

# Natural Refrigerant Training Summit

Building a Sustainable Workforce

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## E3 Controls Introduction

Mike Hill

Emerson



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Refrigeration  
Council



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Council

  
EMERSON



## Supervisory Control

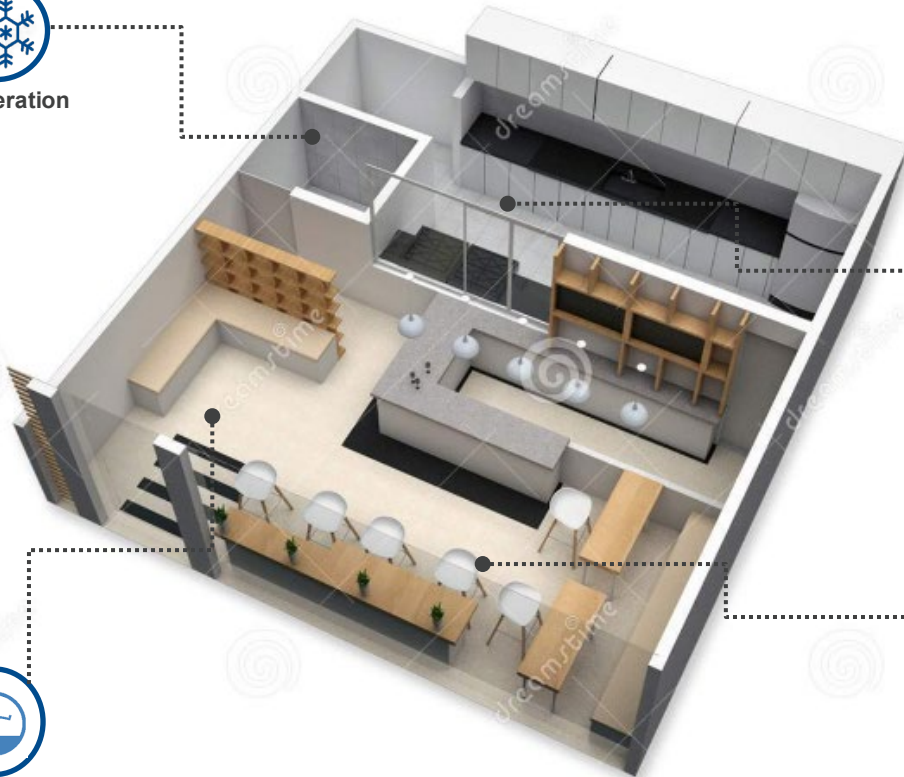
# What Does Emerson Supervisory Control System Do?

New Store

Remodel



Refrigeration



Lighting



HVAC



Energy Monitoring



- Built In Display
- Communicates to Modbus, BACnet Devices
- Multiple Ethernet Ports
- Onboard Graphics



- Cost flexibility
- Ideal for space constrained areas
- Flexible display options
  - Onboard I/O
- Flexible mounting

- HVAC Control
- Refrigeration Control
- Lighting Control
- Energy Metering
- Remote Monitoring
- Operational Optimization
- Energy Savings

# Touch Screen's 10, 15, 21 Inch Models Available

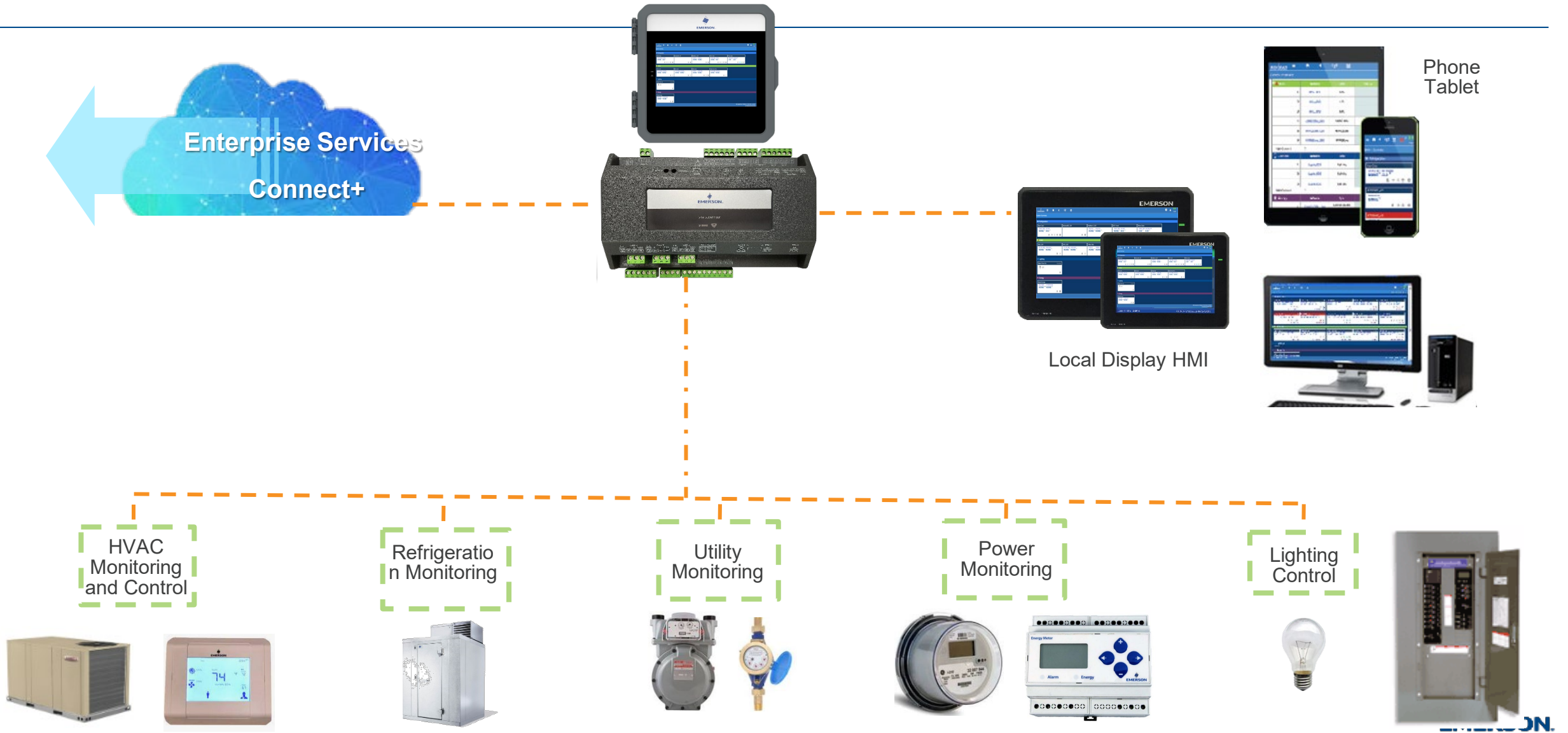
## 2. Optional Touch Screen and Sizes Available



### Wall-Mounted Control Screen and Interface

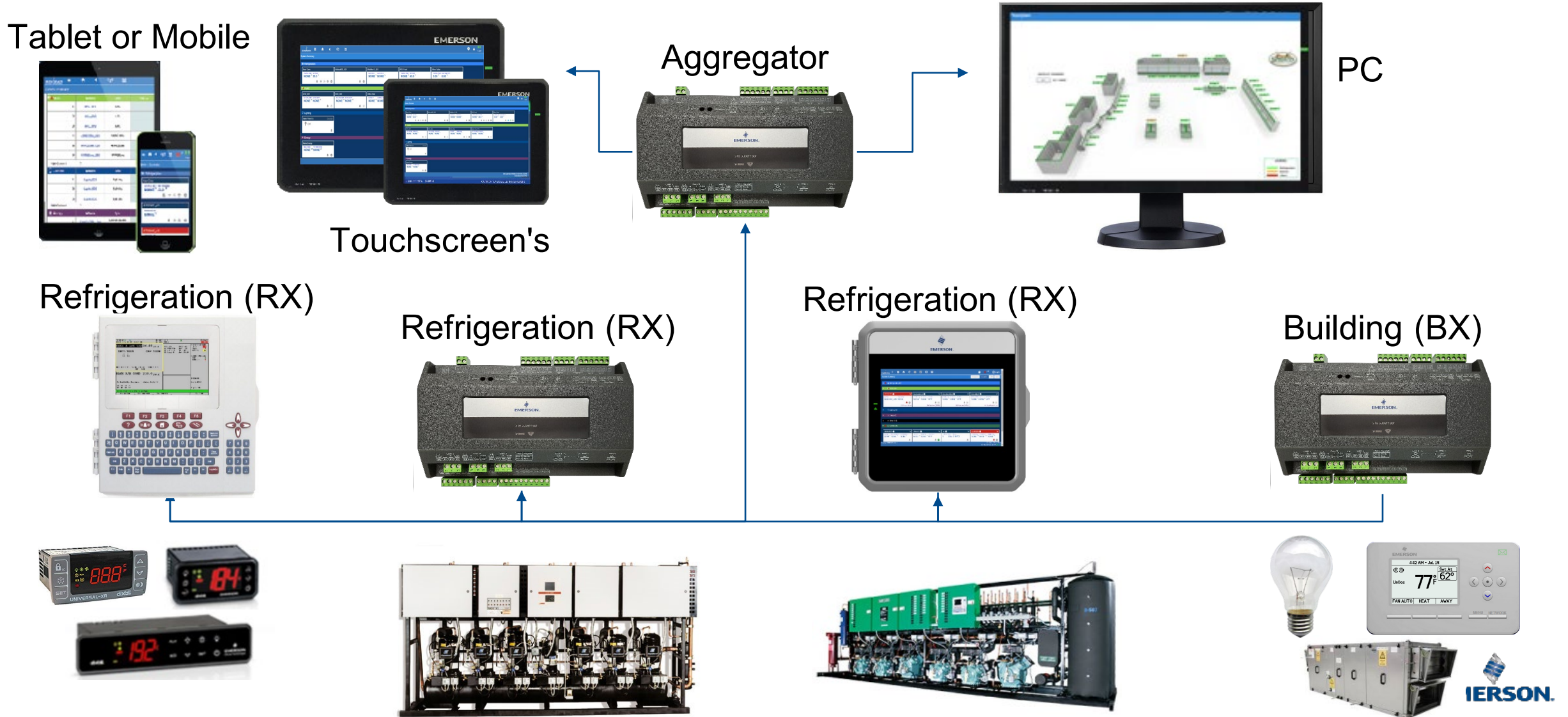
- Optional Sizes/Price point and user experience
- Primary access for local-level users
- Touchscreen color display
- Icon- and menu-driven operation
- Intuitive functions are familiar to all; no special training required
- View-only default
- Password protected access to advanced functions for managers and technician user modes
- Access to advanced functions requires authorization

