iPro Case Controller Installation and Operation Manual

FW Version 1.00

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EMERSON

Emerson
1065 Big Shanty Road NW, Suite 100
Kennesaw, GA 30144 USA

Phone 770-425-2724
Fax 770-425-9319
www.emerson.com

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1 General Description/ Introduction

The iPro Case Controller is a microprocessor-based controller for use in controlling temperature and Superheat in refrigerated fixtures and walk-in boxes. The controller is suitable for medium and low temperature applications and can control all loads in a refrigerated box or fixture. These include lighting, fans, defrost heaters, solenoid valves and anti-sweat heaters. The iPro Case Controller system is comprised of at least one iPro Case Controller and one to two XEV20D valve drivers depending on the installation. There is also an input/output expansion module supported by the software that can be used if needed, although typically the I/O available on the iPro Case Controller is adequate for most installations. When more than one case or fixture is used within the refrigeration circuit, the iPro Case Controller can communicate critical information between case controller devices via Modbus from device to device. The controller can be integrated into an EMS system controller via Modbus or BACnet MS/TP/IP and is currently integrated into the Emerson E2E rack controller using BACnet MS/TP or IP. The controller can also be configured to run completely standalone, controlling the refrigeration system with no commands sent from E2E or a higher-level EMS controller.

Overview of Capabilities

- Each case controller can manage control of up to three evaporators Superheat in one case with associated temperature sensors, transducers and electronic valves.
- One master case controller can communicate with up to five (5) slave case controllers within each refrigeration circuit, six (6) case lineup is the maximum configuration.
- Control one (1) EEPR for the refrigeration circuit lineup.
- Manages all loads in a refrigerated case: lighting, fans, defrost heaters, solenoid valves and anti-sweat.

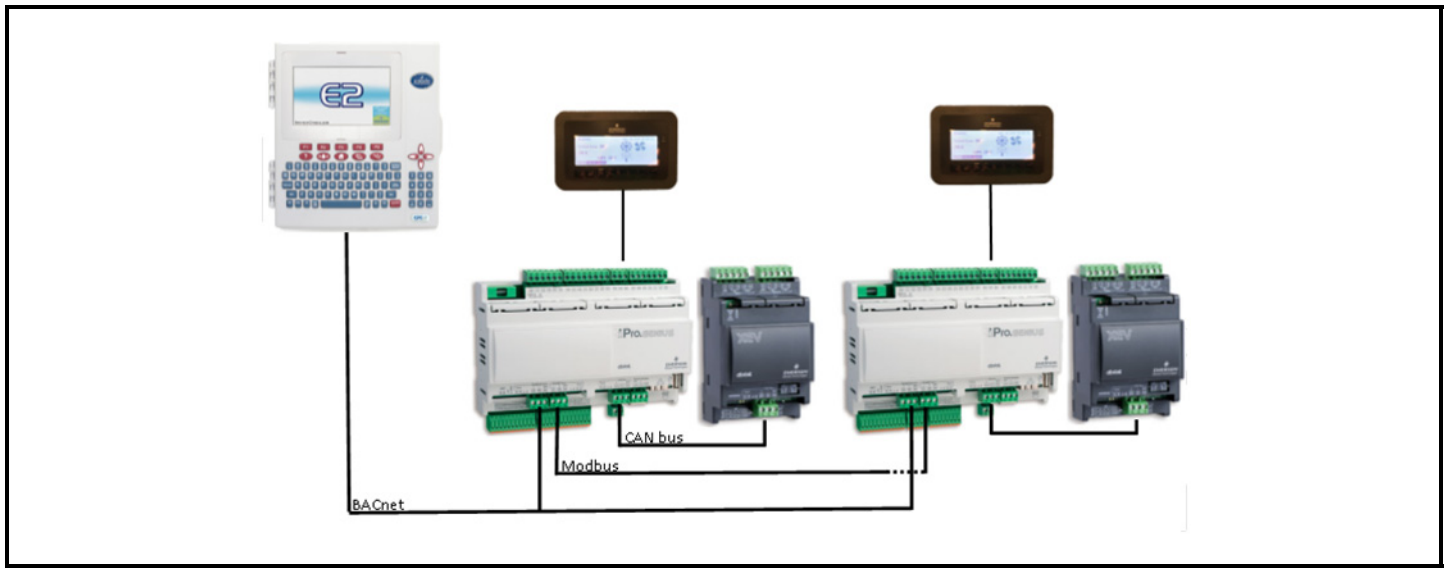


Figure 1-1 *- System Layout*

2 Ordering and Part Numbers

Device	Emerson Part Number
iPro Case Controller	818-9016
XEV20D Dual Stepper Valve Actuator	818-5003
IPX106D Input/Output Expansion Module	818-7000
Visograph 2.0 V2IPG Display	818-9205
20’ Discharge Air Temperature Sensor (Green)	501-1122
20’ Defrost Termination Temperature Sensor (Orange)	501-1127
20’ Return Air Temperature Sensor (Purple)	501-1128
20’ Coil Outlet Temperature Sensor (Red)	501-1126
0-100 PSI transducer	800-2100
100 ohm resistor for RS485 master port	318-4000

Table 2-1 *- Ordering Information*

3 Mounting and Hardware Overview

3.1. Mounting and Dimensions

In most situations, the iPro Case Controller will arrive at the customer's site already installed within a case OEM fixture or within a pre-fabricated Emerson control panel. The installer need only make communication wiring and field sensor wiring terminations (if required). If the need arises for the installer to mount the iPro Case Controller elsewhere, the controller should always be mounted in a moisture-free environment or an environment adequately protected from moisture. Technical specifications can be found in the back of this document.

The iPro Case Controller, XEV20D and IPX106D use a DIN rail mount for installation, see figures below for dimensions.

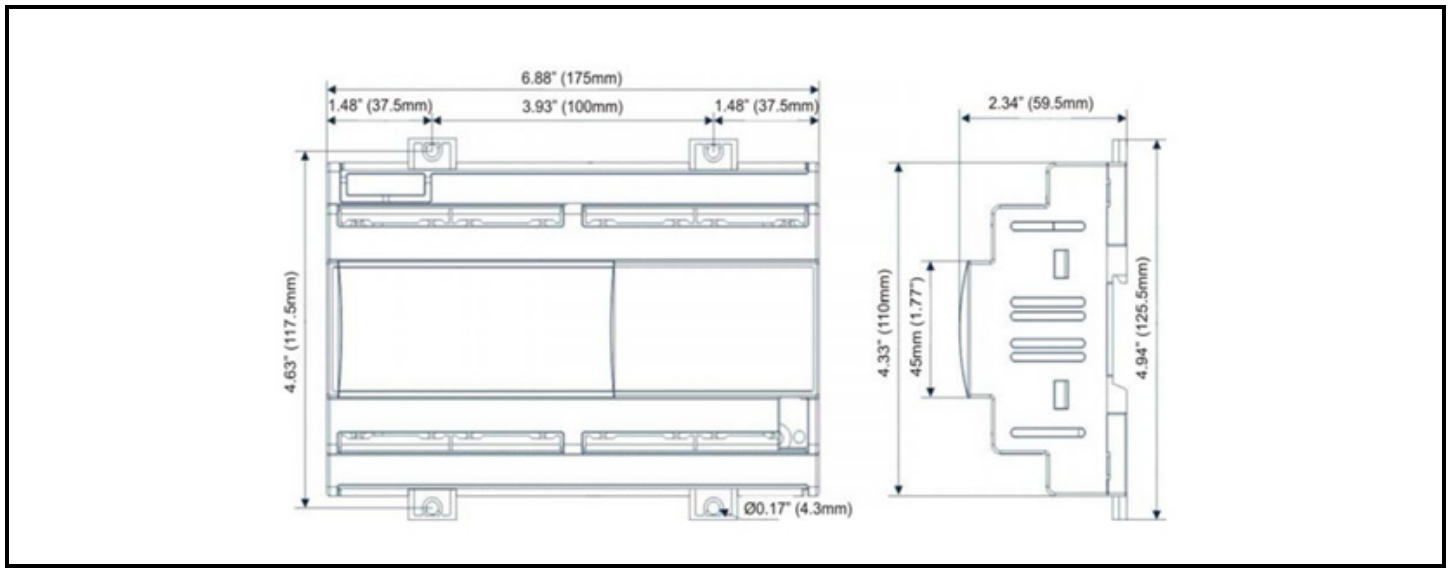


Figure 3-1 *- iPro DIN Mounting*

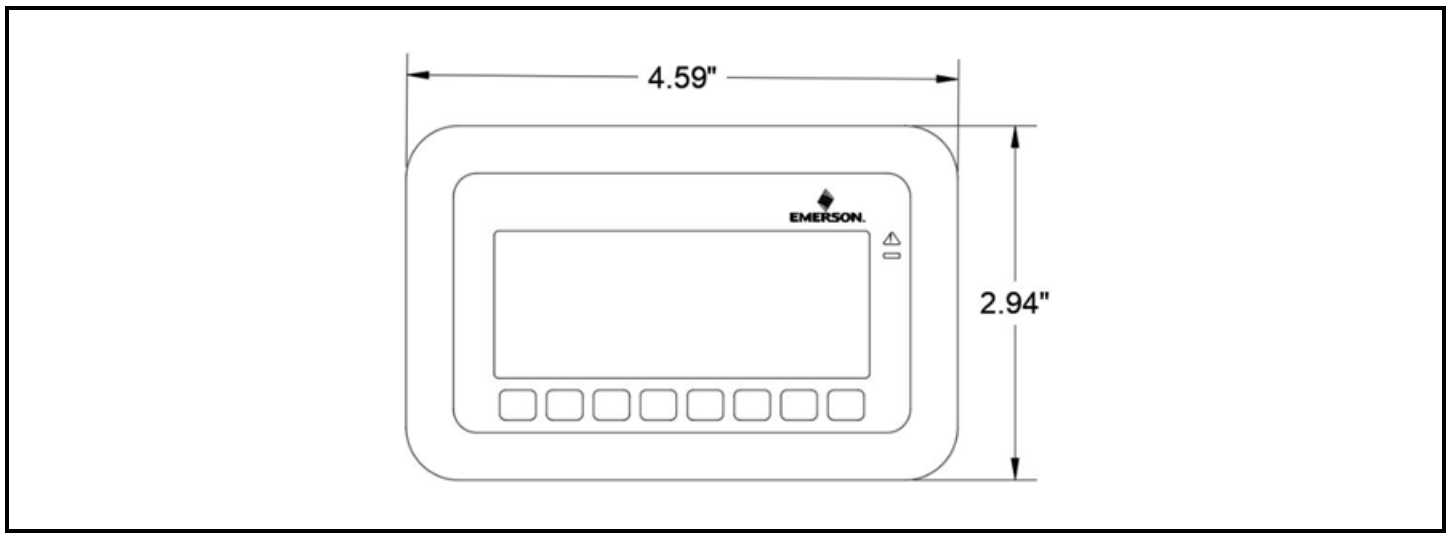


Figure 3-2 *- Visograph Display Dimensions*

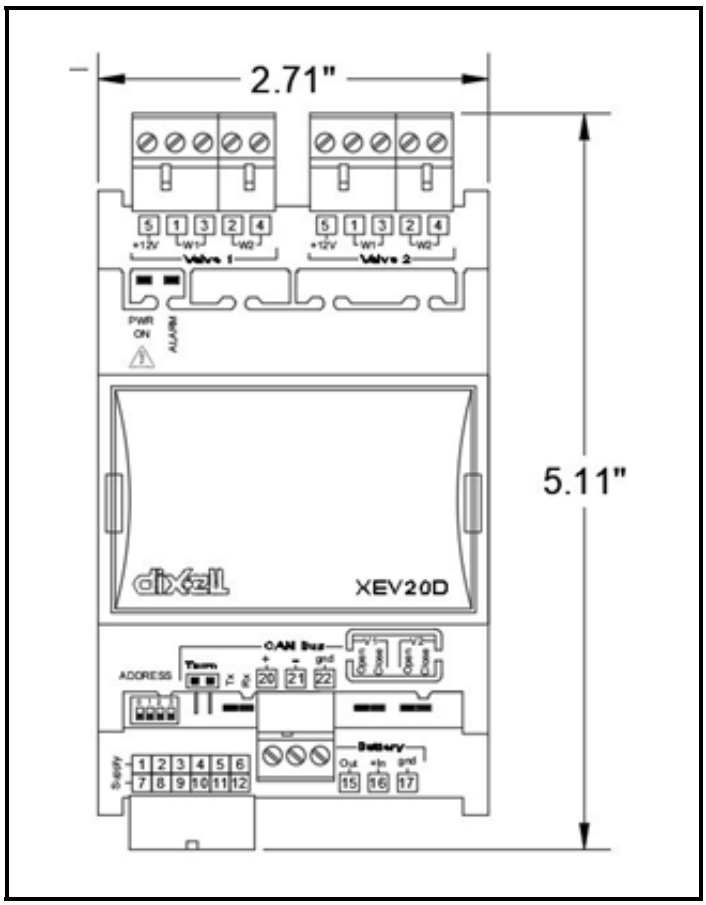


Figure 3-3 *- XEV20D Dimensions*

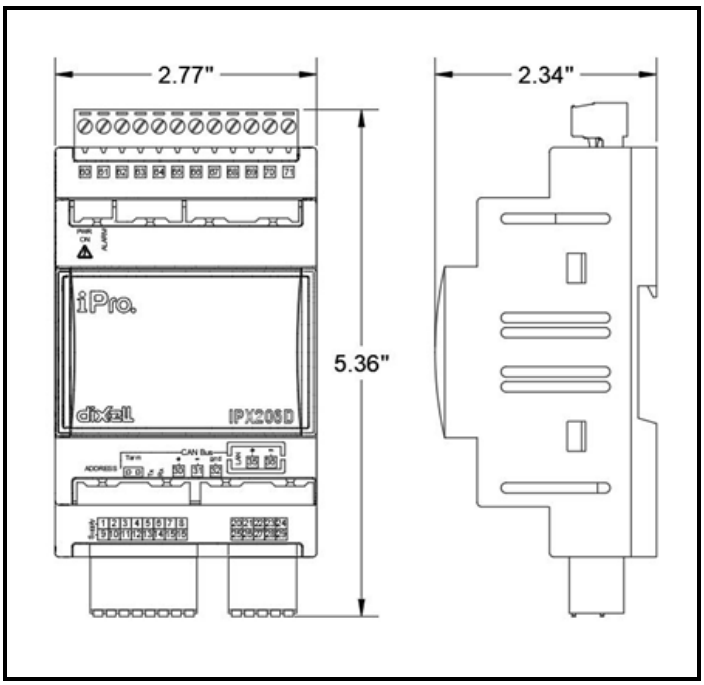


Figure 3-4 *- IPX Dimensions*

4 Overview

4.1. iPro Hardware Overview

The iPro Case Controller is a microprocessor-based fully programmable controller. The controller is powered at 24VAC and uses a high speed performance 32-bit ARM9 (200 MHz) microprocessor. The controller has 15 digital outputs, 20 digital inputs, 10 analog inputs and six (6) analog outputs onboard. Technical specifications for onboard I/O can be found in **Section 6.1.,** *iPro Analog Inputs*, **Section 7.1.,** *iPro Digital Inputs*, **Section 8.1.,** *iPro Digital Outputs*, and **Section 9.1.,** *iPro Analog Outputs*. The iPro Case Controller has three (3) serial communication ports, one (1) TCP/IP port and one (1) USB port. The RS485 master port is used to make the BACnet MS/TP connection to E2E, and the RS485 slave port is used to connect to peer case controllers within a refrigeration circuit. The CAN Bus port is used for iPro to communicate with other peripheral devices such as the XEV20D and IPX106D.

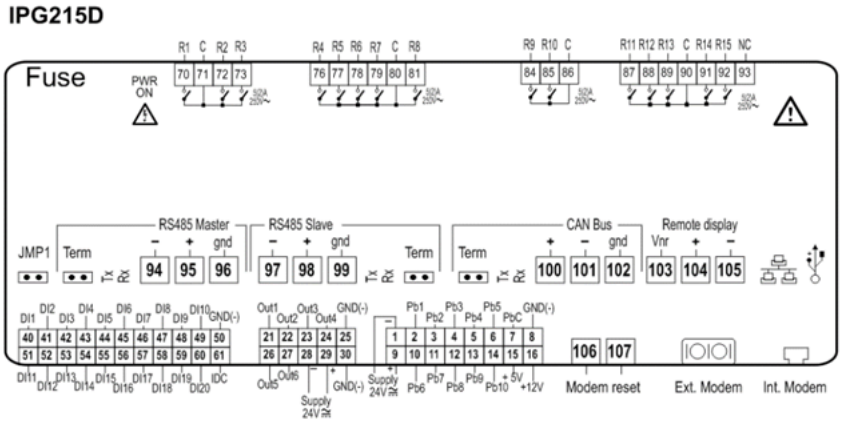


Figure 4-1 *- iPro Wiring and Connections*

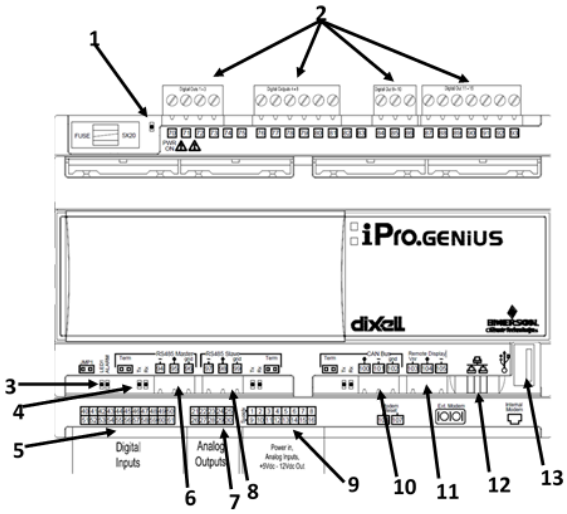


Figure 4-2 *- iPro Hardware*

LEGEND			
1	GENERAL STATUS LED	**8**	RS485 SLAVE PLUG-SLAVE CONTROLLER NETWORK
2	RELAY OUTPUT CONNECTORS	**9**	ANALOG INPUTS/24VAC POWER IN CONNECTOR
3	LED 1 AND GENERAL ALARM LED	**10**	CAN BUS CONNECTION-FOR XEV20D&IPX MODULE
4	RS485 TRANSMIT/RECEIVE LED	**11**	REMOTE DISPLAY PORT-VISOGRAPH
5	DIGTIAL INPUT CONNECTOR	**12**	TCP/IP PORT-BACNET IP PORT
6	BACNET MS/TP CONNECTION	**13**	USB PORT
7	ANALOG OUTPUT CONNECTOR		

Table 4-1 *- iPro Hardware*

4.2. Detailed Description of Connectors for the iPro Case Controller

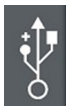
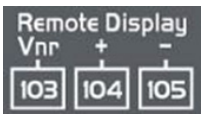
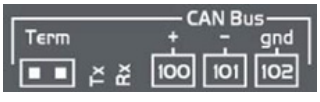
Connector	Description
	Connector for 24VAC/DC power supply. Analog inputs (Pb1 - Pb6, PbC). Additional power: +5VDC, +12VDC, Common (-) Analog outputs (Out1 - Out4, Common).
	Opto-insulated analog outputs (Out1 - Out6, GND) 24VAC/DC power supply required for the opto-insulated analog outputs
	Voltage-free opto-insulated digital inputs (DI1 - DI20, IDC) Opto-insulated 24VAC/DC digital inputs (DI1 - DI20, GND)
	USB port for downloads (BIOS, ISaGRAF® application, maps of parameters, remote display applications, network configuration, website) and uploads (log files).
	TCP/IP Ethernet port. Also used for BACnet IP connection.
	Connector for remote terminal (VISOGRAPH), maximum two (2) terminals per iPro Case Controller.
	CAN Bus port is used to connect the iPro Case Controller and XEV20D and IPX modules.

