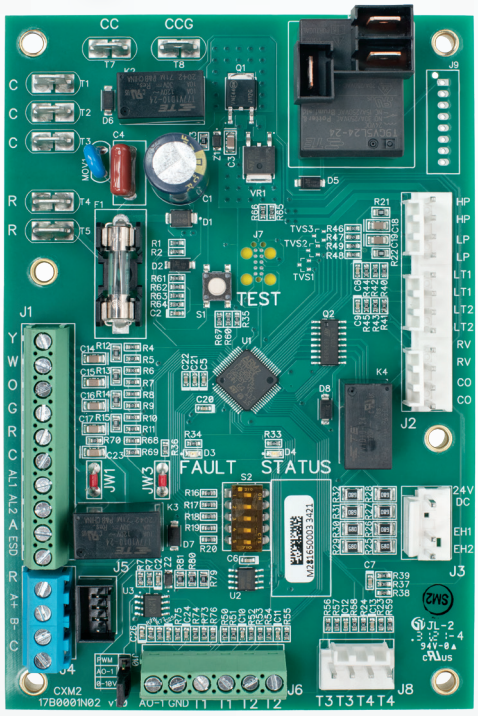
CXM2 COMMUNICATING CONTROLS

APPLICATION, OPERATION & MAINTENANCE MANUAL

Part#: 97B0137N01 | Revised: February 5, 2025

CXM2 Digital Heat Pump Controller



Models:
CXM2

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Overview

Models:
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The CXM2 Communicating Controls is a robust, microprocessor-based heat-pump controller that is advanced and feature-laden for maximum application flexibility. The CXM2 has relay outputs for Compressor, Reversing Valve, Alarm Relay, and a configurable relay for Fan. For on-board diagnostics, there are two LEDs to provide status indication.

There are inputs for safety pressure switches, low-temperature protection thermistors, condensate-overflow sensor, DIP switch selection inputs, thermostat inputs, pump feedback, and emergency-shutdown input. Additional configurable temperature-sensor inputs are available that may be used for compressor discharge, leaving-air, leaving-water, and entering-water temperature sensors (except for TRL and water-to-water products, see product line submittals for details).

The CXM2 has an RS-485 communications port to interface with a communicating thermostat or other communicating controls and tools.

GENERAL OPERATING PARAMETERS

The following are general operating parameters for CXM2 Communicating Controls:

- Operating Environment: -40°F to 176°F (-40°C to 80°C) and up to 95% relative humidity, non-condensing.
- Storage Environment: -40°F to 185°F (-40°C to 85°C) and up to 95% relative humidity, non-condensing.

POWER REQUIREMENTS

CXM2 power draw:

- Normally 5VA draw at 24VAC
- Maximum 10VA draw at 24VAC
- A dedicated 24VAC, 50-60Hz, 1Ph, 40VA transformer minimum is required for typical WSHP application

RELAY CONTACT AND CONNECTION RATINGS

The following relays are mounted on the CXM2:

- Compressor Relay: 40VA at 24VAC
- Alarm Relay: 28VA at 24VAC
- Reversing Valve: 28VA at 24VAC
- Fan Enable / Loop-Pump Relay: 1 HP at 240VAC
- A terminal: 20VA at 24VAC

GROUNDING

The control board must be grounded from one of the C terminals.

BASIC CONTROL FEATURES

- Single-compressor control
- Anti-short cycle protection
- High-pressure cutout
- Low-pressure cutout
- Over- and under-voltage cut-outs
- Water coil low temperature cut-out
- Air coil low temperature cut-out
- Random start
- Status LED and Fault LED
- Reset lockout at unit or disconnect
- Condensate-overflow sensor
- Intelligent fault retry
- Test Mode
- Multiple blower configuration options
- Electric heat outputs
- Unit Performance Sentinel
- Accessory water valve connection

ADVANCED CONTROL FEATURES

- Auxiliary shutdown capability
- Accepts conventional heat pump (Y, O) thermostat types
- RS-485 port to interface with a communicating thermostat or other communicating controls and tools
- Configurable inputs and outputs for advanced functions
- Stores operating condition history during last five faults and offers possible reasons for faults
- Client/server thermostat control of up to three units