# Network Architecture





# Network Layout \_ Flexibility with Existing and New Controllers





# E3 vs E2

## E3 front view



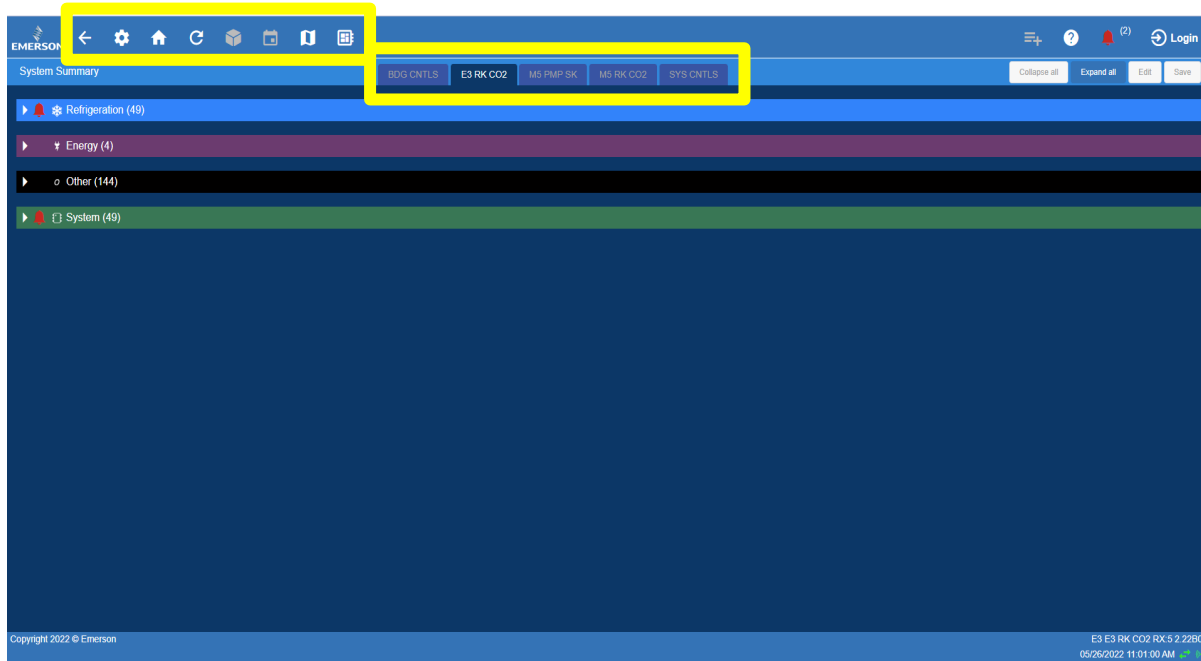
## E2e front view



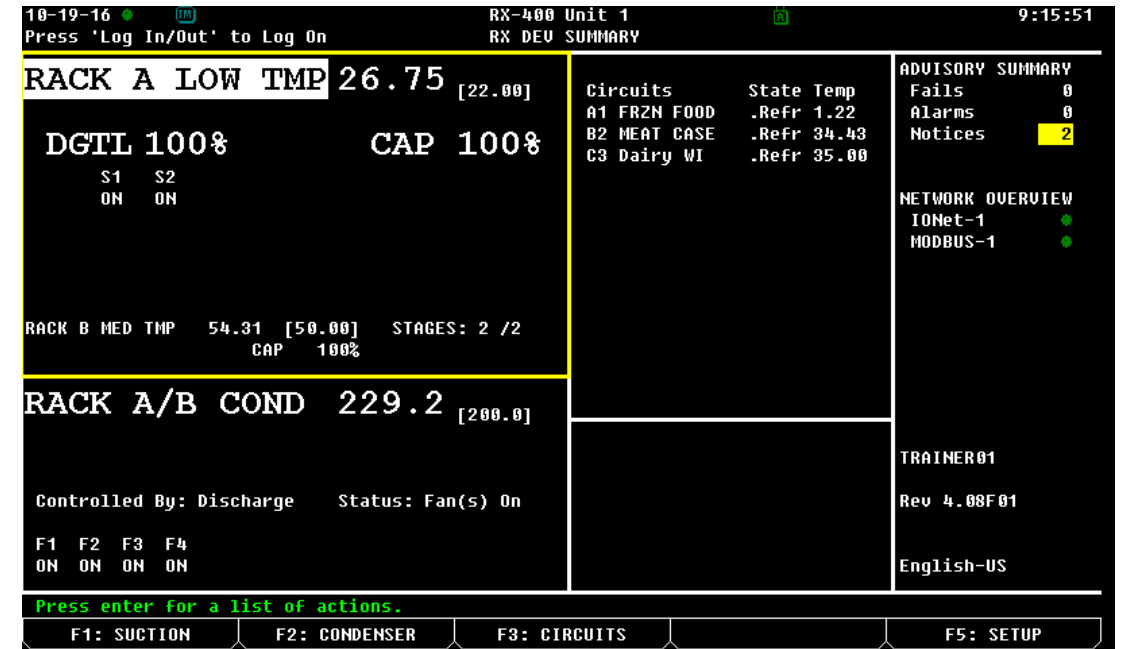


# E3 vs E2

## E3 software: Supervisory Control Software



## E2 Software:



The E3 operates on a shared software platform with Site Supervisor. This new format offers intuitive navigation that technicians will find familiar and easy to use.

# E3 Controller is a Drop-in Replacement for the E2 Product



- **True E2 Drop-in Replacement**
  - Identical wiring holes, mounting points and vents
  - Enclosure fits into existing panel cut-out
- **Updated Integrated Display**
  - **Larger 10"** capacitive color touch-screen
  - User-friendly interface with on-screen keyboard
- **Equivalent COM Port Configuration and Power Connections**
  - **Total of four COM ports** for connected devices with two isolated COM ports
  - Easily swap out an E2 with no need for rewiring
- **Fully Backward Compatible With MultiFlex and IONet Boards**

## E3 Technical Specifications

<b>Operating Temperature</b>	-40°F to 149°F (-40°C to 65°C)
<b>Operating Humidity</b>	5% - 95% RH non-condensing at 90°F
<b>Storage Humidity</b>	5% - 100% RH
<b>24 VAC</b>	24 VAC ±20%, 50/60 Hz, Class 2, 80VA
<b>Dimensions</b>	12" L x 12.5" W x 3.75 H"
<b>4 RS485 ports</b>	COMM 1 = RS485 Com 2 A and B COMM 2 = RS485 Com 6 (isolated) COMM 3 = RS485 (isolated) COMM 4 = RS485 Com 4 A and B
<b>2 Ethernet ports</b>	Ports 0,1
<b>2 USB ports</b>	J2, J3

# Hardware Enhancements and Modified Applications

## Hardware Enhancements

E2 Hardware	E3 Hardware
500 MHz Single Core	1.6 GHz Quad Core
128 MB RAM	2 GB RAM
1 Ethernet Port (1 MAC/PHY)	2 Ethernet Ports (2 MAC/PHY)
3 RS-485 COM Ports	4 RS-485 COM Ports (2 Isolated)
Plug for Optional I/O Daughter Card	Plug for Optional I/O Daughter Card

## Modified Applications in E3

E2 Application Name	New E3 Application Name
Eng. Unit Converter	Localization
Heat/Cool Control	Thermostat or Sensor Control
Power Monitoring	Utility Monitoring
Pulse Accumulator	Utility Monitoring
Time Schedule	Scheduler

**Twelve times faster processing power and 16X additional memory built in to E3 and SS for faster response time and increased storage.**



# Model Cross Reference for Supervisory Control Platform (SS/E3) vs E2

E3 or Site Supervisor to E2 Cross-Reference Guide									
E2 Models	E3 / Site Supervisor Models								
	Small Format Controller SF	Refrigeration Controller RXS	Refrigeration Controller RXSe	Building Controller BXS	Building Controller BXSe	Combination Controller CXS	Combination Controller CXSe	Service Replacement SR	Site Aggregator SA
RX300		✓						✓	
RX400			✓					✓	
BX300				✓				✓	
BX400					✓			✓	
CX100	✓							✓	
CX300						✓		✓	
CX400						✓	✓	✓	
Overlay E2									✓

## New Service Replacement (SR) Model

- **Max** number of all applications RX, BX, CX, 400 level
- **Save time** when emergency replacement needed
- **Reduce complexity** of carrying/stocking multiple types for service calls
- **Simplify** your enterprise with one controller that does the max of everything

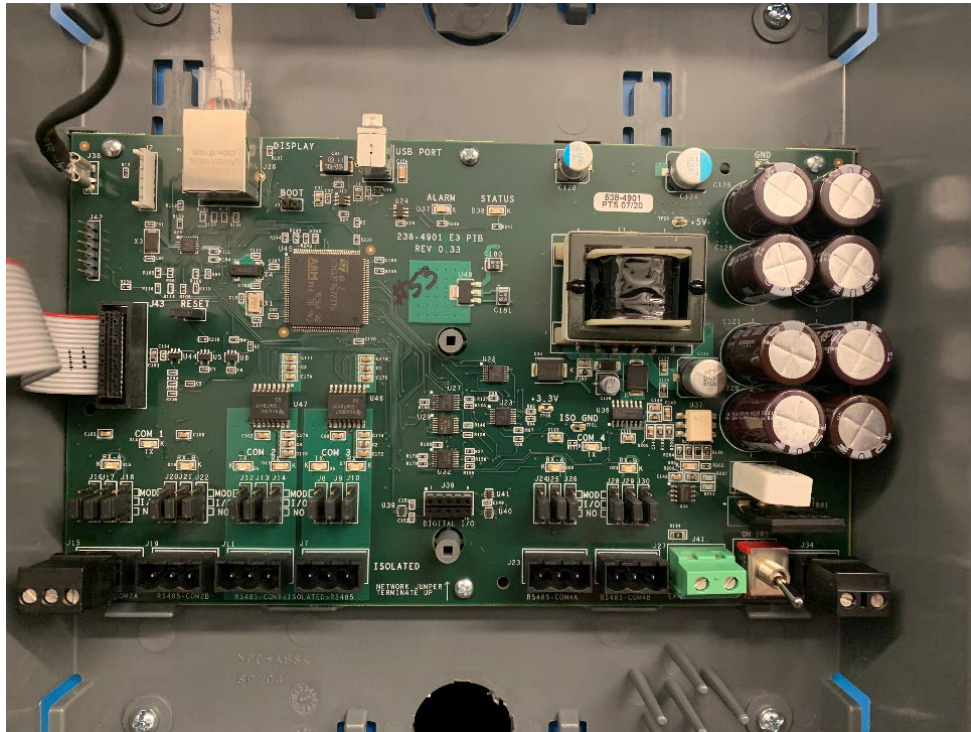
## Site Aggregator (SA)

- True System Supervisor. Dedicated processing power and memory for logging and analytics
- Single view of controllers, compatible with E2's and Supervisors
- Overlay Existing E2 network

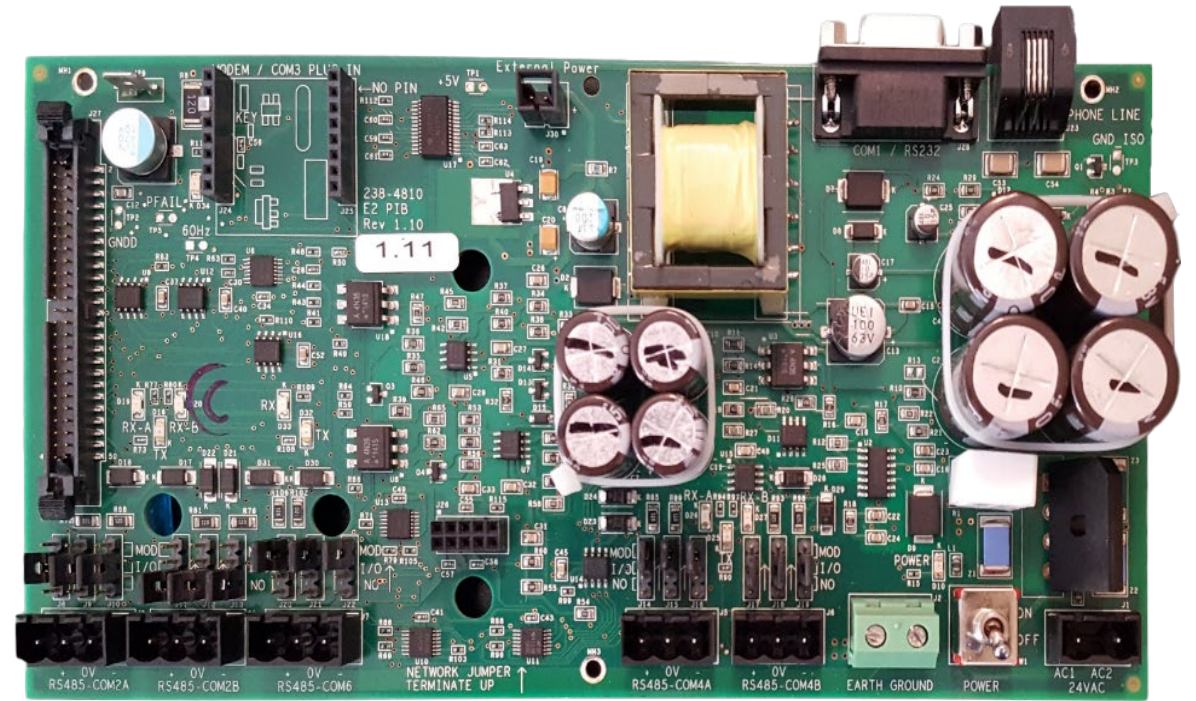


# E3 vs E2

## E3 PIB



## E2 PIB

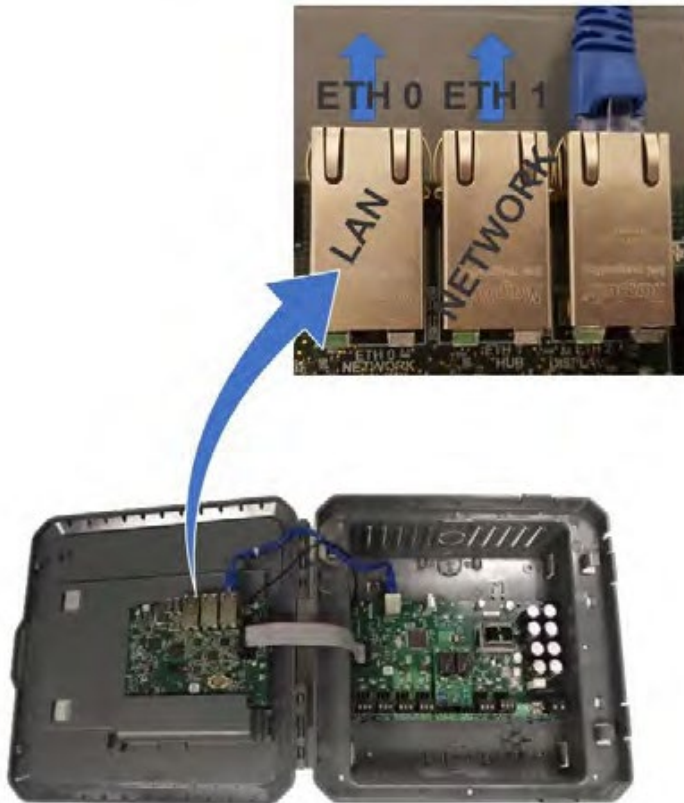


The E3 PIB has been designed to resemble the E2e PIB. This makes the swap easier as the technician is familiar with the layout of wiring and com port terminations. USB on the E3 PIB can be used for making configuration changes to the E3's IP settings.