Table 4-2 *- iPro Connections and Descriptions*

	RS485 Slave port is used to connect the Master and Slave Case Controllers Rx and Tx LED to indicate that communication is active. Closed circuit terminal (Term)
	RS485 Master port is used to connect iPro Case Controller and Master Supervisory Controller Rx and Tx LED to indicate that communication is active Closed circuit terminal (Term)
	Digital relay outputs (for digital outputs with voltage-free contacts) three (3) NO relays, one (1) common
	Digital relay outputs (for digital outputs with live contacts) three (3) NO relays, one (1) common and two (2) voltage free (Neutral)
	Digital relay outputs (for digital outputs with voltage-free contacts) five (5) NO relays, one (1) common
	Digital relay outputs (for digital outputs with live contacts) five (5) NO relays, one (1) common and two (2) voltage free (Neutral)
	Digital relay outputs two (2) NO relays, one (1) common
	Digital relay outputs (only for 215D versions) five (5) NO relays, one (1) common and one (1) voltage free (Neutral)
	Green LED to indicate the presence of power

Table 4-2 *- iPro Connections and Descriptions*

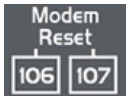
	Jumper to activate the RESCUE MODE
	Yellow status LEDs (LED1) and red LED (ALARM) See relative paragraph
	NOT USED IN CASE CONTROLLER
	NOT USED IN CASE CONTROLLER
	NOT USED IN CASE CONTROLLER

Table 4-2 *- iPro Connections and Descriptions*

4.3. Visograph Overview

The local user interface for iPro Case Controller is Visograph 2.0 V2IPG. The Visograph is an LCD display with eight (8) keys (labeled T1-T8) on a membrane keyboard. The Visograph can be panel mounted or wall mounted as shown above in the Visograph dimensions detail. The Visograph is powered from the iPro remote display port on iPro terminals 103, 104, 105. In most installations, each iPro Case Controller will have its own Visograph display locally mounted for controller navigation and configuration. All parameters and configuration for the case controller can be edited from Visograph. The Visograph provides a quick and easy interface for viewing temperatures, alarm data, system status, valve percentages and status of outputs and loads. More on Visograph navigation is covered later in this document.

Figure 4-3 *- Visograph*

4.4. IPX106D Hardware Overview

The IPX is an input/output expansion board for use in combination with iPro Case Controller. The IPX has six (6) digital outputs, seven (7) analog inputs, three (3) digital inputs and three (3) analog outputs. The case controller supports up to two (2) IPX modules at one time. The IPX communicates with iPro Case Controller on the CAN Bus port, when XEV20D and IPX are present then the CAN Bus communication wiring is simply continued to the IPX in a daisy chain. When the IPX modules are present they communicate at address 4 and 5.

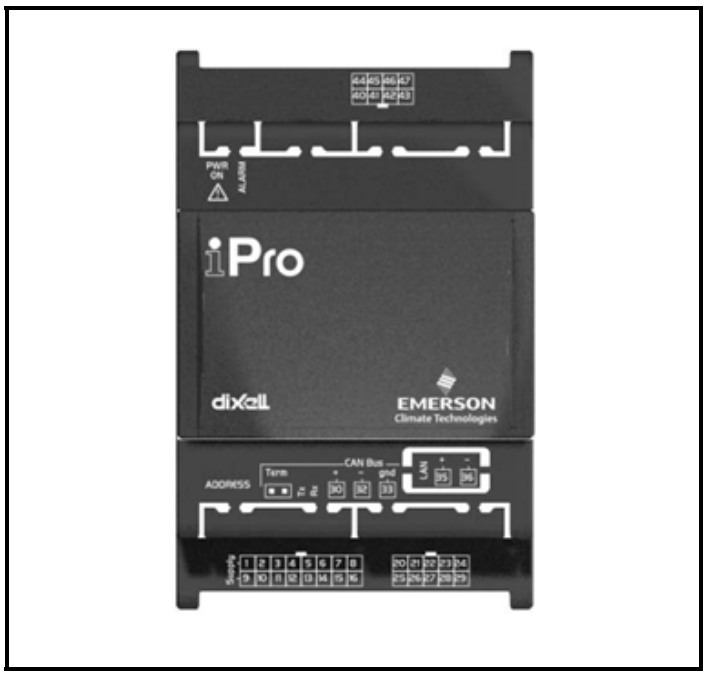


Figure 4-4 *- IPX106D*

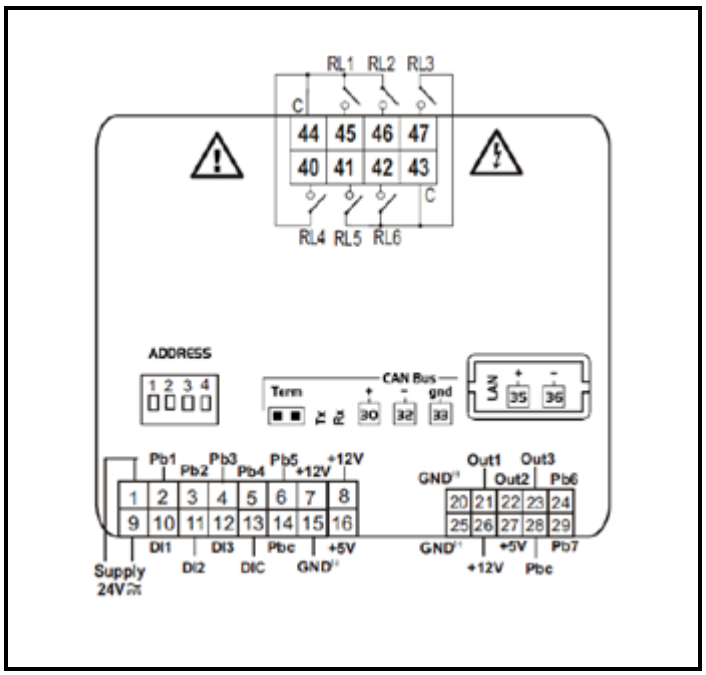


Figure 4-5 *- IPX106D Wiring*

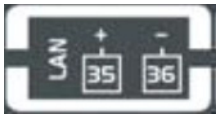
Connector	Description
	Connector for 24VAC/DC power supply Analog inputs (Pb1 - Pb5, PbC) Voltage-free digital inputs (DI1 - DI3, DIC) Additional power (+5VDC, +12VDC, GND)
	Analog outputs (Out1..Out3, GND) Analog inputs (Pb6 - Pb7, PbC) Additional power (+5VDC, +12VDC, GND)
	Digital relay outputs Six (6) NO relays, two (2) common
	CAN Bus Connector Rx and Tx LED to indicate that communication is active Closed circuit terminal (Term)
	LAN serial port connector - *NOT USED IN THIS APPLICATION OF IPRO CASE CONTROLLER*
	Dip switch to set the address of the device.
	Green LED to indicate the presence of power
	Red status LED (ALARM)
	Green LED to indicate the presence of power

Table 4-3 *- Visograph Connections and Descriptions*

4.5. XEV20D Hardware Overview

The XEV20D is a stepper valve actuator is intended for either bipolar stepper valves or unipolar stepper valves. This device is used in combination with the iPro Case Controller to drive the electronic expansion valves and electric evaporator pressure regulator in the refrigerated case or walk in box. Each XEV20D drives two (2) valves and the iPro Case Controller system supports a maximum of two (2) XEV20D per iPro. The XEV20D communicates with the iPro Case Controller via the CAN Bus port on both devices. When driving stepper valves with this actuator, check the valve manufacturer technical specifications for the current ratings and verify if the XEV20D can drive the valve selected for the system.

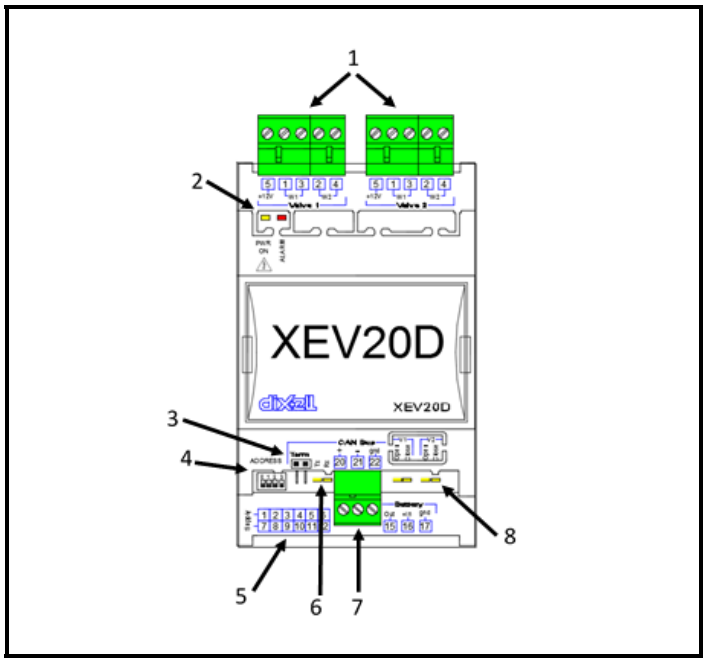


Figure 4-6 *- XEV20D*

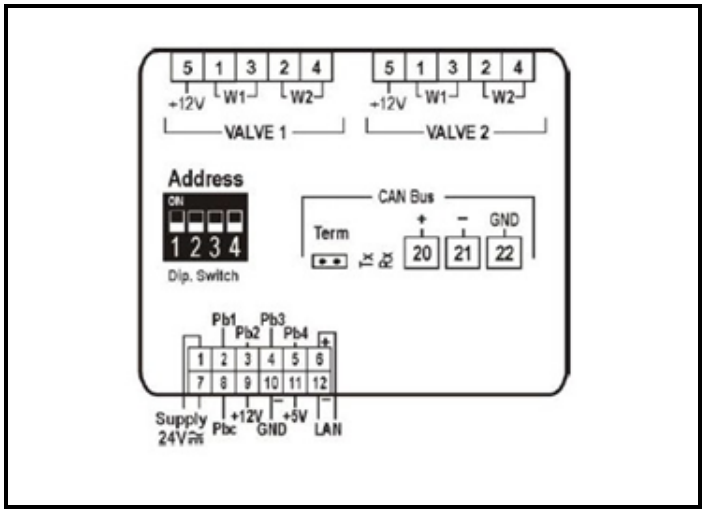


Figure 4-7 *- XEV20D Wiring*

LEGEND			
1	VALVE 1 AND 2 WIRING CONNECTOR	5	ANALOG INPUTS/24VAC POWER
2	POWER ON AND ALARM LED	6	CAN BUS COMMUNICATION TX/RX LED
3	CAN BUS RS485 TERMINATION JUMPER	7	CAN BUS WIRING CONNECTOR
4	CAN BUS ADDRESS DIPSWITCHES	8	VALVE POSITION INDICATOR LED

Table 4-4 *- XEV20D LED Light Descriptions*

The XEV20D driver has onboard LED lights that show device status and the valves being controlled. See ***Table 4-5*** below for LED function descriptions.

LED	MODE	MEANING
PWR ON	On	Tells that the model is powered correctly
ALARM	On	Tells that an alarm is present
TX/RX	Blinking	CAN Bus or LAN activity, communication activated
TX/RX	On	No link
OPEN V1	Blinking	Valve 1 is opening
OPEN V1	On	Valve 1 is completely opened
CLOSE V1	Blinking	Valve 1 is closing
CLOSE V1	On	Valve 1 is completely closed
OPEN V2	Blinking	Valve 2 is opening
OPEN V2	On	Valve 2 is completely opened
CLOSE V2	Blinking	Valve 2 is closing
CLOSE V2	On	Valve 2 is completely closed

Table 4-5 *- LED Functions*

4.6. XEV20D Valve Connections

The wires from the valve wiring harness should be terminated at the XEV20 connectors labeled **valve 1** and **valve 2**. See ***Table 4-6*** and ***Table 4-7*** below for terminal numbers associated with each valve wire color.

	4 Wire Valves (Bipolar)					
Terminal Numbers	Alco EX	Alco EX5/6	Sporlan SEI-SHE	Sporlan CDS4-17	Danfoss ETS	Carel E2V-E7V
1	GREEN	WHITE	GREEN	GREEN	GREEN	GREEN
2	BROWN	BLACK	RED	RED	RED	YELLOW
3	YELLOW	BROWN	BLACK	BLACK	WHITE	BROWN
4	WHITE	BLUE	WHITE	WHITE	BLACK	WHITE
5 - Common	N/A	N/A	N/A	N/A	N/A	N/A

Table 4-6 *- Bipolar Valve Connections*

5-6 Wire Valves (Unipolar)			
Terminal Numbers	Spolar	Saginomiya	EX3
1	BLACK	BLACK	BLUE
2	YELLOW	YELLOW	BLACK
3	RED	RED	BROWN
4	ORANGE	ORANGE	WHITE
5 - Common	GRAY	GRAY	GRAY

Table 4-7 *- Unipolar Bipolar Valve Connections*

4.7. XEV20D Absolute Maximum Power

The XEV20D can drive a wide range of stepper valves. Indicated in the following table are the maximum values of current that the actuator can supply to the stepper wiring.

NOTE: The electrical power absorption of the valve can be unrelated to refrigeration power that valve has. Before using the actuator, read the technical manual of the valve supplied by the manufacturer and check the maximum current used to drive the valve to verify that they are lower than those indicated below.

			CONFIGURATION	
			ONE VALVE	TWO VALVES
		DRIVING MODE	Full step	Full Step
VALVE TYPE		BIPOLAR VALVES (4 wires)	Current 0.9A max Æ TF20D	Current 0.9A max for each valve Æ TF20D
		UNIPOLAR VALVES (5-6 wires)	Current 0.33A max Æ TF20D	Current 0.33A max for each valve Æ TF20D

Table 4-8 *- Maximum Values of Current*

Note: TF20D=20VA transformer, 40D=40VA

4.7.1. Description of XEV20D Connections

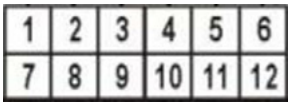
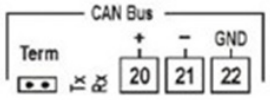
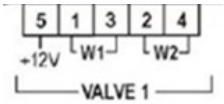
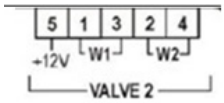
Connector	Description
	Connector for 24VAC/DC power supply analog inputs (Pb1 – Pb4, PbC) Additional power (+5VDC, +12VDC, GND) LAN
	CAN Bus connector for connection to monitoring system. Rx and Tx LED to indicate that communication is active Closed circuit terminal (Term)
	CAN Bus serial line Address
	Connections to valve 1 (W1/W2) Additional power (+12VDC)
	Connections to valve 2 (W1/W2) Additional power (+12VDC)

Table 4-9 *- XEV20D Connection Descriptions*

4.8. CAN Bus Communication Connection

The XEV20D communicates with the iPro Case Controller using the CAN Bus protocol link. The CAN Bus connection will use RS485 wiring standard and the approved wire type is General Cable 92454A (*Emerson P/N 135-0600*). The polarity of the CAN Bus connection between iPro and XEV20D is straight polarity (*see **Figure 4-9***). When two XEV20D devices are connected to the iPro Case Controller, the CAN Bus connection should be in a daisy chain with the last XEV20D device having the CAN Bus termination jumper installed, see figure 8. For successful communication to occur, the addressing dip switches on the XEV20 must be set correctly. When one (1) XEV20D driver is being used by the iPro Case Controller, then the dip switch address will be (two) 2, when two (2) XEV20D modules are being installed, the modules should be address 2 and 3. An example of how to address the device using the dip switches is shown in Figure 7.

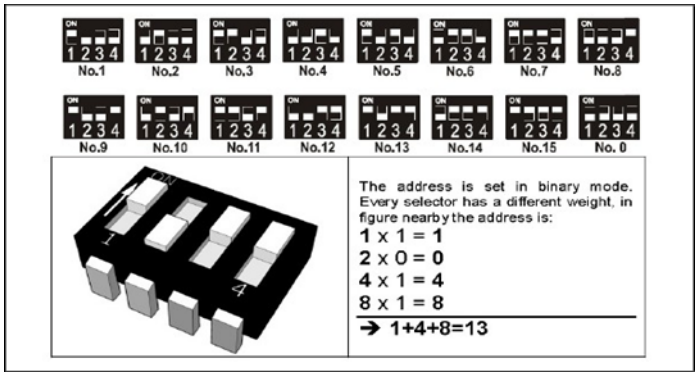


***Figure 4-8** - XEV20D Dip Switch Addressing*

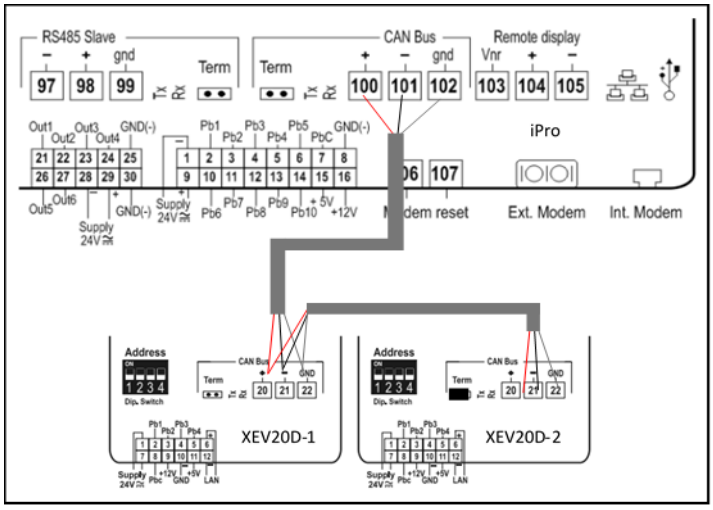


***Figure 4-9** - XEV20D CAN Bus Wiring*

5 Powering Devices and Wiring

5.1. Transformer Selection

The power supply voltage for iPro Case Controller, XEV20D; and IPX is 24VAC. The Visograph remote display is powered from the remote display port on the iPro. Emerson provides a variety of 24VAC non-center tapped transformers that can be used to power these devices. Transformer requirements are a minimum of 20VA for the iPro Case Controller and the iPro must not share a transformer with any other devices. The transformer power requirements of the IPX106D are a minimum of 10VA and requirements for the XEV20D are a minimum of 40VA. Each device must have its own dedicated transformer.

Transformer Part Number	Primary Voltage	VA Rating
640-0040	120/208-240VAC	50 VA
640-0041	120 VAC	50 VA
640-0042	220 VAC	50 VA

Table 5-1 *Transformer Selection*

5.2. Wire Types and Maximum Distance

For powering iPro, XEV20D and IPX106D use only the listed wire types in Table 5-2. Two conductor non-shielded cables are the recommended wire for connecting each of the devices to the secondary of the transformer. *Shielded cable should not be used for power wiring. The center tap should be left disconnected, if present on the transformer*.

Power Wire Types	
14 AWG	**Belden 9495**
18 AWG	**Belden 9495**

Table 5-2 *- Power Wire Types*

The wire length from the transformer determines the wire gauge used. In most cases, the distance between the iPro Case Controller and the transformer that supplies power to it is not enough to be of concern; however, it is very important NOT to exceed this maximum wire length or the controller will not operate correctly. Use these formulas to determine if the wire gauge you are using fits within specification:

14 AWG:
Feet = 1920/VA
18 AWG:
Feet = 739/VA
(VA is the total VA rating of the controller)
For example, if you had an 80 VA load:
14 AWG: 24 ft.
18 AWG: 9 ft. (rounded down)

Table 5-3 *Power Wire Lengths*

5.3. Wire Selection Guidelines

DEVICE TYPE	RETAIL SOLUTIONS WIRING GUIDELINES
ANALOG TEMP SENSOR OR DIGITAL INPUT	General Cable 92454A #22-2 SHIELDED Retail Solutions P/N 135-0600
RS485 NETWORK	General Cable 92454A #22-2 SHIELDED Retail Solutions P/N 135-0600
PRESSURE TRANSDUCERS	**BELDEN #8771 #22-3 SHIELDED Retail Solutions P/N 135-8771 **#8771 for alternate 600v rated wire use BELDEN #8618 16 AWG
STEPPER VALVES	Use valve manufacturer's harness with a maximum length not to exceed 30 feet (10 meters).

