XM678D Controllers for Multiplexed Cabinets with Interior Stepper Driver Installation and Operation Manual for Software Release 2.8

026-1219 Rev 3

EMERSON™

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1 Introduction

1.1. General Precautions and Warnings

Please read the following safety precautions and warnings before using this manual:

WARNING! An isolated transformer for the XM678D power supply must be used. <u>Do not</u> share power with any other devices.

CAUTION!

• This manual is part of the product and should be kept near the device for easy and quick reference.
• The device should not be used for purposes different from those described in this manual. It cannot be used as a safety device.
• Check the application limits before proceeding.

SAFETY PRECAUTIONS AND WARNINGS!

• Check that the supply voltage is correct before connecting the device.

• Do not expose to water or moisture: use the controller only within the operating limits and avoid sudden temperature changes with high atmospheric humidity to prevent condensation from forming.

• Warning! Disconnect all electrical connections before performing any kind of maintenance.

• Fit the probe where it is not accessible by the end user. The device must not be opened.

• In case of failure or faulty operation, send the device back to the distributor or to Emerson Retail Solutions (see address) with a detailed description of the fault.

• Verify the maximum current that can be applied to each relay (see Section 20, Technical Data).

• Ensure that the wires for probes, loads, and the power supply are separated and far enough from each other without crossing or intertwining.

• In case of applications in industrial environments, the use of main filters (our mod. FT1) in parallel with inductive loads could be useful.

2 Before Proceeding

2.1. Software Release of XM678D

1. Look at the software release of XM678D printed on the label of the controller.

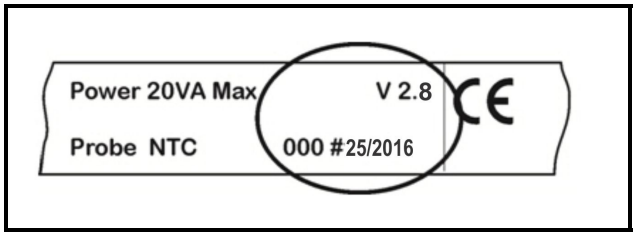


Figure 2-1 *- Software Release of XM678D*

2. If the software release is 2.8, proceed with this manual; otherwise contact Emerson Retail Solutions for the correct manual.

3 Overview

3.1. General Description

The XM678D controller is a microprocessor based controller for multiplexed cabinets suitable for applications on medium or low temperature. It can be inserted in a proprietary Local Area Network (LAN) with up to eight (8) different sections that can operate, depending on the programming, as standalone controllers or by following the commands coming from the other sections. The XM678D controller is provided with six (6) relay outputs to control the solenoid valve, defrost that can be either electrical or hot gas, evaporator fans, lights, an auxiliary output and an alarm output, and with the stepper valve driver. It also has six (6) probe inputs: for temperature control, defrost end temperature control, display and the fourth can be used for application with virtual probe or for inlet/outlet air temperature measurement. The fifth and sixth probe inputs are used to evaluate and control the superheat. The XM678D is also equipped with three (3) free contact digital inputs that are fully configurable by parameters.

The Hotkey connector allows simple programming of the controller. The optional direct serial output RS485 that is MODBUS compatible permits simple XWEB interfacing. Optionally, an RTC is available. Depending on the model, the Hotkey connector can be used to connect the X-REP display.

3.2. Ordering Code

Device Name	Emerson Code
XM678D	318-6600

Table 3-1 *- Product Ordering Code*

4 Quick Reference Guide in Running the Self Adaptive Regulation

1. After wiring the XM678D; **configure the type of valve, bipolar or unipolar,** via **tEu** (Default **tEu = bP**: bipolar) and **tEP** (Default tEP =0) parameters or through the manual settings. See ***Section 6.4., Valve Connections and Configuration*** for details.

NOTE: For Alco EX4, EX5, EX6 tEP = 11. For EX3: tEP = 12

2. **Set the proper gas** via **Fty** parameter.

Preset gas is **R404A**.

LABEL	REFRIGERANT	OPERATING RANGE
R22	r22	-58 to 120°F/ -50 to 60°C
134	r134A	-58 to 120°F/ -50 to 60°C
290	r290 - Propane	-58 to 120°F/ -50 to 60°C
404	r404A	-94 to 120°F/ -70 to 60°C
47A	r407A	-58 to 120°F/ -50 to 60°C
47C	r407C	-58 to 120°F/ -50 to 60°C
47F	r4107F	-58 to 120°F/ -50 to 60°C
410	r410A	-58 to 120°F/ -50 to 60°C
448	r448A	-69 to 120°F/ -45 to 60°C

Table 4-1 *- XM678D Gas Table*

LABEL	REFRIGERANT	OPERATING RANGE
449	r449A	-69 to 120°F/ -45 to 60°C
450	r450A	-69 to 120°F/ -45 to 60°C
507	r507	-94 to 120°F/ -70 to 60°C
513	r513A	-69 to 120°F/ -45 to 60°C
CO2	r744 - Co2	-58 to 120°F/ -50 to 60°C

Table 4-1 *- XM678D Gas Table*

3. Configure the probes:
   - Regulation and evaporator probes are preset as NTC. If another kind of sensors is used, it can be set to P1c and P2c parameters.
   - Superheat evaporator outlet probe is preset as Pt1000, if another kind of sensor is used, it can be set to P6c parameter.
   - The PP11 (-0.5 to 11 bar) is preset as pressure probe. It operates at relative pressure (Pru = rE). If you are using a ratiometric transducer, set P5c = 0-5. Use parameters PA4 and P20 to set the range.

NOTE: Check the pressure gauge reading with the value of dPP. Press the up arrow once to enter the Fast Access Menu. If OK, proceed; otherwise resolve the situation before acting on parameter.

4. Set the parameters for self adaptive regulation of superheat.

NOTE: The parameters Pb (regulation band) and Int (integral time) are automatically calculated by the controller.

   - Set **CrE = no**, this disables the continuous regulation of the temperature. Default is CrE = no.
   - Set **SSH, superheating setpoint.** A value between 4 and 8 is acceptable. Default is SSH=8-.
   - Set **AMS = y**, this starts the **self adaptive regulation**. Default is AMS = y.
   - Set **ATU = y**, this starts the search of the **lowest stable superheat**. Default is ATU = y. This function reduces the setpoint automatically in order to optimize the use of the evaporator, and keeping the superheating regulation stable at the same time. The minimum allowed SH setpoint is LSH+2°C.
   - Set **LSH, low superheating limit**. A value between 2 to 4 is acceptable. Default is LSH = 3.
   - Set **SUb, pressure filter**. Default is SUb = 10. The value can increase up to 20 if the pressure variation respond too fast.

5. Set the parameters for the temperature regulation.
   - Set the temperature **setpoint**. Default is -5°C.
   - Set the **differential HY** Default is 2°C.
   - If the capacity of the valve is higher than requested, it can be reduced by the parameter. **MNF** (default is 100). A proper setting of **MnF** will reduce the time that the algorithm takes to reach the stability. MNF value does not affect the bandwidth.

5 Installation and Mounting

The XM678D controller can function without any user interface, but normal application is with the CX660 keyboard.

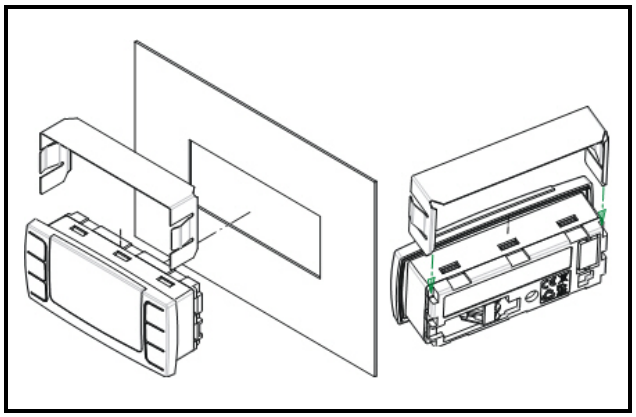


Figure 5-1 *- XM678D Installation and Mounting*

The CX660 keyboard should be mounted on a vertical panel, in a 29 x 71 mm hole, and secured using the special bracket supplied (***Figure 5-1***).

The temperature range allowed for correct operation is 0 to 60°C. Avoid places subject to strong vibrations, corrosive gases, excessive dirt or humidity. The same recommendations apply to probes. Allow air to circulate through the cooling holes.

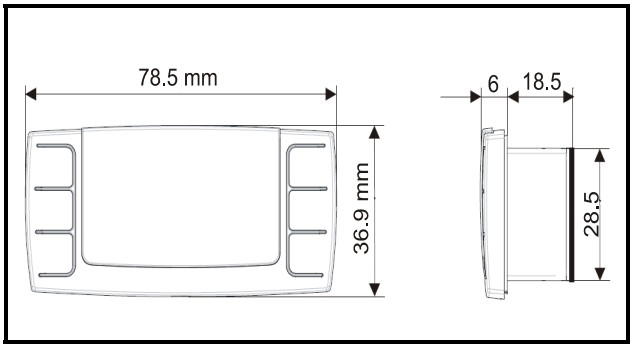


Figure 5-2 *- XM678D Dimensions*

6 Wiring Diagram and Connections

6.1. Important Note

The XM device is supplied with a disconnectable terminal block to connect cables with a cross-section of up to 1.6 mm^2 for all low voltage connections: RS485, LAN, probes, digital inputs, and keyboard. Other inputs, power supply and relay connections are provided with a screw terminal block or Faston connection (5.0 mm). Heat-resistant cables have to be used. Before connecting the cables, verify that the power supply complies with the controller's requirements. Separate the probe cables from the power supply cables, outputs and power connections. Do not exceed the maximum current allowed on each relay. In case of heavier loads, use a suitable external relay. *Maximum current allowed for all loads is 16A*.

The probes should be mounted with the bulb upwards to prevent damages due to casual liquid infiltration. It is recommended to place the thermostat probe away from air streams to measure the average room temperature correctly. Place the defrost termination probe among the evaporator fans in the coldest place (where most ice is formed) and far from heaters or from the warmest place during defrost to prevent premature defrost termination.

6.2. Wiring Guidelines

DEVICE TYPE	RETAIL SOLUTIONS
ANALOG TEMP SENSOR DIGITAL INPUT	BELDEN #8761 #22-2 SHIELDED Retail Solutions *P/N 035-0002*
RS-485 NETWORK	BELDEN #8761 #22-2 SHIELDED Retail Solutions *P/N 035-0002* BELDEN #8641 #24-2 SHIELDED Retail Solutions *P/N 135-8641*
PRESSURE TRANSDUCER	**BELDEN #8771 #22-3 SHIELDED Retail Solutions *P/N 135-8771* **#8771 for alternate 600v rated wire use BELDEN #8618 16 AWG
*STEPPER VALVE	Use valve manufacturer's harness with a maximum length not to exceed 30 feet (10 meters).
POWER LOADS AND VALVE	Allow a maximum wire size of 14 AWG (2 mm^2).

Table 6-1 *- Wiring Guidelines*

6.3. XM678D Wiring and Connections

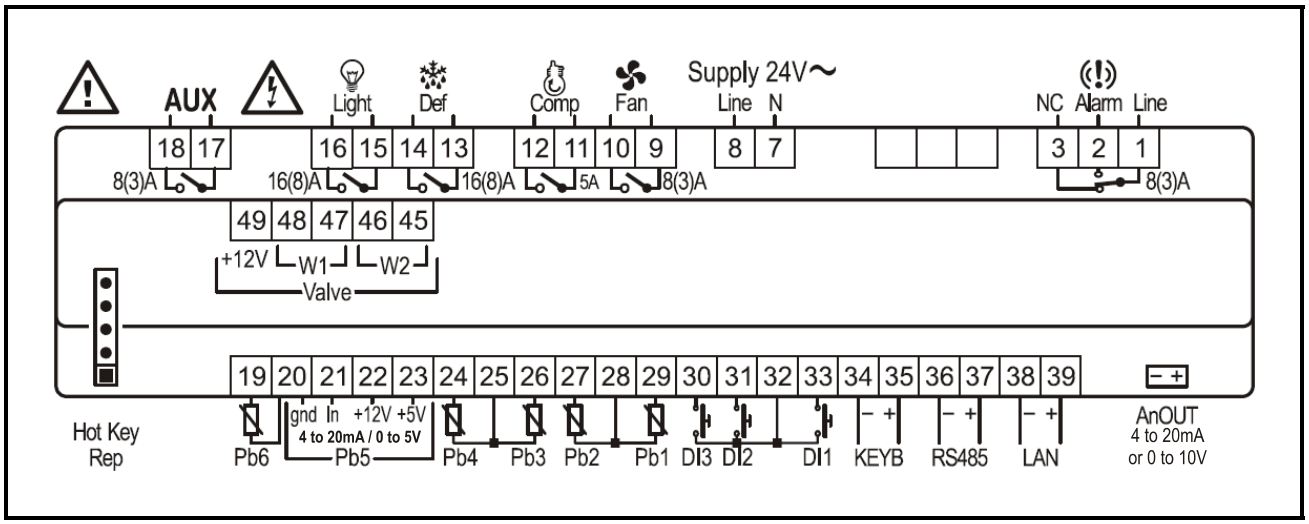


Figure 6-1 *- XM678D Wiring and Connections*

6.4. Valve Connections and Configuration

6.4.1. Types of Cables and Max Length

To connect the valve to the controller, use only the shielded cables with section greater than or equal to 0.823 mm^2 (AWG18). A twisted shielded cable with the above specification is suggested. Don't connect the shield to the ground, keep it floating. The maximum distance between an XM controller and a valve *must not* exceed 10 meters.

6.4.2. Valve Selection

To avoid possible problems, before connecting the valve configure the driver by making the right changes on the parameters.

a. Select the kind of motor **(tEU parameter)**

b. Check if the valve is present in the tEP parameter shown in ***Table 6-2***.

NOTE: In any case, the unique and valid reference has to be considered the data sheet made by valve manufacturer. Emerson Retail Solutions cannot be considered responsible in case of valve damage due to incorrect settings.

CAUTION:

1. Configure the driver by making the correct changes on the parameters before connecting the valve. Select the kind of motor (tEU parameter) and check if the valve is present in the tEP parameter table (Table 6-2).

2. The maximum distance between an XM controller and a valve must not exceed 10 meters. Use only shielded cables with section greater than or equal to 0.325 mm² (AWG22). A twisted shielded cable with the above specification is suggested. Don't connect the shield to any ground, leave it floating.

For valve settings, refer to the manufacturer's data sheet. The manufacturer will not be responsible for any case of valve damage due to incorrect valve settings.

****Note that Sporlan has issued new valve setting recommendations for the following valves. Refer to Sporlan Bulletin F100-10-4 June 5, 2017 for more information. Sporlan recommends manually entering these settings (Table 6-3 below) if you have these valve models. Refer to the XM Release Notes P/N 026-4256 for more information.***

		Type of Stepper Motor	Half/Full Step - Kind of Motor Movement	Minimum Number of Steps	Maximum Number of Steps	Current per Phase	Holding Current per Phase	Step Rate
tEP	**VALVE MODEL**	**tEU (bip/unip)**	**HFS (Half/full)**	**LSt (steps x10)**	**USt (steps x10)**	**CPP (mA x10)**	**CHd (mA x10)**	**Sr (step/sec)**
0	**MANUAL SETTINGS**	Par	Par	Par	Par	Par	Par	Par
1	**Danfoss ETS-25/50**	bP	FUL	7	262	10	10	300
2	**Danfoss ETS-100**	bP	FUL	10	353	10	10	300
3	**Danfoss ETS-250/400**	bP	FUL	11	381	10	10	300
4	***Sporlan SEI 0.5-11**	bP	FUL	0	159	12	0	200
5	***Sporlan SER 1.5-20**	bP	FUL	0	159	12	0	200

***Table 6-2** - XM678D Stepper Valve and Default Values*

6	***Sporlan SEI 30**	bP	FUL	0	319	16	0	200
0	***Sporlan SER(I) G,J,K**	***See Table 6-3 below for the recommended Sporlan valve manual settings***						
8	***Sporlan SEI 50**	bP	FUL	0	638	12	bP	200
9	***Sporlan SEH(I) 100**	bP	FUL	0	638	12	bP	200
0	***Sporlan SEH(I) 175**	***See Table 6-3 below for the recommended Sporlan valve manual settings***						
11	**Emerson EX4-EX5-EX6**	bP	FUL	5	75	50	10	500
12	**Emerson EX3**	uP	HAF	2	33	0	0	50

***Table 6-2** - XM678D Stepper Valve and Default Values*

tEP	SPORLAN MODEL	Minimum Number of Steps LSt (steps x10)	Maximum Number of Steps USt (steps x10)	Current per Phase CPP (mA x10)	Holding Current per Phase CHd (mA x10)	Step Rate Sr (steps/ sec)	Extra Steps During Closing Phase ESt (steps x10)	Kind of Motor Movement HFS
0	**SER-AA, A, B, C, D**	0	250	7	0	200	12	FUL
0	**SERI-F, G, J, K, L CDS(T)-2, 4, 7**	0	250	8	0	200	12	FUL
0	**SEH(I)-175, P, 400, T CDS(T)-9, 17**	0	638	8	0	200	32	FUL

***Table 6-3** - Recommended Sporlan Valve Manual Settings*

If your valve is listed in ***Table 6-2***, select the valve using the **tEP** parameter. This way, you can be sure of the correct configuration.

For connection modes of valves of different manufacturers, refer to *Table 6-4* and *Table 6-5*.

It is highly recommended that the maximum distance of the stepper valve harness length between the valve and the XM678D controller *must not* exceed 30 feet (10 meters).

If the valve harness length *must be* extended beyond 30 feet (10 meters), Emerson Retail Solutions provides an Inductor Extender (*P/N 335-3500*) for use with Sporlan Valves *only*.

The Inductor Extender (*P/N 335-3500*) is *only* for use with Sporlan Bipolar 4-wire stepper valves with 100 ohm or 75 ohm phase resistance.

When using the Inductor Extender, the XM678D controller **CPP** parameter setting *must be* less than 20; otherwise the Valve, Controller, and/or Inductor Extender will be damaged or have its life expectancy drastically shortened.

Refer to ***Table 6-2*** for the list of the XM series controller supported Sporlan Stepper valves. The Inductor Extender can *only be* used with Sporlan Bipolar Stepper valves that have a setting of 16 or 12 in the **CPP** column.

The recommended **CPP** parameter *should not* be increased to create AC voltage at the valve, if the valve harness length is over 30 feet, an Inductor Extender *must be* added into the 4-wire valve harness.

When using the Inductor Extender (*P/N 335-3500*), any stepper valve harness extensions *must not* exceed 170 feet total length.

Use 14 AWG wire for valve harness extensions in conduit. If the valve harness extension is not in conduit, use 16 AWG or 14 AWG shielded cable with the shield terminated to an earth grounded chassis. For valve harness extensions over 100 feet, 14 AWG shielded cable is recommended.

Using an AC volt meter to measure voltage at the Valve will not produce accurate results with a voltage chopper constant current stepper valve drivers as used in XM678D controllers.

Instead, an AC current meter can be used to measure valve milliamps as a field verification method.

If the current measurement using the method described below is less than the recommended value by more than 20%, the **CPP** parameter may be increased by up to 2 (12 to 14 or 16 to 18). The **CPP** parameter must be less than 20 when using the Inductor Extender (*P/N 335-3500*).

For a **CPP** parameter of 12, the measured current should be near 120 mA AC, for a **CPP** setting of 16, the measured current should be near 160 mA AC.

Below is a description of using an AC current meter to test a stepper valve:

Using an AC Volt meter to measure the voltage across a stepper valve will not produce accurate results if the valve is driven by a voltage chopper constant current valve driver. XM678D controllers use a voltage chopper constant current stepper valve driver.

The stepper valve voltage can be checked by using an in-line True RMS AC current meter. The AC current meter will produce a more accurate reading than AC voltage due to the valve drive switching the voltage to the valve on and off at a frequency much higher than a voltmeter can read. The voltage chopper constant current valve driver maintains a constant AC current through the valve while the valve is moving, which makes an AC mA meter ideal to test the valve. The current can be read in each of the stepper valves two windings/phases. Due to the fact that current unlike voltage is the same at any point in a wire, the current test can be performed at the XM678 controller or at the valve, and will have the same results. It is no longer necessary to take apart the case or get on a lift to access the valve, the in-line current test can be performed at the most convenient location.

An AC clamp meter will not have enough resolution to read the stepper valve milliamps.

If the current meter used is not a True RMS meter, the readings will be approximately10% higher due to the stepper drive producing square waves and not sine waves.

1. Power down the XM678D controller.
2. Disconnect the Sporlan valve white wire from the XM678D controller.
3. Connect the meter red lead from the meter 10A terminal to the Sporlan valve white wire.
4. Connect the meter black lead from the meter COM terminal to the XM678D controller where the Sporlan white wire was removed.
5. Change the meter dial selector to AC amps (~A).
6. Note the mA terminal on the meter. It should be labeled 400 mA or 300 mA.
7. Power up the XM678D controller.
8. Cycle the valve and verify the meter AC amp reading is less than 0.3A.

CAUTION: 0.3A is 300mA; if the AC amp reading in step 8 was above your meters mA terminal label: STOP and check. DO NOT proceed or your meter will be damaged.

9. If step ***8*** reading was less than 0.3A, power down the XM678D controller and move the meter red lead from the meter 10A terminal to the meter 400 mA or 300mA terminal.
10. If the meter dial selector has an AC mA selection (~mA), change to the AC mA selection.
11. Power up the XM/678D controller.
12. Cycle the valve and record the maximum constant meter AC mA reading.
13. The mA reading should be within 20% of the Phase current **CPP** setting.
14. The valve voltage can be calculated by multiplying the mA reading by the valve coil resistance. For example: 102 mA x 100 ohm valve coil = 10.2V. 150mA x 75 ohm valve coil = 11.25V.

The 2nd valve coil current/voltage can be tested by repeating the above procedure on the Sporlan valve Green wire and XM678D controller.

The in-line AC mA meter is also compatible with the constant voltage stepper valve drivers used in the MultiFlex ESR, CC100, and CCB.

