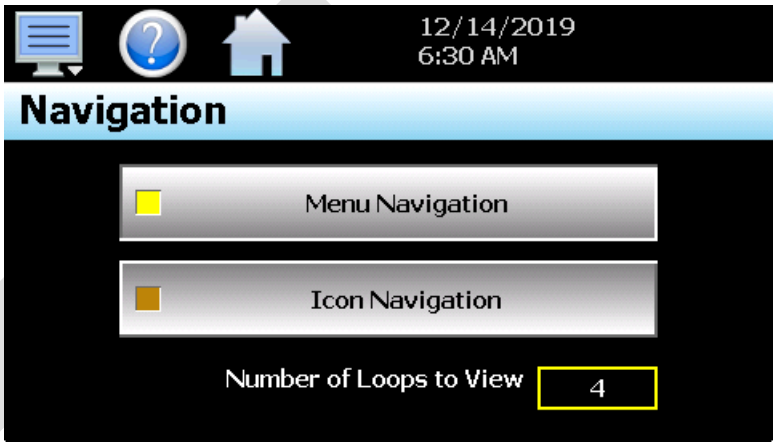
The Event names screen allows the user to change the names of the system events to describe what function they perform. The event names are limited to nine alphanumeric characters.



To change the name of the event, select the event by touching its current tag name in the list to display the text entry keypad. Enter the desired name for the event and press "Done" when finished. The new name will then appear in the event name list box and will be used throughout all MCT screens wherever the event is shown.

Navigation

The MCT provides both text-based PC style menus and icon based/slide page navigation menus like today's "smart" devices. The user can select either type at any time from the Navigation screen. Press the button for the desired menu type to make the selection. The choices are mutually exclusive, so when one selection is made, the other will be de-selected. The button indicator for the active selection will illuminate to show the current selection.

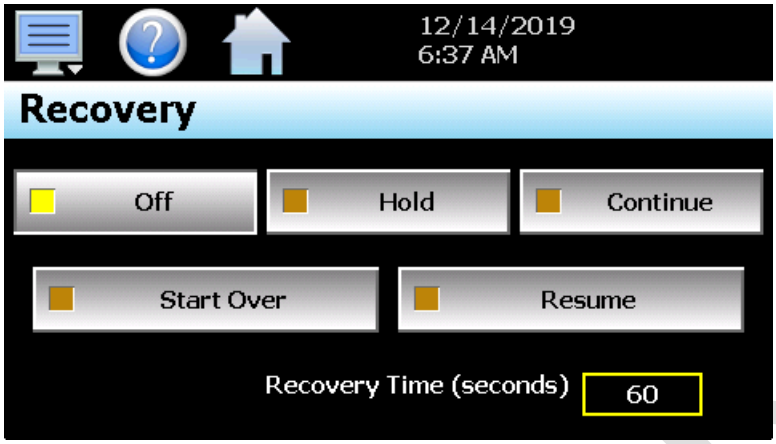


The Number of Loops to View field allows the user to set the number of loops that are to appear on the main Loop view screen. The range is from one to five loops. If less than a total of five loops and monitor points is configured for the system, the maximum value will be equal to the total loops and monitor points. If only one loop is present on the system, the field will not be shown.

Recovery

The power recovery settings allow the user to set the startup state of the system in the event of a power failure when an automatic ramp/soak program was running at the time power was lost. When power is restored, the

MCT compares the amount of time it was off to the recovery time setting and takes whatever action is selected for the recovery state.



To configure the power recovery settings, first determine how long the system can be off without adversely affecting the process. Set the 'Recovery Time' to this value (0–32760 seconds maximum). If power is returned in less time than this setting, the program will continue from where it left off at the time power was lost. If power is restored after a time longer than the recovery time setting, the MCT will act based on the recovery state selection.

To set the power recovery action, push the recovery mode button for the desired setting to set it as the power-up state. The selections are exclusive to one another, i.e., only one can be selected at a time. As a new selection is made, the previous setting will be automatically turned off.

Select **Off** to have the MCT default to the off state on power-up. If a program was running when power was lost, the program will be stopped. In addition, all system events will be turned off. Note that loop controls will maintain the last set point value prior to power loss with loop control outputs active (ON).

Select **Hold** to have the MCT return to operation at the same point it was prior to the power outage. If a program was running, the program will still be active; however, it will remain in hold with the active set points and events that it was operating under prior to losing power until manually set to continue.

Select **Continue** to have the MCT pick-up where it left off on loss of power. If a program was running prior to the power outage, it will resume where it left off and continue through the rest of the program. Note that the set point ramp will continue from the set point value at the time of power interruption unless the program is in the 'ramp rate' configuration.

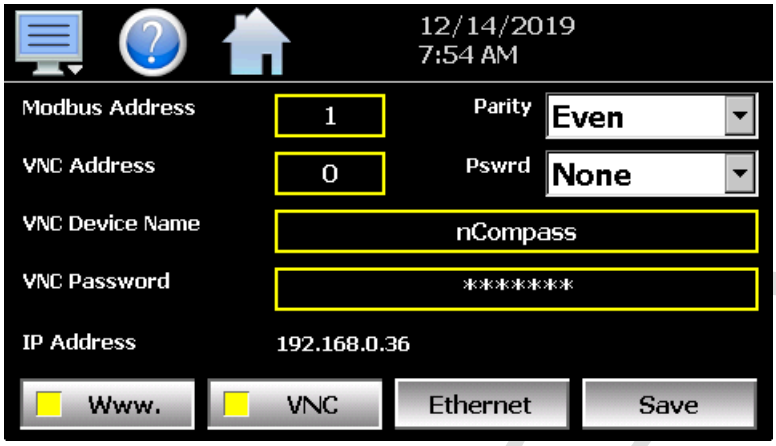
Select **Start Over** to automatically restart the program that was running at power failure. Use this option if it is critical for a program to run from start to finish without interruption.

Select **Resume** to have the MCT pick-up where it would be at the current time if power had not been lost. If a program was running prior to the power outage, the MCT will advance forward through the program to the point where it would be, at the current time, and resume operation from that point.

NOTE: *When a program is NOT running and a power down/up sequence occurs, the MCT will return with the same set points and system events active as when the power was lost. If a program stays in hold regardless of power recovery configuration, refer to the OEM configuration provided by the installer. Digital inputs may be used to place a program in hold. This input may have to be reset to allow the program to continue.*

Communication Settings

The “Comms” screen provides settings for the Modbus serial and TCP interfaces as well as the web server and VNC interfaces. It also provides the MCT IP address, which is required for using the Modbus TCP, VNC and web server interfaces. For more information regarding the use of the MCT data communications interfaces, see section 0 Communications.



The **Modbus Address and Parity** settings are used to configure the serial interface for user communications. Valid addresses are 1 to 247. The Modbus Address is also used to specify the unit ID for Modbus TCP communications. Modbus TCP communications is provided over the Ethernet interface on port 502.

The **VNC Address and Password** set access rights to the MCT VNC server. Valid addresses are from 0 to 99. The VNC password selection defines the connection mode for the server. The selections are “None” and “VncAuth” which requires users to enter the password when connecting to the MCT over the VNC interface.

IMPORTANT: *When multiple MCT controllers are connected to a single router (DHCP server), it is imperative that each MCT have a different VNC address. If multiple MCT controllers have the same VNC address, network errors may result causing the VNC server to shut down or cause the MCT to “lock-up” and become non-responsive requiring the unit to be power cycled to return to normal operation.*

The **VNC Device Name** field is used to enter a name (up to 35 characters) that can better identify the MCT to users logged into the VNC interface. The name entered here will be used on the VNC header window on a PC, so that if multiple VNC clients are open to different systems, each one can be identified.

The **VNC Password** field is used to enter the password (up to 20 characters) that a user must enter for the VNC interface to connect to MCT if the VNC password is enabled.

The **IP Address** field is a static field that provides the IP address of MCT which is required for connecting over the VNC, web and Modbus TCP server interfaces. See the following section 0 Ethernet Settings for more information on how to adjust the device IP and other LAN information.

The **WWW.** (Web server) pushbutton is used to enable or disable the web server interface.

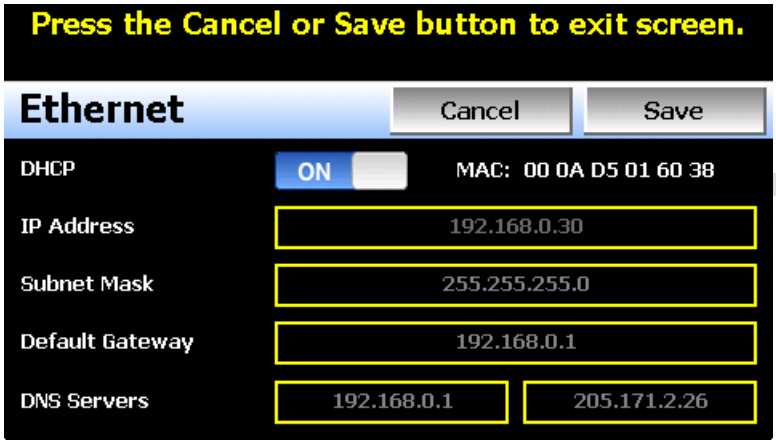
The **VNC** server pushbutton is used to enable or disable the VNC server interface.

The **Ethernet** button is used to access the Ethernet settings screen.

NOTE: *Any changes made to the above settings must be saved for them to take effect. When changes are completed, press the "Save" button. For any changes to the VNC server to take effect, power must also be cycled to MCT. The new VNC settings will only take effect when MCT first boots up. Serial communication and web server settings take effect immediately upon save.*

Ethernet Settings

The "Ethernet" screen provides settings for the network interface of the MCT. It is accessed by pressing the Ethernet button on the Communications screen.



The **MAC** address field displays the media access control address (physical address) of the MCT. This is a unique identifier for the network hardware of the MCT and cannot be changed. It is for informational purposes and may be required by your network administrator when connecting the MCT to your network.

The **DHCP** button is used to turn automatic addressing on and off. By default, the MCT is shipped with the DHCP setting on. This means the MCT will be assigned an IP address by the network router. When on, the entry fields will be disabled, but will display current connection information used by the MCT. To enter a static address, press the button to turn it off.

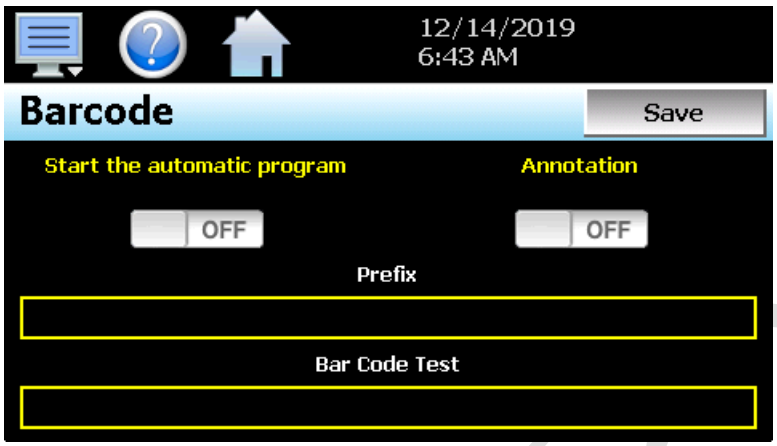
To set the static network address, enter a valid **IP Address**, **Subnet Mask** and **Default Gateway**. The **DNS Servers** are not required, but typically the IP address of the network router is entered to provide one. Consult your network administrator for the proper values. The IP address must not be a duplicate of any other address on the network, or the interface will not operate correctly. The entry fields except IPV4 addressing format only. The MCT does not except IPV6 addressing.

NOTE: *When DHCP is on and the MCT is disconnected from the network, the entry fields on the Ethernet screen will continue to display connection information based on its last valid connection for diagnostic purposes. The IP address on the main Communications screen (or shown in the notifications list) always displays the current address used by the MCT. If the IP address on the Communications screen displays the loop-back address of "127.0.0.1" then no connection is present.*

When DHCP is off, the IP address on the Communications screen will always display the user entered static IP address regardless of connection status. It does not indicate whether a valid network connection is present or not.

Barcode Scanner

The Barcode screen provides access to the settings for the optional barcode scanner. These include settings to turn the barcode scanner on and off, applying a prefix to scanned data and a test window for verifying proper operation.



Barcode scanner operation is enabled through the "Start the automatic program" and "Annotation" on/off buttons. The selections are mutually exclusive, i.e., only one can be enabled at a time. When one option is turned on, the other is automatically turned off.

When the **Start the automatic program** option is turned on, if the scanned data matches the name of a ramp/soak program stored in memory, the MCT will automatically load the program and prompt the user to start it. If the user presses 'Yes" to start the program it will be downloaded to the CM and will begin operation on the first step.

When the **Annotation** option is turned on, the scanned data will be written to the currently running data log file as operator event.

The **Prefix** field allows the user to enter up to 16 characters that will then be used as a prefix to the scanned value when matching a ramp/soak program name or when it is inserted into the active data log file. This can be used as a tag to describe what the scanned value represents, i.e., Lot or Batch number for example.

NOTE: *Any changes made to the above settings must be saved for them to take effect. When changes are complete, press the 'Save' button to save the new settings to use them.*

The **Bar Code Test** field allows the operator to test the operation of the barcode scanner. As a bar code is swiped by the reader, the scanned value will appear in this field. If upon scanning a bar code, no value appears in this field, check the wiring and communication settings of the barcode scanner to be sure that it is connected and set up properly.

Barcode Reader Communication Settings

For the barcode scanner to communicate properly with the MCT, it must be set with the proper communication settings. This includes baud rate, data bits, stop bits, parity and start/end of transmission characters as follows:

Baud rate = 9600 baud
Data bits = 7
Stop bits = 1

Parity = even
Preamble = STX (0x02)
Postamble = ETX (0x03)

The preamble and postamble are the start of transmission and end of transmission characters that must be used to frame the barcode transmitted to the MCT so that it recognizes the beginning and end of the transmission. All other terminator, BCC, ACK and/or handshaking characters must be disabled.

Setting up the Unitech MS-120-2 Barcode Scanner

The following instructions are provided for the Future Design Controls recommended Unitech MS-120-2 barcode scanner. These instructions do not apply to other makes or models of scanner. Consult the manufacturer's manual for other makes or models for information on how to set the proper communications settings.

NOTE: *The steps below are assuming manufacturer default settings are in place. If the scanner settings are unknown, restore the scanner to manufacturer defaults by scanning barcode 'enter group 1' on page 5 of the MS-120 Series Programming Manual and then scanning the 'factory defaults' barcode at the bottom of page 5. Scan 'exit' to complete the process.*

For communication settings see page 11 (RS232 Serial Setting) of the MS-120 Series Programming Manual

Step 1 scan barcode at top of page 11 for 'enter group 4'
Step 2 scan barcode C2 for parity on page 12 and then scan the barcode for the number 0 on page 11
Step 3 scan barcode C3 for data bit on page 12 and then scan the barcode for number 0 on page 11
Step 4 scan the barcode for 'exit' on page 11 to complete RS232 settings

For pre/postamble settings see page 13 (Scanner) of the MS-120 Series Programming Manual

Step 1 scan barcode at top of page 13 for 'enter group 5'
Step 2 scan barcode D1 for terminator at top of page 14 and then scan the barcode for the number 3 on page 13
Step 3 scan barcode PP for preamble at bottom of page 14 and then scan the barcode for STX at top of page 30 (2nd down on left)
Step 4 scan barcode OO for postamble at bottom of page 14 and then scan the barcode for ETX at top of page 30 (2nd down on right)
Step 5 scan the barcode for 'exit' on page 13 to complete settings

Important Notes on Barcode Reader Use

There are certain limitations of use for the barcode scanner based on the mode of operation selected. It is important that the user read and understand these to ensure that the barcode reader operates as expected.

Using the Barcode Reader to Start an Automatic Ramp/Soak Program

When using the barcode scanner to start a program, the scanned barcode data must match the ramp/soak program name exactly for the MCT to load and prompt the user to start it. Program names can be a maximum of 16 characters, which also matches the maximum data that the MCT will accept from the barcode scanner. However, if a prefix is also used, the overall name (prefix + scanned data) can exceed the maximum allowed file name length for a program. If the MCT does not find an exact match, it will ignore the scan. Thus, it is up to the user to ensure that a matching program exists for each bar code that will be scanned.

If an automatic ramp soak program is already in operation, or a program download is active from a remote PC, the MCT will ignore any barcode scan made during that time. The MCT will also ignore a barcode scan if the FTP data backup Is active. The user must manually stop the currently running program or wait for the remote PC download to complete before scanning the barcode to begin the matching program. The user also has the option of cancelling the FTP data backup while it is in progress, if necessary, to scan and start a program.

If the automatic FTP data backup is set to occur while an automatic program start is in progress by a barcode scan, but the user has not yet acknowledged the request to start the program, the FTP data backup will be skipped. The automatic FTP data backup will then occur at the next scheduled interval. This allows the user to proceed without interruption; however, it does prevent the scheduled backup of data. If necessary, a manual FTP backup can be performed once the program has been started.

Using the Barcode Reader to Annotate a Data Log File

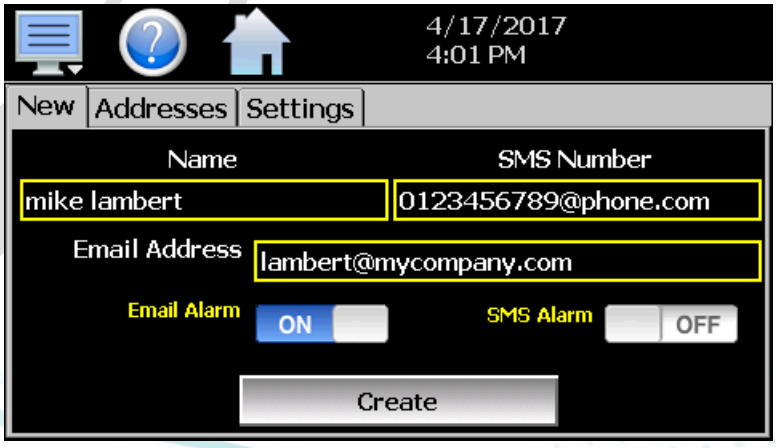
When scanning bar codes, a minimum time of 3 seconds is required between each code scanned. This provides the time necessary for the MCT to acquire the code and insert it as an annotation into a running log file. If multiple bar codes are scanned too quickly, the MCT may miss a scan because it is still processing the previous bar code.

Email

The MCT email server can send alarm messages to email and SMS addresses. Up to 30 addresses can be programmed into the system. Each one can be configured to receive emails, SMS text messages or both. When an alarm occurs, the MCT will send an alert to the specified address for each user in the list. The email settings are accessed by selecting “Email” from the setup “Email” menu.

Email Address Entry

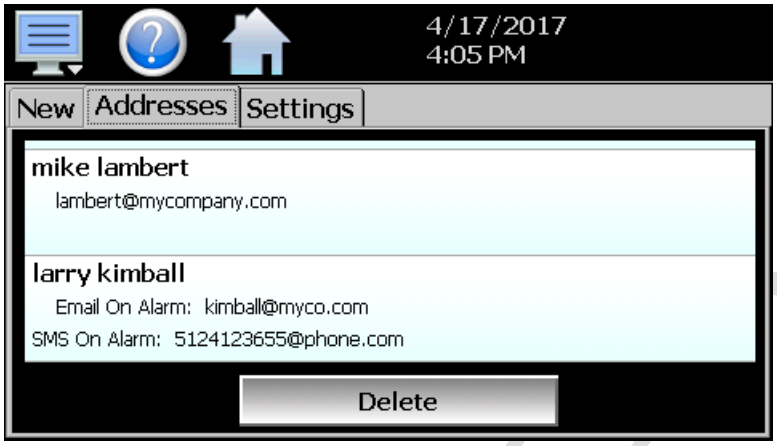
Select the “New” tab to add new email addresses to the system. For each entry, enter the recipient’s Name, Email Address and/or SMS Number (up to 50 characters each). Turn on the Email Alarm and/or SMS Alarm options to specify which addresses the alarm messages are to be sent to. Press the “Create” button to add the user to the list.



NOTE: *The SMS address is specific to the service provider. Each service provider has their own unique address; however, the phone number is always the “name” for the address entry. There are internet sites with this information that cover most of the providers, or when in doubt, contact your service provider for the proper address format.*

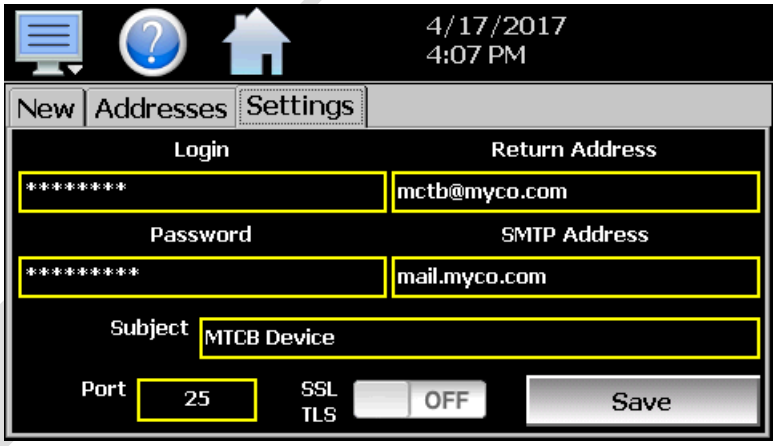
Email Addresses

Selecting the “Addresses” tab allows the user to view the list of email addresses entered in the MCT. Each entry will be shown with the notification method and address associated with it (email/SMS). To delete a user, touch the name of the user in the list box and press the “Delete” button. This will permanently remove the user from the list.



Email Settings

The “Settings” tab provides access to the email server configuration, which is how the MCT can connect and send email messages over its Ethernet connection. Each field may have up to 50 characters.



The **Login** field is used to enter the login name required by the MCT to log in to your company’s mail server. You can use your login if one is not set up specifically for the MCT on your network. Contact your network administrator for assistance.

The **Return Address** is the address given for the MCT on your company’s mail server. The MCT does not accept email messages; however, this field is required for proper email delivery for security/anti-spam purposes. If using your personal login name, you can also use your personal email address if one is not set up specifically for the MCT on your network. Contact your network administrator for assistance.

The **Password** field is used for entering a password, if required by your network server, to send email. Contact your system administrator for assistance.

This **SMTP Address** field is for entering the address of the email server used for sending emails. This must be a valid mail server for which the above settings allow MCT access. Contact your system administrator for assistance.

This **Subject** field is used to enter a subject line for emails and/or SMS text messages. It can be used to provide an identifier to the recipients of the alarm message to know which chamber it is coming from.

NOTE: *It is recommended to put some form of entry in this field. It can be left blank; however, many firewalls and spam filters will filter out messages without subject lines. That may prevent recipients from receiving the email. It can also be useful for identifying a particular unit on the factory floor.*

The **Port** field is used to set the port number that will be used on the device for email operations. For non-secure connections (no SSL/TLS) port 25 is the default. If SSL/TLS is used, port 587 is usually the standard port selected.

The **SSL/TLS** button is used to enable or disable **Secure Socket Layer (SSL)** and **Transport Security Layer** (TLS) functionality. These protocols are used to provide an authenticated connection between servers and clients as well as encrypt information between the two. This provides a more secure environment for email information with many public email services only allowing SSL/TLS connectivity.

Once all settings have been made, be sure to press the "Save" button to begin using the new values and store them, so that on the next power up, the settings will be retained. The body of the email/SMS text message will contain the description of the alarm condition as it would appear on the alarm screen. If the mail server is down, or the MCT is not connected to the network, the message will not be sent and a local alarm message on the Alarm screen will indicate a transmission failure.

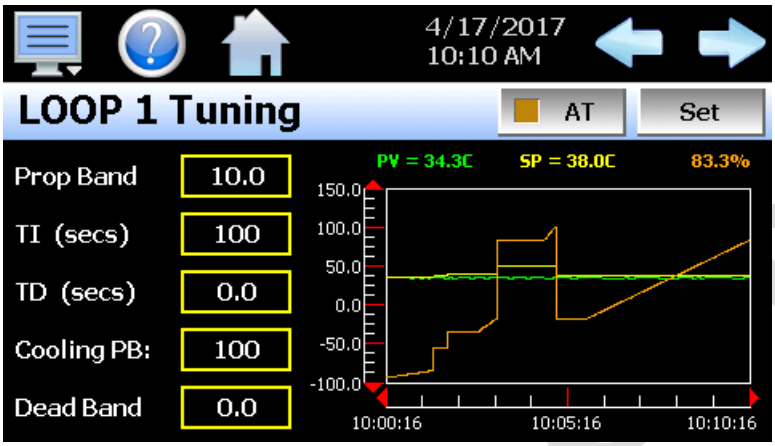
Email Message

The MCT provides the user with the ability to send short email messages to users configured in the MCT email server. To send a message, select "Message" from the device settings, Email menu.

Press the "Compose" button to create a brief message using the keypad (up to 100 characters). When you are finished entering the message, press the "Done" button. The completed message will then be shown in the message window. Press the "Send" button to select the email recipients you wish to receive the message and send the message.

Tuning

The loop Tuning screen allows for manual and automatic tuning of the MCT control loops. Tuning parameters should only be manually adjusted by skilled users familiar with proportional control. Improper settings can result in control loop instability and equipment damage. The loop automatic tune function is the recommended method of loop tuning. If the control response achieved after performing an auto tune does not provide the desired control response, then minor adjustment of the tuning parameters may be done manually to obtain the desired response.



The available tuning parameters are dependent upon the loop configuration. If programmed for heat or cool only control, then the available parameters will be PB (proportional band), TI (integral time) and TD (derivative time). If the loop is configured for heat/cool operation, then two additional parameters for Cooling PB (cooling proportional band) and Dead Band (heat/cool dead band) will be provided.

The tune screen also provides a live real time chart for monitoring the control response of the control loop while adjusting tuning parameters. The chart is fixed at a 10-minute time and updates once per second.

Pressing the **Set** button allows the user to adjust the loop set point without having to leave the tuning screen to observe the control response.

Pressing the **AT** button allows the user to activate/deactivate the loop auto tuning feature. When auto tune is active, the indicator on the button will be illuminated. In addition, the process value of the loop on the Loop view screen will flash while auto tune is active. This allows the user to activate auto tune and then return to the main Loop view screen to observe system operation while being informed of the loop auto tune status.

NOTE: *When manually entering new tuning values, it may take several seconds for the new entry to be shown as the values have to be written and saved to the loop control selected for tuning.*

Heat/Cool (Bimodal) Control

When a loop is programmed for heat/cool operation, the values of the Cooling PB and Dead Band affect the way the heat and cool outputs work together to control the process.

The **Cooling PB** is measured in % of the proportional band with a range 1-255. Set cooling PB to 100% to

begin and examine the cooling effect. If cooling action should be enhanced, then decrease the cooling band. If cooling action is too strong then increase the cooling band. The value of the cooling proportional band is

related to the heating proportional band and its value remains unchanged throughout any auto tuning procedures.

NOTE: *The adjustment of the Cooling PB is also related to the cooling media used. When air is used as the cooling media, it is recommended that the Cooling PB be set to 100%. For oil, a typical setting to use for the Cooling PB is 125%. If water is used as the cooling media, then adjust the Cooling PB to 250%.*

The adjustment of **Dead Band** is more dependent upon system requirements. If more positive values of dead band (greater dead band) are used, an unwanted cooling action can be avoided but an excessive overshoot may occur. If more negative values of dead band (greater overlap) are used, an excessive overshoot can be minimized but an unwanted cooling action may occur.

Dead band is adjustable in the range of -36.0% to 36.0 % of the heating proportional band. A negative dead band value provides an overlap between heating and cooling action in which both outputs can be active at the same time. A positive dead band value provides a dead band area in which neither output is active around set point.

OFFLINE

To enter offline setup, automated ramp/soak program operation and data logging must be manually stopped.

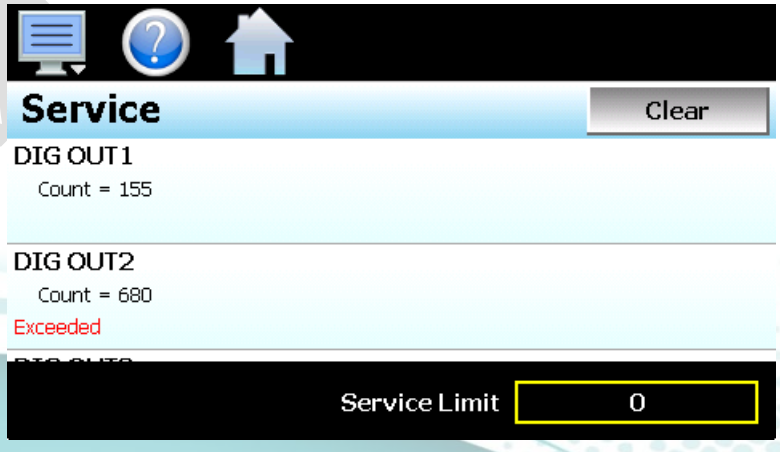
NOTE: Upon entering offline setup, all MCT digital and analog outputs will be turned off.

To assist in setup and documentation of the MCT, see the "MCT Configuration and Worksheets" Excel file provided on the Future Design Controls website (http://www.futuredesigncontrols.com/MCT.htm). This document provides setup and configuration forms and templates for all MCT features including those provided under Offline Setup.

The offline menu provides navigation to the following functions

Service

The service counters provide service interval alerts and life total service numbers for each of the digital outputs available on the MCT control module. The service intervals (counter set points) are adjustable and can be set to match service intervals for equipment operated by the MCT.



Two service alert set points are provided for each output of the MCT. One service alert is available for the number of times each output turns on and is adjustable from 0 to 4,000,000,000 cycles. The second service alerts are for 'on' time and is adjustable from 0.0 to 400,000,000.0 hours.

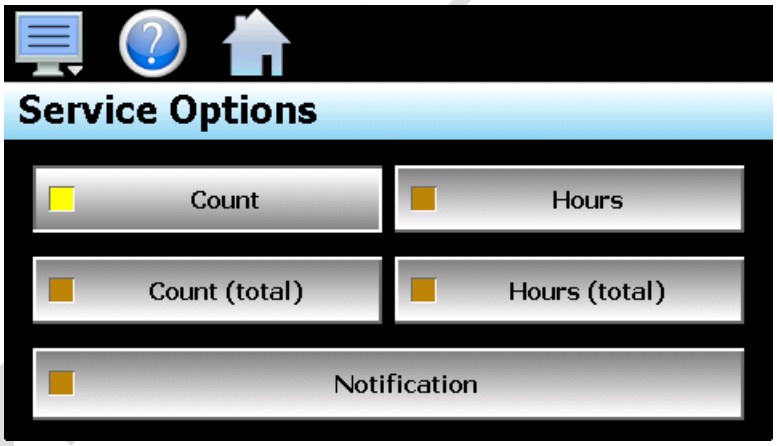
To adjust a counter set point, select the output from the list by touching its description. The current set point for that output will be shown in the set point field at the bottom of the screen. Enter the new set point by touching the set point field and press the 'Done' button on the numeric keypad when finished.

NOTE: *To adjust the cycle counter, you must be viewing the elapsed interval or life total counts for the outputs. To adjust the set point for hours of operation, you must be viewing the elapsed run or total life hours of the outputs. See section Service Options.*

When a service interval is exceeded, a service alert can be set to appear on the alarm screen. This alert will notify the operator that service should be performed at the next available down period. However, the alert will not be able to be cleared from the alarm screen until the service counter that has been exceeded is reset.

To determine which service counter has been elapsed, scan the list of outputs, and look for the 'Exceeded' description. To clear the counter, select the output from the list and press the 'Clear' button. This will clear the counter so that it can begin totalizing for the next service interval.Service Options

The service display options as well as alert action can be adjusted from the Options screen. The count and hours selection buttons are used to choose what information will be shown for the digital outputs on the Service screen. The selections are mutually exclusive, so when one item is selected, the other items will be de-selected.



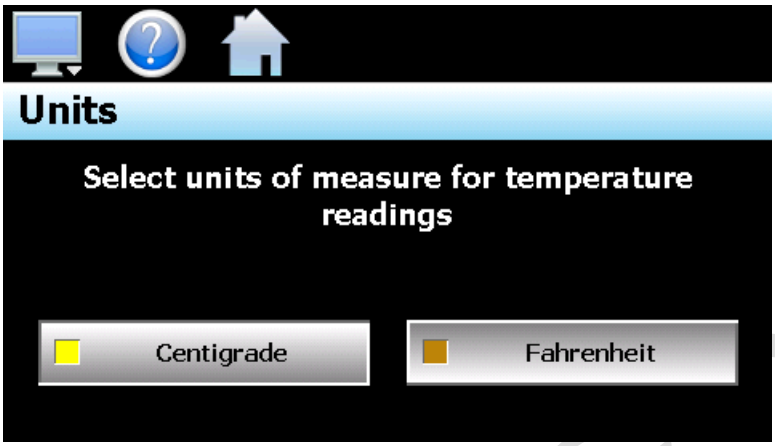
The **Count** and **Hours** are what generate the service alert when the set point is exceeded for the output. These are the counters that must be cleared to remove the service alert from the alarm screen. When either of these is selected, the service screen will display the elapsed count or hours for each output.

The **Count (total)** and **Hours (total)** selections are for displaying the life total count and hours for each output. These maintain separate count and hour values from the elapsed selections. Note that these can also be cleared from the Service screen by pressing the 'Clear' button if they are selected for view. This allows life total operation to be tracked for external equipment, and then reset when the external equipment is replaced with new.

*The **Notification** button is used to turn the service alert option on and off. Service alerts are turned off by default. When the service alerts are turned off, there will be no notification on the alarm screen when an output exceeds its service interval.*

Degrees C/F Units Selection

The MCT can display temperatures in either degrees Centigrade or Fahrenheit. To change the temperature display units, select "Units" from the offline Set menu.



Press the button for the desired temperature units to make the selection. The choices are mutually exclusive so when one selection is made, the other will be de-selected.

NOTE: *When changing display units, ramp/soak program set points will not be converted between units. Separate programs are required for each temperature range. Operating the MCT with programs that have been written using alternate units could cause property damage or personal injury.*

The temperature unit's selection only effects control loops and monitor inputs configured as temperature, i.e., controllers or monitor input cards with a temperature input device such as a thermocouple or RTD. The units display for loop controls and monitor input cards configured with linear inputs (mA or Vdc) will not be affected by this selection.

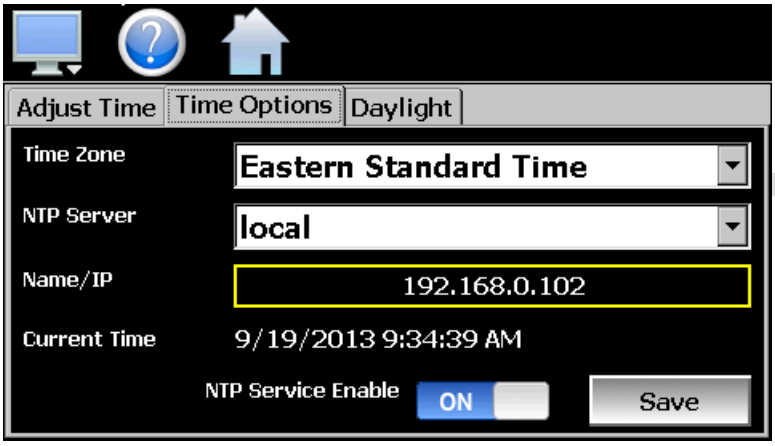
Clock Settings

The system date and time is adjusted from the "Adjust Time" tab under the Set/Clock menu. The current date and time will be displayed in the thumb wheels as shown below.

To adjust, scroll each time wheel to adjust the month, day, year, hour, minutes, seconds, and AM/PM selection. Once all adjustments have been made, press the "Save" button to set the system clock to the date and time entered.

Time Options

Select the "Time Options" tab to configure the time zone and national time server clock settings. If the MCT is connected to the internet, these settings can be used to have the MCT automatically synchronize its time with one of the nationally provided time servers.



To enable the national time server, select your time zone and which time server you wish to use from the drop-down menu selections. Turn on the "NTP Service Enable" option and press the "Save" button. The MCT will then synchronize its time with the selected national time server at 2:00AM each day.

If the MCT is not connected to the internet, a local alarm message will be shown on the alarm screen; "*NTP Failure. Check cable and server"* to indicate that the time server could not be located.

Local Time Server Settings

If an active internet connection is not available, or company policy prohibits internet access, the MCT can be configured to use a local time server instead of one of the national time servers. To configure the use of a local time server, select "local" from the NTP server list. When selected, the "Name/IP" entry field will be shown. The computer name or IP address of the computer running the local timer server on the LAN can then be entered. The MCT will then contact the local computer to synchronize time.

NOTE: *The steps required to configure and provide NTP service from a computer on the LAN is outside the scope of this manual. Contact your network administrator for assistance.*

Daylight Savings

Select the "Daylight" tab to configure daylight saving time options. The daylight savings time options allow the user to set the start date and end date for daylight savings time.

NOTE: *If the NTS time server setting is enabled, and the selected time zone uses daylight savings time, daylight savings must be properly configured and enabled, or the clock will not show the correct time.*

If your locale utilizes daylight savings time, set the start, and stop dates for daylight savings and turn on the "Daylight Savings Enable" option. Press the "Save" button to store the settings. The MCT will then automatically update its clock for daylight savings time.

Language

The Language screen is used to select the language for all of the online help, menus and most static display fields. Note that the keypad will remain in English, so all user text entry will still be in the English language.

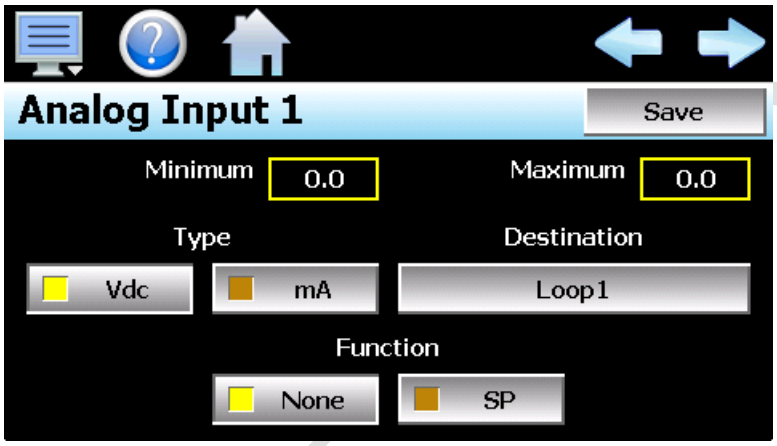
Available language selections include:

- ✓ Chinese Simplified
- ✓ Chinese Traditional
- ✓ English
- ✓ French
- ✓ German
- ✓ Italian
- ✓ Japanese
- ✓ Korean
- ✓ Portuguese
- ✓ Russian
- ✓ Spanish

DISCLAIMER: English is the default language for the MCT control system. All other language selections provided through translation from the English language. FDC does not guarantee the accuracy or validity of alternative language selections and shall not be liable for any damages or losses, whether direct, indirect, incidental, special, consequential or any other damages for misinterpretation of other languages. FDC offers a free, PC based application which allows the end user or OEM to create the translation files for the desired language selection. The translation files can then be copied to the MCT control system to provide a more accurate or desired translation.

Analog Inputs

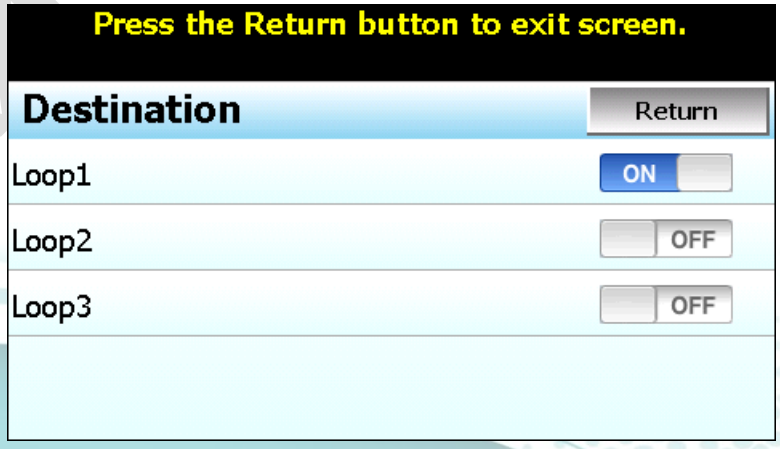
The MCT supports up to 14 analog inputs which are used for remote set point inputs. Each of the available analog inputs can be configured from the 'Analog Input' screen.