Table 5-4 *- Wiring Specifications*

5.4. Powering the iPro Case Controller

The iPro can be powered from one of the transformers listed in the *Table 5-1* and *Figure 5-1* shows how to connect the 24VAC wiring from the transformer to the iPro connector. The 24VAC power is connected to terminals 1 and 9 on the analog input connector. The iPro should have its own dedicated transformer for providing the 24VAC needed for supply power.

NOTE: Neither side of the secondary should be connected to ground. Also, do not connect the center tap (if provided on the transformer) to ground. The entire secondary of the transformer should be isolated from any ground.

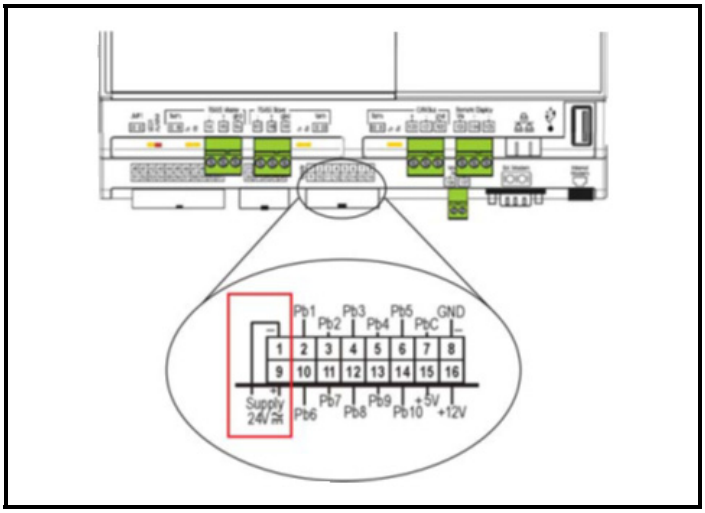


Figure 5-1 *- Non-Center Tapped Transformer Connection to iPro*

Power Supply:	24VAC +10/-15%, 50/60Hz 20 - 36VDC
Consumption:	20VA (VAC), 15W (VDC)
Connectors:	Phoenix quick coupling connectors for low voltage STELVIO 90° screw connectors for digital outputs (250VAC, 6A max)
Microprocessor:	AT91RM9200 32-bit 200Mhz
Permanent FLASH memory:	128MB, in 8-bit
RAM:	32MN o 64MB, in 16-bit
Internal clock:	standard

Table 5-5 *- Power Wire Types*

5.5. Powering XEV20D

The power supply voltage for XEV20D is 24VAC and connects to terminals 1 and 7 on the wiring harness. Reference *Table 5-1* for transformer selection and part numbers. The iPro Case Controller currently supports a maximum of two (2) XEV20D. Each XEV20D should have its own dedicated transformer.
Do not share transformers between multiple XEV20D devices.

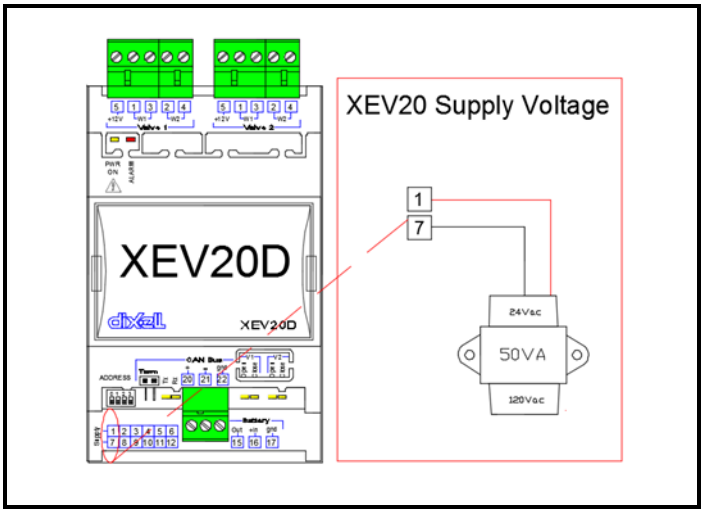


Figure 5-2 *- XEV20D Supply Voltage*

Power Supply:	**24VAC/DC**
Consumption:	**40VA max**

Table 5-6 *XEV20D Power Supply*

5.6. Powering IPX106D

The power supply voltage for IPX106D is 24VAC and connects to terminals 1 and 9 on the device wiring harness. Use ***Table 5-1*** for selecting a transformer to power IPX. Each IPX device requires its own transformer, sharing transformers between devices is not allowed.

Power Supply:	24VAC +10/-15%, 50/60Hz
Consumption:	10VA (VAC), 10W (VDC)
Connectors:	Molex connectors with low voltage wiring SELECOM/CIVILUX connectors for digital outputs (250VAC, 6A max) or with a different order code: Phoenix quick coupling connectors for low voltage STELVIO 90° screw connectors for digital outputs (250VAC, 6A max)

Table 5-7 *- Power Wire Types*

5.7. Wiring Visograph Display

The Visograph connection to iPro is made with three (3) wires from the iPro remote display port terminals 103,104,105 to the Visograph wiring connector terminals 1,2,3 located on the back side of the Visograph. The wire type used for this connection should be Belden #8771.

CAUTION: Special care should be taken when making this connection so that no wires are incorrectly landed or crossed, a mistake in this connection likely will result in damage to either device or both devices.

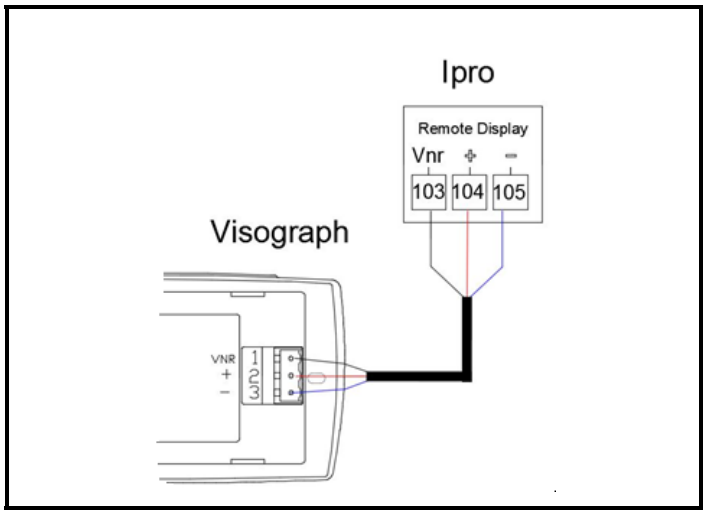


Figure 5-3 *- Wiring Visograph Display*

6 Wiring Analog Inputs

6.1. iPro Analog Inputs

The iPro analog inputs are located on the same connector as the controller power supply. The iPro Case Controller has 10 analog inputs available, a 5VDC power supply and a 12VDC power supply for sensors that require voltage. The 10 inputs are fully configurable through the Visograph and may be arranged per the installation requirements within the input connector. The controller has separate input commons depending on the type of sensor connected. For temperature probes, all commons should be wired to **PbC** on Terminal **7**. For Voltage output transducers, all commons should be wired to GND on Terminal 8.

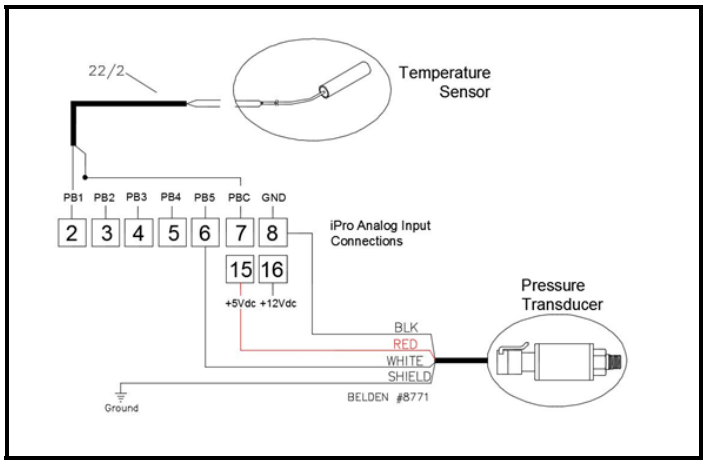


Figure 6-1 *- iPro Temperature Sensor and Transducer Wiring*

6.2. XEV20D Analog Inputs

The XEV20D analog inputs are located on the same connector as the controller power supply. The XEV20D has 4 analog inputs available, a 5VDC power supply and a 12VDC power supply for transducers that require voltage. Analog input **1** or **2** can be resistive type sensors only (**NTC**/**PTC**), inputs **3** and **4** can be resistive or voltage. However, inputs **3** and **4** must not have a resistive sensor and a voltage sensor connected at the same time; both sensors must be of the same type. The controller has separate input commons depending on the type of sensor connected. For temperature probes, all commons should be wired to **PbC** on Terminal **8**. For voltage output transducers, all commons should be wired to GND on Terminal **10**.

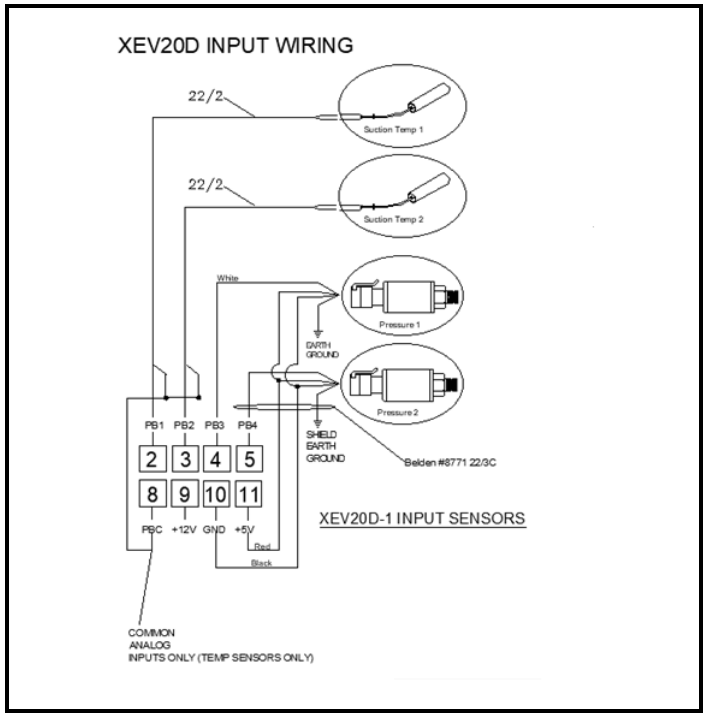


Figure 6-2 *- XEV20D Analog Input Wiring*

6.3. IPX106D Analog Inputs

The iPro Case Controller supports the use of the IPX106D expansion module. The expansion module has seven (7) analog inputs, a 5VDC and a 12VDC power supply. All the inputs are fully configurable from the Visograph display. If the installation requires input/output capacity beyond what the iPro Case Controller hardware can handle, then up to two (2) IPX expansion modules can be added. Like the iPro, the IPX has separate input commons depending on the type of sensor connected. For temperature probes, all commons should be wired to **PbC** on Terminal **14**. For voltage output transducers, all commons should be wired to GND on Terminal **15**.

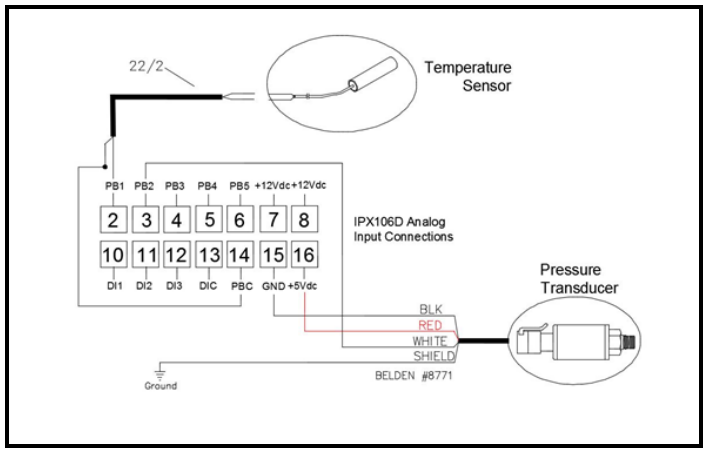


Figure 6-3 *- IPX106D Temperature Sensor and Transducer Wiring*

7 Wiring Digital Inputs

7.1. iPro Digital Inputs

The iPro digital inputs are located on their own 22-pin connector along the bottom of the device. The iPro provides a maximum of 20 opto-insulated digital inputs that are configurable through the Visograph display. See figures below for connection details.

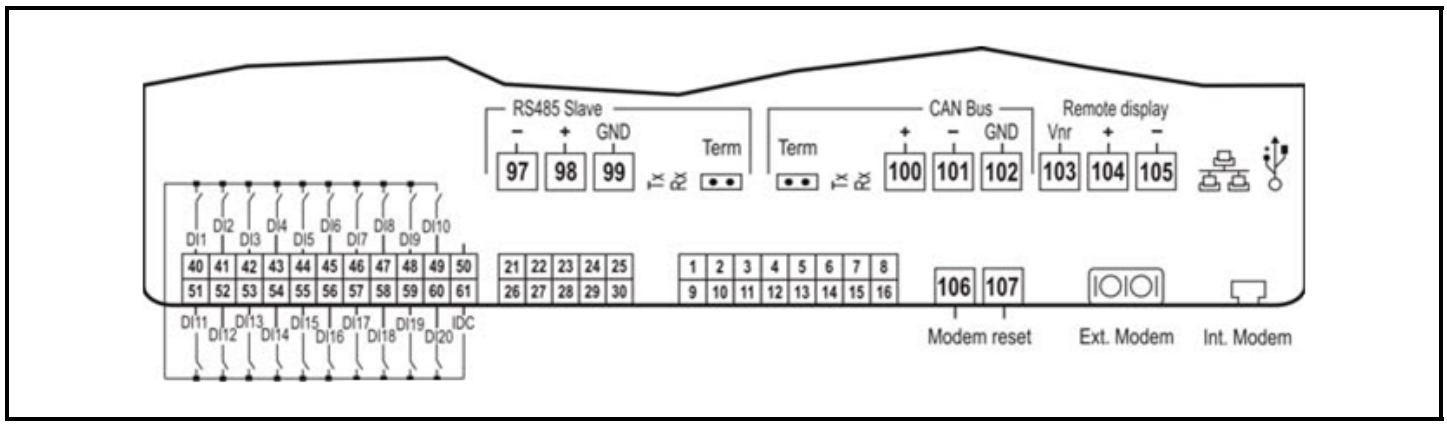


Figure 7-1 *- iPro Digital Input Wiring - Dry Contacts*

DIGITAL INPUTS	
TYPE:	Opto-insulated voltage free or live contact (24VAC/DC) External power 24VAC/DC ±20%
NUMBER OF INPUTS:	20
NOTES:	If the digital inputs are used with voltage, use another transformer (do not use the same secondary of the controller's power) in order to prevent the inputs from malfunctioning or being damaged.

Table 7-1 *iPro Digital Input Specifications*

7.2. IPX106D Digital Inputs

The IPX has a maximum of three (3) digital inputs that can be configured for use with the case controller through the Visograph display. The three (3) digital inputs have a single point for common, Terminal **13**. Connect one side of the inputs to the signal terminals 10, 11 or 12 and the other side to common Terminal **13**.

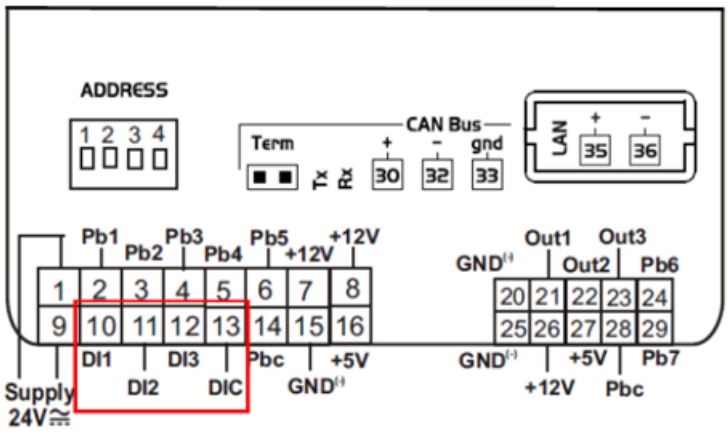


***Figure 7-2** - IPX106D Digital Input Wiring*

DIGITAL INPUTS	
TYPE:	Opto-insulated voltage free contact
NUMBER OF INPUTS:	3
NOTES:	Do not use live contacts to prevent the inputs from being damaged.

***Table 7-2** - IPX106D Digital Input Specifications*

8 Wiring Digital Outputs

8.1. iPro Digital Outputs

The 15 digital outputs are located across four (4) separate connectors across the top side of the iPro Case Controller. The normally open outputs on each connector share the same common and are not fused. Make sure to use the same voltage for all loads connected to these relays; do not mix voltages.

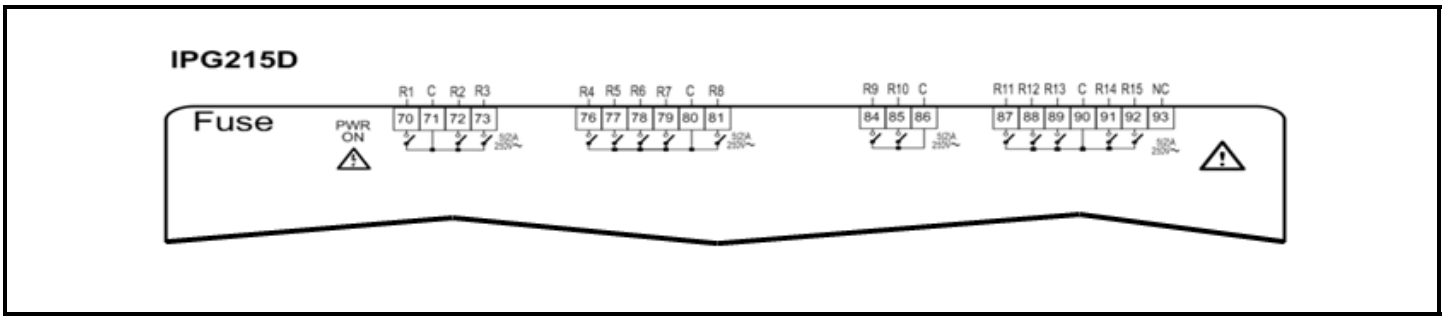


Figure 8-1 *- iPro Digital Output Wiring - Dry Contacts*

	DIGITAL OUTPUTS
TYPE:	Relays with NO contacts
NUMBER OF OUTPUTS:	15
TYPE OF OUTPUT:	Relays with normally open contact
MAXIMUM LOAD:	5A (250 VAC) SPST 5(2)A
NOTES:	Verify the capacity of the output used. There is double insulation between the digital outputs and the low voltage of the rest of the circuit. Do not use different voltages for the various groups of relays or within each group.

Table 8-1 *- iPro Digital Output Specifications*

8.2. IPX106D Digital Outputs

The IPX106D has six (6) digital outputs with normally open contacts that can be used in addition to iPro digital outputs if required. The IPX relays are split into two different groups: terminals 40-43 and terminals 44-47, each having its own common (43 and 44).