# E3 vs E2 Network Connections

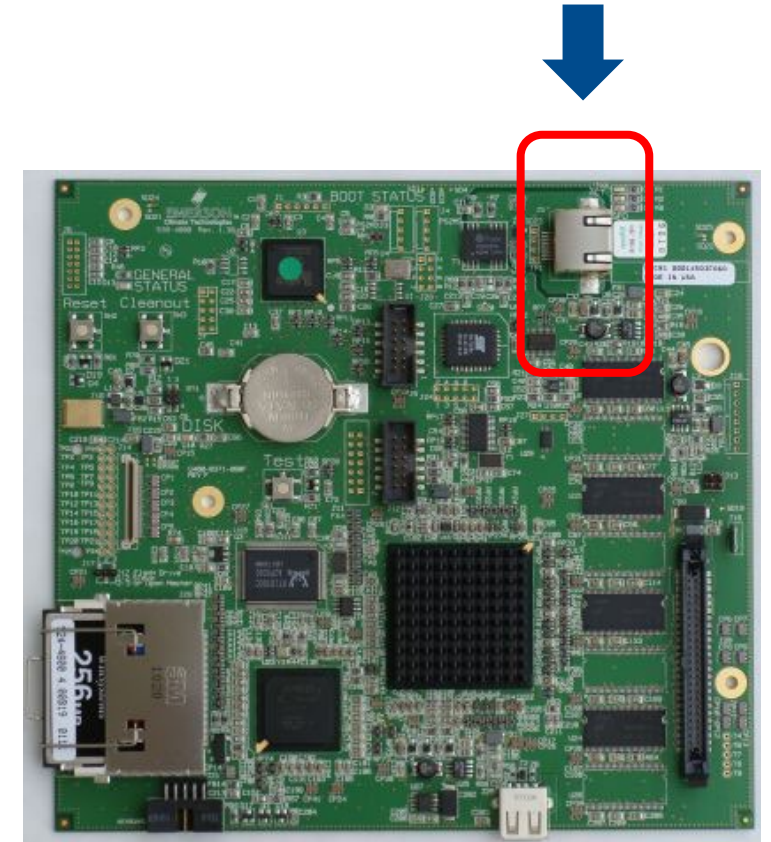
## E3 Ethernet Connections



## E3 Ethernet Connections

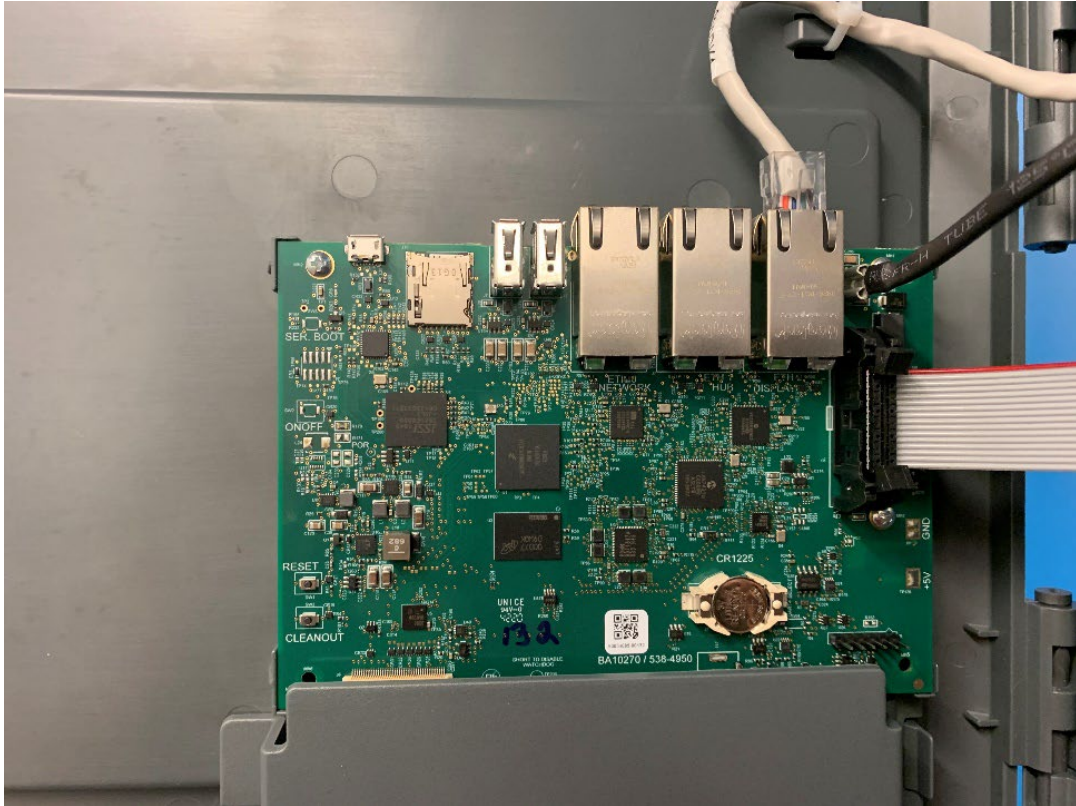
- The E3 provides an additional Ethernet connection on back of the door. ETH 0 is used to connect to corporate LAN.
- ETH 1 is designed to be used for directly connecting to PIB and laptop or PC and network devices.
- This allows a user to be hard wired to the E3 device while still connected to the store's corporate network. Added security has been incorporated by keeping the ETH1 and ETH 0 connections physically separated.

## E2 Ethernet Connections



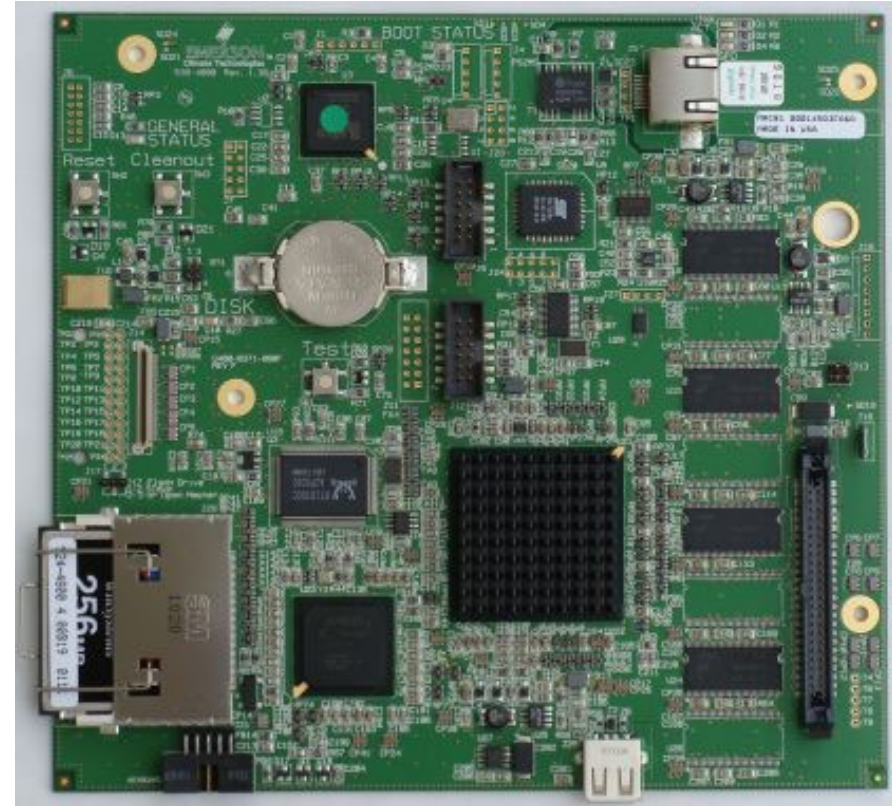
# E3 vs E2

## E3 Back of door



Two USB ports are available on the door of the E3 and can be used for backup/restoring of the setpoint files, and firmware updates.

## E2 Back of door





# E3 Back Of Door

- E3 Ethernet connections

## SD Card

Archive log data, backup and restore of setpoints files

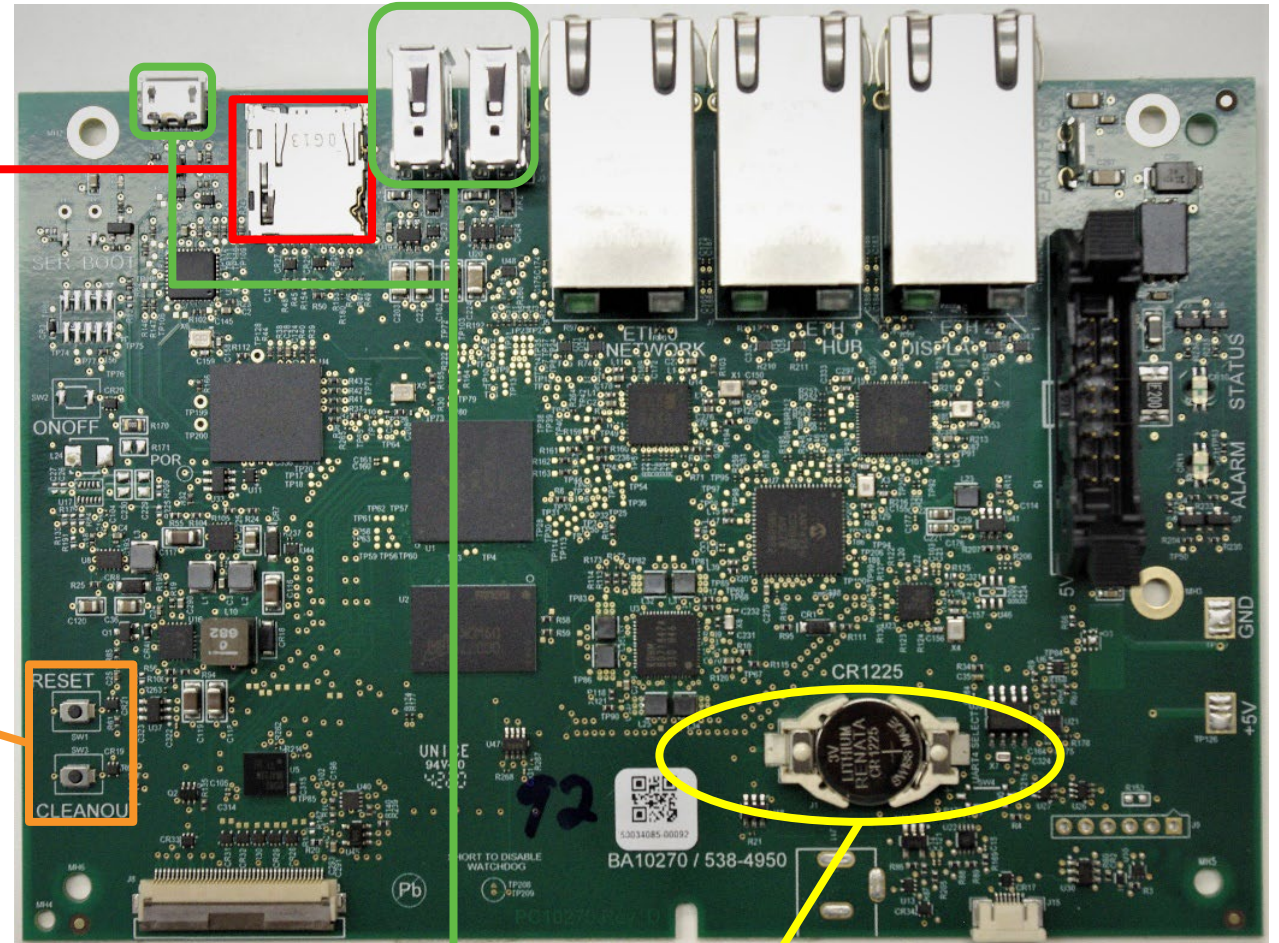
## Reset and Cleanout

Performs a manual reset and cleanout of the device

For Site Supervisor the 'Cleanout' is done via software in the Logs and Statistics page.

## USB and Micro USB Drives

File and Firmware updates, setpoints file backup and restore.