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Legend and Glossary of Abbreviations

Abbreviations	Descriptions
Btuh	Btu (British Thermal Unit) per hour
CDT	Compressor discharge temperature
CFM	Airflow, cubic feet per minute
COP	Coefficient of performance = Btuh output/Btuh input
CT EC	Electronic commutated constant torque blower motor
CV EC	Electronic commutated constant volume blower motor
DB	Dry bulb temperature, °F
EAT	Entering air temperature
EER	Energy efficient ratio = Btuh output/Watt input
ESP	External static pressure, inches w.g.
EWT	Entering water temperature
FPT	Female pipe thread
GPM	Water flow in U.S., gallons per minute
HC	Air heating capacity, Btuh
HE	Total heat of extraction, Btuh
HR	Total heat of rejection, Btuh
HWC	Hot water generator (desuperheater) capacity, MBtuh
kW	Total power unit input, kilowatts
LAT	Leaving air temperature, °F
LC	Latent cooling capacity, Btuh
LOC	Loss of charge
LWT	Leaving water temperature, °F
MBtuh	1,000 Btu per hour
MPT	Male pipe thread
MWV	Motorized water valve
PSC	Permanent split capacitor
RDS	Refrigerant Detection System
SC	Sensible cooling capacity, Btuh
S/T	Sensible to total cooling ratio
TC	Total cooling capacity, Btuh
TD or delta T	Temperature differential
VFD	Variable frequency drive
WB	Wet bulb temperature, °F
WPD	Waterside pressure drop, psi or feet of head
WSE	Waterside economizer

CXM2 Board Identification

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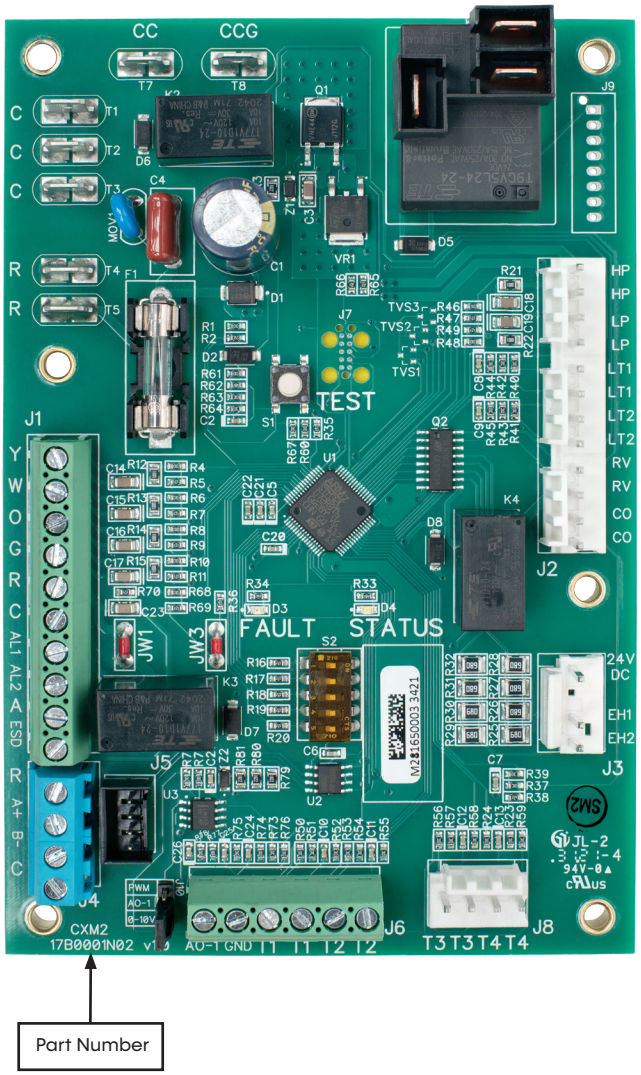
Before beginning a repair, verify your CXM2 Part Number. Reference the images below for differences in Part Numbers 17B0001N02 and 17B0001N05.