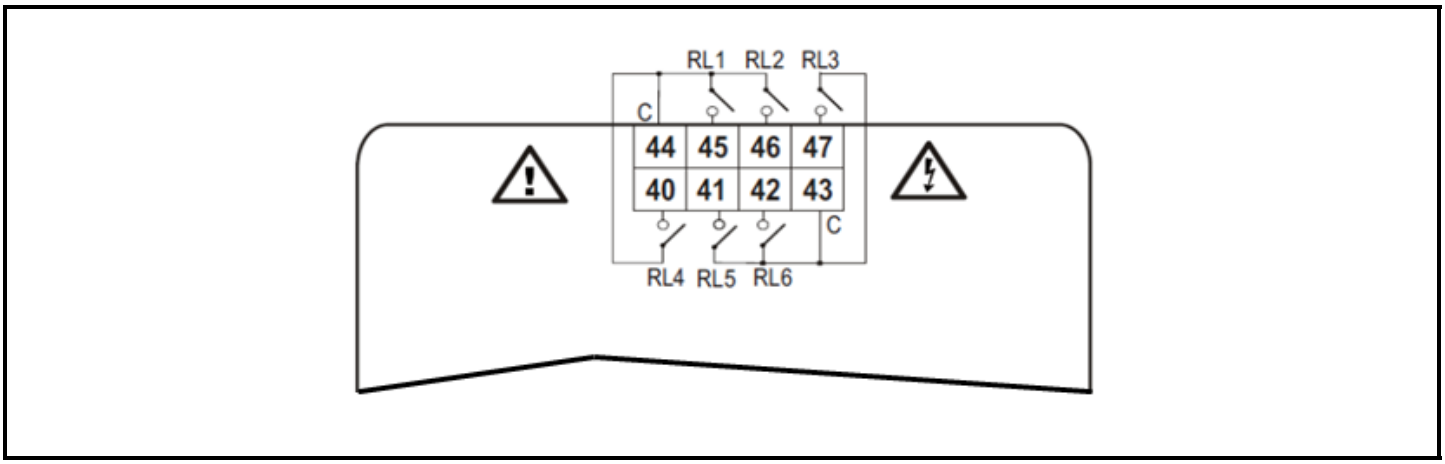


Figure 8-2 *- IPX106D Digital Output Wiring*

	DIGITAL OUTPUTS
TYPE:	Relays with NO contacts
NUMBER OF OUTPUTS:	6
TYPE OF OUTPUT:	Relays with normally open contact
MAXIMUM LOAD:	5A (250 VAC) SPST 5(2)A
NOTES:	Verify the capacity of the output used. There is double insulation between the digital outputs and the low voltage of the rest of the circuit. The common relays of the outputs are separate and split into groups. Different voltages can be used for different groups of relays but the same voltage must be used within each group.

Table 8-2 *- iPro Digital Output Specifications*

9 Wiring Analog Outputs

9.1. iPro Analog Outputs

The iPro Case Controller has six (6) opto-insulated analog outputs available along the bottom side of the device on terminals 21-30. Because the analog outputs are opto-isolated, they must be powered separately from the case controller device by 24VAC at terminals 28-29.

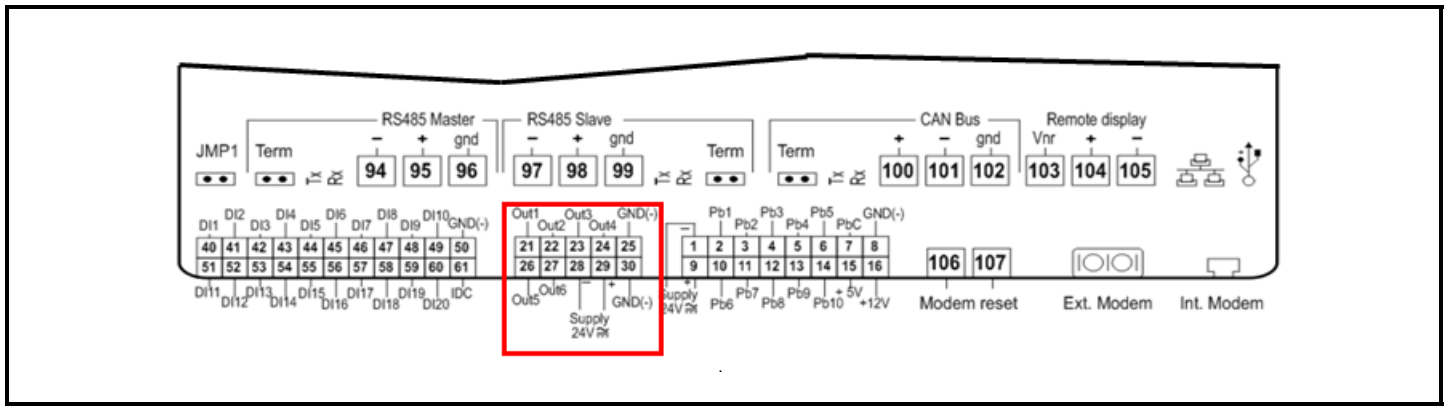


Figure 9-1 *- iPro Analog Output Connection*

ANALOG OUTPUTS	
TYPE:	Opto-insulated with separate 24VAC/DC power supply
NUMBER OF OUTPUTS:	6
TYPE OF OUTPUT:	4 fixed outputs 0-10VDC (Out1 - Out4) 2 configurable outputs 0-10VDC, 4-20mA (Out5 and Out6)
MAXIMUM LOAD:	40mA (Out1 - Out4) 20mA (Out5 and Out6) max with configured outputs 0-10VDC 400Ω max with configured outputs 4-20Ma 22Ω per live analog output
NOTES:	The electrical devices controlled by these analog outputs must be powered separately with another transformer (do not use the same secondary of the controller's power) in order to prevent the outputs from malfunctioning or being damaged.

Table 9-1 *- iPro Digital Output Specifications*

9.2. IPX106D Analog Outputs

The IPX expansion module has (three) 3 additional analog outputs available that can be used with the case controller if needed. The outputs are located on terminals 20-23. Note that the IPX AO do not require dedicated 24VAC power like iPro analog outputs.

ANALOG OUTPUTS	
TYPE:	Non opto-insulated internal power
NUMBER OF OUTPUTS:	3
TYPE OF OUTPUT:	3 fixed outputs 0-10VDC (Out1 - Out3)
MAXIMUM LOAD:	40mA (Out1 - Out3) 22Ω per live analog output
NOTES:	The electrical devices controlled by these analog outputs must be powered separately with another transformer (do not use the same secondary of the controller's power) in order to prevent the outputs from malfunctioning or being damaged.

Table 9-2 *- IPX Digital Output Specifications*

10 Software Overview

10.1. Refrigeration Control Modes

The iPro Case Controller controls the temperature, defrost and Superheat for the refrigerated case or walk-in box based on the selection of the control mode parameter (parameter name=**CrE**). There are five different control modes available to accommodate the different refrigeration system designs that iPro can support. In general, the iPro supports systems using electric expansion valves with no suction regulation valve, electric expansion valves with EEPR suction regulation, mechanical expansion valves with EEPR suction regulation and mechanical expansion valves with no suction regulation. The five different control modes are outlined below.

10.1.1. Standard Control Mode

In the Standard mode, each case controller will manage case temperature and the Superheat setpoints for up to three (3) electric expansion valves per case controller. There is no suction regulation or management of EEPR stepper valves in this control mode. For EEPR valve management, select either suction or Superheat/Suction control mode described below.The management of case temperature in the Standard control mode is accomplished by the use of setpoint and deadband control of the refrigeration relay, which is typically controlling the system's liquid line solenoid valve. The control temperature in this mode is a calculated temperature value that is compared to the setpoint. When more than one (1) discharge air sensor is present, the control temperature calculation method is applied to give the final control temperature. The options for control temperature calculation are: minimum, maximum, and average. The deadband is split in half around the setpoint, so when control temperature is above setpoint plus ½ of band, the refrigeration relay is set to true/ON. When the control temperature is below setpoint minus ½ of band, the refrigeration relay is set to false/OFF. During defrost the refrigeration relay is set to OFF.

10.1.1.1. Standard Mode Control Value Calculation-Parameter CTM

Minimum - The controller will choose the minimum value as the final control temperature among the available (configured and reading) discharge air sensors.

Maximum - The controller will choose the maximum value as the final control temperature among the available configured discharge air sensors.

Average - The controller will perform an average of the available configured discharge air sensors for the final control temperature.

Note that if a temperature sensor fails, all the above calculation methods will disregard the failed sensor readings and only calculate based on the remaining valid sensor readings.

10.1.2. Superheat-Only Control Mode

In Superheat-only mode, Superheat is controlled to a target setpoint of up to three (3) electric expansion valves, managed, each by its own PID. Control of the Superheat for each valve is accomplished using a suction pressure transducer and suction pipe temperature sensor (coil outlet) per evaporator to make the Superheat calculation. Each of the three EEV valves has its own Superheat setpoint parameter **EEV1_SSH-EEV3_SSH**. The PID can be tuned manually or can be put into Auto-adaptive mode by setting the proportional band value=0. When the **P** value is set to 0, the system monitors the stability of the evaporator Superheat and dynamically adjusts the proportional band value to the optimum number. This eliminates the need for manual tuning at every system and can greatly reduce the time required to tune systems at system startup.

10.1.2.1. Superheat Only-EEV Management

The Superheat control mode is designed to control the evaporator Superheat in systems using electronic expansion valves. The iPro Case Controller can control up to three (3) EEV, this is selected through the value of parameter **EEV Count**. While in the Superheat-only control mode the refrigeration relay is fixed ON during the refrigeration cycle, no cycling of this relay is managed in this mode. Refrigeration relay is fixed OFF during defrost cycle.

10.1.2.2. Superheat Only Mode-Control Value Failure

In the event that a suction pressure transducer fails or suction temperature sensor fails, the EEV will be driven to the position defined by parameter SHF%.

10.1.3. Suction Control Mode

Selecting the Suction control mode can be done by setting parameter **CRE=suction**. The Suction mode is designed to perform temperature control and EEPR valve regulation for a lineup of refrigerated cases. Case controllers in this mode are designated as either master controllers or slave controllers, with the master controller regulating EEPR and liquid line solenoid valve for the refrigeration circuit lineup. The slave case controllers communicate with the master controller through the RS485 slave port on each device. Case temperature information from the slave controllers is shared with the master over this connection. The master case controller regulates the EEPR to maintain the case temperatures to the target setpoint. The maximum number of case controllers in a lineup is six (6), where one of the six (6) is the master controller. The EEPR regulation can be done based on the average, minimum or maximum case local temperature, where *local* means the discharge air sensors are connected to the master controller only. The EEPR regulation can also be done based on the average, minimum or maximum lineup temperature, where *lineup* means all the case controllers are connected to the RS485 slave network. The selection is made through the parameter **SSCP**.

10.1.3.1. Suction Control Mode-PID

The EEPR valve regulation is accomplished by comparing control value to the target setpoint and determining a PID output value for the position of the EEPR valve. The PID control can be put into Manual or Automatic mode by setting the **P** value. When the **P** value is set to 0, the application will automatically adjust the proportional band value to find the best stable value for regulation.

Parameter	Recommended Value
PB	0-for Automatic mode
INC	0
DER	0

Table 10-1 *- Recommended Settings*

10.1.3.2. Configuring Controllers for Suction Control Mode

To configure the controller as a master in Suction mode, the following parameters must be set:

Parameter	Description	Parameter Value for Master Controller
CrE	Control Type	Suction
SSCP	Superheat and suction control probe selection	User choice, Average Lineup Recommended
EEPR	EEPR driver	XEV20
EEV	EEV driver	Not Present
EEVCnt	Number of EEVs in the case	0
S1Addr	Modbus address of slave device 1	2 if 1 slave CC is present; otherwise set at 0
S2Addr	Modbus address of slave device 2	3 if 2 slave CC are present; otherwise set at 0
S3Addr	Modbus address of slave device 3	4 if 3 slave CC are present; otherwise set at 0
S4Addr	Modbus address of slave device 4	5 if 4 slave CC are present; otherwise set at 0
S5Addr	Modbus address of slave device 5	6 if 5 slave CC are present; otherwise set at 0
Modbus_Addr	Modbus address of this controller	1
Baud	Baud of Modbus communication	19200

Table 10-2 *- Master Controller Configurations for Suction Control Mode*

Note that if the Modbus address or baud rate is changed, the controller must be rebooted.

To configure the controller as a slave case controller in Suction mode, the following parameters must be set:

Parameter	Description	Parameter Value for Master Controller
CrE	Control Type	Suction
SSCP	Superheat and suction control probe selection	User choice, Average Lineup Recommended
EEPR	EEPR driver	Not Present
EEV	EEV driver	Not Present
EEVCnt	Number of EEVs in the case	0

Table 10-3 *- Slave Controller Configurations for Suction Control Mode*

S1Addr	Modbus address of slave device 1	0
S2Addr	Modbus address of slave device 2	0
S3Addr	Modbus address of slave device 3	0
S4Addr	Modbus address of slave device 4	0
S5Addr	Modbus address of slave device 5	0
Modbus_Addr	Modbus address of this controller	Set based on the S1-S5Addr of the master CC
Baud	Baud of Modbus communication	19200

Table 10-3 *- Slave Controller Configurations for Suction Control Mode*

Note that if the Modbus address or baud rate is changed, the controller must be rebooted.

10.1.3.3. Suction Mode-Refrigeration Relay Control

In Suction mode, the refrigeration relay is controlled based on the selection of the parameter SSCP. The control value is used with the case target setpoint and deadband. The control temperature sensors include the master controllers connected sensors as well as all online slave controller sensors in the lineup. If the calculated control temperature is greater than the setpoint, the refrigeration relay is on. If the control temperature is less than the setpoint plus the deadband, the refrigeration relay is off (entire deadband is applied below the setpoint). The refrigeration relay is set to OFF during defrost.

10.1.4. Superheat and Suction Control Mode

Selecting the Superheat and Suction control mode can be done by setting parameter **CRE=Superheat** and **Suction**. This mode is designed to manage one EEPR, one LLSV, and up to three EEV in one case. When a lineup of cases is present with EEV valves and there is one EEPR for the lineup, this mode must be selected on the master controller of the lineup, which is the controller that the EEPR is connected to. This mode manages the EEPR for the circuit and its own locally connected EEVs. Case controllers in this mode are designated as either master controllers or slave controllers, with the master controller regulating EEPR and liquid line solenoid valve for the refrigeration circuit lineup. The slave case controllers communicate with the master controller through the RS485 slave port on each device. Case temperature information from the slave controllers is shared with the master over this connection. The master case controller regulates the EEPR to maintain the case temperatures to the target setpoint. The maximum number of case controllers in a lineup is six (6), where one of the six (6) is the master controller. The EEPR regulation can be done based on the average, minimum or maximum case local temperature where *local* means the discharge air sensors connected to the master controller only. The EEPR regulation can also be done based on the average, minimum or maximum lineup temperature where *lineup* means all the case controllers connected to the RS485 slave network. The selection is done through the parameter SSCP.

10.1.4.1. Superheat and Suction Control Mode-PID

The EEPR valve regulation is accomplished by comparing control value to the target setpoint and determining a PID output value for the position of the EEPR valve. The PID control can be put into Manual or Automatic mode by setting the **P** value. When the **P** value is set to **0**, the application will automatically adjust the proportional band value to find the best stable value for regulation.

10.1.4.2. Configuring Controllers for Superheat and Suction Mode

To configure the controller as a master in the Superheat and Suction mode, the following parameters must be set:

Parameter	Description	Parameter Value for Master Controller
CrE	Control Type	Superheat and Suction
SSCP	Superheat and suction control probe selection	User choice, Average Lineup Recommended
EEPR	EEPR driver	XEV20
EEV	EEV driver	XEV20
EEVCnt	Number of EEVs in the case	0-3
S1Addr	Modbus address of slave device 1	2 if 1 slave CC is present; otherwise set at 0
S2Addr	Modbus address of slave device 2	3 if 2 slave CC are present; otherwise set at 0
S3Addr	Modbus address of slave device 3	4 if 3 slave CC are present; otherwise set at 0
S4Addr	Modbus address of slave device 4	5 if 4 slave CC are present; otherwise set at 0
S5Addr	Modbus address of slave device 5	6 if 5 slave CC are present; otherwise set at 0
Modbus_Addr	Modbus address of this controller	1
Baud	Baud of Modbus communication	19200

Table 10-4 *- Master Controller Configurations for Superheat and Suction Control Mode*

Note that if the Modbus address or baud rate is changed, the controller must be rebooted.

To configure the controller as a slave case controller in a lineup where the master controller is Superheat and Suction mode, the following parameters must be set:

Parameter	Description	Parameter Value for Master Controller
CrE	Control Type	Superheat only
SSCP	Superheat and suction control probe selection	User choice, Average Lineup Recommended
EEPR	EEPR driver	Not Present
EEV	EEV driver	XEV20
EEVCnt	Number of EEVs in the case	0-3
S1Addr	Modbus address of slave device 1	0
S2Addr	Modbus address of slave device 2	0
S3Addr	Modbus address of slave device 3	0
S4Addr	Modbus address of slave device 4	0
S5Addr	Modbus address of slave device 5	0
Modbus_Addr	Modbus address of this controller	Set based on the S1-S5Addr of the master CC
Baud	Baud of Modbus communication	19200

Table 10-5 *- Slave Controller Configurations Where Master is Superheat and Suction Mode*

Note that if the Modbus address or baud rate is changed, the controller must be rebooted.

10.1.4.3. Superheat and Suction Control-Refrigeration Relay

The management of the refrigeration relay in this mode is the same as described in ***Section 10.1.3.,*** *Suction Control Mode*.

10.1.5. Defrost Control and Operation

10.1.5.1. Local Initiation of Defrost

Defrost control can be managed locally by the case controller or by a supervisory controller if there is a supervisory controller connected. When the defrost is managed locally by the case controller, only then is the initiation of defrost accomplished using an internal schedule. The internal schedule is based on a start time and number of defrosts per day. Based on the start time and the number per day the controller will evenly space the defrosts based on a 24-hour day. For example, if the start time is 0:00 and the number per day is 4, the controller will schedule four (4) defrosts evenly every six (6) hours at 0:00, 6:00, 12:00, and 18:00. When a scheduled defrost time is reached, the controller starts the defrost cycle and drives the EEV valves to the percentage defined by **SHDef%** and drives the EEPR valve to the parameter **SuctionDef%**. The defrost relay is switched to ON and the refrigeration relay is switched to OFF.

10.1.5.2. Supervisory Initiation of Defrost

When the case controllers are connected to a supervisory controller, the supervisor control will initiate the defrost cycle of each controller through the BACnet MS/TP network. The supervisory controller will contain the defrost schedule and be responsible for triggering each defrost cycle. Once the controller receives a defrost start signal from the supervisory controller, the case controller will begin the defrost cycle. If the case controller loses communication to the supervisory, it will defrost on its own internal schedule as described in ***Section 10.1.5.2.,*** *Supervisory Initiation of Defrost* above.

10.1.5.3. Defrost Operation of Relays and Valves

Whenever the defrost cycle begins, the case controller drives the electronic valves to their respective defrost positions as defined by parameters **SHDef%** and **SuctionDef%**. The refrigeration relay is driven to the OFF position and the defrost relay is switched to ON.

The evaporator fan operation during defrost is governed by the parameter **FanOp**. The options are shown in the table below:

FanOp Parameter Values	Description
OnR-OffD	Fan relay is on during refrigeration and off during defrost cycle
OnR-OnD	Fan relay is on during refrigeration and on during defrost cycle
OnF-OffD	Fan relay is on continuously and off during defrost cycle
OnF-OnD	Fan relay is on continuously and on during defrost cycle

Table 10-6 *- Evaporator Fan Operation During Defrost*

10.1.5.4. Defrost Termination

No matter what method initiates the defrost, the termination is managed locally by the case controller. The termination options are: temperature, digital inputs, and time.