6.4.3. 4-Wire Valves (Bipolar)

Connection numbering	ALCO EX4/5/6/7/8	SPORLAN SEI-SEH-SER	DANFOSS ETS
45	BLUE	WHITE	BLACK
46	BROWN	BLACK	WHITE
47	BLACK	RED	RED
48	WHITE	GREEN	GREEN

Table 6-4 *- 4-Wire Valves (Bipolar)*

6.4.4. 5- to 6-Wire Valves (Unipolar)

Connection numbering	SPORLAN	SAGINOMIYA
45	ORANGE	ORANGE
46	RED	RED
47	YELLOW	YELLOW
48	BLACK	BLACK
49 – Common	GRAY	GRAY

Table 6-5 *- 5- to 6-Wire Valves (Unipolar)*

NOTE: After making the connection, switch the XM controller OFF and ON to make sure that the valve is positioned properly.

6.5. Wiring Connection of Emerson EX3 Valve

XM678D and EX3 Connection

The EX3 valve integrates a solenoid valve with positive shut off on the top and a stepper valve.

6.5.1. Solenoid Valve Connection

a. Verify the coil voltage of solenoid valve and ensure that it is the same voltage with relay output.

b. Set **oA1 or oA6 = E3r (solenoid coil of EX**3). Any other setting of the oA1 or oA6 parameter can damage the solenoid valve.

c. With **oA1 = E3r** connect the solenoid valve to the terminals 11-12.

d. With **oA6 = E3r** connect the solenoid valve to the terminals 17-18.

NOTE: The solenoid coil will be energized every time the temperature regulation is on and de-energized when the temperature regulation is off and during the standby of the controller.

6.5.2. EX3 with 24Vac Coil: Transformer Capacity

When the coil of the EX3 is at 24Vac and a unique transformer is used to supply both the controller and the coil of the valve, a 40VCA transformer *must be* used like TF40D. Any transformer with lower capacity can damage the valve or the controller.

6.5.3. Stepper Valve Connection

The EX3 unipolar valve has to be connected to the following terminals listed in *Table 6-6*.

XM678D	EX3
Terminal 49	Grey wire
Terminal 48	Blue wire
Terminal 47	Black wire
Terminal 46	Brown wire
Terminal 45	White wire

Table 6-6 *- EX3 Unipolar Valve Terminals*

6.5.4. EX3-C230

E.I connection of EX3 with oA1 = E3r and 230V coil of solenoid valve.

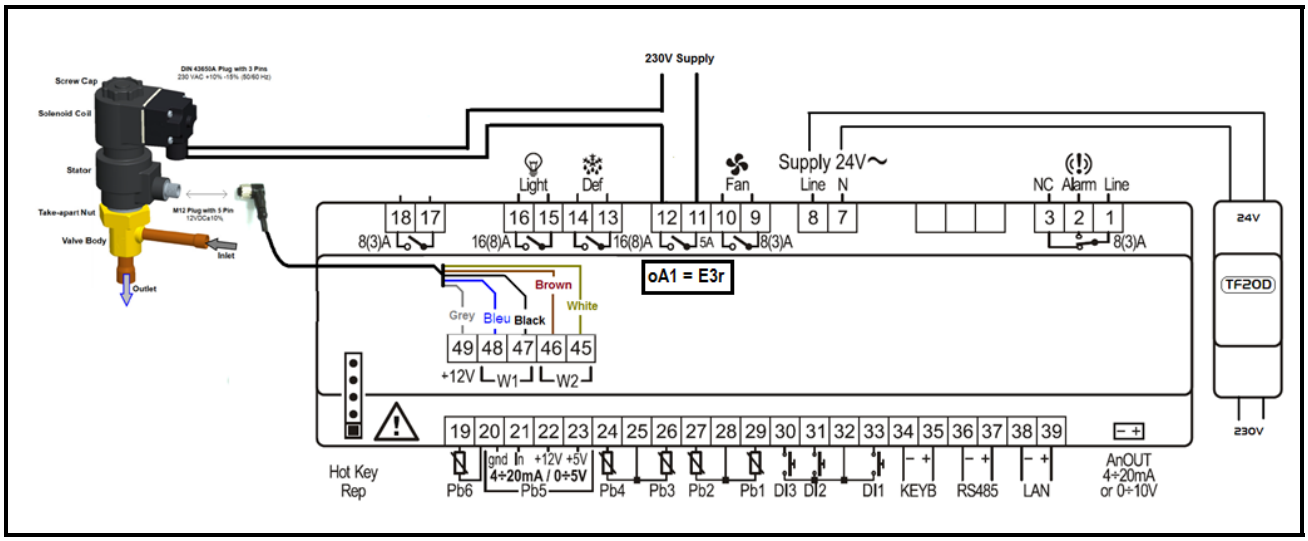


Figure 6-2 *- EX3-C230 Connection*

6.6. Absolute Maximum Power

XM678D is capable of driving a wide range of stepper valves. *Table 6-7* lists the maximum amount of current that the actuator can supply to the stepper wiring. The 640-0041 or 640-0040 (24V out, 20VA min) transformer should be used.

NOTE: The electrical power absorption of the valve is not related to the valve's refrigeration power. Before using the actuator, please read the technical manual of the valve supplied by the manufacturer and check the maximum current used to drive the valve; verify that the values are lower than those indicated in Table 6-7.

VALVE TYPE		
	BIPOLAR VALVES (4 wires)	Max Current 0.9A
	UNIPOLAR VALVES (5-6 wires)	Max Current 0.33A

Table 6-7 *- Absolute Maximum Power*

6.7. Keyboard Display CX660

The XM678D controller can also operate without the keyboard.

Polarity:

- Terminal [34] [-]
- Terminal [35] [+]

Use twisted shielded cable AWG 18 or less in case of long distance.

Max Distance: 30m

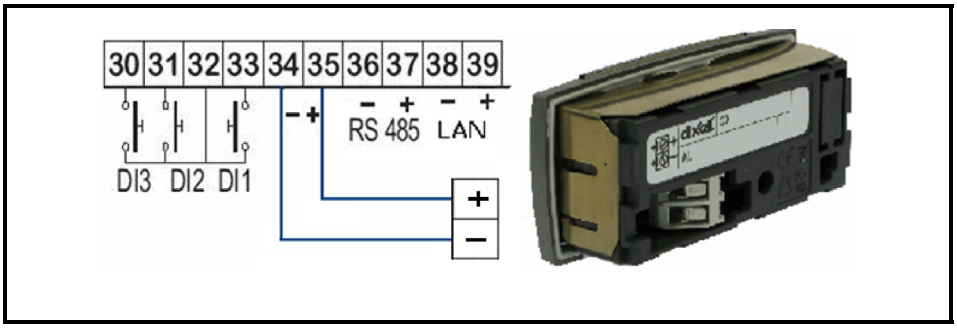


Figure 6-3 *- XM678D Keyboard Display*

6.8. LAN Connection

To create a LAN connection and to a perform synchronized defrost (also called master-slave functioning):

1. Connect a shielded cable between terminals 38 [-] and 39 [+] for a maximum of eight (8) sections.
2. The **Adr** parameter is the number that identifies each electronic board. *Address duplication is not permitted*; in this case, synchronized defrost and the communication with the monitoring system are not guaranteed (the **Adr** is also the MODBUS address). See ***Figure 6-4*** for an example of a properly configured LAN connection:

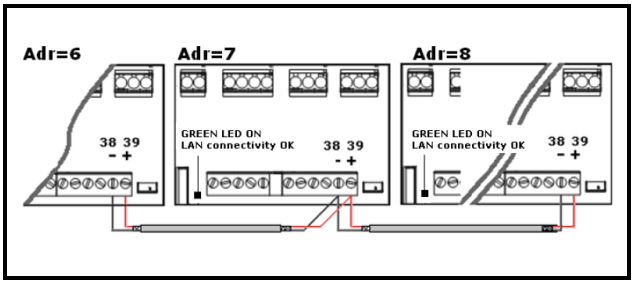


Figure 6-4 *- LAN Connection*

NOTE: If the LAN is connected properly, the green LED will be ON. If the LAN is not connected properly, a blinking LED will display. The maximum allowed distance is 30m.

6.9. Sensors for Superheat Control

Temperature probe: Pb6 Terminals 19-20 without any polarity.

Select the kind of sensor with the **P6C** parameter.

Pressure transducer: Pb5 Terminals

[**21**] = signal input

[**22**] = power supply for 4 to 20mA transducer

[**20**] = GND

[**23**] = +5VDC power supply for ratiometric pressure transducer

Select the transducer configuration with the **P5C** parameter.

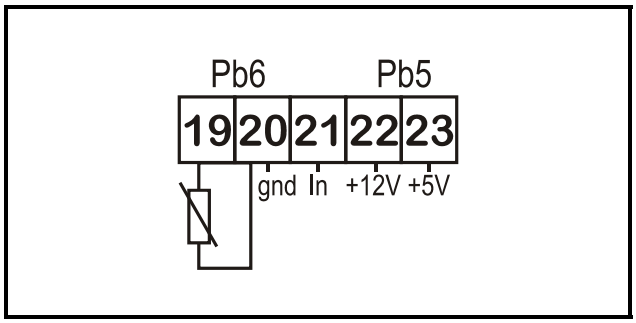


Figure 6-5 *- Sensors for Superheat Control*

6.10. How to Use a Single Pressure Transducer on Multiplexed Applications

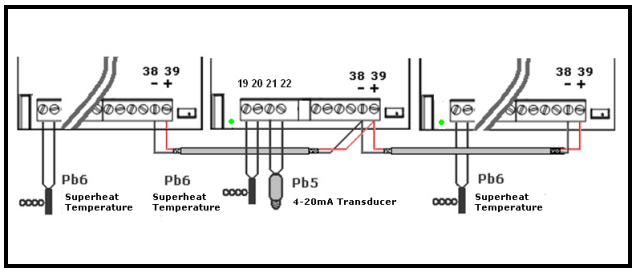


Figure 6-6 *- Pressure Transducer on Multiplexed Applications*

A working LAN connection is required (green LED lit on all XM678D boards of the same LAN). Connect and configure the pressure transducer only on one XM678D of the network. Afterwards, the pressure value read by that single transducer will be used by each device connected to the same LAN.

To read the pressure value, press the up arrow button to access the fast selection menu and read the value of the following parameters:

- **dPP** - measured pressure (only on the master device)
- **dP5** - temperature value obtained from the pressure value (temperature conversion)
- **rPP** - pressure value read from remote location (only for slave devices)

Examples of error messages:

- **dPP = Err** -> the local transducer read an incorrect value; the pressure value is out of range of the pressure transducer or the **P5C** parameter is incorrect. Check if any of the above causes the error, otherwise replace the transducer.
- **rPF** -> there is an error in the remote pressure transducer. Check the status of the board (GREEN LED); if the LED is OFF, then the LAN is not functioning, otherwise, check the remote pressure transducer.

Last Checks about the Superheat:

On the fast access menu:

- **dPP** - the value read by the gauge.
- **dP6** - the value read by the temperature probe, the temperature of the gas on the evaporator outlet.
- **SH** - the value of the superheat. The nA or err message means that the superheat cannot be read at the moment and the value is not available.

6.11. How to Connect the Monitoring System

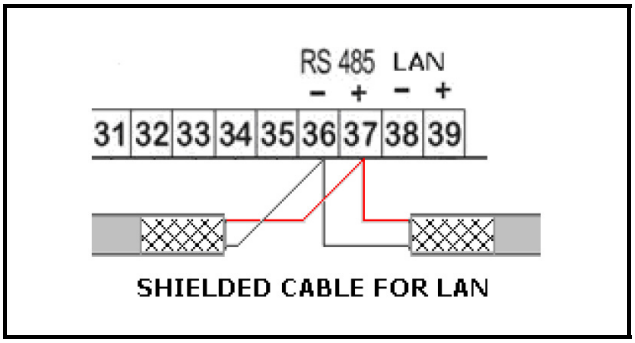


Figure 6-7 *- Connecting the Monitoring System*

- Connect through terminals **36** [-] and **37** [+].
- Use a shielded twisted cable (for example, Belden 8762 or CAT 5 cable).
- The maximum allowable distance is 1 kilometer.
- Do not connect the shield wire to the earth or ground terminals of the device. Use insulation tapes to avoid accidental contacts.

Only one controller for each LAN should be connected to the RS485 connection.

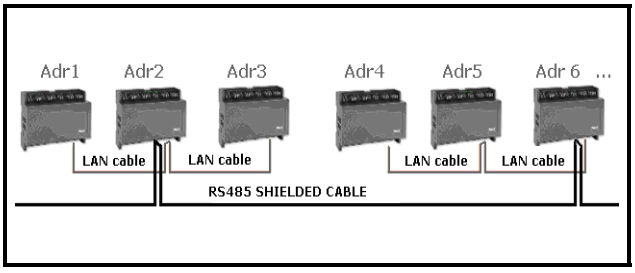


Figure 6-8 *- Connecting Monitoring Systems*

The **Adr** parameter is the number that identifies each electronic board. Address duplication is not permitted; in this case, synchronized defrost and the communication with the monitoring system are not guaranteed (the **Adr** is also the MODBUS address).

6.12. Digital Inputs

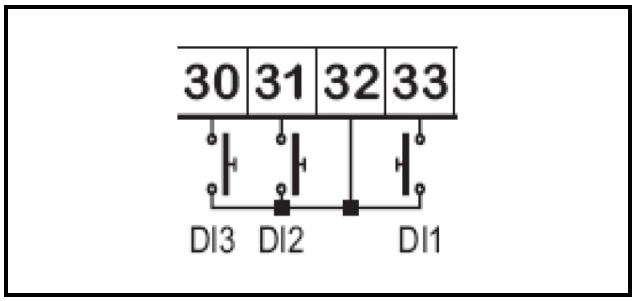


Figure 6-9 *- Digital Inputs*

- Terminals [**30**] through [**33**] are all free of voltage.
- Use a shielded cable for distances higher than one meter.

For each digital input, configure the parameters: **i1P** (polarity of activation), **i1F** (function of the input), and **i1d** (delay of signaling).

The **i1P** can be set to: **cL**= active when closed; or **oP**= active when opened.

The **i1F** parameter can be set to: **EAL**= external alarm, **Bal**= serious lock alarm, **PAL**= pressure switch alarm, **dor**= door switch, **dEF**= external defrost, **AUS**= auxiliary activation command, **LiG**= light activation, **OnF**= board On/OFF, **FHU**= do not use this configuration, **ES**= day/night, or **HdY**= do not use this configuration.

The **i1d** parameter is for the delay of activation.

For the other digital inputs, same set of parameters is present: **i2P**, **i2F**, **i2d**, **i3P**, **i3F**, **i3d**.

6.13. Analog Output

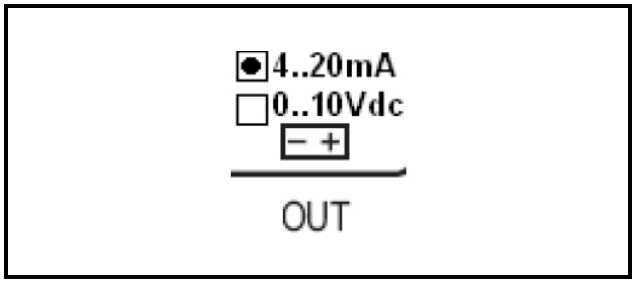


Figure 6-10 *- Analog Output*

- Can be set between 4 to 20mA and 0 to 10VDC.
- Use a CABCJ15 cable for connections.

The analog output is located near the terminal [**39**] on a two-pin connector. The analog output can be used to control anti-sweat heaters using a chopped phased controller, XRPW500 (500 watt) or family, XV*xx*D or XV*xx*K.

7 Battery Back Up Connection

7.1. XEC Supercap Connection

XEC Supercap is designed to be used with Dixell products (XM678D, XEV, IEV, and others); compatibility with Dixell devices has to be verified in the user manual/technical sheet of the device. If problems occur, contact Dixell Service department at 770-425-2724.

NOTE: XEC Supercap and XM678D must be powered by two different transformers; failure on observance of this rule may result to damage to the XEC Supercap and/or to the connected XM678D.

Wiring Connection

XM678D	XEC
Terminal 61 (+)	Terminal 4 (12Vdc)
Terminal 62 (-)	Terminal 3 (gnd)

Table 7-1 *- XM678D and XEC Wiring Connection*

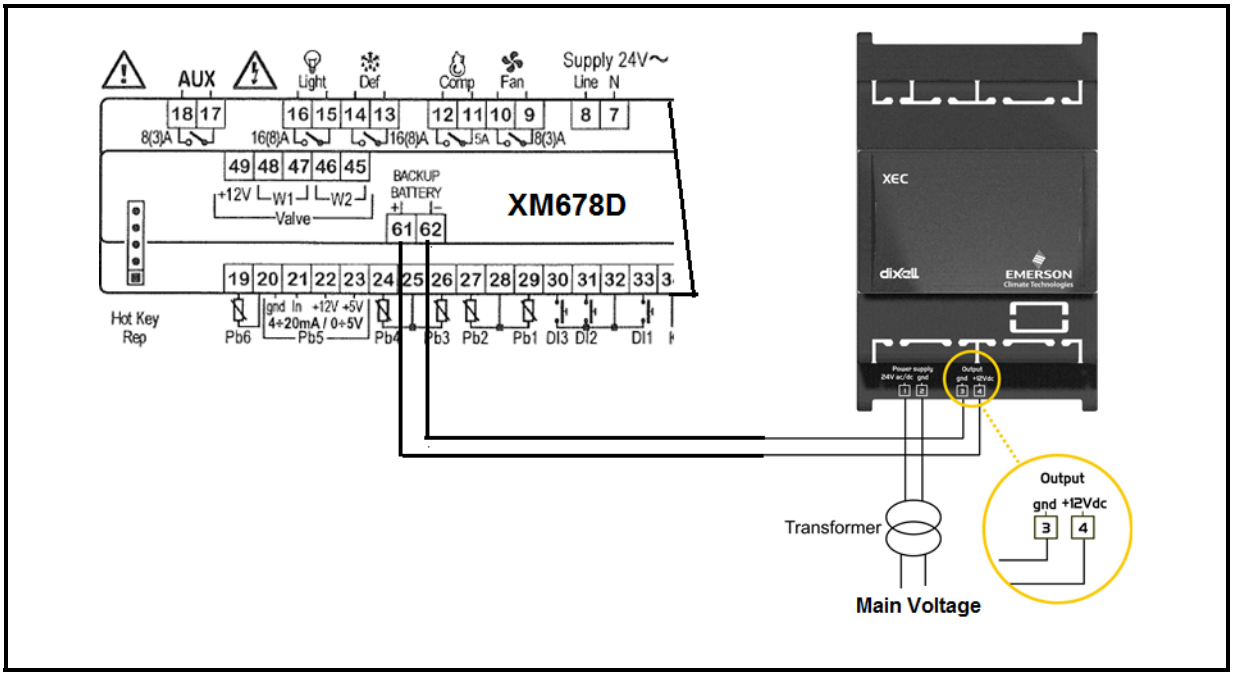


Figure 7-1 *- XM678D - XEC Supercap Connection*

7.2. Emerson ECP-024 Connection

The Emerson ECP-024 rechargeable accumulator can be connected to the XM678D to close the stepper valve in case of power interruption. Please refer to the ECP-024 manuals for the terms and conditions of use and limitations.

Wiring Connection

XM678D	ECP-024
Terminal 61 (+)	Terminal +
Terminal 62 (-)	Terminal -

Table 7-2 *- XM678D and XEC Wiring Connection*

8 Wiring Layout for Sharing a Pressure Transducer on a LAN

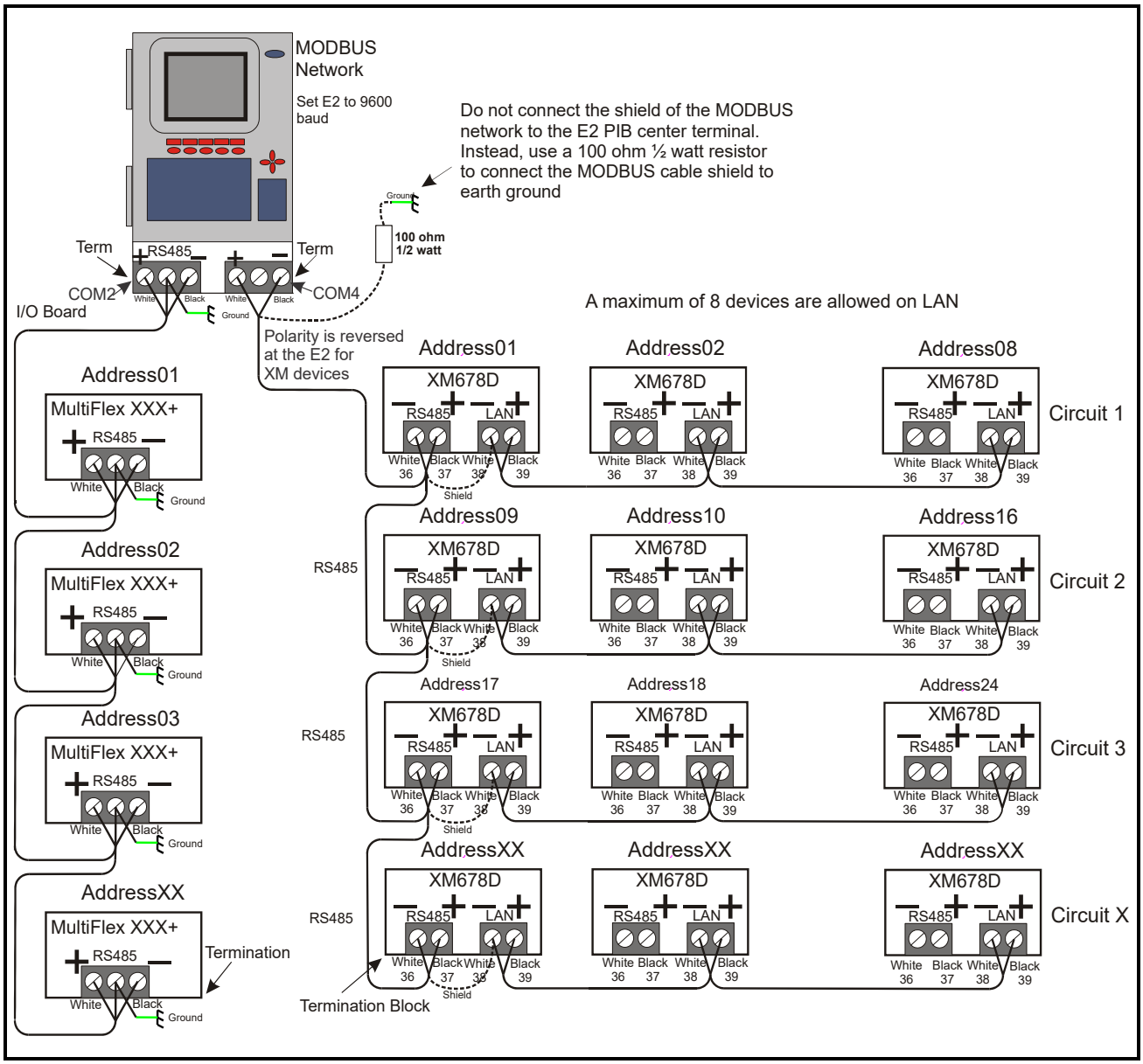
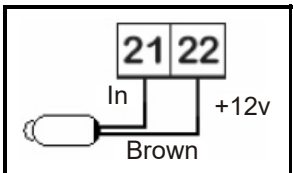
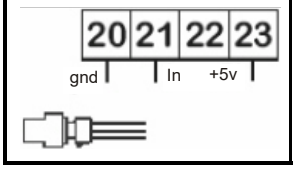
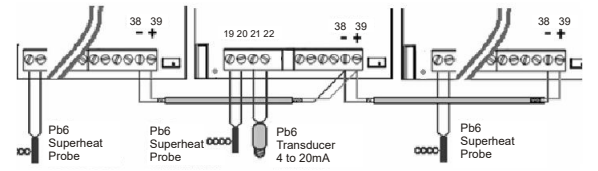


Figure 8-1 *- Wiring Guidelines for Sharing a Pressure Transducer Across Multiple Units on the Same Circuit*

9 Pressure Transducer Setup

	4 to 20 mA for PP07, PP11, or similar models
	Generic metric ratio 0 to 5V

Virtual Pressure: In this example of programming, the master device is the regulator with the pressure probe connected.