## Battery

Protects log and alarm data during power loss



# Supervisory Control Software Differences

Features and Benefits



# Connecting to the E3 thru Internal Webpage



All configuration can be accomplished through the E3's Built-in Display, Remote Display or laptop, PC. **No Software Needed**

- IP Address 192.168.1.250 – Port 1
- IP Address 192.168.0.250 – Port 0



# New Control Software Features

## Software Features

Supervisory Control Software provides the Same Control Function as E2, and includes new:

- Faster Response and Navigation
- Text and Email Alerting
- Prioritized Alarms
- Floor Plan Views
- Aggregate Devices
- Enhanced Upstream Communication Capabilities
- Intuitive Navigation with Graphical Interface
- Increased Security
- Increased Network Functionality
- No Additional Software Needed





# Internal Webpage

The screenshot displays the Emerson internal webpage interface. At the top left, the Emerson logo and a navigation bar with icons for settings, home, refresh, cube, calendar, document, and grid are highlighted with a yellow box. To the right, a secondary navigation bar contains a hamburger menu, help icon, notification bell with a (5) badge, and a Logout button, also highlighted with a yellow box. Below these is a 'System Summary' section with a 'Collapse all' button and 'Expand all', 'Edit', and 'Save' buttons. The main content area lists system categories: Refrigeration (7), HVAC (2), Lighting (2), Energy (7), and System (6). The bottom footer includes 'Copyright 2022 © Emerson', a user profile for 'user', and a site supervisor demo ID 'SR:1 2.21F01' with a timestamp '08/03/2023 09:27:21' and connectivity icons, all highlighted with a yellow box.

EMERSON

System Summary

Refrigeration (7)

HVAC (2)

Lighting (2)

Energy (7)

System (6)

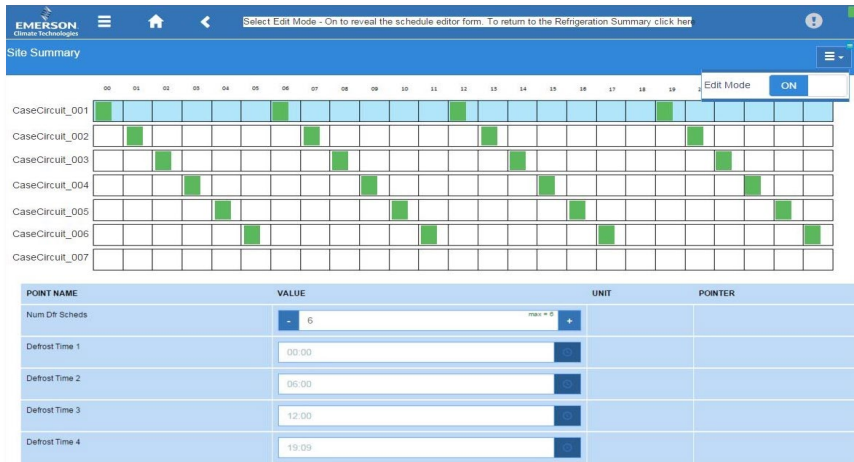
Copyright 2022 © Emerson

user

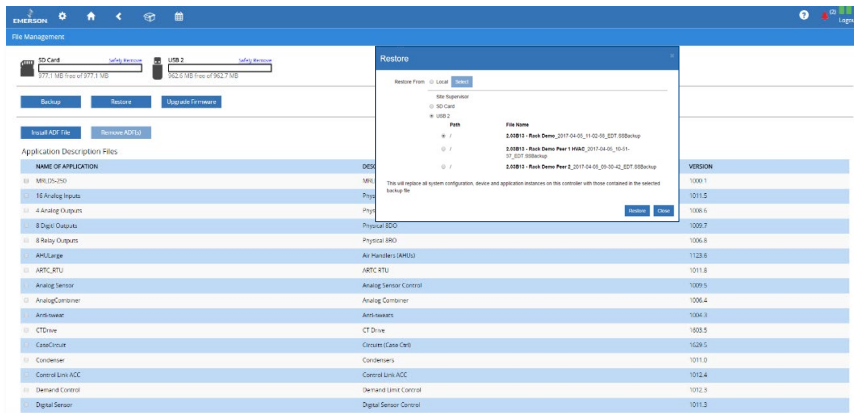
Site Supervisor Demo SR:1 2.21F01  
08/03/2023 09:27:21

# Supervisory Control Differentiators vs. E2

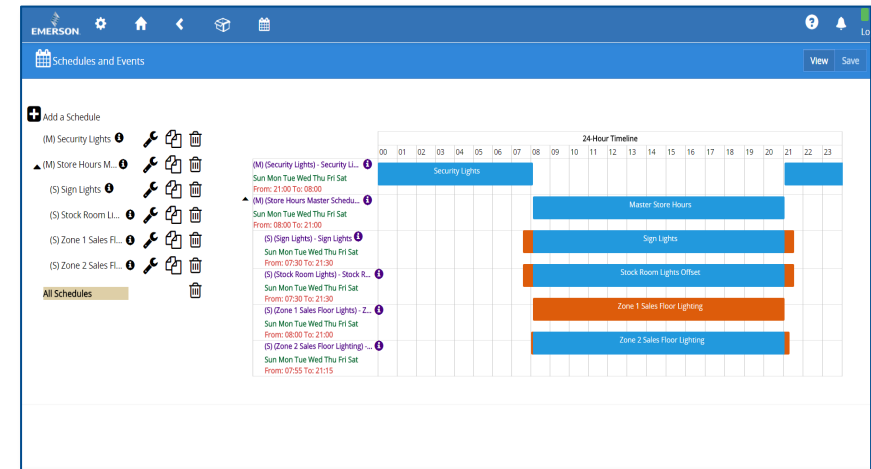
## Graphical Defrost Summary



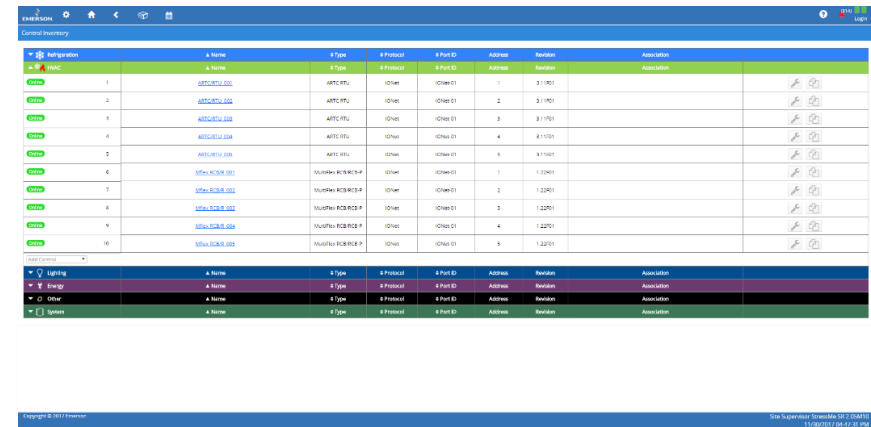
## File Management



## Graphical Schedule



## Site Inventory



# Fast Troubleshooting via Smart Alarms and Custom Graphing

## Smart Alarms

- Provides high level explanation, possible causes, and suggested actions to take. Can enter custom user defined messages.

The screenshot displays the 'Active Alarms (311)' list on the left and a detailed view of a 'Non-Critical Alarm 1 of 1' on the right.

#	Description	A Type	# Time Occurred	# Age
1	Non-Critical Alarm	Non-Critical	11/08/2021 10:12:12 PM	1h 17m
2	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
3	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
4	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
5	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
6	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
7	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
8	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
9	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
10	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
11	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
12	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
13	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
14	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
15	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
16	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
17	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
18	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
19	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
20	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
21	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
22	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
23	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
24	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
25	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
26	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
27	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
28	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
29	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m
30	Failed Sensor or Bad Wiring	Non-Critical	11/08/2021 09:41:59 PM	0h 20m

**Non-Critical Alarm 1 of 1**

**Details** [View Graph]

**Explanation** You are receiving this alarm because your condenser fan has cycled more than the recommended times per time period

**Possible Causes**

1. Failed temperature sensor.
2. Improper temperature sensor location.
3. Improper pressure transducer connection.
4. Extreme ambient conditions.
5. High pressure discharge valve malfunction.
6. PID not properly tuned.
7. Capacity cannot meet load.

**Suggested Actions**

1. Check temperature sensor for proper operation and placement.
2. Check pressure probe for proper operation.
3. Check valve setpoint for appropriate ambient conditions.
4. Check high pressure valve for proper operation.
5. Check PID related parameters for proper configuration.
6. Check unit sizing for proper load capacity.

**User Defined Message**

Type: Non-Critical  
Time Occurred: 01/01/2021 10:12:12 PM  
Age: 6d 17h 44m  
Unit Number: 1  
Unit Name: Market  
Device Type: SS  
Originator: Condenser A: PRES CTRL IN  
Condenser A: TEMP CTRL IN  
Ex: Fan\_001:Cycle number

## Graphical System Status Pages

- Monitor system status and performance visually with graph-based reports that identify historical patterns, trends and issues.

The screenshot displays the 'EMERSON' graphical system status page for '+23 R507 SUC Suction Groups'. The interface includes a navigation menu with options like Status, General, Setpoints, Float Setup, Inputs, Outputs, Comp Setup, Comp Outs, Alarms, Proof, Comp On, Advanced, Power, Hot Gas, Checkit, ISD, Associations, and Input/Output Status.

**System Parameters:**

SUCTION PRESS	64.15 PSI
CUR PRESS SETPT	58.00 PSI
STAGES ACTIVE	2
TOTAL STAGES	6
PERCENT USED	37.31 %
RACK FAIL	OFF
COMP 1	OFF
COMP 2	OFF
COMP 3	ON
COMP 4	OFF
COMP 5	ON
COMP 6	OFF

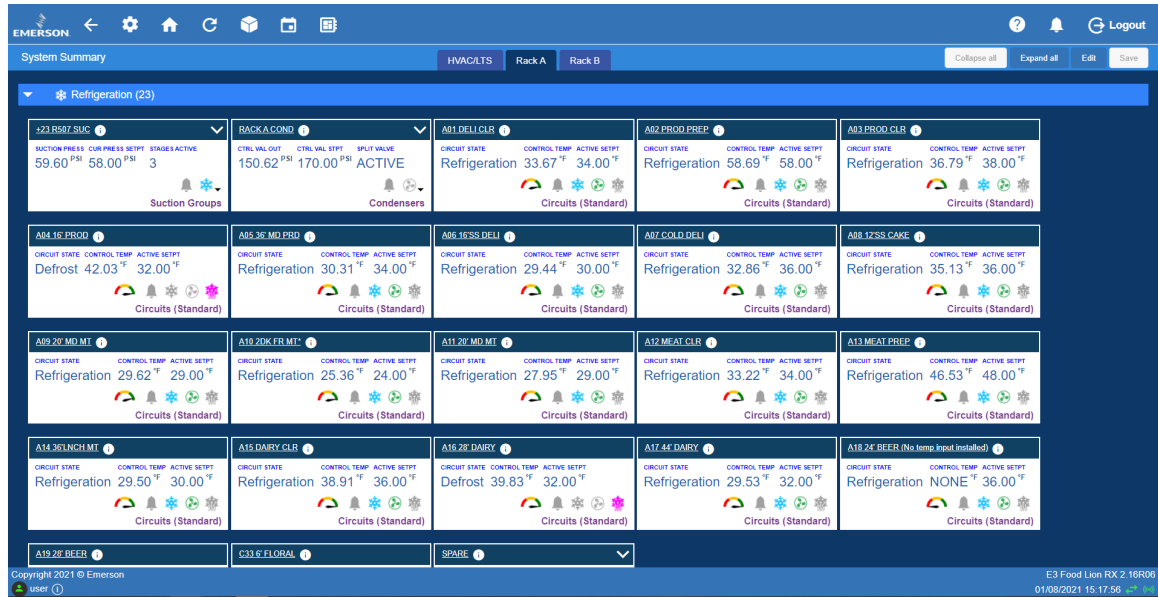
**Graphs:**

- Graph 1: SUCTION PRESS (PSI) vs Time (06:00:00 to 12:00:00). Shows a fluctuating pressure around 60 PSI.
- Graph 2: CUR PRESS SETPT (PSI) vs Time (06:00:00 to 12:00:00). Shows a constant setpoint of 58.00 PSI.
- Graph 3: PERCENT USED (%) vs Time (06:00:00 to 12:00:00). Shows a fluctuating usage percentage around 37.31%.
- Graph 4: COMP 1 (ON/OFF) vs Time (06:00:00 to 12:00:00). Shows the compressor is OFF.
- Graph 5: COMP 2 (ON/OFF) vs Time (06:00:00 to 12:00:00). Shows the compressor is OFF.
- Graph 6: COMP 3 (ON/OFF) vs Time (06:00:00 to 12:00:00). Shows the compressor is ON.
- Graph 7: COMP 4 (ON/OFF) vs Time (06:00:00 to 12:00:00). Shows the compressor is OFF.
- Graph 8: COMP 5 (ON/OFF) vs Time (06:00:00 to 12:00:00). Shows the compressor is ON.
- Graph 9: COMP 6 (ON/OFF) vs Time (06:00:00 to 12:00:00). Shows the compressor is OFF.