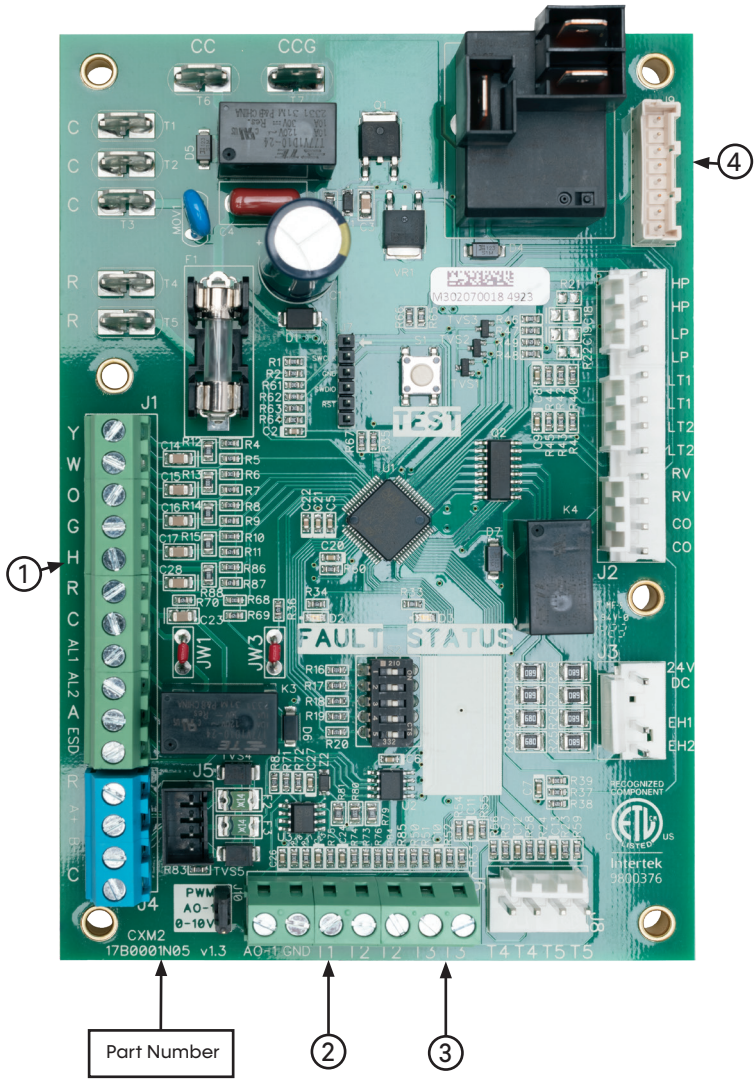
The following list details the changes between Part Numbers 17B0001N02 and 17B0001N05:

1. The J1 terminal block includes an H terminal on the 17B0001N05 board (the H jumper is for future use)
2. The J6 terminal block includes a T1 input on the 17B0001N05 board
3. Due to the addition of a T1 input on the J6 terminal block, the T3 terminals are now located on the J6 terminal block on the 17B0001N05 board
4. The J9 terminal block is populated on the 17B0001N05 board

CXM2 (17B0001N02)



CXM2 (17B0001N05)