Slave	Master	Slave
tPP = LAn LPP = n P5C = nP	tPP = PP LPP = Y P5C = 420 (transd.)	Tpp = LAn LPP = n P5C = nP
		
Press the arrow keys to access menu readings for pressure.		
Once set up, check these readings:		
Slave device pressure: **rPP**: Shows the value of pressure received by remote pressure probe connected to other XM600K device.	Master device pressure: **dPP** = Shows the value of pressure measured by pressure transducer. **dP5** = Shows the temperature value measured by probe 5.	Slave device pressure: **rPP**: Shows the value of pressure received by remote pressure probe connected to other XM600K device.

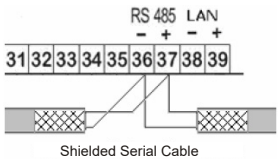
Check for error messages. Error message examples:

- **dPP = Err**: in the Master device, the value of pressure read from the transducer is outside the acceptable range regarding parameters **PA4- PA20**; is connected incorrectly or it is not configured to parameter **P5C**.
- **PPF** = reading on the slave device - LAN communication is not functional.
- **tPP** = **LAn**: in the master controller, LAN address sequences are not correct. **LPP** = **Y** means the address sequences are not correct.

Final Control From Superheat (**SH**) Reading Control Values:

- **dPP** = Shows the value of pressure measured by pressure transducer.
- **dP6** = Shows the temperature measured by probe 6. Corresponds to the outlet temperature of gas of the evaporator.
- **SH** = Shows the actual superheat value. It must have a consistent value for difference between the values **dP6** and **dP5**. If displaying **nA**, **err** or **nd**, the value is not calculable at the moment of the reading.

9.1. RS485 Net Monitoring Temperatures

	1. Terminals -36 and +37 2. Use Belden cable #8762 or #8772 3. Keep at a maximum distance of approximately 1Km

9.1.1. RS485 Connection

Sharing a single pressure transducer across multiple controllers on a LAN:

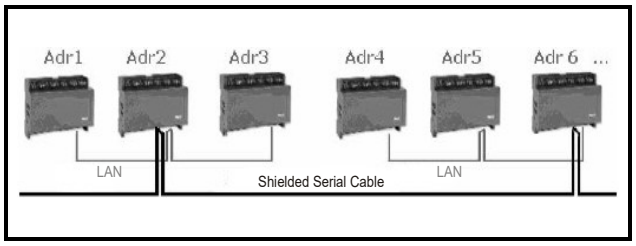


***Figure 9-1** - Sharing a Pressure Transducer Between Devices on LAN*

CAUTION! Do not connect the RS485 cable to all the instruments that are already connected on the LAN - only connect the RS485 to the master device of the LAN.

The parameter (**Adr**) also defines the number of configurations on the RS485 network (besides the **LAn**); its value must be only from 1 to the total number of devices present on the RS485 and the LAN networks.

CAUTION! The same value of the Adr parameter in different controllers creates malfunctioning in the monitoring system or problems on the synchronized defrosts.

9.2. How to Enable a Pressure Probe to Share Across the LAN

1. Enter the **Pr1** level. Follow the steps in **Section 12, *How to Program the Parameters (Pr1 and Pr2)***.
2. Select **Pr2** parameter and press the **SET** key.
3. The **PAS** flashing message will display, followed shortly by "**0 --**" with a flashing zero.
4. Use the up arrow or down arrow button to input the security code in the flashing digit. Confirm the security code by pressing **SET**. The security code is **321**.
5. If the security code is correct, the access to Pr2 is enabled by pressing **SET** on the last digit.
6. Navigate to the **LPP** of the Master device (the device where the pressure probe is connected) and select **(Y)**. Set the **LPP** to **(N)** for all other slave devices.
7. Navigate to **tPP** of the Master device and set it to **PP** (Pressure Probe). The slave devices **tPP** parameter will be set to **LAn**.
8. Navigate to **P5C** parameter (Pressure Probe will always be assigned to **P5C**) of the Master device and set it to Pressure Probe type. The slave devices **P5C** parameter will be set to **nP** (No Probe).

NOTE: If pressure is not being shared across the LAN, each XM678D will need its own Pressure Transducer. Please reference Figure 8-1.

10 Wiring Connection to Site Supervisor

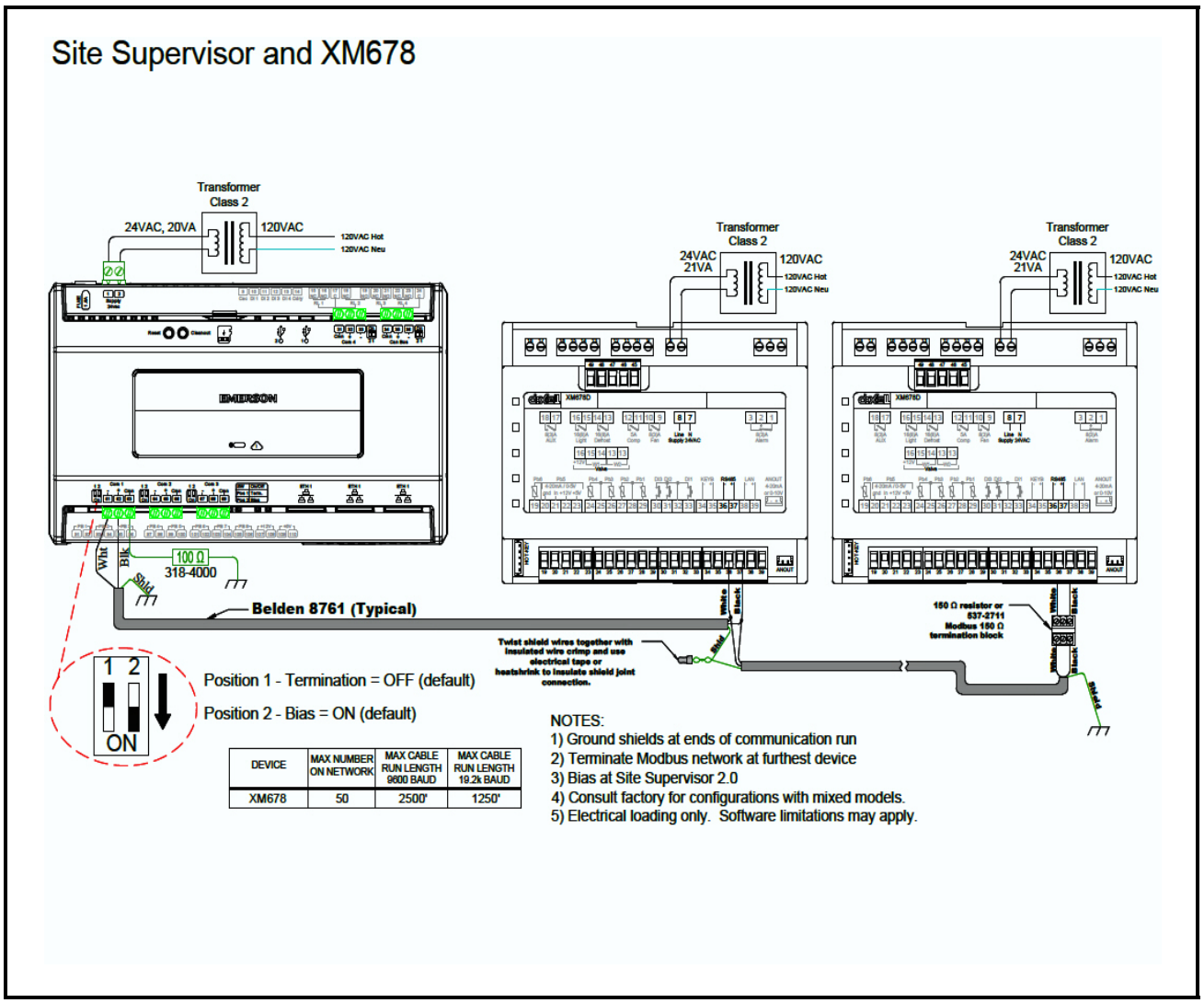


Figure 10-1 *- Site Supervisor Wiring*

11 User Interface

11.1. Direct Command Interface

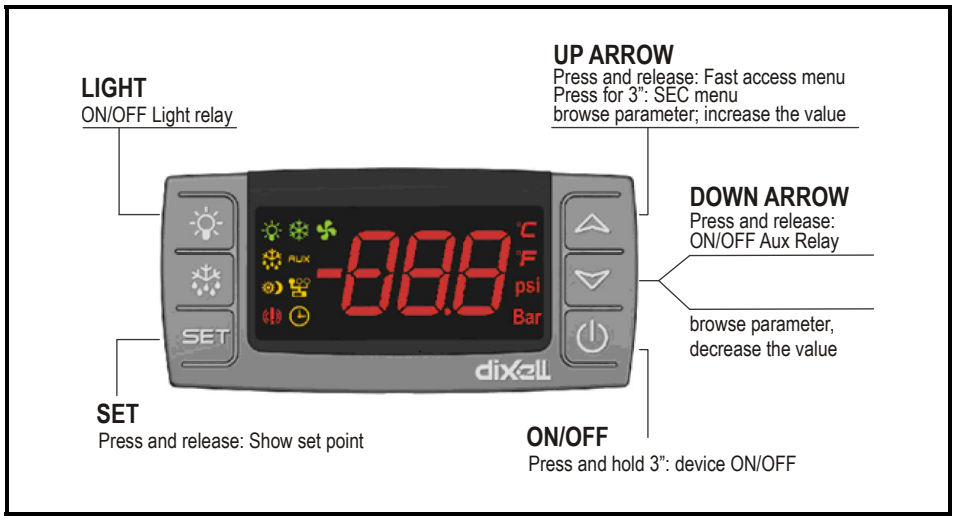


Figure 11-1 *- XM678D Front Panel*

11.2. Icons

Cooling Output					
Light				Fan	The output is activated when the icon is ON. A delay is present when the icon is blinking. MEASUREMENT UNIT **°C**, **Bar**, and (time) are ON depending on the selection.
Defrost		AUX	Auxiliary relay		
Energy Saving			Multimaster enabled		
Generic alarm			Clock/time		
DURING PROGRAMMING: The measurement units of temperature and pressure will blink.					

Table 11-1*- Icons*

11.3. Keyboard Commands

- LIGHT relay: Press the light button
- AUX relay: Press the down arrow button
- Manual defrost: Press the defrost button for three (3) seconds
- ON/OFF: Press the ON/OFF button for three (3) seconds (if the function is enabled)
- ES: Press the ON/OFF button for three (3) seconds (if the function is enabled)

11.3.1. Double Commands

▽ + △	Press for three (3) seconds to lock (Pon) or unlock (PoF) the keyboard.
SET + △	Press both keys to exit the programming mode or from a menu; when on submenus **EEV**, pressing these keys return you to the previous level.
SET + ▽	Press both keys for three (3) seconds to enter the first level of the programming mode.

Table 11-2 *- Double Commands*

11.4. How to Modify the Air Temperature Regulation Setpoint

The thermostat setpoint is the value used to regulate the air temperature. The regulation output is controlled by the electronic valve or the relay.

BEGIN	SET	Press the **SET** key for three (3) seconds (the measurement units will blink).
Value modification	△ or ▽	Use the up arrow and down arrow keys to change the LS and US parameters value.
EXIT	SET	Press the **SET** key to save the value (the value will blink for two (2) seconds).

Table 11-3 *- Modifying the Air Temperature Regulation Setpoint*

Wait for 10 seconds to exit. Press and release the **SET** button to display the air temperature setpoint (value displays for 60 seconds).

12 How to Program the Parameters (Pr1 and Pr2)

The device has two programming levels: **Pr1** (direct access) and **Pr2** (password-protected, access for higher level users).

ACCESS to Pr1	SET + ▽	Press for three (3) seconds to enter the first programming level (Pr1).
Select item	▽ or △	Press the up arrow or down arrow key to select the parameter or submenu.
Show value	SET	Press the **SET** button.
Modify	▽ or △	Press the up arrow or down arrow key to change the value.
Confirm and store	SET	Press **SET** (the value will blink for three (3) seconds and then display the next parameter).
EXIT	SET + △	Press to exit the programming mode, or wait for 10 seconds to exit.

Table 12-1 *- Programming the Parameters (Pr1 and Pr2)*

12.1. How to Enter Pr2

To enter **Pr2** programming menu:

1. Press **SET**+ down arrow keys for three (3) seconds to enter **Pr1** menu (the first label will display).
2. Press down arrow until the **Pr2** label displays and then press **SET**.
3. A blinking "PAS" label displays. Wait for a few seconds.
4. When a blinking "0 - -" displays, enter the password [**321**] by pressing the up arrow and down arrow keys. Press **SET** to save.

GENERAL STRUCTURE: The first two items, rtC and EEV, are related to the submenus of the other parameters.

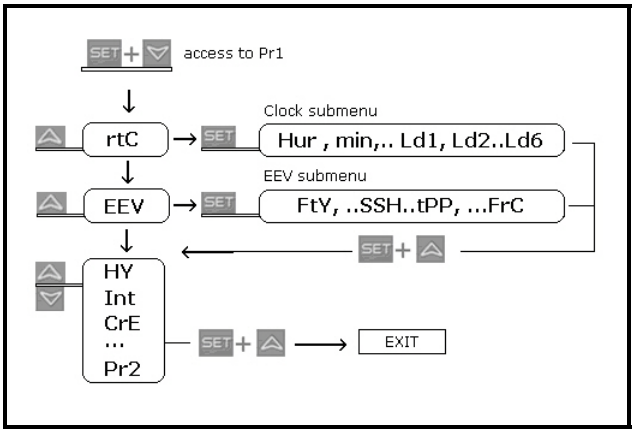


Figure 12-1 *- General Structure*

- Pressing the **SET** + up arrow keys on the rtC or EEV submenu returns you to the parameter list.
- Pressing the **SET** + up arrow keys on the parameter list exits the screen.

12.2. How to Move a Parameter From Pr1 to Pr2 Level and Vice Versa

Enter the Pr2 level. Select the desired parameter then press the **SET**+ down arrow keys. If the LED on the left-hand side of the screen is ON, it means that the parameter is present in Pr1 level; if the LED is OFF, it means that the parameter is not present in Pr1 (Only Pr2).

13 Fast Access Menu

The Fast Access menu contains the list of probes and values that are automatically emptied by the board such as the superheat and percentage of valve opening. The values: **nP** or **noP** stands for *probe not present* or *value not emptied*, and **Err** means the value is out of range, or the probe is damaged, not connected or configured incorrectly.

ENTERING THE FAST ACCESS MENU	∧	Press and release the up arrow key. The duration of the menu in case of inactivity is about 3 minutes. Depending on the configuration of the board, the values display.
To select an entry, press the ∧ or ∨, then press SET to view the value or to move to the next value.	**HM** Access to clock menu or reset the RTC alarm **An** Value of analog output **SH** Value of superheat. nA= not Available **oPP** Percentage of valve opening **dP1** (Pb1) Value read by probe 1 **dP2** (Pb2) Value read by probe 2 **dP3** (Pb3) Value read by probe 3 **dp4** (Pb4) Value read by probe 4 **dP5** (Pb5) Temperature read by probe 5 or value obtained from pressure transducer **dP6** (Pb6) Value read by probe 6 **dPP** Pressure value read by (Pb5) transducer **rPP** Virtual pressure probe, only on slave **L°t** Minimum room temperature **H°t** Maximum room temperature **dPr** Virtual probe for room temperature regulation [**rPA** and **rPb**] **dPd** Virtual probe for defrost management [**dPA** and **dPb**] **dPF** Virtual probe for fan management [**FPA** and **FPb**] **rSE** Real thermoregulation setpoint: the value includes the sum of **SET**, **HES** and/or the dynamic setpoint if the functions are	
EXIT	SET + ∧	Press together or wait the time out for 60 seconds.

Table 13-1 *- Fast Access Menu*

14 Multimaster Function Menu (SEC)

The function “section” SEC is enabled when the icon is lit. It allows entering in the remote programming mode from a keyboard not physically connected to the board through the LAN functionality.

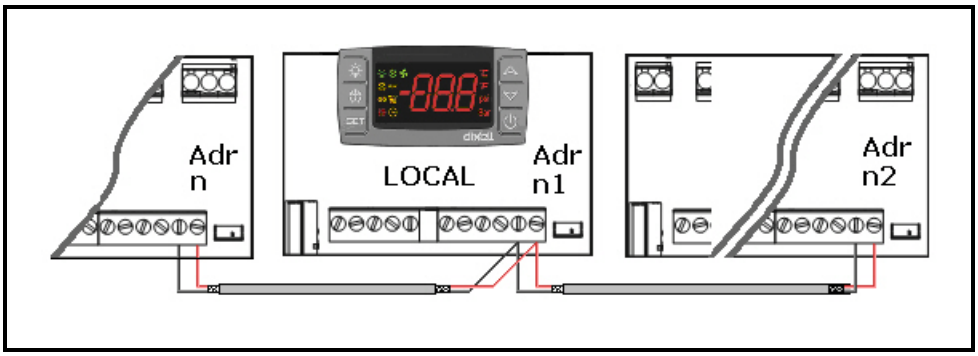


Figure 14-1 *- Multimaster Function Menu (SEC)*

Action	Button or display		Notes
Enter menu	∧		Press the up arrow key for about three (3) seconds, the icon will be ON.
Waiting for action	SEC		The menu to change the section will be entered. **SEC** label will be displayed.
Enter section list	SET		Press **SET** to confirm. The following list will be available to select the proper network function.
Select proper function	∧ or ∨	LOC ALL SE1 SEn SE8	To gain access only to the local device. To gain access to all the devices connected to the LAN. To gain access to the device with 1st **Adr** (*)… To gain access to the device with 8th **Adr** (*)
Confirm	SET		Select and confirm an entry by pressing **SET** button.
Exit menu	SET + ∧		Press **SET** and up arrow together or wait about 10 seconds.

Table 14-1 *- Multimaster Function Menu Action Buttons*
*(*) The devices on the LAN are indexed by using the **Adr** parameter (in ascending order).*

EXAMPLES:

1. To modify the same parameter values in all the devices connected to the LAN: enter the multimaster menu. Select and confirm **ALL**. Exit from the multimaster menu. Enter the programming menu and change the required parameter values. The new values will be changed on all devices connected to the LAN.
2. To modify a parameter value in the device with [**Adr = 35**]: find the relevant indexed section (the one linked to [**Adr = 35**]). Enter the multimaster menu. Select and confirm this section from the multimaster menu. Exit from the multimaster menu. Enter the programming menu and change the required parameter value.
3. If the alarm **nod** is present: enter the multimaster menu. Select and confirm the **LOC** section. Exit from multimaster menu.

CAUTION! At the end of programming, select the LOC section to switch OFF the icon.

14.1. Synchronized Defrost

The synchronized defrost allows multiple defrosts to be managed from different boards connected through the LAN connection. In this way, the boards can perform simultaneous defrosts with the possibility to end them in a synchronized manner.

CAUTION! In this case, the Adr parameter cannot be duplicated because defrost cannot be managed correctly.

BEGIN	SET + ▽	Press for three (3) seconds, the **EEU** or other will be showed. The measurement unit blinks.
Find Adr	▽	Press the down arrow key several times to find the **Adr** parameter, then press **SET**.
Modify Adr	△ or ▽	Set the value of **Adr** parameter, then press **SET** to confirm the parameter.
EXIT	SET + △	Press both keys to exit from menu or wait for about 10 seconds.