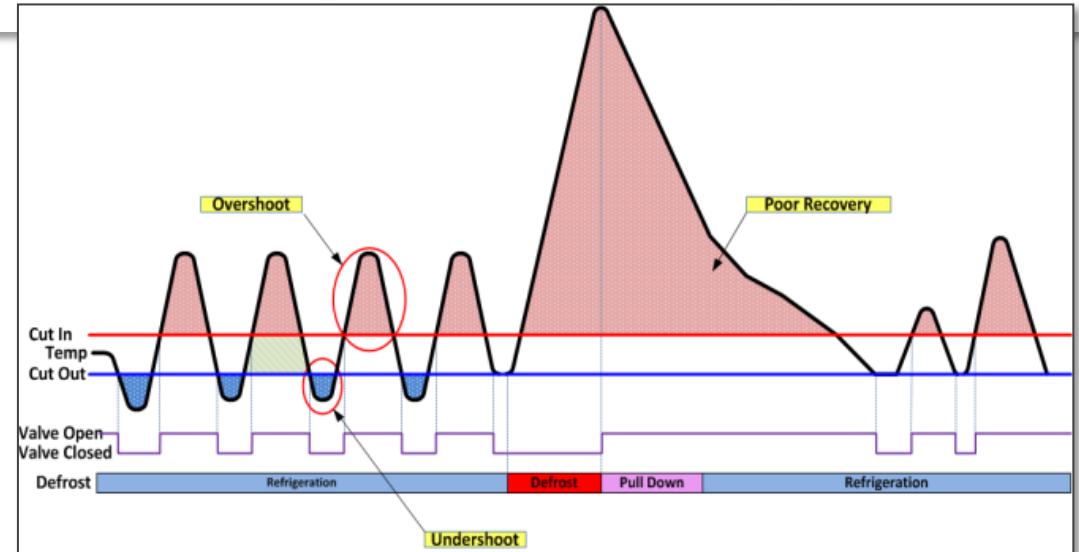
**Benefit: Faster Trouble Shooting, Saving Time**

# Performance Meter, A Simple Way to Recognize Site Performance

- Case performance rolls-up into circuit performance. Graph or download performance data for detailed analysis. Up to 13 months of performance history for seasonal performance comparison is available.



POINT NAME	VALUE	POINTER
FOM	99 %	
% Time Above	3.91 %	
% Time Below	0.00 %	
% Time At Target	96.00 %	
% Time In Defrost	13.06 %	
% Time In Recovery	0.00 %	
PB Hi Offset	5.40 Δ°F	
PB Low Offset	5.40 Δ°F	
Sensitivity	1.00	





# CO2 Control Additions

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# One CO2 System Application

## E2e Control

LOW TEMP NONE [884.0]

DGITL 100% CAP 100%

VS 950. RPM CAP 100%

GAS COOLER NONE [78.00]

VS 950. RPM CAP 100%

Controlled By: Differential Status: Fan(s) On

Press Enter For a list of actions:

F1: SUCTION F2: CONDENSER F3: STRATICS F4: SCHEDULES F5: SETUP

EQ INJ MT SCT

NEW OIL PULSE

MT CKT SHUTDOWN

Reading Name	Unit	Digital Inputs
1: EN SLOW STOP SENSOR	0.0000	1: RED SECTION BACK FUEL
2: EN SLOW STOP SEN	0.0000	2: STOPPED FOR SECTION CRP
3: EN SLOW STOP SEN	0.0000	3: RED STOP BY CONTROL
4: EN SLOW STOP SEN	0.0000	4: TRIP STOP BY CONTROL
5: EN SLOW STOP SEN	0.0000	5: EN STOP BY CONTROL
6: EN SLOW STOP SEN	0.0000	6: STOPPED FOR SECTION CRP
7: EN SLOW STOP SEN	0.0000	7: STOPPED FOR SECTION CRP
8: EN SLOW STOP SEN	0.0000	8: STOPPED FOR SECTION CRP

```

Output Eq      Value
A01 Eq        : IF(AI1<(AI2-10psi),3,IF(AI1<(AI2+4psi),a
A01 Eq 2      : i3,if(AI1<(ai2+10psi),ai3+ai4,ai5)))
    
```

Enhanced Suction Groups + or - 20 Flex Combiners For liquid Injection HG Injection Oil Management Circuit Shutdown Heat Reclaim

Hard To Read Hard to Write

Enhanced Suction Groups + Native Algorithms for CO2 Booster Control + Custom System Layout Feature

## New E3 CO2 Suction Group Control

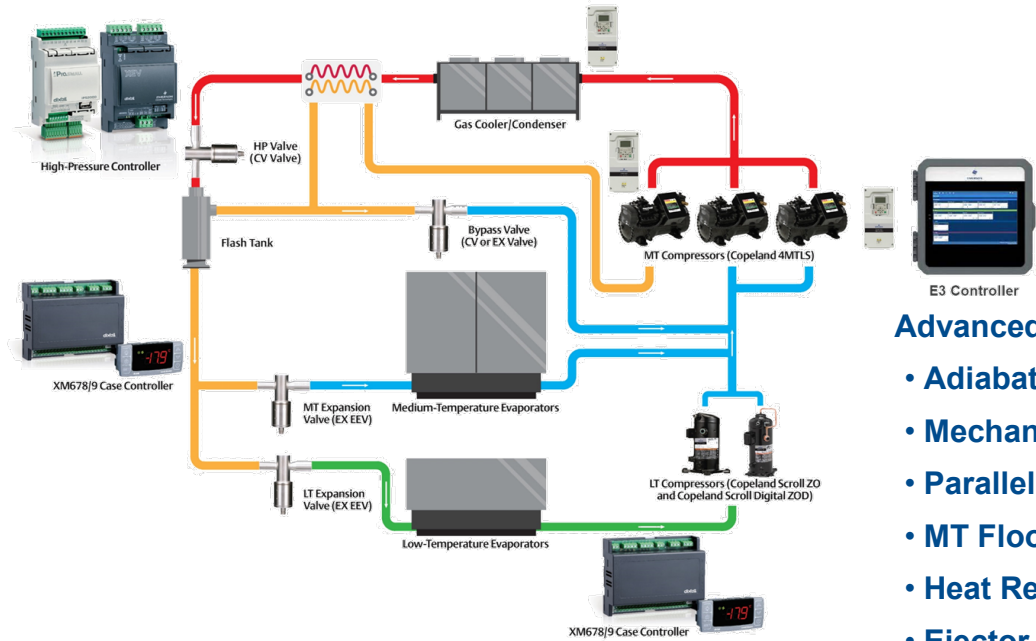
Customize Layout By User with tables, graphs & tiles!

Component	Unit	Value
1: En SLOW STOP SENSOR	0.0000	1: RED SECTION BACK FUEL
2: En SLOW STOP SEN	0.0000	2: STOPPED FOR SECTION CRP
3: En SLOW STOP SEN	0.0000	3: RED STOP BY CONTROL
4: En SLOW STOP SEN	0.0000	4: TRIP STOP BY CONTROL
5: En SLOW STOP SEN	0.0000	5: EN STOP BY CONTROL
6: En SLOW STOP SEN	0.0000	6: STOPPED FOR SECTION CRP
7: En SLOW STOP SEN	0.0000	7: STOPPED FOR SECTION CRP
8: En SLOW STOP SEN	0.0000	8: STOPPED FOR SECTION CRP

# Simplified Control Configuration

# Emerson CO<sub>2</sub> Solution Offering

## Centralized CO<sub>2</sub> Booster System



### Advanced CO<sub>2</sub> Technologies:

- Adiabatic Condensers
- Mechanical Subcooling
- Parallel Compression
- MT Flooded Evaporators
- Heat Reclaim,
- Ejector Control/Management

### Controls:

- Rack Controller
- Updated High Pressure & Bypass Valve Control with Visibility Into Rack Controller

### Compression:

- LT Compression
- MT Compression
- Core Sense Protection
- VFD Drives

### System Components:

- High Pressure Valves
- Case Controls
- System Protectors

### Emerson Breadth of CO<sub>2</sub> Products



Comprehensive Portfolio Offering To Accelerate Industry Adoption Of CO<sub>2</sub> Solutions

# Software User Interface Can Be Customized To User Preference

The screenshot displays the Emerson software interface for a CO2 system. The main title is "CO2 Suction Groups". The interface is divided into several panels:

- CO2 Suction Groups:** A table with columns: Name, FILTERED PRES, CUR PRES, SETPT, SAT SUCT TEMP, CUR SUPERHEAT, PERCENT USED, CONTROL STATUS, RACK FAIL, STAGE OUT, and ST. It lists three suction groups: CO2 Suction LI, CO2 Suction LT, and CO2 Suction NT.
- Condenser:** A table with columns: Name, T CTRL VAL OUT, DISCHARGE OUT, VS FAN OUT, CONTROL METHOD, and CONDENSER STATE. It shows data for GAS COOLERS.
- Circuits:** A table with columns: Name, CIRCUIT STATE, and CONTROL TEMP. It lists various refrigeration circuits like 01 VALVE P/CLB, 02 VALVE P/CLB, etc.
- HPV Controller:** A table with columns: Name, HPV Mode, P1 PRES-OUTLET, VALVE 1 OUTPUT, P2 PRES-RECEIVE, and VA. It shows data for HPV CO2 301.
- XM Case Controllers:** A table with columns: Name, CONTROL VALUE, and COMMAND OUT. It lists various sensors and controllers like AD EXCH 30 FWH, CO2 INLET SPT, etc.
- Control Ambient Air Temperature:** A line graph showing temperature fluctuations over time.
- Sensors:** A table with columns: Name, CONTROL VALUE, and COMMAND OUT. It lists various sensors like CO2 INLET SPT, CO2 COVER LG TP, etc.
- OAT RH:** A table with columns: Name, OAT OUT, and OUTDOOR HUM OUT. It shows data for GLOBAL DATA.

Match Traditional “CX” View for Facility Or Refrigeration Specific for Service Technician



# Separate Customizable Status Screens For LT, MT, and Parallel Compressor CO2 Suction Groups



Pull In Data From Any Application

# Separate Customizable Status Screens For HP/BPV Controller















Pull In Data From Any Application

# Tabs With New CO2 Features



# Tabs With New CO2 Features

POINT NAME	VALUE	
 SUCT PRES SETPT	<input type="text" value="375.0"/>	+ PSI  
Ext Pres Shift	<input type="text" value="0.0"/>	+ PSI 
Pres Deadband	<input type="text" value="10.0"/>	+ PSI 
Liquid Injection Setpoint	<input type="text" value="50.00"/>	+ Δ°F 
Liquid Injection Deadband	<input type="text" value="5.00"/>	+ Δ°F 
Hot Gas Injection Setpoint	<input type="text" value="10.00"/>	+ Δ°F 
Hot Gas Injection Deadband	<input type="text" value="5.00"/>	+ Δ°F 
Enable Oil Separator Pulse	<input checked="" type="radio"/> ENABLED <input type="radio"/> DISABLED	
Oil Dump Interval	<input type="text" value="00:03:00"/>	
Oil Dump Pulse Duration	<input type="text" value="00:00:05"/>	

New CO2 Application



# Tabs With New CO2 Features

POINT NAME	VALUE	POINTER
▶ Load Management State	<input type="text" value="Startup"/>	<input data-bbox="1640 411 1707 462" type="button" value="?"/>
▶ Next Load Enable	<input type="text" value="00h:01m:19s"/> ⓘ	<input data-bbox="1640 491 1707 542" type="button" value="?"/>
▶ DISREGARD ALARMS	<input type="text" value="OFF"/> ▼	<input data-bbox="1640 571 1707 622" type="button" value="?"/>
Persist Active Advisories	<input checked="" type="radio"/> YES <input type="radio"/> NO	<input data-bbox="1640 651 1707 702" type="button" value="?"/>
Hide inactive Alarms outputs	<input checked="" type="radio"/> YES <input type="radio"/> NO	<input data-bbox="1640 731 1707 782" type="button" value="?"/>
Num Load Enables	<input type="text" value="4"/> - +	<input data-bbox="1640 811 1707 862" type="button" value="?"/>
▶ MT Load Enable 1	<input type="text" value="ENABLED"/>	<input data-bbox="1640 891 1707 942" type="button" value="?"/>
▶ LT Load Enable 1	<input type="text" value="DISABLED"/>	<input data-bbox="1640 971 1707 1022" type="button" value="?"/>
▶ MT Load Enable 2	<input type="text" value="DISABLED"/>	<input data-bbox="1640 1051 1707 1102" type="button" value="?"/>
▶ LT Load Enable 2	<input type="text" value="DISABLED"/>	<input data-bbox="1640 1130 1707 1182" type="button" value="?"/>