Temperature-When temperature termination is selected, the terminating sensor must be specified by parameter **dTS**, the options for sensors to select are: defrost termination, discharge air, or coil outlet. Once the combined termination value reaches the defrost termination setpoint, the defrost cycle is terminated and the system enters Drip mode if applicable. Following Drip mode, the system enters Wait mode. Wait mode is only entered if the controller is a part of a master/slave lineup network. If there is no master/slave network, Wait mode is skipped. During Temperature Termination mode the case controller is always monitoring maximum time, if the maximum duration is ever exceeded, the defrost is terminated immediately.

Time-When time termination is selected, the defrost cycle runs for a time value only and then terminates. No temperature sensors are considered. Following the time termination, the case controller performs drip time if applicable and then enters Wait mode.

Digital Inputs-When digital input termination is selected, the defrost cycle runs continuously until the controller receives a digital input signal. To run this option, one of the digital inputs must be configured for DefTerm1-3. During Digital Input Termination mode the case controller is always monitoring maximum time - if the maximum duration is ever exceeded, the defrost is terminated immediately.

10.1.5.5. Wait Mode

When the case controllers are connected in a lineup together and one lead case is the master, the case controller utilizes Wait mode. If there is no master slave network configured, Wait mode is skipped. During Wait mode there is no refrigeration or defrost occurring - the system is idle. The operation of the fan is outlined by the fan parameter **FanOp**. In the refrigeration lineup, the master controller has control of certain system critical valves: the EEPR and liquid line solenoid valve. Therefore, when the entire lineup is in defrost, the slave case will terminate before the master case and attempt to enter refrigeration again. Because the slave cases cannot enter refrigeration without the master opening the EEPR and LLSV for the entire circuit, the slave must wait for the master to finish defrost before it can enter refrigeration again.The opposite situation also exists where the master case can terminate defrost before any of the slave cases and enter refrigeration again before the slave controller defrost completes. In this situation, the master case enters refrigeration again while the slave cases are still in defrost, which results in refrigeration and defrost occurring at the same time on the slave cases since the master controls the liquid feed for the entire circuit. In order to avoid these critical problems and synchronize defrost, the case controller utilizes a Wait mode after termination of defrost. After termination of defrost and Drip mode, the controller enters Wait mode. Once in Wait mode, refrigeration can start again in one of two ways: 1. The controller can receive an **end Wait mode** signal from a supervisory controller through the BACnet MS/TP network. 2. The controller will timeout on a failsafe parameter-maximum wait time. When connected with a supervisory controller, the supervisor will monitor all Wait mode signals. Once all Wait mode signals for a lineup are set = ON, the supervisor will issue an end wait signal to each controller in the lineup, and refrigeration begins again.

Parameter	Description	Range
DefTyp	Defrost type	Electric/Hot gas
DefDur	Maximum defrost cycle duration	1-360 Minutes
MinDef	Minimum runtime of each defrost cycle	1-45 Minutes
Drip	Number of minutes of dripping time	0-30 Minutes
TermSet	Defrost termination temperature setpoint	0-99° Fahrenheit
MinI	Minimum time between the start of each defrost cycle	1-255 Minutes
DefDly	Minutes of delay of each defrost cycle start	0-30 Minutes
MaxWait	Maximum time the controller can stay in Wait mode	0-60 Minutes
dTS	Defrost term sensor selection	Discharge Air, Defrost Term or Coil Outlet
TempComb	Defrost termination sensor value combination method	Minimum, maximum, average
TermTyp	Method of defrost termination	Time, temperature or digital inputs
SHDef%	Defrost position of the electric expansion valves	0% or 100%
SuctionDef%	Defrost position of the EEPR	0% or 100%
SchHour	The scheduled starting hour of the defrost cycle	0-23 hours
SchMin	The scheduled starting minute of the defrost cycle	0-59 minutes
SchPerDay	The number of defrost cycles per day	0-6

***Table 10-7** - Defrost Parameter List*

10.2. Lighting Control Overview

There are three options for controlling the case lights: motion detector, BAS scheduled, and dimming.

When a BAS supervisory controller is online with the iPro Case Controller, the lights relay is switched ON/OFF by the BAS schedule through the BACnet network. The iPro Case Controller comes with BAS lighting control default enabled.

When the lights are controlled by the motion detector, the lights are turned ON when motion is detected by the digital input from the motion sensor. The light output stays ON for a defined amount of time selected with the parameter **Offd**. Each time the motion detector is triggered, the **Offd** timer resets, so when no motion is detected the lights will turn OFF after the time defined in **Offd**.

To set up light dimming, select one of the available analog inputs as **LightSensor**. The sensors' light levels at 0V and 10V must be set up in parameters **MxL** and **MiL**. When the light level is detected at its lowest programmed point (**LDS**), the analog output is driven to its maximum output percentage (**MaxLP**). When the light level is detected at its highest programmed point (**HDS**) then the analog output is driven to its minimum output percentage (**MinLP**). The dimming analog output control modulate to be linear in between **LDS** and **HDS**. If the light level input sensor fails or the sensor is in error then the dimming percentage will default to a fixed output defined by parameter **PPER**.

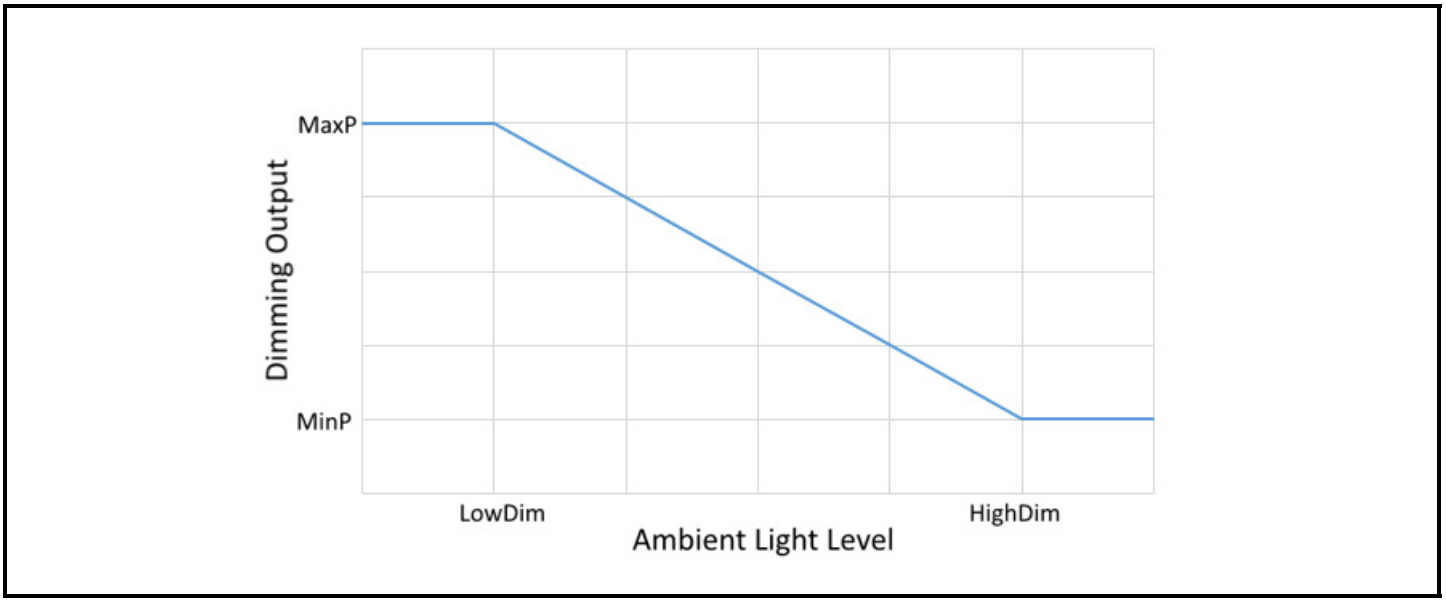


Figure 10-1 *- Light Dimming Output*

10.3. Fan Control Overview

The fan control relay will operate according to the control mode selection made for parameter **Fop**. The table below outlines the options and their descriptions:

FanOp Parameter Values	Description
OnR-OfD	Fan ON with the refrigeration output ON, Fan OFF during defrost
OnR-OnD	Fan ON with the refrigeration output ON, Fan ON during defrost
OnF-OfD	Fan ON continuously; fan OFF during defrost
OnF-OnD	Fan ON continuously; fan ON during defrost

Table 10-8 *- Fan Control Relay Values for Fop*

If the fan is OFF during the defrost, it turns ON once refrigeration starts using these methods:

Temperature activation: Following defrost, once refrigeration is active again, the defrost termination temperature must drop to a setpoint (**Fst**) minus hysteresis (**Fhy**), causing the fan relay to turn ON.

Time: The controller will monitor the defrost sequence to determine when defrost ends and when refrigeration is back ON. Once refrigeration is back ON following a defrost, the fan will start after a time delay (**Ftd**).

Not Used: The fan will start immediately after defrost with the refrigeration cycle again.

Parameter Values	Description	Range
FanOp	Fan mode of operation	OnR-OffD, OnR-OnD, OnF-OnD, OnF-OffD
FAd	Fan activation method after defrost	Nu, time, temperature
FSt	Fan temperature activation setpoint	-10 to 70° Fahrenheit
FHy	Fan temperature activation setpoint hysteresis	1 to 30° Fahrenheit
Ftd	Fan activation time delay	0 to 10 minutes

Table 10-9 *- Fan Control Relay Values If Fan is OFF During Defrost*

10.3.1. Dual Temperature Mode

Regardless of the control mode selected, the application has the capability to switch to a dual temperature setpoint for the case or box. In Dual Temperature mode, the normal refrigeration setpoint shifts to have the dual temperature offset (**DT**) added to it to obtain the dual temperature setpoint. The system will switch to the dual temperature setpoint once the dual temperature digital input is active. The BAS supervisory controller can also activate Dual Temperature mode via the BACnet network.

10.3.2. System Enable/Disable

The case controller can be enabled/disabled through a digital input or by the BAS via the BACnet network. When the disable command is received the controller will:

- Disable all regulation of refrigeration
- Drive EEVs and EEPR to 0%
- Disable fans, lights, anti-sweat

There is a configurable time delay on the closing of the valves to allow the system to pump out the evaporator coil before shutting the suction valve.

11 Electronic Valves

11.1. Presence and Position

Depending on the application of the case controller the system may be using 0-3 expansion valves or 1 EEPR. The position of the valves on the XEV20D driver is fixed and can be represented by the table below:

Parameter	Description
EEPR	Not used or XEV20. Defines if the system has an EEPR or no EEPR
EEV	Not used or XEV20. Defines if the system has an EEPR or no EEPR
EEV Count	0-3. Defines the number of EEVs the system needs to manage

Table 11-1 *- EEV Count Parameters and Definitions*

EEV Count Parameter	Description
EEPR = XEV20 **EEV Count = 0**	EEPR-Valve 1-on Module XEV20-1 No EEV valves activated in the system
EEPR = XEV20 **EEV Count = 1**	EEPR-Valve 1-on Module XEV20-1 EEV1-Valve 2 on Module XEV20-1
EEPR = XEV20 **EEV Count = 2**	EEPR-Valve1-on Module XEV20-1 EEV1-Valve 2 on Module XEV20-1 EEV2-Valve 1 on Module XEV20-2
EEPR = XEV20 **EEV Count = 3**	EEPR-Valve1-on Module XEV20-1 EEV1-Valve 2 on Module XEV20-1 EEV2-Valve 1 on Module XEV20-2 EEV3-Valve 2 on Module XEV20-2

Table 11-2 *- Valve Positions of XEV20D*

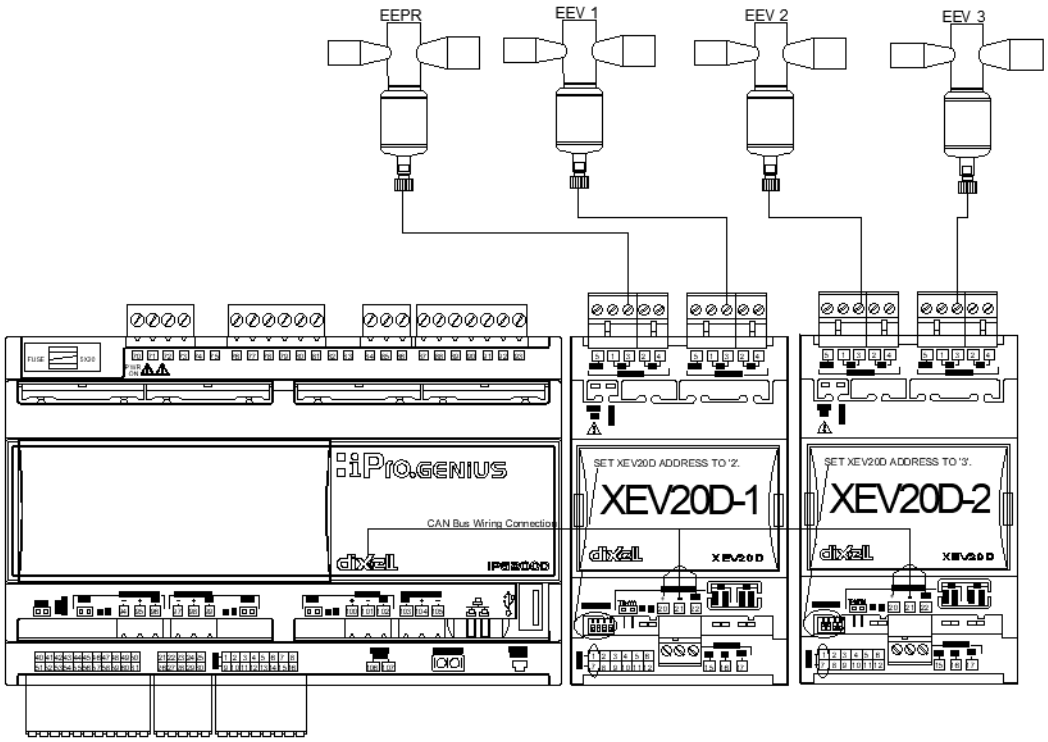


Figure 11-1 *- EEPR and EEV XEV20D Layout*

11.2. EEV and EEPR Calibration Procedure

When power is cycled to the XEV20D driver and during power-up, the driver will initiate a valve calibration procedure for both valve positions. The application will calibrate the valves during the first defrost cycle after a set number of hours depending on the value of parameter **ExtraS_Cal_Timer**. So if the timer value = 24 hours, the valves will be automatically calibrated during the first defrost for each 24 hours. Additionally, a calibration can be performed on each valve from the Visograph menu.

11.3. Valve Calibration From the Visograph Display

To calibrate electronic valves from the Visograph, press and hold the T4 key on the display for three (3) seconds to enter the main menu (for iPro Case Controller versions older than version 1.00, pressing and holding the T1 and T4 keys may be required).
Note that the keys are labeled T1 - T8 in these graphics only and not on the actual device.

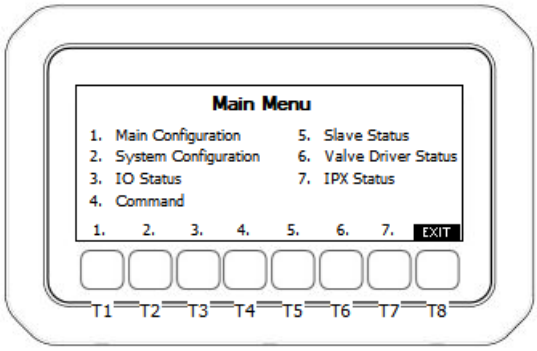


Figure 11-2 *- Enter the Main Menu By Holding the T4 Key*

Enter the Command menu by pressing the key labeled T4 again and use T8 to scroll all the way to the right.

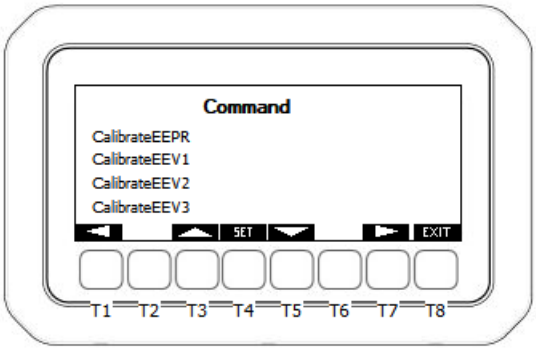


Figure 11-3 *- Initiate Valve Calibration*

To initiate a calibration on the valve, press the key labeled T5 to scroll down, then T4 (**SET**) to edit. Change the value from **NO** to **YES** and choose **SET** to save the selection. The value will remain at **YES** for a few seconds while the calibration is performed and will automatically toggle back to **NO**.

12 The BACnet Network

The case controller operates as a stand alone controller, but also can be connected to a supervisory controller as well for remote access, setpoint configuration and alarming. The case controller comes equipped with BACnet MS/TP and BACnet over IP communications. For communication with the E2E controller the case controller uses an RS485 network and BACnet MS/TP.

12.1. Wire Types

Retail Solutions specs General Cable 92454A (Emerson P/N 135-0600) shielded twisted pair cables for use as BACnet MS/TP wiring.

12.2. Daisy Chain Wiring

The BACnet MS/TP connection should be wired in a daisy chain topology, *no star or T configurations are allowed*. Connect the BACnet network cable to the three terminal connector on the E2E COM port you wish to assign as BACnet MS/TP. Reverse the polarity of +/- on the RS485 cable between the E2E and the iPro Case Controller.