Table 14-2 *- Synchronized Defrost Keys*

The **LSn** and **LAn** parameter are used only to show the actual settings (read only). See ***Figure 14-2*** for an example of configuration:

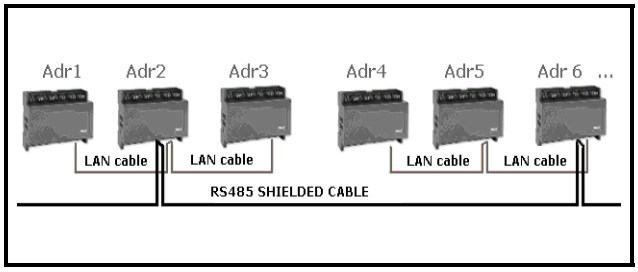


Figure 14-2 *- Configuration Example*

14.1.1. Daily Defrost From RTC: [EdF = rtC]

- **IdF Parameter:** For safety reason, force the value of **Idf** at +1 with respect to the interval between the two **Ld** parameters. The **IdF** timer is restarted after defrost and at every power ON.
- **DEFROST START:** At the time selected by the parameters **Ld1** to **Ld6** or **Sd1** to **Sd6**.
- **DEFROST END:** If the probes reach the **dtE** temperature or for maximum **MdF** time.
- **SAFETY and RtC or RtF ALARM:** With clock alarm, the device will use the parameters **IdF**, **dtE** and **MdF**.

CAUTION! <u>Do not</u> set [EdF = rtC] and [CPb = n].

- **MULTIMASTER DEFROST:** All the probes with clock

Par	Unit A (RTC)	Unit B (RTC)	Unit C (RTC)
Adr	n	N + 1	N + 2
IdF	9 hours safety	9 hours safety	9 hours safety
MdF	45 min safety	45 min safety	45 min safety
dtE	12°C safety	12°C safety	12°C safety
Ld1	06:00 1°	06:00 1°	06:00 1°
Ld2	14:00 2°	14:00 2°	14:00 2°
Ld3	22:00 3°	22:00 3°	22:00 3°

Table 14-3 *- Multimaster Defrost Example*

15 Commissioning

15.1. Clock Setting and RTC Alarm Reset

If the clock is present: [**EdF** = **rtC**] enable the defrost from rtc [**Ld1** to **Ld6**].

BEGIN	⌃	Press the up arrow key once to access the fast access menu.
Display	HM identify the clock RTC, press SET	
Display	HUr = hour -> press SET to save or change MIn = minutes -> press SET to save or change Do not use the other parameters if present.	
EXIT	SET + ⌃	Press **SET** + up arrow keys for 10 seconds to reset the RTC alarm.

Table 15-1 *- Clock Setting and RTC Alarm Reset*
Note: The rtC clock menu is present also on the second level parameters.

CAUTION! If the board displays the rtF alarm, it means that the board has to be replaced.

15.2. Electronic Valve Settings

The following parameters needs to be checked:

[1] Superheat temperature probe: NtC, PtC, Pt1000 with parameter **P6C**. The sensor has to be fixed at the end of the evaporator.

[2] Pressure transducer: [4 to 20mA] or ratiometric **P5C**=**420** or **5Vr** with parameter **P5C**.

[3] Range of measurement: Check the conversion parameters, **PA4** and **P20**, that are related to the transducer.

TRANSDUCER: For [-0.5/7Bar] or [0.5/8Bar abs], the correct setup is relative pressure with **PA4**=-0.5 and **P20**=7.0. For [0.5/12Bar abs], the correct setup is relative pressure with **PA4**=-0.5 and **P20**=11.00.

Example or virtual pressure with unique [4 to 20mA] or [0-5V] transducer:

Parame-ter	XM6x8D_1 w/o transducer	XM6x8D_ 2 + with transducer	XM6x8D_3 + w/o transducer
Adr	n	n+1	n+2
LPP	LPP=n	LPP=Y	LPP=n
P5C	LAN or probe not connected	P5C=420 or 0-5V	LAN or probe not connected
PA4	not used	-0.5 bar	not used
P20	not used	7.0 bar	not used

Table 15-2 *- Example or virtual pressure with unique 4-20mA or 0-5V transducer*

[4] From the EEV submenu: Select the correct kind of gas with the **FTy** parameter.

[5] Use the following parameters to set up the correct valve drive (based on the valve data sheet of the manufacturer):

tEU
Type of stepper motor: (**uP- bP**)
Allows selection of the kind of valve.
uP= 5- 6 wires unipolar valves, **bP**= 4 wires bipolar valves

CAUTION! Changing this parameter will require a valve restart.

tEP
Predefined valve selection: (0 to 10)
If **tEP=0**, the user has to modify all the configuration parameters to use the valve. If **tEP is not equal to 0**, the device performs a fast configuration of the following parameters: **LSt**, **uSt**, **Sr**, **CPP**, **CHd**. To select the right number, please read ***Table 6-2***.
If **tEP is not equal to 0**, previous configuration of the **LSt**, **uSt**, **Sr**, **CPP**, and **CHd parameters is overwritten.**

HFS
Kind of motor movement: (HAF; FUL)
HAF= half step. Use this setting for the unipolar valve.
FUL= full step. Use this setting for the bipolar valve.

LSt	**Minimum number of steps:** (**0** to **USt**) Allows selection of the minimum number of steps. At this number of steps, the valve should be closed. Read the manufacturer's data sheet to set this parameter correctly.Configure the value of this parameter within the allowed range of functioning.
	***CAUTION! Changing this parameter will require a valve restart.When the programming mode ends, the controller will automatically restart.***
USt	**Maximum number of steps:** (LSt to 800*10) Allows the user to select the maximum number of steps. At this number of steps, the valve should be opened completely. Read the manufacturer's data sheet to set this parameter correctly. Configure the value of this parameter within the allowed range of functioning.
	***CAUTION! Changing this parameter will require a valve restart.When the programming mode ends, the controller will automatically restart.***
Est	**Extra step during closing phase:** (0 to 255 (*10)) it sets the number of extra steps the controller performs, when the valve is closed at start up, and during the pauses of regulation, to force the closure of the valve.
	***Note: To set the ESt, the following steps has to be done:*** ***1. Set the kind of valve by the parameter tEP. This pre-set the parameters related to the valve*** ***2. Set the right value of ESt.***
Sr	**Step rate:** (10 to 600 step/sec) The maximum speed to change step without losing precision (losing steps). It is recommended to set this parameter below the maximum speed.
CPP	Current per phase (only for bipolar valves): (0 to 100*10mA) The maximum current per phase used to drive the valve. (Used only with bipolar valves)
CHd	**Holding current per phase (only for bipolar valves):** (0 to 100*10mA) The current per phase when the valve is stopped for more than 4 minutes. (**Used only with bipolar valves**)

16 Regulation for Superheat: Self Adaptive or Manual Operating Mode

16.1. Pressure Filtering - Sub Parameter

For optimal SH regulation, use a filtered value of pressure. This can be accomplished by using the parameter Sub.

Suggested values:

- From 1-5 evaporators for each racks: Sub = 20
- From 6-30 evaporators for each racks: Sub = 15
- More than 30 evaporators for each racks: Sub =10

16.2. General Considerations

The controller can regulate the superheat in manual or self adaptive mode, according to the value of the parameter **AMS, auto-tuning enabling**.

- With **AMS = n: the normal SH regulation is performed**.
- With **AMS = y: the self adaptive SH regulation is performed**.

16.3. Manual Operating Mode - AMS = NO

The temperature and SH regulation can be performed in two ways, according to the value of the parameter CrE: on/off or continuous. See the Standard temperature regulation in details below.

16.3.1. ON/OFF Temperature Regulation [CrE = n]

1. Temperature regulation is ON/OFF and it depends on the Setpoint and HY parameter (differential). Valve is closed when the temperature reaches the setpoint and open when the temperature is higher than setpoint + differential.
2. With more pauses normally also the humidity is larger.
3. Regulation pauses can be realized using the **Sti** and **Std** parameters (during these pauses the valve is closed).

16.3.2. Continuous Temperature Regulation [CrE = Y] (With Superheat Regulation)

1. The **HY** parameter becomes the temperature band for PI control. A good default value is **5°C**.
2. The regulation of injection is continuous and the cooling output is always ON. The ❄ icon is always ON except for the defrost phase.
3. The superheat is regulated following the **SSH** parameter.
4. Regulation pauses can be realized using **Sti** and **Std** parameters (during these pauses the valve is closed).
5. Increasing the **Int** integral time can decrease the speed of reaction of the regulator on the **HY** band.

16.3.3. Continuous Temperature Regulation [CrE = Y] (Without Superheat Regulation)

1. The **HY** parameter becomes the temperature band for PI control. A good default value is **5°C**.
2. The regulation of injection is continuous and the cooling output is always ON. The ❄ icon is always ON except for the defrost phase.
3. The superheat is not regulated because the valve is at the end of the evaporator. There is another valve at the beginning of the evaporator.
4. Regulation pauses can be realized using **Sti** and **Std** parameters (during these pauses the valve is closed).
5. Increasing the **Int** integral time can decrease the speed of reaction of the regulator on the **HY** band.

16.4. Self Adaptive Operating Mode - AMS = YES

Auto-adaptive means to find and maintain the condition of the lowest super heating according to the load and environmental conditions present in a given time on the evaporator.

The parameter **AMS** enables the self adaptive mode in the superheat regulation.

In this functioning the values of **Pb** and **inC** parameter are automatically set by the controller according to the kind of applications and the response of the system.

With the **AMS = YES, CrE** must be set to **NO**.

The **self adaptive algorithm** does not affect the functions related to the forced opening of the valve in special situations, such as:

- **Forced opening of the valve at start of regulation**, parameter **SFd** (percentage) and **SFd** (time).
- **Forced opening of the valve after defrost**, parameter **oPd** (percentage) and **Pdd** (time).

16.5. Minimum Stable Superheat Search - AMS = YES, ATU = YES

With the parameter **ATU**, the minimum stable superheat search function is enabled.

With **ATU = yES**, controllers start searching the minimum stable value for the SH. The minimum admitted value in any case is LSH + 2°C (4°F). Take it in consideration, before setting LSH value.

16.6. Valve Capacity Reducing - MNF Parameter

The parameter **MnF** reduce the capacity of the valve, to fine tune the valve to the evaporator.

The regulation band is not affected from the modification of the **MnF** parameter.

See the figure below (***Figure 16-1***) for the behavior of the capacity of the valve, when the **MnF** parameter is adjusted.

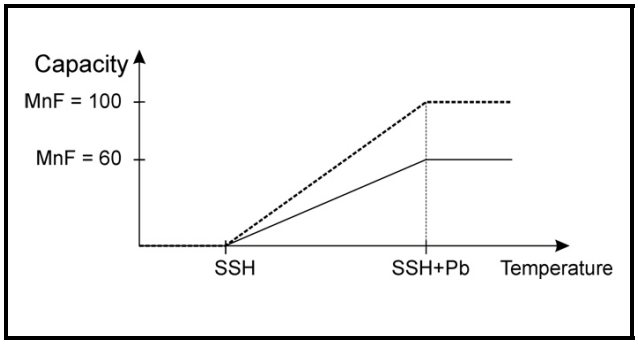


Figure 16-1 *- Capacity of Valve in Adjusted MnF Parameter*

NOTE: During the soft start phase (oPE, SFd), MnF parameter is not taken in consideration and the capacity of the valve is set by the parameters oPE and oPd, respectively.

16.6.1. Auto Zero Procedure (Go Home Functions)

To prevent any possible wrong positions caused by a long period of working for the step valve without closing, the controller after **gTH** hours, as soon as the opening open percentage is under 20%, will force a "go home" procedure:

1. Close the valve at max speed until the complete closure is reached.
2. Perform extra steps (Est).
3. Re-open to the requested regulation position.

This position is valid for all the valves and has to be done at set speed for each valve.

17 Display Messages

	Display	Causes	Notes
KEYBOARD			
1	nod	No display: the keyboard is trying to work with another board that is not working or not present	Press for three (3) sec the up arrow, enter the **SEC** menu and select **LOC** entry.
2	Pon	Keyboard is unlocked	
3	PoF	Keyboard is locked	
4	rSt	Alarm reset	Alarm output deactivated.
5	noP, nP nA	Not present (configuration) Not available (evaluation)	
6	noL	The keyboard is not able to communicate with the XM668D or XM678D	Verify the connection or call the Emerson Retail Solutions Technical Service.
ALARM FROM PROBE INPUT			
7	P1 P2 P3 P4 P5 P6 PPF CPF	Sensor brake down, value out of range or sensor incorrectly configured **P1C**, **P2C** to **P6C**. **PPF** can be showed by slaves of pressure that don't receive the value of pressure. **CPF** is showed when the remote probe 4 is not working.	**P1**: the cooling output works with **Con** and **COF**, With defrost probe on error the defrost is performed only at interval. For **P5**, **P6** and **PPF**: the percentage of the valve opening is fixed at **PEO** value.
TEMPERATURE ALARM			
8	HA	Temperature alarm from parameter **ALU** on probe **rAL**.	Outputs unchanged.
9	LA	Temperature alarm from parameter **ALL** on probe **rAL**.	Outputs unchanged.
10	HAd	Alarm from parameter **dLU** on probe defrost probe [**dPa** / **dPb**].	Outputs unchanged.
11	LAd	Alarm from parameter **dLU** on probe defrost probe [**dPa** / **dPb**].	Outputs unchanged.
12	HAF	Alarm from parameter **FLU** on probe defrost probe [**FPa** / **FPb**].	Outputs unchanged.
13	LAF	Alarm from parameter **FLL** on probe defrost probe [**FPa** / **FPb**].	Outputs unchanged.
DIGITAL INPUT ALARM			
14	dA	Door open alarm from input **i1F**, **i2F** or **i3F** = after delay **d1d**, **d2d** or **d3d**.	Cooling relay and fan follow the **odc** parameter. Cooling restart as specified on **rrd** parameter.
15	EA	Generic alarm from digital input **i1F**, **i2F**, **i3F** = **EAL**.	
16	CA	Severe alarm of regulation lock from digital input **i1F**, **i2F**, **i3F** = **bAL**.	Regulation output OFF.

Table 17-1 *- Display Messages*

	Display	Causes	Notes
17	PAL	Pressure switch lock **i1F**, **i2F** o **i3F** = **PAL**.	All the outputs are OFF.
ELECTRONIC VALVE ALARM			
18	LOP	Minimum operating pressure threshold from **LOP** parameter.	The valve output increases its opening of **dML** quantity every second.
19	MOP	Maximum operating pressure threshold from MOP parameter.	The valve output decreases its opening of **dML** quantity every second.
20	LSH	Low superheating from **LSH** parameter and **SHd** delay.	The valve will be closed; the alarm will be showed after **SHd** delay.
21	HSH	High superheating from **HSH** parameter and **SHd** delay.	Only display.
CLOCK ALARM			
22	rtC	Clock settings lost.	Defrost will be performed with **IdF** till restoring the settings of RTC.
23	rtF	Clock damaged.	Defrost will be performed with **IdF**.
OTHERS			
24	EE	EEPROM serious problem.	Output OFF.
25	Err	Error with upload/download parameters.	Repeat the operation.
26	End	Parameters have been correctly transferred.	

Table 17-1 *- Display Messages*

17.1. Alarm Recovery

Probe alarms **P1**, **P2**, **P3**, and **P4** start some seconds after the fault in the related probe; they automatically stop some seconds after the probe restarts normal operation. Check the connections before replacing the probe.

Temperature alarms **HA**, **LA**, **HA2**, and **LA2** automatically stop as soon as the temperature returns to normal values.

Alarms **EA** and **CA** (with **i1F** = **bAL**) recover as soon as the digital input is disabled. Alarm **CA** (with **i1F** = **PAL**) recovers only by switching OFF and ON the device.

18 Use of the Programming Hot Key

XM controllers can download or upload the parameter list from its own non-volatile internal memory to the Hot Key and vice-versa through a 5-pin connector. The Hot Key will not change the **Adr**.

18.1. Download (From the Hotkey to the Device)

1. Turn OFF the controller by pressing the on/off button ⏻ for five (5) seconds. **OFF** will display. Insert the Hot Key into the 5-pin connector labeled **HOT-KEY**, and then turn the controller back ON by pressing the on/off button again for five (5) seconds. The normal temperature value will display to indicate the controller is ON.
2. The parameter list of the Hot Key is downloaded into the controller memory automatically and **doL** will display. After 10 seconds, the controller will start working with the new parameters.
3. **End** will display at the end of the data transfer phase if the controller is programmed correctly. **Err** will display if there is an error or failure in programming.
   - **End** = correct programming. This means the controller will start regularly with the new programming.
   - **Err** = failed programming. In this case, turn the controller OFF and then ON if you want to restart the download again or remove the Hot Key to abort the operation.
4. Remove the Hot Key.

Note: The procedure may fail if the firmware version and the controller models are different.

18.2. Upload (From the Device to the Hotkey)

1. When the XM controller is ON, insert the Hot Key into the 5-pin connector labeled **HOT-KEY**.
2. Press and release the up arrow button.
3. The upload will begin, and **UPL** will blink on the display. **End** will display at the end of the data transfer phase if a successful upload has occurred. **Err** will display if there is an error or failure in programming.
   - **End** = correct programming.
   - **Err** = failed programming. In this case, press the **SET** key if you want to restart the programming again or remove the unprogrammed Hot Key.
4. Remove the Hot Key.

Note: The upload procedure will overwrite everything previously uploaded from the last Hot Key upload.

19 Controlling Loads

19.1. Cooling Output

Regulation is performed according to the temperature measured by the thermostat probe (physical probe or virtual probe) obtained by a weighted average between the two probes following the formula:

$$\text{value\_for\_room\_regulation} = \frac{(rPA*rPE + rPb*[100-rPE])}{100}$$

If the temperature increases and reaches the setpoint plus differential, the solenoid valve opens and then closes when the temperature reaches the setpoint value again.

In case of error in the thermostat probe, the opening and closing time of the solenoid valve is configured by the **Con** and **CoF** parameters.

19.2. Standard Regulation and Continuous Regulation

The regulation can be performed in three ways:

- *Standard regulation* - the goal of the first regulation (standard regulation) is to reach the best superheat via a classic temperature regulation obtained using hysteresis.
- *Continuous regulation* - the second regulation allows the valve to realize a high performance temperature regulation with a good factor of superheat precision. This kind of regulation can be used only in centralized plants and is available only with the electronic expansion valve by selecting the [**CrE = Y**] parameter.
- *Use of evaporator valves* - the third kind of regulation is through the use of evaporator valves [**CrE = EUP**]; in this configuration, the valve is placed at the end of the evaporator. In any case, the regulation is performed via the PI regulator that determines the valve opening percentage.

19.2.1. Standard regulation: [CrE = n]

The **HY** parameter is the differential for the standard ON/OFF regulation. In this case, the **int** parameter is neglected.

19.2.2. Continuous regulation: [CrE = Y]

The **HY** parameter is the proportional band of the PI that is in charge of the room temperature regulation. It is recommended to use at least [**HY = 12°F/6.0°C**]. The **int** parameter is the integral time of the same PI regulator. Increasing the **int** parameter causes the PI regulator to react slowly and is true vice versa. To disable the integral part of regulation, set [**int = 0**].

19.2.3. Evaporator valves: [CrE = EUP]

In this case, the system performs a regulation of the temperature without considering the superheat (in fact, the valve is at the end of the evaporator). The **HY** parameter is the proportional band for the temperature regulation and **int** is the integral time for the regulation. In this case, there is no superheat regulation.

19.3. Defrost

19.3.1. Defrost starting

In any case, the device checks the temperature that is read by the configured defrost probe before starting the defrost, after that:

- (If RTC is present) Two defrost modes are available through the **tdF** parameter: defrost with electrical heater and hot gas defrost. The defrost interval is controlled by the parameter **EdF**: (**EdF = rtC**) defrost is made in real time depending on the hours set in the parameters **Ld1** to **Ld6** in workdays and in **Sd1** to **Sd6** on holidays; (**EdF = in**) the defrost is made every **IdF** time.
- Defrost cycle starting can be operated locally (manual activation by means of the keyboard or digital input or end of interval time) or the command can come from the master defrost unit of the LAN. In this case, the controller will operate the defrost cycle following the parameters it has programmed. At the end of the drip time, it will wait until all the other controllers of the LAN finish their defrost cycle before restarting the normal regulation of the temperature according to **dEM** parameter.
- Each time any of the LAN controller begins a defrost cycle, it issues the command into the network making all the other controllers start their own cycle. This allows a perfect synchronization of

the defrost in the whole multiplexed cabinet according to the **LMd** parameter.

- **Differential defrost:** Selecting the **dPA** and **dPb** probes and by changing the **dtP** and **ddP** parameters, the defrost can be started when the difference between **dPA** and **dPb** probes is lower than **dtP** for all **ddP** time. This is useful to start defrost when a low thermal exchange is detected. If [**ddP = 0**], this function is disabled.

19.3.2. Defrost Ending

- When defrost is started via **rtC**, the maximum defrost duration is obtained from the **Md** parameter and the defrost end temperature is obtained from the **dtE** parameter (and **dtS** if two defrost probes are selected).
- If **dPA** and **dPb** are present and [**d2P = Y**], the device stops the defrost procedure when **dPA** is higher than **dtE** temperature and **dPb** is higher than **dtS** temperature.

At the end of defrost, the drip time is controlled through the **Fdt** parameter.

19.4. Fans

19.4.1. Control With Relay

The fan control mode is selected by means of the **FnC** parameter:

- **C-n** = running with the solenoid valve, OFF during defrost
- **C-Y** = running with the solenoid valve, ON during defrost
- **O-n** = continuous mode, OFF during defrost
- **O-Y** = continuous mode, ON during defrost

An additional parameter **FSt** provides the setting of the temperature, detected by the evaporator probe, above which the fans are always OFF. This can be used to verify that air is circulated only if this temperature is lower than set in the **FSt**.

19.4.2. Control With Analog Output (If Present)

The modulating output [**trA = rEG**] works in a proportional manner (excluding the first **AMt** seconds where the fans speed is the maximum; 10 seconds is the minimum value). The regulation setpoint is relative to the regulation setpoint and is indicated by **ASr**, the proportional band is always located above the [**SET + ASr**] value and its value is **PbA**. The fans are at minimum speed **AMi** when the temperature read by the fan probe is [**SET + ASr**] and the fan is at maximum speed (**AMA**) when the temperature is [**SET + ASr + PbA**].