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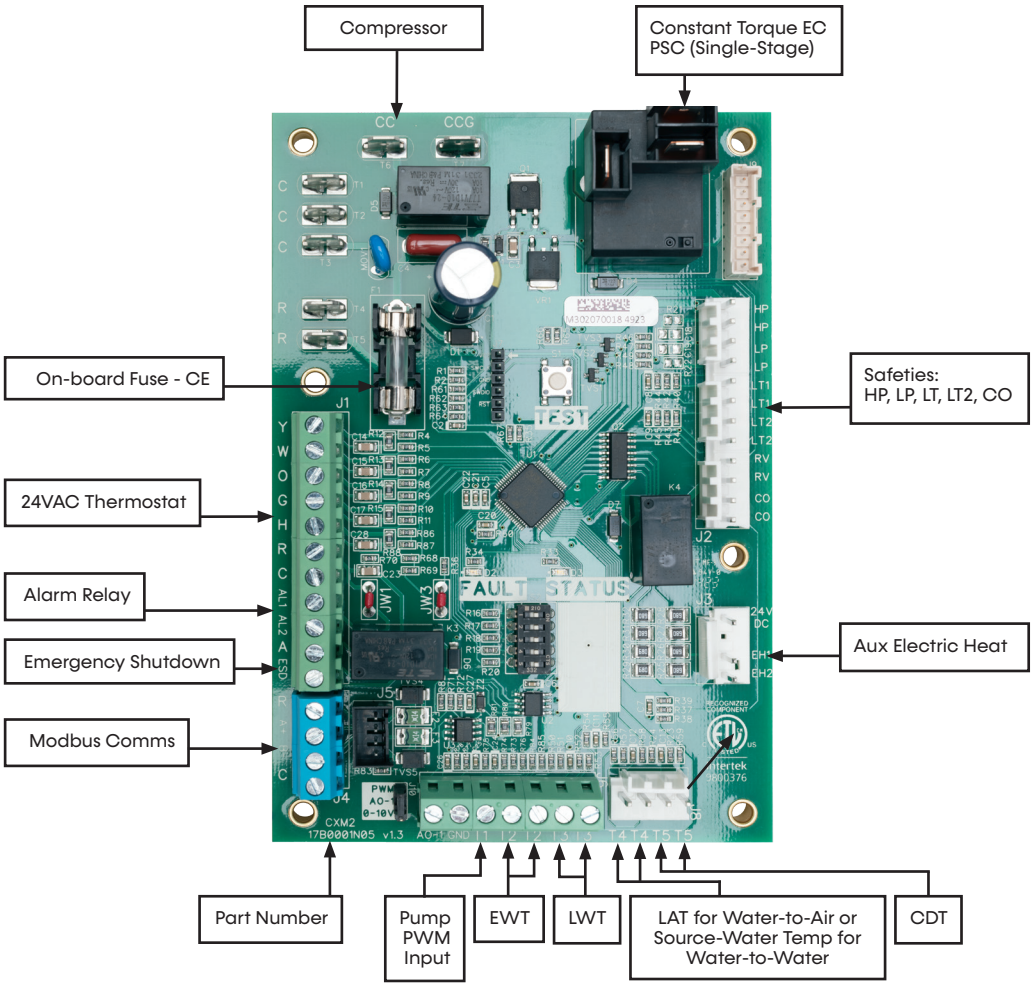
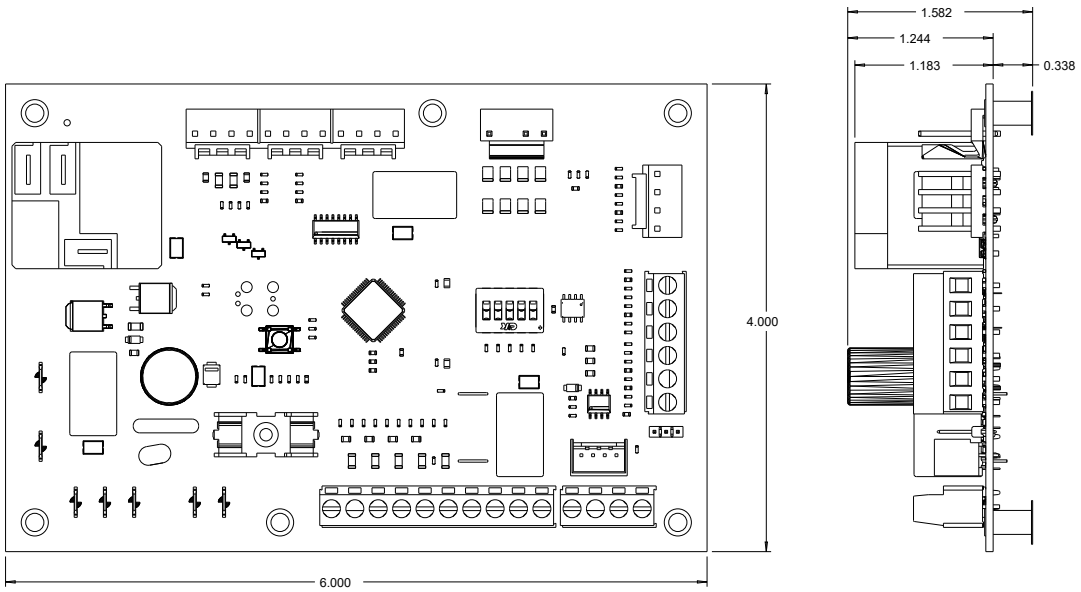
Physical Dimensions and Layout