The left and right navigation buttons at the upper right of the screen allow the user to scroll through each available input. To make changes to the analog input's configuration, select the desired input type by pressing the voltage (Vdc) or current (mA) button to select a 2-10V or a 4-20mA input signal.

NOTE: *If the analog input type is changed from voltage to current or vice versa, power must be cycled to the MCT controller for the input to switch signal types.*

Select the desired loop by pressing the 'Destination' button to select from the list of available control loops.



Select the desired control loop and press the 'Return' button to return to the Analog Input screen. Enter the desired minimum and maximum values for the loop set point that the input is to represent. The input range is -32760 to 32760 for a decimal point resolution of zero, -3276.0 to 3276.0 for a decimal point of one, -327.60 to 327.60 for a decimal point of two and -32.760 to 32.760 for a decimal point resolution of three.

The function selection buttons, **None** and **SP**, enable and disable the analog input. This allows the analog input configuration to be maintained but disable its operation until it is required. Select 'None' to prevent the analog input from taking set point control over the selected loop. Press the 'SP' button to enable the analog input set point control override.

Once all settings have been made, press the 'Save' button to save the changes. If you do not press the 'Save' button, all changes will be lost if you leave the screen or navigate to another analog input.

Remote Set Point Operation

Once an input is configured for loop set point control, as the analog input signal is varied, it will provide a linear set point change from the minimum to maximum value over the range of the input (2-10Vdc for voltage input and 4-20mA for current selection).

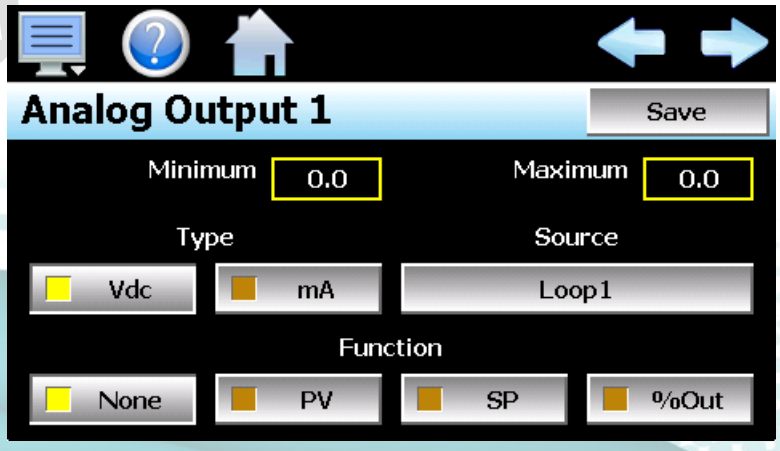
Signals below 2Vdc for the voltage input type, and below 4mA for the current input type, will disable remote set point control so that the loop set point can be changed manually at the MCT. It also prevents the remote set point control from setting a false input if the signal wires are cut or the signal is lost from the remote set point source device.

NOTE: *When remote set point control is activated, it will override the local set point as well as the ramp/soak program set point if a program is running. Once deactivated, the loop set point will return to the previous local set point of the loop, i.e., the value prior to the remote set point being activated and taking control of the loop's set point, or the current program set point if a program is running.*

If the minimum or maximum range exceeds the set point limits for the loop as set in the MCT configuration, the MCT will limit the set point to the minimum or maximum value as defined under the loop's configuration.

Analog Outputs

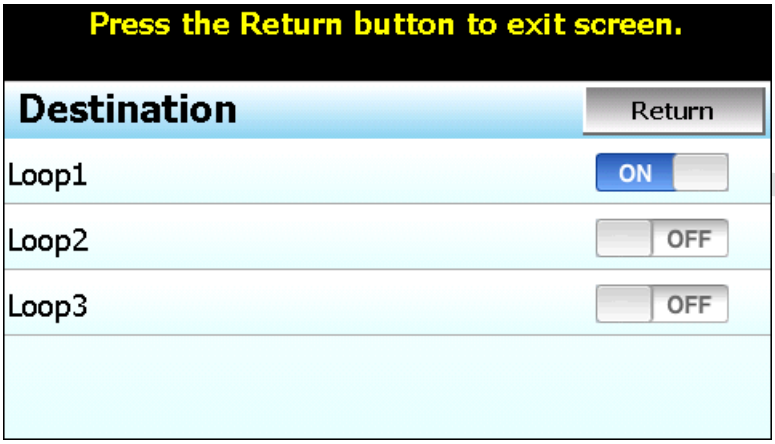
The MCT can support up to 7 analog outputs which can be used to retransmit set points, process variables or percentage of output from the installed control loops. Each of the available analog outputs can be configured from the 'Analog Output' screen.



The left and right navigation buttons at the upper right of the screen allow the user to scroll through each available output. To make changes to the output's configuration, select the desired output type by pressing the voltage (Vdc) or current (mA) button to select a 0-10V or a 4-20mA input signal.

NOTE: *If the analog output type is changed from voltage to current or vice versa, power must be cycled to the MCT controller for the output to switch types.*

Select the desired source loop by pressing the 'Source' select button to choose from the list of available control loops. Select the desired control loop and press the 'Return' button to return to the Analog Output screen.



Choose which loop value is to be retransmitted for the loop by pressing the appropriate function select button; PV, SP or %Out. If 'None' is selected, the output will remain in the off state, i.e., 0Vdc or 4mA depending upon the output type selection.

Enter the minimum and maximum values for which the output is to retransmit. The output range is -32760 to 32760 for a decimal point resolution of zero, -3276.0 to 3276.0 for a decimal point of one, -327.60 to 327.60 for a decimal point of two and -32.760 to 32.760 for a decimal point resolution of three.

Once all settings have been made, press the 'Save' button to save the changes. If you do not press the 'Save' button, all changes will be lost if you leave the screen or navigate to another analog output.

Retransmitting Loop Percentage of Output

Depending upon the loop control being used, the percentage of output value for bimodal control (heat/cool) is represented differently. For example, FDC 100 and 300 series controls represent heat output as a value from 0% to 100% while the cool output is represented as a value from 0% to -100%. Other controls supported by the MCT may split the standard 0% to 100% range and use 50% to 100% for heating and 50% to 0% for cooling.

If the analog output is being used to control the position of a cooling valve or SCR power controller of a heater bank for example, it is important that the analog output supply only the signal for the proper heating or cooling range to properly control the amount of cooling or heating applied to a process.

The MCT provides the ability to supply only the heating output, cooling output or a combination of heating and cooling outputs from its analog outputs. For example, if an FDC 300 series control is used, setting an 'Out Min' to 'Out Max' range of 0% to 100% will result in an analog output of 0-10Vdc or 4-20mA for an output of 0% to 100% heating. If a different model of controller is used that represents heating as 50% to 100% with

cooling from 50% to 0%, setting an 'Out Min' to 'Out Max' range of 50% to 100% will result in an analog output of 0-10Vdc or 4-20mA for an output of 0% to 100% of the heat output.

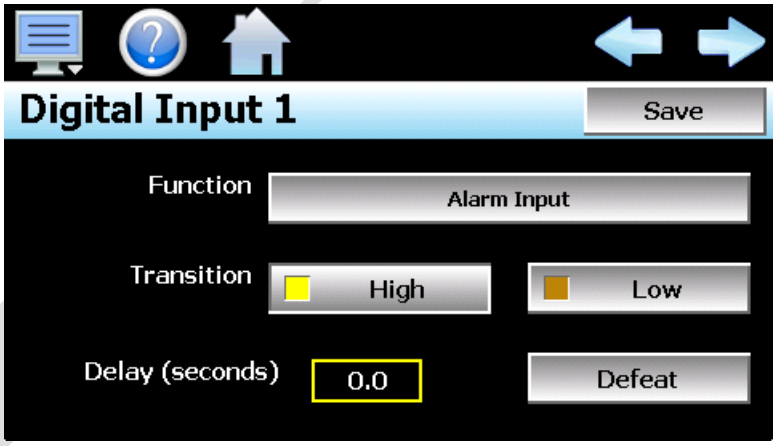
To retransmit a cooling percentage of output, the MCT allows the analog output range to be inverted relative to the value representing the cooling percentage of output. This allows the positioner of a cooling valve for example, to receive a 0-10Vdc or 4-20mA signal representing 0% (full closed) to 100% (full open) of cooling even if the cooling percentage represented by the controller is 50% (no cooling output) to 0% (full cooling output).

For example, if 0% to -100% represents no cooling to full cooling, setting the 'Out Min' field to 0% and the 'Out Max' field to -100% will produce an analog output of 0-10Vdc or 4-20mA for an output of 0% to 100% cooling. If a model of controller is used that represents cooling as 50% to 0% while heating is represented as 50% to 100%, setting an 'Out Min' to 'Out Max' range of 50% to 0% will result in an analog output of 0-10Vdc or 4-20mA for an output of 0% to 100% of the cool output.

NOTE: *The analog outputs always treat the 'Out Min' field as the 0Vdc or 4mA output value and the 'Out Max' field as the 10Vdc or 20mA output value. This allows any portion of a control loop's output range to be retransmitted and represented as a range of 0% to 100% of output or 100% to 0% of output.*

Digital Inputs

The MCT provides eight digital inputs standard and is configurable up to 16. The inputs can be used as alarm inputs, used to start, and stop a ramp/soak program, start, and stop data logging or even disable set point communications to the MCT loop controls. The digital inputs can be configured to work on either a low to high transition or a high to low transition. Upon seeing the selected transition, the input will perform the action selected from the input function list.



The left and right navigation buttons at the upper right of the screen allow the user to scroll through each available input. To make changes to the input's configuration, select the desired transition mode and function for the input. Once all selections have been made, press the 'Save' button to save the changes. If you do not press the 'Save' button, all changes will be lost if you leave the screen or navigate to another digital input.

NOTE: *More than one digital input can be configured for the same function. If more than one is set for the same function, make sure that they do not interfere with each other or the selected function they are to perform may not operate as expected.*

The **Delay** is used to delay the input function for a time (in seconds) once the input transition state is detected (and maintained). It can be used to 'debounce' an input or act as an alarm delay to prevent false alarms. The time is configurable from 0.0 to 3276.0 seconds.

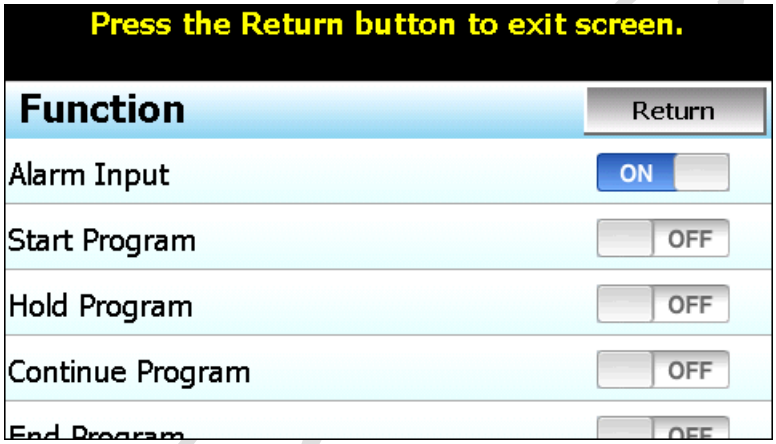
The **Transition** select buttons set the input state that makes the input perform the required function.

High: This setting sets the input up to perform the desired function when the input goes from an off state to an on state. This requires the application of 24Vdc power to the input.

Low: This setting sets the input up to perform the desired function when the input goes from an on state to an off state. That requires the removal of 24Vdc power from the input.

The digital input **Function** defines what event is to happen when the input meets the transition state.

The Input Function list is shown when the function selection button is pressed. The input functions selections are mutually exclusive, i.e., only one can be made at a time. An input can also be disabled by turning off all the input functions. Once the desired selection has been made, press the Return Button to return to the Digital Input screen.



***** *Alarm Input:* When selected, the input will provide a visual alarm notification on alarm screen. Using the 'Defeat' selection, the input can be configured to disable specific digital outputs on the MCT control module. The alarm condition will be maintained if the input is activated. The alarm will not clear until the input returns to its deactivated state and the alarm is reset on the alarm screen or through a digital input configured as 'Reset Alarm'.

Start Program: When selected, the input will start the currently loaded program at step one. If a program is currently running, no action will occur. This is a 'single-shot' activation in which the input must make the required transition state to activate the function.

Hold Program: When selected, the input will put a running program into the hold state. If a program is not currently running, no action will occur. This is a 'single-shot' activation in which the input must make the required transition state to activate the function.

Continue Program: When selected, the input will put a program that is in hold, into the run state. If a program is not active or the program is not currently in hold, no action will occur. This is a 'single-shot' activation in which the input must make the required transition state to activate the function.

End Program: When selected, the input will turn the program off. This will also turn off all system events. If a program is not running, no action will occur, and event status will not be affected. This is a 'single-shot' activation in which the input must make the required transition state to activate the function.

Wait Input: When selected, the input acts as a trigger for the program wait for digital input function. The input can then be selected in the program to pause a step until the input is activated.

Control Output: When selected, the input will act as a switch that can be used to directly control a digital output of the MCT control module. To use the input as a switch for an output, the digital output must be configured to use the input for control. See section 0 Digital Outputs for more information.

* *Defeat Output:* When selected, the input will cause digital outputs selected under 'Defeat' to turn off. The operation is like the alarm input function, but no alarm message is displayed.

* *Start Data:* When selected, the input will start and stop the data logging operation of the MCT.

* *Halt Setpoint Control:* When selected, the input will disable set point communications from the MCT control module to all loop controls attached to the system. This allows for direct, manual adjustment of the loop set point(s) on the process controllers. The input acts as a manual override, but still allows the MCT to gather process data for proper display and data logging purposes.

When activated the loop set point on the MCT will reflect the set point of the loop control if the loop is not under ramp/soak program control. If a change is made to the set point at the loop control, the new set point will be updated on the MCT.

If a ramp/soak program is operating, the set point indicated on the MCT will remain at the value as defined by the running program even though it is not being sent to the loop controller. If the program is put into hold; however, the set point on the MCT will match that on the loop control since the loop set point change at the MCT is allowed when a program is in hold.

Reset Alarm: When selected, the input will reset any active alarms on the alarm screen. If a digital output is set to 'Remote Alarm (NO)', the output will be turned off. Note that the input will not clear any alarms from the list on the alarm screen and the alarm icon will continue flashing.

This is a 'single-shot' activation in which the input must make the required transition state to carry out the function. Thus, for each new alarm, the input must be re-activated to reset the new alarm. Leaving the input in an activated state will not reset alarms when they occur.

* *Defeat Input:* When selected, the input will disable the digital inputs selected under 'Defeat'. The selected inputs will not perform their function until the input defeat is deactivated.

Halt Defrost: When selected, the input will terminate an active defrost cycle and the fan delay will begin. If the input is active when a defrost cycle is to begin, the cycle will be skipped, and defrost will not take place. See section 0 Defrost for more information regarding defrost operation.

Load Timer: When selected, the input will active the redundancy product load timer. If the load timer is already active, the input will reset the timer. See section 0 Redundancy for more information on redundant system operation.

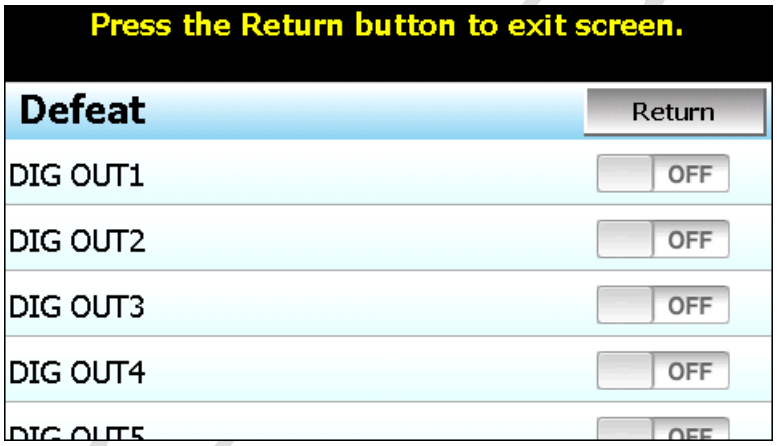
***NOTE:** For the input control functions listed with an asterisk (*), the "on" state for the input is defined by the transition mode. If "high" is selected, the input is on when voltage is applied to the input. If "low" is selected, the input is on when voltage is removed from the input.

***IMPORTANT:** *Functions performed via the digital inputs such as starting or stopping a ramp/soak program are not logged to the audit trail. These are external inputs to the control module and are not protected by security.*

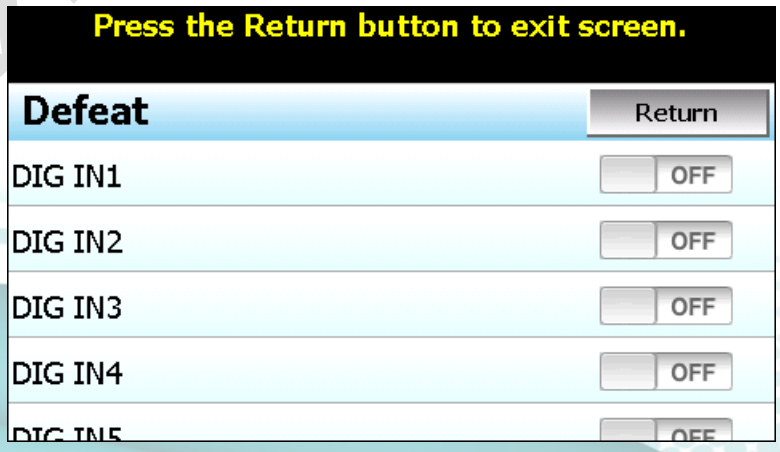
If a digital input is programmed for the "Halt Setpoint Control" function and the input is active, any set point change entered by an operator for a control loop will be logged to the audit trail; however, the set point on the loop control will not change. This will cause a discrepancy in the audit trail file as it will log the new set point entry even though the loop control is prevented from taking it.

Digital Input Defeat

The Defeat selections are only available for specific digital input functions. Output defeat selections are available for the Alarm Input and Output Defeat functions. Any of the available MCT control module outputs can be selected for defeat, and multiple outputs can be selected for defeat when the input is activated.

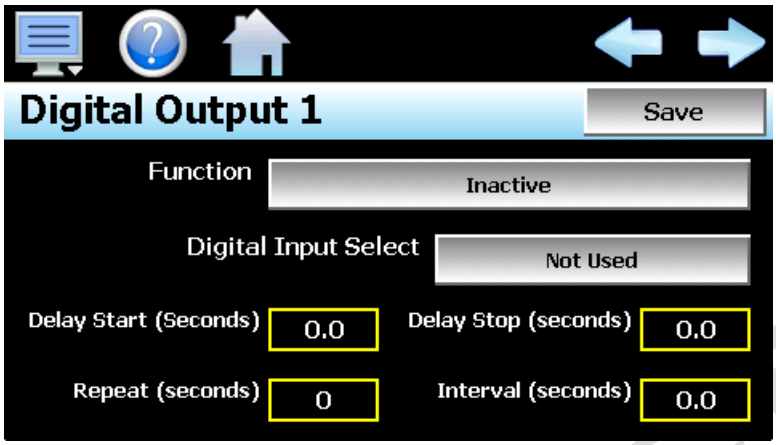


Input defeat selections are available for the Defeat Input function. Any of the available MCT control module inputs can be selected for defeat, and multiple inputs can be selected for defeat when the input is activated. Note that the current input cannot be selected for defeat, or the function would not be able to be activated.



Digital Outputs

The MCT provides eight digital outputs standard and is configurable up to 32. The outputs can be used as system event outputs, alarm outputs or for other signaling needs.



The left and right navigation buttons at the upper right of the screen allow the user to scroll through each available output. To make changes to the output's configuration, select the desired function of the output and set any necessary delay times. Once all changes have been made, press the 'Save' button to save them. If you do not press the "Save" button, the change will be lost if you leave the screen or navigate to another digital output.

NOTE: *More than one output can be set for the same function. Each output is independent of the others, thus they each perform their own task.*

The **Delay Start** delays the output from coming on for the time entered, for any output function selected. The delay time can be set from 0.0 to 3276.0 seconds.

The **Delay Stop** maintains the output for the time entered once the condition requiring the output to be on is removed. The delay time can be set from 0.0 to 3276.0 seconds.

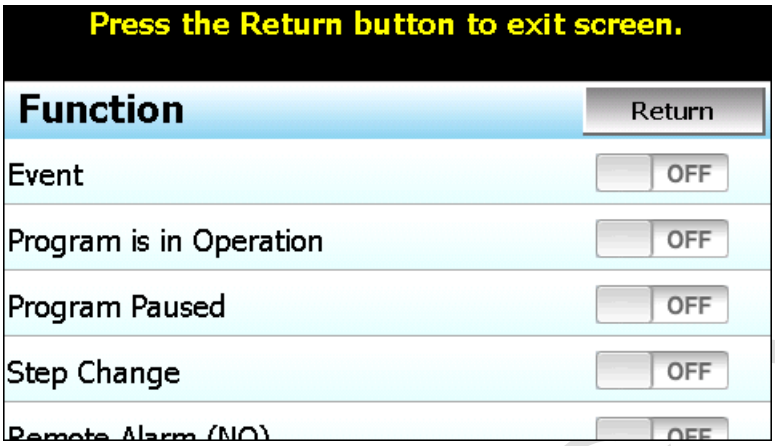
The **Interval** time can be used to pulse the output on and off when the condition requiring the output to be on is present. The interval time is used for both the on period and off period. For example, if the interval is set to 1 second, the output will be on for 1 second, then off for 1 second, and so on. A value of zero indicates a constant on condition (output does not cycle). The interval time can be set from 0.0 to 3276.0 seconds.

The **Repeat** time is shown when the digital output is configured as a 'Remote Alarm (NO)' or 'Remote Alarm (N/C)'. It can be used to re-activate the output after a time if an alarm is still active (ring back). If the repeat time is set to zero, the feature is disabled. When disabled, once the output activates on a new alarm and the alarm is then reset, the output will not activate again for the same alarm condition until it is cleared and reactivates. The repeat time can be set from 0 to 32,760 seconds.

The **Digital Input Select** is only available when the output is set for the 'Digital Input Control' function. The selected input will then act as the switch to turn the output on and off. To use the input as a switch for the output, the digital input must be set for the 'Alarm Input' or 'Control Output' function. See section 0 Digital Inputs for more information.

The digital output **Function** defines what condition causes the output to turn on and off.

The Output Function list is shown when the function selection button is pressed. The output functions selections are mutually exclusive, i.e., only one can be made at a time. An output can also be disabled by turning off all the output functions. Once the desired selection has been made, press the Return Button to return to the Digital Output screen.



Event: When selected, the output is controlled directly from the corresponding event on the Events screen. When the event is selected, the output turns on. When the event is not selected, the output turns off.

NOTE: *Outputs can be assigned to specific events in the MCT configurator. If an output is assigned as a system event in the configurator, the output function will not be able to be changed. Consult your OEM configuration for output assignments.*

Program is in Operation: When selected, the output will turn on when a ramp/soak program is active. The operating condition is defined as a ramp, soak, guaranteed soak or wait for condition. The output will not be on if the program is in autostart, since it has not yet started, or when it is placed in hold by an operator.

Program Paused: When selected, the output will turn on when the program is in hold. When the program is in any other condition, the output will be off.

Step Change: When selected, the output will provide a one-shot pulse each time the program changes steps. This also includes an output pulse each time the program is manually advanced to the previous or next step while in hold. When used in conjunction with the delay stop time, this can be used for a brief audible/visual alert signal to tell operators that a step of the process has completed and the next one is starting.

NOTE: *When a program is started, the output will pulse when the first step of the program is entered.*

**Remote Alarm (NO):* When selected, the output acts as a general fault output. Any alarm in the MCT will activate this output. A common use would be for connection to an audible/visual alarm to alert operators of a problem. When the alarm 'Reset' button is pressed on the Alarm screen, the output will be turned off. When used in conjunction with the repeat time setting, the output will automatically turn back on, after the repeat time, if any alarm condition is still present.

Analog Input Alarm: When selected, the output can be controlled directly by a loop/monitor alarm. The alarm must be configured to control the output. See section 0 Alarms for information on assigning the alarm to the digital output.

NOTE: *If more than one loop/monitor alarm is assigned to the output, the output will not operate correctly and may cycle on and off uncontrollably. Do not assign more than one alarm to an output.*

Digital Input Alarm: When selected, the output will turn on when the selected digital input alarm occurs. The output will stay on until the alarm is silenced. The selected digital input must be configured as an alarm input, or the output will not operate.

Digital Input Control: When selected, the output will turn on and off based on the selected input status. The input acts as the switch to turn the digital input on and off. The selected digital input must be configured for digital output control, or the output will not operate.

**Remote Alarm (NC):* When selected, the output acts as a 'fail-safe' fault output. When no alarm is present, the output will be energized. Any alarm in the MCT will de-activate the output. When the alarm 'Reset' button is pressed on the Alarm screen, the output will turn back on. When used in conjunction with the repeat time setting, the output will automatically turn back off, after the repeat time, if any alarm condition is still present.

Defrost: When selected, the output will turn on during an active defrost cycle. When defrost is inactive or the fan delay is active, the output will be off. See section 0 Defrost for more information on defrost operation.

Precool: When selected, the output will turn on during the fan delay period after a defrost cycle. When defrost is inactive or a defrost cycle is in progress, the output will be off. See section 0 Defrost for more information on defrost operation.

Redundant System 1: When selected, the output will turn on when system 1 is selected for operation based on system redundancy settings. See section 0 Redundancy for more information on redundant system operation.

Redundant System 2: When selected, the output will turn on when system 2 is selected for operation based on system redundancy settings. See section 0 Redundancy for more information on redundant system operation.

****NOTE:*** For the output control functions listed with an asterisk (*), the output is not activated for failed FTP or email transmissions, NTS clock synchronization or communication alarms between the MCT and the control module.

Digital Input Monitor

The Monitor screen provides the on/off status of all digital inputs available on the MCT control module. It is useful for offline troubleshooting to verify input operation.

Digital Output Force

The Force screen allows the user to force any of the digital outputs on the MCT control module on, to test output functionality and verify proper operation of equipment controlled by the output.

The **Time** setting limits the maximum amount of time the outputs can be forced on. The force time can be set from 0 to 32,760 seconds. This provides an automatic method to help prevent 'runaway' conditions in case an operator leaves an output on but must walk away to accomplish another task and forgets to turn the output off.

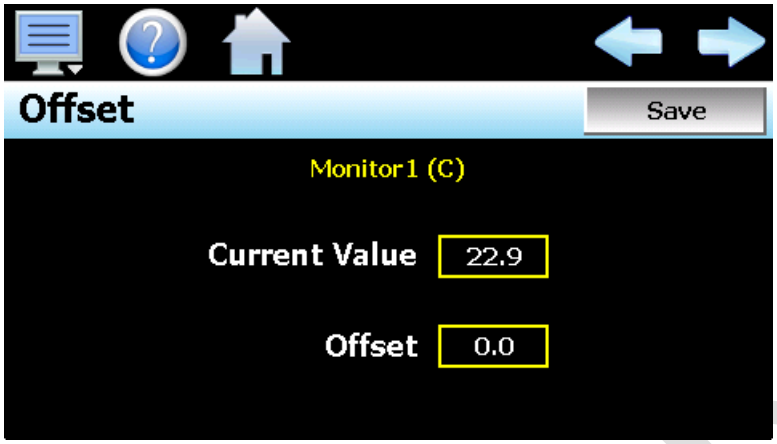
NOTE: *Each time an output is turned on or off, the output force delay timer is reset. The automatic force disable time begins from the moment an output switch is pressed.*

Monitor Offset Calibration

The monitor option provides up to 15 additional process inputs, which can be configured from any combination of thermocouple, analog and RTD inputs from the optional monitor input modules. The monitor input option can also be configured to display the second input from compatible loop controllers attached to the system (one from each available control loop).

The calibration range is fixed within the thermocouple, analog and RTD monitor input cards; however, the user can input a linear offset to adjust for sensor tolerances and lead affects. When the second input of a control loop is used for the monitor input, the loop controller provides calibration, range, and input bias adjustments.

The input bias of the loop control can be used to set the linear offset for the input, or the monitor offset calibration of the MCT can be used.

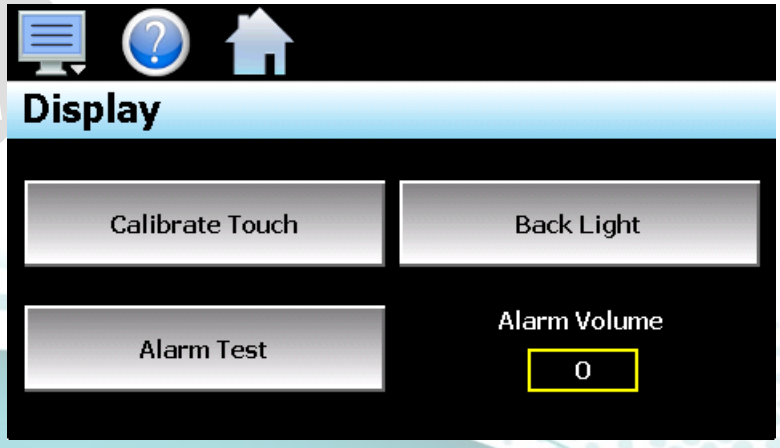


The left and right navigation buttons at the upper right of the screen allow the user to scroll through each available monitor input. To adjust the input reading, enter the offset value in the 'Offset' field and verify the reading. The offset range is -32760 to 32760 for a decimal point resolution of zero, -3276.0 to 3276.0 for a decimal point of one, -327.60 to 327.60 for a decimal point of two and -32.760 to 32.760 for a decimal point resolution of three. Be sure to press the 'Save' button to save the new offset value before proceeding onto other inputs or exiting the monitor input offset screen or the offset value will revert to its original value.

NOTE: *If using the monitor input offset of the MCT to offset the reading for the second input of a loop control, the value for the monitor input as shown on the MCT will not match that on the loop controller's display. The monitor input offset of the MCT only offsets the reading on the display, not on the loop control. Therefore, to avoid confusion when using the second input of the loop controls for monitor points, it is recommended that any input offset is applied through the loop controller's input bias setting and not the monitor input offset of the MCT.*

Display Settings

The Display screen provides access to the touch screen calibration utility, back light settings, and alarm volume adjustment.

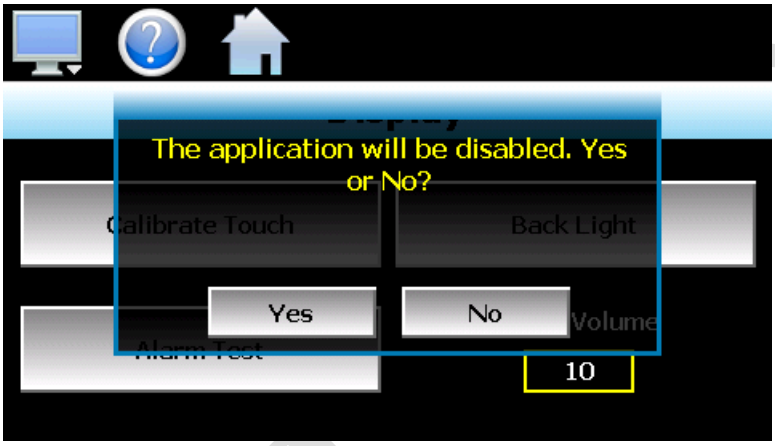


The **Alarm Volume** adjusts how loud the internal alarm buzzer of the MCT will be when activated under an alarm condition. The volume can be set from 0 (off) to 100. To edit the alarm volume, touch the entry field and enter the desired volume level. To test the buzzer, press the "Alarm Test" button.

Calibrate Touch

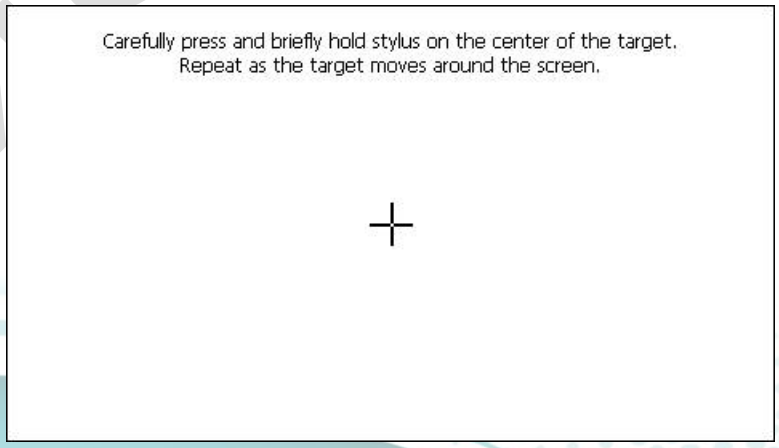
After extended use and many hours of operation, it may be necessary to recalibrate the touch screen of the MCT. A typical sign that the screen may be out of adjustment, is inaccurate responses when attempting to press buttons, check boxes or adjust fields on the display. The calibration utility is provided to re-adjust the screen when this happens.

To begin the calibration process, press the "Calibrate Touch" button. An alert message will appear stating that the application will be disabled to perform the calibration procedure. Press "Yes" to continue.

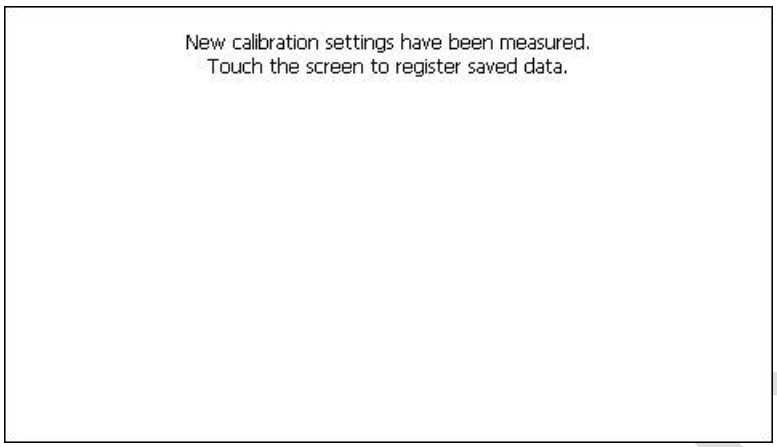


The calibration utility will start, and crosshairs will appear on the screen. At each crosshair position, touch the screen at the center of the crosshairs. Repeat this for each position to set the calibration. The calibration requires five points, the center and four corners.

NOTE: *It is recommended that you use your finger rather than a stylus when calibrating the screen. The touch response will be more fluid after calibrating it with your finger.*



Once complete, the calibration utility will provide a notification message that the new calibration settings have been measured and to touch the screen to register the new calibration data; just touch anywhere on the screen to close the window and return to the MCT application to resume normal operation.

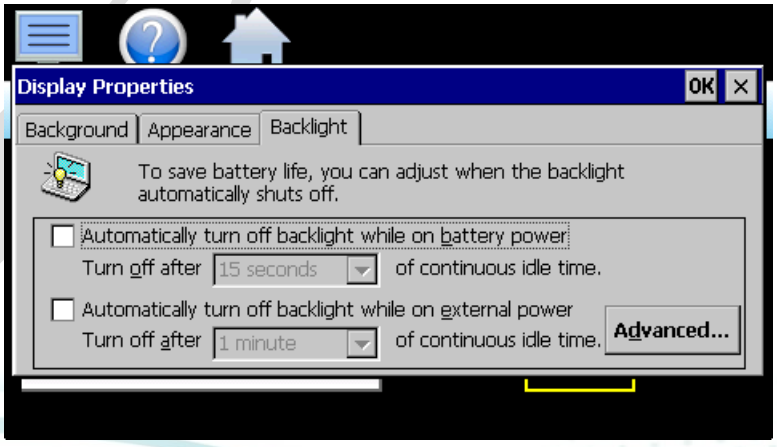


Backlight Settings

The backlight settings allow the user to adjust the screen brightness as well as set a time for dimming the backlight after a period of inactivity which can extend the life of the display. To adjust the backlight settings, press the "Back Light" button. An alert message will appear stating that the application will be disabled to enter the backlight settings, press "Yes" to continue.

Select the "Backlight" tab from on the Display Properties window. Press the "Advanced…" button to access the settings for the backlight.

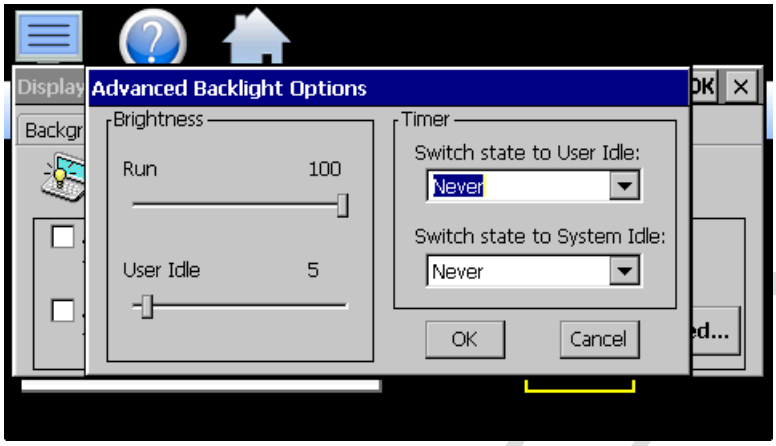
NOTE: *The checkboxes on the Backlight tab for "Automatically turn off backlight while on battery power" and "Automatically turn off backlight while on external power" have no effect on backlight operation and should be left unchecked.*



The brightness of the display during operation is set by adjusting the "Run" slider. The default setting is 100. The "User Idle" slider is used to adjust the brightness of the display during periods of inactivity. The default setting is 5. Use caution when adjusting the "Run" slider. It is possible to set the brightness to zero (0), in which case the screen will go black, and you will be no longer able to see the settings. Should this occur, it is possible to tap the screen in the general area of the run slider. If you tap the screen in the proper position of

the slider, it can set the slider to make the screen visible again. It is recommended that the slider not be adjusted below 20.

When adjusting the “User Idle” slider, the screen will temporarily adjust to the setting of the slider as you move it. If you choose a value of zero (0), the screen will go black. However, once you lift your finger, the screen will return to the “run” brightness level after a couple seconds.



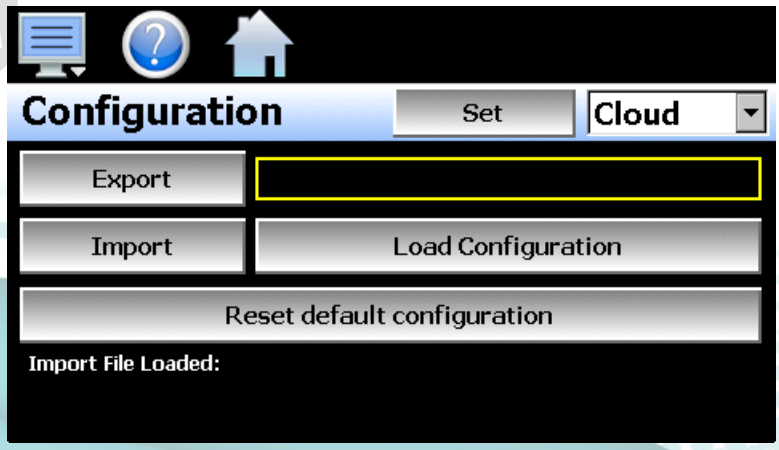
To enable the backlight dimming function, use the “Switch state to User Idle” drop-down menu and select a time for no activity at which the screen should dim. The delay time can be set at fixed intervals from 1 minute up to 30 minutes. To disable the dimming feature, select “Never”.

Once all settings are complete, press the “OK” button and then press the “OK” button at the top right of the “Display Properties” window to return to the MCT application and begin normal operation.

Configuration

The Configuration utility allows the user to back up the entire configuration of the MCT and save it to a file for “safe keeping” in case of system damage due to a lightning strike, etc. The utility also allows the MCT to be configured with a push of a button by selecting from a list of preconfigured setups that could be created and saved on a USB memory device or remote server for loading a configuration to a new MCT system.

IMPORTANT: Do not import configuration files that are not intended for use with the current hardware configuration of the MCT as unexpected operation may result.



By default, the import/export procedure is set to operate via USB. To perform import/export operations from a remote server, use the drop-down menu to select "Cloud". When "Cloud" is selected, a "Set" button will appear to the left of the drop-down menu. Pressing the button will display the Cloud setup screen where the remote server settings can be entered (see section 0 Cloud Server Settings). The settings only need to be entered once as they can be saved and used for any future import/export operations.