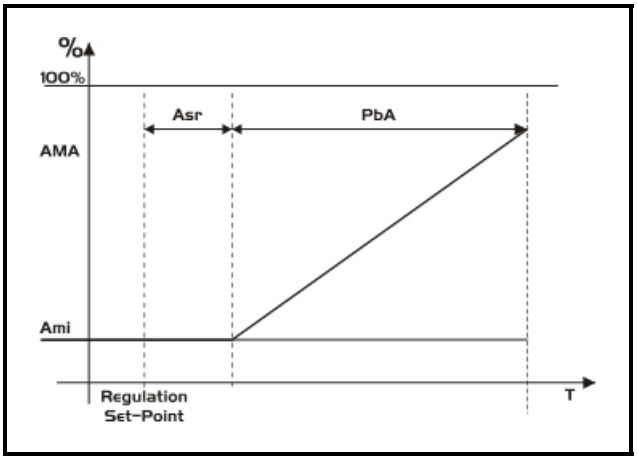


Figure 19-1 *- Control With Analog Output*

19.5. Anti-Sweat Heaters

Anti-sweat heater regulation can be performed with the on board relay (if **OA6 = AC**) or with the analog output (if present by setting **trA = AC**). However, the regulation can be performed in two ways:

- Without real dewpoint information: in this case the default value for dewpoint is used (**SdP** parameter).
- Receiving dewpoint from **XWEB5000** system: the **SdP** parameter is overwritten when a valid value for dewpoint is received from XWEB. In case the XWEB link is lost, **SdP** is the value that will be used for safety.

The best performance can be obtained using probe 4. In this case, the regulation follows the chart illustrated in ***Figure 19-2***:

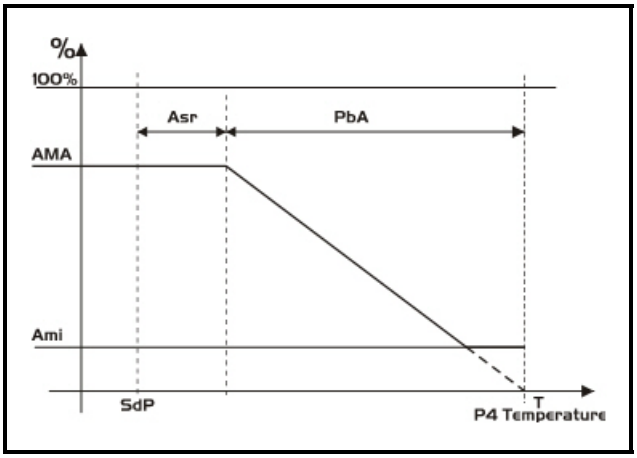


Figure 19-2 *- Anti-Sweat Heaters*

Probe 4 should be placed on the showcase glass.
For each cabinet, only one probe 4 (P4) can be used; the P4 will send its value to the other sections that are connected to the LAN.

Functioning with Probe 4 within the LAN:

Parameter	XM6x8D_1 Without Probe 4	XM6x8D_2 + With Probe 4	XM6x8D_3+ Without Probe 4
Adr	n	n + 1	n + 2
LCP	LCP = n	LCP = Y	LCP = n
P4C	LAN or probe not connected	P4C = NTC, PtC or PtM	LAN or probe not connected
trA	trA = AC if the device has the analog output		
OA6	OA6 = AC if the device will use the AUX relay for regulation		

Table 19-1 *- Functioning with Probe 4 within the LAN*

Functioning Without Probe 4:

Parameter	XM6x8D Without Probe 4
P4C	nP
AMt	% of ON

Table 19-2 *- Functioning Without Probe 4*

In this case, regulation is performed by switching the auxiliary relay ON and OFF on a 60-minute time base. The ON time will be the **AMt** value, so that the relay will be ON for **AMt** minutes and OFF for [**60-AMt**] minutes.

In case of P4 error or if P4 is absent, the output is at **AMA** value for the **AMt** time then the output is at **0** value for the time [**255 - AMt**] time performing a simple PWM modulation.

19.6. Auxiliary Output

The auxiliary output is switched ON and OFF by means of the corresponding digital input or by pressing and releasing the down arrow key.

20 Technical Data

CX660 KEYBOARD	
Housing	Self-extinguishing ABS
Dimensions	**Case:** CX660 fascia **Front**: 35 mm x 77 mm **Depth**: 18 mm
	Panel Mount: 29 mm x 71 mm panel cut-out
Protection	IP20
	Frontal: IP65
Power Supply	From XM600K power module
Display	Three (3) digits, red LED, 14.2 mm high
Optional Output	Buzzer
POWER MODULES	
Case	8 DIN
Connections	Screw terminal block ≤ 1.6 mm^2 heat-resistant wiring and 5.0 mm Faston or screw terminals
Power Supply	24VAC - *An isolated transformer for the XM678D power supply must be used. Do not share power with any other devices.*
Power Absorption	20VA max
Inputs	Up to 6 NTC/PTC/Pt1000 probes
Digital Inputs	Three (3) voltage-free
Relay Outputs (Total current on loads MAX 16A) Refer to **Section 21** for UL Ratings	**Solenoid Valve:** relay SPST 5A, 250Vac **Defrost:** relay SPST 16A, 250Vac **Fan:** relay SPST 8A, 250Vac **Light:** relay SPST 16A, 250Vac **Alarm:** SPDT relay 8A, 250Vac **Aux:** SPST relay 8A, 250Vac
Valve Output	Bipolar or unipolar valves
Maximum Distance between Controller and Valve	Up to 10m with shielded twisted cables, AWG 18 (0.823mm2) or less.
Maximum Length for LAN	Up to 30m with shielded twisted cables, AWG 20 (0.51mm2) or less.
Optional Output (AnOUT) Depending on the model	**PWM/ Open Collector outputs:** PWM or 12VDC max 40mA
	Analog Output: 4 to 20mA or 0 to 10V
Serial Output	RS485 with MODBUS-RTU and LAN
Data Storing	On the volatile memory (EEPROM)
Kind of Action	1B
Pollution Degree	2
Software Class	A

Table 20-1*- XM678D Technical Specifications*

Operating Temperature	32 to 140°F (0 to 60°C)
Storage Temperature	-13 to 140°F (-25°C to 60°C)
Relative Humidity	20 to 85% (no condensing)
Measuring and Regulation Range	**NTC probe:** -58 to 230°F (-40 to 110°C)
	PTC probe: -67 to 302°F (-50 to 150°C)
	Pt1000 probe: -148 to 212°F (-100 to 100°C)
Resolution	1°C or 1°F or 0.1°C (selectable)
Accuracy (ambient temperature 77°F (25°C))	±0.5 °C ±1 digit

Table 20-1*- XM678D Technical Specifications*

21 UL Ratings

	Ratings	Terminal
Relay Outputs UL Ratings	**Evaporator Fan**: 120 V, 50/60 Hz, 1/4 HP, 30k cycles 125 V, 50/60 Hz, 1/3 HP, 6k cycles 250 V, 50/60 Hz, 1/2 HP, 30k cycles	Terminals 9 and 10
	Compressor: 120 V/240 V, D300 Pilot Duty, 30k cycles	Terminals 11 and 12
	Auxiliary (not populated in XM66 series): 120/240 V, 50/60 Hz, 5 A, General Purpose, 6k cycles 120/240 V, 50/60 Hz, 3 A, Resistive, 100k cycles	Terminals 18 and 17
	Light: 120 V, 50/60 Hz, 5 A, General Purpose, 6k cycles, 120 Vac, 1000 W Tungsten, 6k cycles 240 Vac, 1400 W Tungsten, 6k cycles	Terminals 16 and 15
	Defrost: 120/240 V, 50/60 Hz, 10A, Resistive, 30k cycles 120/240 V, 50/60 Hz, C300, Pilot Duty, 30k cycles	Terminals 14 and 13
	Alarm (not populated on XM66 series): 120/240 V, 50/60 Hz, 5 A, General Purpose, 6k cycles 120/240 V, 50/60 Hz, 3 A, Resistive, 100k cycles	Terminals 1, 2 and 3
	Stepper Valve (24 V models only): 24 V, 0.9 A maximum	Terminals 45 to 49

Table 21-1*- XM678D UL Ratings*

Temperature - Maximum ambient operating temperature 60°C

Pollution Degree - 2 (Normally only nonconductive pollution. However, a temporary conductivity caused by condensation may be expected.)

Overvoltage Category - III

Software Class: A

Maximum Phase to Ground Voltage: 120 Vac

22 E2 MODBUS Network Wiring

- Connect the MODBUS Network to the RS485 Connector on the E2 PIB board (Belden 8641 recommended).
- Note to wire the RS485 +/- polarity at the E2 in the *reverse* of the XM678D devices.
- Position the three termination jumpers to the UP (terminated) position to provide RS485 termination at the E2.
- Do not connect the shield of the MODBUS network to the E2 PIB center terminal. Instead, use a 100 ohm 1/2 watt resistor to connect the MODBUS cable shield to earth ground.
- At each XM678D device, wire the MODBUS cable to the RS485 +/- terminals and connect the MODBUS shield to the pin **38** terminal.
- Terminate the end of the MODBUS network at the last XM678D device on the daisy chain with the MODBUS termination block (*P/N 535-2711*), or by connecting a 150 ohm resistor between the MODBUS +/- terminals.

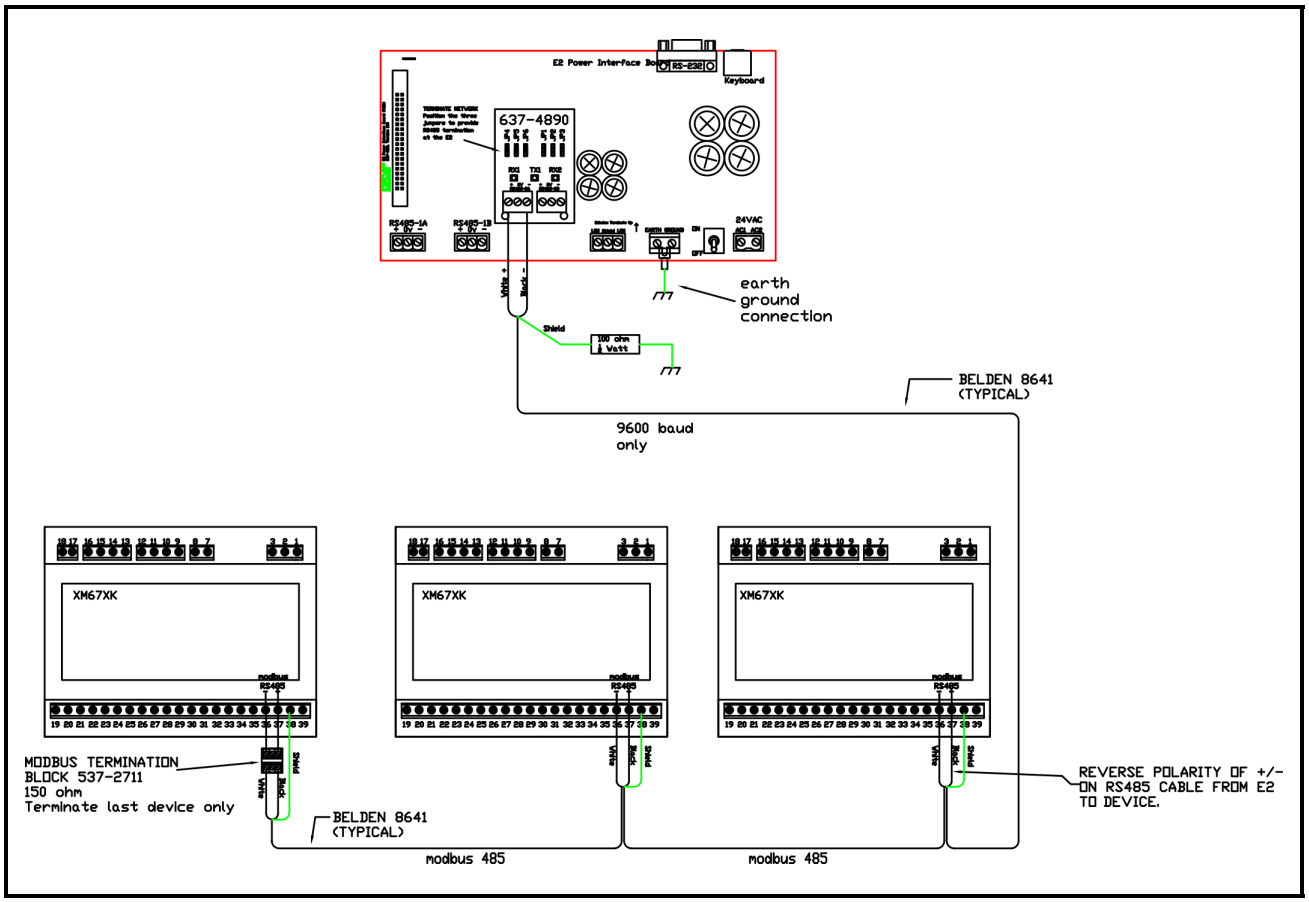


Figure 22-1 *- XM678D to E2 MODBUS Network Wiring*

CAUTION! For the XR, XM, and XEV series of controllers, the shield wire must not come into contact with any other wire or ground source. If contact with other wires or devices does occur, the 485 MODBUS network will malfunction or connected devices will be damaged. This applies to all installations where the shield is tied to ground through a 100 ohm ½ Watt resistor.

Refer to ***Appendix A - Alternate MODBUS COM Wiring Method for E2, XR, XM, and XEV Devices***. *(Technical Bulletin P/N 026-4148.)*

23 ECT MODBUS Networking to E2s

Connecting a XM678D controller to an E2 requires the E2 to be version 2.84 or above. Contact Emerson Retail Solutions for upgrade information if the controller is a version before 2.84.

An E2 has up to three COM ports that can be assigned for MODBUS communication: COM2, an RS485 port on the E2 power interface board, and COM4 and COM6, which are optional ports requiring expansion cards. *COM4 is recommended for MODBUS connection of XM678D units.*

COM ports can only be used for one function; in other words, if COM2 is set up as the I/O network, you cannot connect MODBUS devices to COM2. Ensure your E2 is equipped with an RS485 COM Card *(P/N 637-4890)* and configured in E2 General Services (Menu 7 3 1, **Serial** tab) to enable COM4 or an E2 Expansion COM Card *(P/N 637-4871)* to enable COM6.

Connect the MODBUS network cable to the three-terminal connector on the COM port you wish to assign as MODBUS. Reverse polarity of +/- on RS485 cable from E2 to the device.

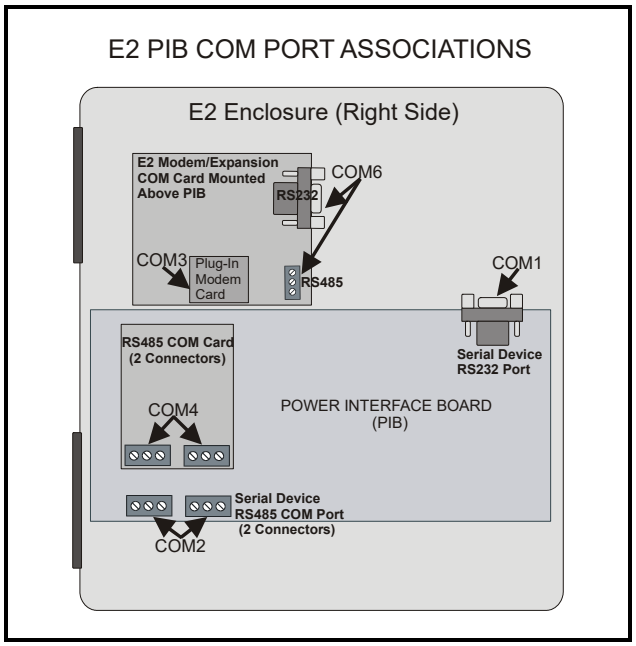


Figure 23-1 *- Location of E2 Com Ports (E2 versions 3.xx and Below)*

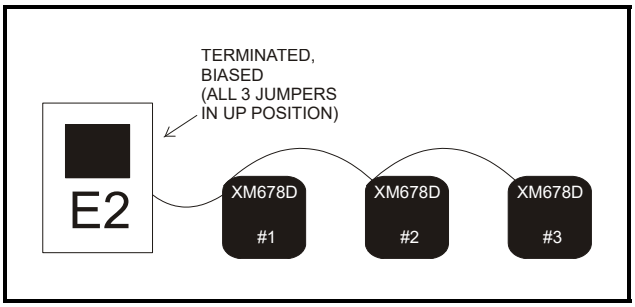


Figure 23-2 *- MODBUS Networking*

23.1. COM Port Associations - E2 Versions 4.0 and Above

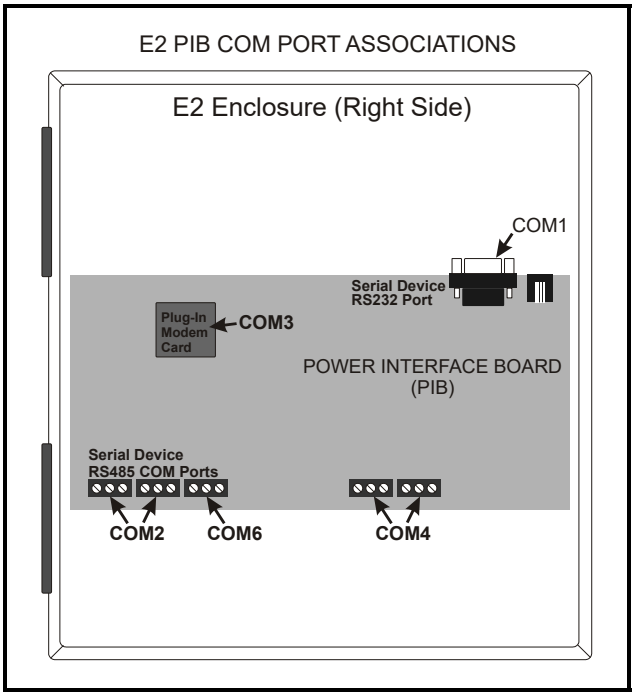


Figure 23-3 *- Location of E2 Com Ports - E2 PIB Board (E2 versions 4.0 and Above)*

An E2 has three COM ports that can be assigned for MODBUS communication (COM2). COM ports can only be used for one function; in other words, if COM2 is set up as the I/O network, you cannot connect MODBUS devices to COM2. Ensure your E2 is configured in E2 General Services (Menu 7 3 1, **Serial** tab) to enable COM4 or COM6.

Connect the MODBUS network cable to the three-terminal connector on the COM port you wish to assign as MODBUS. Reverse polarity of +/- on RS485 cable from E2 to the device

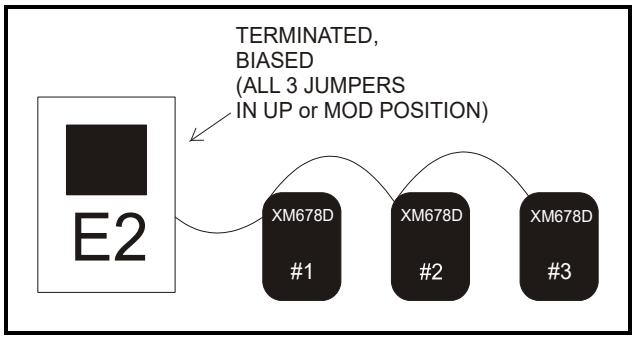


Figure 23-4 *- MODBUS Networking*

23.2. E2 Setup of Devices

23.2.1. Set Up Network Ports

Before setting up a device, the port on the E2 that has the MODBUS cable connected must be set up as a MODBUS port.

1. Log in to the E2 with Level 4 access.
2. Press Menu followed by & 7 # 3 ! 1 - **General Controller Info**.
3. Press Ctrl + # 3 to open the **Serial** tab of the General Controller Info setup screens:

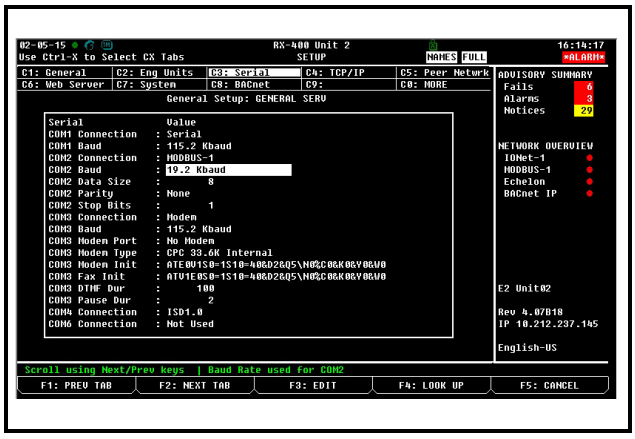


Figure 23-5 *- Serial Communications Manager Screen*

4. This screen will have a "Connection" field for all COM ports on the E2. Highlight the COM port connection field that will be used for the device, and press F4 - **LOOK UP**. From the list of network types, select **MODBUS**.
5. Four fields will become visible underneath the COM port connection field, which pertain to the way the device communicates:
   - **Baud -** Default setting is **19.2K**. The baud rate setting should be set to match the baud rate of the XM678D device (**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 value (**None**).
   - **Stop Bits -** Leave this field at the default value (**1**).
6. Press ↘ to save changes and exit.

23.2.2. Add and Connect the Device

To enable communications between E2 and the XM678D units, the devices must be added and addressed in E2.

1. Log in to the E2 with Level 4 access.
2. Press Menu & 7 & 7 @ 2 - **Connected I/O Boards and Controllers**.

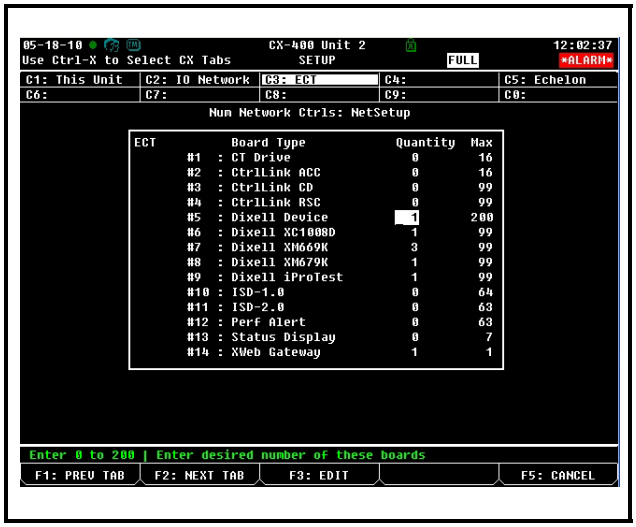


Figure 23-6 *- Num Network Ctrls: NetSetup Screen*

3. In the *Num Network Ctrls: NetSetup* screen, under the **ECT** tab, enter the number of devices in the **Quantity** field. (**Max** shows the maximum number of devices allowed on the network.)
4. Press ↘ to return to the *Network Setup* menu, then select ! 1 - **Network Summary**.
5. Locate the units you added to the network list (press Page Up and Page Down to scroll through the list). If desired, enter a new name for each device in the **Name** field.