# Tabs With New CO2 Features

< Status General Setpoints Inputs Outputs Stage Setup Stage Outs **Load Enables** Var Cap CO2 Alarms Alarm IO Alarms Proof Comp Oil Normal Power H

POINT NAME	VALUE	POINTER
POINTER <input type="checkbox"/> Show non-visible points		
TARGET	<input type="text" value="5G +34 Cooler Coil 1"/>	PROPERTY <input type="text" value="LOAD ENABLE"/>
+ <input type="button" value=""/>		
Override		
In Override <input type="text" value=""/> <input type="button" value="OFF"/>		
Expanded Information		
Enabled <input type="text" value=""/> <input type="button" value="OFF"/>		
MT Delay Load Enable 1	<input type="text" value="00:02:00"/> ⓘ	<input type="button" value="?"/>
MT Load Enable 1 Alarms	<input type="text" value="MT-Hi Discharge Pressure 2 × Hi Flash Tank Pressure 2 ×"/> ⌵	<input type="button" value="?"/>

New CO2 Application

# Tabs With New CO2 Features

< **Status** General Setpoints Inputs Outputs Stage Setup Stage Outs Load Enables Var Cap **CO2 Alarms** Alarm IO Alarms Proof Comp Oil Normal Power

POINT NAME	VALUE	POINTER
▶ High Superheat Alert	Non-Critical	?
▶ Low Superheat Alert	Non-Critical	?
▼ Low Superheat Alarm 1	Non-Critical	?
Category	Refrigeration	
Display Message		
Repeat Rate	00:00	
Monitor Alarm	<input type="radio"/> ON <input checked="" type="radio"/> OFF	
Low Superheat Alarm 1	10.00 Δ°F	?
Low Superheat Alarm 1 Delay	00:10:00	?
Low Superheat Alarm 1 Deadband	10.00 Δ°F	

New CO2 Application

# Tabs With New CO2 Features

POINT NAME	VALUE	POINTER
▶ PARALLEL STATE	<input type="text" value="Input Error"/>	<input data-bbox="1702 425 1768 476" type="button" value="?"/>
▶ Inputs in Error	<input type="text" value="BYPASS VALVE POSITION, SUCTION PRES"/>	
▶ RACK IN STANDBY	<input type="text" value="ON"/>	<input data-bbox="1702 591 1768 642" type="button" value="?"/>
▶ BGV CONTROL SETPOINT	<input type="text" value="460.0"/> <input type="button" value="-"/> <input type="button" value="+"/> PSI	<input data-bbox="1702 671 1768 722" type="button" value="?"/>
▶ BYPASS VALVE POSITION	<input type="text" value="NONE"/> <input type="button" value="-"/> <input type="button" value="+"/> %	<input data-bbox="1702 756 1768 808" type="button" value="?"/>
▶ ENABLE IT	<input type="text" value="ENABLED"/>	<input data-bbox="1702 836 1768 888" type="button" value="?"/>
Enable GC Temp	<input type="radio"/> YES <input checked="" type="radio"/> NO	<input data-bbox="1702 922 1768 973" type="button" value="?"/>
▶ BGV Setpoint in Standby	<input type="text" value="460.0"/> <input type="button" value="-"/> <input type="button" value="+"/> PSI	<input data-bbox="1702 1002 1768 1053" type="button" value="?"/>
▶ BGV Setpoint Running	<input type="text" value="500.0"/> <input type="button" value="-"/> <input type="button" value="+"/> PSI	<input data-bbox="1702 1088 1768 1139" type="button" value="?"/>

New CO2 Application



# Tabs With New CO2 Features Heat Reclaim

Heat Reclaim Heat Reclaim View Basic Delete Save Send To

- Status
- General
- Settings
- Conversions
- Reclaim
- Inputs
- Outputs
- Alarms
- Input/Output Status
- Generic Alarms

POINT NAME	VALUE	POINTER
Reclaim Type	Single with Water Tank Temperatures	
Minimum Vessel Level	10.0 %	
Restore Vessel Level	15.0 %	

- Status
- General
- Settings
- Conversions
- Reclaim
- Inputs
- Outputs
- Alarms
- Input/Output Status
- Generic Alarms

POINT NAME	VALUE	POINTER
Reclaim Use	Water Heater	
External Signal EU	Temperature	
Water Tank Setpoint	113.00 °F	
Water Tank Hysteresis	7.20 Δ°F	
Water Pump Off Delay	00h:00m:30s	
Water Pump	Digital	
Control Pump By	Temperature	

New CO2 Application

## HP and BP Valve Control

---



**High-Pressure Controller**

## HPV and BPV Control

- The High-Pressure Valve (HPV) operates in two normal-control Modes; Subcritical and Transcritical
  - The Mode is defined by Control Temperature (T1)
  - In the Subcritical Mode, the valve modulates to maintain a Subcool Setpoint
  - In Transcritical Mode, the High-Pressure Valve starts modulating to maintain a Setpoint defined by an Efficiency Table and using only the Pressure Input to control (P1)
- The Bypass Valve (BGV) operates to maintain an adjustable Pressure Setpoint.
  - The control reading is from The Flash Tank (P2)
- Both the High-Pressure Valve and the Bypass Gas Valve have Safety Modes
- The Safety Control Point In Both Valves Is The Receiver Pressure (P2)
  - If the Receiver Pressure is higher than a High Pressure Setpoint, the HPV will Close and the BPV Opens
  - If the Flash Tank Pressure is too low, the HPV will Open and the BGV Closes

# HPV and BPV Inputs

## Analog Inputs:

DESCRIPTION	TYPE	USER CONFIGURABLE	USER DEFINABLE	DEFAULT INPUT
P1 Gas Cooler Pressure (req)	AI	YES	YES	AI01
T1 Cooler Gas Temp (req)	AI	YES	YES	AI02
P2 Receiver Pressure (req)	AI	YES	YES	AI03
T2 Bypass Cooler Gas Temp	AI	YES	YES	TBD
T3 Ambient	AI	YES	YES	TBD

## Digital Inputs:

DESCRIPTION	TYPE	USER CONFIGURABLE	USER DEFINABLE	DEFAULT INPUT	DEFAULT VALUE
HTR RECLAIM	DI	YES	YES	DI01	OFF/CL
ENABLE	DI3	YES	YES	DI03	OFF/CL
CTS T2 ENABLE	DI	YES	YES	DI02	OFF/CL

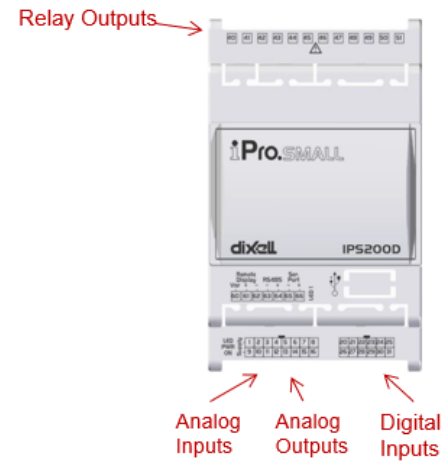




# HPV and BPV Hardware - Controller

- **High Pressure CO2 Controller based on Dixell iPro small Platform, all sensors connected to iPro only**

- Uses the iPro model IPG200D
- Communicates with E2 over Modbus
- 3-5 Analog Inputs functions
  - T1 Gas Cooler Temp
  - P1 Gas Cooler Pressure
  - P2 Receiver Pressure
  - T2 Gas Cooler Bypass Temp (optional)
  - T3 Ambient (Optional)
- 3 Digital Inputs functions
  - [HTR Heat Reclaim Setpoint Shift](#)
  - [Enable/Shutdown](#)
  - [CTS for T2 Enable](#)
- 4 Relay Outputs Alarms – Low Pressure , High Pressure, Shutdown, General Sensor Fail
- 2 Analog Outputs (0-10Vdc) for HPV and BGV
- DIN rail mountable
- **Compatible with Visograph Remote Display**
  - A Visograph can be used to configure controller
  - Installed in panel



# HPV and BPV Hardware - Valve Driver

- **XEV20D Driver** – is a stepper valve driver intended for bipolar or unipolar stepper valve
  - Optional to drive the HPV and/or BGV if preferred
  - Communicates using LAN network
- **Technical Data**
  - Power Supply 24VAC/DC 40VA
  - DIN rail mountable
  - Voltage Copper constant current
  - max 0.9mA per valve output



Part Number	Material Item Kit Description
	<u>iPro High Pressure Controller</u>
818-9002	<u>Viziograph Display</u>
318-7201	<u>iPro Small Connectors</u>
318-5003	XEV20 Controller
318-8022	XEV20 Wiring Harness
800-2720	2000 PSI Transducers
501-1122	Temp Sensors

# HPV and BPV Operation

- **Subcritical Mode:**

- When the Control Temp is below the Mode Setpoint minus Hysteresis
- When the Control temp is above the Mode Setpoint, In Transcritical
- PID Loop control using a Calculated Subcool Value, from the Pressure-1 (P1) And Temperature-1 (T1) to maintain the Subcool Setpoint.

Subcritical Parameter	Description	Default Value
HPV Mode <u>Setpoint</u>	Setpoint for Subcritical and Transcritical mode	87 DF
HPV Mode Hysteresis	Control Temperature Hysteresis	5 DDF
HPV <u>Subcool Setpoint</u>	<u>Subcool Setpoint</u> in Subcritical Mode	5 DDF
HPV RS-Temp	Subcritical proportional band offset	0 DDF
HPV PB-Temp (P)	Subcritical proportional band	30 DF
HPV INC (I)	Integral sampling time	180 Sec
HPV DDER (D)	Derivative time	0 Sec

# HPV and BPV Operation

- **Transcritical Mode:**

- When the Control temp is above the Mode Setpoint, System in Transcritical
- Stop maintaining a Subcool Setpoint and switch to Pressure Setpoint from Transcritical Table. PID loop start controlling using The Pressure (P1)
- Transition from subcritical to Transcritical:
  - Locks last known PID valve percentage and allows a linear-ratio transition between the two PIDs by the TransMaxtime

Transcritical Parameter	Description	Default Value
HPV Mode <u>Setpoint</u>	Setpoint for Subcritical to Transcritical mode	87 DF
Transcritical Setpoint	<u>Setpoint from Transcritical table</u>	From Table
HPV RS-Press	Subcritical proportional band offset	0 PSI
HPV PB-Press (P)	Subcritical proportional band	170 PSI
HPV INC (I)	Integral sampling time	180 Sec
HPV DDER (D)	Derivative time	0 Sec
<u>TransMaxTime</u>	Transition Time of the Two Sub and Trans PID	120 Sec

# HPV and BPV Operation

- **Transcritical Setpoint:**

- Control Temperature Value determines setpoint
  - T1 (gas cooler outlet temp) or T2 (gas cooler temp bypass) calculation setpoint

## Reference Table

Gas Cooler T1 or T2 Transcritical Setpoint			
C	Bar	F	PSI
21	65	69.8	942.5
22	65	71.6	942.5
23	65	73.4	942.5
24	65	75.2	942.5
25	65	77	942.5
26	65	78.8	942.5
27	66.1	80.6	958.7
28	69.2	82.4	1002.7
29	72.2	84.2	1047.0
30	75.3	86	1091.5
31	78.3	87.8	1135.9
32	81.4	89.6	1180.2
33	84.4	91.4	1224.2
34	87.4	93.2	1267.7
35	90.4	95	1310.7
36	93.3	96.8	1352.8
37	96.1	98.6	1394.1
38	98.9	100.4	1434.4
39	101.6	102.2	1473.5
40	104.2	104	1511.2
41	106.7	105.8	1547.4
42	109.1	107.6	1582.0



## HPV and BPV Display

- **Menu Driven Local Display With Ability To Change:**
  - The Modbus Address, Baud Rate, Screens Update, Time And Date, I/O, And Valve Setup
- **Status Screen Shows Both HPV And BGV With Their Corresponding Control Values And Parameters.**
  - HPV Dual And Failure/Alarm Operation Modes
  - Online/Offline Status On The XEV20
- **The I/O Configuration Screen Shows Type Of Sensors & Polarities**
- **Setup Screens Protected**