When the **Export** button is pressed, the MCT configuration data will be written to the USB memory device or remote server. The export file function will use the name entered in the text field to the right of the export button and create a directory on the memory stick with that name, to contain the configuration data. The filename can be entered with up to 10 characters which permits multiple configurations to be identified and saved for later retrieval. The export files will be saved to a directory with a name format of "mctCM_*filename*_mm-dd-yyyy-hh-mm-ss" to identify the configuration according to the date and time it was created. This prevents multiple configuration files with the same name from overwriting previous files. It also allows the user to identify a backup of the MCT so that it could be reconfigured to a previous date if multiple back-ups are created.

If the export is being sent to a remote server, a single file is created with the format of "mctCM_*filename*_mm-dd-yyyy-hh-mm-ss.ccg". The file is encrypted and automatically signed with a digital signature to protect it and prevent alteration of the file. Should a file be tampered with, it would fail the import, thus protecting MCT from accepting a bad configuration file.

The **Import** button is used to configure the MCT according to the currently loaded configuration file. To load a configuration file, the USB memory device must first be inserted into the USB port (or the remote server must be properly configured and the MCT connected to the internet when Cloud is selected).

When the **Load Configuration** button is pressed, a list of available configuration files from the memory stick (or remote server) will be shown. Select the desired file from the list and press "Open" to load the file. Once the file is loaded, the import process can be started. Pressing the "Import" button will begin the process. When the import is complete, you must cycle power to the MCT for the new configuration data to be loaded into runtime memory for proper operation.

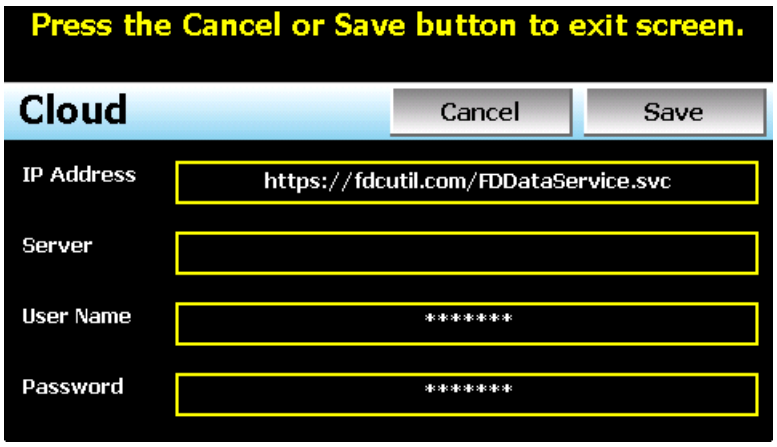
The **Reset default configuration** button can be used to clear the current MCT configuration and reset the system back to default values. This function clears all user and/or OEM configuration values and returns the system to an "as new" factory state allowing the system to be configured from scratch. This function is provided to start over if the system configuration has been altered to an unknown state and is not operating properly, and a known good configuration is not available to import. Rather than go through every setting of every feature to try and determine where the configuration error exists, this allows the system to be cleared so that it can be reconfigured from a clean slate.

NOTE: *The configuration functions do not affect the VNC server configuration. The enable state, VNC address, device name and password fields must be manually changed as these settings are specific to each device and must be set independently for proper VNC server operation over a network.*

The network settings, i.e., DHCP/ Static IP address settings and control loop settings are also not saved to the configuration file. These settings must be done manually.

Cloud Server Settings

The "Cloud" screen provides settings for the remote configuration FileWeb server. The screen is accessed by pressing the "Set" button on the Configuration screen. Note that the "Set" button is only shown when "Cloud" is selected for the import/export configuration location.



The **IP Address** field is used to enter the IP address of the remote server site that the MCT is to interface with.

The **User Name** field allows you to enter a user name for site access. When the MCT connects to the site, the user name will be used to identify the connection. The user name is required for FileWeb access.

The **Password** field is used in conjunction with the user name field and is for entering a password, so the MCT can access the site. A password is required for FileWeb access.

The **Server** field is used to enter additional directory information for the server (if desired) where the files are to be stored during import/export operation. The field can be left blank. By default, the MCT is hard coded to store files on the specified server in the "\configs*user name*\" directory. If an entry is made in the Server field, the path would be "\configs*user name**server*\".

MCT Field Setup	FileWeb Server Setup
IP Address = https://fdctuil.com/FDDataService.svc	Actual named address of FileWeb server/service.
Server = *optional path*	The FileWeb server/service must be configured with a root "\configs\" directory to use the MCT cloud import/export feature. The MCT is hard coded to transfer configuration files to the "configs" directory in the root of the server. This results in a typical file path of "\configs*userName*\". If the Server field also contains an entry, the resulting path would be "\configs*userName**Server*\". It is recommended that this field be left blank for most users to ensure all configuration files are stored in the base "configs" directory. When loading a configuration for import, only the files in the specified directory will be available for selection. If a configuration file was stored to a location specified by the Server field and the proper entry is not known, the user will be unable to select the proper configuration file for import.

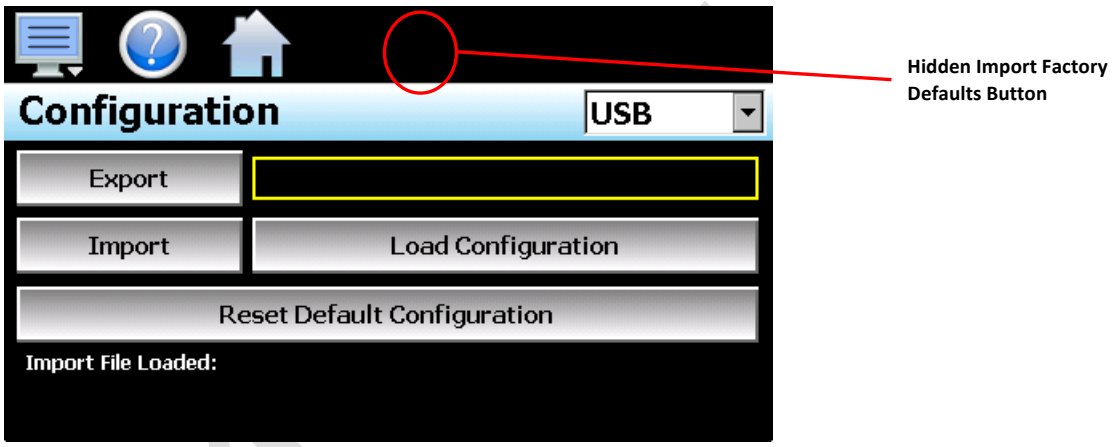
User Name = *userName*	Actual user name for login at FileWeb server (required).
Password = *userPassword*	Actual password for login at FileWeb server (required).

NOTE: *Make sure proper permissions are set at the server for access/creation of directories and read/write access. Also check root directory structure at the server to identify the actual root that was created for the files since there can be additional layers created by the server field and displayed in the path (see Appendix section A.2 FTP, FileWeb, DataWeb Requirements/Installation for additional information).*

Importing a Darwin Chambers Default Configuration

The "Reset default configuration" button loads a predefined configuration stored in memory on the MCT. The factory configuration is "blank" meaning it will reset all control module inputs and outputs to the FDC factory defaults. All user and/or EOM configuration settings will be cleared which will require the user to reconfigure the entire device for the intended application.

The MCT provides a means of importing a default factory configuration. If an end user happens to make configuration changes that affect operation, or to ensure the system is configured properly to Darwin Chambers specifications while providing customer support, the Darwin Chambers configuration can be stored in the MCT and will be installed when the "Reset default configuration" button is pressed.



To import a factory default configuration, insert the USB memory device containing the desired configuration file. Next to the "Home" icon is a hidden button. Tap the location repeatedly 10 times within a period of 4 seconds. A dialog will be shown prompting to copy a configuration as factory defaults. When "Yes" is selected, the open file screen will be shown. Select the desired configuration file and press the "Open" button to import the file as factory defaults.

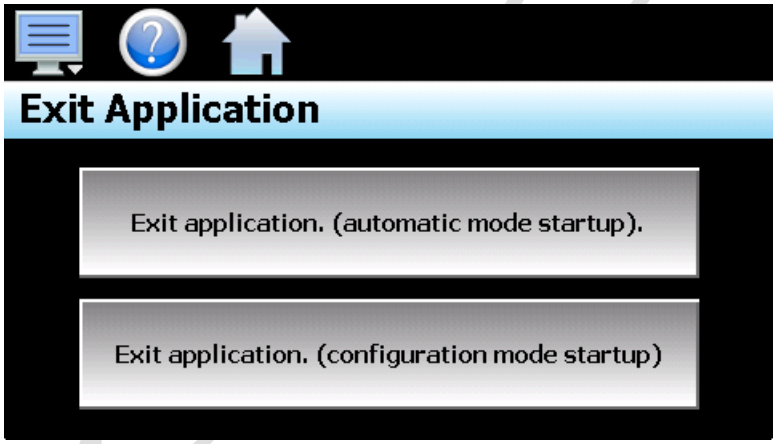
NOTE: *Importing a factory defaults file does not affect the current configuration of the unit. This only imports a configuration file as the factory defaults file.*

About MCT

The "About" MCT screen provides operating system version numbers for the currently installed firmware and program of both the MCT HMI and control module. This information should be recorded prior to any service request so that proper assistance can be provided for your control model.

Exit Application

The "Exit" Application screen allows the user to quit the MCT runtime software and return to the CE.Net operating system. This operation is NOT recommended except for users who oversee system configuration due to the danger of editing or removing files by accident.



The **automatic mode startup** option will return the MCT to normal operation on the next power up.

The **configuration mode startup** option will start the MCT Configurator program on the next power up so that the user can access control loop and MCT configuration settings.

COMMUNICATIONS

This section provides instructions on how to use the MCT communication interfaces. As a standard, the MCT is equipped with both an Ethernet interface and an RS232 serial interface for user communications.

Ethernet Communications

The MCT provides several options for remote control and monitoring over the Ethernet communications interface. The web server interface provides a monitor only connection, while the VNC server and Modbus TCP interfaces allow a user to manipulate and control the MCT remotely. The VNC interface allows the user to view and observe operation of the MCT display directly on their PC screen while the Modbus TCP interface

allows the user to manipulate MCT operation via other devices and/or software capable of Modbus TCP communications.

NOTE: *To use Ethernet communications, the MCT must be properly connected to a network. To connect the MCT to a network, connect the touch screen's Ethernet port to your network using a standard CAT5 cable connection. Note that after connecting the network cable, it may be necessary to cycle power to the MCT for it to obtain a valid IP address.*

Guide to Smart Networking Practices

The expansion of Ethernet onto the industrial floor has brought forth a new realm of possibilities from the gathering of information to the inherent control of equipment from anywhere around the world. The flexibility and convenience that this provides makes it a very desirable feature for new equipment. The MCT provides this ability, but there are considerations that must be taken by the end user to protect their equipment and investment.

Just like placing a personal computer on the internet opens it up to outside attack, placing your MCT on a network poses the same risk. The first thing to remember is this: The most likely cause of problems is not a hacker trying to sabotage your equipment, but more often to be related to the ubiquity of PCs with Ethernet cards, the ease with which your own co-workers can "hang stuff on the network", and careless or nonexistent internal security measures. Accidental problems are more common than deliberate ones.

Allowing anyone access to the MCT by placing it on the office LAN, also opens the door for accidental shutdown, damage to equipment, loss of data, lost time, etc. This is possible even by the most well-intentioned co-workers. Thus, there are several steps that should be taken to minimize this risk.

The first is to never mix your office LAN with your control LAN. The control LAN should be a separate network that consists of your MCT controller(s) and possibly any other equipment that you may have that is related to the operation of the system. It should be separated from your office LAN by a firewall, or at minimum, a bridge or router. A control network and a business network have two entirely different purposes and their interaction should be closely controlled.

It is also unwise to assume that any Ethernet capable devices themselves have any security features at all. The MCT VNC server only provides minimal single password-based security access. Separating the control LAN from the office LAN using a firewall would increase security and only allow control access that is based on a combination of IP source address, destination address, and port number. This is by no means completely "hacker-proof", but it should keep the well-meaning co-workers out.

Another hazard is connecting consumer "plug and play" devices to your control LAN. A printer for example, might flood the network with traffic in a "broadcast storm" as it tries to self-configure or advertise its presence to all nodes on the network. Faulty devices, for example defective NIC cards, can transmit large amounts of bad packets (i.e., runts, which are abnormally short Ethernet frames) into your network. Using switches instead of hubs will limit the effect of such problems.

The most overlooked source of problems is cabling. Not all cables are created equal. Electrical noise generated by factory equipment or other electrical equipment in the area, could easily corrupt transmitted data over the network and cause devices to "lock up" or shut down the VNC server, both of which then require the MCT to be shut down and restarted to clear the problem.

Select the right cable for the environment. Shielded twisted pair (STP) cable is naturally more noise immune and is preferable to unshielded twisted pair or UTP in noisy situations. STP should have at least 40dB CMRR and less than 0.1pF capacitance unbalance per foot. Ground STP cable, making sure the ground is connected

only at one end. CAT5 STP patch panels normally provide a grounding strip or bar. Hubs and switches don't provide grounding, use cables.

It's wise to be pessimistic about a cable's ability to reject noise from 230 VAC and 460 VAC power lines and electrically "noisy" equipment in the area. Capacitance imbalance in cables greater than 70pF per 100m can introduce harmonic distortion resulting in bit errors. The cost of cable is quite small compared to total equipment cost, so if you're looking to save money, this is not a place to do it. Choose a well-designed cable to minimize bit-error rate after installation, and that will give faster throughput with fewer glitches.

The MCT and Network Security

When most people think of security, they think of anti-virus programs and continuous operating system updates to ensure their system is running with the "latest-and-greatest" software. For consumer devices, this is well and good, but when it comes to industrial devices not so much. How many times has an update to the OS caused an issue with an existing program that for now some reason is not working correctly or crashes inexplicably? How about an anti-virus program updating its threat definitions and now sees an application as a potential threat and blocking it from operating? To have this occur on a control device could be catastrophic to a process. So how does the MCT address these concerns while still providing threat protection?

The MCT software validation uses a specific OS version and revision number as part of the validation process. WinCE is not the same as Win7, 10, etc. and does not support automatic updates since the OS must be installed in a specific portion of memory using a cable or SD with the device present. The OS layout is also specific to the hardware on the device. FDC has never had an update to the OS unless the hardware changed on our units which required a driver (mostly third party) for the new hardware. This also provides stability since this is an industrial device that provides specific functionality without most of the "overhead" of the OS's that full PC's run.

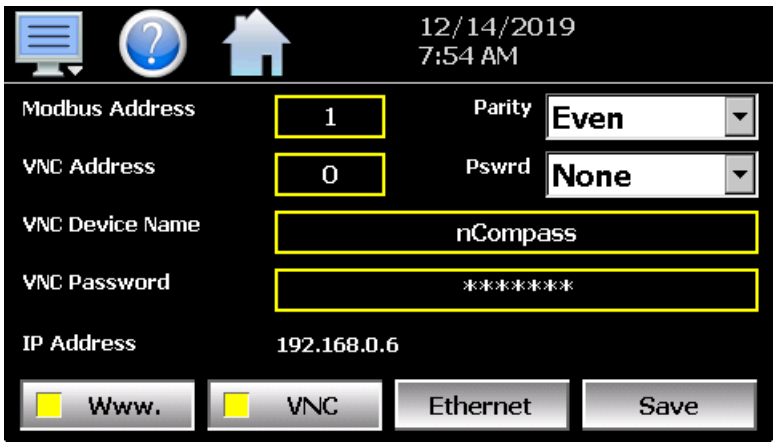
Most security issues arise from browsing or opening an email attachment that carries harmful code. The MCT does not support the addition of anti-virus software: however, the MCT does not have a browser or an email server to receive emails or attachments. The FTP, FileWeb and DataWeb interfaces are also client based only. They transmit files and data to remote servers, but do not receive.

MCT writes data to a web page in memory that can be accessed by an external browser. This is a read only web page (from the remote browser) that contains process values, set points, event, and current program data only. The internal web page data is written over with real time data every 30 seconds. The MCT does not read any data from its internal web page so any corruption of the web page would not affect MCT display/control operations. There are no passwords or sensitive data sent from the remote browser to the "read only" web page.

A virus to attack Windows CE would be difficult, but not impossible. Every Windows CE device is different (by manufacturer), so not an easy standard to write the virus against. The virus would need to be built for Windows CE and the CPU that the MCT runs, and the storage device doesn't have a standard name. There might be industrial devices that run anti-virus on their CE devices; however, FDC is not aware of any. As the saying goes, the best defense is a good offense. It is best to design a "smart network" to prevent intruders from gaining access in the first place than to try and defend them off once they are already in the door.

Using the Web Server

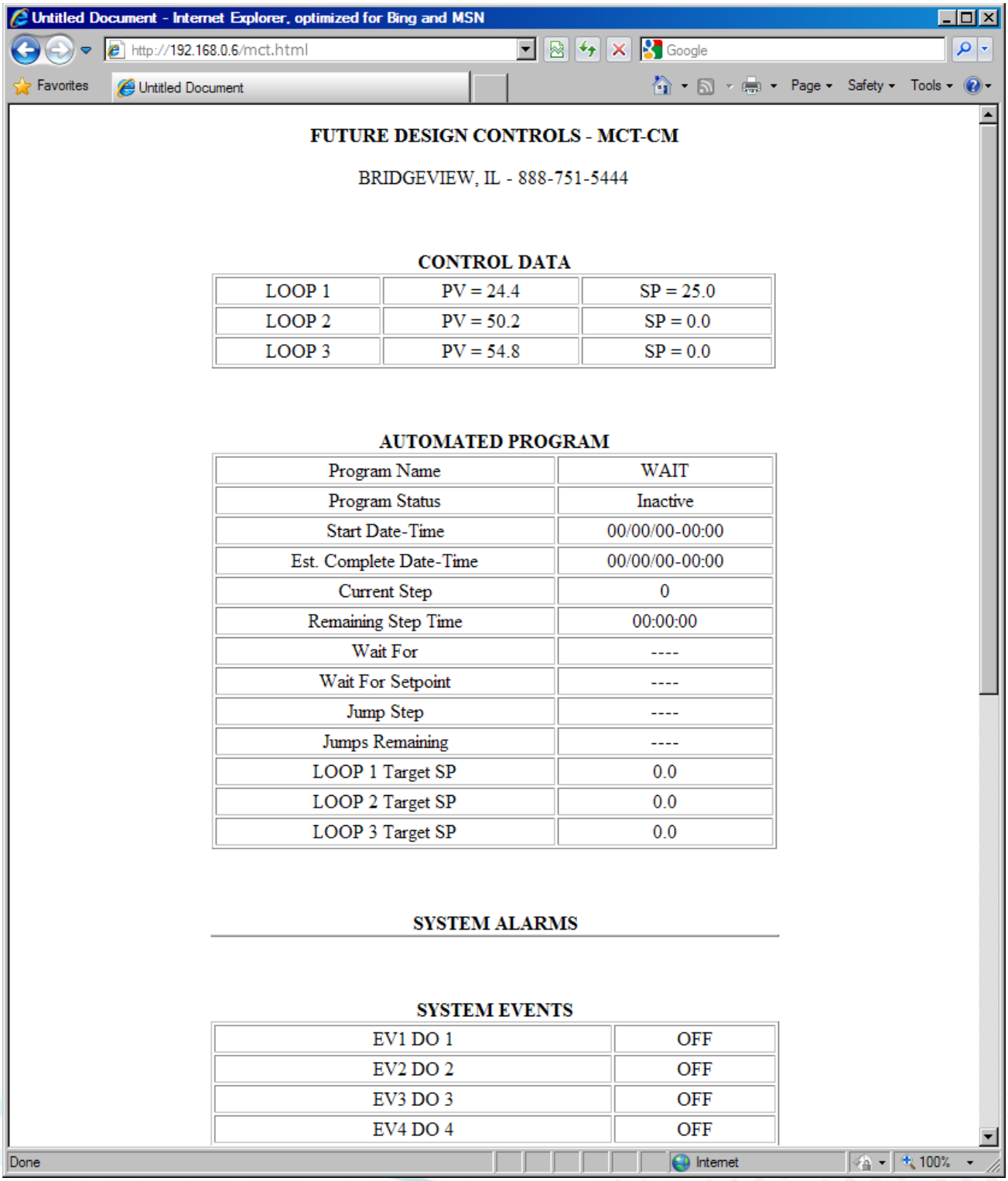
The MCT web server allows a user to remotely monitor operations anywhere via a PC's standard web browser. When enabled, the web server provides a detailed status page of the current operating conditions. The web server can be enabled and disabled by pressing the web server (Www.) button on the communications screen (select "Comms" from the Device\Settings\Set menu).



You must use the assigned IP address to access the MCT. The IP address is shown on the communications screen and is also included in the notifications list. Write down the IP address so you will have it later to enter your web browser.

NOTE: *Contact your network administrator prior to enabling the web server of the MCT. Company policy may prohibit the use of web servers for security reasons. Future Design Controls is not responsible for the use of, nor makes any claims as to the security of the web server interface over your network. The use of the web server is the responsibility of the end user.*

To access and view the MCT web page, enter the following link in your PC's browser address window: **Error! Hyperlink reference not valid.** From the example address shown on the screen above, then entry would be: http://192.168.0.6/mct.html. The following example is typical of the MCT web page appearance. The web page updates automatically every 30 seconds and provides information on each individual control loop, ramp/soak program status, alarm status and system event status.



Using the VNC Server

The MCT VNC server allows a user to remotely monitor and control the MCT by directly viewing and manipulating the touch screen over the network. You must use the assigned IP address and VNC port number

to access the MCT. The IP address is shown on the communications screen and is also included in the notifications list. Write down the IP address and port number so you will have it to enter your VNC viewer.

There are many VNC viewers available for both PC and tablet use. Due to the ever-changing market and availability of such applications, it is not possible to test them all for compatibility or aid with their use with the MCT. It is the responsibility of the end user to test the chosen VNC client for compatibility with the MCT prior to putting the unit into service. If the VNC client viewer has compatibility issues with the MCT, it can cause the VNC server to stop responding and/or shut down requiring power to be cycled to the MCT to reboot the system and restart the server.

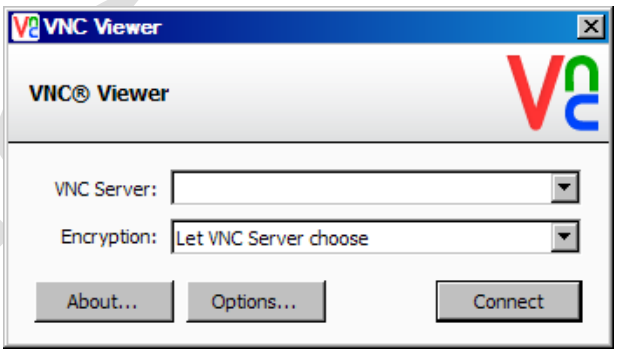
Future Design Controls has tested and recommends the use of RealVNC's viewer. It has been tested for compatibility with the MCT and a free version can be obtained from http://www.realvnc.com/ for PC/MAC use. RealVNC does offer a version for the iPad that can be obtained through the App Store for a small fee. The App Store also offers a free VNC client called Remotix for the iPad. It has also been tested for compatibility with the MCT.

NOTE: *Contact your network administrator prior to enabling the VNC server of the MCT. Company policy may prohibit the use of VNC servers and/or viewers for security reasons. Future Design Controls is not responsible for the use of, nor makes any claims as to the security of the VNC server interface over your network. The use of the VNC server is the responsibility of the end user.*

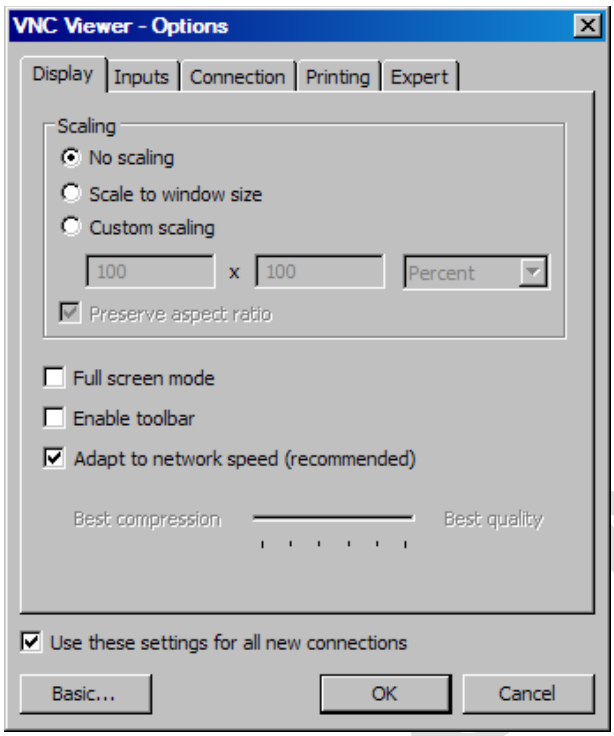
Recommended VNC Viewer Settings (PC/MAC)

This section applies to setup of the recommended RealVNC viewer for PC/MAC. These settings have been tested and evaluated to provide the best performance and quickest response to user input when using the VNC viewer with the MCT. After installing the VNC viewer software, it is recommended that the following changes be made to the default viewer settings.

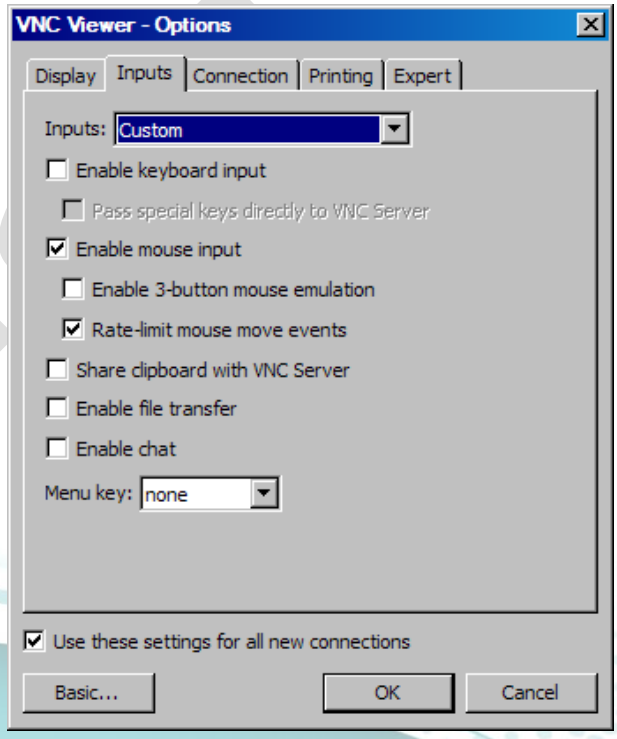
To begin, start the VNC viewer. Click on the "Options" button to open the VNC Viewer - Options window. Click on the "Advanced" button at the bottom left of the window to show the advanced setup options.



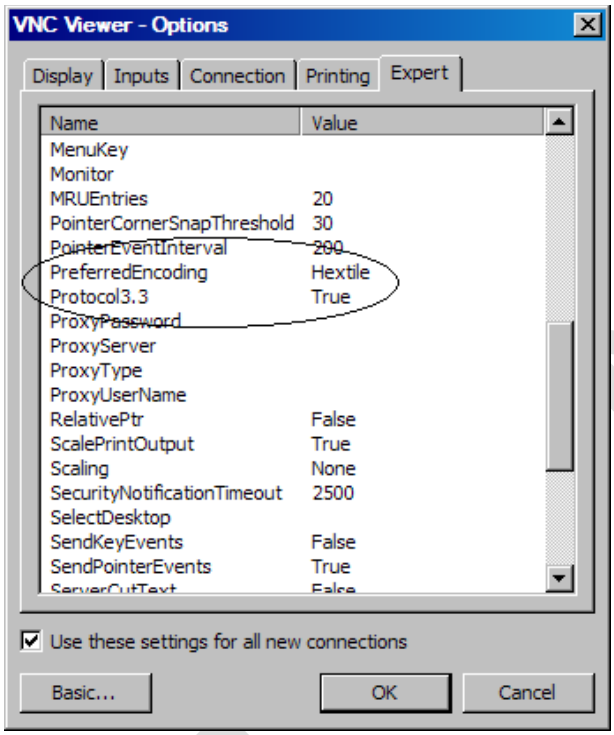
On the Display tab, make sure the scaling is set to "No scaling" and the checkbox for "Adapt to network speed (recommended)" is checked.



Next, select the Inputs tab and deselect all entries except for “Enable mouse input” and “Rate-limit mouse move events”. The “Inputs:” drop down selection box will automatically change to “Custom” when the settings are made.



Proceed to the Expert tab. Scroll down the list of settings until you find the "PreferredEncoding" and "Protocol3.3" options. Set the preferred encoding to Hextile and the Protocol 3.3 option to true. Verify that the "Use these settings for all new connections" checkbox at the bottom of the window is checked and click the OK button. This will set the selections to the default start settings for the VNC viewer.



Recommended VNC Viewer Settings for Tablets

The VNC clients for tablets have been found to offer limited flexibility for use with the MCT. Most clients have default settings requiring security to be enabled on the server to connect. If you have trouble connecting with a VNC viewer through an iPad, iPhone or even an Android based phone, start by enabling the security on the MCT VNC server and be sure to enter those settings in the client viewer.

Color and encoding options can also affect the connectivity. If the client offers the option, leave color and encoding options to "automatically detect" or "server decides". If the client is still unable to connect, try default encoding of Hextile and set the color option to limited colors such as 256-bit color. Future Design Controls does not write or create VNC clients (3rd party software), so final selection of client and testing is the end user responsibility. The following settings are provided as an example for the Remotix client for the iPad. When adding an MCT server to the Remotix client, use the following settings. Note that the VNC server in the MCT must have security enabled for this client to connect.

Connection Type:VNC
Host/IP: *IP address of MCT*
Port: *VNC address of MCT (5900 = 0, 5901 = 1, etc…)*
Use SSH Tunnel:Off
VNC Authentication:VNC Password
VNC Password: *VNC password of MCT*
VNC Server Type: AutoDetect
Operating System: Windows
Preferred Encodings: Hextile

Color Depth: 16 bits

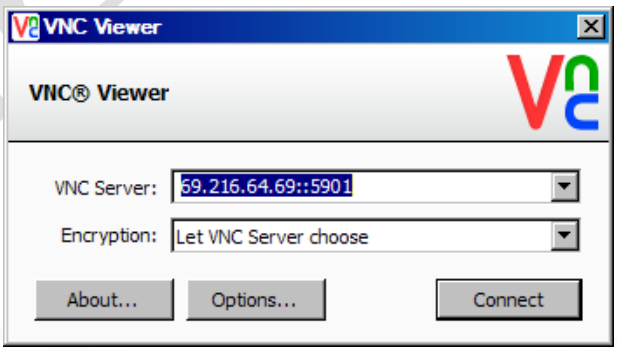
Accessing the MCT through a VNC Viewer

The following examples are based on the use of the RealVNC viewer for PC/MAC. Once the default settings have been entered, just enter the IP address and port number for the MCT and click the "Connect" button to access the MCT over the network.

Intranet Example: If the IP address assigned is 192.168.3.5 and the configured VNC Address is 1, from the PC's VNC Viewer address field, enter '192.168.3.5:1' to access the device (address 1 relates to port 5901, address 2 to port 5902, etc., which is the port opened by the VNC server to allow communications with the MCT over the network).

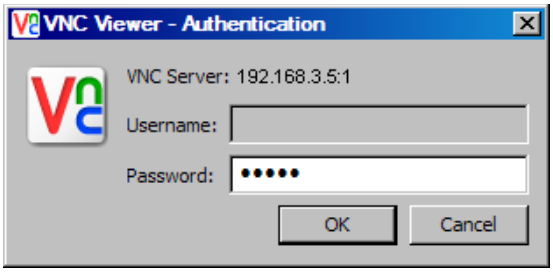
Internet Example: Internet connection usually requires a qualified network System Administrator. Typically, a permanent IP address and specific port address are assigned to the MCT; support on this action is beyond the scope of this guide. *Consult your network system administrator for assistance in setting up an Internet connection.*

If the IP address of the LAN is 69.216.64.69 and the configured VNC Address is 1 (port 5901 has been opened and assigned to this specific MCT controller), from the remote PC (outside of the site Servers LAN), in the VNC Viewer address field enter '69.216.64.69::5901' to access the device (5901 relates to address 1, 5902 to address 2, 5903 to address 3, etc., note the double colon).

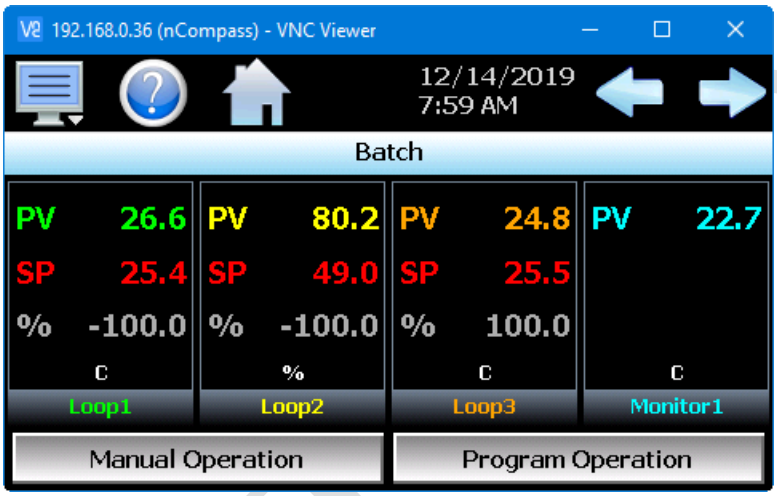


NOTE: The IP address shown on the communications screen of the MCT is the local LAN address and would not typically be used for an Internet connection.

Security Example: If the VNC server password is enabled on the MCT for either example above, upon pressing the "Connect" button to make the connection, the VNC viewer will prompt for the proper password. The connection will only be established once a valid password is entered.



Once the connection is established, the current MCT display will be shown on your desktop. The image will be a duplicate of what is on the MCT. As you manipulate the screen, the display of the MCT will also be manipulated so that any local operator will be able to see what is happening and vice versa.



Multiple instances of the VNC viewer can be started on your PC. By running multiple viewers, you can have access to multiple MCT controllers right from your desktop. The heading of each VNC viewer window will use the "VNC Device Name" entry for the header. By entering a unique name for each MCT, you can identify each VNC connection and know which system you are accessing.

The VNC viewer is meant to be used for short term control access to the MCT. It is not meant for long term monitoring of system operation. If long term monitoring access is desired, use the built-in web server of the MCT or a PC with FDC software to monitor and control the MCT over its serial communications port. The web server interface and PC software is designed for long term monitoring and status updates.

Due to the nature of VNC operation, and for security reasons, the VNC viewer connection should not be left open on your desktop. The viewer connection should be opened to perform the necessary control and/or status check of system operation, and then closed once the task is complete. Accidental manipulation of the control or erroneous network activity could cause connection problems over the VNC interface and result in the VNC server shutting down and requiring the MCT to be restarted to regain access.

NOTE: *Some viewers may also contain additional features for file transfer and other high-level functions. These functions are NOT compatible with the MCT. Any attempt to use them may cause the MCT VNC server to malfunction and require power to be cycled to reboot the system. All viewers should be used ONLY to monitor and manipulate the MCT as if you were standing directly in front of the unit and touching the screen.*

The MCT Modbus TCP server interface allows a user to remotely monitor and control the MCT via another device or software application compatible with Modbus TCP/IP protocol. The acronym TCP stands for Transmission Control Protocol while IP stands for Internet Protocol. These protocols are used together and handle the transfer of data over the internet. When Modbus information is sent using these protocols, the data is passed to the TCP layer where additional information is attached and then passed to the IP layer. The IP layer then places the data in a packet (or datagram) and transmits it.

Like the MCT Modbus serial interface, the TCP interface is always active; however, rather than using the Modbus Address on the communications screen as the slave address, the MCT IP address is used as the slave address. For Modbus TCP communications to function, the Master (or Client in Modbus TCP) establishes a connection with the Slave (or Server) using the IP address. In this case, the server is the MCT. The MCT waits for an incoming connection from the client, and once a connection is established, the MCT then responds to queries from the client until the client closes the connection.

For a client to establish a connection with the MCT, the following settings must be used by the client:

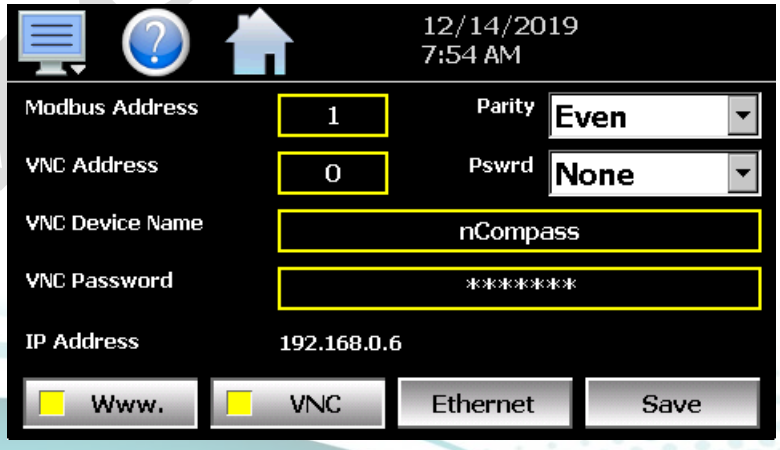
IP address (of slave) = MCT IP address as displayed on the Communications screen
Unit Identifier = MCT Modbus Address as displayed on the Communications screen.
Port Number = 502

NOTE: *The implementation and/or use of a Modbus TCP client is outside the scope of this manual. For additional information regarding Modbus TCP/IP protocol there are many resources available online (http://www.modbus.org/specs.php) or consult the documentation provided with your client software application.*

For a list of supported functions and data available over the Modbus TCP interface, see Appendix section A.1 Modbus Communications.

Serial Communications Option

The MCT serial interface uses Modbus RTU protocol. Any device used to communicate with the MCT over the serial interface must use this protocol.



The MCT communication address and parity can be set on the communications screen. All other communication settings are fixed. The port settings of the device used to communicate with the MCT must be set to match for the communications to take place.

Address:1-247 (user selectable)
Baud Rate:9600
Data Bits:8
Stop Bits: 1
Parity: None, Odd, Even (user selectable)

The Modbus address is used to identify the MCT on the serial link. When a multi-drop connection is used, each controller on the link must have a different address so that each one can be identified separately. If two or more MCT controllers have duplicate addresses, communications with those controllers will fail because they will each try to respond to the same message. For single MCT connections, the address only needs to match that of the commands being sent from the host device.

ALARM CODES AND TROUBLESHOOTING

This section provides explanations of standard MCT alarms to help in diagnosing and resolving the alarm conditions. Note that the information provided here covers standard alarms only, and not alarms configured by the OEM. If you are unable to diagnose a problem using this guide, contact your Darwin Chambers for further assistance.

Some of the troubleshooting procedures may require access to live circuitry. Dangerous accidental contact with line voltage may be possible. Only qualified service personnel should be allowed to perform these procedures.

Alarm Monitor Description	Explanation/Corrective Action
Communications read error. Check communication cable.	Communication wiring between the MCT touch screen and control module (CM) faulty or not properly connected. If alarm will not clear, check communication wiring between the touch screen and port 1 of the CM. ***NOTE:*** *Intermittent alarms do not affect the operation of the MCT or shut down the system. The system will continue to operate according to its last given commands, including ramp/soak program operation. Data logging may be affected depending upon the logging rate selected.* *Frequent alarms indicate a problem that should be resolved. ensure that the communication wiring is properly shielded and routed away from control and power wiring.*
"tagname" Communications Error	Check communication wiring between the control module and the loop control indicated by *"tagname".* Verify that the loop control has the proper communications address and communications settings. Verify that set point ranges set in the MCT configurator for the control loop do not exceed the loop control's input range. ***NOTE:*** *A tagname of "CM RS485" indicates that the communications to the optional input monitor module(s) is at fault.*

Alarm Monitor Description	Explanation/Corrective Action
Data file error. SD card full or missing.	Indicates that data logging could not be started or has been stopped due to an issue in accessing the SD memory card. This will occur if the memory card does not have any remaining memory space available or the maximum number of files has been reached in the data log directory. Use the USB file utilities or FTP to backup (copy) and delete data files from the MCT to free up memory. Verify that an SD card is properly inserted into the MCT display. Replace SD card.
Email Error! Check cable or server down.	Indicates that the MCT was unable to send an alarm message through the mail server. Verify that the MCT is properly connected to the network and that the email settings and addresses are valid.
FTP! Check cable or server down.	Indicates that the FTP back-up attempt of the data files failed. Verify that the MCT is properly connected to the network and that the FTP settings are valid. *If the MCT is not connected to a network, disable the FTP data back-up to prevent this alarm from occurring.*
Memory Error Please check SD card.	Indicates that the SD card cannot be accessed when checking available memory space. Verify that an SD card is properly inserted into the MCT display. Replace SD card.
NTP Ping Failed. Check Cable.	Indicates that the MCT was unable to synchronize its clock with the selected time server. Verify that the MCT is properly connected to the network and the selected time server is accessible. *If the MCT is not connected to a network, disable the NTS clock to prevent this alarm from occurring.*
SD card damaged or missing.	Indicates that the SD card cannot be accessed for USB file transfer. Verify that an SD card is properly inserted into the MCT display. Replace SD card.