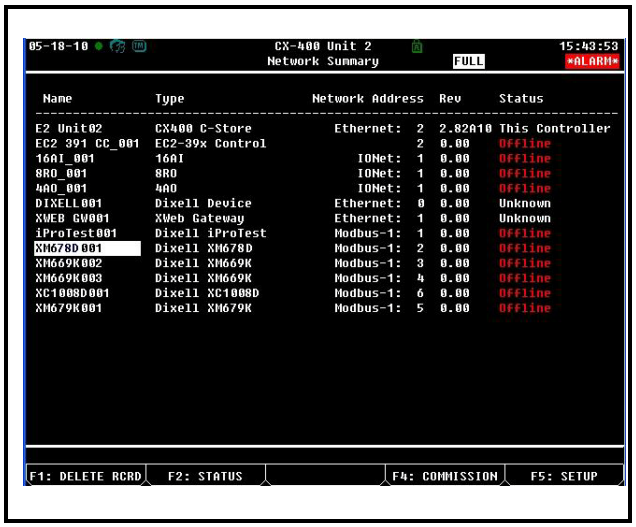


Figure 23-7 *- Network Summary Screen*

6. By default, each device in the network list has a board number of 0. To set the address and begin communication, choose the device and press F4. In the list of MODBUS devices, choose the address number corresponding to the XM678D address set up through the front display, and press Enter to select it. A window will open where you can specify the address of the controller. If a network ID has already been selected, its name will be shown next to the network ID in this list. If the network ID you are trying to assign has already been used, you must set the address on this device to a different number that is not being used.

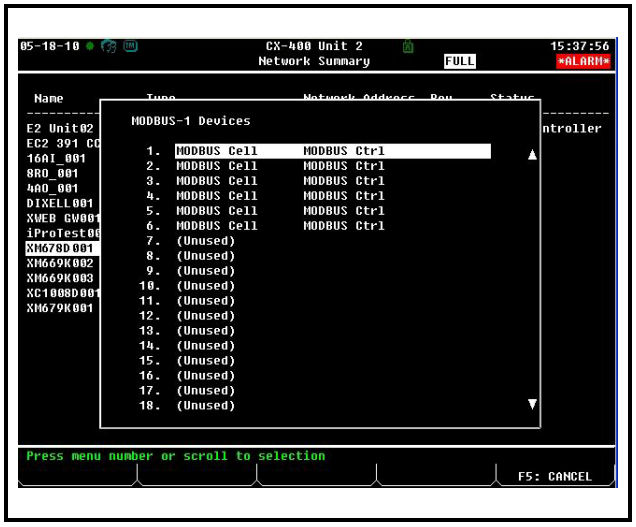


Figure 23-8 *- List of MODBUS Devices*

7. Repeat ***Steps 5*** and ***6*** until each device has a name and address.

8. When finished, press ESC to return to the *Network Setup* menu, then press 1 - **Network Summary** (***Figure 23-7***). Locate the devices you set up, and look at each device's status in the **Status** field. You will see one of the following messages:

   - ***Online*** - The device is communicating normally.
   - ***Offline*** - The device is not communicating, has not been commissioned, is not functional, or is not powered up. Verify the device is powered up, wired correctly, and has the proper network address, baud rate, and parity.
   - ***Unknown*** - The device is not communicating or has not been commissioned. Verify the device is powered up, wired correctly, and has the proper network address, baud rate, and parity.
   - ***No Port*** - No port is set up in the E2 Serial Configuration Manager to be a MODBUS port.
   - ***Wrong FW Rev*** - This message is likely caused by the device having a firmware version older than the minimum revision required by E2 for communication. Replace the device with a new one or a device that has the latest version of firmware on it.

Figure 23-9 *- Network Summary Screen*

23.3. Wiring Types

Emerson Retail Solutions specifies Belden #8761 shielded twisted pair cables for use as MODBUS wiring (or Belden #82761 and Belden #88761 for plenum installations).

For MODBUS network wiring of XM678D controllers to E2, Belden #8641 (*P/N 135-8641*) is the recommended wire type to use.

If the recommended cable is not available in your area, be sure the wiring meets or exceeds the following specs:

Shielded?	Yes
Conductor Type	Twisted Pair
Gauge	18 - 24 AWG
Capacitance between signal wires	31 pF/ft or less (9.45 m) or less
Capacitance between signal and shield	59 pF/ft or less (17.98 m) or less
Maximum Length	4000 ft/18 to 22 AWG (1219.2 m) 2500 ft/24 AWG (762 m)
Nominal Impedance	120W±50W

23.4. MODBUS Termination Blocks

Because the XM678D device has no on-board means of termination, use the MODBUS termination block (*P/N 535-2711*) for termination that can be wired to the end of the cable segment using the three-pin connector. Wire the two signal wires to the outside terminals, and connect the shield to pin 38 of the device, keeping the exposed shield wire length as short as possible (3 inches ideal maximum length).

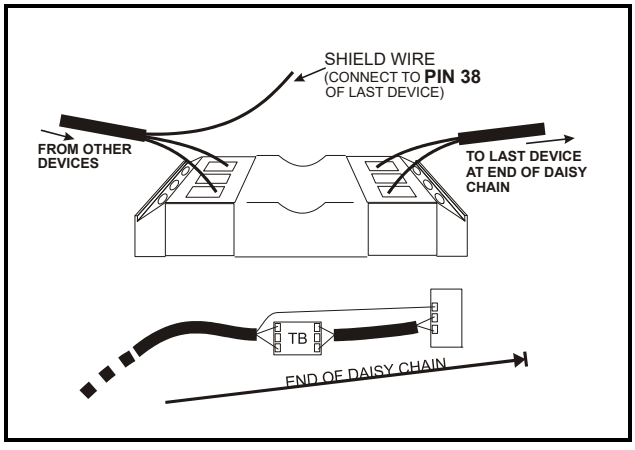


Figure 23-10 *- MODBUS Termination Block (P/N 535-2711)*

24 Default Parameter Map

The first column numbers are simple indexes not related to the position on the device menu. The total amount of parameters can be different depending on the applications. SUBMENUS: V1...V30 ELECTRONIC VALVE belongs to EEV.

<table>
<tr><th></th><th>Label</th><th>Value</th><th>Description</th><th>Range</th><th>Notes</th></tr>
<tr><td></td><td>EEU</td><td></td><td>ELECTRONIC VALVE</td><td></td><td>By pressing SET you can enter the electronic expansion valve submenu.</td></tr>
<tr><td></td><td>FtY</td><td>290</td><td>Kind of gas</td><td colspan="2">Type of gas used by plant. <u>Fundamental parameter for correct functioning of all system</u>.
<table>
<tr><th>LABEL</th><th>REFRIGERANT</th><th>OPERATING RANGE</th></tr>
<tr><td>R22</td><td>r22</td><td>-58 to 120°F/
-50 to 60°C</td></tr>
<tr><td>134</td><td>r134A</td><td>-58 to 120°F/
-50 to 60°C</td></tr>
<tr><td>290</td><td>r290 – Propane</td><td>-58 to 120°F/
-50 to 60°C</td></tr>
<tr><td>404</td><td>r404A</td><td>-94 to 120°F/
-70 to 60°C</td></tr>
<tr><td>47A</td><td>r407A</td><td>-58 to 120°F/
-50 to 60°C</td></tr>
<tr><td>47C</td><td>r407C</td><td>-58 to 120°F/
-50 to 60°C</td></tr>
<tr><td>47F</td><td>r407F</td><td>-58 to 120°F/
-50 to 60°C</td></tr>
<tr><td>410</td><td>r410A</td><td>-58 to 120°F/
-50 to 60°C</td></tr>
<tr><td>448</td><td>r448A</td><td>-69 to 120°F/
-45 to 60°C</td></tr>
<tr><td>449</td><td>r449A</td><td>-69 to 120°F/
-45 to 60°C</td></tr>
<tr><td>450</td><td>r450A</td><td>-69 to 120°F/
-45 to 60°C</td></tr>
<tr><td>507</td><td>r507</td><td>-94 to 120°F/
-70 to 60°C</td></tr>
<tr><td>513</td><td>r513A</td><td>-69 to 120°F/
-45 to 60°C</td></tr>
<tr><td>CO2</td><td>r744 - Co2</td><td>-58 to 120°F/
-50 to 60°C</td></tr>
</table></td></tr>
</table>

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	Atu	n	Minimum STABLE superheat search	No; Yes	This parameter enables the search of the minimum stable superheat. The lowest admitted value is LSH+2°C.
	AMS	n	Self adaptive SH regulation enabling	No; Yes	This parameter enables the self adaptive regulation of the superheat. CrE = no must to be set, when this function is enabled.
	SSH	9	Superheat setpoint	[1°F to 45°F] [0.1°C to 25.5°C]	This is the value used to regulate the superheat.
	Pb	36	Proportional band	[1°F to 108°F] [0.1°C to 60.0°C]	The valve changes its opening on the band **[SSH**, **SSH + Pb]**. At **SSH** value of superheat the valve will be at 0% (without integral contribution) and at **[SSH + Pb]** value of superheat the valve will be at **MnF**. For values bigger than **[SSH + Pb]** the valve is completely opened.
	rS	-3	Proportional band reset	[-12.0°C to 12.0°C]	It allows to move the regulation band, above or below the SH setpoint.
	inC	220	Integration time for superheat regulation	0 to 255s	-
	PEO	0	Valve opening in case of error on probes P5 or P6	0 to 100%	If a temporary probe error occurs, valve opening percentage is **PEo** until **PEd** time is elapsed.
	OPE	85	Start opening percentage for the time **SFD.** It's not limited by the **MnF** parameter.	0 to 100%	Opening valve percentage when the start function is active. This phase duration is **SFd** time.
	SFd	0.0	Duration of soft start phase with opening at **OPE**	0.0 to 42min00sec (252)	Set start function duration and post-defrost duration. **During this phase the alarms are neglected.** **Format**: min.10sec **Resolution**: 10sec
	OPd	85	Valve opening percentage during hot gas defrost. It's not limited by the **MnF** parameter.	0 to 100%	Opening valve percentage during hot gas defrost. During hot gas defrost there is no **SH** control.
	MnF	100	Maximum percentage of opening admitted (during normal functioning)	0 to 100%	During the regulation it sets the maximum valve opening percentage. This value is not used during the **SFd** phase (soft start) and during hot gas defrost, where the fixed percentage of the valve opening is set by **oPd**.

Table 24-1 *- Default Parameter Map*

<table>
<tr><th></th><th>Label</th><th>Value</th><th>Description</th><th>Range</th><th>Notes</th></tr>
<tr><td></td><td>Fot</td><td>nU</td><td>Manual opening</td><td>0 to 100%
nU</td><td>Allows the valve opening to force to the specified value. This value overwrites the one calculated by PID algorithm. CAUTION! It must be [Fot = nU] to have correct superheat regulation.</td></tr>
<tr><td></td><td>PA4</td><td>0</td><td>Probe value at 4mA or at 0V</td><td><table><tr><th>Meas Unit</th><th>Range</th></tr><tr><td rowspan="2">BAR</td><td>[PrU=rE]
-1.0 to P20</td></tr><tr><td>[PrU=Ab]
0.0 to P20</td></tr><tr><td rowspan="2">PSI</td><td>[PrU=rE]
-14 to P20</td></tr><tr><td>[PrU=Ab]
0 to P20</td></tr><tr><td rowspan="2">dKP</td><td>[PrU=rE]
-10 to P20</td></tr><tr><td>[PrU=Ab]
0 to P20</td></tr></table></td><td>Pressure value at 4mA for current probe [4 to 20mA] or value at 0V for ratiometric probes. The value is absolute or relative according to PrU parameter.</td></tr>
<tr><td></td><td>P20</td><td>200</td><td>Probe value at 20mA or at 5V</td><td><table><tr><th>Meas Unit</th><th>Range</th></tr><tr><td rowspan="2">BAR</td><td>[PrU=rE]
PA4 to 60.0</td></tr><tr><td>[PrU=Ab]
PA4 to 60.0</td></tr><tr><td rowspan="2">PSI</td><td>[PrU=rE]
PA4 to 870</td></tr><tr><td>[PrU=Ab]
PA4 to 870</td></tr><tr><td rowspan="2">dKP</td><td>[PrU=rE]
PA4 to 600</td></tr><tr><td>[PrU=Ab]
PA4 to 600</td></tr></table></td><td>Pressure value at 20mA for current probe [4 to 20mA] or value at 5V for ratiometric probes. The value is absolute or relative according to PrU parameter.</td></tr>
<tr><td></td><td>LPL</td><td>0</td><td>Lower Pressure Limit for superheat regulation</td><td>PA4 to P20</td><td>EXPERT: When the suction pressure goes down the lower bound LPL, superheat regulation will use a fixed pressure value. Otherwise, the normal pressure value will be used (according to PrU parameter).</td></tr>
<tr><td></td><td>MOP</td><td>100</td><td>Maximum operating pressure threshold and valve closing of dML value</td><td>LOP to P20</td><td>If the suction pressure exceeds the maximum operating pressure value, the device will signal this situation generating the MOP alarm (according to PrU parameter).</td></tr>
</table>

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	LOP	0	Minimum operating pressure threshold and valve opening of **dML** value	PA4 to MOP	If the suction pressure exceeds the minimum operating pressure value, the device will signal this situation generating the **LOP** alarm (according to **PrU** parameter).
	dML	30	Delta **[MOP - LOP]**	0 to 100%	Until the **MOP** alarm is active, the valve will close, every second, of a value equal to the **dML** percentage. Until the **LOP** alarm is active, the valve will open, every second, to a value equal to the **dML** percentage.
	MSH	144	Maximum superheat alarm threshold	[LSH to 144°F] [LSH to 80.0°C]	If the superheat value exceeds **MSH** value, the display will show the **MSH** message until the delay time **SHd** expires.
	LSH	3	Minimum superheat alarm threshold	[0°F to MSH] [0.0°C to MSH]	If the superheat value is lower than **LSH** during the **SHd** delay time, then the display will show the message **LSH**. **As soon as the superheat value is lower than LSH value, the valve will close immediately, without waiting the SHd delay time (to avoid evaporator flooding).**
	SHY	1	Hysteresis for superheat alarm recovery **[MSH – SHY]** and **[LSH + SHY]**	[1°F to 45°F] [0.1°C to 25.5°C]	-
	SHd	0.0	Delay of superheat alarm signaling	0.0 to 42min00sec (252)	If a superheat alarm occurs, the delay time **SHd** expires before the controller shows an alarm. **Format**: min.10sec **Resolution**: 10sec
	FrC	0	Integration additive constant (Fast-recovery)	0 to 100s	It permits to decrease faster the integral action when **SH** value is below the setpoint. With higher values the valve closes faster. If **[FrC = 0]** fast recovery function is disabled.
	Sub	10	Number of pressure values used to calculate the average pressure	0 to 100	It uses the last average values of the pressure to calculate the superheat.
	SLb	0	Reaction Time	0 to 255s	0 = controller calculates automatically the time to update the valve position. 1 to 255s = controller updates valve position every SLb seconds
	tEP	nU	Predefined valve selection	nU to 10	**nU** = manual setting See **Section 6.4.,** ***Valve Connections and Configuration***

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	tEU	bP	Kind of valve	uP; bP	**uP** = unipolar valve (5-6 wires) **bP** = bipolar valve (4 wires)
	HSF	FUL	Kind of motor movement	HAF; FUL	**HAF** = half step. Use this setting for the unipolar valve. **FUL** = half step. Use this setting for the bipolar valve.
	LSt	0	Minimum number of steps where the valve can be considered as completely closed	0 to USt (* 10)	For manual adjusting of the valve.
	USt	0	Maximum number of steps that can be performed	LSt to 800 (* 10)	For manual adjusting of the valve.
	ESt	0	Extra steps in closing phase	0 to 255 (*10)	Extra steps done by the valve during closing phase to assure the valve closes completely.
	Sr	10	Step rate: the speed to change step. A too high value causes incorrect driving	10 to 600 (steps/sec)	For manual adjusting of the valve.
	CPP	0	Current per phase during bipolar valve driving	0 to 100 (* 10mA)	For manual adjusting of the valve.
	CHd	0	Current per phase to maintain the actual position (Holding current)	0 to 100 (* 10mA)	For manual adjusting of the valve.
	GtH	0	Auto zero function	0 to 15h	To prevent any possible wrong position caused by a long period without closing the valve, the controller after **gtH** hours, as soon as the opening open percentage is under 20%, will force complete closer of the valve, and then will restart working.
REGULATION					
	SET	-5.0	Setpoint	LS to US	Target setpoint for temperature regulation.
	HY	18	Differential	[1°F to 45°F] [0.1°C to 25.5°C]	If **[CrE = n]** then **HY** is the hysteresis for ON/OFF thermoregulation. If **[CrE = Y]** or **[CrE = EUP]** then **HY** is the proportional band for temperature PI controller. On these cases the value should be greater than 5°C.

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
❄	int	220	Integral time for room temperature regulation	0 to 255s	This value is used only when **[CrE = Y]** or **[CrE = EUP]**. It is the integral time for thermoregulation: high values mean slower regulation. **0 (zero)** = no integral action
❄	CrE	Y	Continuous regulation activation	n(0); Y(1); EUP(2)	With **[CrE = Y]** or **[CrE = EUP]**, the regulation becomes **PI**, **HY** becomes a band and **int** an integral time. **n** = standard regulation **Y** = continuous regulation, to be used only in centralized plants **EUP** = evaporator valves (See **Section 19.2., *Standard Regulation and Continuous Regulation***)
❄	LS	-50	Minimum setpoint	[-67°F to **SET**] [-55.0°C to **SET**]	Sets the minimum acceptable value for the setpoint.
❄	US	70	Maximum setpoint	[**SET** to 302°F] [**SET** to 150.0°C]	Sets the maximum acceptable value for the setpoint.
❄	odS	0	Outputs activation delay at start up	0 to 255min	This function is enabled at the initial startup of the device and inhibits any output activation for the period of time set in this parameter *(AUX and Light can work)*.
❄	AC	0	Anti-short cycle delay	0 to 60min	Interval between the solenoid valve stop and the following restart.
❄	CCt	0.0	Continuous cycle duration	0.0 to 24h00min (144)	**Compressor ON time during continuous cycle:** Allows the length of the continuous cycle to set: compressor stays ON without interruption for the **CCt** time. It can be used, for instance, when the room is filled with new products. **Format**: hours.10min **Resolution**: 10min
❄	CCS	36	Continuous cycle setpoint	[-67°F to 302°F] [-55.0°C to 150.0°C]	**Setpoint for continuous cycle:** value used during the continuous cycle.
❄	Con	15	Compressor ON time with faulty probe	0 to 255min	**Solenoid valve ON time with faulty probe:** Time during which the solenoid valve is ON in case of faulty thermostat probe. With **COn = 0**, solenoid valve is always OFF.
❄	CoF	30	Compressor OFF time with faulty probe	0 to 255min	**Solenoid valve OFF time with faulty probe:** Time during which the solenoid valve is OFF in case of faulty thermostat probe. With **COF = 0**, solenoid valve is always ON.

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	CF	°F	Temperature measurement unit	°F(1); °C(0)	**°F** = Fahrenheit. **°C** = Celsius; *CAUTION! When the measurement unit changes, **all parameters** with temperature values **will have to be checked**.*
❄	PrU	rE	Pressure Mode	rE(0); Ab(1)	Defines the mode to evaluate the pressure values. *CAUTION! **PrU** value is used for all the pressure parameters. If **[PrU = rE]**, all pressure parameters are in relative pressure unit, if **[PrU = Ab]**, all pressure parameters are in absolute pressure unit.*
	PMU	PSI	Pressure measurement unit	bAr(0); PSI(1); MPA(2)	Selects the pressure measurement units. **MPA** means the value of pressure measured by kPA*10.
	PMd	PrE	Pressure probe visualization	tEM, PrE	Selects the visualization of pressure probe (P5): **tEM** = temperature; **PrE** = pressure
	rES	dE	Resolution (only °C)	dE; in	Sets decimal point display. **in** = 1°C; **dE** = 0.1°C.
	Lod	tEr	Local display: default display	nP(0); P1(1); P2(2); P3(3); P4(4); P5(5); P6(6); tEr(7); dEF(8)	Selects which probe is displayed by the instrument. **nP** = no probe; **P1, P2, P3, P4**, **P5**, **P6**, **tEr =** virtual probe for thermostat; **dEF =** virtual probe for defrost.
	rEd	tEr	Remote display: default display	nP(0); P1(1); P2(2); P3(3); P4(4); P5(5); P6(6); tEr(7); dEF(8)	It selects which probe is displayed by the X-REP. **nP** = no probe; **P1, P2, P3, P4**, **P5**, **P6**, **tEr =** virtual probe for thermostat; **dEF =** virtual probe for defrost.
	dLY	0.0	Display delay	0.0 to 24h00min (144)	When the temperature changes, the display is updated of 1°F/1°C when the delay time expires. **Format**: min.10sec **Resolution**: 10sec
❄	rPA	P1	Regulation probe A	nP(0); P1(1); P2(2); P3(3); P4(4); P6(5)	First probe used to regulate room temperature. If **[rPA = nP]**, the regulation is performed with the real value of **rPb**.
❄	rPb	nP	Regulation probe B	nP(0); P1(1); P2(2); P3(3); P4(4); P6(5)	Second probe used to regulate room temperature. If **[rPb = nP]**, the regulation is performed with the real value of **rPA**.