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Field-selectable Inputs and DIP Switches

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FIELD-SELECTABLE INPUTS

Test Mode

Test mode allows the service technician to check the operation of the control in a timely manner. By **momentarily** pressing the TEST push button, the CXM2 enters a 30-minute test-mode period in which all time delays are sped up 15 times. Upon entering Test mode, the Status and Fault LED displays change. The Status LED flashes rapidly to indicate the control is in the Test mode. The Fault LED displays the most recent fault condition in memory.

NOTE: A flash code of 1 indicates there are no faults stored in memory.

For diagnostic ease at conventional thermostats, the alarm relay cycles during Test mode. The alarm relay cycles on and off in sync with Fault LED to indicate a code representing the last fault at the thermostat.

To exit Test mode, press the TEST button for 3 seconds. Alternatively, exit Test mode by cycling the G input three times within 60 seconds.

In Test mode, the control monitors to see if the LT1 and LT2 thermistors are connected and operating properly. If the control is in Test mode, the control locks out with Code 9 after 60 seconds if:

a. The compressor is On in Cooling Mode and the LT1 sensor is colder than the LT2 sensor. Or,

b. The compressor is On in Heating Mode and the LT2 sensor is colder than the LT1 sensor.

Retry Mode

If the control is attempting a retry of a fault, the Fault LED slow flashes to indicate the control is in the process of retrying (slow flash = one flash every 2 seconds).

FIELD-CONFIGURATION OPTIONS

NOTE: In the following field configuration options, jumper wires should be clipped ONLY when power is removed from the CXM2.

NOTE: Jumper 3 must not be clipped prior to adding antifreeze to the water loop. Antifreeze protection to 10°F required. Clipping JW3 without antifreeze may result in freeze damage and voids the unit warranty.

Water Coil Low Temperature Limit Setting

Jumper 3 (JW3-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F (-1°F or -12°C) (refrigerant temperature).

- Not Clipped = 30°F, Clipped = 10°F

Alarm Relay Setting

Jumper 1 (JW1-AL2 Dry) provides field selection of alarm function when Alarm Relay is energized.

- Not Clipped = AL1 connected to R (24VAC) with Alarm Relay active
- Clipped = Dry contact connection between AL1 and AL2 with Alarm Relay active

DIP SWITCHES

NOTE: In the following field configuration options, DIP switches should only be moved when power is removed from the CXM2 to ensure proper operation.

DIP Package S2

DIP Package #2 is five position and provides the following setup selections.

- **DIP 2.1 – Unit Performance Sentinel Disable:** Provides field selection to disable the UPS feature
  - On = Enabled, Off = Disabled
- **DIP 2.2 – Compressor Relay Staging Operation:** Provides selection of Compressor Relay staging operation. The Compressor Relay can be selected to turn on with Stage 1 or Stage 2 call from the thermostat. This is used with Dual Stage units (two compressors where two CXM2 are being used) or with client/server applications. In client/server applications, each compressor and fan stages according to its appropriate DIP 2.2. If set to Stage 2, the compressor has a 3-second on-delay before energizing during a Stage 2 demand. Also, if set for Stage 2, the Alarm Relay does NOT cycle during Test mode.
  - On = Stage 1. Off = Stage 2.

NOTE: For two-compressor or client/server operation, Y1 from thermostat is wired to the stage-1 CXM2 and Y2 is wired to the stage-2 CXM2.