Alarm Monitor Description	Explanation/Corrective Action
SD card filled. Please use USB file transfer.	Indicates that a file was unable to be written due to lack of available free space on the memory card. Use the USB file utilities or FTP to backup (copy) and delete alarm, audit, and data files from the MCT in order to free up memory. Can also occur if the SD card is missing/not properly inserted.
"tagname" sensor break	Check sensor wiring for the loop or limit control indicated by *"tagname"*. Verify lead connections. If sensor requires power, verify power to sensor. *If the MCT is running a ramp/soak program when this alarm occurs, the program will be terminated if it occurs on either **Loop 1 or ***Loop 2. If the alarm occurs on ***Loop 3, the program will continue operation.*

APPENDIX

A.1 Modbus Communications

The MCT utilizes Modbus as its standard protocol and offers both Modbus RTU serial and Modbus TCP forms. This section provides information on the supported functions and data available over the Modbus interface. It is assumed that the user is already familiar with Modbus protocol and has a basic understanding of its implementation and use. For additional information and support, modbus.org (http://modbus.org/tech.php) provides an abundance of technical documents, standards, and support applications.

Listed below are a few of the more common software packages that claim to support Modbus protocol. This list is provided as informational only. Contact the software manufacturer for more information on applying their software.

LabView by National Instruments
11500 N Mopac Expwy
Austin, TX 78759-3504
Phone 800-683-8411
http://www.natinst.com

Wonderware by Wonderware
26561 Rancho Pkwy. South
Lake Forest, CA 92630
Phone 949-727-3200
http://www.wonderware.com

SpecView by SpecView Corporation
13409 53rd Ave NW
Gig Harbor, WA 98332
Phone 253-853-3199
http://www.specview.com

A.1.1 Supported Function Codes

Modbus bases its data model on a series of tables, each of which defines a particular range of values. In the case of the MCT, all data is contained within the Holding Register data table. This means that all communication transactions between the MCT and the master (client) are performed using three command types. These include Read Holding Registers, Write Single Register and Write Multiple Registers.

		Function Codes	
		code	(hex)
	Read Holding Registers	03	03

16 bits access (word)	Write Single Register	06	06
	Write Multiple Registers	16	10

Function code 03 (read holding registers) is used to read the contents of a contiguous block of data registers from the MCT. The request from the master specifies the starting register address and the number of registers. The response message from the MCT contains the value of each register requested (two bytes per register).

Function code 06 (write holding register) is used to write to a single data register in the MCT. The request from the master specifies the address of the register to be written and the value. The response message from the MCT is an exact duplicate of the sent message (if completed successfully).

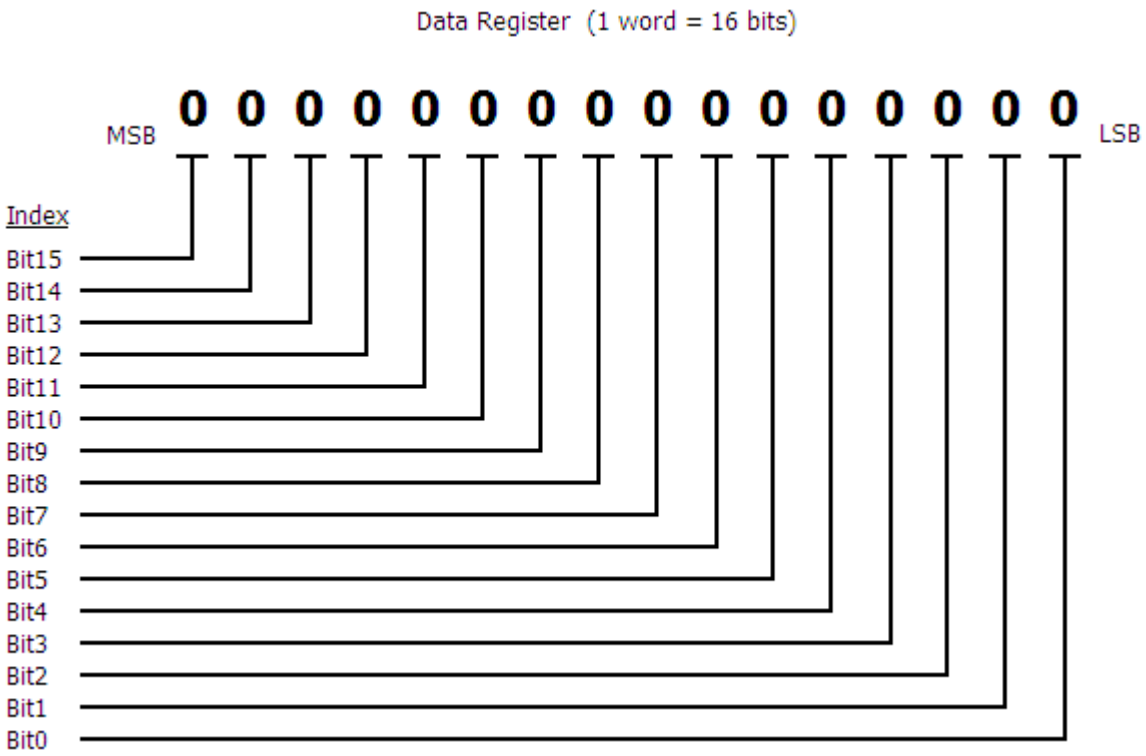
Function code 16 (write multiple registers) is used to write to a contiguous block of data registers in the MCT and is used from ramp/soak program download only. The request from the master specifies the starting register address to be written, the number of registers to write and two bytes of data for each register. The normal response message from the MCT returns the function code, starting address and quantity of data registers written.

A.1.2 MCT Data Registers

Some of the values contained in the MCT register base contain bit-oriented values. This means that each bit of the word indicates an on/off status for a specific setting or condition. When handling these values, it is recommended that the word be converted to its binary equivalent.

By converting the value to its binary equivalent, it produces a Boolean array of true [bit on (1)] and false [bit off (0)] values. This allows each bit to be examined individually. In the same manner, creating a Boolean array of 16 bits produces an equivalent hexadecimal value that can be sent to the MCT to set a control register.

For this manual, parameters defined as bit oriented will have the function of each bit associated with the bit's index number in the data word. The index number is equal to that of a typical array function. Thus, an index number of zero, selects the first bit in the word (LSB). An index number of 1 selects the second bit in the word, and so on. This helps eliminate offset selection errors that may occur when coding software and using array functions to select which bit in the word that is required for examination.



Adhere to the following lists of registers and their allowable data ranges. DO NOT attempt to write to any other register number than those listed. DO NOT write to registers that are for options your controller does not have. Failure to adhere to this requirement can result in erratic control and/or damage to equipment.

A.1.2.1 *Control Registers*

Modbus Address	Register Number	Parameter Description	Data *A Type	Range *B Low	Range *B High	*C Unit
400001	0 **(0x0000)**	System Mode Control	R/W	*B1	*B1	-
400002	1 **(0x0001)**	**RESERVED** – DO NOT WRITE				
400003	2 **(0x0002)**	Power Out Recovery Mode	R/W	*B2	*B2	-
400004	3 **(0x0003)**	Recovery Power Out Time	R/W	0	32767	seconds
400005	4 **(0x0004)**	Demand Defrost/Status	R/W	*B3	*B3	-
400006	5 **(0x0005)**	Defrost Interval	R/W	0	999	hours
400007	6 **(0x0006)**	Defrost Duration	R/W	0	999	minutes
400008	7 **(0x0007)**	Fan Delay (PreCool)	R/W	0	999	seconds
400009	8 **(0x0008)**					
400010	9 **(0x0009)**	Control Loop Auto/Manual Control	R/W	*B4	*B4	-
400011	10 **(0x000A)**	Control Loop Autotune Activation	R/W	*B5	*B5	-
400012	11 **(0x000B)**	**RESERVED** – DO NOT WRITE				
400013	12 **(0x000C)**	System Events 1-16	R/W	*B6	*B6	-
400014	13 **(0x000D)**	System Events 16-32	R/W	*B7	*B7	-

Modbus Address	Register Number	Parameter Description	Data Type *A	Range *B		*C Unit
				Low	High	
400015	14 **(0x000E)**	Program Start Step Number	W	1	99	-
400016	15 **(0x000F)**	Program Operating Status	R/W	*B8	*B8	-
400017	16 **(0x0010)**	Program Advance Previous/Next Step	W	*B9	*B9	-
400018	17 **(0x0011)**	Program Step Time Addition	W	0	32767	minutes
400019	18 **(0x0012)**	Program Name Characters 1 & 2	R	*B10	*B10	-
400020	19 **(0x0013)**	Program Name Characters 3 & 4	R	*B10	*B10	-
400021	20 **(0x0014)**	Program Name Characters 5 & 6	R	*B10	*B10	-
400022	21 **(0x0015)**	Program Name Characters 7 & 8	R	*B10	*B10	-
400023	22 **(0x0016)**	Program Name Characters 9 & 10	R	*B10	*B10	-
400024	23 **(0x0017)**	Year/Month Program Started	R	*B11	*B11	-
400025	24 **(0x0018)**	Day/DOW Program Started	R	*B12	*B12	-
400026	25 **(0x0019)**	Hour/Minute Program Started	R	*B13	*B13	-
400027	26 **(0x001A)**	Year/Month Estimated Program End	R	*B11	*B11	-
400028	27 **(0x001B)**	Day/DOW Estimated Program End	R	*B12	*B12	-
400029	28 **(0x001C)**	Hour/Minute Estimated Program End	R	*B13	*B13	-
400030	29 **(0x001D)**	Current Step of Program	R	1	99	-
400031	30 **(0x001E)**	Hours Left in Current Step	R	0	999	hours
400032	31 **(0x001F)**	Minutes/Seconds Left in Current Step	R	*B14	*B14	-
400033	32 **(0x0020)**	Program Wait Status	R	*B15	*B15	-
400034	33 **(0x0021)**	Waiting For Input (loop/monitor/digital)	R	*B16	*B16	-
400035	34 **(0x0022)**	Wait Setpoint	R	-3276.8	3276.7	*C1
400036	35 **(0x0023)**	Current Step Jump Step Number	R	1	99	-
400037	36 **(0x0024)**	Current Step Jumps Remaining	R	0	999	-
400038	37 **(0x0025)**	Program Loop 1 Target Setpoint	R	-32768	32767	*C2
400039	38 **(0x0026)**	Program Loop 2 Target Setpoint	R	-32768	32767	*C2
400040	39 **(0x0027)**	Program Loop 3 Target Setpoint	R	-32768	32767	*C2
400041	40 **(0x0028)**	Program Loop 4 Target Setpoint	R	-32768	32767	*C2
400042	41 **(0x0029)**	Program Loop 5 Target Setpoint	R	-32768	32767	*C2
400043	42 **(0x002A)**	Program Loop 6 Target Setpoint	R	-32768	32767	*C2
400044	43 **(0x002B)**	Program Loop 7 Target Setpoint	R	-32768	32767	*C2
400045	44 **(0x002C)**	Program Loop 8 Target Setpoint	R	-32768	32767	*C2
400046	45 **(0x002D)**	Program Loop 9 Target Setpoint	R	-32768	32767	*C2
400047	46 **(0x002E)**	Program Loop 10 Target Setpoint	R	-32768	32767	*C2
400048	47 **(0x002F)**					
400049	48 **(0x0030)**					
400050	49 **(0x0031)**					
400051	50 **(0x0032)**					
400052	51 **(0x0033)**					
400053	52 **(0x0034)**	Last Program Jump Made from Step	R	1	99	-

Modbus Address	Register Number	Parameter Description	Data Type *A	Range *B		*C Unit
				Low	High	
400054	53 **(0x0035)**	Last Program Jump Made to Step	R	1	99	-
400055	54 **(0x0036)**	Total Program Jumps Made	R	0	32767	-
400056	55 **(0x0037)**	Loops Under Program Control	R	*B17	*B17	-
400057	56 **(0x0038)**					
400058	57 **(0x0039)**					
400059	58 **(0x003A)**					
400060	59 **(0x003B)**					
400061	60 **(0x003C)**	Loop 1 Process Variable (PV)	R	-32768	32767	*C2
400062	61 **(0x003D)**	Loop 1 Setpoint (SP)	R/W	-32768	32767	*C2
400063	62 **(0x003E)**	Loop 1 Percent Output (%Out)	R/W	-100.00	100.00	%
400064	63 **(0x003F)**	Loop 2 Process Variable (PV)	R	-32768	32767	*C2
400065	64 **(0x0040)**	Loop 2 Setpoint (SP)	R/W	-32768	32767	*C2
400066	65 **(0x0041)**	Loop 2 Percent Output (%Out)	R/W	-100.00	100.00	%
400067	66 **(0x0042)**	Loop 3 Process Variable (PV)	R	-32768	32767	*C2
400068	67 **(0x0043)**	Loop 3 Setpoint (SP)	R/W	-32768	32767	*C2
400069	68 **(0x0044)**	Loop 3 Percent Output (%Out)	R/W	-100.00	100.00	%
400070	69 **(0x0045)**	Loop 4 Process Variable (PV)	R	-32768	32767	*C2
400071	70 **(0x0046)**	Loop 4 Setpoint (SP)	R/W	-32768	32767	*C2
400072	71 **(0x0047)**	Loop 4 Percent Output (%Out)	R/W	-100.00	100.00	%
400073	72 **(0x0048)**	Loop 5 Process Variable (PV)	R	-32768	32767	*C2
400074	73 **(0x0049)**	Loop 5 Setpoint (SP)	R/W	-32768	32767	*C2
400075	74 **(0x004A)**	Loop 5 Percent Output (%Out)	R/W	-100.00	100.00	%
400076	75 **(0x004B)**	Loop 6 Process Variable (PV)	R	-32768	32767	*C2
400077	76 **(0x004C)**	Loop 6 Setpoint (SP)	R/W	-32768	32767	*C2
400078	77 **(0x004D)**	Loop 6 Percent Output (%Out)	R/W	-100.00	100.00	%
400079	78 **(0x004E)**	Loop 7 Process Variable (PV)	R	-32768	32767	*C2
400080	79 **(0x004F)**	Loop 7 Setpoint (SP)	R/W	-32768	32767	*C2
400081	80 **(0x0050)**	Loop 7 Percent Output (%Out)	R/W	-100.00	100.00	%
400082	81 **(0x0051)**	Loop 8 Process Variable (PV)	R	-32768	32767	*C2
400083	82 **(0x0052)**	Loop 8 Setpoint (SP)	R/W	-32768	32767	*C2
400084	83 **(0x0053)**	Loop 8 Percent Output (%Out)	R/W	-100.00	100.00	%
400085	84 **(0x0054)**	Loop 9 Process Variable (PV)	R	-32768	32767	*C2
400086	85 **(0x0055)**	Loop 9 Setpoint (SP)	R/W	-32768	32767	*C2
400087	86 **(0x0056)**	Loop 9 Percent Output (%Out)	R/W	-100.00	100.00	%
400088	87 **(0x0057)**	Loop 10 Process Variable (PV)	R	-32768	32767	*C2
400089	88 **(0x0058)**	Loop 10 Setpoint (SP)	R/W	-32768	32767	*C2
400090	89 **(0x0059)**	Loop 10 Percent Output (%Out)	R/W	-100.00	100.00	%
400091	90 **(0x005A)**					
400092	91 **(0x005B)**					

Modbus Address	Register Number	Parameter Description	Data Type *A	Range *B		*C Unit
				Low	High	
400093	92 **(0x005C)**					
400094	93 **(0x005D)**					
400095	94 **(0x005E)**					
400096	95 **(0x005F)**					
400097	96 **(0x0060)**					
400098	97 **(0x0061)**					
400099	98 **(0x0062)**					
400100	99 **(0x0063)**					
400101	100 **(0x0064)**					
400102	101 **(0x0065)**					
400103	102 **(0x0066)**					
400104	103 **(0x0067)**					
400105	104 **(0x0068)**					
400106	105 **(0x0069)**	Monitor 1 Process Variable	R	-32768	32767	*C2
400107	106 **(0x006A)**	Monitor 2 Process Variable	R	-32768	32767	*C2
400108	107 **(0x006B)**	Monitor 3 Process Variable	R	-32768	32767	*C2
400109	108 **(0x006C)**	Monitor 4 Process Variable	R	-32768	32767	*C2
400110	109 **(0x006D)**	Monitor 5 Process Variable	R	-32768	32767	*C2
400111	110 **(0x006E)**	Monitor 6 Process Variable	R	-32768	32767	*C2
400112	111 **(0x006F)**	Monitor 7 Process Variable	R	-32768	32767	*C2
400113	112 **(0x0070)**	Monitor 8 Process Variable	R	-32768	32767	*C2
400114	113 **(0x0071)**	Monitor 9 Process Variable	R	-32768	32767	*C2
400115	114 **(0x0072)**	Monitor 10 Process Variable	R	-32768	32767	*C2
400116	115 **(0x0073)**	Monitor 11 Process Variable	R	-32768	32767	*C2
400117	116 **(0x0074)**	Monitor 12 Process Variable	R	-32768	32767	*C2
400118	117 **(0x0075)**	Monitor 13 Process Variable	R	-32768	32767	*C2
400119	118 **(0x0076)**	Monitor 14 Process Variable	R	-32768	32767	*C2
400120	119 **(0x0077)**	Monitor 15 Process Variable	R	-32768	32767	*C2
400121	120 **(0x0078)**	RESERVED – DO NOT WRITE				
400122	121 **(0x0079)**	RESERVED – DO NOT WRITE				
400123	122 **(0x007A)**	RESERVED – DO NOT WRITE				
400124	123 **(0x007B)**	RESERVED – DO NOT WRITE				
400125	124 **(0x007C)**	RESERVED – DO NOT WRITE				
400126	125 **(0x007D)**	RESERVED – DO NOT WRITE				
400127	126 **(0x007E)**	RESERVED – DO NOT WRITE				
400128	127 **(0x007F)**	RESERVED – DO NOT WRITE				
400129	128 **(0x0080)**	RESERVED – DO NOT WRITE				
400130	129 **(0x0081)**	RESERVED – DO NOT WRITE				
400131	130 **(0x0082)**	RESERVED – DO NOT WRITE				

Modbus Address	Register Number	Parameter Description	Data Type *A	Range *B		*C Unit
				Low	High	
400132	131 **(0x0083)**	RESERVED – DO NOT WRITE				
400133	132 **(0x0084)**	RESERVED – DO NOT WRITE				
400134	133 **(0x0085)**	RESERVED – DO NOT WRITE				
400135	134 **(0x0086)**					
400136	135 **(0x0087)**					
400137	136 **(0x0088)**	Alarm Acknowledge	W	0	1	-
400138	137 **(0x0089)**	Loop Communication Fault Alarms	R	*B18	*B18	-
400139	138 **(0x008A)**					
400140	139 **(0x008B)**	Loop Input Alarms	R	*B19	*B19	-
400141	140 **(0x008C)**	Monitor Input Alarms	R	*B20	*B20	-
400142	141 **(0x008D)**	Loop/Monitor Alarms	R	*B21	*B21	-
400143	142 **(0x008E)**	Loop/Monitor Alarms (w/Service Alert)	R	*B22	*B22	-
400144	143 **(0x008F)**	Digital Input Alarms	R	*B23	*B23	-
400145	144 **(0x0090)**					
400146	145 **(0x0091)**					
400147	146 **(0x0092)**	RESERVED – DO NOT WRITE				
400148	147 **(0x0093)**	RESERVED – DO NOT WRITE				
400149	148 **(0x0094)**	RESERVED – DO NOT WRITE				
400150	149 **(0x0095)**	RESERVED – DO NOT WRITE				
400151	150 **(0x0096)**	RESERVED – DO NOT WRITE				
400152	151 **(0x0097)**	RESERVED – DO NOT WRITE				
400153	152 **(0x0098)**	RESERVED – DO NOT WRITE				
400154	153 **(0x0099)**	RESERVED – DO NOT WRITE				
400155	154 **(0x009A)**	RESERVED – DO NOT WRITE				
400156	155 **(0x009B)**	RESERVED – DO NOT WRITE				
400157	156 **(0x009C)**	RESERVED – DO NOT WRITE				
400158	157 **(0x009D)**	RESERVED – DO NOT WRITE				
400159	158 **(0x009E)**					
400160	159 **(0x009F)**	Redundancy Primary System/Status	R/W	*B24	*B24	-
400161	160 **(0x00A0)**	Alternating Run Time	R/W	0	32767	minutes
400162	161 **(0x00A1)**	Alternating Time of Day (HH)	R/W	0	23	hours
400163	162 **(0x00A2)**	Alternating Time of Day (MM)	R/W	0	59	minutes
400164	163 **(0x00A3)**	Product Load Timer Demand/Status	R/W	*B25	*B25	-
400165	164 **(0x00A4)**	Concurrent Minimum Run Time	R/W	0	32767	minutes
400166	165 **(0x00A5)**	RESERVED – DO NOT WRITE				
400167	166 **(0x00A6)**	RESERVED – DO NOT WRITE				
400168	167 **(0x00A7)**	RESERVED – DO NOT WRITE				
400169	168 **(0x00A8)**	RESERVED – DO NOT WRITE				
400170	169 **(0x00A9)**	RESERVED – DO NOT WRITE				

Modbus Address	Register Number	Parameter Description	Data Type *A	Range *B		*C Unit
				Low	High	
400171	170 **(0x00AA)**	RESERVED – DO NOT WRITE				
400172	171 **(0x00AB)**	RESERVED – DO NOT WRITE				
400173	172 **(0x00AC)**	RESERVED – DO NOT WRITE				
400174	173 **(0x00AD)**	RESERVED – DO NOT WRITE				
400175	174 **(0x00AE)**					
400176	175 **(0x00AF)**					
400177	176 **(0x00B0)**	Control Module Input Status	R	*B26	*B26	-
400178	177 **(0x00B1)**	Auxiliary Input Status	R	*B27	*B27	-
400179	178 **(0x00B2)**	Control Module/Auxiliary Output Status	R	*B28	*B28	-
400180	179 **(0x00B3)**	Auxiliary Output Status	R	*B29	*B29	-

Notes:

*A R/W Specifies readable / writable data, R specifies read only data and W specifies a write only control value.

*B The range of certain parameters are dependent upon system options. Consult the following range tables for information regarding the use of these parameters.

Reading bit-oriented parameters

The value contained in these parameters is dependent upon the combination of “on” bits (1). Therefore, only the individual status of each bit has meaning, not the value of the parameter.

Setting bit-oriented parameters

The value that must be written to these parameters is dependent upon the combination of “on” bits. Therefore, it is necessary to know the current value of the parameter before setting it so that only the bit status you want to update is changed. Otherwise, sending a value derived from only the bit you wish to set will turn off all other functions related to the other bits in the parameter.

*B1

Parameter Value	Description
Bit0	MCT Online
Bit1 - Bit15	Not Assigned

DO NOT alter the state of this register. Bit0 is the system online bit and is set by the MCT HMI when the unit is ready for operation. Turning off this bit will turn off the system.

The status of this register should be used for information only, as a means of determining if the system is ready for operation.

*B2

Parameter Value	Description
Bit0	Off
Bit1	Hold
Bit2	Continue
Bit3	Restart
Bit4	Resume
Bit5 – Bit15	Not Assigned

*B3

Parameter Value	Description
Bit0	Demand Defrost
Bit1-7	Not Assigned
Bit8	Defrost Off
Bit9	Defrost Cycle Active
Bit10	Fan Delay (PreCool) Active
Bit11-15	Not Assigned

Note: Bit0 (demand defrost) will automatically reset after being written to activate defrost. Bits 8-10 are status bits only and will indicate the current defrost status.

*B4

Parameter Value	Description
Bit0	**Loop 1 in Manual
Bit1	***Loop 2 in Manual
Bit2	***Loop 3 in Manual
Bit3	Loop 4 in Manual
Bit4	Loop 5 in Manual
Bit5	Loop 6 in Manual
Bit6	Loop 7 in Manual
Bit7	Loop 8 in Manual
Bit8	Loop 9 in Manual
Bit9	Loop 10 in Manual
Bit10-15	Not Assigned

Note: Manual operation may not be available on certain loop controls depending upon their configuration. If manual operation is not available, the bit for the loop will automatically turn off after being set.

When in manual mode, writing to the loop %Out register will adjust the output percentage of the control loop.

*B5

Parameter Value	Description
Bit0	**Loop 1 in Autotune
Bit1	***Loop 2 in Autotune
Bit2	***Loop 3 in Autotune
Bit3	Loop 4 in Autotune
Bit4	Loop 5 in Autotune
Bit5	Loop 6 in Autotune
Bit6	Loop 7 in Autotune
Bit7	Loop 8 in Autotune
Bit8	Loop 9 in Autotune
Bit9	Loop 10 in Autotune
Bit10-15	Not Assigned

Note: Autotune operation is not supported on all loop controls compatible with the MCT or may be unavailable depending upon their configuration. If autotune operation is not available, the bit for the loop will automatically turn off after being set.

When autotune completes normally, the bit for the loop will automatically turn off indicating that tune is complete. To terminate an autotune in progress, turn off the bit for the desired loop.

*B6

Parameter Value	Description
Bit0	System Event 1
Bit1	System Event 2
Bit2	System Event 3
Bit3	System Event 4
Bit4	System Event 5
Bit5	System Event 6
Bit6	System Event 7
Bit7	System Event 8
Bit8	System Event 9
Bit9	System Event 10
Bit10	System Event 11
Bit11	System Event 12
Bit12	System Event 13
Bit13	System Event 14
Bit14	System Event 15
Bit15	System Event 16

Note: Not all system events may be available on your system. Event names and functions are defined by system configuration. Consult your system documentation or contact your OEM for information on event use.

*B7

Parameter Value	Description
Bit0	System Event 17
Bit1	System Event 18
Bit2	System Event 19
Bit3	System Event 20
Bit4	System Event 21
Bit5	System Event 22
Bit6	System Event 23
Bit7	System Event 24
Bit8	System Event 25
Bit9	System Event 26
Bit10	System Event 27
Bit11	System Event 28
Bit12	System Event 29
Bit13	System Event 30
Bit14	System Event 31
Bit15	System Event 32

*B8

Parameter Value	Description
0	Program Not Running
1	Stop Program
2	Stop Program (All Off)
4	Hold Program
8	Run/Resume Program
16	Program in Autostart**
32	Program in Wait **
64	Program in Ramp**
128	Program in Soak**
256	Program in Guaranteed Soak**

**These values are set by the MCT to indicate the operating status of the profile and cannot be set directly.

*B9

Parameter Value	Description
1	Program Advance to Previous Step
2	Program Advance to Next Step

This parameter only performs its function when the profile is in hold. Once the set function is executed, this parameter automatically resets to zero (0).

*B10

Parameter Value	High Order Byte	Low Order Byte	Description
Range Low	32	32	Program Name Character (ASCII Table)
Range High	126	126	Program Name Character (ASCII Table)

See the ASCII character chart in Section 3.1 for the character representation of these values.

Example

Read command of registers 18 to 22 from the MCT returns the following values:

Register Values:	0x74 53	0x72 6F	0x20 65	0x65 54	0x74 73
ASCII Equivalent:	t S	r o	e	e T	t s

Assemble the ASCII characters in order from low to high byte starting with register 18 to assemble the Program name: “Store Test”. Note that null characters are not used in the Program name. A space (0x20) will be used is used in place of a null character to maintain the 10-character name length if the Program name is not ten characters long.

*B11

Parameter Value	Range Low	Range High	Description
High Byte	0	99	Year
Low Byte	1	12	Month

*B12

Parameter Value	Range Low	Range High	Description
High Byte	1	31	Day
Low Byte	0	6	Day of Week**

**The days of the week are represented as numbers:

0=Sun, 1=Mon, 2=Tue, 3=Wed, 4=Thu, 5=Fri, 6=Sat

*B13

Parameter Value	Range Low	Range High	Description
High Byte	0	23	Hour
Low Byte	0	59	Minute

Example

Read command of registers 23 to 25 for program start time or 26 to 28 for estimated program stop time from the MCT returns the following values:

Register Values:	0x0A 0B	0x04 04	0x0A 1D
Decimal Equivalent:	10 11	4 4	10 29

Translating the values into an actual date and time provides a date and time of Thursday November 4, 2010, at 10:29am.

*B14

Parameter Value	Range Low	Range High	Description
High Byte	0	59	Minutes
Low Byte	0	59	Seconds

*B15

Parameter Value	Description
Bit0	Not Waiting
Bit1	Wait For Loop
Bit2	Wait For Monitor
Bit3	Wait For Digital Input
Bit4 - Bit15	Not Assigned

Note: Multiple wait for conditions can be active at once, i.e., the profile could be waiting for a combination of loops, monitors and/or digital inputs at the same time.

*B16

Parameter Value	Description
Bit0	Loop/Monitor/Digital Input 1
Bit1	Loop/Monitor/Digital Input 2
Bit2	Loop/Monitor/Digital Input 3
Bit3	Loop/Monitor/Digital Input 4
Bit4	Loop/Monitor/Digital Input 5
Bit5	Loop/Monitor/Digital Input 6
Bit6	Loop/Monitor/Digital Input 7
Bit7	Loop/Monitor/Digital Input 8
Bit8	Loop/Monitor/Digital Input 9
Bit9	Loop/Monitor/Digital Input 10
Bit10	Monitor/Digital Input 11
Bit11	Monitor/Digital Input 12
Bit12	Monitor/Digital Input 13
Bit13	Monitor/Digital Input 14
Bit14	Monitor/Digital Input 15
Bit15	Digital Input 16

Note: Each bit in the word can represent a wait for condition for more than one input, i.e., Bit0 can be on to indicate it is waiting for **Loop 1, monitor input 1 or digital input 1.

*B17

Parameter Value	Description
Bit0	**Loop 1 Under Program Control
Bit1	***Loop 2 Under Program Control
Bit2	***Loop 3 Under Program Control
Bit3	Loop 4 Under Program Control
Bit4	Loop 5 Under Program Control
Bit5	Loop 6 Under Program Control
Bit6	Loop 7 Under Program Control
Bit7	Loop 8 Under Program Control

Parameter Value	Description
Bit8	Loop 9 Under Program Control
Bit9	Loop 10 Under Program Control
Bit10-15	Digital Input 16

*B18

Parameter Value	Description
Bit0	**Loop 1 Communications Fault
Bit1	***Loop 2 Communications Fault
Bit2	***Loop 3 Communications Fault
Bit3	Loop 4 Communications Fault
Bit4	Loop 5 Communications Fault
Bit5	Loop 6 Communications Fault
Bit6	Loop 7 Communications Fault
Bit7	Loop 8 Communications Fault
Bit8	Loop 9 Communications Fault
Bit9	Loop 10 Communications Fault
Bit10-14	Not Assigned
Bit15	Monitor Communications Fault

*B19

Parameter Value	Description
Bit0	**Loop 1 Sensor Break
Bit1	***Loop 2 Sensor Break
Bit2	***Loop 3 Sensor Break
Bit3	Loop 4 Sensor Break
Bit4	Loop 5 Sensor Break
Bit5	Loop 6 Sensor Break
Bit6	Loop 7 Sensor Break
Bit7	Loop 8 Sensor Break
Bit8	Loop 9 Sensor Break

Parameter Value	Description
Bit9	Loop 10 Sensor Break
Bit10-15	Not Assigned

*B20

Parameter Value	Description
Bit0	Monitor 1 Sensor Break
Bit1	Monitor 2 Sensor Break
Bit2	Monitor 3 Sensor Break
Bit3	Monitor 4 Sensor Break
Bit4	Monitor 5 Sensor Break
Bit5	Monitor 6 Sensor Break
Bit6	Monitor 7 Sensor Break
Bit7	Monitor 8 Sensor Break
Bit8	Monitor 9 Sensor Break
Bit9	Monitor 10 Sensor Break
Bit10	Monitor 11 Sensor Break
Bit11	Monitor 12 Sensor Break
Bit12	Monitor 13 Sensor Break
Bit13	Monitor 14 Sensor Break
Bit14	Monitor 15 Sensor Break
Bit15	Not Assigned

*B21

Parameter Value	Description
Bit0	Loop/Monitor Alarm 1
Bit1	Loop/Monitor Alarm 2
Bit2	Loop/Monitor Alarm 3
Bit3	Loop/Monitor Alarm 4
Bit4	Loop/Monitor Alarm 5
Bit5	Loop/Monitor Alarm 6
Bit6	Loop/Monitor Alarm 7
Bit7	Loop/Monitor Alarm 8
Bit8	Loop/Monitor Alarm 9
Bit9	Loop/Monitor Alarm 10
Bit10	Loop/Monitor Alarm 11
Bit11	Loop/Monitor Alarm 12
Bit12	Loop/Monitor Alarm 13

Parameter Value	Description
Bit13	Loop/Monitor Alarm 14
Bit14	Loop/Monitor Alarm 15
Bit15	Loop/Monitor Alarm 16

*B22

Parameter Value	Description
Bit0	Loop/Monitor Alarm 17
Bit1	Loop/Monitor Alarm 18
Bit2	Loop/Monitor Alarm 19
Bit3	Loop/Monitor Alarm 20
Bit4	Loop/Monitor Alarm 21
Bit5	Loop/Monitor Alarm 22
Bit6	Loop/Monitor Alarm 23
Bit7	Loop/Monitor Alarm 24
Bit8	Loop/Monitor Alarm 25
Bit9	Loop/Monitor Alarm 26
Bit10	Loop/Monitor Alarm 27
Bit11	Loop/Monitor Alarm 28
Bit12	Loop/Monitor Alarm 29
Bit13	Loop/Monitor Alarm 30
Bit14	Service Alert
Bit15	RESERVED

*B23

Parameter Value	Description
Bit0	Digital Input 0 Alarm
Bit1	Digital Input 1 Alarm
Bit2	Digital Input 2 Alarm
Bit3	Digital Input 3 Alarm
Bit4	Digital Input 4 Alarm
Bit5	Digital Input 5 Alarm
Bit6	Digital Input 6 Alarm
Bit7	Digital Input 7 Alarm
Bit8	Digital Input 8 Alarm
Bit9	Digital Input 9 Alarm
Bit10	Digital Input 10 Alarm
Bit11	Digital Input 11 Alarm

Parameter Value	Description
Bit12	Digital Input 12 Alarm
Bit13	Digital Input 13 Alarm
Bit14	Digital Input 14 Alarm
Bit15	Digital Input 15 Alarm

*B24

Parameter Value	Description
Bit0	Redundancy in Manual
Bit1	Redundancy in Auto
Bit2	Redundancy Reset
Bit3	Not Assigned
Bit4	System A Primary Selection
Bit5	System B Primary Selection
Bit6-7	Not Assigned
Bit8	Running System A in Auto
Bit9	Running System A in Manual
Bit10	Running System B in Auto
Bit11	Running System B in Manual
Bit12	Running System A in Fail Mode
Bit13	Running System B in Fail Mode
Bit14	Running System A/B Concurrent
Bit15	Fail Mode System A and B

Note: When setting manual mode (Bit0=on, Bit1=off), be sure to also set the current primary system (Bit4 or Bit5). To do this, read the register to get the status first, set the lower two bits of the word to the desired mode, and then write the result back to the MCT. If neither bit is set for system A or system B, the MCT will default system A as the primary.

Bits8-15 are status only bits and will indicate the current operating condition. If none of the bits are on, redundancy is inactive and neither system A nor system B outputs are on.

*B25

Parameter Value	Description
Bit0	Demand Inhibit
Bit1-7	Not Assigned
Bit8	Product Load Timer Off
Bit9	Product Load Timer On
Bit10-15	Not Assigned

Note: Bit0 (demand inhibit) will automatically reset after being written to activate the product load timer. Bit8 and Bit9 are status bits only and will indicate the product load timer status.

*B26

Parameter Value	Description
Bit0	Digital Input 0 On
Bit1	Digital Input 1 On
Bit2	Digital Input 2 On
Bit3	Digital Input 3 On
Bit4	Digital Input 4 On
Bit5	Digital Input 5 On
Bit6	Digital Input 6 On
Bit7	Digital Input 7 On
Bit8 – Bit15	Not Assigned

*B27

Parameter Value	Description
Bit0	Digital Input 8 On
Bit1	Digital Input 9 On
Bit2	Digital Input 10 On
Bit3	Digital Input 11 On
Bit4	Digital Input 12 On
Bit5	Digital Input 13 On
Bit6	Digital Input 14 On
Bit7	Digital Input 15 On
Bit8 – Bit15	Not Assigned

*B28

Parameter Value	Description
Bit0	Digital Output 0 On
Bit1	Digital Output 1 On
Bit2	Digital Output 2 On
Bit3	Digital Output 3 On
Bit4	Digital Output 4 On
Bit5	Digital Output 5 On
Bit6	Digital Output 6 On
Bit7	Digital Output 7 On
Bit8	Digital Output 8 On
Bit9	Digital Output 9 On

Parameter Value	Description
Bit10	Digital Output 10 On
Bit11	Digital Output 11 On
Bit12	Digital Output 12 On
Bit13	Digital Output 13 On
Bit14	Digital Output 14 On
Bit15	Digital Output 15 On

*B29

Parameter Value	Description
Bit0	Digital Output 16 On
Bit1	Digital Output 17 On
Bit2	Digital Output 18 On
Bit3	Digital Output 19 On
Bit4	Digital Output 20 On
Bit5	Digital Output 21 On
Bit6	Digital Output 22 On
Bit7	Digital Output 23 On
Bit8	Digital Output 24 On
Bit9	Digital Output 25 On
Bit10	Digital Output 26 On
Bit11	Digital Output 27 On
Bit12	Digital Output 28 On
Bit13	Digital Output 29 On
Bit14	Digital Output 30 On
Bit15	Digital Output 31 On

*C1 The 'wait setpoint' does not have units of measure. It is a raw numerical value, i.e., it is compared directly to the numerical value of any loop or monitor input selected as a 'wait for' input. The wait for setpoint uses an implied decimal point of 1 for all comparisons regardless of the decimal point configuration of the loop or monitor input.

*C2 The units of measure and range of a loop or monitor input is dependent upon the configuration of the input and/or the units of temperature selection (Celsius or Fahrenheit) of the MCT. The decimal point position for the loop or monitor input is an implied value based on the configuration of the input. Thus, a register value of 345 can represent an actual process value of 345, 34.5, 3.45 or 0.345 depending upon the decimal point configuration of the loop or monitor input.

A.1.2.2 *Automatic Program Registers*

The automatic program parameters are a separate group of registers that are used to load programs to the MCT. The way the program steps are configured and sent to the MCT is specific and must be followed exactly.

Each program step consists of 28 data registers. The program must be written one step at a time, using a multiple write command (0x10) to write the data for all 28 registers at once. This allows programs to be stored as two-dimensional arrays, of which code can be written to simply index through the array step-by-step and transmit the program file to the MCT.

The first 28 registers of the Program contain specific settings related to the program. These include auto start settings, the program name, the length of the program (number of steps), and guaranteed soak band settings.