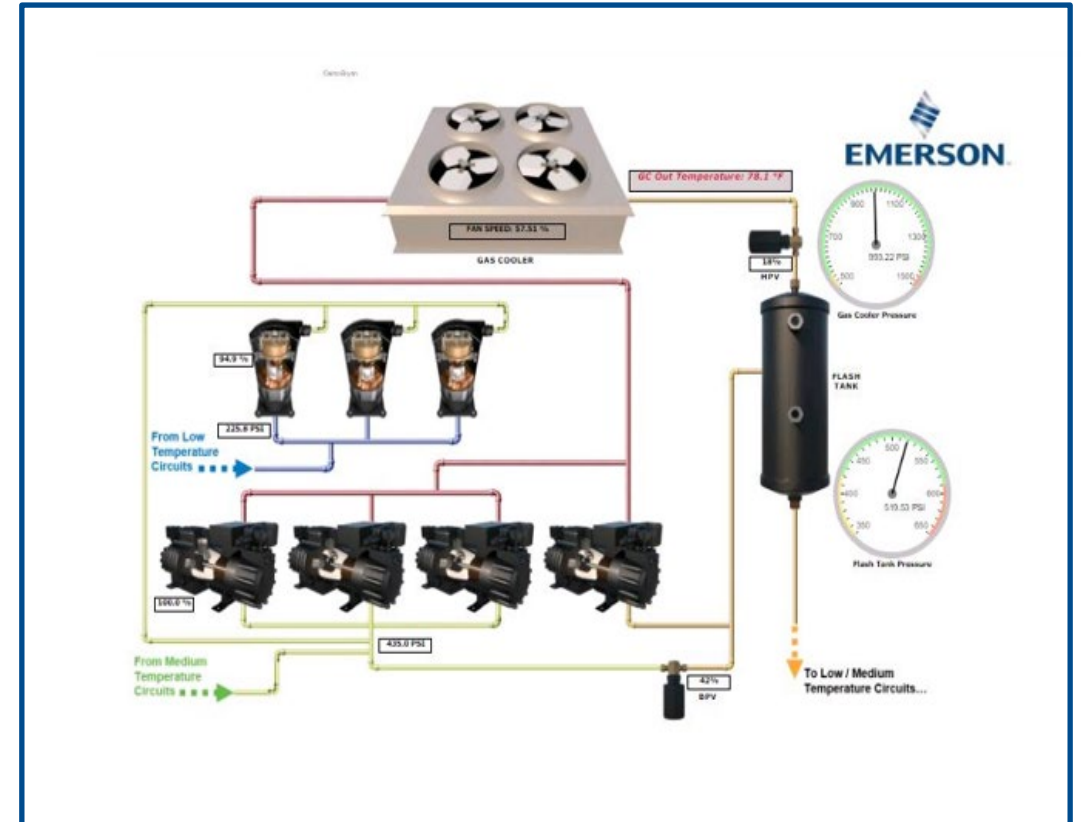
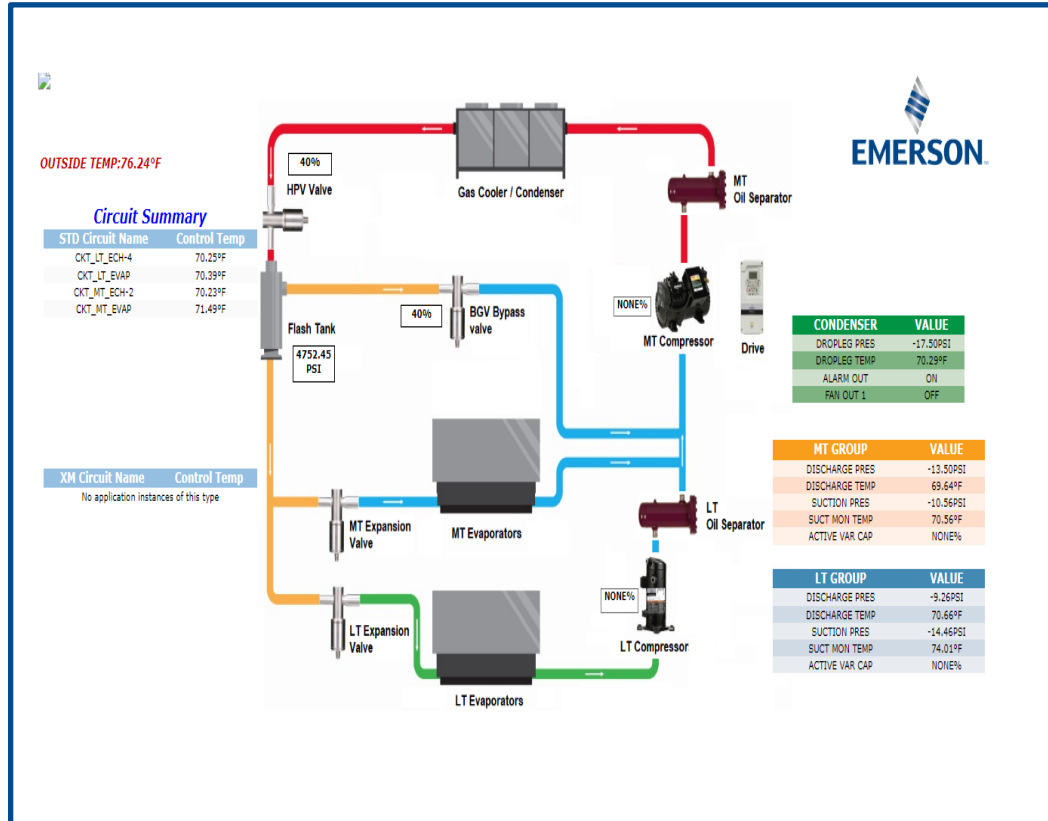


# HPV and BPV Safety Fallback Operation

- Low Receiver Pressure – HPV Opens & BGV Close
- High Receiver Pressure – HPV Closes & BGV Opens
- Pressure Sensor Fail – Use Network value if available, else fix opening %
- Temp Sensor Fail - Use network temp if available, else use Alternate sensor (T1/T2) or predetermined failsafe %

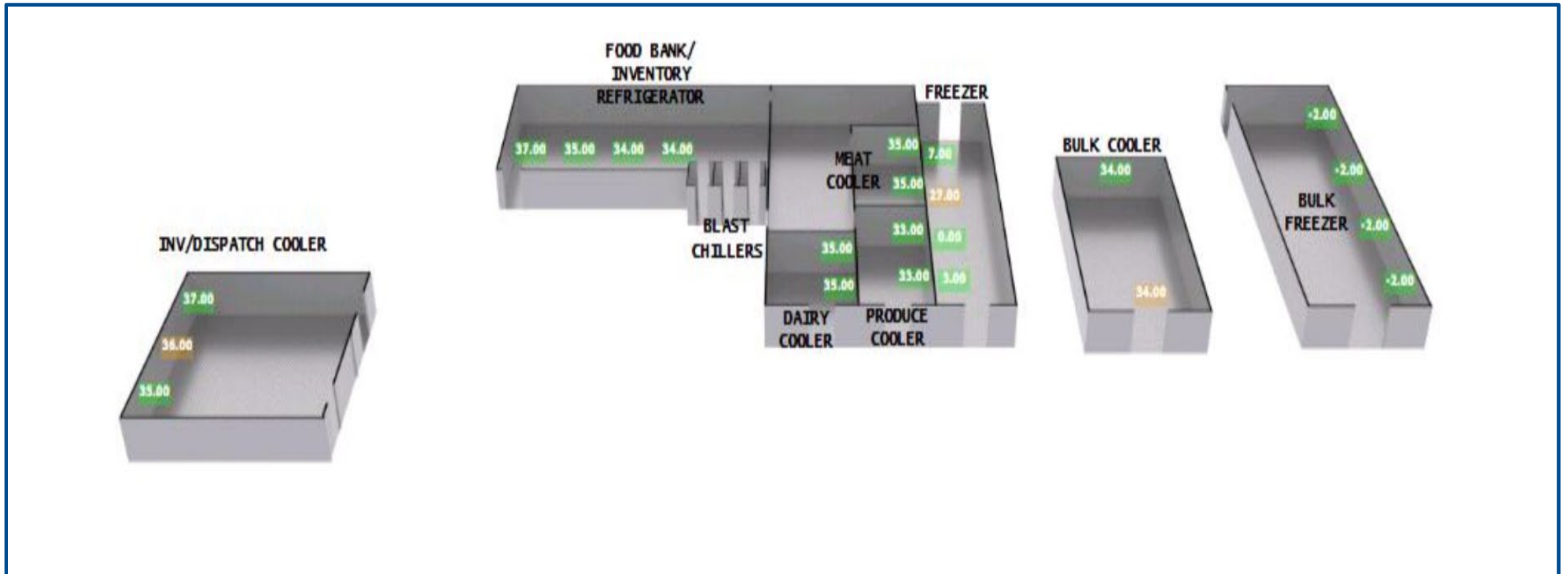
Safety Parameter	Description	Default Value
Hi PSI Set	High receiver pressure setpoint (depends on system design)	620 PSI
Hi Hy	High receiver pressure hysteresis	15 PSI
Lo PSI Set	Low receiver pressure <u>setpoint</u>	450 PSI
Lo Hy	Low receiver pressure hysteresis	15 PSI
HPV% Open Fail-SC	Valve % open during Subcritical with sensor fail	0 %
HPV% Open Fail-TC	Valve% open during Transcritical with sensor fail	0 %
HPV% Open Fail Lo	Valve% open during low pressure safety mode	15 %
BGV% Open Fail	Valve% open during high pressure safety mode	100 %

# Custom Graphics to E3 Screen



Can Add Multiple Graphics

# Custom Graphics to E3 Screen



Can Add Multiple Graphics

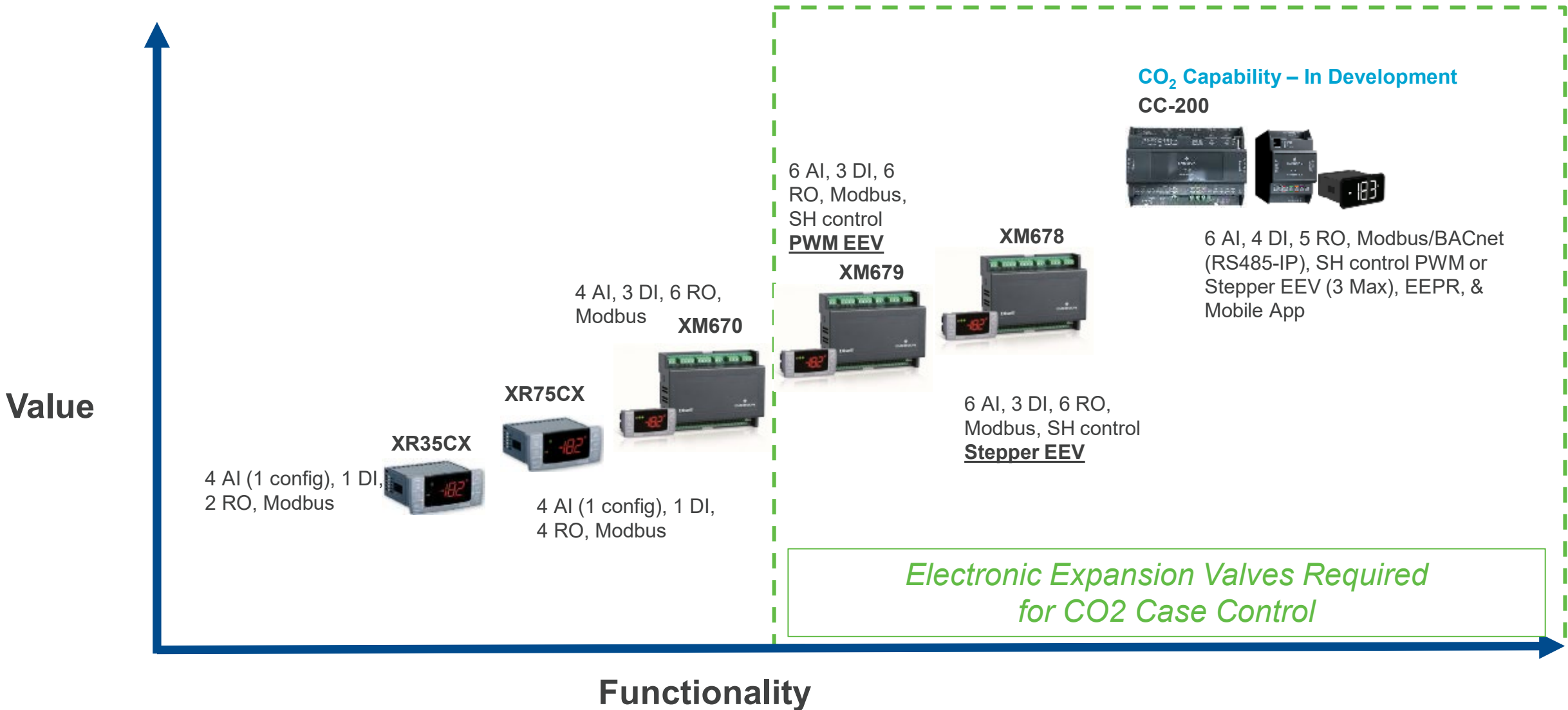
# Case Control for CO2 Systems

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# Case Control Portfolio Overview

AI→ Analog input  
 DI→ Digital input  
 RO→ Relay output  
 SH→ Superheat  
 EEPR→ Electronic  
 Evaporator Pressure  
 Regulator



# XM Version 5.4



**XM670  
v4.2**

**XM678  
v2.8**

**XM679  
v4.2b**

**Complexity**

**Easy E2& E3 Integration Promotes Serviceability Increased Functionality**

**v5.4**

**Customer Effort**

- One integration file for all 3 models
- Supports one integration for futures version
- Simplified parameter list
- Support firmware upgrade in the field