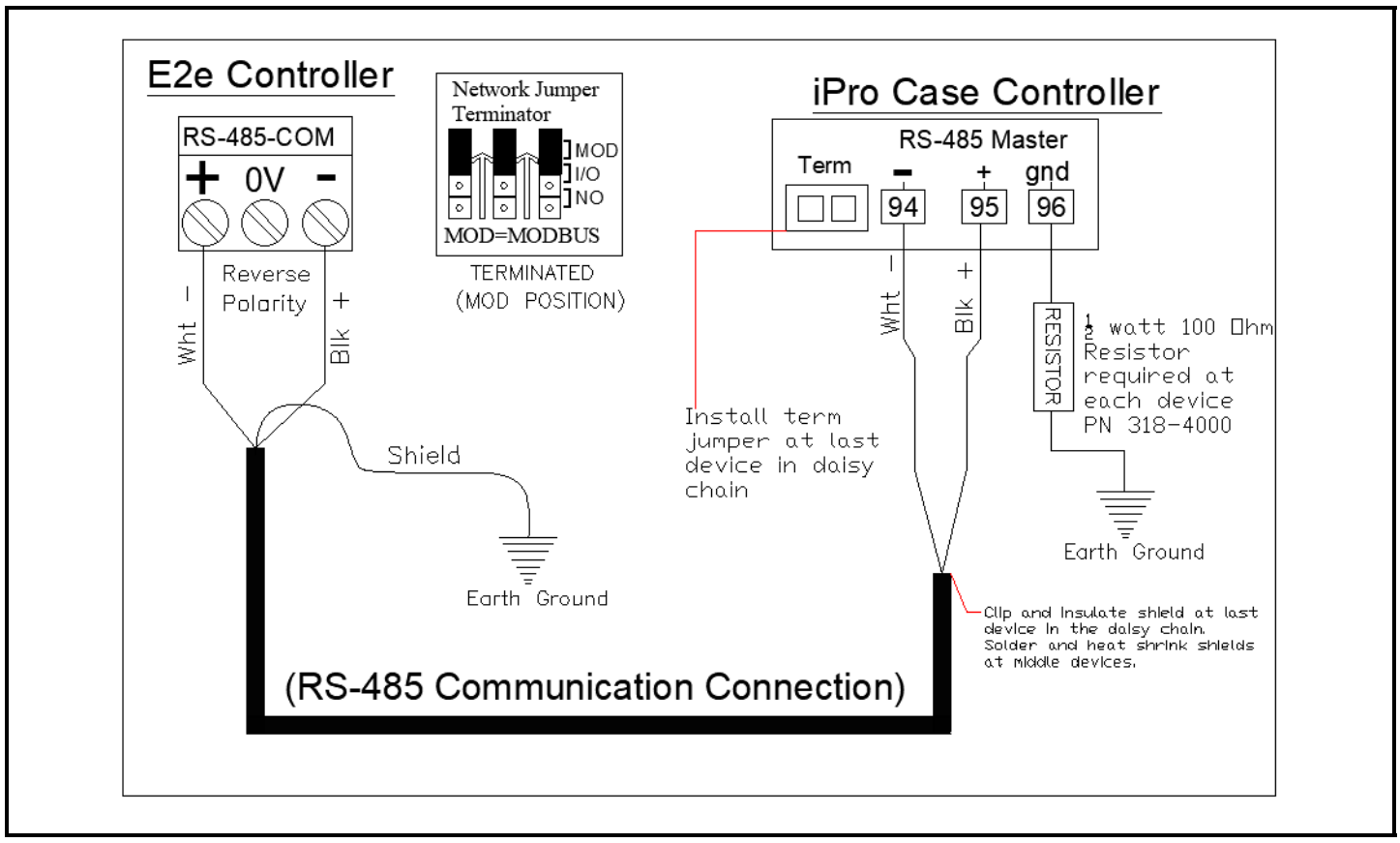


Figure 12-1 *- BACnet MS/TP Wiring*

12.3. Setting the BACnet MS/TP MAC Address

The network address makes a board unique from other boards on the network of the same type. This allows the supervisory controller to find it and communicate with it easily. The case controller address can be set using the Visograph display. Case controllers connected to E2E controllers using description file *P/N 527-0599* should be set to address **128-254** and a baud rate of **19200**. ***Note that the keys are labeled T1 - T8 in these graphics only and not on the actual device.***

1. Press the T4 key for three (3) seconds to enter the Main Menu:

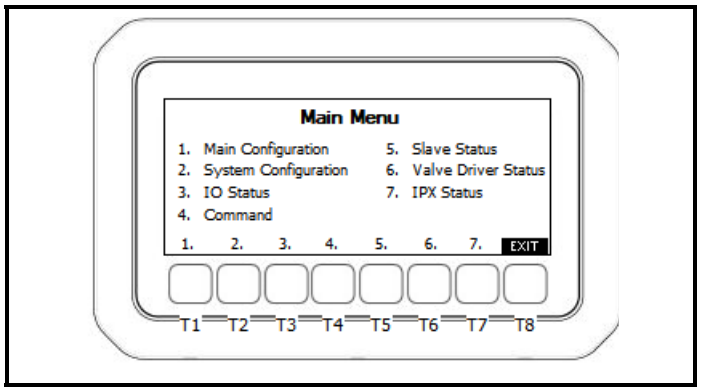


Figure 12-2 *- Main Menu*

2. Press the T2 key to enter System Configuration and then press T1 for **System**:

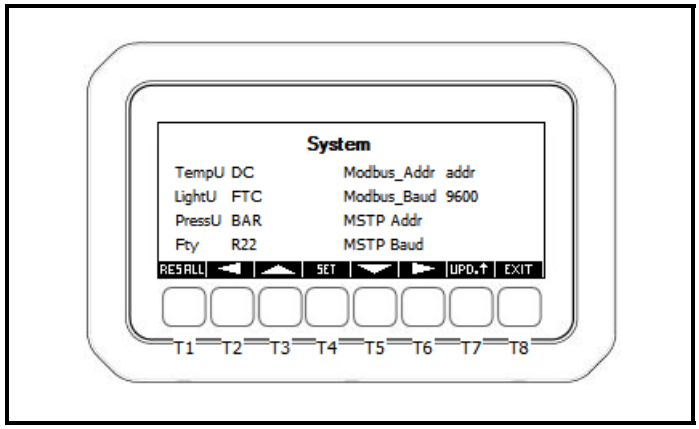


Figure 12-3 *- System Configuration*

3. Press the T5 key to move the cursor to the **MSTP Addr** and **MSTP Baud** fields.
4. Press T4 (**SET**) to edit and use T4/T5 to move the values to the desired selection. Press T4 (**SET**) to save the selection.
5. After saving the address selection, press T6 (right arrow key) two times to page over to reboot:

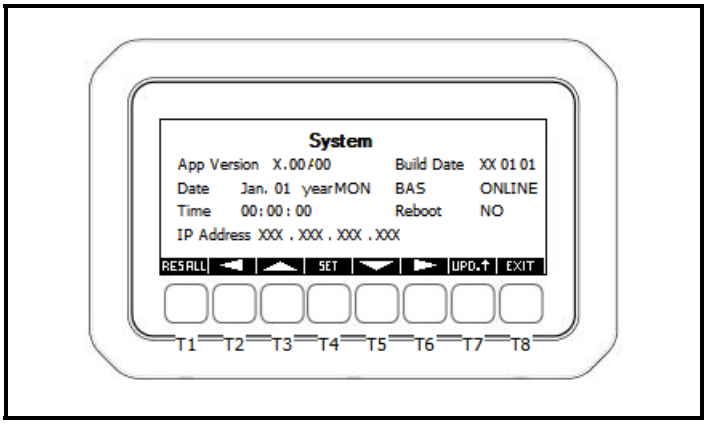


Figure 12-4 *- Reboot*

6. Arrow down until **Reboot NO** is selected and press T4 (**SET**) to edit and change the value to **YES**. Press T4 (**SET**) to save **YES**. Now the device will reboot to initialize the address and baud rate change. ***Note that any time address or baud rate is changed, a reboot is required***.

13 MODBUS Networking-Master Slave Lineup

When an EEPR is used in the refrigeration system, the case controllers communicate from controller to controller within each lineup. This is done through the use of RS485 and a local MODBUS network. The device controlling the EEPR is the master controller and the other devices in the lineup are slave case controllers. The Modbus connection is a local connection that is within each refrigeration circuit. The Modbus connection does not and should not be extended to all controllers within a store.

13.1. Wire Types

Emerson specs General Cable 92454A (*Emerson PN 135-0600*) shielded twisted pair cables for use in MODBUS network wiring.

13.1.1. Daisy Chain Wiring

The MODBUS network must be wired in a daisy chain topology, no star or T configurations are allowed. Connect the 3-wire connection from the master case controllers RS485 slave port to each slave case controllers RS485 slave port. See ***Figure 13-1*** for connection detail:

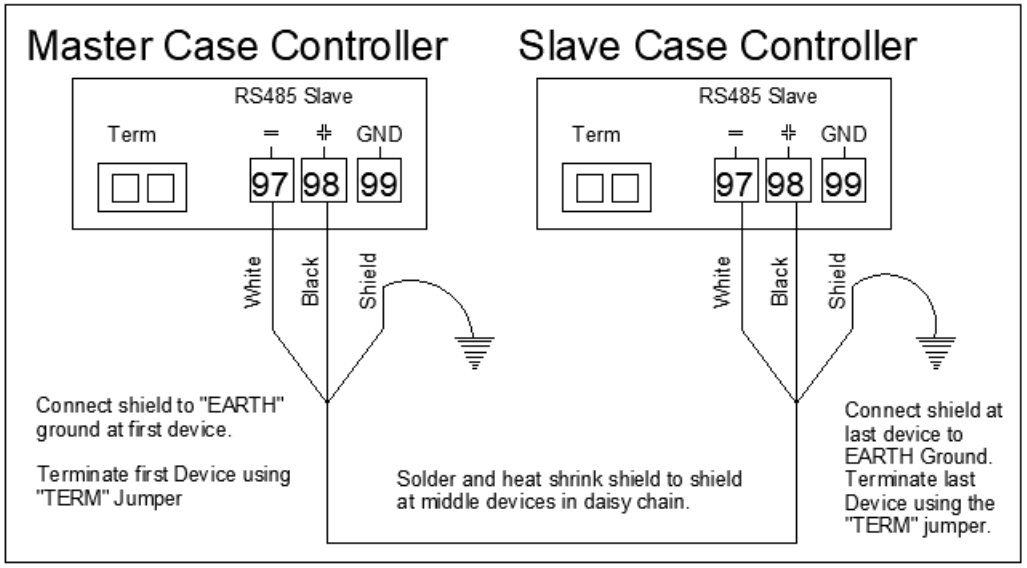


Figure 13-1 - *Master/Slave Wiring Detail*

13.1.2. Setting the MODBUS Address and Baud Rate

Each device in the local Modbus network must have a unique Modbus address. Because the connection typically begins with the master case controller and ends with the last slave case controller, the master case controllers address is set to **1**. Each slave case controller is subsequently addressed **2**, **3**, **4** and so on. A maximum of five slave case controllers can be connected to one master.

1. Press and hold the T4 key for three (3) seconds to enter the main menu:

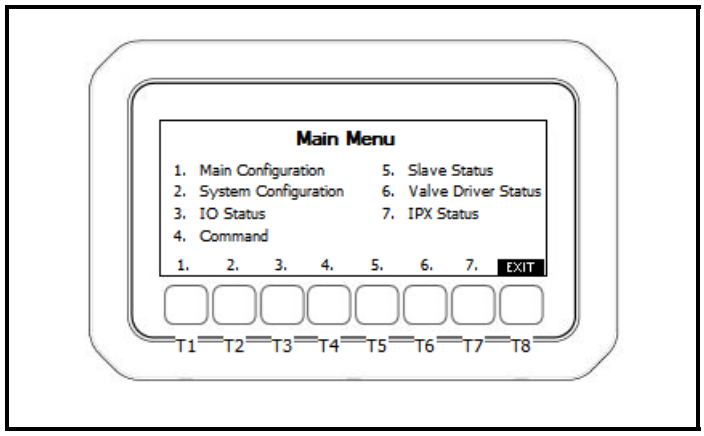


Figure 13-2 *- Enter the Main Menu By Pressing the T4 Key*

2. Select T2 for **System Configuration**, and then T1 for **System**:

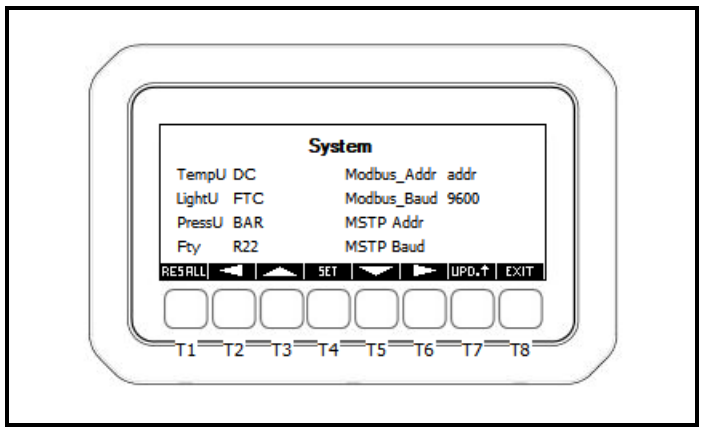


Figure 13-3 *- System Configuration*

3. Press the T5 key to move the cursor to the **Modbus Addr** and **Baud** fields. Press T4 (**SET**) to edit and use T4/T5 to move the values to the desired selection. Press T4 (**SET**) to save the selection.

4. After saving the address selection press the T6 (right arrow key) two times to page over to reboot:

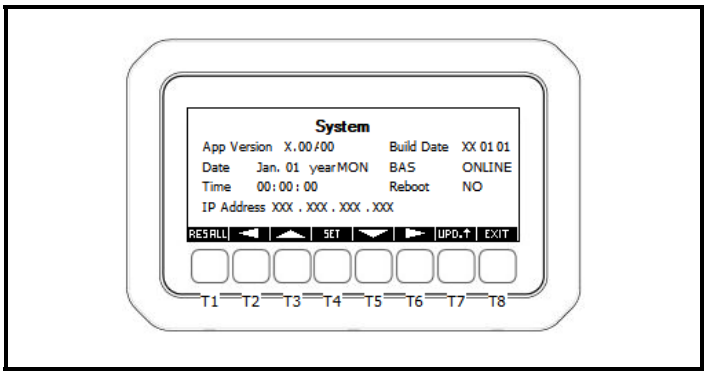


Figure 13-4 *- Reboot*

Arrow down until reboot **NO** is selected, press T4 to edit and change the value to **YES**. Press T4 (**SET**) to save **YES**. The device will now reboot to initialize the address and baud rate change. ***Note that any time address or baud rate is changed, a reboot is required***.

13.1.3. Defining Slave Case Controllers Within the Master

When a master slave lineup configuration is used, each slave case controller's Modbus address needs to be defined within the master case controller's menu. Perform the following steps to configure the slave addresses on the master case controller:

1. Press the T4 key for three (3) seconds to enter the Main Menu:

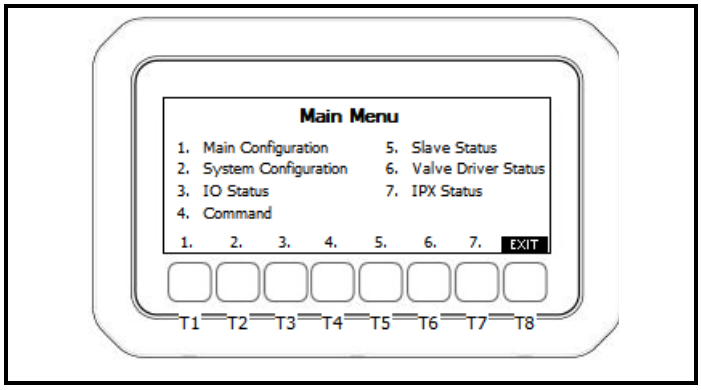


Figure 13-5 *- Main Menu*

2. Press the T2 key to enter System Configuration and then press T1 at the next menu to select **System**:

:

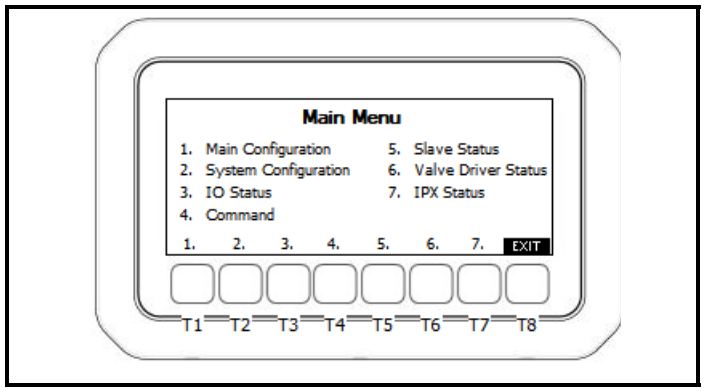


Figure 13-6 *- Main Menu*

3. Press T5 to arrow over to the **S1-S5 Addr** screen:

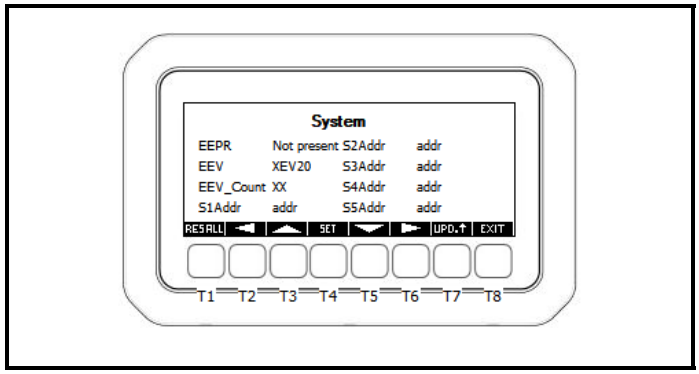


Figure 13-7 *- S1-S5 Address Screen*

4. Move the cursor to highlight the **S1 Addr** to set the address of slave case controller 1. Press **SET** to edit and **SET** to save the selection. Repeat this process until all present slaves are addressed. Set an address of **0** for unused slave controllers.

14 E2 Setup

The iPro Case Controller is capable of communicating with the E2E controller version 4.08 or above. Using the iPro Case Controller with E2E offers benefits over using the case controller as a standalone device.

- Reporting of case controller related alarms
- The ability to log case controller data in an E2E logging group
- The ability to shut down refrigeration in walk in boxes in the event of a refrigerant leak event (available if Emerson leak detection panel is used)
- Remote access to case controller status and programming from the E2E front panel
- The ability to remotely access the case controllers from UltraSite32 or Site Manager

Communication between E2E and the case controller takes place over the RS485 BACnet MS/TP network. Follow the instructions in **Section 12,** *The BACnet Network* to connect a case controller to the E2E network and comm plug connector. Then follow the instructions in this chapter to set up the case controller in the E2E. An E2E has up to three COM ports that can be assigned for BACnet MS/TP communication: COM2, COM4 and COM6 are the available RS485 ports on the E2E power interface board.

14.1. Set Up Network Ports

Before setting up an iPro Case Controller in the E2E, the port that has the BACnet MS/TP cable connected to it must be set up as a BACnet MS/TP port.

1. Log in to the E2E with level 4 access or higher.
2. Press **Alt-M** on the keyboard to access the serial tab of the general controller info setup screens.

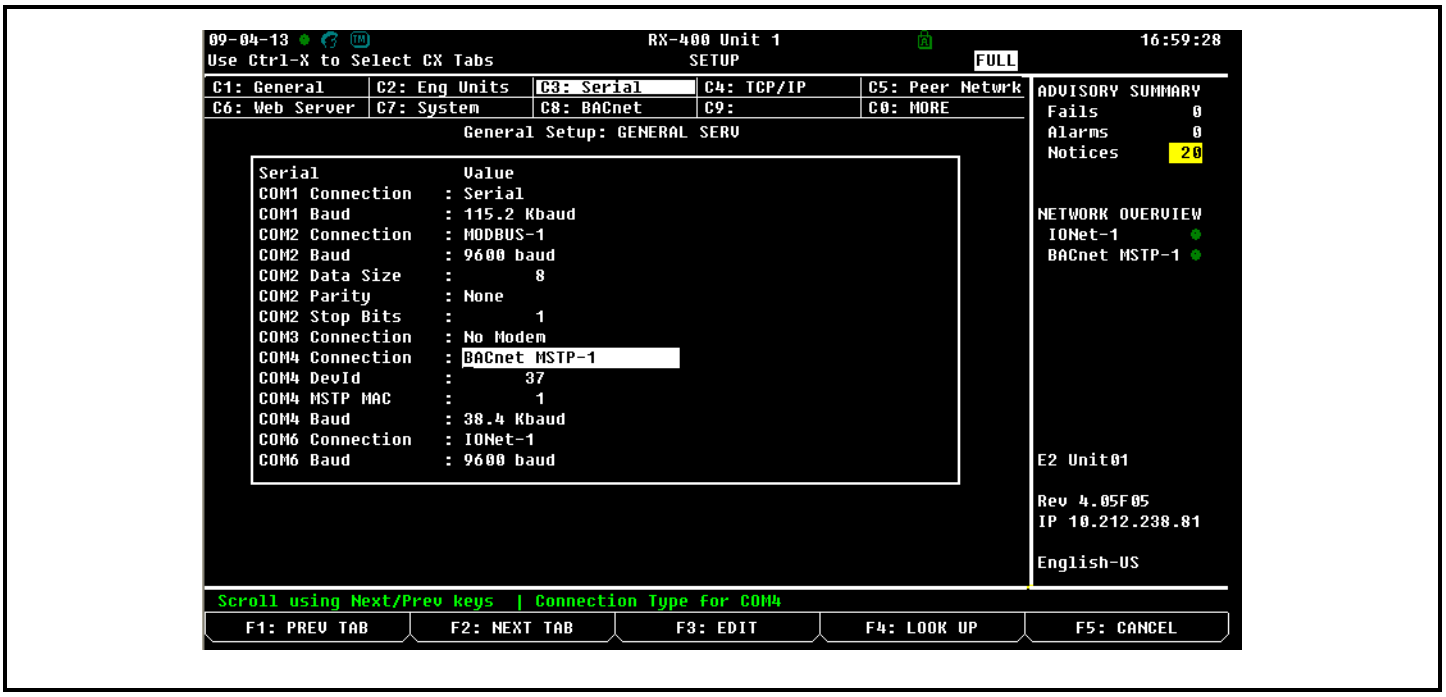


Figure 14-1 *- E2E Serial Setup in General Configuration*

3. This screen will have a connection field for all available COM ports on the E2E. Highlight the COM port connection you will be using for BACnet MS/TP and press **F4:LOOKUP** and select **BACnet MS/TP** from the list of network types.