Modbus Address	Register Number	Parameter Description	Data *D Type	Range *E		*F
				Low	High	Unit
402001	2000 **(0x07D0)**	Autostart On/Off	W	*E1	*E1	-
402002	2001 **(0x07D1)**	Year/Month for Autostart	W	*E2	*E2	-
402003	2002 **(0x07D2)**	Day/DOW for Autotstart	W	*E3	*E3	-
402004	2003 **(0x07D3)**	Time of Day for Autostart	W	*E4	*E4	-
402005	2004 **(0x07D4)**	Program Name (Chars 1 & 2)	W	*E5	*E5	-
402006	2005 **(0x07D5)**	Program Name (Chars 3 & 4)	W	*E5	*E5	-
402007	2006 **(0x07D6)**	Program Name (Chars 5 & 6)	W	*E5	*E5	-
402008	2007 **(0x07D7)**	Program Name (Chars 7 & 8)	W	*E5	*E5	-
402009	2008 **(0x07D8)**	Program Name (Chars 9 & 10)	W	*E5	*E5	-
402010	2009 **(0x07D9)**	Total Number of Steps in Program	W	1	99	-
402011	2010 **(0x07DA)**	Not Assigned	W	-	-	-
402012	2011 **(0x07DB)**	Guaranteed Soak Band Loop 1	W	0	32767	PV
402013	2012 **(0x07DC)**	Guaranteed Soak Band Loop 2	W	0	32767	PV
402014	2013 **(0x07DD)**	Guaranteed Soak Band Loop 3	W	0	32767	PV
402015	2014 **(0x07DE)**	Guaranteed Soak Band Loop 4	W	0	32767	PV
402016	2015 **(0x07DF)**	Guaranteed Soak Band Loop 5	W	0	32767	PV
402017	2016 **(0x07E0)**	Guaranteed Soak Band Loop 6	W	0	32767	PV
402018	2017 **(0x07E1)**	Guaranteed Soak Band Loop 7	W	0	32767	PV
402019	2018 **(0x07E2)**	Guaranteed Soak Band Loop 8	W	0	32767	PV
402020	2019 **(0x07E3)**	Guaranteed Soak Band Loop 9	W	0	32767	PV
402021	2020 **(0x07E4)**	Guaranteed Soak Band Loop 10	W	0	32767	PV
402022	2021 **(0x07E5)**	Not Assigned	W	-	-	-
402023	2022 **(0x07E6)**	Not Assigned	W	-	-	-
402024	2023 **(0x07E7)**	Not Assigned	W	-	-	-
402025	2024 **(0x07E8)**	Not Assigned	W	-	-	-
402026	2025 **(0x07E9)**	Not Assigned	W	-	-	-
402027	2026 **(0x07EA)**	Not Assigned	W	-	-	-
402028	2027 **(0x07EB)**	Not Assigned	W	-	-	-

The following 28 registers of the Program contain the data for step 1 of the Program.

Modbus Address	Register Number	Parameter Description	Data *D Type	Range *E		*F Unit
				Low	High	
402029	2028 **(0x07EC)**	Step Time Hours	W	0	9999	-
402030	2029 **(0x07ED)**	Step Time Minutes/Seconds	W	*E6	*E6	-
402031	2030 **(0x07EE)**	System Events 1-16	W	*E7	*E7	-
402032	2031 **(0x07EF)**	System Events 17-32	W	*E8	*E8	-
402033	2032 **(0x07F0)**	Guaranteed Soak Events	W	*E9	*E9	-
402034	2033 **(0x07F1)**	Wait For Loop	W	*E10	*E10	-
402035	2034 **(0x07F2)**	Wait For Monitor	W	*E11	*E11	-
402036	2035 **(0x07F3)**	Wait For Digital Input	W	*E12	*E12	-
402037	2036 **(0x07F4)**	Wait For Loop/Monitor Setpoint	W	-3276.8	3276.7	-
402038	2037 **(0x07F5)**	Wait For Type/Jump Step	W	*E13	*E13	-
402039	2038 **(0x07F6)**	Jump Count	W	0	999	PV
402040	2039 **(0x07F7)**	Delta Control	W	*E14	*E14	-
402041	2040 **(0x07F8)**	Delta Setpoint	W	-3276.8	3276.7	-
402042	2041 **(0x07F9)**	Loop 1 Setpoint	W	-32768	32767	PV
402043	2042 **(0x07FA)**	Loop 2 Setpoint	W	-32768	32767	PV
402044	2043 **(0x07FB)**	Loop 3 Setpoint	W	-32768	32767	PV
402045	2044 **(0x07FC)**	Loop 4 Setpoint	W	-32768	32767	PV
402046	2045 **(0x07FD)**	Loop 5 Setpoint	W	-32768	32767	PV
402047	2046 **(0x07FE)**	Loop 6 Setpoint	W	-32768	32767	PV
402048	2047 **(0x07FF)**	Loop 7 Setpoint	W	-32768	32767	PV
402049	2048 **(0x0800)**	Loop 8 Setpoint	W	-32768	32767	PV
402050	2049 **(0x0801)**	Loop 9 Setpoint	W	-32768	32767	PV
402051	2050 **(0x0802)**	Loop 10 Setpoint	W	-32768	32767	PV
402052	2051 **(0x0803)**	Not Assigned	W	-	-	-
402053	2052 **(0x0804)**	Not Assigned	W	-	-	-
402054	2053 **(0x0805)**	Not Assigned	W	-	-	-
402055	2054 **(0x0806)**	Not Assigned	W	-	-	-
402056	2055 **(0x0807)**	Not Assigned	W	-	-	-

All remaining steps of the Program follow the same format and data structure as is represented for step one above. Up to the following 2744 registers are used to contain the additional step data of the Program as required for steps 2 through 99. Since few if any programs will contain the maximum of 99 steps, it is only necessary to write the step data for the number steps used in the Program.

Register Numbers:	*Modbus Addresses:*	
2056 (0x0808) – 2083 (0x0823)	402057 – 402084	Program Step 2 Data Registers
2084 (0x0824) – 2111 (0x083F)	402085 – 402112	Program Step 3 Data Registers
2112 (0x0840) – 2139 (0x085B)	402113 – 402140	Program Step 4 Data Registers
2140 (0x085C) – 2167 (0x0877)	402141 – 402168	Program Step 5 Data Registers
2168 (0x0878) – 2195 (0x0893)	402169 – 402196	Program Step 6 Data Registers
2196 (0x0894) – 2223 (0x08AF)	402197 – 402224	Program Step 7 Data Registers
2224 (0x08B0) – 2251 (0x08CB)	402225 – 402252	Program Step 8 Data Registers
2252 (0x08CC) – 2279 (0x08E7)	402253 – 402280	Program Step 9 Data Registers
Through		
4772 (0x12A4) – 4799 (0x12BF)	404773 – 404800	Program Step 99 Data Registers

Notes:

*D W Specifies writable data.

*E1

Parameter Value	Description
0	Autostart Off
1	Autostart by Date
2	Autostart by Day

*E2 See note *B10 in section A.1.2.1 for information on the range of this parameters.

*E3 See note *B11 in Section A.1.2.1 for information on the range of this parameters.

*E4 See note *B12 in Section A.1.2.1 for information on the range of this parameters.

*E5 These parameters contain data which represent up to ten ASCII characters in order to display the name of the currently loaded (or operating) program in the MCT.

See note *B9 in section A.1.2.1 for information on the range of these parameters.

*E6

Parameter Value	Range Low	Range High	Description
High Byte	0	59	Minutes
Low Byte	0	59	Seconds

*E7 See note *B5 in section A.1.2.1 for information on the range of this parameters.
*E8 See note *B6 in section A.1.2.1 for information on the range of this parameters.

*E9

Parameter Value	Description
Bit0	Guaranteed Soak **Loop 1
Bit1	Guaranteed Soak ***Loop 2
Bit2	Guaranteed Soak ***Loop 3
Bit3	Guaranteed Soak Loop 4
Bit4	Guaranteed Soak Loop 5
Bit5	Guaranteed Soak Loop 6
Bit6	Guaranteed Soak Loop 7
Bit7	Guaranteed Soak Loop 8
Bit8	Guaranteed Soak Loop 9
Bit9	Guaranteed Soak Loop 10
Bit10-15	Not Assigned

*E10

Parameter Value	Description
Bit0	Wait For **Loop 1
Bit1	Wait For ***Loop 2
Bit2	Wait For ***Loop 3
Bit3	Wait For Loop 4
Bit4	Wait For Loop 5
Bit5	Wait For Loop 6
Bit6	Wait For Loop 7
Bit7	Wait For Loop 8
Bit8	Wait For Loop 9
Bit9	Wait For Loop 10
Bit10-15	Not Assigned

*E11

Parameter Value	Description
Bit0	Wait For Monitor 1
Bit1	Wait For Monitor 2
Bit2	Wait For Monitor 3
Bit3	Wait For Monitor 4
Bit4	Wait For Monitor 5

Parameter Value	Description
Bit5	Wait For Monitor 6
Bit6	Wait For Monitor 7
Bit7	Wait For Monitor 8
Bit8	Wait For Monitor 9
Bit9	Wait For Monitor 10
Bit10	Wait For Monitor 11
Bit11	Wait For Monitor 12
Bit12	Wait For Monitor 13
Bit13	Wait For Monitor 14
Bit14	Wait For Monitor 15
Bit15	Not Assigned

*E12

Parameter Value	Description
Bit0	Wait For Digital Input 1
Bit1	Wait For Digital Input 2
Bit2	Wait For Digital Input 3
Bit3	Wait For Digital Input 4
Bit4	Wait For Digital Input 5
Bit5	Wait For Digital Input 6
Bit6	Wait For Digital Input 7
Bit7	Wait For Digital Input 8
Bit8	Wait For Digital Input 9
Bit9	Wait For Digital Input 10
Bit10	Wait For Digital Input 11
Bit11	Wait For Digital Input 12
Bit12	Wait For Digital Input 13
Bit13	Wait For Digital Input 14
Bit14	Wait For Digital Input 15
Bit15	Not Assigned

*E13

This parameter is split into upper and lower bytes. The high byte of the word is for setting the 'wait for' type while the lower byte contains the step number for jump step operation.

High Byte (0x**00**XX)

Parameter Value	Description
0	Auto
1	Wait for Rising
2	Wait for Falling

Low Byte (0xXX**00**)

Parameter Value	Description
1 - 99	Jump Step

***Important:** If the jump step is set to a value greater than the number of steps in the Program that was loaded, the MCT will jump to that step if the recycle count for the step is greater than zero, and attempt to execute that step based on the data contained in the step whether it is valid or not.*

*E14

Parameter Value	Description
Bit0	Enable Delta Control for **Loop 1
Bit1	Enable Delta Control for ***Loop 2
Bit2	Enable Delta Control for ***Loop 3
Bit3	Enable Delta Control for Loop 4
Bit4	Enable Delta Control for Loop 5
Bit5	Enable Delta Control for Loop 6
Bit6	Enable Delta Control for Loop 7
Bit7	Enable Delta Control for Loop 8
Bit8	Enable Delta Control for Loop 9
Bit9	Enable Delta Control for Loop 10
Bit10-15	Not Assigned

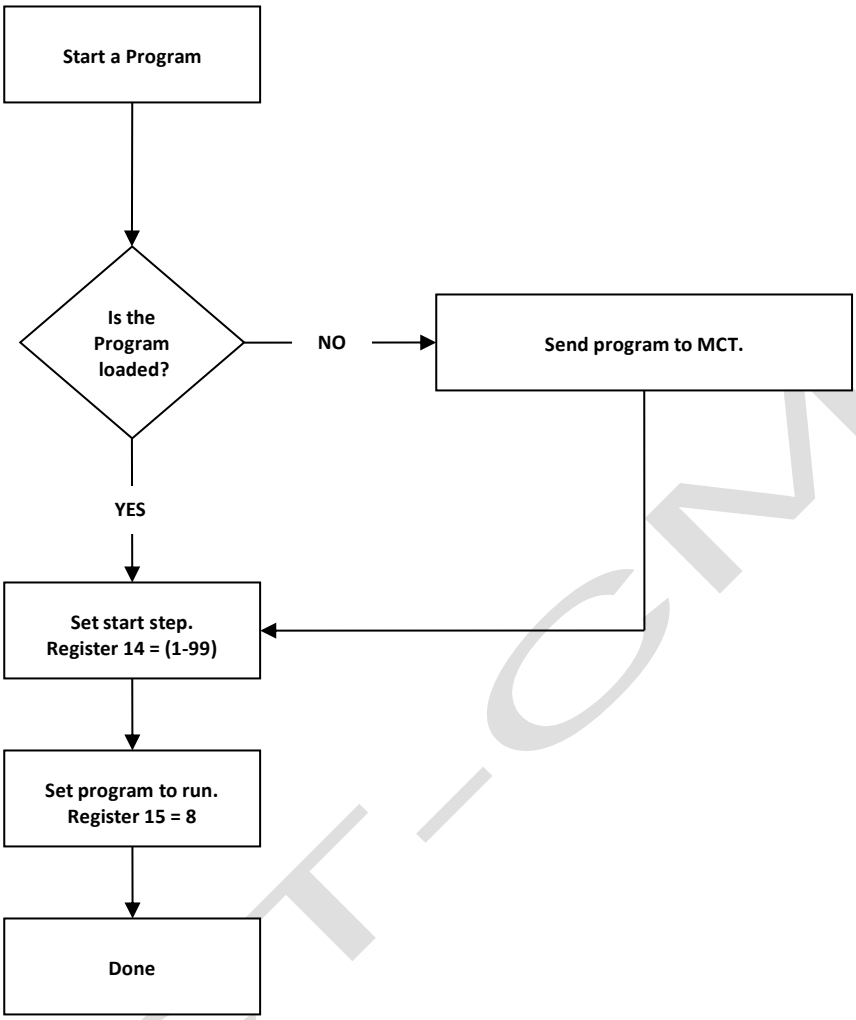
*F The unit PV means that the unit of the parameter is the same as the unit of PV (the loop/monitor input configuration).

Use caution when loading a program to the MCT. You must ensure that the decimal point scaling and units of measurement in the program match the loop setting. Loading a program with a temperature setpoint of 80 will result in a control temperature of 80°F if the MCT is in degrees Fahrenheit. However, if the MCT is set for degrees Centigrade, it will result in a control temperature of 80°C (176°F).

A.1.2.3 *Starting an Automatic Program*

Once a program has been downloaded to the MCT, two control parameters must be set in order to start the program. These are the program start step (14) and the program control (15) registers. The program start step register must first be set to the step number that the program is to start on. Note that this must be a value from 1 to the last step of the program.

Once this parameter has been set, the program can be started by setting the program control register to a value of eight (8). This will put the program into run mode, and it will begin operation on the step number designated in the program start step parameter. Note that once the program is started, the program start step register (14) will reset to zero. This forces you to set it each time you want to start a program. A program will not start unless this parameter is set. This ensures that each time a program is started; it is starting on the proper step number that you designate.



A.2 FTP, FileWeb, DataWeb Requirements/Installation

A.2.1 Introduction

The following describes the system requirements and components for the FDC Cloud service and website. The FDC cloud service provides the ability to upload data from FDC devices to cloud storage for backup and/or further analysis. The website provides the ability to verify data, uploads, and to manage users.

A.2.2 System Overview

There are four server components: the data transfer service (FDDataService), the website (FDDataWeb), the FTP server, and a MySQL database. FDDataService and FDDataWeb are Microsoft .Net services and use Microsoft Internet Information Services (IIS) as a web platform. The MySQL (Can be SQL, Oracle, etc.) database stores user configuration information as well as providing cloud data storage if desired.

A.2.3 System Requirements

A Microsoft Windows server is required, with the following minimum capabilities:

- Windows Server 2008 or greater

- 2 GB RAM or greater
- 2 Cores or greater
- 40GB Storage or greater (this will vary depending on the user's expected uploads)
- .Net framework version 4.5 or greater
- MySQL 5.6 or greater

The server should be setup to provide the web server role.

A.2.4 FDC Cloud "Server" Services

Future Design Controls does not provide direct support or hosting services; however, third party support is available from our partner ***Mooseworks Software*** which can provide:

1. Complete site and installation without hosting charges (includes FDC site with custom banner, site setup, all code/data model definitions and manual). User provides the server and hosting credentials including domain name and https certificate.
2. Purchase of #1 above with hosting using Amazon Web Services (AWS). AWS T2 small server with 30GB storage. User provides the domain name and https certificate. Support cost on a yearly basis.
3. Purchase of #1 above with no hosting but support of client server at customer facility or customer selected location. Support cost on a yearly basis for web service and application.
4. DIY documentation – interface/data model definitions and server setup directions. DIY experience recommendations include installation and configuration of web servers, web services, SQL language and HTML/.NET code. Support packages for DIY documentation can be purchased in 5-, 10- and 25-hour increments.
    - Custom development services:
    - Fixed pricing available for well-defined systems.
    - Time and material options available for less defined, continuous engagements.

A.3 Touch Screen Interface Specifications

Technical Specifications

Description	HMI 4.3"	HMI 7" (high performance)
Size	4.3"	7"
Resolution (W X H in pixels)	480 x 272	800 x 480
Display type	TFT, Wide touch Screen	
Colors	65,536	
Touch screen Type	Resistive analog	
Active display area (W X H mm)	95 X 54	152 X 91
MTBF back light at 25 0C	30,000 hrs	50,000 hrs
Backlight	LED	
Brightness Adjustment	Yes	
Screen Saver	Yes	
Language Fonts	Yes	

Main Hardware

Description	HMI 4.3”	HMI 7” (high performance)
Processor, CPU speed	ARM Cortex-A8, 1GHz	
Flash Memory (ROM)	128 MB	
SDRAM(RAM)	256 MB	
Operating system	WinCE 6.0	
Real Time Clock	Yes	
Buzzer	Yes	
SD card slot	Yes	

Communication Ports/Interfaces

Description	HMI 4.3”	HMI 7” (high performance)
RS232C, DB9 Male	1	
RS232C/ RS422/ RS485, DB25 Female	1	
Ethernet 10/100 Mbps, RJ45	1	
USB Host	1	

General Specifications

Description	HMI 4.3”	HMI 7” (high performance)
Rated Voltage	24 VDC	24 VDC, 110/220VAC
Power supply	11-36VDC	11-36VDC, 90-250VAC
Rated Current	0.91A (DC)	1.18A (DC), 0.29A (AC)
Power Consumption	10 W	13W
Power on LED indicator	Yes	
Outer dimensions (W X H X D mm)	140 X 116 X 57	212 X 156 X 57
Mounting depth (mm)	51	
Panel cutout (W X H mm)	123^{+1} X 99^{+1}	197^{+1} X 141^{+1}
Protection	IP65 front, IP20 rear	
Front bezel, housing	Plastic, plastic	Aluminum, plastic
Installation	Panel Mount	
Net Weight (Kg)	0.5	1.4

Standards, Certificates and Approvals

Description	Details
UL approval	UL 508 and CSA C22.2 No.142
Low Voltage Directive	2006/95/EC
EMC Directive	2004/108/EC
Requirements for Emission	EN 61000-6-4 :2007
Requirements for Interference Immunity	EN 61000-6-2 :2005
Tick mark for Australia	AS/NZS CISPR 11:2004
FCC	FCC Part 15, Subpart B, Class A

NOTE: *The table above shows the approvals that may be available.*

Base Standards for EMC & Safety

Description	Details
Electrostatic discharge	IEC 61000-4-2: 2008
Radiated radio-frequency electromagnetic fields	IEC 61000-4-3: 2006 + A1:2007 + A2:2010
Electrical fast transient/burst	IEC 61000-4-4: 2004 + A1: 2010
Surge	IEC 61000-4-5: 2005
Conducted disturbances induced by radio-frequency fields	IEC 61000-4-6: 2008
Power frequency magnetic field	IEC 61000-4-8: 2009
Voltage dips, short interruptions and voltage variations	IEC 61000-4-11: 2004
Emission from Electromagnetic fields	CISPR 11:2009 + A1:2010 Class A
Harmonics Current	IEC61000-3-2:2005 + A1:2008 + A2:2009
Voltage Fluctuation and Flicks	IEC61000-3-3:2008
Requirements for Safety	EN61010-1:2001

Protective class

Description	Details
Standard enclosures	IP 65 (Front), IP20 housing and terminals

Operating conditions

Description	Details
Temperature	0C to + 50C
Relative Humidity	10% to 90%, no condensation
Altitude	2000 meters maximum
Pollution	Degree 2
Sinusoidal vibration conforming to IEC 60068-2-6	10 to 58Hz: 0.75mm amplitude 58 to 150Hz: 1g 1oct/min. 10 sweeps
Shock conforming to IEC 60068-2-29	3 shocks per direction 11ms 10g

NOTE: *In temperatures below 0°C, the response time of liquid crystal display becomes slower, and color of the display will be darker than normal. Do not operate HMI in ambient temperature less than 0°C.*

LCD specifications

Description	Details
Touch operations	1,000,000 times using R 0.8 Polyacetal stylus with force 250g
Vibration test	10-55 Hz, Stroke: 1.5mm, 2 hrs. for each direction of X, Y, Z
Shock test	100 G, 6 ms, +/- X, +/- Y, +/- Z, 3 times for each direction
Typical viewing angle	Vertical (up/down), 50° / 70° Horizontal (left/right), 70° / 70°

Description	Details
Temperature	-20C to + 60C
Relative Humidity	10% to 90%, no condensation
Altitude	2000 meters maximum
Sinusoidal vibration conforming to IEC 60068-2-6	5 to 10 Hz: 3.5 mm amplitude 10 to 150 Hz: 2g 1oct/min. 40 sweeps
Shock conforming to IEC 60068-2-29	3 shocks per direction 11ms 15g

WARNING*: **Cancer and Reproductive Harm:** This warning is intended to address certain Prop 65 chemicals that may be found in Future Design Controls products. These products can expose you to chemicals including lead and lead compounds which are known to the State of California to cause cancer, birth defects or other reproductive harm.*

A.4 Control Module Specifications

Main CPU

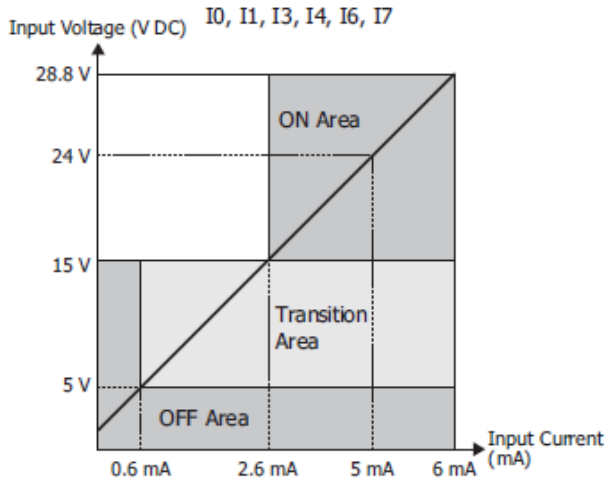
Type No.		**FC6A-D16R1CEE, FC6A-D16P1CEE**	
Rated Power Voltage		24V DC	
Voltage Fluctuation Range		20.4 to 28.8V DC (including ripple)	
Maximum Power Consumption		**Standalone**	**When Maximum Load is Connected**
	FC6A-D16R1CEE	2.88 W (24V DC)	18.24 W (24V DC)
	FC6A-D16P1CEE	2.88 W (24V DC)	18.24 W (24V DC)
Allowable Momentary Power Interruption		10 ms or longer (when rated power supply voltage)	
Withstand Voltage		Between power and FE terminals: 500V AC, 1 minute	
		Between input and FE terminals: 500V AC, 1 minute	
		Between transistor output and FE terminals: 500V AC, 1 minute	
		Between relay output and FE terminals: 2,300V AC, 1 minute	
		Between power and input terminals: 500V AC, 1 minute	
		Between power and transistor output terminals: 500V AC, 1 minute	
		Between power and relay output terminals: 2,300V AC, 1 minute	
		Between input and transistor output terminals: 500V AC, 1 minute	
		Between input and relay output terminals: 2,300V AC, 1 minute	
Insulation Resistance		Between power and FE terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
		Between input and FE terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
		Between transistor output and FE terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
		Between relay output and FE terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
		Between power and input terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
		Between power and transistor output terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
		Between power and relay output terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
		Between input and transistor output terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
		Between input and relay output terminals: 100 MΩ or higher (500V DC insulation resistance tester)	
Inrush Current		35 A maximum	
Isolation		Between power terminal and internal circuit: Transformer isolated	
Ground		D-type ground (Class 3 ground)	
Effect of Improper Power Supply Connection		Reverse polarity: Normal operation	
		Improper voltage or frequency: Permanent damage may be caused	
		Improper lead connection: Permanent damage may be caused	
Weight	**FC6A-D16R1CEE**	290 g	
	FC6A-D16P1CEE	275 g	

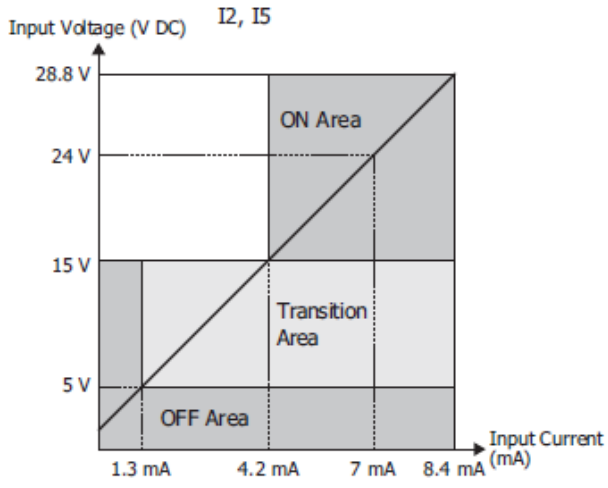
DC Input Specifications

Rated Input Voltage			24V DC shared sink/source
Input Voltage Range			20.4 to 28.8V DC
Rated Input Current		**I0, I1, I3, I4, I6, I7**	5 mA/point (at 24V DC)
		I2, I5	7 mA/point (at 24V DC)
Input Impedance		**I0, I1, I3, I4, I6, I7**	4.9 kΩ
		I2, I5	3.4 kΩ
Input Delay Time	**Turn ON Time**	**I0, I1, I3, I4, I6, I7**	5 µs + software filter setting
		I2, I5	35 µs + software filter setting
	Turn OFF Time	**I0, I1, I3, I4, I6, I7**	5 µs + software filter setting
		I2, I5	35 µs + software filter setting
Quantity of Inputs			8 points in 1 common line
Isolation		**Between Input Terminals**	Not isolated
		Internal circuit	Photocoupler isolated
Input Type			Type1 (IEC61131-2)
External Load for I/O Interconnection			Not needed
Signal Determination Method			Static
Effect of Improper Input Connection			Even if wiring for sink or source connection is incorrect, no damages are caused. However, if high voltage is applied that exceeds the input voltage range, there is a risk of permanent damage.

Operating Ranges

The operating range of Type 1 (IEC 61131-2) DC input is as follows.



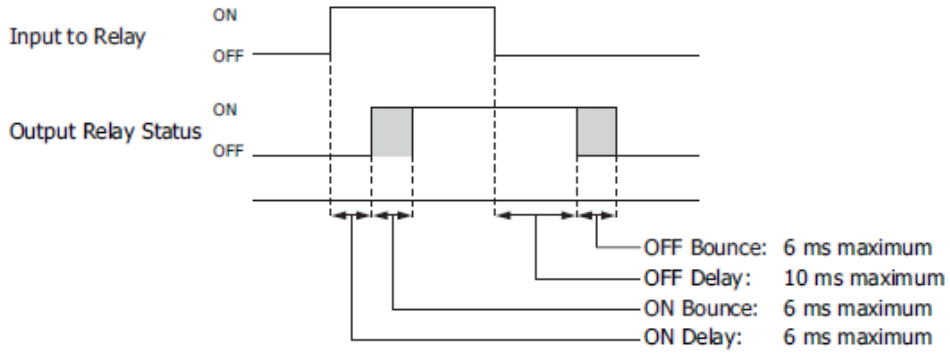


Relay Output Specifications

Type No.		FC6A-D16R1CEE
No. of Outputs		8
Output Points per Common Line	COM1	4
	COM2	4
Output Type		1a contact
Maximum Load Current *1	1	2 A maximum
	1 Common	7 A maximum
Minimum Switching Load		0.1 mA/0.1V DC (reference value)
Initial Contact Resistance		30 mΩ or lower
Electrical Life		100,000 operations minimum (rated load 1,800 operations/hour)
Mechanical Life		20,000,000 operations minimum (no load 18,000 operations/hour)
Rated Load *1		240V AC 2 A, 30V DC 2 A
Withstand Voltage	Between Output Terminal and FE	2,300V AC, 1 minute
	Between Output Terminal and Internal Circuit	2,300V AC, 1 minute
	Between Output Terminals (COMs)	2,300V AC, 1 minute
I/O Terminal Connector	Insertion/Removal Durability	100 times minimum

*1 Values for resistive/inductive load.

Output Delay



Transistor Protection Source Output Specifications

Type No.		FC6A-D16P1CEE
Output Points		8
Output Points per Common Line		8
Rated Load Voltage		24V DC
Operating Load Voltage Range		20.4 to 28.8V DC
Maximum Load Current	1	0.5 A maximum
	1 Common	4 A maximum
Voltage Drop (ON Voltage)		1 V or less, voltage between COM and output terminal when ON
Maximum Inrush Current		1 A
Leakage Current		0.1 mA maximum
Clamping Voltage		39 V±1 V
Maximum Lamp Load		12 W
Inductive Load		L/R = 10 ms (28.8V DC, 1 Hz)
External Current Draw		100 mA maximum, 24V DC (-V terminal supply power)
Output Protection Functions		Overcurrent protection function (not a thermal shutdown function). Overcurrent detected with 4 outputs as 1 group. (Group 1: Q0 to Q3, Group 2: Q4 to Q7) When overcurrent is detected, the 4 outputs in the corresponding group are turned off for a fixed period (1 s). When overcurrent is detected, a special internal relay turns on (M8172 to M8175) and the error LED [ERR] turns on.
Output Current Limit Value		1.0 to 2.0 A
Isolation	Between Output Terminal and Internal Circuit	Photocoupler isolated
	Between Output Terminals	Not isolated
I/O Terminal Connector	Insertion/Removal Durability	100 times minimum
Output Delay	Turn ON Time	Q0 to Q7: 5 µs or less
	Turn OFF Time	Q0 to Q7: 5 µs or less

Analog I/O Card

External Power	**Power Supply Voltage**		24V DC
	Allowed Fluctuation Range		20.4 to 28.8V DC
Connector Module	**Insertion/Removal Durability**		100 times minimum
Internal Current Draw	**5V DC**		60 mA
	24V DC		0 mA
Module Internal Power Consumption: All Points ON, Calculated at 24V DC			0.37 W
Module External Power Supply Current Draw*1			80 mA (24V DC)
Input Type and Input Range	**Voltage**		0 to 10 V -10 to 10 V
	Current		4 to 20 mA 0 to 20 mA
Input Impedance	**Voltage**		1 MΩ or higher
	Current		50 Ω or lower
AD Conversion	**Sampling Time**		10 ms, 100 ms, or 104 ms
	Sampling Repetition Time		Sampling time × Number of enabled input channels
	Total Input Delay Time*1		Sampling time + Sampling repetition time + 1 scan time
	Type of Input		Single-ended
	Operation Mode		Self-scan
	Conversion Method		ΣΔ type ADC
Input Error	**Maximum Error at 25°C**		±0.1% of full scale
	Temperature Coefficient		0.006% of full scale/°C
Data	**Digital Resolution**	**Voltage**	65,536 (16 bits)
		Current	65,536 (16 bits)
	Input Value per Step	**Voltage**	0.15 mV (0 to 10 V) -0.30 mV (-10 to +10 V)
		Current	0.30 µA (0 to 20 mA) 0.244 µA (4 to 20 mA)
	Monotonicity		Yes
	Input Data Out of Range		Detectable
Noise Resistance	**Maximum Temporary Deviation during Electrical Noise Tests**		±4% or less of full scale
	Input Filter		Yes
	Recommended Cable for Noise Immunity		Current/voltage: Pair shielded cable Other: Pair cable
	Crosstalk		1 LSB or lower
Isolation	**Between Input and Power Circuit**		Transformer isolated
	Between Input and Internal Circuit		Photocoupler isolated
Effect of Improper Input Connection			No damage
Maximum Permanent Allowed Overload (No Damage)			13V DC, 40 mA or lower
Selection of Input Type and Input Range			Using programming software
Calibration or Verification to Maintain Rated Accuracy			Not possible

*1 The value when the input is not open and the output is 100% output.

■ Analog Output Specifications

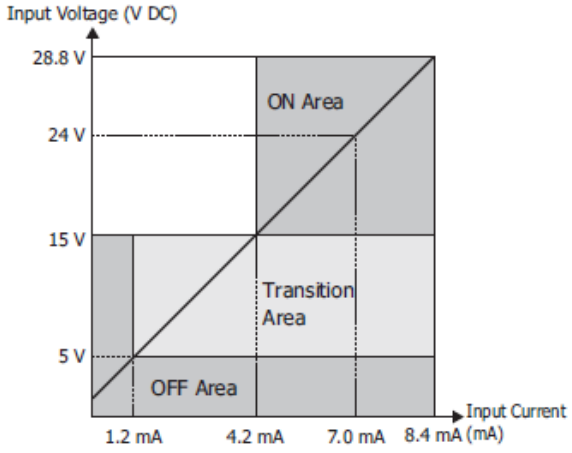
		Voltage	Current
Output Type and Output Range		0 to 10 V -10 to 10 V	4 to 20 mA 0 to 20 mA
Load	Impedance	1 kΩ or higher	300 Ω or lower
	Load Type	Resistive load	
DA Conversion	DA Conversion Time	1 ms	
	Output Update Interval	1 ms	
	Total Output System Transfer Time	DA conversion time + Output Update Interval + 1 scan time	
Output Error	Maximum Error	±0.1% of full scale	
	Output Ripple	1 LSB or lower	
	Overshoot	0%	
Data	Digital Resolution	4,096 steps (12 bits)	
	Input Value per Step	2.44 mV (2 to 10 V) 3.91 µA (4 to 20 mA)	
	Monotonicity	Yes	
	Current Loop Open	Not detectable	
Noise Resistance	Maximum Temporary Deviation during Electrical Noise Tests	±4% or less of full scale	
	Recommended Cable for Noise Immunity	Current/voltage: Pair shielded cable Other: Pair cable	
	Crosstalk	1 LSB	
Isolation	Between Output and Power Circuit	Transformer isolated	
	Between Output and Internal Circuit	Photocoupler isolated	
Effect of Improper Output Connection		No damage	
Calibration or Verification to Maintain Rated Accuracy		Not possible	

■ DC Input Module Specifications

Type No.		FC6A-N08B1
Rated Input Voltage		24V DC shared sink/source
Operating Load Voltage Range		0.0 to 28.8V DC
Rated Input Current		7 mA/point (at 24V DC)
Input Points		8 (8 points in 1 common line)
Input Impedance		3.4 kΩ
Input Delay Time (24V DC)	Turn ON Time	4.1 ms
	Turn OFF Time	4.1 ms
Isolation	Between Channels	Not isolated
	Internal Circuit	Photocoupler isolated
External Load for I/O Interconnection		Not needed
Signal Determination Method		Static
Effect of Improper Input Connection		Even if wiring for sink or source connection is incorrect, no damages are caused. If any input exceeding the rated value is applied, permanent damage may be caused.
Cable Length		3 m
Connector	Insertion/ Removal Durability	100 times minimum
Internal Current Draw	All Points ON	30 mA (5V DC) 0 mA (24V DC)
	All Points OFF	17 mA (5V DC) 0 mA (24V DC)
Module Internal Power Consumption: All Points ON, Calculated at 24V DC		0.20 W
Weight		Approx. 110 g

Operating Ranges

The operating range of Type 1 (IEC 61131-2) DC input modules is as follows.

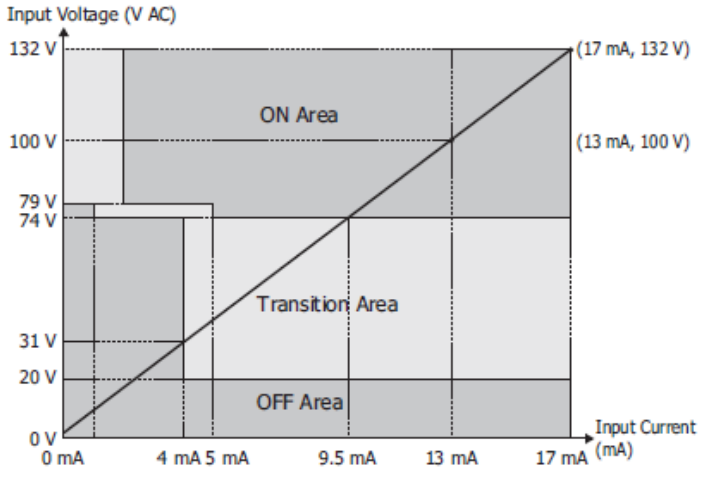


■ AC Input Module Specifications

Type No.		FC6A-N08A11
Rated Input Voltage		100 to 120V AC
Operating Load Voltage Range		0 to 132V AC
Rated Power Frequency		50/60 Hz
Rated Input Current		15 mA/1 point (at 120V AC, 50/60 Hz)
Input Points		8 points in 2 common lines
Terminal Arrangement		See 2-64
Input Type		AC input Type 1, 2 (IEC 61131-2)
Input Impedance		0.8 kΩ (at 60 Hz)
Input Delay Time	Turn ON Time	25 ms
	Turn OFF Time	30 ms
Isolation	In the Same Common Channel	Not isolated
	In Different Common Channels	Isolated
	Between Input and Internal Circuit	Photocoupler isolated
External Load for I/O Interconnection		Not needed
Signal Determination Method		Static
Effect of Improper Input Connection		If high voltage is applied that exceeds the input voltage range, there is a risk of permanent damage.
Connector	Insertion/Removal Durability	100 times minimum
Internal Current Draw	All Points ON	40 mA (5V DC) 0 mA (24V DC)
	All Points OFF	17 mA (5V DC) 0 mA (24V DC)
Module Internal Power Consumption: All Points ON, Calculated at 24V DC		0.27 W
Weight		Approx. 110 g

Operating Ranges

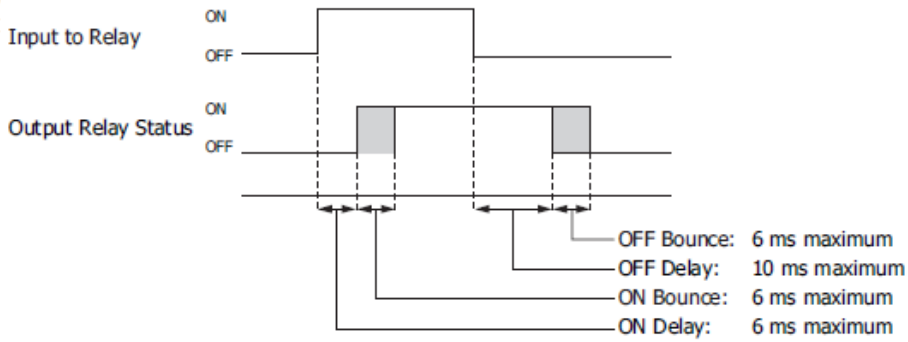
The operating range of Type 1 and 2 (IEC 61131-2) AC input modules is as follows.