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Safety Features

Table 1: DIP Switch Settings

DIP Switch	Description	Options	Default
DIP 2.1	Unit Performance Sentinel	Enable, Disable	Enable
DIP 2.2	Compressor Staging	Stage 1, Stage 2	--
DIP 2.3	Modbus Communications	Modbus Server, Modbus Client	Modbus Server
DIP 2.4	EH2/DDC Operation	EH2 Normal, DDC Output at EH2	--
DIP 2.5	Factory Setting	--	ON

- **DIP 2.3 – Communications Configuration:** Provides selection of the CXM2 operation in a communicating system. The CXM2 may operate as a communicating server or client device depending on the network configuration. In most configurations, the CXM2 operates as a leader device.
  - On = Communicating Server device (default)
  - Off = Communicating Client device
- **DIP 2.4 – DDC Output at EH2:** Provides selection for DDC operation. If set to **DDC Output at EH2**, the EH2 terminal continuously outputs the last fault code of the controller. If set to **EH2 normal**, then the EH2 operates as standard electric heat output.
  - On = EH2 Normal, Off = DDC Output at EH2
- **DIP 2.5 – Factory Setting:** Normal position is On. Do not change selection unless instructed to do so by the Factory.

SAFETY FEATURES

The following safety features are provided to protect the compressor, heat exchangers, wiring, and other components from damage caused by operation outside of design conditions.

Anti-Short Cycle Protection: The control features a 7-minute anti-short cycle protection for the compressor. The anti-short cycle time begins when a call for the compressor ends.

NOTE: The default anti-short cycle delay at power-up is 7 minutes.

Random Start: The control features a 5-80 second random start upon power up. The random start delay is present after a control power up and after returning from Emergency Shutdown mode.

Extended Compressor Operation Monitoring: If the compressor relay is on for four continuous hours, the control automatically turns off the compressor relay and waits the anti-short cycle protection time. All appropriate safeties are monitored during the off time. If all operation is normal, and if the compressor demand is still present, the control turns the compressor back on.

Fault Retry: In Fault Retry mode, the Fault LED begins slow flashing to signal that the control is trying to recover from a fault input. The CXM2 stages off the outputs and then attempts to satisfy the thermostat call for compressor. Once the thermostat input calls are satisfied, the control continues as if no fault occurred. If three consecutive faults occur without satisfying the thermostat call for compressor, then the control enters Lockout mode. The last fault causing the lockout is stored in memory and is displayed at the Fault LED by entering the Test mode.

NOTE: LT1 and LT2 faults are factory set for one try, so there are no retries for LT1 and LT2 faults. The control is factory configured to enter lockout mode after first LT1 or LT2 fault.

Refrigerant Leak Detection: If a refrigerant leak above the maximum threshold is detected or the control registers a fault with the refrigeration detection system, all outputs turn off and the fan turns on.

Fault Codes

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FAULT CODES

Lockout: In Lockout mode, the Fault LED begins flashing fast. The compressor relay is turned off immediately. The fan output is turned off after the current blower-off delay unless auxiliary heat is active. The Lockout mode can be soft reset via the thermostat by removing the call for compressor, or by a hard reset (disconnecting power to the control). The fault code is stored in non-volatile memory that can be displayed by the Fault LED by entering the Test mode even if power was removed from the control.

Fault Code 2 – High-Pressure Switch: When the High-Pressure switch (HP) opens due to high refrigerant pressures, the compressor relay is de-energized immediately. The high-pressure fault recognition is immediate (does not delay for 30 continuous seconds before de-energizing the compressor). When Test mode is activated, the Fault LED displays a fault code of 2 for a high-pressure fault.

Fault Code 3 – Low-Pressure Switch: The Low-Pressure Switch (LP) must be open and remain open for 30 continuous seconds during a compressor-on cycle to be recognized as a low-pressure fault. If the Low-Pressure switch is open for 30 seconds prior to compressor power up, it is considered a low-pressure fault. The Low-Pressure switch input is bypassed for the initial 120 seconds of a compressor run cycle. When the test mode is active, the Fault LED displays a fault code of 3 for a low-pressure fault.