***Table 24-1** - Default Parameter Map*

	Label	Value	Description	Range	Notes
❄	rPE	100	Virtual probe percentage (room temperature)	0 to 100%	Defines the percentage of the **rPA** with respect to **rPb**. The value used to regulate the room temperature is obtained by: value_for_room = (rPA*rPE + rPb*(100-rPE))/100
DEFROST					
❄	dPA	P2	Defrost probe A	nP(0); P1(1); P2(2); P3(3); P4(4); P6(5)	First probe used for defrost. If **[dPA = nP]**, the regulation is performed by time.
❄	dPb	nP	Defrost probe B	nP(0) - P1(1) - P2(2) - P3(3) - P4(4) - P5(5)	Second probe used for defrost. If **[dPb = nP]**, the regulation is performed with **dPA**.
❄	dPE	100	Percentage of the first defrost probe	0 to 100 (100=dPA, 0=dPb)	Defines the percentage of the **dPA** with respect to **dPb**. The value used to regulate room temperature is obtained by: value_for_defrost= (dPA*dPE + dPb*(100-dPE))/100
❄	tdF	EL	Defrost kind	EL; in	**EL** = defrost with electrical heater **in** = hot gas defrost *NOTE: The valve opening percentage during the defrost is set by the parameter oPd.*
❄	Srt	302	Heater setpoint during defrost	[-67°F to 302°F] [-55.0°C to 150°C]	If **tdF=EL** during the defrost the defrost relay perform an ON/OFF regulation with **Srt** as set point.
❄	Hyr	4	Differential for heater	[1°F to 45°F] [0.1°C to 25.5°C]	If the defrost probe temperature is bigger than **Srt** for all **tod** time, the defrost ends although the defrost probe temperature is lower than **dtE** or **dtS**. It permits to reduce defrost duration.
❄	tod	255	Time out for heater	0 to 255min	If the difference between the two defrost probes stays lower than **dtP** for all **ddP** time the defrost is activated;
❄	dP2	n	Defrost with two probes	n(0) – Y(1)	**n**= only the **dPA** probe is used to defrost management; **Y**= defrost is managed with **dPA** probe and **dPb** probe. Defrost can performed only if both probe value are lower than **dtE** for **dPA** probe and **dtS** for **dPb** probe
❄	dtE	46	End defrost temperature on probe A (**dPA**)	[-67°F to 122°F] [-55.0°C to 50.0°C]	Set the temperature measured by the evaporator probe **dPA** which stops the defrost. *Parameter enabled only when the evaporator probe is present.*
❄	dtS	46	Defrost termination temperature (Probe B)	[-67°F to 122°F] [-55.0°C to 50.0°C]	(Enabled only when the evaporator probe is present) Sets the temperature measured by the evaporator probe **dPb** resulting to end of defrost.

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
❄	idF	6	Defrost interval	0 to 120hours	Sets the time interval between the beginning of two defrost cycles. **[idF = 0]:** the defrost can only be activated manually, or through RS485 or from an external contact or from the LAN.
❄	MdF	45	(Maximum) defrost duration	0 to 255min	When **dPA** is not present, it sets the defrost duration, otherwise it sets the maximum duration for defrost.
❄	dSd	0	Defrost start delay after request	0 to 255min	Useful when different defrost start times are necessary to avoid overloading the plant.
❄	dFd	it	Display during defrost	rt; it; SEt; dEF	**rt** = real temperature for **Lod** probe **it** = initial temperature (reading when defrost start) **SEt** = setpoint value **dEF** = "dEF" label is visualized
❄	dAd	30	Display delay	0 to 255min	Set the maximum time between the end of defrost and the restarting of the real room temperature display.
❄	Fdt	0	Drain downtime after defrost	0 to 255min	Time interval between reaching the defrost termination temperature and the restoration of the control's normal operation. This time allows the evaporator to eliminate water drops that might have formed due to defrost. The fan and the thermoregulation outputs are OFF during this time.
❄	dPo	n	Defrost at power ON	n; Y	First defrost after startup: **Y** = immediately **n** = after the **idF** time
❄	dAF	0.0	Defrost delay after continuous cycle	0.0 to 24h00min (144)	Time interval between the end of the fast freezing cycle and the following defrost related to it. **Format**: hours.10min **Resolution**: 10min
FAN					
✣	FPA	P2	Fan probe A	nP(0); P1(1); P2(2); P3(3); P4(4); P6(5)	First probe used for fan. If **[FPA = nP]**, the regulation is performed with real value of **FPb**.
✣	FnC	O-n	Fan operating mode	C-n; C-Y; O-n; O-Y	**C-n** = running with the solenoid valve, OFF during the defrost **C-Y** = running with the solenoid valve, ON during the defrost **O-n** = continuous mode, OFF during the defrost **O-Y** = continuous mode, ON during the defrost

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	Fnd	1	Fan delay after defrost	0 to 255min	Time interval between the ending of defrost and the starting of the evaporator fans.
	FCt	10	Temperature differential to avoid short cycles of fans	[0°F to 90°F] [0.0°C to 50.0°C]	If the difference of temperature between the evaporator and the room probes is more than the value of the **FCt** parameter, the fans will start.
	FSt	99	Fan stop temperature	[-67°F to 122°F] [-55.0°C to 50.0°C]	Evaporator probe temperature above which the fan is always OFF.
	FHY	2	Fan stop differential	[1°F to 45°F] [0.1°C to 25.5°C]	When stopped, the fan restarts when the fan probe reaches **[FSt – FHY]** value of temperature.
	tFE	n	Fan thermostat during defrost	n; Y	**n** = fan follows **FnC** setting during defrost without temperature control **y** = fan follows **FnC** setting during defrost with **FSt** temperature control
	Fod	0	Fan activation time after defrost (without compressor)	0 to 255min	Forces fan activation for the indicated time.
	Fon	0	Fan ON time	0 to 15min	With **[FnC = C-n** or **C-Y]** (fan activated in parallel with compressor), it sets the evaporator fan ON cycling time when the compressor is OFF. With [**Fon = 0]** and [**FoF ≠ 0]**, the fan is always OFF. With [**Fon = 0]** and [**FoF = 0]**, the fan is always OFF.
	FoF	0	Fan OFF time	0 to 15min	With **[FnC = C-n** or **C-Y]** (fan activated in parallel with compressor), it sets the evaporator fan OFF cycling time when the compressor is OFF. With **[Fon = 0]** and **[FoF ≠ 0]**, the fan is always OFF. With **[Fon = 0]** and **[FoF = 0]**, the fan is always OFF.
	trA	UAL	Kind of PWM regulation	UAL; rEG; AC	PWM output if **CoM** value is different from **OA7**. **UAL** = the output is at **FSA** value (manual value). **rEG** = the output is regulated with fan algorithm described in fan section. **AC** = anti-sweat heaters control (require XWEB5000 system).
	SOA	0	Manual value of the analog output	AMi to AMA	Value for the output if **[trA = UAL]** (0 to 100%).
	SdP	55	Default Dewpoint value (or safety value in case of XWEB link lost)	[-67°F to 122°F] [-55.0°C to 50.0°C]	Default value of dewpoint used when there is no supervising system (XWEB5000). Used only if **[trA = AC]**.

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	ASr	1	Differential for fan/offset for anti-sweat heater	[-45°F to 45°F] [-25.5°C to 25.5°C]	**trA = AC:** dewpoint offset. **trA = rEG:** differential for modulating fan regulation.
	PbA	10	Proportional band for modulating output	[1°F to 45°F] [0.1°C to 25.5°C]	Differential for anti-sweat heaters
	AMi	0	Minimum output for modulating output	0 to AMA	Minimum value for analog output: (0 to **AMA**)
	AMA	100	Maximum output for modulating output	AMi to 100	Maximum value for analog output: (**AMi** to 100)
	AMt	20	Time with fan at maximum speed or ON time for relay on anti-sweat regulation	[10 to 60s] or [10 to 60min]	**trA = AC:** Anti-sweat heaters cycle period. **trA = rEG:** Time with fan at maximum speed. The fan works at maximum speed during this time. If intended for fan, time is based in seconds; for anti-sweat regulation, the time is based in minutes.
ALARM					
	rAL	tEr	Probe for room temperature alarm	nP; P1; P2; P3; P4; P6; tEr	Selects the probe used to signal the alarm temperature.
	ALC	Ab	Room temperature alarm configuration: relative to setpoint or absolute	rE; Ab	**rE** = High and Low alarms related to the setpoint. **Ab** = High and Low alarms related to the absolute temperature.
	ALU	41	High room temperature alarm setting	[0.0°C to 32.0°C] or [ALL to 150.0°C]	**ALC = rE:** [32°F to 90°F] or [0.0°C to 32 °C] **ALC = Ab:** [**ALL** to 302°F] or [**ALL** to 150°C] When this temperature is reached and the **ALd** delay time is expired, the **HA** alarm will be enabled.
	ALL	-25	Low room temperature alarm setting	[0.0°C to 50.0°C] or [-55.0°C to ALU]	**ALC = rE:** [32°F to 90°F] or [0.0°C to 32.0°C] **ALC = Ab:** [-67.0°F to **ALU**] or [-55.0°C to **ALU**] After this temperature is reached and the **ALd** delay time is expired, the **LA** alarm will be enabled.
	AHY	2	Differential for room temperature alarm	[1°F to 45°F] [0.1°C to 25.5°C]	Threshold recovery after a temperature alarm.
	ALd	60	Room temperature alarm delay	0 to 255min	Time interval between the detection of an alarm condition and the corresponding alarm signaling.

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
(!)	dAo	0.0	Delay of temperature alarm at start-up	0.0 to 24h00min	After powering the device: time interval between the detection of the temperature alarm condition and the alarm signaling. **Format:** hours.10min **Resolution:** 10min
(!)	EdA	30	Alarm delay at the end of defrost	0 to 255min	At the end of the defrost cycle: time interval between the detection of the temperature alarm condition and the alarm signaling.
(!)	dot	15	Temperature alarm exclusion after door open	0 to 255min	-
(!)	Sti	nU	Stop regulation interval	0.0 to 24h00min; nU	After regulating continuously for **Sti** time, the valve closes for **Std** time to prevent ice from forming. **Format:** hours.10min **Resolution:** 10min
(!)	Std	1	Stop duration	1 to 255min	Defines the stop regulation time after **Sti**. During this interval, the display shows **StP** message.
(!)	tbA	n	Silencing alarm relay by pressing a key	n; Y	-
OUTPUT CONFIGURATION					
	OA1	CPr	Relay on terminals 11-12 configuration	nU; CPr; dEF; FAn; ALr; LiG; AUS; db; onF; AC	**nU** = not used; **CPr** = compressor/ valve; **dEF** = defrost; **FAn** = Fan; **ALr** = Alarm; **LiG** = Light; **AUS** = auxiliary; **db** = heater for neutral zone (not available with **CrE = Y**); **onF** = ON/OFF; **AC** = anti-sweat; **E3r**: solenoid valve for EX3 or for mechanical solenoid valve
	OA6	AUS	Relay on terminals 17-18 configuration	nU; CPr; dEF; FAn; ALr; LiG; AUS; db; onF; AC	**nU** = not used; **CPr** = compressor / valve; **dEF** = defrost; **FAn** = Fan; **ALr** = Alarm; **LiG** = Light; **AUS** = auxiliary; **db** = heater for neutral zone (not available with **CrE = Y**); **onF** = ON/OFF; **AC** = anti-sweat; **E3r**: solenoid valve for EX3 or for mechanical solenoid valve
	OA7	nU	Relay on terminals	nU; CPr; dEF; FAn; ALr; LiG; AUS; db; onF; AC	**nU** = not used; **CPr** = compressor/ valve; **dEF** = defrost; **FAn** = Fan; **ALr** = Alarm; **LiG** = Light; **AUS** = auxiliary; **db** = heater for neutral zone (not available with **CrE = Y**); **onF** = ON/OFF; **AC** = anti-sweat; **E3r**: solenoid valve for EX3 or for mechanical solenoid valve

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	CoM	tEn	Modulating output configuration	PM5; PM6; OA7; CUr; tEn	**For models with PWM/ O.C. output:** **PM5** = PWM 50Hz **PM6** = PWM 60Hz **OA7** = two state, it can be used as an open collector output. **For models with [4 to 20mA] or [0 to 10V] output:** **Cur** = 4 to 20mA current output. **tEn** = 0 to 10V voltage output.
	AOP	CL	Alarm relay polarity	OP; CL	**CL** = normally closed **OP** = normally opened
	iAU	n	Auxiliary output independent from ON/OFF state	n; Y	**n** = if the instrument is switched off also the auxiliary output is switched off. **Y** = the auxiliary output state is unrelated to the ON/OFF device status.
DIGITAL INPUTS					
	i1P	CL	Digital input 1 polarity	OP; CL	**CL** = the digital input is activated by closing the contact. **OP** = the digital input is activated by opening the contact.
	i1F	dor	Digital input 1 configuration	EAL; bAL; PAL; dor; dEF; AUS; LiG; OnF; Htr; FHU; ES; HdY	**EAL** = external alarm; **bAL** = serious external alarm; **PAL** = pressure switch activation; **dor** = door open; **dEF** = defrost activation; **AUS** = auxiliary activation; **LiG** = light activation; **OnF** = switch on/off the instrument; **Htr** = change type of action; **FHU** = not used; **ES** = activate energy saving; **HdY** = activate holiday function
	d1d	15	Digital input 1 activation delay	0 to 255min	When **[i1F** = **PAL]**: time interval to calculate the number of the pressure switch activation. When **[i1F = EAL** or **bAL]** (external alarms): **d1d** parameter defines the time delay between the detection and the successive signaling of the alarm. When **[i1F = dor]**: this is the delay to activate door open alarm.
	i2P	CL	Digital input 2 polarity	OP; CL	**CL =** the digital input is activated by closing the contact. **OP** = the digital input is activated by opening the contact.

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	i2F	LiG	Digital input 2 configuration	EAL; bAL; PAL; dor; dEF; AUS; LiG; OnF; Htr; FHU; ES; HdY	**EAL** = external alarm; **bAL** = serious external alarm; **PAL** = pressure switch activation; **dor** = door open; **dEF** = defrost activation; **AUS** = auxiliary activation; **LiG** = light activation; **OnF** = switch on/off the instrument; **Htr** = change type of action; **FHU** = not used; **ES** = activate energy saving; **HdY** = activate holiday function.
	d2d	5	Digital input 2 activation delay	0 to 255min	When **[i2F** = **PAL]**: time interval to calculate the number of the pressure switch activation. When **[i2F = EAL** or **bAL]** (external alarms): **d2d** parameter defines the time delay between the detection and the successive signaling of the alarm. When **[i2F = dor]**: this is the delay to activate door open alarm.
	i3P	CL	Digital input 3 polarity	OP; CL	**CL** = the digital input is activated by closing the contact. **OP** = the digital input is activated by opening the contact.
	i3F	ES	Digital input 3 configuration	EAL; bAL; PAL; dor; dEF; AUS; LiG; OnF; Htr; FHU; ES; HdY	**EAL** = external alarm; **bAL** = serious external alarm; **PAL** = pressure switch activation; **dor** = door open; **dEF** = defrost activation; **AUS** = auxiliary activation; **LiG** = light activation; **OnF** = switch on/off the instrument; **Htr** = change type of action; **FHU** = not used; **ES** = activate energy saving; **HdY** = activate holiday function.
	d3d	0	Digital input 3 activation delay	0 to 255min	When **[i3F** = **PAL]**: time interval to calculate the number of the pressure switch activation. When **[i3F = EAL** or **bAL]** (external alarms): **d3d** parameter defines the time delay between the detection and the successive signaling of the alarm. When **[i3F = dor]**: this is the delay to activate door open alarm.
	nPS	15	Number of pressure switch activations before lock	0 to 15	Number of pressure switch activation, during the **d1d**, **d2d** and **d3d** interval, before signaling the alarm event **[i1F, i2F or i3F = PAL]**. If the **nPS** activation in the **d1d, d2d or d3d** time is reached, switch off and on the instrument to restart normal regulation.

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	OdC	F-C	Compressor and fan status with door open	no; FAn; CPr; F-C	**no** = normal; **Fan** = Fan OFF; **CPr** = Compressor OFF; **F_C** = both Compressor and Fan OFF
	rrd	15	Output restart delay with door open	0 to 255min	The outputs stopped by the **OdC** parameter can restart after the **rrd** time.
ENERGY SAVING					
	ESP	P1	Energy saving probe selection	nP; P1; P2; P3; P4; P6; tEr	-
	HES	0	Temperature increasing during Energy Saving	[-54°F to 54°F] [-30.0°C to 30.0°C]	Sets the increasing value of the setpoint during the Energy Saving cycle.
	PEL	nU	Energy saving activation when Light or/and AUX are switched OFF	nU(0); LIG(1); AUS(2); LEA(3)	Energy saving enabled when: **LiG**: light switched OFF **AUS**: AUX switched OFF **LEA**: both light and AUX switched OFF **nU**: function not used
LAN MANAGEMENT					
	LMd	Y	Defrost Synchronization	n; Y	**n** = the section does not send a global defrost command. **Y** = the section sends a command to start defrost to other controllers.
	dEM	Y	Defrost end Synchronization	n; Y	**n** = the end of the LAN defrosts are independent. **Y** = the end of the LAN defrosts are synchronized.
	LSP	n	LAN setpoint Synchronization	n; Y	**n** = the setpoint value is modified only in the local section. **Y** = the section setpoint, when modified, is updated to the same value on all the other sections.
	LdS	n	LAN Display Synchronization (temperature sent via LAN)	n; Y	**n** = the setpoint value is modified only in the local section. **Y** = the value displayed by the section is sent to all the other sections.
	LOF	n	LAN ON/OFF Synchronization	n; Y	This parameter indicates if the ON/OFF command of the section will act also on all the other sections: **n** = the ON/OF command acts only in the local section. **Y** = the ON/OFF command is sent to all the other sections.
	LLi	Y	LAN Light Synchronization	n; Y	This parameter indicates if the light command of the section will act also on all the other sections: **n** = the light command acts only in the local section. **Y** = the light command is sent to all the other sections.

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	LAU	n	AUX Synchronization	n; Y	This parameter indicates if the AUX command of the section will act also on all the other sections: **n** = the light command acts only in the local section. **Y** = the light command is sent to all the other sections.
	LES	n	Energy Saving Synchronization	n; Y	This parameter indicates if the energy saving command of the section will act also on all the other sections: **n** = the Energy Saving command acts only in the local section. **Y** = the Energy Saving command is sent to all the other sections.
	LSd	n	Remote probe displaying	n; Y	This parameter indicates if the section has to display the local probe value or the value coming from another section: **n** = the displayed value is the local probe value. **Y** = the displayed value is from another section (which has parameter **LdS = Y**).
	LPP	n	Pressure probe through the LAN	n; Y	**n =** the value of pressure probe is read from the local probe. **Y =** the value of pressure probe is sent via LAN.
	LCP	n	Probe 4 through the LAN	n; Y	
	StM	n	Cooling request from the LAN enables compressor relay	n; Y	**n =** not used. **Y =** a generic cooling request from the LAN activates the solenoid valve connected to compressor relay.
	ACE	n	Cooling request from the LAN enable even if compressor is stopped by door switch	n; Y	**n =** not used. **Y =** a generic cooling request from the LAN activates the solenoid valve connected to compressor relay.
PROBE CONFIGURATION NTC (10KΩ a 25°C), PtC (806Ω a 0°C)					
	P1C	ntC	P1 configuration	nP; PtC; ntC; CtC; PtM	**nP** = not present; **PtC** = Ptc; **ntC** = ntc; **CtC** = ntc US; **PtM** = Pt1000
	Ot	0	P1 calibration	[-12.0°C to 12.0°C]	Allows possible offset of the thermostat probe to adjust.
	P2C	CtC	P2 configuration	nP; PtC; ntC; CtC; PtM	**nP** = not present; **PtC** = Ptc; **ntC** = ntc; **CtC** = ntc US; **PtM** = Pt1000
	oE	0	P2 calibration	[-12.0°C to 12.0°C]	Allows possible offset of the evaporator probe to adjust.
	P3C	nP	P3 configuration	nP; PtC; ntC; CtC; PtM	**nP** = not present; **PtC** = Ptc; **ntC** = ntc; **CtC** = ntc US; **PtM** = Pt1000

Table 24-1 *- Default Parameter Map*

	Label	Value	Description	Range	Notes
	O3	0	P3 calibration	[-12.0°C to 12.0°C]	Allows possible offset of the probe 3 to adjust.
	P4C	nP	P4 configuration	nP; PtC; ntC; CtC; PtM; LAN	**nP** = not present; **PtC** = Ptc; **ntC** = ntc; **CtC** = ntc US; **PtM** = Pt1000; **LAN** = value received from master
	O4	0	P4 calibration	[-12.0°C to 12.0°C]	Allows possible offset of the probe 4 to adjust.
	P5C	5Vr	P5 configuration	nP; PtC; ntC; CtC; PtM; 420; 5Vr; LAN	**nP** = not present; **PtC** = Ptc; **ntC** = ntc; **CtC** = ntc US; **PtM** = Pt1000; **420** = 4 to 20mA; **5Vr** = 0 to 5V ratiometric; **LAN** = value received from master
	o5	0	P5 calibration	[-12.0°C to 12.0°C]	Allows possible offset of the probe 5 to adjust.
	P6C	CtC	P6 configuration	nP; PtC; ntC; CtC; PtM	**nP** = not present; **PtC** = Ptc; **ntC** = ntc; **CtC** = ntc US; **PtM** = Pt1000.
	o6	0	P6 calibration	[-12.0°C to 12.0°C]	Allows possible offset of the probe 6 to adjust.
SERVICE					
	CLt	- - -	ON/OFF percentage (C.R.O.)	(read only)	Shows the effective cooling time calculated by XM600 during regulation (cooling time percentage).
	tMd	- - -	Time remaining before the next defrost activation (only for interval defrost)	(read only)	Shows the time before the next defrost when interval defrost is selected.
	LSn	Auto	Number of devices in the LAN	1 to 8 (read only)	Shows the number of sections available in the LAN.
	LAn	Auto	List of address of the LAN devices	1 to 247 (read only)	Identifies the device address (**1 to LSn**) inside the local network of multiplexed cabinet controller.
	Adr	1	MODBUS address	1 to 247	Identifies the device address when connected to a MODBUS compatible monitoring system.
	br	96	Baud rate	96, 192	Baud rate selection.
	rEL	2.5	Firmware release	(read only)	Microprocessor firmware release.
	Ptb	- - -	Parameter table	(read only)	Shows the original code of the parameter map.
	Pr2	- - -	Pr2 menu access	(read only)	Access to the protected parameter list.