■ Relay Output Module Specifications

Type No.		FC6A-R081	FC6A-R161
No. of Outputs		8 (4 points in 1 common line)	16 (8 points in 1 common line)
Output Type		1a contact	
Load Current	1	2 A maximum	
	1 Common	7 A maximum	8 A maximum
Minimum Switching Load		1.0 mA/5.0V DC (reference value)	
Initial Contact Resistance		30 mΩ or lower	
Electrical Life		100,000 operations minimum (rated load 1,800 operations/hour)	
Mechanical Life		20,000,000 operations minimum (no load 18,000 operations/hour)	
Rated Load		240V AC 2 A (resistive load, cosφ=0.4 inductive load)	
		30V DC 2 A (resistive load, L/R=7 ms inductive load)	
Withstand Voltage	Between Output Terminal and FE	2,300V AC 1 minute	
	Between Output Terminal and Internal Circuit	2,300V AC 1 minute	
	Between Output Terminals (COMs)	2,300V AC 1 minute	
Connector	Insertion/Removal Durability	100 times minimum	100 times minimum
Module Internal Current Draw	All Points ON	35 mA (5V DC) 50 mA (24V DC)	50 mA (5V DC) 100 mA (24V DC)
	All Points OFF	17 mA (5V DC) 0 mA (24V DC)	17 mA (5V DC) 0 mA (24V DC)
Module Internal Power Consumption : All Points ON, Calculated at 24V DC		1.44 W	2.74 W
Weight		Approx. 130 g	Approx. 140 g

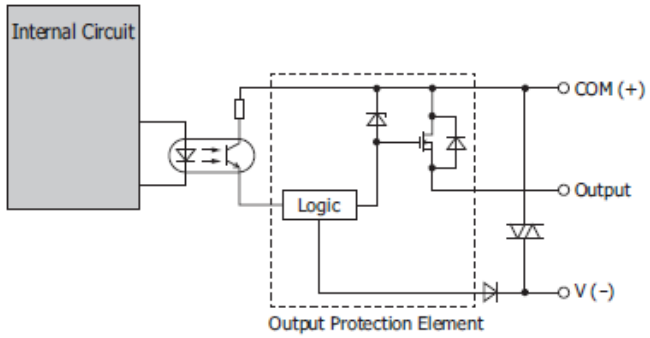
Output Delay



■ Transistor Protection Source Output Module Specifications

Type No.		FC6A-T08P1	FC6A-T16P1
Output Signal		Transistor protection source output	
Rated Load Voltage		24V DC	
Operating Load Voltage Range		20.4 to 28.8V DC	
No. of Outputs		8 (8 points in 1 common line)	16 (16 points in 1 common line)
Rated Load		0.5 A 1 point	
Output Current Limit Range		1.01 to 2.6 A	
Voltage Drop (ON Voltage)		0.4 V or less, voltage between COM and output terminal when ON	
Allowed Inrush Current		1 A maximum	
Leakage Current		0.1 mA maximum	
Clamping Voltage		41 to 52 V	
Lamp Load		12 W maximum	
Inductive Load		L/R = 10 ms (28.8V DC, 1 Hz)	
Protection Operation		Temporarily protected by element heat generation, automatic recovery. (There is no function that detects the protection error.)	
External Current Draw		100 mA maximum, 24V DC (-V terminal supply power)	
Isolation	Between Output Terminal and Internal Circuit	Photocoupler isolated	
	Between Output Terminals	Not isolated	
Connector	Insertion/Removal Durability	100 times minimum	
Module Internal Current Draw	All points ON	25 mA (5V DC) 15 mA (24V DC)	30 mA (5V DC) 25 mA (24V DC)
	All points OFF	17 mA (5V DC) 0 mA (24V DC)	
Module Internal Power Consumption : All Points ON, Calculated at 24V DC		0.53 W	0.80 W
Output Delay	Turn ON Time	450 µs or lower	
	Turn OFF Time	450 µs or lower	
Weight		Approx. 110 g	Approx. 105 g

Output Internal Circuit



Dual Communications Card

■ FC6A-SIF52

Connector	**Insertion/Removal Durability**	100 times minimum
Internal Current Draw	**5V DC**	35 mA
	24V DC	35 mA

■ Communication Specifications

Points		2
Electrical Characteristics		EIA RS-232C/EIA RS-485
Maximum Communication Speed		115,200 bps
Modbus Master		Yes
Modbus Slave		Yes
Maximum Cable Length		15 m (RS232C)/1,200 m (RS485)
Isolation between Internal Circuit	**Between Communication Port and Internal Circuit**	Photocoupler isolation
	Between Ports	Transformer isolation
Cable	**Recommended Cable**	RS-232C: 24 AWG shielded multicore cable RS-485: 24 AWG twisted-pair shielded cable

Barcode and Remote Display Communication Cartridges

Type No.	**FC6A-PC1**	**FC6A-PC3**
Rated Power Voltage	5.0 V, 3.3 V (supplied from module)	5.0 V, 3.3 V (supplied from module)
Current Draw	5.0 V: Max 23 mA 3.3 V: Max 6 mA	5.0 V: Max 23 mA 3.3 V: Max 6 mA
Weight	15 g	15 g

■ Communication Specifications

Type No.		**FC6A-PC1**	**FC6A-PC3**
Electrical Characteristics		EIA RS232C	EIA RS485
Maximum Communication Speed		115,200 bps	115,200 bps
User Communication		Yes	Yes
Modbus Slave		Yes	Yes
Maximum Cable Length		5 m	200 m
Isolation between Internal Circuit		Not isolated	Not isolated
Cable	**Recommended Cable**	Shielded multicore cable: 24 AWG	Shielded twisted-pair cable: 24 AWG

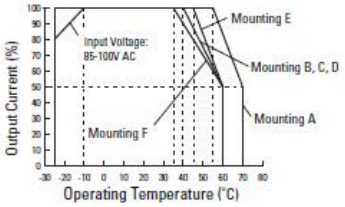
⚠ Caution When connecting cables to the communication cartridges, the tightening torque is 0.22 to 0.25 Nm.
Recommended screwdriver: SZS 0.4×2.5 (Phoenix Contact)

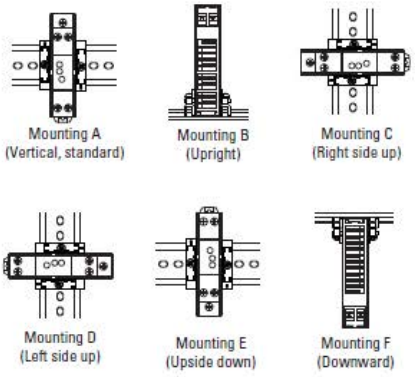
A.5 Power Supply Specifications

Model			24V DC output	PS5R-VD24
Output Capacity				60W
Input	Rated Input Voltage (Single-phase two-wire)[1]			100 to 240V AC (Voltage range: 85 to 264V AC/100 to 370V DC) (Load ≤ 80% at 100-105V DC)
	Frequency			50/60 Hz
	Input Current (Typ.)		100V AC	1.3A
			230V AC	0.8A
	Inrush Current (Typ.) (Ta=25°C, cold start)		100V AC	18A
			230V AC	45A
	Leakage Current		120V AC	0.5mA max.
			230V AC	1.0mA max.
	Efficiency (Typ.) (at rated output)[2]		100V AC	86%
			230V AC	86%
	Power Factor (Typ.)		100V AC	—
			230V AC	—
Output	Rated Voltage/Current			24V/2.5A
	Adjustable Voltage Range			±10%
	Output Holding Time (Typ.) (at rated output)		100V AC	13ms
			230V AC	105ms
	Start Time (at rated input and output)			800ms max.
	Rise Time (at rated input and output)			200ms max.
	Regulation	Input Fluctuation		0.4% max.
		Load Fluctuation		1.0% max.
		Temperature Change		0.05%/°C max. (-10 to +55°C)
		Ripple (including noise)		4% p-p max. (-25 to -10°C)
				1.5% p-p max. (-10 to +0°C)
				1% p-p max. (0 to +55°C)
Overcurrent Protection				105% min. (auto reset)
Operation Indicator				LED (green)
Dielectric Strength	Between input and output terminals			3,000V AC, 1 minute
	Between input and ground terminals			2,000V AC, 1 minute
	Between output and ground terminals			500V AC, 1 minute
Insulation Resistance				Between input and output terminals: 100MΩ min. (500V DC megger)
Operating Temperature[4] (No freezing)				-25 to +70°C
Operating Humidity (no condensation)				20 to 90% RH
Storage Temperature (No freezing)				-25 to +75°C
Storage Humidity (no condensation)				20 to 90% RH
Vibration Resistance				10 to 55Hz, amplitude 0.33mm, 2 hours each in 3 axes (when used with BNL6 end clips) 10 to 55Hz, amplitude 0.375mm, 2 hours each in 3 axes (when used with BNL8 end clips)
Shock Resistance				300 m/s² (30G), 3 times each in 6 directions
Expected Life[5]				8 years minimum (at the rated input, 50% load, operating temperature +40°C, standard mounting direction)
EMC	EMI			EN61204-3 (Class B)
	EMS			EN61204-3 (industrial)
Safety Standards				UL508 (Listing), UL1310 Class 2, ANSI/ISA-12.12.01 CSA C22.2 No. 107.1, 213, 223 EN60950-1, EN50178
Other Standard				SEMI F47 (at 208V AC input only)
Degree of Protection				IP20 (EN60529)
Dimensions (mm)				95H × 36W × 108D
Weight (approx.)				260g
Terminal Screw				M3.5

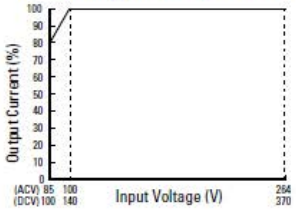
*At normal temperature and humidity unless otherwise specified.
Note 1: DC input voltage is not subject to safety standards. When using on DC input, connect a fuse to the input terminal for DC input protection.
Note 2: Under stable state.
Note 3: PS5R-VB05 (5V DC/2.0A) is 10W (Up to 3.0A at Ta = 0 to 40°C. Not subject to safety standards above 2.0A.)
Note 4: See the output derating curves.
Note 5: Calculation of the expected life is based on the actual life of the aluminum electrolytic capacitor. The expected life depends on operating conditions.

Operating Temperature vs. Output Current (Derating Curves)

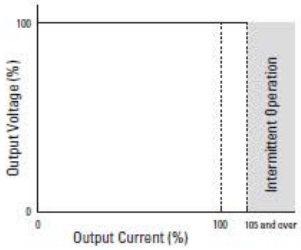




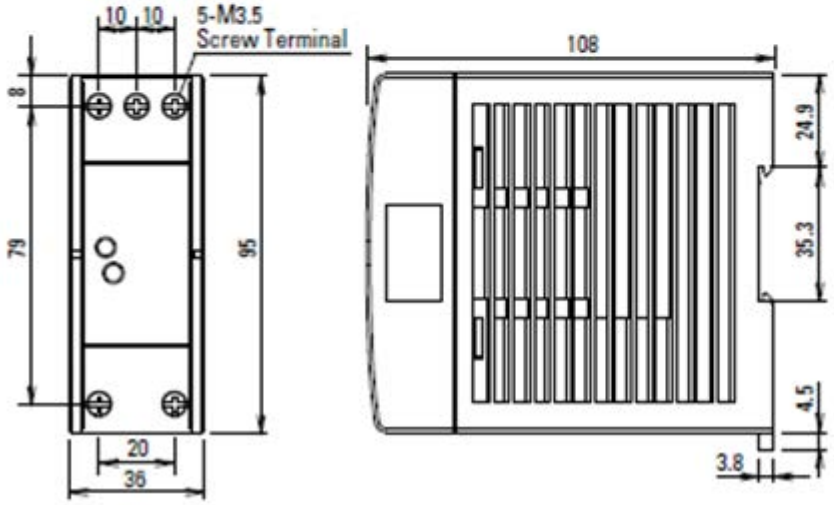
Input Voltage vs. Output Current



Overcurrent Protection Characteristics



Marking	Name	Description
L, N	AC Input Terminal	Voltage range: 85 to 264V AC/100 to 370V DC
⏚	Ground Terminal	Be sure to connect this terminal to a proper ground.
+V, -V	DC Output Terminals	+V: Positive output terminal -V: Negative output terminal
VR.ADJ	Output Voltage Adjustment	Allows adjustment within ±10%. (VE = ±5%) Turning clockwise increases the output voltage. Turning counterclockwise decreases the output voltage.
DC ON	Operation Indicator (green)	Illuminates when the output voltage is on.



A.6 Support and Warranty Information

SOFTWARE VERSIONS FOR FDC MCT-CM Control System

The software version levels for the MCT Control system can be viewed in the offline system setup, from the System menu; select 'About'. Both the HMI (Human Machine Interface – color touch screen) and Control Module (Idec PLC) firmware and software versions will be displayed.

When obtaining replacement parts or to get assistance for setup and/or troubleshooting purposes, it is important to have this information available to ensure that your request is processed properly and in a timely manner. It is recommended that this information be written down and kept in a readily accessible location along with this manual, so that it is available when required.

CE Net Version: _____
CM Firmware Version: _____
HMI Version: _____
CM Program Version: _____
CE Image Version: _____
CE BSP Version: _____

The CE Net version of the HMI, and firmware versions of the Control Module and FDC loop control of the MCT control system are proprietary and only available directly from Future Design Controls.

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Future Design Controls reserves the right to make changes without notification to purchaser to materials or processing that do not affect compliance with any applicable specifications.

FAN MOTOR(S)

Evaporator Fan motors

Darwin Chamber uses various style evaporator fan motors. On model sizes 030, 055 and 084 an energy saving centrifugal fan module is used. These size chambers move air from right to left when facing the chamber doors. A plenum is used on the right side of the chamber. On 084 a plenum can be found on both side walls. Whereas the supply still originates on the right-side plenum.

Models 03, 011, and 034 and custom models will typically use an axial style fan motor. These units will flow air from the front of the chamber down the back wall through the condition space. Multiple fans may be utilized.

Thermoelectric series chambers will have the evaporator fan disabled during a high alarm. Thermoelectrics do not have substantial heat removal capabilities. Therefore, they are disabled in high alarm as they have likely failed. This will prevent the chamber form heating too much to save the product load.

Refrigerated series will have the evaporator fan on all the time with couple exceptions. Refrigerated series chamber will disable fans during a defrost. When the defrost is complete the evaporator fan may either be on a time delay (FZ and TH Series) or enabled when evaporator coil has reached a certain temperature. (FS

Series) the fan may be controlled by a on delay relay or the second stage on a two stage Dwyer controller. Door opening on freezer model chambers will also disable the evaporator fan. This is to help keep as much of the cooled air in the chamber while door is open. Door opening should be kept to a minimum on freezers.

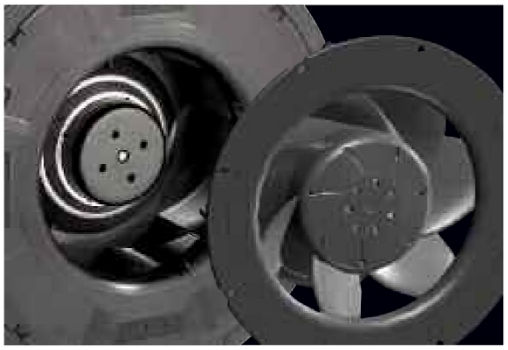
Evaporator fan motors should be inspected on a regular basis for debris build up, leaking of oil, and/or abnormal noises or vibrations. Chambers with humidity will be susceptible to mineral build up on the fans. Chambers with humidity should be inspected more regularly and water quality inspection.

Condenser Fan Motor

Condenser fan motors use axial style fan motors. Condenser fan motors will be mounted on the condensing coil. At initial start up the fan motor will blow air through coil. Then reverse direction and pull air into the coil. This is to clear and remove any dust that may have accumulated on the coil. Air will be pulled in through the coil during normal operation. Direction of flow relative to the chamber may vary by model size. Air flow will either be left to right or front to back. Direction of air flow should be noted when setting up multiple chambers. Air from one condensing unit could inhibit the performance of another condensing unit down wind.

Condensing fan motors should be inspected on a regular basis for debris build up, leaking of oil, and/or abnormal noises or vibrations.

Centrifugal Fan motor



Axial Fan motor

Figure 219

HUMIDITY CONTROLLER OPERATION (OPTIONAL)

Darwin Chambers Co. achieves precise humidity control using the PID Controller coupled with the Humidity Sensor. Together, the controller and RH Sensor simultaneously measures the %RH within the chamber and calculates the humidifier output that is required to ensure accurate, consistent, and stable control of the chamber's humidity.

Changing the humidity/%RH

To change the set value of the humidity, refer to the controller manual section for set point adjustment. Once the SV has been set, allow the chamber's process value (PV) to reach the SV and stabilize before performing any testing or auto tuning of the controls.

Humidity Alarms

The humidity controller utilizes three different alarms. The humidity controller has a high alarm, a low alarm, and an alarm that is used to activate/deactivate the optional dehumidification

EXAMPLE: *A humidity controller with deviation alarms set at ±5.0% is set to control at 60.0% RH. In this configuration, High Alarm would be equivalent to 60.0% + 5.0% or 65.0% RH. Low Alarm would equal 60.0% - 5.0% or 55.0% RH. With the alarms set at these values, High Alarm will go into alarm if the humidity level reaches 65.0% RH. If the humidity level goes below 55.0% RH, Low Alarm will go into alarm.*

By default, on the %RH controller, the Dehumidification alarm parameter is utilized to send 24 Volts AC to the dryer terminations on the chamber. If a chamber has been factory configured for the optional MG90 or a similar dehumidifier (designated by a DD15 or a DD within the model number), then the Dehumidification Alarm parameters are utilized to create continuity on the dryer circuit through the dryer terminations. Typically, Dehumidification Alarm on the humidity controller is set as a high deviation alarm.

EXAMPLE: *If a chamber has been controlling at 40.0ºC and 75.0% RH and is then set to control at 40.0ºC and 60.0% RH, the dehumidification Alarm would be triggered due to the humidity being greater than 1.0% higher than the set value (SV).*

To change the factory preset alarms, go to "Sequence of Operation / Alarm Output Functions." To determine the name of alarm by the controller type on your chamber. Set the value to the desired setting (1.0% RH is the factory preset) by reference the correct controller manual.

NOTE: *Setting dehumidification alarm to a negative value will always keep dehumidification active except for the %RH falling to low (lower than the alarm parameter setting). When utilizing a heat regenerative desiccant dryer, it is not recommended to set dehumidification alarm to a negative value during operation at high temperatures with a high %RH. Operation with a heat regenerative desiccant dryer at high temperatures and high relative humidity may result in condensation occurring within the dryer piping that could result in damage to the dehumidification system.*

Humidifier Ultrasonic (Optional)

Figure 220

Humidifier Introduction

The ultrasonic humidifier system affixes to the top of the chamber. An external water source supplies the system upon which a float valve then regulates the humidifier's water level. The humidifier is powered through a transformer located in the overhead mechanical area and controlled by a dedicated microcontroller. The humidifier supplies a cool mist born water vapor on demand as predetermined by customer set value.

External Humidifier Operation

After the initial setup of the humidifier, the temperature needs to stabilize at the set value (SV). When the temperature has stabilized, adjust the humidity controller to the desired set value and allowed it to stabilize. During normal operation, the Fuji Microcontroller will request more humidity as the PV begins to dip below the SV. When this happens, the OUT1 light on the top left of the Fuji controller will illuminate green. Simultaneously, an LED on the ultrasonic transducer will illuminate bright red. With each flash of the red LED, an ultrasonic frequency will pulse throughout the humidifier's tank atomizing the water into a fine mist to supply the chamber.

Each humidifier is equipped with a ball valve that allows airflow adjustments to be made to the humidifier, increasing the flexibility of the unit. At the set value 25.0°C 60.0% or any %RH less than 60.0%, residual humidity may be introduced into the chamber through the air passing over the humidifier reservoir. In these circumstances, valving the humidifier down may help. To adjust the humidifier's airflow, first locate the humidifier's supply inlet (a dry pipe with a white or red ball valve) and then adjust the handle until the ball valve is approximately 75% closed.

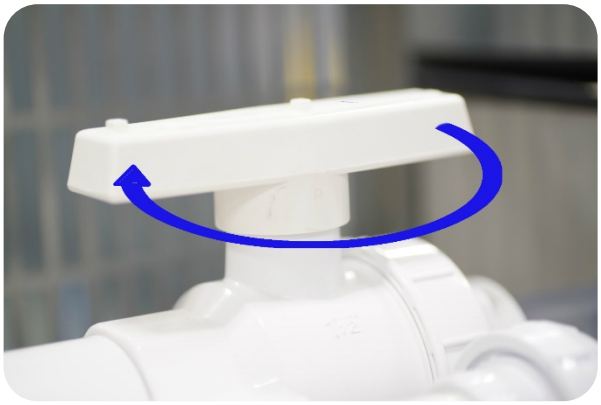


Figure 221

Special Considerations

- It is crucial to have water quality that falls within Darwin Chambers water quality specifications. Poor water quality is the leading cause of a humidifier failing to operate correctly.
- Tap water should not be utilized within the humidifier for any purpose other than troubleshooting. Over time, atomized tap water may leave behind an assortment of mineral deposits that cling to walls of humidifier, that accumulate onto floor of the humidifier, and mineral deposits that ultimately cover the ultrasonic ceramic discs and the conductivity sensor (crossbeam), leading possibly to future humidification complications.
- After the initial start-up and for day-to-day operations you should use either distilled, Reverse Osmosis (R.O.), or water from a Darwin Chambers brand DI water filtration system (10 psi max preferred).
- Softened water should never be utilized with the ultrasonic humidifier.

Thermodiabatic Humidifier (Optional)

The Thermodiabatic Humidifier utilizes several components to humidify the condition space of the chamber. First component is a reservoir to maintain the water level in the second component the water tower. An electric bellows style pump (third component) is used to push ambient air in the water tower when the loop controller calls for humidity. The water tower has a thermostat-controlled heater to maintain the water temperature with a high temp safety (fixed to 85C). Initial setup should have the water temperature set to 75C. This helps to humidify the chamber making the water less dense while also disaffecting the water tower of waterborne pathogens. For lower temperatures or less aggressive humidity levels the temperature can be turned down. Darwin recommends keeping water temperature above 55C for the benefit of disinfecting the water for pathogens.

Water Reservoir. The water should be cleaned and expected every 3 to 6 months.

Water Tower: the tower is made of stainless steel. The tower is thermally insulted for protection and efficiency of use. Water tower has a Sense bulb for adjustable temperature and a max limiting thermal switch fixed at 85C. This is to prevent boiling of water. Thermal switch will automatically reset after cooling down.

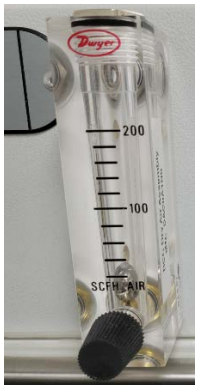
Bellow Pump: used to push ambient air in the water tower to be humidified and pumped into the condition space in the chamber.

Thermostat for water temperature. Best to start temperature setting to 75C. Let water heat up fully before performing an autotune on the chamber humidity control.

Water and dry air inlet. Water Quality is the same as the ultrasonic humidifier. The dry air supply will be the determining factor for lowest humidity achievable. A point of use dryer can be put in series with the compressor for dry air.

DEHUMIDIFICATION CONTROLLER OPERATION

Darwin Chambers utilizes multiple dryers from different dryer manufactures. There are two types of dryers. Heated regenerative desiccant dryer and point of use pneumatic dryer. Heated regenerative dryers will require a separate power source than the chambers power source/ outlet. A pneumatic dryer (point of use dryer) will require compressed air. See Pneumatic dryer for specification or contact technical support with the dryer information. Some chambers will come with just a flow meter to regulate incoming dry air from the facility. See the facility Maintenance department for dry air capabilities and what the regulated PSI is. Darwin chamber recommends 70 to 90 PSI. A psi rating any higher than 90 PSI can cause catastrophic failure of the flow meter and injure or damage nearby objects.



Located on front of chamber. Located on the back or behind sign shield.

There are **three modes** of operation for dehumidification. The first two modes can be configured on how the parameters are set for the dehumidification outputs using the alarm set point, delay, and hysteresis settings.

The **first mode** of operation set from factory is recovery mode. This only allows the dryer to come on to bring down the humidity level after an overshoot in humidity. This is a deviation high alarm. Set higher than the humidity set point. Delays are put in to keep solenoid from short cycling (rapid on and off).

The **second mode** of operation is a dry air purge or constant dry air. This is where absolute humidity levels are lower than the ambient and requires constant dry air to either displace (dry air Purge) or continuous running of the heated regenerative dryer. This is a deviation high alarm. Set lower deviation or no deviation and a hysteresis to keep dryer from short cycling. This will keep the dryer on during normal operation and turn off the dehumidification if the humidity level gets too low.

The **third mode** of operation are heated controlled dryers. This mode only utilizes heated regenerative dryers. The humidity control will be configured to control the heater in the dryer rather than a mister. These are drying chambers for archival purposes. This design is specific to that application to preserve product stored on the chamber. There will not be a way for the unit to add moisture. Where added moisture in failure situation would ruin or permanently damage the product. Dryers configured in this mode can be subjected to condensation build up when the condition space is cold. Regular inspection of the dryer is advisable. Buildup of water in the dryer will shorten the life and warranty of the dryer.

Dryers are enabled or disabled by the dehumidification output of the controller. Low Humidity alarms will disable the dryer. Pneumatic dryers will have a flow meter that needs to be manually adjusted for proper operation and efficient use of compressed air.

DAMPER SYSTEM

The HT and HH chambers incorporate a damper system. The damper system consists of two components; a damper that is located on the top rear of the chamber (pictured below to the left) and an access port (pictured below to the right). The damper system is designed to utilize the chambers ambient to remove excess heat. This allows for quick cooling to sub-40.0°C set points. The damper system can be utilized at any set value less than 40.0°C providing the ambient conditions meet Darwin Chambers Co. ambient requirements.

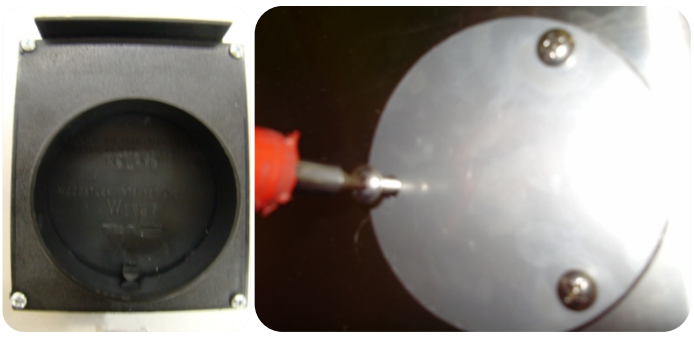


Figure 222

Operating the Damper System

At temperatures less than 40.0°C: In this scenario it is recommended that the damper system is utilized. To use the damper system, the following needs to be done:

1. Remove the cover from the access port.

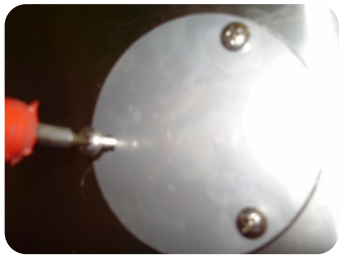


Figure 223

2. Remove the foam plug from the access port.

Figure 224

3. Using a ladder, climb above the damper and adjust the damper open 3/8” (Figure 225).

Figure 225

At temperatures 40.0°C or greater: The damper system is not necessary at this condition. Before operating the chamber, please ensure that the following two prerequisites are met:

1. The access port should be plugged and have its cover in place.

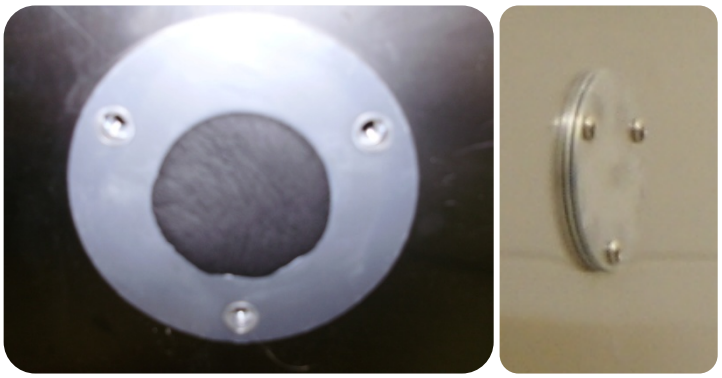


Figure 226

2. The damper needs to be fully closed.

Figure 227

CONTROLLED LIGHT OPERATION

Chambers with controlled lights for either diurnal or plant growth will have several possible operation methods. The methods that could be used are on/ off binary control and dimmable lights with multiple staged or linear control.

Chambers using just on and off control of lights will use a 24 hour or digital timer to turn lights on and off. Some controllers like the nCompass and MCT4 may use an event output to control the lights. See the event output section for the appropriate controller (Chamber Loop Controls) on your chamber to know how to setup events. See "Grasslin Timer - Lighting Operation (Optional)" section for 24 hour and digital light timer operation.

Chambers having dimmable lights will either use a toggle/rocker switch for multiple stage lighting, a manual turn dial for linear control of light output or a proportional loop controller for automatic or manual linear control of lights. Note that some manual only dimmable lights may work in conjunction with a light timer for maximum light output when on. Only lights controlled with a proportional loop controller will have automatic dimming using the ramp soak feature in the controller. To adjust light output on these controllers, the set point value must be changed for the output desired. Note that the process value may read 0.0 or nothing is displayed at all. This is because the light output is not measured to give the feedback like temperature or humidity sensor would.

NOTE: *Proportional loop-controlled lights will not enable lights until >=5% output is requested via set point. This is due to the characteristics of LED and light Ballast. Lights are known to flicker a low output. Some LED drivers and light ballast will not turn off or go below 3% output. Therefore, lights are not enabled by the controller until 5% or more is demanded at the set point value.*

For Light replacement bulbs or LED strips refer to spare parts list.

Grasslin Timer - Lighting Operation (Optional)

Figure 228

The Grasslin Mechanical Timer is used to control chamber lighting. With user selectable switches, the Grasslin Timer can be programmed to turn the chamber's lighting on and off throughout a 24-hour period for 15-minute (or longer) intervals. This design gives the users full testing customizability and the ability to simulate diurnal cycles.

Setting the Time

To set the time on the Grasslin, simply turn the minute hand clockwise until the time of day (and AM or PM) on the outer dial is aligned with the triangle marker on the inner dial.

NOTE: *Although the Grasslin Timer is mechanical in nature, it cannot maintain time and/or function without the aid of electricity. As a result, the timer may need to have the time resynchronized following the loss of power or the removal of the chamber from its voltage source.*

Programming the Grasslin

To program the Grasslin Timer, first locate the white tab (or tripper) on the outer dial. Move the white tab outward at each desired initiation time. To set initiation times at 6:00 AM, 11:30 AM, 4:30 PM and 11:00 PM, move the tab adjacent to the "M" in AM on the dial (6:00 AM), the tab that lies between 11:30 AM and 11:45 AM, the tab between 4:30 PM and 4:45 PM, and the tab adjacent to the 11:00–11:15 PM marks. Different run durations may be set for each initiation setting. Each white tab (tripper) provides a 15-minute interval. The tabs that set the initiation time provide a minimum of 15 minutes of run time. For longer durations, move additional tabs (following in time) from the initiation tab.

EXAMPLE: *If a 45-minute run time is to start at 7:00 AM, move the tab that lies between 7:00 and 7:15 (on the AM side of the dial) outward. Move the tabs adjacent to 7:15-7:30 and 7:30-7:45 outward as well. When finished, three tabs should be in the outward position. The run will initiate at 7:00 AM and terminate at 7:45 AM.*

Figure 229

Figure 230

The Grasslin Digital Timer is like the Mechanical Grasslin Timer and is also utilized to control chamber lighting. Unlike the mechanical timer, the digital timer allows for additional user customization providing precision seven-day 24-hour program that can be set down to the minute. This enhanced customization gives the user confidence to determine the exact behavior of their Diurnal Cycles whether it be a Monday next week or a Thursday in three weeks.

Setting the Mode

The Grasslin Digital Timer can be placed in one of two modes. The default mode is the Automatic mode. In the Automatic Mode the digital timer will execute programs that have been user selected/created. The Manual Mode simply enables the lights when it is desired. To enable Manual Mode, press the "+" button one time and the OVR_AUTO indicator will illuminate. Press the "+" one additional time to return to Automatic Mode.

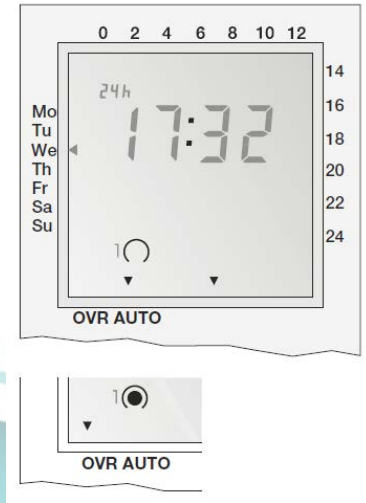


Figure 231

Setting a Program

To set a program follow the steps below:

1. Press the Res. Button one time.
2. Set the time format by using the “+/-“ buttons. The time format can be either 24 hours or 12 hours. Once the desired format has been chosen, press the “OK” button.
3. Using the “+/-“ buttons, set the current hour of the day and then confirm by pressing “OK.” Then set the minutes and confirm the time by pressing “OK.”

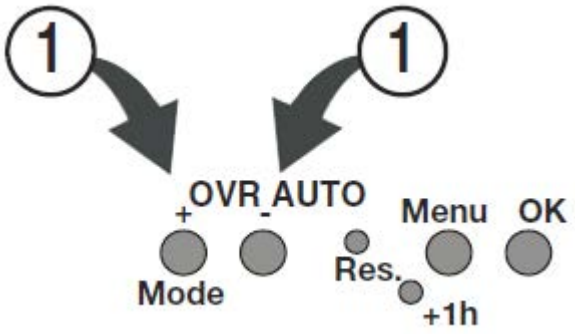


Figure 232

4. Select the day of the week through the use of the “+/-“ buttons and then confirm the day with “OK” button.
5. Next choose the desired program (P01-P03) and then press “OK.”
6. Then set the memory location to program (memory location Prog 01-03) by using the “+/-“ and then press “OK.”

NOTE: *Each location by default includes an on step and an off. Each subsequent step will continue the pattern. There is a maximum of 20 memory locations.*

7. Set the time (both hours and then minutes) within the desired memory location with the “+/-“ buttons and then confirm each setting with the “OK” button. The first step is an “ON” step.
8. Select the desired day(s) for the programed “ON” step and then press “OK” to confirm the day(s).
9. Edit the next step (an: Off step) by placing the desired time and day(s) into the memory location. Confirm the step by pressing “OK.”
10. Continue to add steps or simply press “Menu” to exit the programing setup.

NOTE: *To delete a step set the time to “--.” Programs are deleted in pairs of On and Off steps*

DEFROST OPERATION

Paragon Defrost

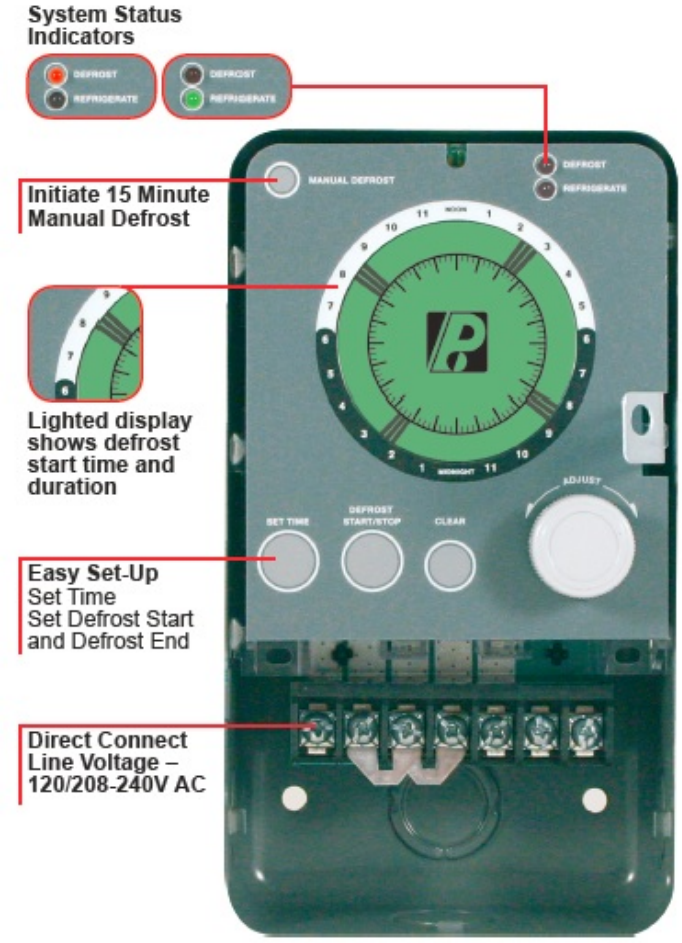


Figure 233

The Paragon Defrost Timer is used to enable a defrost cycle on a freezer. Situated within a protective housing (typically behind the chamber control panel), the Paragon Defrost Timer permits user selectable defrosts cycles. Through the timer activated defrost, freezer evaporator coils can remain ice-free, thus allowing the chambers to operate in subzero degree temperatures at optimum performance. Paragon defrost timers are offered standard on the FS and TH Series of chambers. The timer is also an option on extended range chambers designed to operate <4.0°C.

NOTE: *Chamber operation at set values 4.0°C or colder for periods of 24 hours or greater will require regular defrost cycles to ensure proper chamber operation.*

Setting the Time

To set the current time on the Paragon, press the Set Time button once and then simply turn the adjust knob until the time of day (and AM or PM) is displayed on the timer. Confirm the desired time by pressing Set Time button.

Setting a Defrost

To set a defrost cycle on the Paragon, turn the Adjust knob until the time of the desired defrost is displayed on the timer. Then press the Set Time button one time. Next, choose the desired defrost cycle length by turning the Adjust knob (Defrost cycles are set in 15-minute segments) to add (clockwise) or remove (counter-clockwise) time segments. When the desired defrost cycle, length is displayed on the timer, press the Set Time button to confirm the new settings. If additional defrost cycles are desired simply repeat the previous steps for each additional cycle. To remove a defrost cycle simply place the curser/marker on the first segment of the defrost and then press the Set Time button.

Figure 234

NOTE: *The typical frequency of defrost cycles is two defrosts a day for a period of 15 minutes each. The standard defrost cycle on the FZ, FS, and TH Series chambers are temperature terminated.*

Dwyer Controller (Optional)

Some models (standard on the TH, FZ, and FS Series) of chambers may utilize the Dwyer Controller to limits the temperature of the defrost cycle. Designed to remove power from the defrost heater or disable Humidity in coil freezing temperatures or enable fans based on temperature of coil rather than a duration of time, the Dwyer Controller ensures that the chamber effectively defrosts the evaporator coil while ensuring the product placed within spends the least amount of time possible out of specification during the defrost cycles.

NOTE: *On chambers that are designed to operate below 0.0°C (freezers and extended range chambers) and have humidification capabilities, a dual stage Dwyer is utilized to both terminate/end a defrost cycle and to disable the chamber's humidifier when the evaporator temperature reaches temperatures capable of freezing. This is implemented to reduce the risks of icing the evaporator. In use when the evaporator temperature reaches 0.0°C power will be removed. Power will not be restored until the evaporator temperature reaches a preset temperature above 0.0°C (Typically 4.0°C).*

The Dwyer Controller has been factory configured for optimum performance. If a problem occurs as a result of the defrost duration and/or operation, it is recommended that no adjustments are performed on the Dwyer Controller without first contacting Technical Support by phone at 1-877-783-6774 or through email at technicalsupport@darwinchambers.com.

Figure 235

TSXT Defrost Timer

The Series TSXT Digital Temperature Switch is designed with many refrigeration applications in mind. Darwin utilizes the controller for defrost only. It accepts up to 3 temperature inputs of either PTC or NTC temperature probe types and can control the compressor, defrost, fan, alarm, and light in a refrigeration system. Darwin uses only one sensor in the evaporator coil. Darwin utilizes the defrost feature to use/override the hot gas and heaters to control the coil temperature to get above freezing. The fan delay/Drip allows time for coil to cool down before blowing air across coil. This is to keep warm air from the defrost to reach the conditioned space. The Series TSXT programming performed by the front keypad, the TS2-K programming key, or by RS485 module communication. Standard features include capacitive buttons, real time clock, HACCP alarm logging, temperature alarms, and password protected parameter settings.

Figure 236

Parameter Programming

Note: Set Point and the time programming are the only parameters accessible without access code.

Set Point

- Press SET. Set Point value will appear on the display.
- Press SET again. The real value is shown on the display and can be modified with the UP and DOWN arrows.
- Press SET to confirm any new values.
- Press SET and DOWN simultaneously to quit programming or wait one minute for the display to automatically exit programming mode.

Real Time Clock

- Press SET. The Set Point value will appear on the display.
- Press the UP or DOWN arrow to change to Hour or Minute.
- Press SET to see the assigned value. • Use the UP and DOWN arrows to set the desired value. • Press and hold SET for 8 seconds to program value. The word “Pro” should appear on the screen if the value has been programmed correctly.
- Press SET and DOWN simultaneously to exit or wait for the timeout.

Protected Parameters

- Press and hold SET for 8 seconds. The access code value 00 is shown on the display. • Using the UP and DOWN arrows, set the code (factory-set code is 00).
- Press SET to enter the code. If correct, the first parameter label will be shown on the display (SP).
- Use the UP and DOWN arrows to move to desired parameter and SET to view parameter value.
- While viewing a parameter value, use the UP and DOWN arrows to modify parameter value. Use SET to enter value and exit parameter.
- The display will blink when there is an error recording a parameter in memory or when awaiting confirmation of a value.
- Press SET and DOWN simultaneously to quit programming or wait one minute to automatically exit programming mode.

LED Indication and Display Messages:

Indicates if the load is connected. If continuous cool cycle is being performed, this LED flashes (90% ON, 10% OFF). If the unit is waiting the stopping time value stored in c0 to start a cool cycle the LED flashes (10% ON, 90% OFF). :

Indicates if defrosting is active. :

Indicates an active alarm. The LED will flash if the alarm is cleared, but the alarm condition persists.

Indicates when fan control relay is active. Either H7 or H8 must be set to one of the fan control modes (FAN or FAI).

HACCP: Indicates HACCP alarm recording feature is active.

If an alarm or error occurs, the following messages will be shown, and an internal buzzer will sound.