4. Four fields will become visible underneath the COM port connection field, which pertain to the way the device communicates:
   - **Baud -** Default setting is 9600 but this must be changed to **19.2k** (all devices connected to the same COM port should be set to the same baud rate)
   - **Data size -** leave this field at the default value (**8**)
   - **Parity -** leave this field at the default (**none**)
   - **Stop Bits -** leave this field at the default value (**1**)

14.2. Add and Connect iPro Case Controllers

To enable communications between the E2E and the iPro Case Controllers, the devices must be added to E2E and addressed.

1. Log into the E2E with level 4 access or higher.
2. Press Menu 7 7 2 to access **Connected I/O Boards and Controllers**.

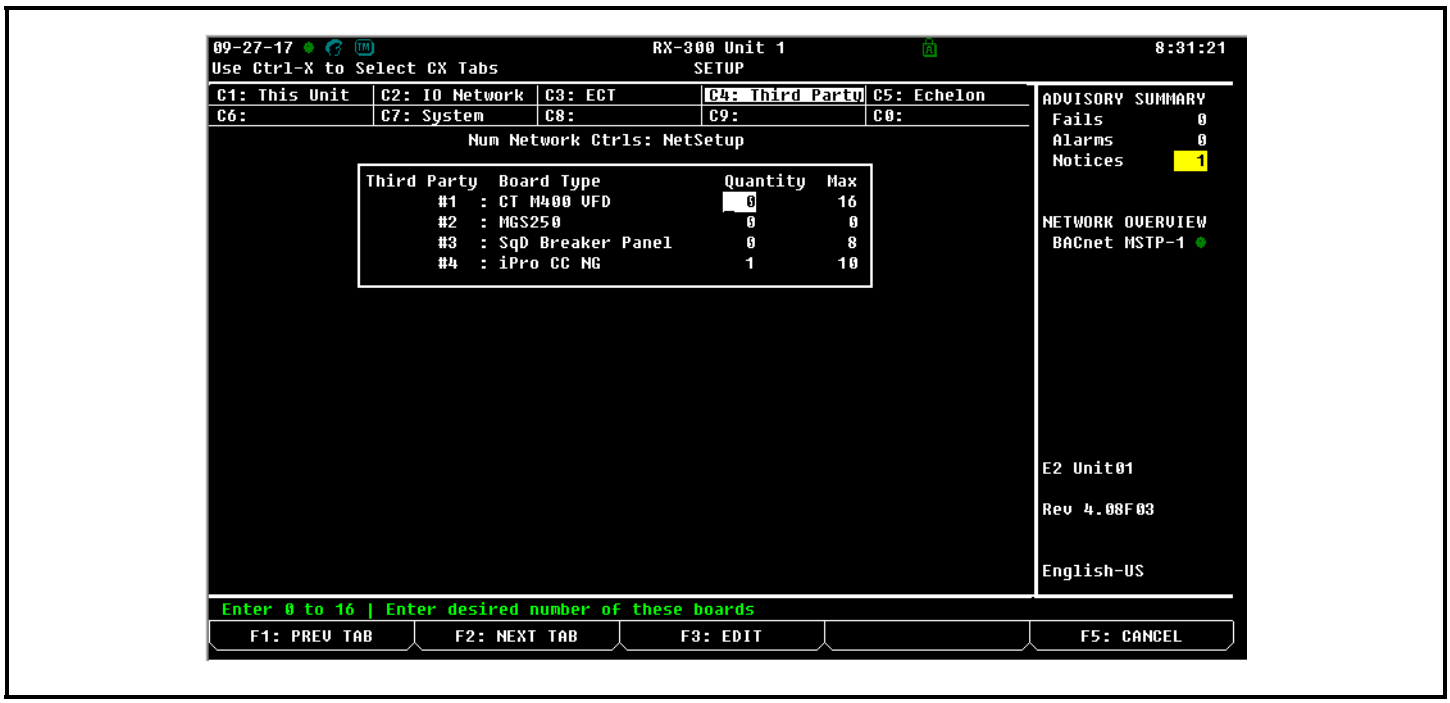


***Figure 14-2** - E2E Connected I/O Net Screen - Third Party Tab*

3. In the Connected I/O screen under the **Third Party** tab, enter the number of iPro CC devices in the **Quantity** field.
4. Press the key.
5. Press the key to return to the home screen.
6. Press **Alt-N** on the keyboard to access the Network Summary screen.
7. The number of iPro CC units added in Step 3 should now be visible in the Network Summary screen.

14.3. Setting Static Binding and Address

1. From the Network Summary screen, highlight the first device and press **F5:SETUP** to enter the devices setup menu.

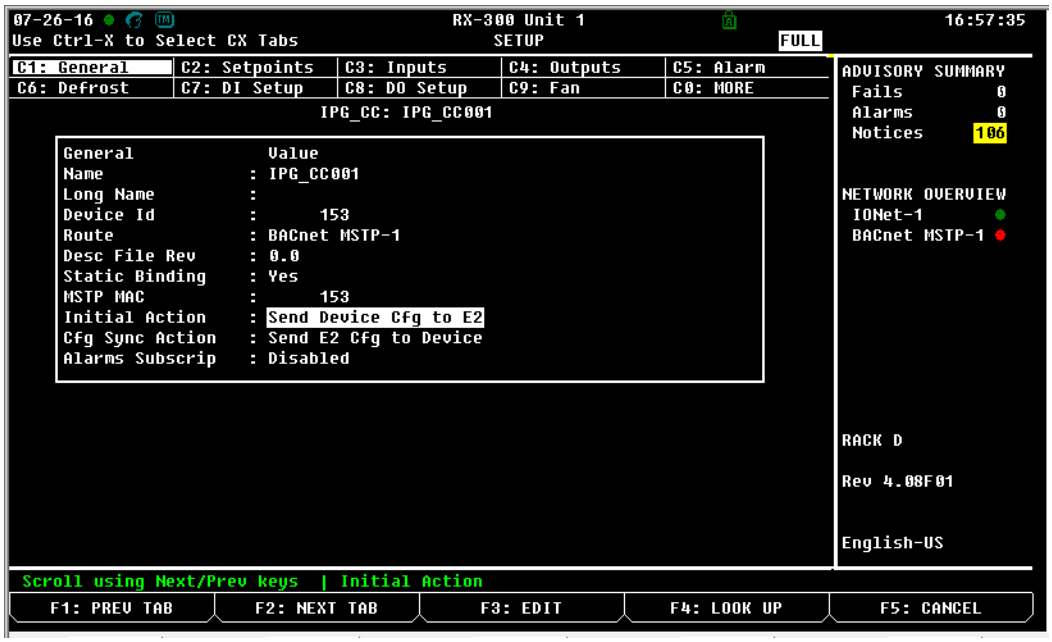


Figure 14-3 *- Setting the Device ID and MSTP MAC*

2. Set the device ID number = to the device MSTP MAC address. For instructions on how to set the MSTP mac of each device, see **Section 12.3.,** *Setting the BACnet MS/TP MAC Address*.
3. Scroll down and change the field **Static Binding** from **No** to **Yes**.
4. Scroll down to **MSTP MAC** and set the number = the devices MSTP MAC
5. Press ⏎ to save and exit back to Network Summary.
6. After Steps 2-5 have been completed for a device, highlight the device in the Network Summary and press F4 to commission.

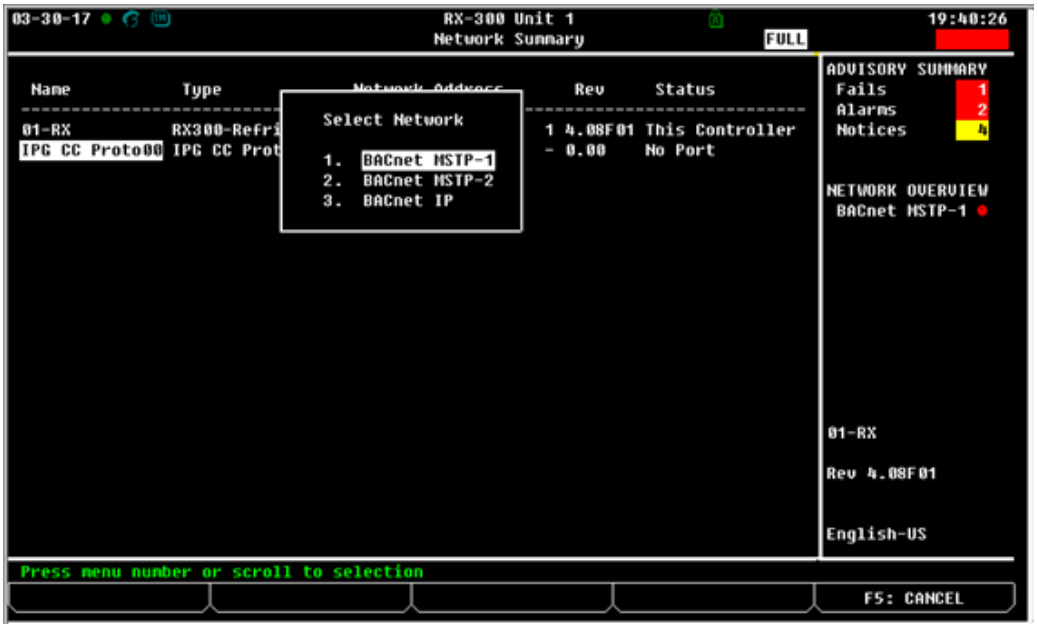


Figure 14-4 *- Commissioning the Device - Select BACnet MSTP Network*

7. Select the **BACnet MS/TP** network, the E2E will then scan for available devices:

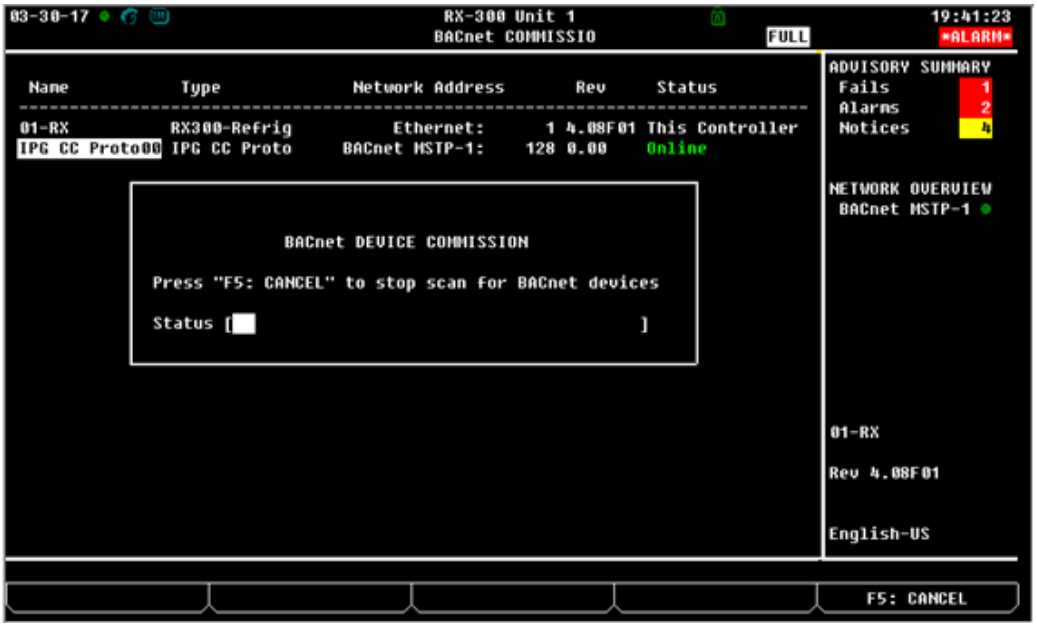


Figure 14-5 *- E2E Scan for Available BACnet Devices*

8. If the E2E is not successful in finding the device during the scan, enter the MSTP MAC of the device manually and press Enter and then press .

Figure 14-6 *- Commissioning the BACnet Device*

9. Once the device is commissioned, addressed, and wired properly, the device should come online on E2E Network Summary screen.

Figure 14-7 *- Network Summary Screen*

15 Using the Visograph

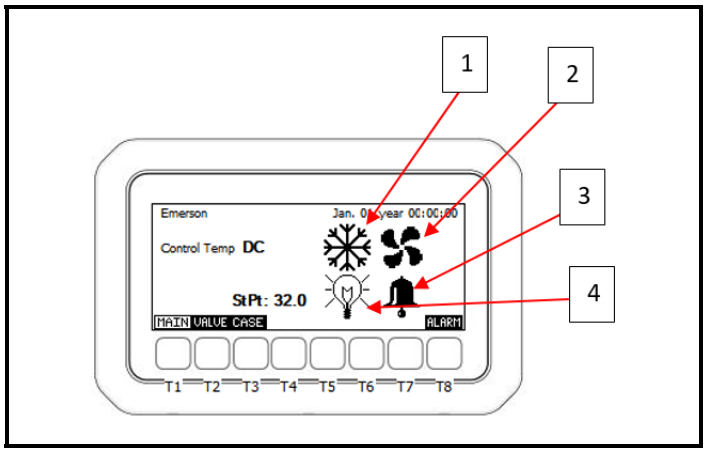


Figure 15-1 *- Main Status Screen*

The main status screen is used to show a quick overview of the system control temperature and loads. Icons 1-4 are defined below:

1 - The snowflake icon represents the status of the refrigeration or defrost in the system: below are the different options and their meanings for this icon:

Represents the system in Refrigeration mode with refrigeration relay active; defrost OFF.

Represents the system cycled OFF when the case temperature setpoint is reached.

Represents the system is shut down on a disable command either locally or through the BACnet network.

Represents the system is in a defrost cycle.

Represents the system is in Drip mode following a defrost cycle.

PUMP DOWN

Represents the system in a Pump-out mode where EEVs and LLSV are closed and the EEPR valve is open for a specified amount of time before closing.

2 - The evaporator fan status icon gives the user a quick indicator if the fan is ON or OFF. A spinning icon indicates fan ON, while no spinning (idle fan) indicates the fan is OFF.

3 - The system alarms indicator. When this icon is present it indicates there is 1 or more system alarms present. Press the T8 key to see detailed alarm information.

4 - The case lights status indicator:

indicates case lights are ON.

indicates case lights are OFF.

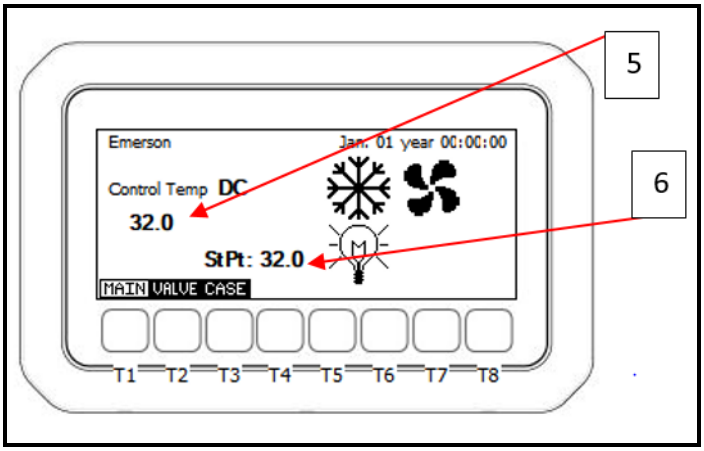


Figure 15-2 *- Main Status Screen*

5 - The system control temp is displayed in this area below the label **Control Temp**. For the lead case the control temp is the average of all the discharge air sensors on the lineup. For the slave cases on the lineup, the control temp displayed here is the average of the controller's locally connected discharge air sensors.

6 - The case temperature setpoint is displayed next to the label **St Pt**.

15.1. Viewing Temperature Input Status

To see an overview of temp input values, use the T3 key to access the case tab:

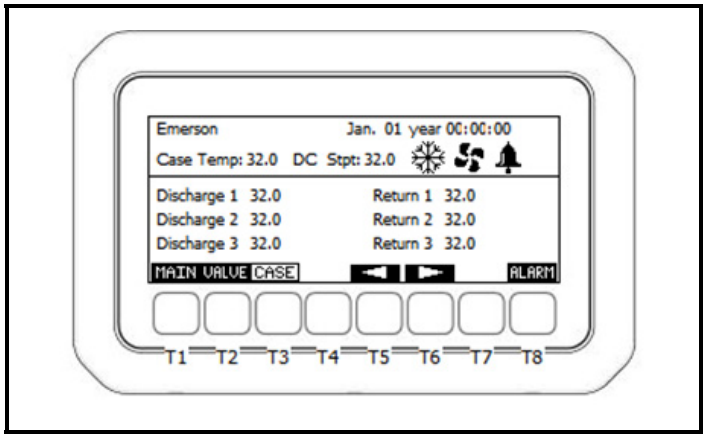


Figure 15-3 *- Case Tab*

Use the T5/T6 keys to scroll through the different configured inputs, and press the T1 key to return to the main tab.

15.2. Viewing Valve Positions and Superheat Data

To see an overview of valve positions and current system Superheat, press the T2 key from the Main Menu to access the valve overview tab:

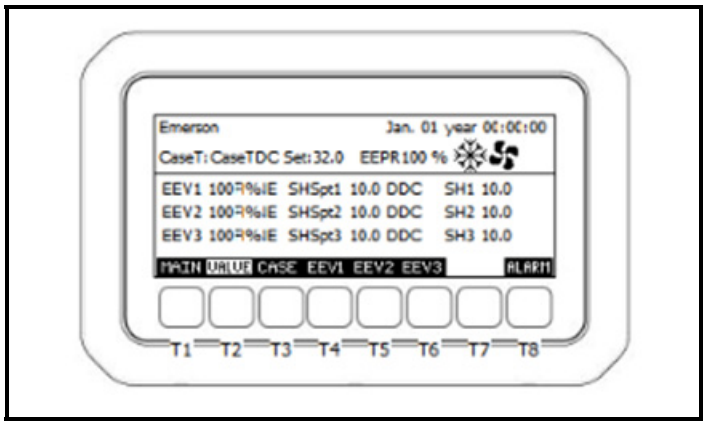


Figure 15-4 *- Valve Overview Tab*

To see in-depth data for a specific EEV valve, select the corresponding EEV tab with the T4-T6 keys.

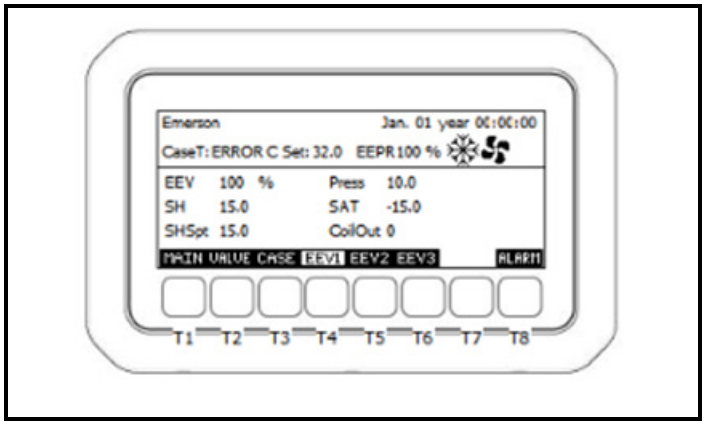


Figure 15-5 *- Valve Overview Tab*

Press the T1 key to jump back to the Main Menu.