Table 24-1 *- Default Parameter Map*

25 XM678D Controller Association and Replacement Procedure

24.1. Overview

The XM678D controller version 2.5 can be associated with a Case Control Circuit application in E2 to provide the XM678D with the information necessary to synchronize Defrost, Lights, and Case Setpoint.

Only the information listed below is shared between the Case Control Circuit application and the XM678D applications. All other configuration must be done in the XM678D applications, especially for Defrost Duration, Defrost Wait Time, Defrost Termination, and Alarming.

24.2. Case Circuit Output Connections

The Case Control Circuit application uses pointer connections to send the Case Setpoint, Lights ON/OFF command, Start Defrost command, Active Dewpoint, and Rack Fail shutdown information to the XM678D. See ***Figure 24-5*** and ***Figure 24-6*** for example pointer connections of: ACTIVE SETPT, LIGHTS, START DEFR OUT, DEW POINT OUT, and RACK FAIL INV.

24.3. Defrost Synchronization

START DEFR OUT connection allows synchronization of the defrost of the XM678Ds associate with the circuit using the Defrost Schedule times under the "Defr Times" tab of the circuit. *Note: The Circuit information under the "Defrost" tab is NOT shared with the XM678Ds.*

24.4. Case Circuit Input Connections

The Case Control Circuit application uses pointer connections to display the Case Temp, Defrost Status, and Refrigeration Status information from the XM678D. See ***Figure 24-7*** and ***Figure 24-8*** for example pointer connections of: CASE TEMP, CASE DEFR STATUS, and CASE REFR STATUS.

24.4.1. Associating the XM678D with Case Control Circuit in E2

NOTE: This applies only to XM678D controllers version 2.5.

5. 1. Add and commission the XM678D controller in E2. From the E2 controller, press Menu & 7 & 7 @ 2 and then add the XM678D controller under the C3: ECT tab. Commission the device from the Network Summary screen and configure device address, MODBUS port, etc.
6. Create a Case Control Circuit application in E2. Press Menu & 7 & 7 $ 4 (Controller Associations), and select Case Control Circuit.

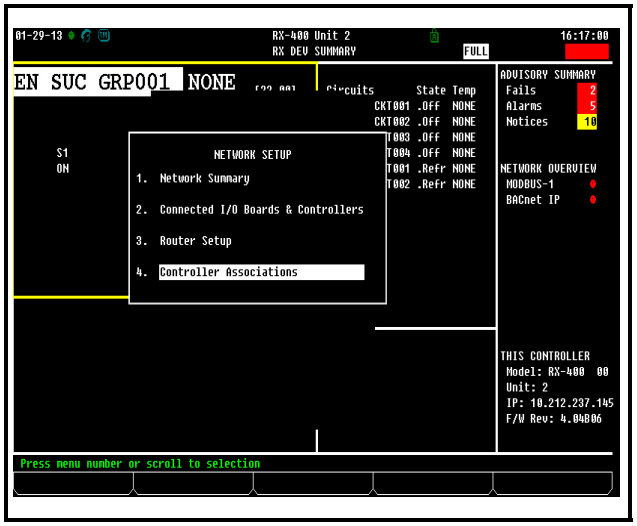


Figure 24-1 - *Network Setup Menu*

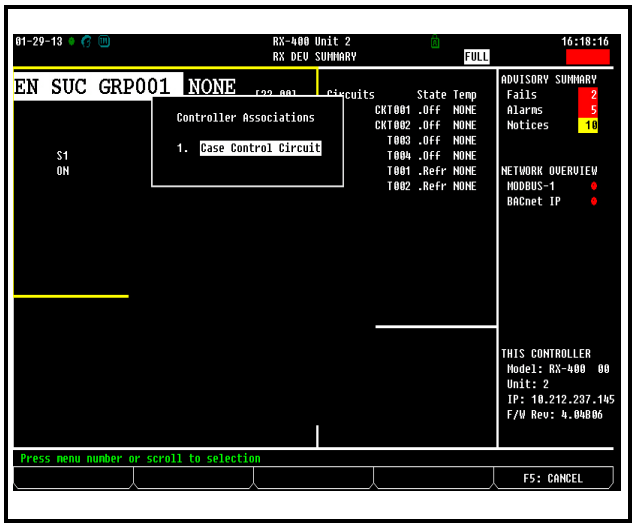


Figure 24-2 *- Controller Associations List*

7. Scroll to the field of the XM678D device that will be associated with the Case Control Circuit, press F4 (LOOK UP), and select the circuit.

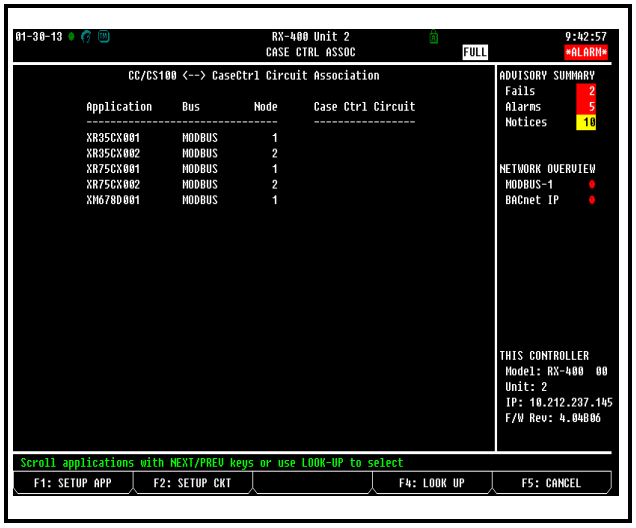


Figure 24-3 *- Case Control Association Screen*

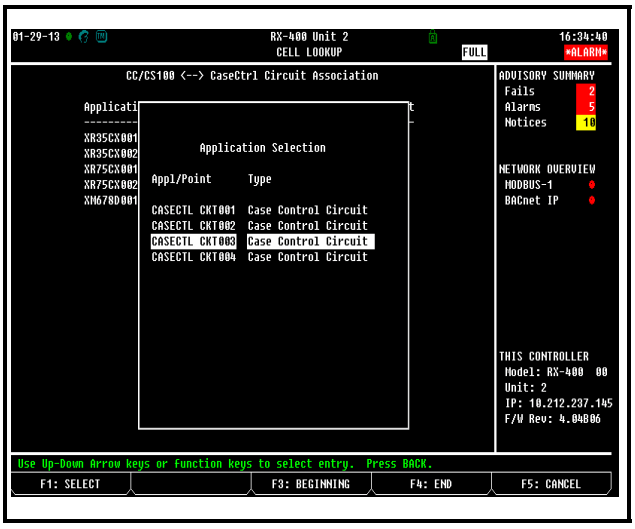


Figure 24-4 *- Case Control Circuit Selection*

To verify the connections from the Case Circuit to the XM678, select the circuit from the Case Control Association screen (***Figure 24-3***) Press F2 (SETUP CKT), and go to the Outputs tab.

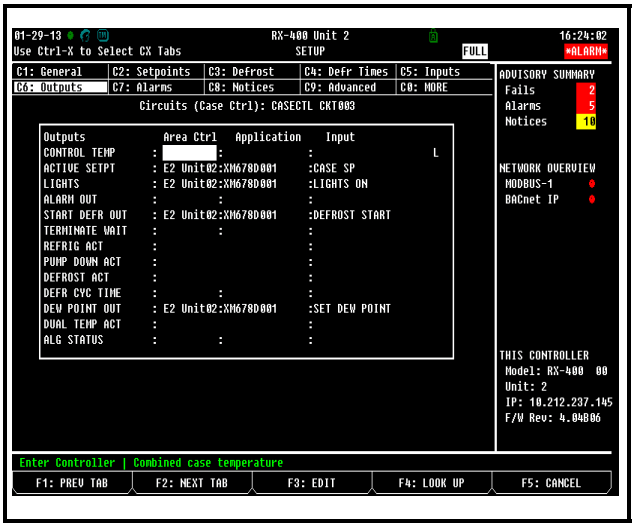


Figure 24-5 *- Case Control Circuit Outputs Tab*

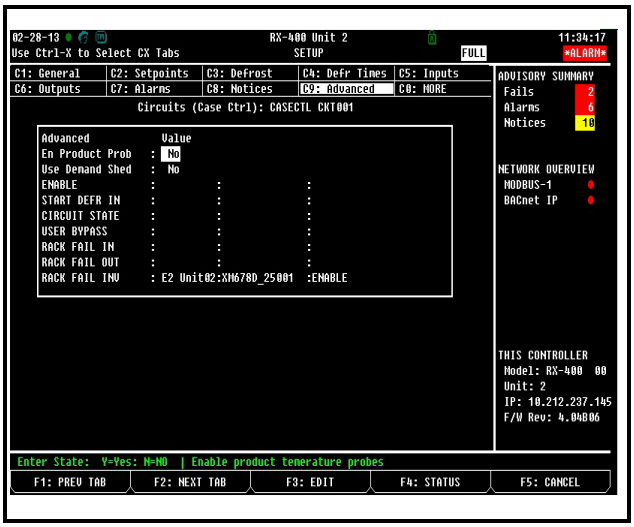


Figure 24-6 *- Advance Tab*

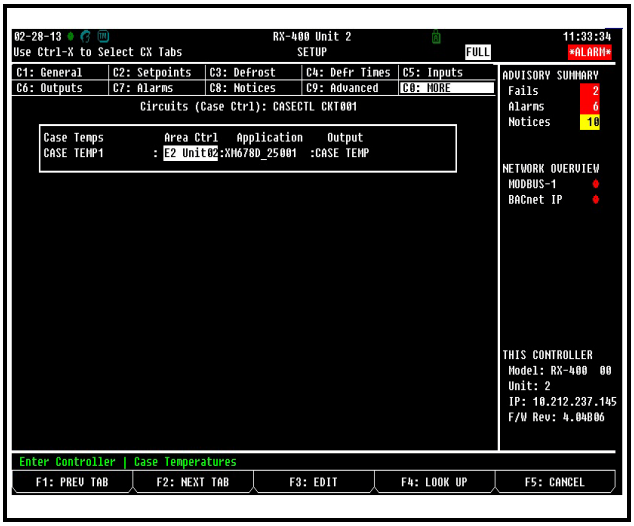


Figure 24-7 *- Case Temps*

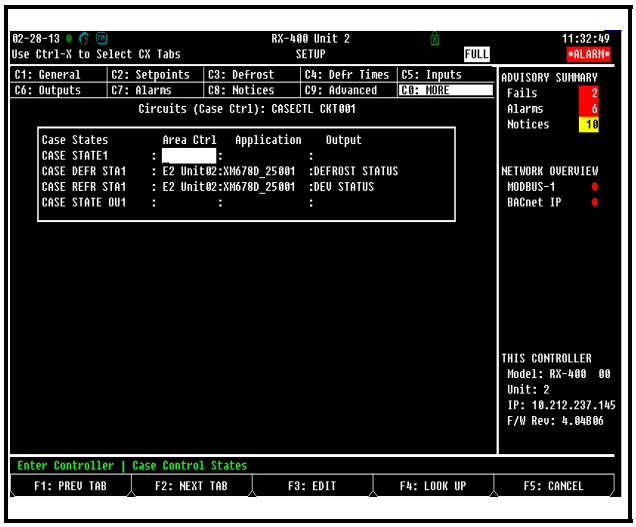


Figure 24-8 *- Case States*

24.4.2. Replacing the XM678D on E2

1. Press Menu % 5 and press the down arrow key to scroll down and highlight **XM678D**.
2. Press Enter to enter the *Summary* screen.
3. Press F5 (SETUP) to enter the *Setup* screen.
4. On the **C1: General** tab, check if the **CfgSyn Action** parameter is set to **Send E2 Cfg to Device**.
5. **If CfgSyn Action** is not visible, press Alt and F at the same time to view full options. The word **FULL** should appear on the upper right-hand corner of the screen.

If the **CfgSyn Action** parameter is not set to **Send E2 Cfg to Device**:

1. Press ! 1 (*LOOK UP*).
2. Select **Send E2 Cfg to Device** and press Enter or ! 1 .
3. Disconnect and remove the faulty XM678D device from the network.
4. Connect the new XM678D.
5. Assign the address of the faulty XM678D to the new XM678D using the CX660 keyboard.
6. Once the address has been assigned, press Menu & 7 & 7 ! 1 and check if the new XM678D is online.
7. Press Menu % 5 and press the down arrow key to scroll down and highlight **XM678D**.
8. Press Enter to enter the *Summary* screen.

9. Press Enter to enter the *Status* screen.

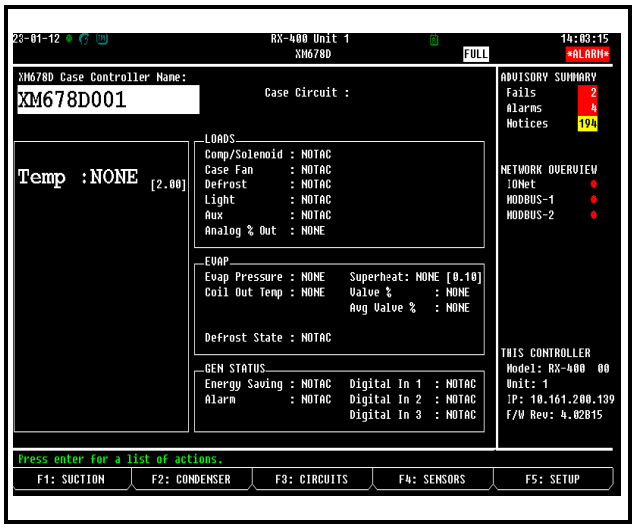


Figure 24-9 *- Device Status Screen*

10. Press Enter to open *Actions* Menu.
11. Highlight **9. Applications Commands** and press Enter.

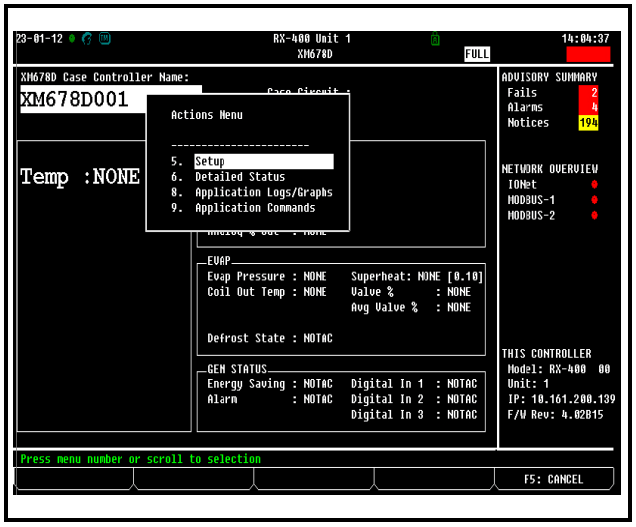


Figure 24-10 *- Actions Menu*

12. Scroll down using the down arrow key and highlight **Send E2 Cfg to Device**. The **Send E2 Cfg to Device** command sends the backup XM678D configuration that is in the E2 to the XM678D controller.
13. Press Enter to apply the command.

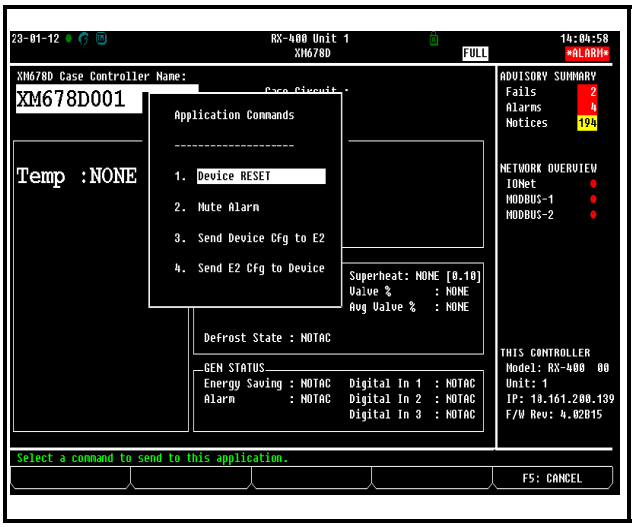


Figure 24-11 *- Applications Command*

14. The E2 XM678D configuration will be sent to the new XM678D. Make sure to check the parameters and functionality on the device.
15. Reboot the XM678D controller after five (5) minutes. If P5 and P6 are flashing, resend the **E2 Cfg to Device** and reboot after five (5) minutes.

Appendix A - Alternate MODBUS COM Wiring Method for E2, XR, XM, and XEV Devices

Overview

To simplify MODBUS communication wiring with E2, (both Standard and Enhanced versions) XR, XM, and XEV series devices, the alternate method outlined below may be used.

Wire Type

Use Belden 8761 or equivalent cable.

Shield

DO NOT connect the shield to the device. Keep the shield continuous throughout a network segment. The shield must be twisted together and insulated with electrical tape or heatshrink at each device within a network segment. Securely connect the shield to an earth grounded chassis at each end of a network segment.

Termination

Each network segment must be biased and terminated at the E2 controller's end (all three jumpers in the MOD position for E2 Enhanced, or all three jumpers in the UP position for E2 Standard) and terminated with a 150 ohm resistor at the other end of the network segment (150 ohms between the two communication wires).

Recommended

For reliable communication on some installations, it may be necessary to connect a 100 ohm resistor between the XR, XM, or XEV device's previously identified ground terminal and earth ground.

Some E2 MODBUS COM Ports Can Support Two Network Segments

For E2 Enhanced 4.x Controller Hardware

COM2 supports two network segments: one on connector RS485-COM2A, and the second on connector RS485-COM2B.

COM4 supports two network segments: one on connector RS485-COM4A, and the second on connector RS485-COM4B.

COM6 only supports one network segment on connector RS485-COM6.

For E2 Standard 3.x Controller Hardware

COM2 supports two network segments: one on connector RS485-1A, and the second on connector RS485-1B.

For information on the maximum recommended number of XR, XM, and XEV devices for each network segment (load and bandwidth calculations), contact Emerson Retail Solutions Technical Support at 770-425-2724.

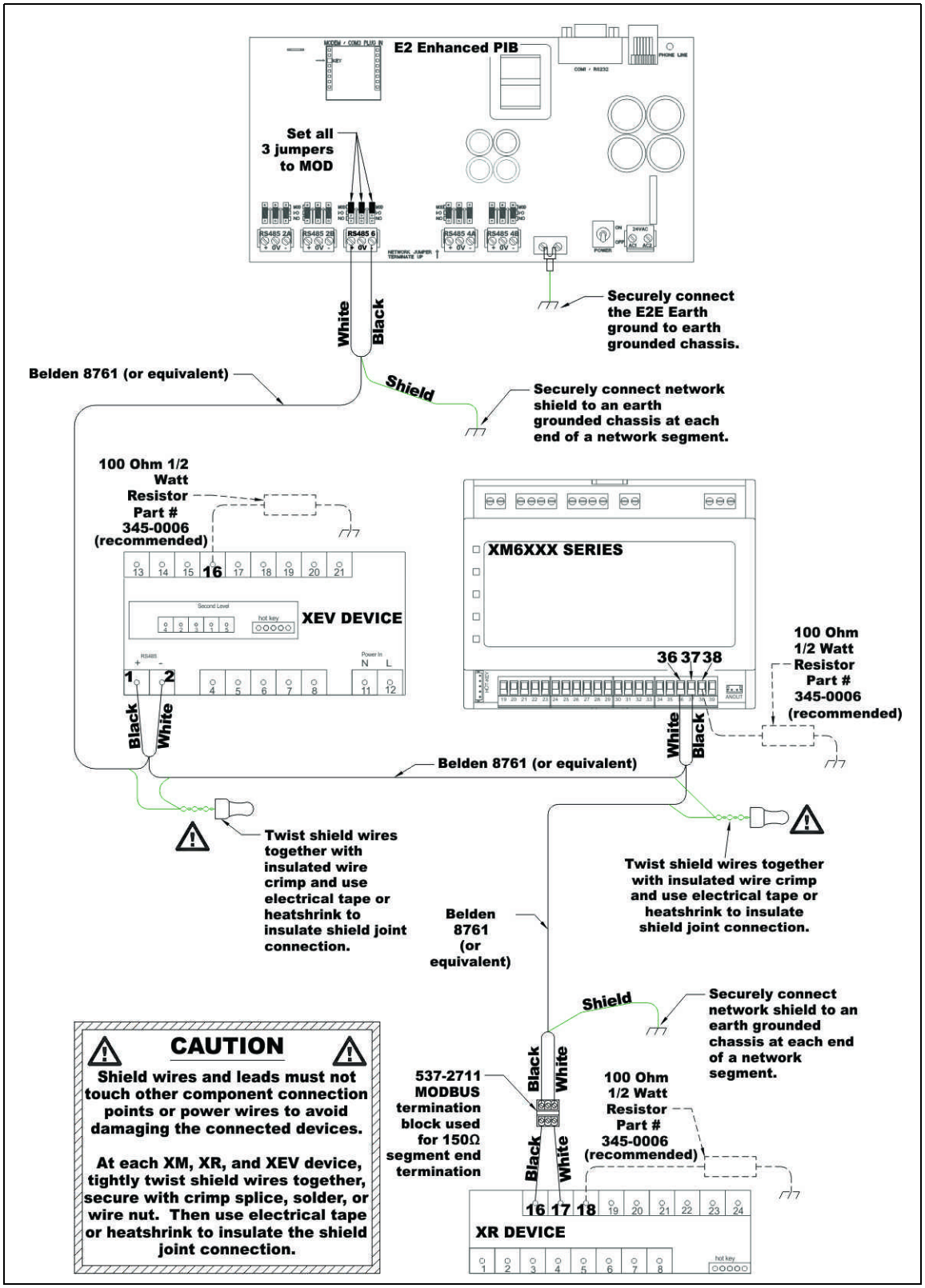


Figure 1 - MODBUS COM Wiring Diagram

For Technical Support call 770-425-2724 or email SolutionsTechSup@Emerson.com

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