The alarm can be cleared, and buzzer silenced by pressing the SET and DOWN buttons simultaneously. The alarm message will not be shown, but the alarm LED will flash while the alarm condition persists.

- Err = Memory error
- ErP1 = Probe 1 error
- ErP2 = Probe 2 error
- ErP3 = Probe 3 error
- Eri = Internal parameter error. In this case enter the factory default configuration, as described in the Resetting to Factory Defaults section.
- ALH = High temperature alarm
- ALL = Low temperature alarm
- ALE = External alarm
- AEH = High temperature and external alarm

- AEL = Low temperature and external alarm
- ooo = Open probe error
- - - - = Short circuit probe error
- DON = Defrosting activated
- DOF = Defrosting deactivated or cannot be done
- CON = Continuous cold cycle activated
- COF = Continuous cold cycle deactivated
- -d- = Defrosting (when d5 set to -d-)

Setting Keyboard Code to Zero

- Turn unit off and back on. Press and hold SET for 8 seconds. Value 00 should flash on the display.
- Set the code to 123 using the UP and DOWN arrows.
- Press SET to confirm the code. The code is now set to 00.

Activating and Deactivating Manual Defrost Cycle

Press and hold the AUX button for 2 seconds to activate defrosting. Repeat this process to stop the defrosting. If a cool cycle is activated, the defrosting is disabled.

Activating and Deactivating Cool Cycle

Press and hold the DOWN arrow for 8 seconds to activate a continuous cool cycle. Repeat this process to stop the cool cycle. If defrosting is activated, the cool cycle is disabled.

Fault Cycle

If the probe fails, the load is connected for the time set in c2 and then disconnected for the time set in c3. In case of memory error, the load is connected for 5 minutes and then disconnected for 5 minutes.

On/Off Mode

This option is used to turn the control into an OFF or standby mode, disabling the display and outputs.

- Press and hold SET and DOWN for 8 seconds. The display will read OFF.
- Press and hold SET and DOWN for 8 seconds to return the control to normal operation.

On/Off Light

The 2nd or 3rd relay can be configured as a lighting switch by setting the H7 or H8 parameter to Li. To activate or deactivate the light relay, press, and hold AUX and UP for 3 seconds.

Probe View

To view the probe not chosen in P5, press the SET and UP buttons.

HACCP

If this option is activated, the thermostat registers up to 5 high, low, and power loss alarms. These alarms can be seen in the menu Registry of Alarms (HAC). To access this menu, proceed to the parameter's menu.

The first value (nAt) that appears is the number of registered alarms. Next, the value of the temperature (Adx) and the time of each alarm that exists (tdx) are displayed. For the disconnection alarm, the temperature when returning the connection is registered, as well as the time until the correct value is reached. (Probe<Set+A1-A0)

When the elapsed time is shown it will appear dxx (days). Pressing UP, hxx (Hours) will be shown, and pressing UP again, nxx (Minutes) will be displayed. When located over a temperature of alarm or time, pressing AUX + UP for 3 seconds, both recorded data of the alarm (time and temperature value) are deleted.

In the HAC menu, pressing AUX + UP keys for 3 seconds, all the recorded alarm data is deleted.

Resetting to Factory Defaults

- Access to parameter H0 as explained in parameter programming.
- Choose desired configuration.
- For Series TSXT-xx1: H0 is set to 0
- For Series TSXT-xx2: H0 is set to 1
- For Series TSXT-xx3: H0 is set to 2
- Press SET for 8 seconds, and the thermostat will be reset.

List of Parameters

COn	Description	Units	Range
SET	Set point	Degrees	r1 to r2
r0	Differential or hysteresis	Degrees	0.1 to 20
r1	Minimum value for set point	Degrees	-99.9 to r2
r2	Maximum value for set point	Degrees	r1 to 302
r6	Fan operation	Option	off/on/con
F0	Fan stoppage temperature	Degrees	-99.9 to 302
F1	Stop compressor & fan with door open	Option	no/yes/con/fan
c0	Minimum compressor stoppage time	Minutes	0 to 240
c1	Continuous cycle time	h - m	0.0 to 18
c2	ON time of fault cycle	Minutes	0 to 999
c3	OFF time of fault cycle	Minutes	0 to 999
c4	Minimum ON time of the compressor	Minutes	0 to 240
c5	Minimum time between two connections of the compressor	Minutes	0 to 240
dEF	Description	Units	Range
d0	Cool/Heat mode (ST13)	Option	re/in
d0	Type of defrosting (ST23 & 33)	Option	re/in
d1	Temperature at which defrosting will stop	Degrees	-99.9 to 302
d2	Maximum defrosting time	Minutes	0 to 240
d3	First hour of day for defrosting	h - m	00.0 to 18.0
d4	Delay of first defrosting	Minutes	0 to 999
d5	Display on defrosting	Option	off/on/-d-
d6	Display return limit	Minutes	0 to 240
d7	Compressor drip time	Minutes	0 to 240
d8	Interval between defrosting	h – m	00.0 to 99.0
d9	Fan works on defrosting	Option	no/yes
d10	Fan drip time	Minutes	0 to 240

d11	Minimum defrosting time	Minutes	0 to 240
d12	Fan/defrosting control probe	Option	sd1/sd2/sd3
d14	Units to count the defrosting cycle	Option	rt/ct
Pro	Description	Units	Range
P0	Temperature scale	Option	°C/°F
P1	Ambient probe 1 calibration	Degrees	-20.0 to 20.0
P2	Defrosting probe 2 calibration	Degrees	-20.0 to 20.0
P3	Product probe 3 calibration	Degrees	-20.0 to 20.0
P4	Decimal point	Option	no/yes
P5	Probe to display	Option	sd1/sd2/sd3
P6	Probe 2 present	Option	no/yes
P7	Probe 3 present	Option	no/yes
ALA	Description	Units	Range
A0	Fan and alarm differential	Degrees	0.1 to 20.0
A1	Maximum alarm temperature	Degrees	0.1 to 99.9
A2	Minimum alarm temperature	Degrees	0.1 to 99.9
A3	Time validation open door or external alarm	Minutes	0 to 999
A4	Time without alarm after defrosting	h - m	0.0 to 18.0
A5	Time without alarm after opening the door	h - m	0.0 to 18.0
A6	Time without alarm after connection	h - m	0.0 to 18.0
A7	Alarm verification time	h – m	0.0 to 18.0
A8	Probe for alarm	Option	sd1/sd2/sd3
Ini	Description	Units	Range
Hor	Hour	Hours	0 to 23
Min	Minutes	Minutes	0 to 59
E0	Configure digital input	Option	all/AI/In/def/ndf
H0	Factory settings	Option	0 to 3
H1	Master slave	Option	Mst/Slv
H2	Keypad protection	Option	no/yes
H3	Delay time on connecting	Seconds	0 to 240
H5	Keyboard code	Numeric	0 to 999
H6	Type of probe	Option	PTC/NTC
H7	Relay 2 setup	Option	lit/FAn/ALA/dEF/FAI
H8	Relay 3 setup	Option	lit/FAn/ALA/dEF/FAI
H10	HACCP activated	Option	no/yes
HdE	Next defrost time	Hours	(only read)
MdE	Next defrost time	Minutes	(only read)

Parameter Descriptions

Compressor (COn)

SET = Working Set Point. Temperature the system trys to maintain. Variable between r1 and r2.
r0 = Differential. When primary probe temperature >= Set+r0 Compressor ON When primary probe temperature <= Set Compressor OFF
r6 = Fan operation on regulation.

- Off = Fan does not connect on regulation.
- On = Fan is always connected on regulation.
- Con = Fan linked to compressor start-up. (Fan ON if allowed by the temperature set in F0)

F0 = Fan temperature limit.
Direct mode. Relay selected as FAN. Fan OFF on regulation when probe temperature set in d12 is >= F0. Fan ON on regulation when temperature is =< F0 - A0.
Reverse mode. Relay selected as FAI. Fan OFF on regulation when probe temperature set in d12 is < F0. Fan ON on regulation when temperature is >= F0 + A0.
F1 = Stop compressor and Fan if door opened (Circuit closure between input terminal 5 and common terminal 4)

- No = the fan and compressor do not stop on regulation and continuous cycle when opening the door.
- Yes = the fan and compressor stop on regulation and continuous cycle when opening the door.
- Con = the compressor stops but the fan does not stop on regulation and continuous cycle when opening the door.
- Fan = the fan stops but the compressor does not stop on regulation and continuous cycle when opening the door.

c0 = Minimum compressor stop time. Minimum time since compressor stops until it is starts again.
c1 = Continuous cycle time. Duration of a continuous cold cycle.
c2 = ON time of fault cycle when ambient probe is broken
c3 = OFF time of fault cycle when ambient probe is broken
c4 = Minimum time since compressor starts until it stops.
c5 = Minimum time since compressor starts until it starts again.

Defrost (dEF)

d0 = Cool / Heat mode (ST13). re = cool; In = heat
d0 = Type of defrosting (ST23, ST33)

- re = defrosting without connecting the compressor.
- in = defrosting by connecting the compressor.

d1 = End of defrosting temperature. When this temperature is reached the defrosting will end.
d2 = Maximum defrosting time. The defrosting will stop when this time is reached. If it is zero, there will be no defrosting.
d3 = First hour defrosting of the day. From 00:00 hours the first defrosting is at d3 hours. Until this time no defrosting is performed.
d4 = Delay first defrosting. Time to carry out the first defrosting if d3 = yes.
d5 = Display during the defrosting. Off = the current temperature will be shown during defrosting. On = the temperature at defrost beginning is frozen on display until the end of defrosting and until the current temperature is equal or lower than the initial one, or until d6 time elapses. -d- = Label -d- is displayed during defrosting, until the end of defrosting and until the current temperature is equal or lower than the initial one, or until d6 time elapses.
d6 = Display return limit. Maximum time before viewing the current temperature again after defrosting.
d7 = Compressor drip time. Time since defrosting ends until the compressor can be connected.
d8 = Interval between defrosting. Time between the start of a defrosting and the start of the following one. If it is zero defrosting is not done automatically by time.
d9 = Fan operation during defrosting time. It determines if the fan is connected or not during defrosting.
d10 = Fan drip time. Time since defrosting ends until fan can be connected.
d11 = Minimum Time duration defrosting. Once defrosting begins it stays at least during this time
d12 = Fan & defrosting control probe.

- sd1 = primary probe
- sd2 = defrosting probe
- sd3 = product probe

d14 = Units to count the defrosting cycle.

- rt = according to the working time of the controller
- ct = according to the working time of the compressor

PROBES (Pr0)

P0 = Temperature scale. Select between °F and °C.
P1 = Primary probe calibration. Degrees shift of the primary probe display value.
P2 = Defrost probe calibration. Degrees shift of the defrosting probe display value.
P3 = Product probe calibration. Degrees shift of the product probe display value.
P4 = Decimal point
P5 = Probe to display. Probe to be viewed normally on the display.
P6 = Probe 2 present. If there is a probe 2 connected to thermostat.
P7 = Probe 3 present. If there is a probe 3 connected to thermostat.

ALARMS (ALA)

A0 = Fan & alarm differential. This is the temperature difference between the on and off cycle of the alarms and fan.
A1 = Maximum alarm. High alarm ON at Set+A1. High alarm OFF at Set+A1-A0.
A2 = Minimum alarm. Low alarm ON at Set-A2. Low alarm OFF at Set-A2+A0.
A3 = Time validation open door or external alarm. If open door or external alarm is maintained during this time, alarm will be indicated. (Depending on the E0 configuration of digital input).
A4 = Alarm exclusion time after defrosting. During the defrosting and this time after it, temperature alarms will be ignored.
A5 = Alarm exclusion time after opening the door. While the door is open (if A5>0) and time A5 after closing it, alarms will be ignored.
A6 = Alarm exclusion after connection. Until this time has elapsed since the connection, temperature alarms will be ignored.
A7 = Temperature alarm time validation. Time since the alarm situation occurs, until it is given.
A8 = Probe Alarm.

- sd1 = primary probe
- sd2 = defrosting probe
- sd3 = product probe

INITIALIZATION (Ini)

Hor = Hour
Min = Minutes
E0 = Digital input configuration.

- Off = Digital input disabled.
- AI = External alarm. There is an alarm if input is short-circuited.
- In = Door open if input is short-circuited.
- def = Order to initiate a defrost if input is short-circuited.
- ndf = No defrosting will be made if input is short-circuited.

H0 = Factory Configuration. Record Factory Configuration.
H1 = Master/Slave

- H1 = Master. The thermostat issues defrosting orders to slave connected thermostats through the digital input.
- H1 = Slave. The thermostat performs defrosting ordered by the master connected to its digital input.
- In both cases the input must be E0=def.

H2 = Keyboard protection.

- Yes = Keyboard protected. To modify Set, activate/de-activate defrosting and activate/de-activate continuous cycle we must enter the code and then quit. The protection is removed momentarily. It is activated again 1 minute after the last key is pressed.
- No = Keyboard not protected.

H3 = Delay time on connecting. Until this time has elapsed since turning-on power, the compressor will not start-up.
H5 = Input code to parameters. This code is set to 0 from factory.
H6 = Type of Probe. PTC or NTC.
H7 = Configuration Relay 2.
H8 = Configuration Relay 3. We can choose that it is light (Li), fan (Fan), alarm (ALA), defrosting (dEF), or reverse fan (FAI).
H10 = HAACP activated. Yes or no.
HdE = Hours (HdE) portion of the time the defrost will begin at.
MdE = Minutes (MdE) portion of the time the defrost will begin at.
HACCP (HAC): (Only appears when H10 is set to yes).
nAt = # of recorded alarms.
Adx = Temperature of alarm point where x can be 1 through 5.
tdx = Time of alarm point where x can be 1 through 5.

- dxx = days

- hxx = hours
- nxx = minutes

MAINTENANCE/REPAIR

Upon final installation of the Series TSXT no routine maintenance is required. The Series TSXT is not field serviceable and should be returned if repair is needed. Field repair should not be attempted and may void warranty.

CLEANING & REPAIR

Clean the surface of the display controller with a soft, damp cloth. Never use abrasive detergents, petrol, alcohol, or solvents.

THERMOELECTRIC OPERATION

Thermoelectric Introduction

Darwin Chambers Co. employs the use of thermoelectric cooling to condition the chambers product storage area. Thermoelectric cooling involves the use of heat sinks, Peltier Junctions (a solid-state active heat pump that transfers heat from one side of the device to the other.), a DC Fan, and a DC power supply to remove heat from within the chamber. The collection of the heat sinks, Peltier Junctions, DC fan, and the DC power supply is referred to as a thermoelectric assembly.

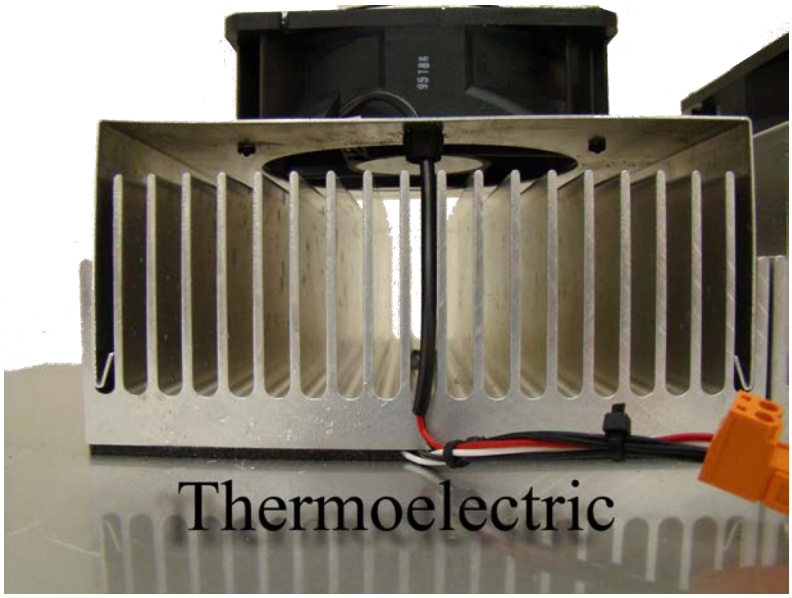


Figure 237

Thermoelectric Requirements

Thermoelectric assemblies (TEC) do not require any refrigerants. The thermoelectric assemblies (TEC) need to be cleaned on a regular basis. (Every 6 months) from dust and debris. When placing the chamber ensure the building HVAC does not blow air directly on the TEC. Or that one chamber does not blow air on another chamber. With AC air blowing on the TEC, this can cause fluctuations in humidity within the chamber. With heated air blowing on the TEC can cause insufficient cooling of the condition space of the chamber.

Putting the Thermoelectric to Use

Each thermoelectric assembly is designed to operate automatically at set values less than 32.0°C. At set values greater than 32.0°C, on the temperature controller will disable the thermoelectric cooling and then the chamber will go into Heat-Only Mode. Heat Only Mode also occurs when the process value falls to or exceeds 1.0°C less than the set value. This is only applicable to chambers that include electrical heat (PH, IN, and TE Series). For more information regarding "Heat Only Mode" please, refer to "Table 5" section of this product manual.

Special Considerations

- Ambient conditions may have a dramatic effect on the operation of your chamber. Due to the large heat sinks on thermoelectric chambers, a thermoelectric based chamber can operate at lower set values in cooler environments. In environments above the recommended ambient, thermoelectric units will lose cooling capacities and may have difficulties reaching ambient-like temperatures such as 25.0°C.

  NOTE: *The operation of a chamber in ambient conditions that are extreme in nature may render the chamber inoperable and should be avoided.*

- All thermoelectric systems rely on the ability to remove heat. Throughout the course of normal operation, a chamber may accumulate dust upon its thermoelectric components. Large accumulations of dust upon a thermoelectric system will limit a chambers ability to remove/transfer heat. In addition, dust will affect moving components by limiting the means heat can escape thus resulting in components running hot and at a greater risk for failure. To ensure that your chamber last a normal life cycle and remains within warranty, preventive maintenance should be performed on a regular basis. This should involve routine cleaning and thermoelectric system checks to ensure that the system is operating as intended. The recommended preventive maintenance routine for a thermoelectric chamber should involve the removal of dust from the heat sinks, heat sink fans, and power supplies.

HIGH TEMPERATURE SAFETY

The high temperature safety is an adjustable temperature safety switch. When properly set, the high temperature safety will disable the chambers heaters in the event the chamber's process value reaches the threshold/limit that is dictated by the user and the device's dial. The designed intent is to provide a reliable backup to the chamber's alarms to ensure that the samples within the chamber are not jeopardized in the event the chamber deviates from its set value.

NOTE: *The factory preset setting is 42.0°C, unless a higher intended chamber set value has been indicated during the time the order was placed.*

Figure 238 **Figure 239Figure 240**

Setting the High Temperature Safety

To set the high temperature safety, the user should determine the maximum allowable chamber temperature threshold that does not jeopardize the product placed within the chamber. A safe rule of thumb to follow is to adjust the high temperature safety 2.0°C above the chamber's set value. When the ideal temperature threshold has been determined, the safety can be adjusted through clockwise and counterclockwise adjustments of the black dial. Utilize the scale on the dial to locate the appropriate temperature setting.

Please Note: *If it is desired to decontaminate the chamber, this can be achieved through operation at 60.0°C. For operation at 60.0°C, the High Temperature Safety will require to a higher temperature to ensure that the maximum SV is achieved.*

REFRIGERATION OPERATION

Refrigeration Systems Introduction

Darwin Chambers Company uses mechanical refrigeration to condition the product storage area of certain chambers. Mechanical refrigeration utilizes a condensing unit (i.e., compressor, condenser, and condenser fan) and an evaporator assembly (i.e., evaporator and evaporator fans) to cool the product area. The Refrigerated Series of chambers also utilizes a hot-gas bypass system to stabilize the chamber's temperature. A hot-gas bypass involves transferring high pressure, high temperature gas directly into the chamber's evaporator to heat the chamber. The hot-gas bypass system is controlled by a temperature controller and a (normally) closed solenoid that opens when heat is required to increase the chamber's process value.

Figure 240

Refrigerant Charge Requirements

Mechanical refrigeration relies solely on refrigerants and their ability to change from a gas to a liquid and back again for the removal of heat within the chamber. Refrigerant types and amounts vary depending on the condensing unit size and the chambers intended use. To determine the correct refrigerant type and charge amount needed for your chamber, please refer to the chamber's data label.

Please note that that the use of refrigerants is regulated by the EPA (Environmental Protection Agency) and require certification for the purchase and handling of. In addition, refrigeration systems require the use of hot pressurized gas to efficiently remove heat. To avoid injury and/or damage to your system, only qualified/licensed technicians should open, reclaim, or charge the refrigeration system. Failure to adhere to the EPA may result in government fines. Furthermore, failure to utilize a qualified technician may damage and/or void the chamber's warranty.

Refrigeration in Use

The refrigeration system is setup to operate automatically. The standard setup has each mechanical refrigeration system designed to consistently operate/stay on at set values less than 32.0°C. At set values greater than 32.0°C and/or when the process value is ≤1.0°C of the set value, An Alarm output (see "Table 6") on the temperature controller will disable the refrigeration and place the chamber into "Heat Only Mode." This is only applicable to chambers that are intended to operate at temperatures greater than 32.0°C and chambers that include electrical heat.

Special Considerations

- Ambient conditions have a dramatic effect on the operation of your chamber. If a chamber is placed in an area outside of the recommended ambient, it will cause the refrigeration systems' operating pressures to vary with the ambient temperature. Changes in ambient pressures will also result in variances in a chamber's energy usage and functionality (i.e., operational range)."

NOTE: *Ambient conditions that are extreme in nature may render a chamber inoperable and should be avoided.*

- All refrigeration systems rely on the ability to remove heat. Any chamber may accumulate dust on its refrigeration components during normal operation. It is important to check for dust buildup regularly, as large amounts of dust can limit a refrigeration system's ability to remove or transfer heat. Dust buildup may also affect a chamber's moving components by limiting the ability of heat to escape, thus resulting in components running hot and increasing the risk for failure. The recommended preventive maintenance for a chamber with a mechanical refrigeration system should include the removal of dust from the compressor, condenser, and condensing unit fan. In addition, a qualified technician should perform system leak testing regularly to prevent unexpected refrigerant losses.

ADDED ELECTRICAL OUTLETS

Additional Outlets maybe installed by request. These outlets maybe installed in or on the exterior of the chamber. Outlets will be limited to requirements to the warning label next to outlet. Exceeding the use of the warning label may cause electrical issues with the chamber and or the performance. Electrical device placed in the chamber can also cause electrical noise that may interfere with the chamber sensors. Some outlets placed on the chamber will have a separate circuit needed for use. Refer to Darwin Chambers technical support team for requirements on your chamber.

Outlets placed in the chamber for lights or other specific devices should only have the lights or specified device that came with the chamber plugged into those outlets. Other manufacturers lights or additional Darwin Chamber lights or devices may inhibit performance of the chamber.

PREVENTIVE MAINTENANCE

Cleaning the Chamber

Darwin Chambers Co. recommends cleaning your chamber with vinegar, club soda, or a mild germicidal soap with water should be used for cleaning. Vinegar can be used to clean and polish the stainless steel. To use vinegar for this purpose, first moisten a cloth with undiluted white or cider vinegar. Then use the cloth to wipe the stainless-steel surface clean. Club soda can be used to remove streaks or heat stains from the stainless steel. A mild, germicidal soap can be used with warm water for basic routine cleaning. Isopropyl alcohol can be used for chamber sterilization.

A chamber's stainless-steel components need to be cleaned not only for aesthetic purposes, but also to preserve corrosion resistance. Stainless steel is protected from corrosion by a thin layer of chromium oxide that forms because of oxygen from the atmosphere combining with the chromium in the stainless steel. Any contamination of the surface by dirt, or other materials, hinders this passivation process and traps corrosive agents, reducing corrosion protection.

NOTE: *If your chamber is heavily soiled and routine, cleansing with germicidal soap and/or vinegar cannot remove the stains, then it is suggested that an Oxalic Acid based cleanser is used to thoroughly clean and re-passivate the chamber. Re-passivating the chamber will renew the corrosion resistance of the stainless steel. When applying the cleaner, it is recommended that a soft cloth or synthetic sponge be used. Dry the chamber by drip drying the unit or rubbing the chamber in the direction of the finish with a soft cloth dry cloth.*

Additional Preventive Maintenance

A thorough preventative maintenance routine should include the removal of sediment accumulation throughout the chamber and from the chamber's sensors. It is also imperative to remove any dust that has amassed on the chamber's instruments and/or cooling components. If dust accumulates on any of these areas, it may hinder the chamber's ability to effectively remove heat. Failure to perform preventive maintenance on your environmental chamber may result in mechanical difficulties and/or damage to the chamber's individual components. It could also void a chamber's warranty.

Darwin Chambers Company strongly recommends that a professional service team perform all additional preventative maintenance. For preventive maintenance, calibration, and validation services please call 877-783-6774 or email us at calsandvals@darwinchambers.com.

Humidifier Preventive Maintenance

Humidifier Cleaning

The ultrasonic humidifier is comprised of a transducer with ceramic discs that vibrate due to ultrasonic frequency. These ultrasonic vibrations create a fine mist because of water atomization. As the mist sprays into the chamber, particulates separated from the water supply during the atomization process may then accumulate upon the humidifier's components. Without a routine cleaning regiment, particulate accumulation (particularly on the ultrasonic transducer and ceramic discs) may lead to diminished humidifier performance over time. Darwin Chambers Co. recommends regular humidifier inspections and/or cleanings on a 3 to 6-month interval to help ensure against excessive accumulations and general mister wear.

NOTE: *The recommended periods between preventative maintenance, humidifier inspections, and cleanings are solely dependent upon the quality of the humidifier's water supply. All recommendations and generalizations are intended for consumer awareness and as a reminder to customers that proper preventive maintenance is required to uphold the chamber's warranty.*

Humidifier Cleaning Procedure

1. De-energize the humidifier unit by disconnecting power to the chamber. (Best practice is to turn off via front mounted switch then unplug chamber from outlet.)
2. Disconnect the water supply by separating the supply line from the inline quick connect shutoff fitting.
3. Remove the humidifier from the chamber, and pour out the water.

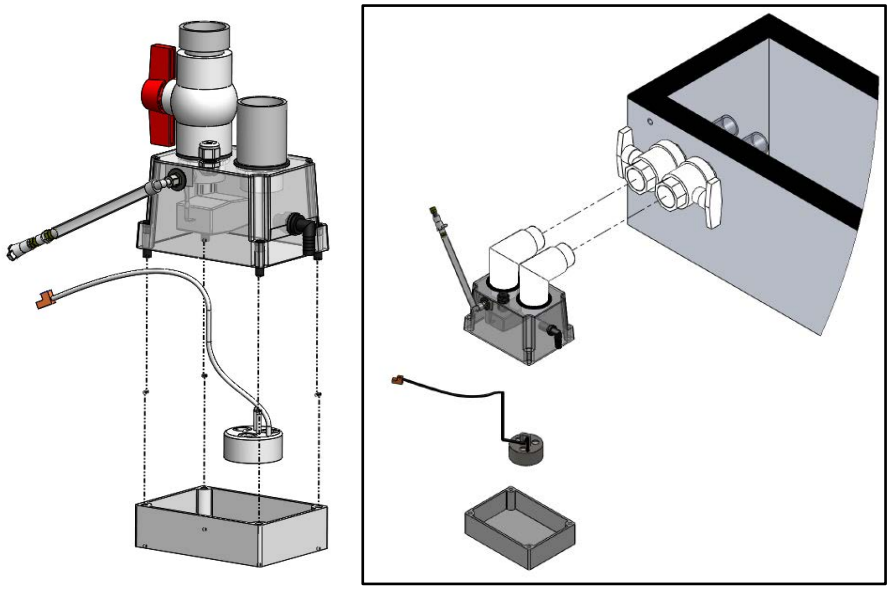


Figure 241

Single door rear mounted humidifier	Two and Three door mechanical area mounted humidifier.

4. Loosen the cord grip securing the transducer power cord.
5. Use a #3 Phillips screwdriver to turn the four back plastic screws counterclockwise and then separate the top half of the humidifier from the bottom.
6. Separate the ultrasonic transducer from the humidifier's base.
    - the transducer is affixed to the humidifier base by Velcro
    - do not lift the transducer by the black conductivity sensor
7. Set the cover with the ultrasonic transducer aside.
8. Discard any remaining water from the humidifier base.
9. Wipe down the interior of the humidifier with a 50/50 water and vinegar solution.
10. Gently clean the ultrasonic transducer and its ceramic discs with soft damp cloth or moist paper towel.
11. Use only water and a soft cloth to clean any individual parts (e.g., ultrasonic transducer and its ceramic discs) of the humidifier. Special care must be taken to remove any mineral deposits from the humidifier's floor, walls, and float valve.

    NOTE: *Do not use any household or industrial cleaners containing abrasives to clean the humidifier.*

12. Rinse the humidifier and ultrasonic transducer with clean water, drain, and wipe dry.
13. Reassemble the humidifier.

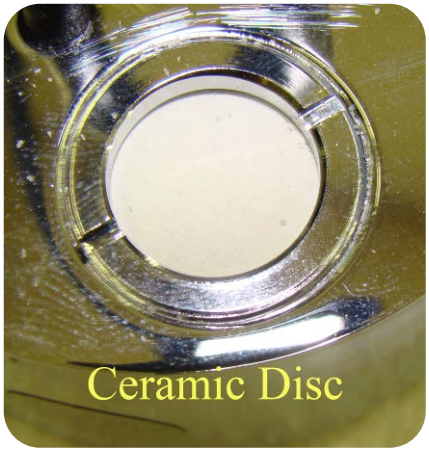


Figure 242

Filters

MJ Series Filter

The MJ series will have a particulate filter to keep debris build occurring on the evaporator coil. This filter will need to be replaced based on the chamber use and product loaded in the chamber.

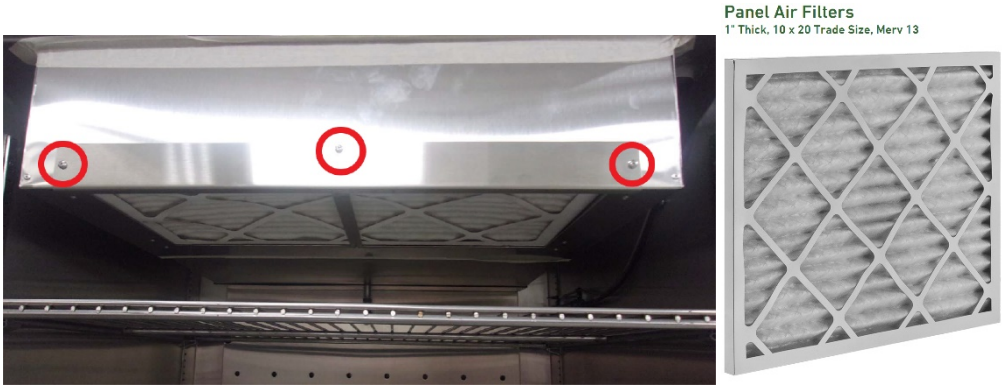


Figure 243

Remove the screws circled in red. Then remove cover and pull-out filter. Be aware of filter getting caught on brackets to prevent any tearing of the filter. Replace filter with like for like filter. See your parts list for part number to get a Darwin Chambers replacement filter.

NOTE: *The filter needs to be checked regularly. Clogged or using the wrong filter can inhibit the performance of the Cooling and Heating of the chamber.*

Dryer filters

Desiccant dryers require clean air to operate. Whether your dryer is using ambient air or the conditioned air to circulate through the dryer, regular checks of the filter is required. This frequency of checking the filter will vary depending on chamber use and the ambient condition space. Check spare parts list for replacement filter part numbers. Note the dryer manufacture on your dryer when selecting the appropriate filter.

Some dryers are equipped with an ambient odor carbon filter. Replace when filter no longer is containing the odor coming from the product loaded in the chamber. Check spare parts list for replacement filter part numbers. Note the dryer manufacture on your dryer when selecting the appropriate filter.

Pneumatic Dryers

Pneumatic Dryers will have a water separator and oil filter. These should be checked on a regular basis. Typically, in conjunction with the air compressor maintenance. Check spare parts list for replacement filter part numbers. Note the dryer manufacture on your dryer when selecting the appropriate filter.

FAQS

My chamber has a dehumidification system on it, and I would like to control humidity more precisely. How is this accomplished?

Control of humidity can be accomplished through the application of a dehumidification system. Darwin Chambers Company offers two types of dehumidification systems: electric heat regenerated desiccant or compressed air.

The electric heat regenerating type of dehumidification systems are typically controlled via PID loop Controllers. This type of dehumidification system can remove large amounts of humidity but can also cycle frequently. For this reason, Darwin Chambers Company recommends the following: Set the dryer to automatic mode and connecting the control wires to the dryer terminations (green and black wires terminated into a male green two pin quick connector) on the chamber. Utilizing the automatic mode allows the user to tighten the dryer's humidity control through using dehumidification output on the Fuji Micro Controller. An example of this method of operation AL3 is set on the controller at 1.0% (which is the factory-preset value) and 60.0% RH for the set value (SV). Since AL3 is a high deviation alarm, this would equate to SV+1.0%. In other words, AL3 would equate to 61.0%. Each time the PV reaches 61.0%, the dehumidification becomes active until the PV falls below SV+AL3H.

To tighten the control of the %RH, AL3 can be adjusted lower. If AL3 is adjusted lower, the process value (PV) should be observed to determine if the dryer dehumidifies to a suitable level (suitability is strictly based upon user preference and testing requirements).

NOTE: *Through the lowering of the AL3 setting, additional wear may incur upon the dryer components and reduce the products life cycle. Care should be taken during adjustments of AL3 to avoid scenarios that result in continuous energizing and de-energizing of the dryer.*

For example: *Hypothetically if AL3 is set to 0.1% and the chambers %RH set value (SV) is 60.0%. The chamber has a MG90 desiccant dryer. Without the dryer, the %RH fluctuates from 59.8 to 60.2% within a 25 second interval. As a result, when the dryer is utilized, the %RH fluctuates from 59.6 to 60.1%. In such a scenario, due to the AL3 setting of 0.1%, the dryer may power on for 10 seconds and then powers off as the PV reaches 60.0%. This results in dryer activations approximately 1 to 3 times a minute. Such a scenario may cause excessive wear on the dryer and may void any warranties associated with dehumidification system. In addition, many scenarios that results in control within ±0.2% RH may possibly be resolved by performing an Auto-tune. By contrast AL3 can be set to a -1.0%RH. In this configuration the dryer would always remain active, and the humidifier would humidify against the dehumidification system to maintain 60.0%. If the relative humidity falls lower than 1.0% (due to the -1.0% parameter value) of the SV the dehumidification system would then disable.*

NOTE: *Care must be taken to set up the humidification and dehumidification systems to avoid "Hunting." "Hunting" occurs when the humidity level rapidly overshoots, then rapidly undershoots on a continuous basis. The best way to control this problem is to make sure the system moves slowly in each direction. Performing an Auto-tune should help alleviate the problem.*

On the MG90 or similar dehumidifiers, additional dehumidification control can be achieved through adjusting the ball valve on the "Dry Air Inlet" dehumidification pipe. If subtle amounts of dehumidification are required, it is recommended that the ball valve remains cracked (approximately 75% closed). This allows for a slower response time and may help eliminate over dehumidification.

Compressed air dryers are typically operated in a similar manner as an MG90. The difference between a compressed air and a heated desiccant dryer is that compressed air dehumidification does not adversely affect the temperatures within the chamber. In addition, compressed air dryers do not degrade from being cycled on and off. To achieve finite control over the dehumidification rate, the supply flowing into the chamber can be modulated through the flow meter. Modulating the supply will allow the dryer to operate continuously at a low level while permitting active chamber dehumidification at higher %RH set values (for instance 60.0%).

Which control setting(s) controls the temperature point at which the cooling ceases and the cabinet operates on heat alone?

AL3L and AL3H are the parameters in the Fuji PXF4 that control the temperature switchover to "Heat Only Mode." This sets the temperatures at which the cooling control ceases and the electric heaters control temperature alone. To determine if AL3L or AL3H is active, locate the Ev3 LED on the top right of the temperature controller, and then observe the Ev3 LED to determine if it is illuminated. If the LED is illuminated red, AL3L or AL3H is active.

NOTE: *Some chambers do not utilize AL3L or AL3H to achieve "Heat Only Mode." "Heat Only Mode" is only available on chambers that feature heaters and exclude most freezers (except the TH Series). To determine if your chamber features a heater, please locate the chambers data label plate.*

I would like to operate my chamber more precisely at a wider temperature/humidity. How can this be accomplished?

This can be accomplished through selecting a mid-point value between the low and the high set values and then using the Auto-tune feature.

What kind of water filtration does Darwin Chambers Co. recommend for use in the ultrasonic humidifier?

Darwin Chambers Co. strongly recommends the use of an R.O., Distilled, a Darwin Chambers Co. brand DI system, or a Darwin Chambers brand R.O. D.I. water filtration system that meets the recommended water quality specifications.

The humidity required has changed! (For example, 60.0% instead of the 75.0% RH the chamber was initially used for). However, when venting of the cabinet occurs (for instance, the door is opened), the humidity drops, and the controller overcompensates. Then, it fails to return to the set value. What can be done to correct this?

First, the chamber needs to be set to the new SV. Then, it is recommended that the chamber be turned off and left with the door open for a period of at least four hours. Finally, power on the chamber and let stabilize. If the chamber fails to maintain set value, it may be necessary to perform an Auto-tune.

There is not a drain near my cabinet.

Purchase a condensate removal kit. Contact parts@Darwinchambers.com to inquire about the purchase of a unit.

TROUBLESHOOTING

The chamber's process value will not hold steady.

Temperature

- Make certain the ambient conditions of the area in which the chamber is located are no more than 72.0°F and 50.0% RH.
- AUTO-TUNE the controller.
- Inspect the door gasket for possible leaks.
- Ensure that the product inside is not impeding the chamber's airflow.
- Inspect the condensing unit fan(s) to determine if it is operational. This is not applicable to the chamber operation during "Heat Only Mode" (If the Ev3 LED on the temperature controller is illuminated, the chamber is in "Heat Only Mode").
- Check the space around the exterior of the chamber to make sure there is a clearance of 12" from the top and 6" from each side.
- Make certain that no product has been placed lower than 3" from the floor, 2" from all sides, and no less than 4" away from the ceiling of the unit.

Relative Humidity (%RH)

- Ensure the ambient conditions at the chamber's location are no more than 72.0°F and 50.0% RH.
- Ensure that the chambers temperature process value (PV) is holding steady. A stable %RH process value will be nearly impossible to achieve without first having a stable temperature.
- Make certain that no product has been placed lower than 3" from the floor, 2" from all sides, and no less than 4" away from the ceiling of the unit.

- Inspect the door gasket for possible leaks.
- AUTO-TUNE the controller.
- Inspect humidifier's ceramic disc for mineral deposits (to determine if it needs cleaning or an ultrasonic transducer replacement).
- Check humidifier tank water level to see if it is receiving an adequate supply of water. If it is not, determine if the water supply is reaching the humidifier. If the problem is within the humidifier itself, contact your customer support representative at technicalsupport@darwinchambers.com.
- When the humidifier's water supply is too pure, the ultrasonic transducer may not function properly. Conductivity problems can be identified by intermittent humidifier operation. One way to test the conductivity is to place an ounce (few centiliters) of tap water into the humidifier and then observe if the problem is alleviated.
- Check the AL3H parameter (Located within Operation Control Mode) on the temperature controller and ensure that it has been set to 32.0°C.
- At set values 60.0% RH or less, ensure that the humidifier's ball valve on the dry pipe has been adjusted to approximately 75.0% closed.

My chamber is not cooling.

- Check the Ev3 indicator on the temperature controller to see if AL3L or AL3H is active or not. If the alarm is active and the chamber's PV is greater than 32.0°C, AL3H will need to be increased to a value greater than the current PV for the cooling to enable.
- Ensure that the chamber's door is closed.
- Ensure that the chamber's surrounding environment is approximately 72.0°F, 50.0% Relative Humidity (RH).
- Inspect the fans on the condensing unit fan(s) to determine if it is operational. This is not applicable to the chamber operation during "Heat Only Mode" (If the Ev3 LED on the temperature controller is illuminated, the chamber is in "Heat Only Mode").
- Make certain that no product has been placed lower than 3" from the floor, 2" from all sides, and no less than 4" away from the ceiling of the unit. (Pictured below, the product is pressed against the wall. This will severely disrupt the chamber's airflow and ability to condition the product within.)

Figure 244

- On the FS Series chamber ensure the chamber is not in a Defrost Cycle by inspecting the Paragon Timer for an illuminated Red LED.
- Have a qualified technician service the chamber.