15.3. Entering the Visograph Main Menu

To enter the Main Menu, press and hold the T4 key continuously for three (3) seconds. Then the Main Menu will appear.

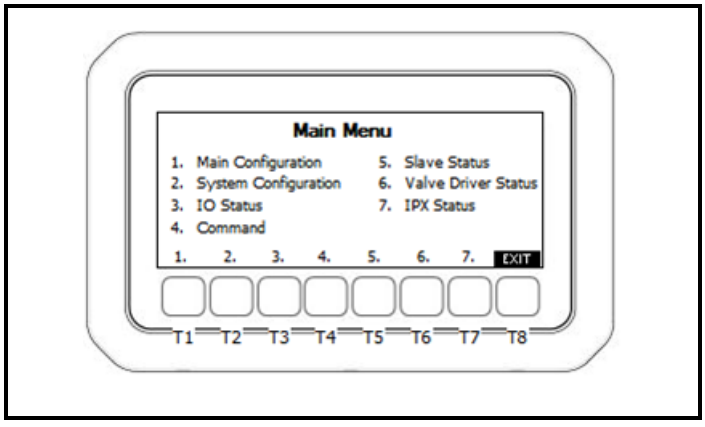


Figure 15-6 *- Main Menu*

The seven (7) sub menus are selectable with keys T1-T7, and key T8 can be used to exit submenus and the Main Menu back to the home screen.

15.4. I/O Configuration

15.4.1. Analog Inputs

From the Main Menu select T2 to navigate to **System Configuration** and then T2 again to enter **I/O Configuration**.

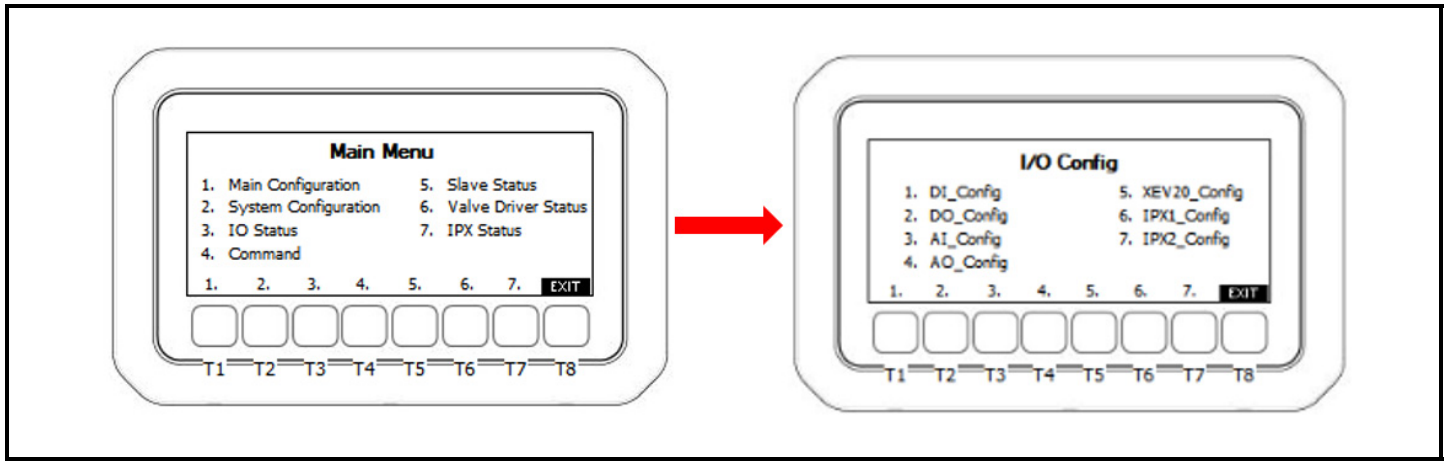


***Figure 15-7** - I/O Configuration*

Select T3 for iPro AI Configuration, T5 for **XEV20_Config**, T6 for Expansion 1 (**IPX1_Config**) AI Configuration or T7 for Expansion 2 (**IPC2_Config**) AI Configuration.

Example of iPro AI Configuration, press T3 for iPro **AI_Config**. The iPro analog input selections are shown below. I/O can be set by using T3/T5 keys to navigate and T4 to edit and save.

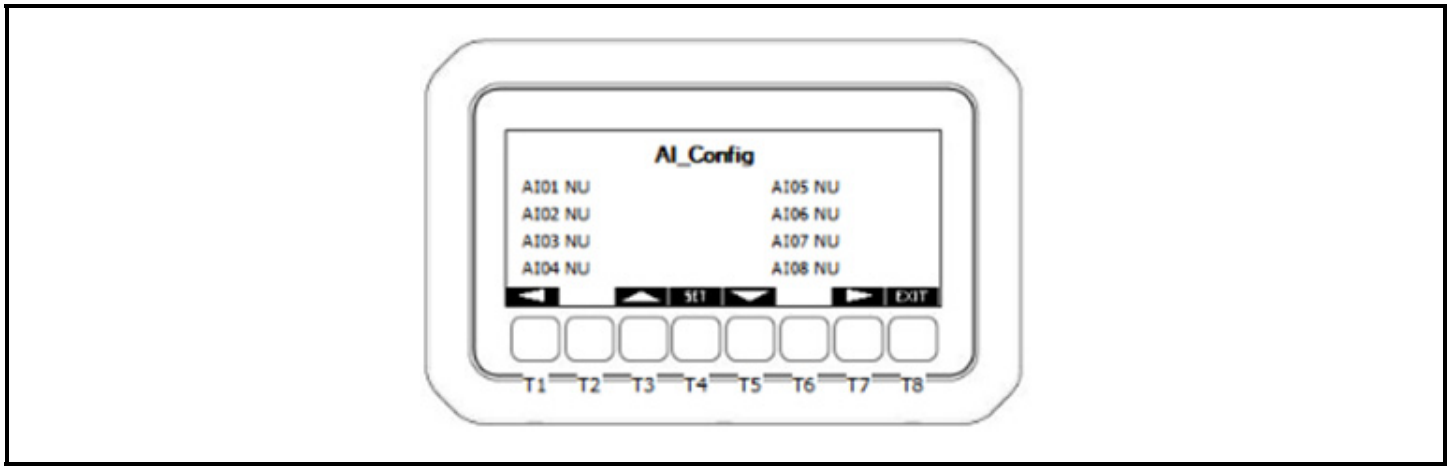


***Figure 15-8** - AI Configuration*

Pressing T7 advances to the next page where sensor offsets are shown by **AI01O-AI10O**, an offset for the connected sensor can be set up here.

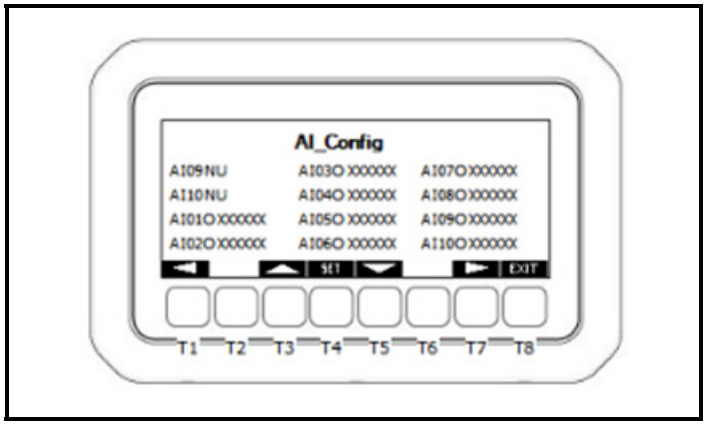


Figure 15-9 *- Sensor Offsets*

Press T7 to advance to the sensor type pages, the sensor type can be set up here. (NTC, PTC, 0-20mA, 4-20mA, 0-1VDC, 0-5VDC, 0-10VDC, CPC temp).

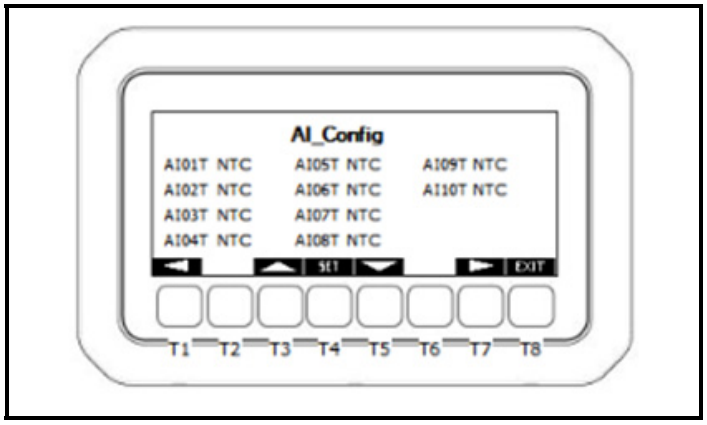


Figure 15-10 *- Sensor Types*

Press T7 to advance to the sensor scaling pages for pressure transducers. When a pressure transducer is set up on AI1-10, the EU scaling can be configured based on the transducers min/max ranges.

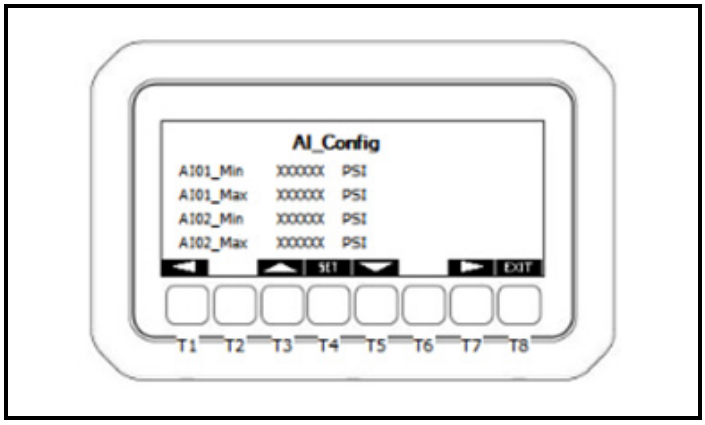


Figure 15-11 *- Sensor Types*

Press **EXIT** to return to the main I/O Configuration page. Pressing T5, T6 or T7 will allow AI on XEV20 and expansion modules to be configured.

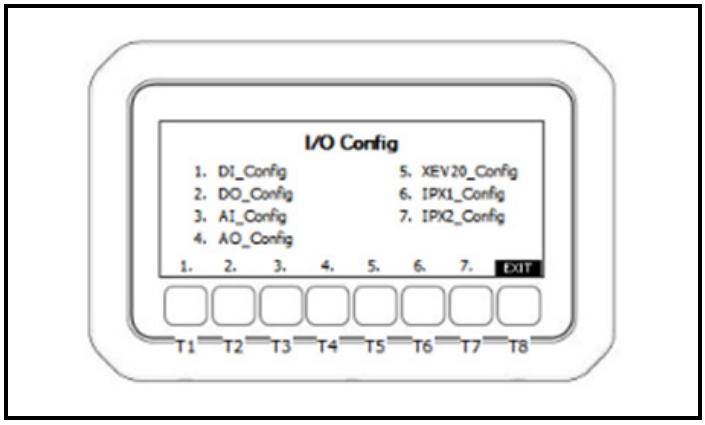


Figure 15-12 *- Sensor Types*

15.4.2. Digital Inputs

To configure digital inputs, press the T1 key from the **I/O Config** menu shown above. The DI Configuration page is now displayed.

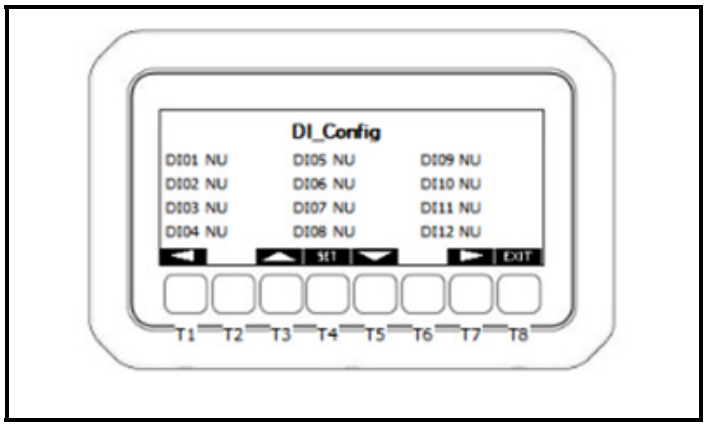


Figure 15-13 *- DI Configuration*

Pressing the T1/T7 keys will scroll through the pages left/right. Press T7 to scroll to the right to access the polarity settings.

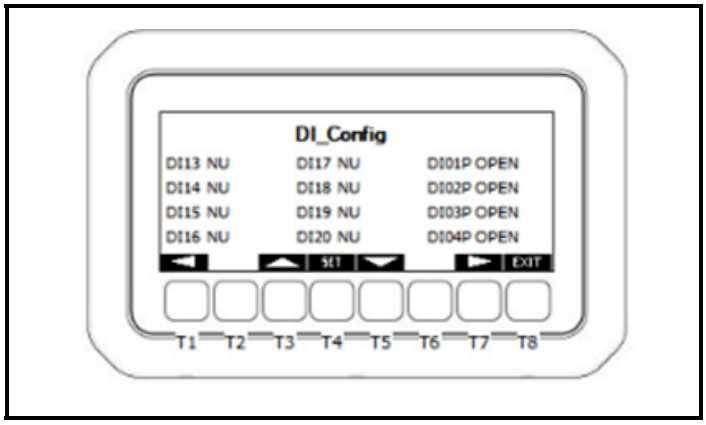


Figure 15-14 *- DI Polarity Settings*

The polarity of all 20 digital inputs is configurable to OPEN or CLOSE. The polarity is the active state of the input. Example: DI01P=Open, so an open signal input on digital input results in a logical value of ON/TRUE for DI1 in the logic of the controller. DI01P=Close, a closed signal input on digital input 1 results in a logical value of ON/TRUE in the logic of the controller.

15.4.3. Digital Outputs

To configure digital outputs, press the T2 key from the **I/O Config** menu shown above. The DO configuration page is now displayed:

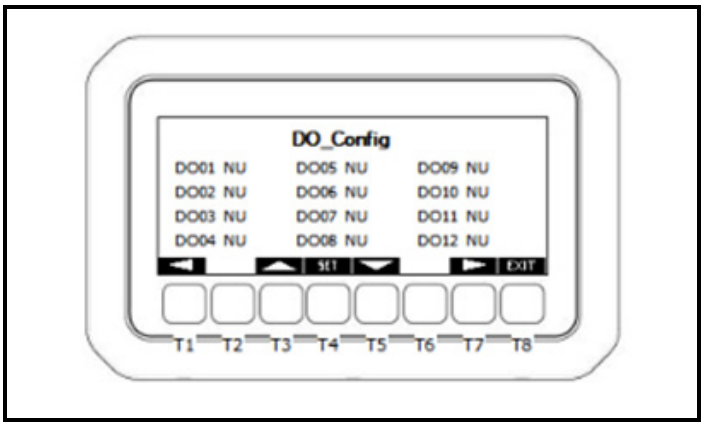


Figure 15-15 *- DO Configuration*

Press **SET** to change a **DO_Config**. The iPro comes defaulted with D04=Refrigeration relay, D05=Defrost, D06=Fan and D07=Lights. Press the T7 key to scroll to relay polarity.

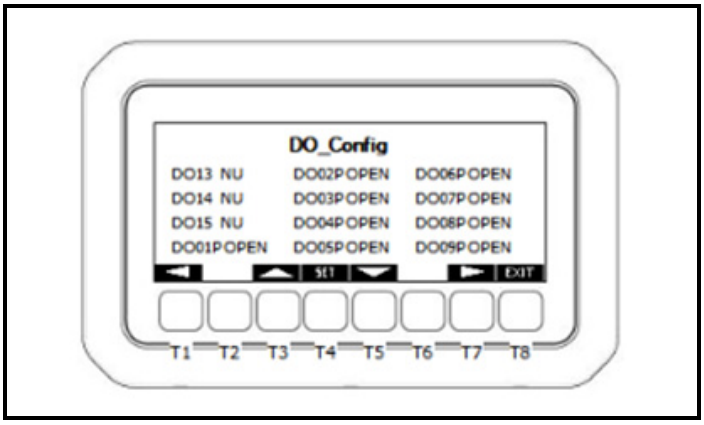


Figure 15-16 *- DO Relay Polarity*

Press **SET** to edit relay polarity and press **SET** again to save. The table below outlines the relay polarity operation:

Relay Polarity	Logical Value	Physical State of Relay Contacts
Open	TRUE	Open relay
Close	TRUE	Closed relay
Open	FALSE	Closed relay
Close	FALSE	Open relay

Table 15-1 *- Relay Polarity Operation*

15.5. System Overrides

The iPro Case Controller has a menu where system relay output and electronic valve overrides can be entered. The relay output overrides are fixed until a user removes them, and the valve overrides are active for 30 minutes before the system enters automatic regulation again.

Press and hold T4 key for 3 seconds from the main status screen to enter the Main Menu, then press T4 for the **Command** screen:

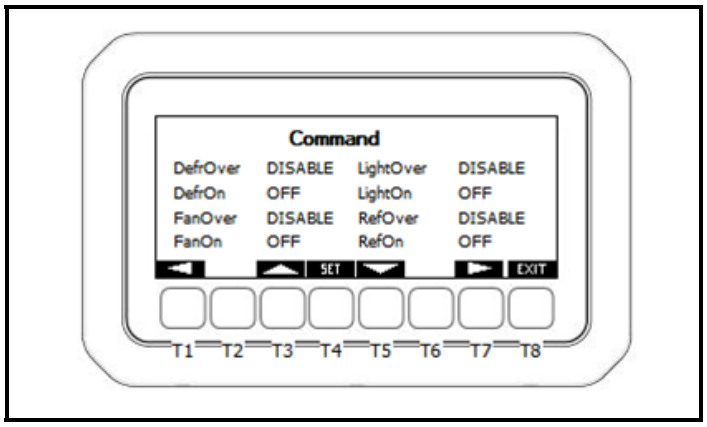


Figure 15-17 *- Command Page*

For each system load there is a corresponding override enable and override value. Use the T3/T5 keys to make a selection and the T4 key to edit. Press T4 again to save.

Example of overriding the defrost relay to ON: Highlight **DefrOver** and press T4 to edit, press T3/T5 to set = enable. Use T3/T5 to highlight **DefrOn** and press T4 to edit, change from OFF to ON and press T4 to save. The relay point the defrost is assigned to is now active/ON. To remove the override, edit the **DefrOver** back to disable.

From the relay overrides page, press the T7 key to arrow over to the valves override page shown below:

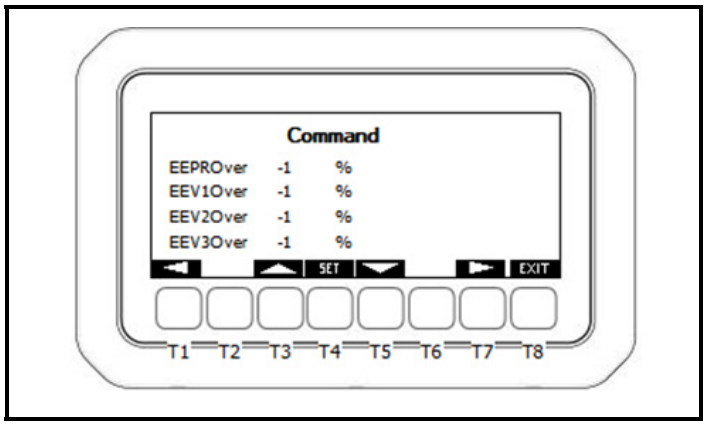


Figure 15-18 *- Valves Override Page*

To override a valve, use the T3/T5 keys to highlight the desired valve. Press T4 to edit and then T3/T5 keys to change the value, press T4 to save the override value. The override will be active for 30 minutes unless manually removed. To cancel the override, edit the value to -1 and save.