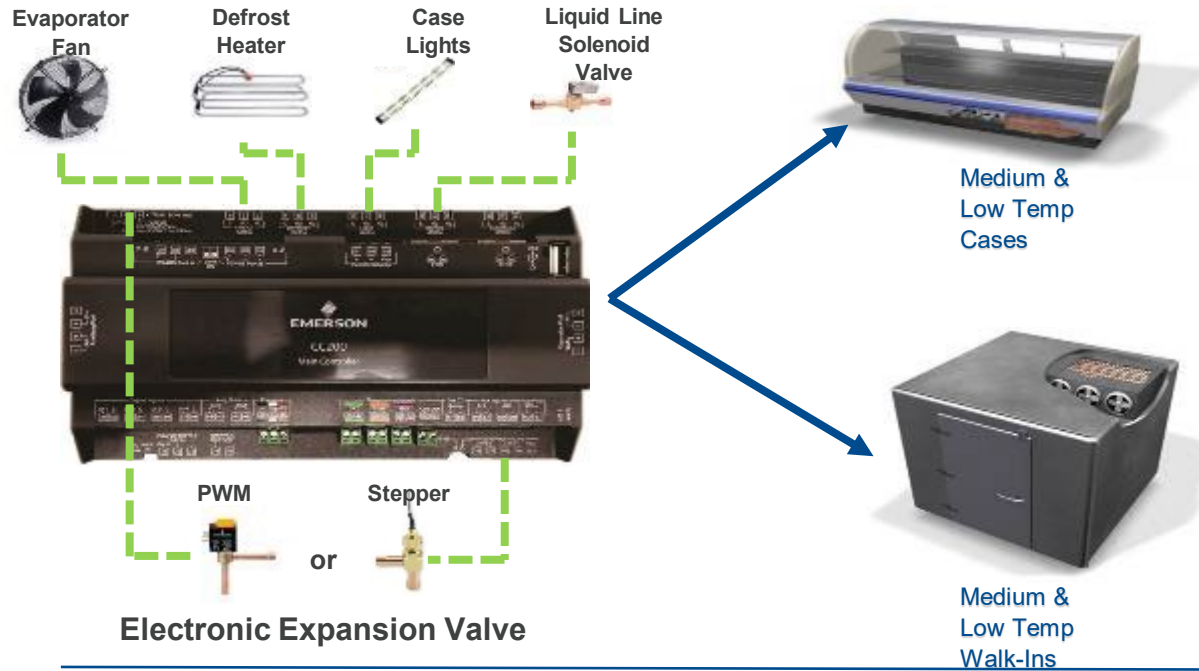


Model	PN	Valve
XM670K	318-6521	TXV
XM678D	318-6601	Stepper
XM679K	318-6702	Pulse

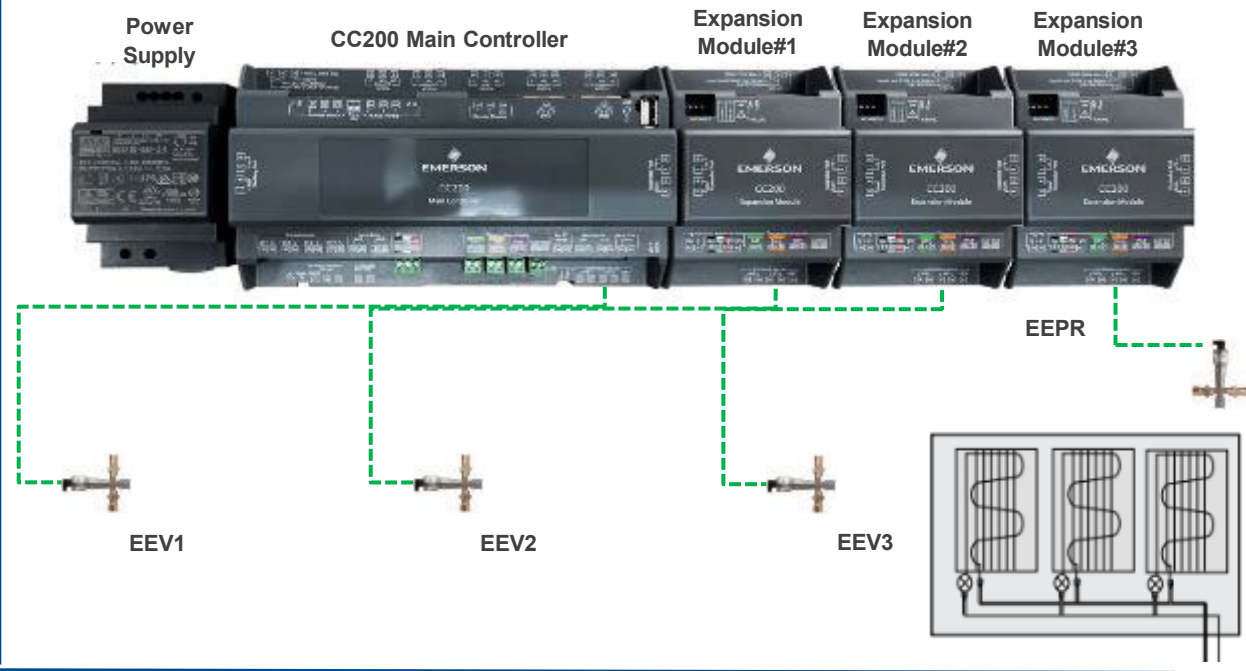
## Benefits Focused on Reducing Complexity and Customer Effort

# CC-200 Technical Overview

## One Evaporator



## Multiple Evaporators



### Relay Outputs (Main Controller)

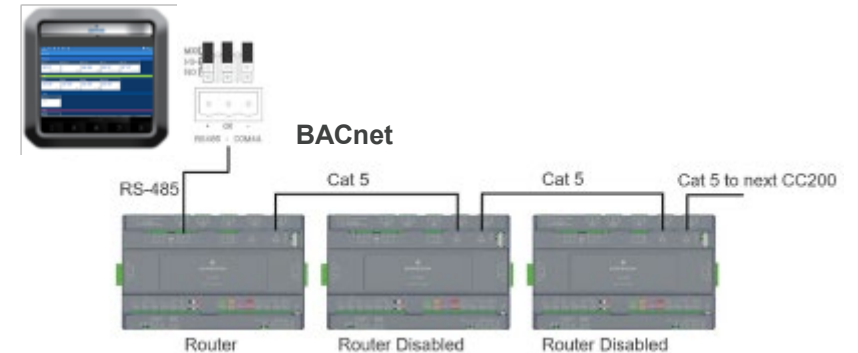
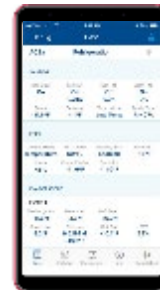
- Defrost
- Refrigeration (LLSV)
- Evaporator Fans
- Lights
- Auxiliary

### Digital Inputs (Main Controller)

- Configurable DI1-DI4 (Free voltage)
  - Door Switch
  - Service Switch
  - Dual Temp Switch
  - Defrost Term Switch
  - Leak Shutdown
  - Satellite 1 or 2 for E2e

### Analog Inputs (Main Controller & Expansion Module)

- Probe Inputs (non configurable)
  - Discharge Air Temperature (1 to 3)
  - Return Air Temperature (1 to 3)
  - Suction Pressure (1 to 3)
  - Defrost Termination (1 to 3)
  - Suction Temperature (1 to 3)
  - Fan and Defrost Amps
- Configurable Inputs (AI1 and AI2)
  - External fan CT
  - Coil Inlet Temp
  - Product Temp
  - Circuit Suction Temp



# CC200 Case Control Platform

## Mobile App

- Test mode – Functional test for production
- Test mode -- Contractor installation testing

## Communication protocols

- Compatible with E2, Site Supervisor and E3
- Can integrate into other BMS systems
  - BACnet MSTP, BACnet IP, Modbus RTU, Modbus IP

## Modular Form Factor

- Modular- Plug in expansion modules
- Small footprint Fitting - allowed space OEM & legacy EMR controllers
- One power source & reduced IO wiring effort

## Interface

- Displaying all necessary information depending on user
- Setting ctrl in an intuitive way locally/remotely
- Testing I/O at start-up and at the OEM

## Innovating Standalone Technologies

- Supporting Stepper and Pulse valve technology with auto tuning SH control (temp-temp/Press-temp)
- Supporting Antisweat control, leak detection, demand defrost



# Emerson Retail Solutions Apps and Popular Sites

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**EMERSON**™

## Training

<https://emersonbeta.myshopify.com/pages/instructor-led-courses>

## Software Updates

<https://climate.emerson.com/en-us/products/controls-monitoring-systems/facility-controls-electronics/facility-and-system-controls/>

# Technical Support Material

## Using the E2 setpoint conversion tool when retrofitting E2 with supervisory or E3 controllers: Using UltraSite32mm version 5.10 and above

### Technical Bulletin

When retrofitting E2 with supervisory controllers, a backup/restore process should be performed on the E2 controller. The supervisory controller will run the same devices and applications as the E2, but instead of manually entering the information, the setpoints and configurations can be automatically converted from the E2 to the supervisory controller using UltraSite.

The conversion tool can be expected to convert 80% or more of your E2 backup file. The conversion process will take between 10 to 20 minutes depending on the complexity of the backup file. You must do a side-by-side comparison of the E2 backup file and the newly converted Supervisor file to verify there are no errors. It will be necessary to review all setpoints and alarms for consistency in addition to the error log report and restore comparison log (see Figure 13) that is generated at the end of the conversion process to ensure your new system will run properly.

Licensed features and 3rd-party integrations will not convert if your new controller does not have the licenses or features installed.

Note that some complex schedules and Flex Combiners may not be converted.

If you feel there is something that should have been converted but did not, or if there is an error that shows a setpoint or parameter did not convert correctly, please contact Emerson Technical Support.

#### Step 1: Set up Supervisor in UltraSite

1. Log into UltraSite as user/pass.
2. Add Supervisor as a Site (right-click **Directory** and click **Add Site**).

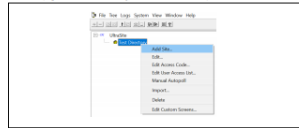


Figure 1 - Click Add Site

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[Conversion Tool](#)

## Supervisory Controller Installation and Operation Manual



Site Supervisor Version 2.13  
026-1800 Rev 17



[Supervisor Controller Manual](#)

## Site Supervisor Controller Quick Setup Guide

The Site Supervisor is a system that combines energy management with the ability to monitor various facility systems and provide alerts when there are issues that need attention. This system provides HVAC control, Refrigeration System Monitoring and Control, as well as Lighting Control. In addition, the Site Supervisor can monitor and report energy consumption and take action to reduce the energy demand during peak periods. This can have a direct impact on utility bills by reducing total energy costs. Site Supervisor ensures that the HVAC and lighting systems are on and off at the appropriate times. This ability to monitor store conditions can potentially minimize energy consumption.

For a copy of the full Site Supervisor Guide (P/N 026-1800), visit the Site Supervisor page on the Emerson website: <http://climate.emerson.com/en-us/products/controls-monitoring-systems/facility-controls-electronics/facility-and-system-control/site-supervisor>. Facility control to download or contact Emerson Electronics and Solutions Customer Service at 770-425-2724.



Figure 1 - Site Supervisor

#### Ethernet Connection

1. ETH1 is designed to be used for directly connecting to laptop, PC, or optional touchscreen with a CAT5 network cable.
2. The default IP for ETH1 is 192.168.1.250.
3. The optional Site Supervisor Display touchscreen default IP is 192.168.1.200 and will connect automatically to the Site Supervisor when plugged into ETH1. **It is recommended that you do not change these defaults.**

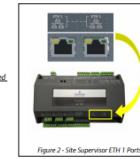


Figure 2 - Site Supervisor ETH 1 Ports

4. ETH0 should be reserved for the secure network connections: store or corporate networks. Ask your network administrator for the correct network IP address for ETH0.
5. ETH0 and ETH1 are physically separated for added security. Directly connecting to ETH1 will not access the secure network connection on ETH0.

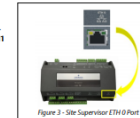


Figure 3 - Site Supervisor ETH 0 Port

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[Supervisor Quick Setup Guide](#)



24/7 Technical Support

Email - [coldchain.technicalservices@emerson.com](mailto:coldchain.technicalservices@emerson.com)  
Phone Number – [833-409-7505 \(opt 2\)](tel:833-409-7505)

[Offline Manager](#) - [offlinemanager.emerson.com](http://offlinemanager.emerson.com)





## Share Your Feedback!

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### To receive an electronic training certificate:

1. Scan or visit [nasrc.org/session-surveys](https://nasrc.org/session-surveys)
2. Provide your name and email at the end of the survey

**Please Note:** *You will not receive a certificate unless you share your name on the survey form.*

## E3 Introduction

Mike Hill

Emerson