The chamber's controller parameters have been adjusted and the chamber does not operate properly.

- Compare the controller parameters with the supplied factory parameter sheet that shipped with the chamber documentation. If any parameter outside the set value, PID settings (Proportional, Integral, and Derivative in Ch1), high alarms, and low alarms have been altered, the parameter(s) should be returned to their factory preset(s).
- If the controller parameters have been altered and the factory-supplied sheet cannot be located, please contact a Darwin Chambers Co. customer support representative at technicalsupport@darwinchambers.com.

The chamber set value is set to a temperature that is less than 0.0°C and the process value has been increasing/warming.

Chambers experiencing a quick temperature rise (< 2 hour)

- Make certain all alarms have been cleared by widening out the alarm parameters (AL1 and AL2).

- Verify the chamber is not in a defrost cycle.
- Inspect the chamber door(s) to ensure they are fully closed.
- Ensure the chamber is not in a program (ramp/soak). Observing the OUT1 LED Indicator on the Fuji will indicate if the controller is requesting to add heat to the chamber. An illuminated OUT1 indicates the chamber heating.
- Inspect the compressor to verify the refrigeration system in operating.

Chambers experiencing a lengthy temperature increase (>2 hour)

- Ensure the chamber is not in an alarm condition.
- Verify the refrigeration system is operational.
- Inspect the product placement within the chamber to ensure airflow is not being impeded near the evaporator fans and sensors.
- The evaporator may be icing. Ensure that the defrost timer has been enabled.
- Inspect the doors to ensure they are fully closed and there are no leaks that could introduce moisture into the chamber. The introduction of moisture may result in icing on the evaporator.
- Inspect the evaporator to determine if it is iced up. Increase the number of defrost cycles by enabling additional trippers on the Paragon Defrost Timer may prevent icing. On the FS Series, the digital defrost termination (Dwyer Controller) may need to be adjusted to a warmer temperature. Locate Dwyer Controller and try adjusting the Set Point (SP1) a degree or two higher to see if there is any effect. ***NOTE:*** *Adjusting the defrost value higher may result in warmer process values during the defrost cycle.*
- If the evaporator is iced up, remove the product and perform multiple back-to-back defrost to ensure the coil is clear.

Power outages frequently affect my testing.

- In many circumstances, a non-chamber related, unexpected power outage could warrant a retest. In some cases, providing the continued collection of data (process values), testing could still be deemed valid during an ensuing power failure. For such instances, Darwin Chambers Co. recommends purchasing an Uninterrupted Power Supply. Contact parts@Darwinchambers.com for additional information.

It takes a very long time for chamber to reach its %RH setting value.

For chambers that do not have a dehumidification system and that is operating high in %RH.

- Ensure that ambient conditions at the chamber's location are no more than 72.0°F and 50.0% RH.
- Ensure that the temperature controller is not in low alarm (observe the Ev2 indicator).
- Check the AL3H parameter (Located within the Operation Control Mode) on the temperature controller and ensure that it has been set to 32.0°C.
- Inspect the door gasket for possible leaks.
- Ensure that the interior fan(s) are operational.
- Make certain that no product has been placed lower than 3" from the floor, 2" from all sides, and no less than 4" away from the ceiling of the unit.
- Inspect the condensing unit fan(s) to determine if they are operational. A non-working fan will affect the ability of the refrigeration to cool, thus affecting the dew point and the %RH. This is not applicable to the chamber operation during "Heat Only Mode" (If the Ev3 LED on the temperature controller is illuminated, the chamber is in "Heat Only Mode").
- On applications requiring 60.0% or less in %RH, adjust the humidifier's ball valve on the dry pipe so that it is approximately 75% closed.

- To determine whether a dehumidifier is needed, contact a Darwin Chambers Company customer service representative at technicalsupport@darwinchambers.com.

For chambers that do not have a dehumidification system and that is operating low in %RH.

- Ensure that ambient conditions at the chamber's location are no more than 72.0°F and 50.0% RH.
- Check the AL3H parameter (located within the Operation Control Mode) on the temperature controller and ensure that it has been set to 32.0°C.
- Inspect the door gasket for possible leaks.
- Ensure that the interior fan(s) are operational.
- Make certain that no product has been placed lower than 3" from the floor, 2" from all sides, and no less than 4" away from the ceiling of the unit.
- Check the humidifier's indicator light to see if it is illuminated.
- Inspect humidifier's ceramic disc for mineral deposits (to determine if it needs cleaning or an ultrasonic transducer replacement).
- Check humidifier tank water level to see if it is receiving an adequate supply of water. If it is not, determine if the water supply is reaching the humidifier. If the problem is within the humidifier itself, contact your customer support representative at technicalsupport@darwinchambers.com.
- Examine the humidifier's ultrasonic transducer. If the indicator light is not illuminated, the water may be too pure. To test the purity, place an ounce of tap water into the humidifier and see if the problem has been resolved.

For chambers with (Optional) dehumidification which is operating high in %RH.

- Ensure the dryer has been connected to the dryer terminations (green and black wires attached to the male quick connect) on the rear of the chamber.
- Ensure that the Ev3 (AL3) indicator on the %RH controller is active. If the LED indicator is not illuminated red, check the AL3 on the %RH controller (the factory preset is 1.0%). To make effective use of the dryer, it may be necessary to tighten/decrease the alarm to allow dehumidification to be enabled at process values closer than 1.0% above the set value or set the parameter value to a negative value.
- If applicable, ensure that the heated regenerative dehumidifier is plugged in to an outlet, set to automatic mode, and the chamber dehumidification pipes are fully opened.
- If applicable, ensure that the compressed air Dryer is plugged into the dryer termination on the top of the chamber. In addition, verify that the Dwyer flow meter indicates there is air pressure supplied to the unit. If air pressure is present, increase the airflow by adjusting the dial on the Dwyer flow meter.

Figure 245

- Ensure that ambient conditions at the chamber's location are no more than 72.0°F and 50.0% RH.
- Check the AL3H parameter (located within the Operation Control Mode) on the temperature controller and ensure that it has been set to 32.0°C.
- Inspect the door gasket for possible leaks.
- Verify that the chamber access port is closed.

Figure 246

- Ensure that the interior fan(s) are operational.
- Make certain that no product has been placed lower than 3" from the floor, 2" from all sides, and no less than 4" away from the ceiling of the unit.
- Inspect the fan(s) on the refrigeration system to determine if it is operational. A non-working fan will affect the ability of the refrigeration system to cool, thus affecting the dew point and the %RH. This is not applicable to the chamber operation during "Heat Only Mode" (If the Ev3 LED on the temperature controller is illuminated, the chamber is in "Heat Only Mode").
- On applications requiring 60.0% or less in %RH, adjust the humidifier's ball valve on the dry pipe so that it is approximately 75% closed.

For chambers with (Optional) dehumidification which is operating low in %RH.

- Ensure that the Ev3 (AL3) indicator on the %RH controller is active. If the LED indicator is not illuminated red, check the AL3 on the %RH controller (the factory preset is 1.0%). To make effective use of the dryer, it may be necessary to tighten/decrease the alarm to allow dehumidification to be enabled at process values closer than 1.0% above the set value or set the parameter value to a negative value.
- Ensure that ambient conditions at the chamber's location are no more than 72.0°F and 50.0 %RH.
- Check the AL3H parameter (Located within Operation Control Mode) on the temperature controller and ensure that it has been set to 32.0°C.
- Inspect the door gasket for possible leaks.
- Verify that the chamber access port is closed.
- Ensure that the interior fan(s) are operational.
- Make certain that no product has been placed lower than 3" from the floor, 2" from all sides, and no less than 4" away from the ceiling of the unit.
- Check the humidifier's indicator light to see if it is illuminated.
- Inspect humidifier's ceramic disc for mineral deposits (to determine if it needs cleaning or an ultrasonic transducer replacement).
- Check humidifier tank water level to see if it is receiving an adequate supply of water. If it is not, determine if the water supply is reaching the humidifier. If the problem is within the humidifier itself, contact your customer support representative at technicalsupport@darwinchambers.com.

- Examine the humidifier's ultrasonic transducer. If the indicator light is not illuminated, the water may be too pure. To test the purity, place an ounce of tap water into the humidifier and see if the problem has been resolved.
- If applicable, ensure that the desiccant wheel dryer is in Automatic Mode.

The humidifier is not working.

- Verify the humidifier has been plugged into its power supply (female green clip with Red and White wires) on the exterior top of the chamber.
- Inspect humidifier's ceramic disc for mineral deposits (to determine if it needs cleaning or an ultrasonic transducer replacement).
- Check humidifier tank water level to see if it is receiving an adequate supply of water (requires approximately 0.75" of water above the conductivity sensor). If it is not, determine if the water supply is reaching the humidifier. If the problem is within the humidifier itself, inspect the mechanical float valve (white plastic rectangular block within the humidifier) to determine if it has been impeded by the transducer or the transducer's power cord. If the float has not been impeded, contact your Darwin Chambers Co. customer support representative at technicalsupport@darwinchambers.com.
- Examine the humidifier's ultrasonic transducer. If the indicator light is not illuminated, the water may be too pure. To test the purity, place an ounce of tap water into the humidifier and see if the problem has been resolved.
- Open a chamber door(s) and observe the condensation levels inside. If there is moisture condensation throughout the chamber's interior and the %RH controller's PV is low, there could possibly be a %RH probe failure.
- Ensure that the chamber's door has been closed. The humidifier is designed to turn off when the chambers door has been opened. In addition, during the shipping process chamber doors may become unaligned and may not fully close the door switch. This can be verified by pressing the door switch(s) with a flat head screwdriver and observing if the %RH begins to rise. If the door switch is the problem, the chamber may need to be adequately leveled. If the problems persist, the doors may require an alignment.
- Make certain that the ultrasonic transducer's indicator illuminates. If the transducer's LED does not illuminate, the transducer potentially does not have power. The humidifier's power supply is fused and should be inspected to determine if it has blown. Locate on the chamber's din rail located within the chamber's mechanical area there is a fused terminal block. Inspect the fuse located within the terminal block to determine if it is blown. If the fuse is blown, replace the fuse.

Figure 247

I am having water conductivity problems. Is there anything I can do?

- When the humidifier's water supply is too pure, the ultrasonic transducer may not function properly. Conductivity problems can be identified by intermittent humidifier operation. One way to test the conductivity is to place one ounce of tap water into the humidifier and then observe if the problem has been alleviated.
- Finally, if the humidifier continues to have conductivity problems it may be necessary to change the humidifier's water supply. One cost effective method is using a carboy filled with bottled R.O. water that meets the water quality specifications. For more information on a carboy, contact technicalsupport@darwinchambers.com.

My humidifier is displaying signs of germ/bacteria growth within the tank, how can I prevent this from taking place?

- It may be necessary to increase the frequency of the humidifier preventive maintenance routine.
- Replace any expended filters on the water filtration system.

There is white powder within my chamber.

- This is very common with ultrasonic transducers and R.O. systems to have small traces of white powder accumulate over a 6-month period. There are several possible causes for this. One potential cause is the need to replace the filters within water filtration system. Another possibility is that the water supply is too harsh for the filtration system to remove enough of the water's sediments. This may result in the need for a water filtration upgrade and/or some means of water pre-filtration.
- If large amounts of powder accumulate over a short time, the interval at which the R.O. system's filters are replaced may need to be increased.

  Large amounts of powder can be defined as visibly being able to see powder in the air and/or significant measurable accumulation over a short time.

- If a D.I. filtration system is being utilized ensure that the resin bed is not due for replacement. In addition, if a water softener utilized in conjunction with a D.I. bed a possible scenario may occur where the salt from the softener overwhelms the D.I. bed and allows salts to pass through the D.I. system.
- A water softener is being utilized with the humidification system. Water softeners should not ever be utilized with an ultrasonic humidification system.

  NOTE: *To ensure proper chamber operation, the interval at which the chamber's preventive maintenance is performed may need to be increased to accommodate the harsh conditions.*

My humidifier keeps blowing power supply fuses.

- Make certain the fuse is securely in place.
- Replace the humidifier's ultrasonic transducer.
- Ensure that humidifier's water supply meets Darwin Chambers Water Quality Requirements.

My humidifier will not fill with water.

- Make sure the chamber has been connected to a water supply.
- Ensure that the water supply has been fully opened.
- Inspect the humidifier to determine if the ultrasonic transducer, or the transducer power cord has shifted during shipment and impeded the mechanical float valve.

There is a pool of water inside of the chamber.

- Ensure the chamber is level.
- Make sure that the interior airflow has not been impeded by product.
- Check the %RH controller to see if it is on the proper set value.
- Inspect the door gasket, access port, and chamber lid for leaks/condensation buildup.

The chart recorder (optional) pens will not record dark enough.

- Contact Darwin Chambers Co. to order replacement pens.

I ordered a digital chart recorder (optional), why is the LED blank?

- Darwin Chambers Company presets each digital chart recorder with the LED set to go blank after a few seconds. The intent of this is that the end data, that is often required to hand over to the FDA or any governing body, is the chart itself. Therefore, Darwin Chambers Company does not calibrate the LED. Only the recorder pens receive a calibration. The advantage of purchasing the digital chart recorder is for the ease of the pen calibrations vs. the analogue recorders. This helps ensure that when capable personnel perform calibrations, the chart recorder is more likely to read correctly across the chamber's operation range. In addition, each chart recorder utilizes a separate temperature sensor than what the chamber uses. In addition, each sensor may operate a little differently. It is important to first observe the pens' readings before deciding if there is indeed a problem.

My calibrated data logger/thermometer does not correspond to the chamber's controllers.

- Inexpensive temperature/humidity reference devices (thermometers, data loggers, etc.) may have poor accuracies. A calibration refers to verifying a device against a known standard. Normally, if adjustments are performed during a calibration procedure, the device may be deemed within calibration if the reading(s) meet the manufacturer's stated accuracies. The problem with calibrations performed upon inexpensive equipment is that they may be limited by the components utilized to construct the sensor. For instance, if a certain manufacturer produces an inexpensive data logger with the stated accuracies of 0.5°C and 3.0%RH (common accuracy numbers for many data loggers) and the data logger have been calibrated, the data logger can be 0.5°C and 3.0%RH off the calibration standard and still be considered within calibration. This means the likelihood of a calibrated data logger or thermometer with an accuracy of 0.5°C and 3.0%RH not aligning with your new environmental chamber (that typically has an accuracy of 0.2°C and 0.8%RH @ 23°C) is very likely. To avoid skewed results, it is strongly recommended that only sensors with equal or better accuracies than the chamber's instrumentation are utilized.

  NOTE: *To determine the stated accuracies of a device please refer to the manufacturer's specification sheet and/or the calibration documentation.*

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REFERENECES USED IN THE MANUAL

- PXF Operation Manual
- West Pro-EC44 User Guide 59540-2
- Future Design Controls MCT-CM User Manual Rev A
- Future Design Controls MCT4 4.3 User manual Rev G
- Dwyer Instruments FR# 444246-00 Rev 1

SUPPLEMENTAL DRAWINGS

Supplemental Drawing Mechanical Area Grate Removal

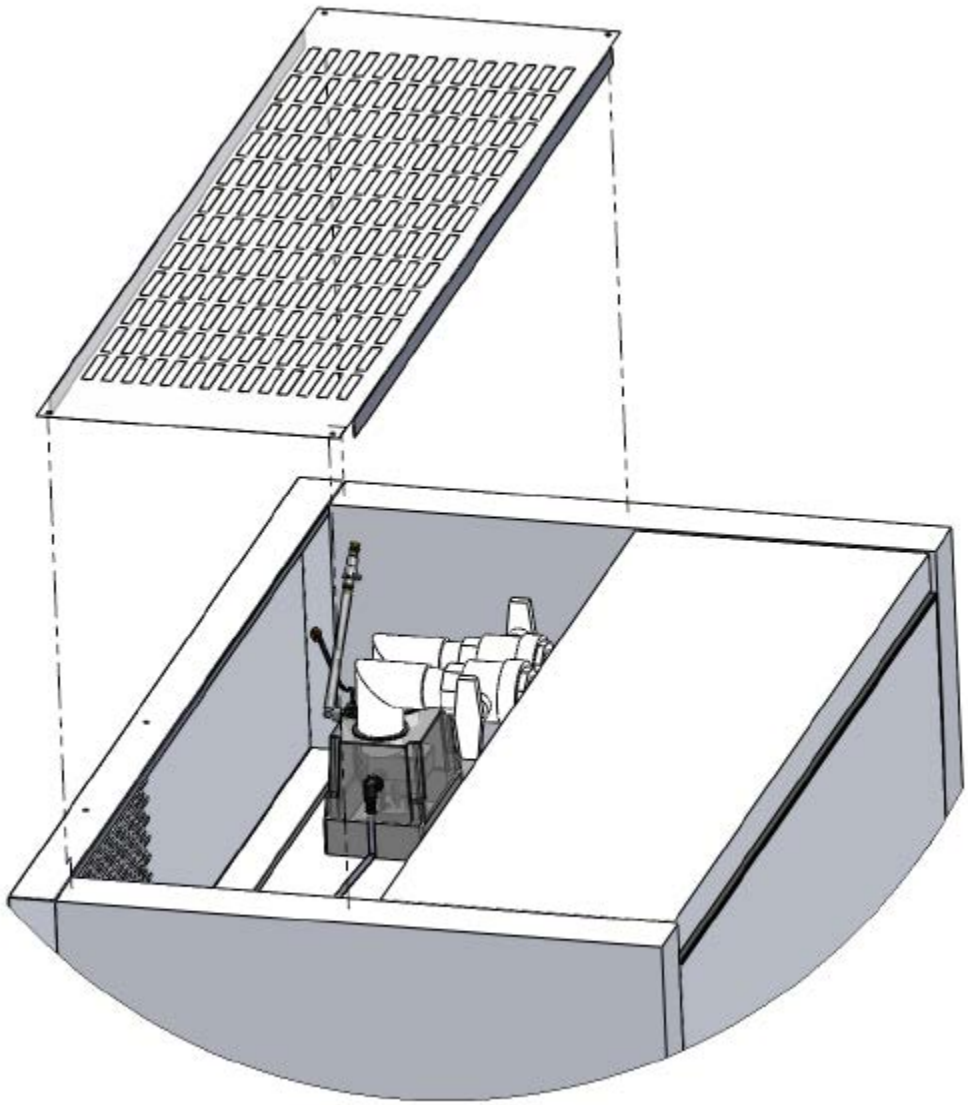

Figure 248

Supplemental Drawing - Humidifier Removal (Single Door Chambers Only)

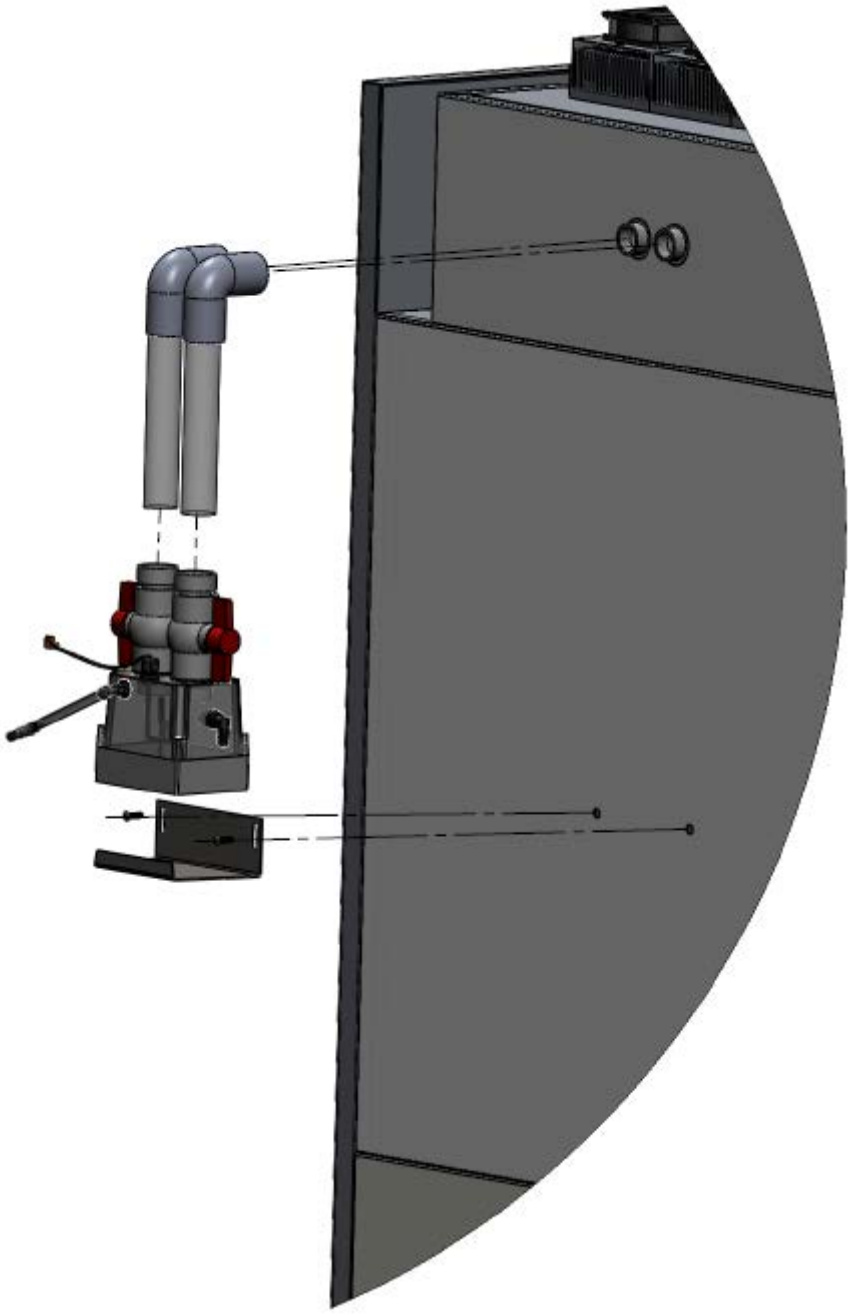

Figure 249

Supplemental Drawing - Optional Chart Recorder Install (Single Door Chambers Only)

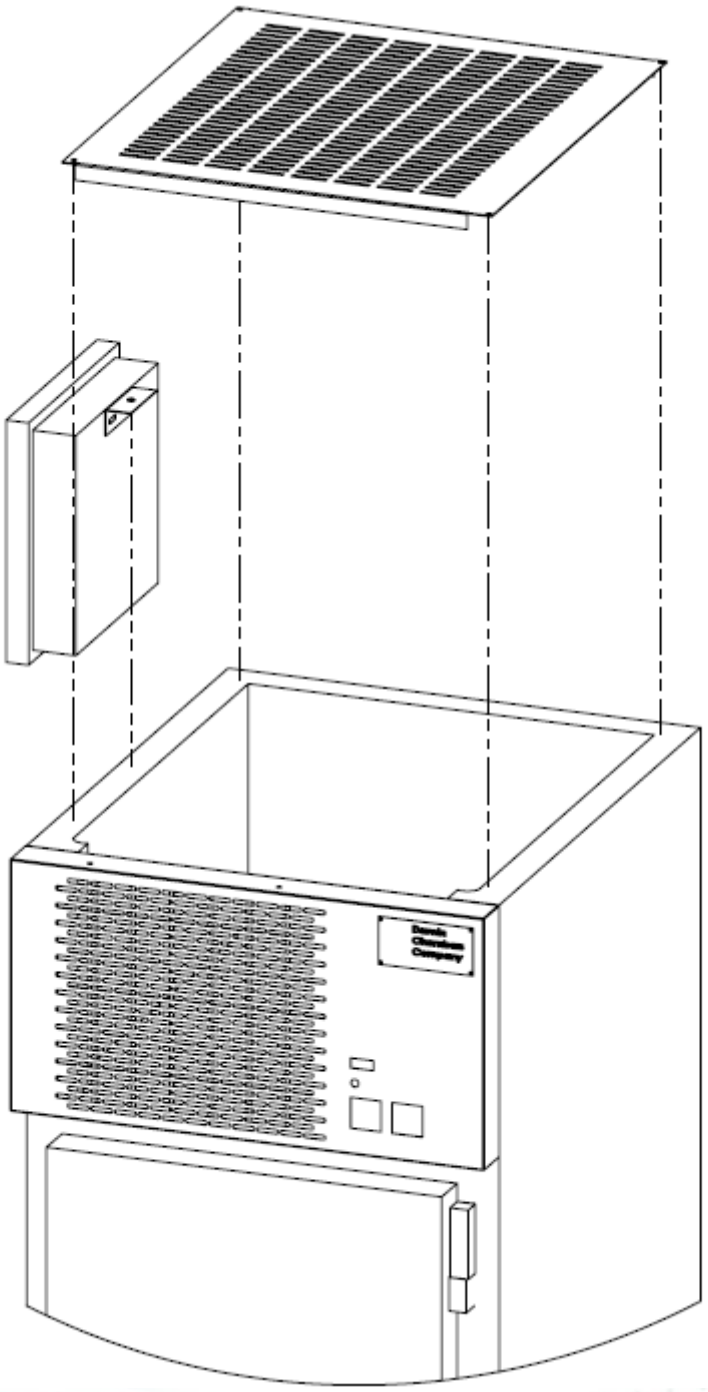

Figure 250

Supplemental Drawing - Single Door Humidifier Disassembly

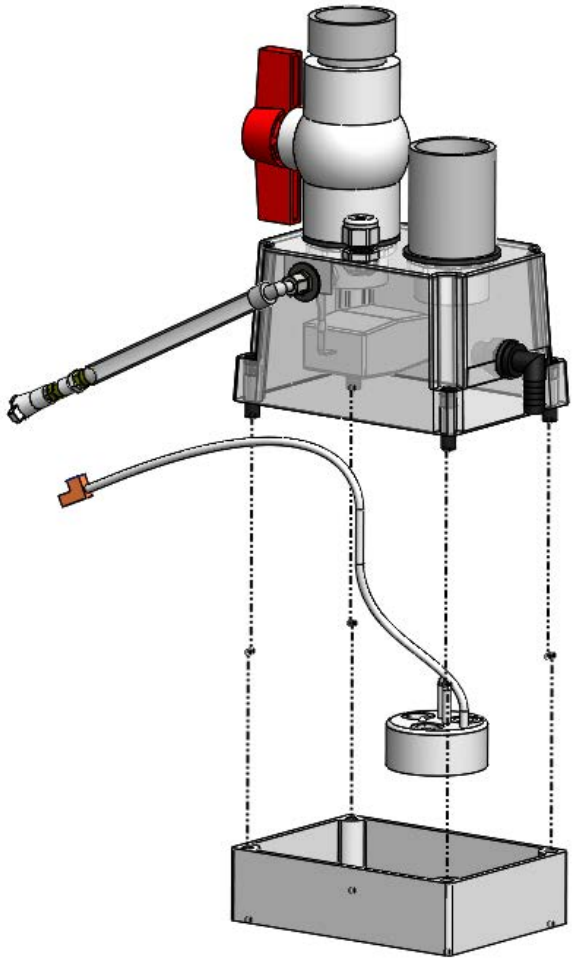

Figure 251

Supplemental Drawing - Humidifier Disassembly (two and three door chambers)

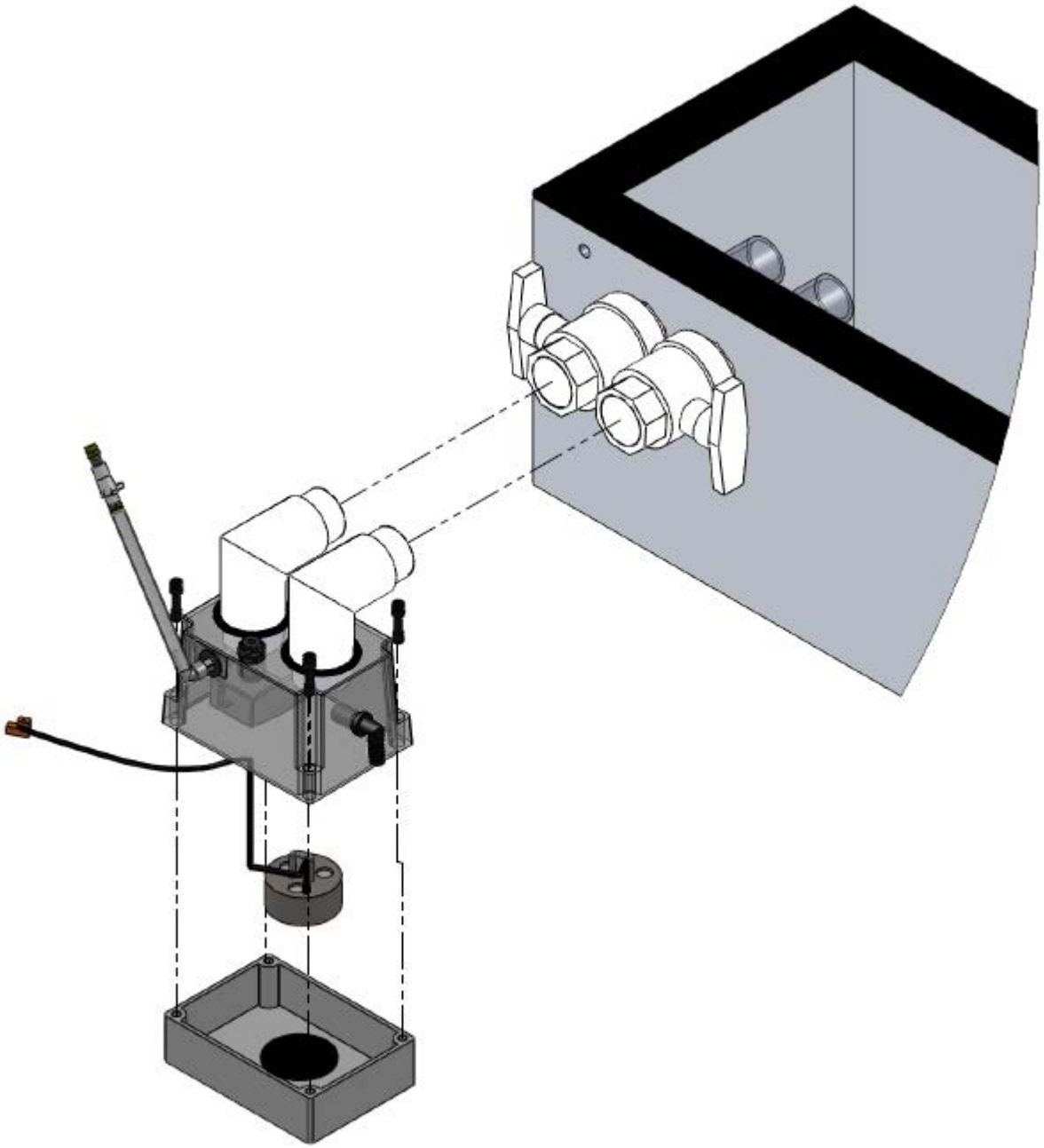

Figure 252

Supplemental Drawing - Humidifier Float

In some instances, after prolonged use, the humidifier may experience a higher than recommended water level, resulting in decreased humidifier performance. The recommended water level is ¾" to 1" above the ultrasonic transducer's conductivity sensor. Figure 253. There are three potential causes of a higher than recommended water level:

1) The humidifier's float, **Error! Reference source not found.**, is being impeded by the ultrasonic transducer's wire.
    - Open the humidifier case and reposition the wire such that it clears of the float.

2) The float has been damaged, resulting in the float not functioning properly.
    - Open the humidifier case and inspect the float. If water is accumulating inside the float body, replace the float assembly. During installation of the replacement float assembly, ensure the ultrasonic transducer is not positioned under the float body.

3) The water pressure is greater than the recommended 10psi.
    - High water pressure can result in excessive wear of the rubber stopper inside the valve. Disassemble the float assembly and inspect the rubber stopper for wear. If there is excessive wear, replace the float assembly.

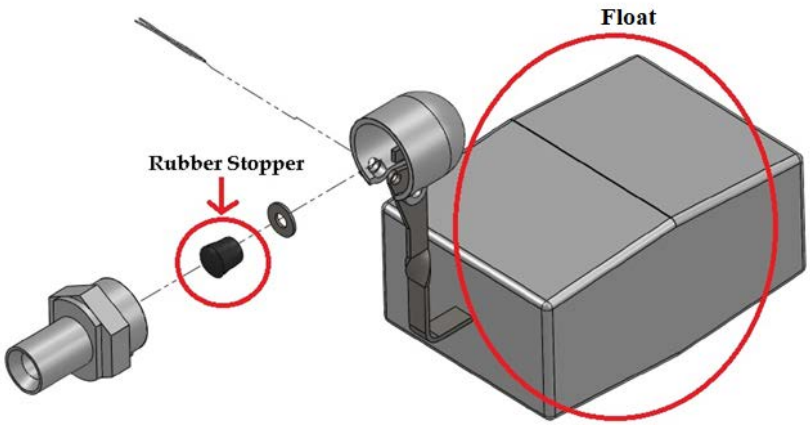

Figure 254

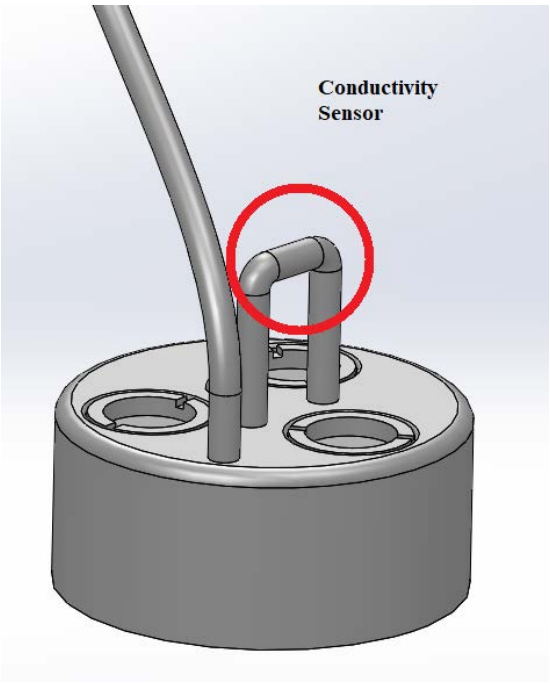

Figure 253

Supplemental Drawing - MG90 Install

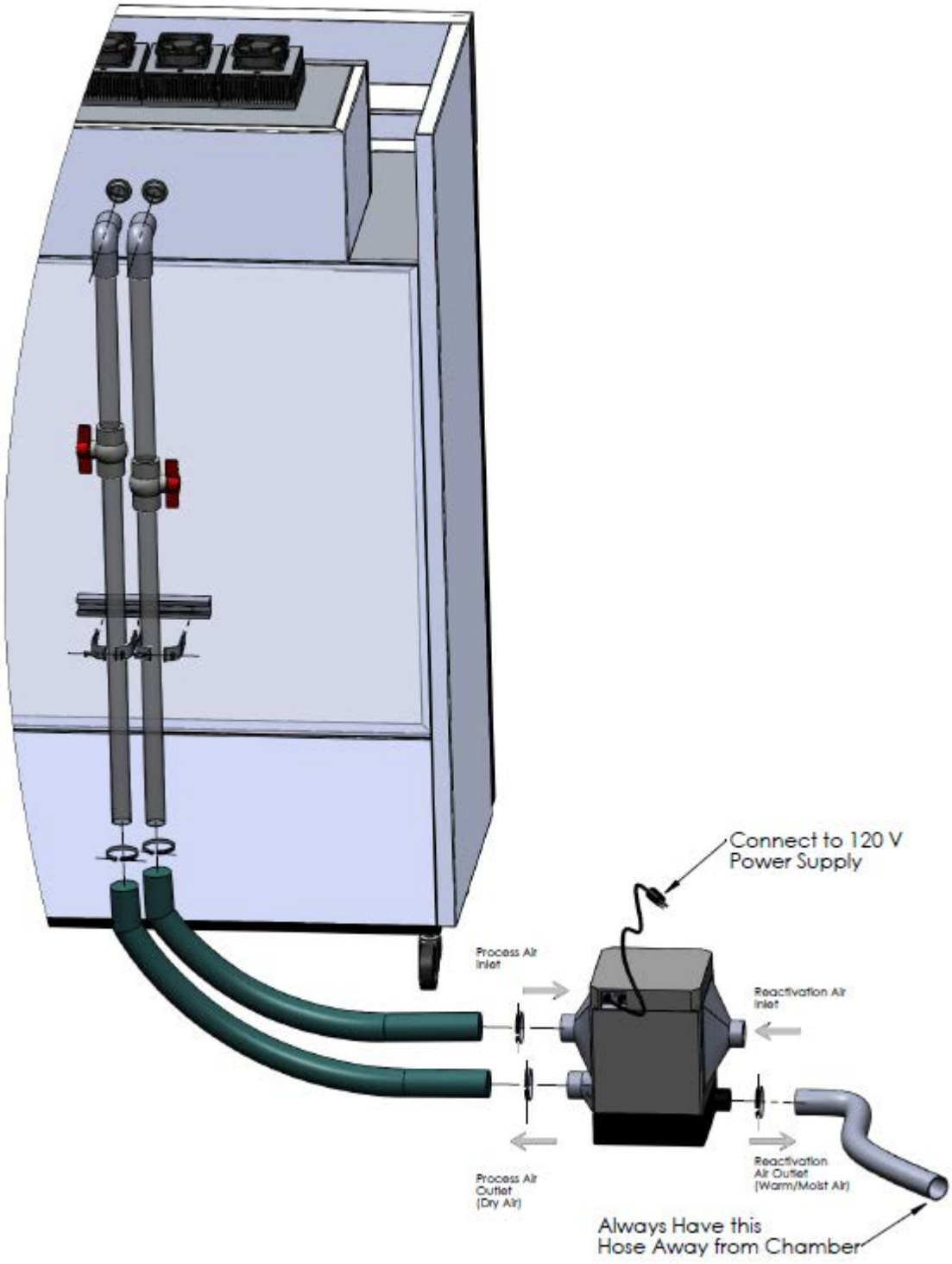

Figure 255

Supplemental Drawing - Membrane Dryer

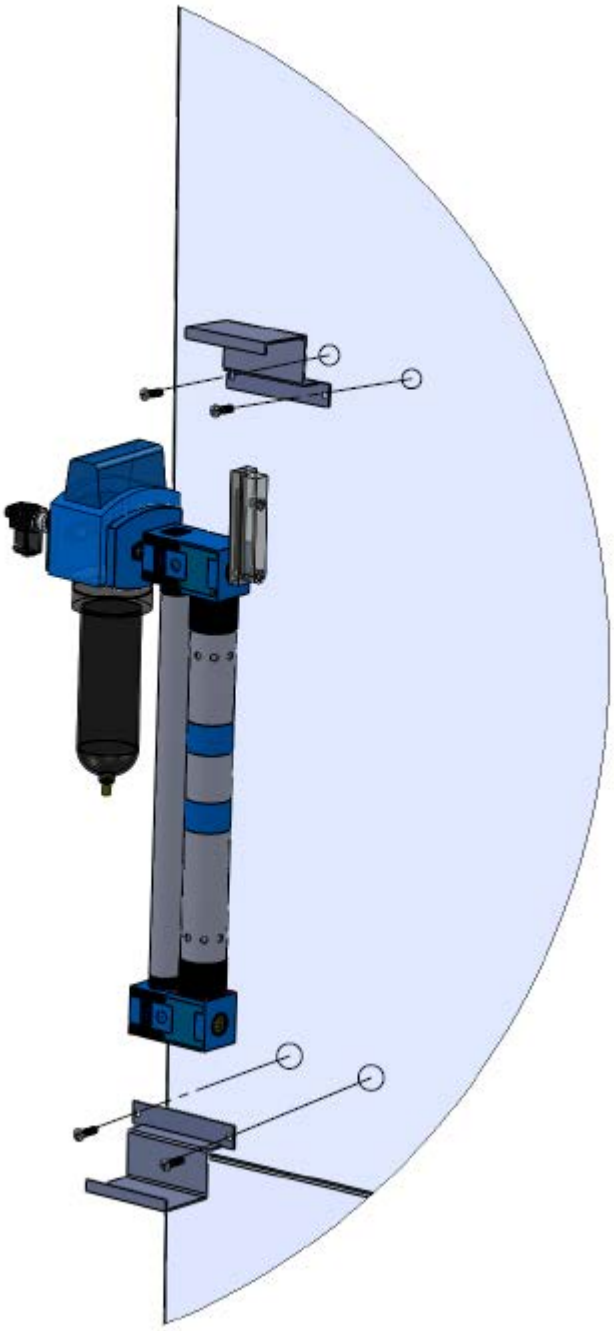

Figure 256