Fault Code 4 – Water Coil Low-temperature Cutout Limit (LT1): The control recognizes an LT1 fault during a compressor run cycle if:

a. The LT1 thermistor temperature is below the selected low temperature protection limit setting for at least 50 seconds, AND

b. The LT1 thermistor temperature is rising (getting warmer) at a rate LESS than 2°F every 30 seconds

The LT1 input is bypassed for the initial 120 seconds of a compressor run cycle. When the test mode is active, the Fault LED displays a fault code of 4 for a LT1 fault.

⚠ CAUTION

Do not restart units without inspection and remedy of faulting condition. Equipment damage may occur.

Fault Code 5 – Air Coil Low-Temperature Cutout (LT2): The control recognizes an LT2 fault during a compressor run cycle if:

a. The LT2 thermistor temperature is below the low-temperature protection limit setting for at least 50 seconds, AND

b. The LT2 thermistor temperature is rising (getting warmer) at a rate LESS than 2°F every 30 seconds

The LT2 input is bypassed for the initial 120 seconds of a compressor run cycle. When the test mode is active, the Fault LED displays a fault code of 5 for a LT2 fault.

Fault Code 6 – Condensate Overflow: The Condensate-Overflow sensor must sense overflow levels for 30 continuous seconds to be recognized as a CO fault. Condensate overflow is monitored continuously during the compressor run cycle. When the Test mode is active, the Fault LED displays a fault code of 6 for a condensate-overflow fault.

Fault Code 7 – Over-/Under-Voltage Shutdown: An Over-/Under-Voltage condition exists when the control voltage is outside the range of 18VAC to 31.5VAC. Over-/Under-Voltage Shutdown is self-resetting in that if the voltage comes back within range of 18.5VAC to 31VAC for at least 0.5 seconds, then normal operation is restored. This is not considered a fault or lockout. If the CXM2 is in Over-/Under-Voltage Shutdown for 15 minutes, the Alarm Relay closes. When the Test mode is active, the Fault LED displays a fault code of 7 for an Over-/Under-Voltage Shutdown.

Fault Code 8 – Unit Performance Sentinel - UPS: The UPS feature warns when the heat pump is operating inefficiently. A UPS condition exists when:

a. In Heating Mode with compressor energized, if LT2 is greater than 125°F for 30 continuous seconds, Or

b. In Cooling Mode with compressor energized, if LT1 is greater than 125°F for 30 continuous seconds, OR LT2 is less than 40°F for 30 continuous seconds.

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Fault Codes

If a UPS condition occurs, the control immediately enters UPS warning. The status LED remains lit as if the control is in Normal mode (See Table 2). Outputs of the control, excluding Fault LED and Alarm Relay, are NOT affected by UPS. The UPS condition cannot occur during a compressor off cycle. During UPS warning, the Alarm Relay cycles on and off. The cycle rate is On for 5 seconds, Off for 25 seconds, On for 5 seconds, Off for 25 seconds, etc. When Test mode is active, the Fault LED displays a fault code of 8 for a UPS condition.

Fault Code 9 – Unit Performance Test-UPT/Swapped LT1 and LT2 Thermistors: During Test mode, the control monitors to see if the LT1 and LT2 thermistors are connected and operating properly. If the control is in Test mode, the control locks out with Code 9 after 60 seconds if:

a. The compressor is On in Cooling Mode and the LT1 sensor is colder than the LT2 sensor. Or,

b. The compressor is On in Heating Mode and the LT2 sensor is colder than the LT1 sensor.

When Test mode is active, the Fault LED displays a fault code of 9 for a Swapped-Thermistor fault.

Table 2: LED and Alarm-Relay Output

CXM2 FAULT CODES			
CXM2 Fault and Status LED Operation with Test Mode Not Active	**Fault LED (Red)**	**Status LED (Green)**	**Alarm Relay**
CXM2 is non-functional	Off	Off	Open
Normal operation - No active communication	On	On	Open
Normal operation - With active communication	Very Slow Flash	On	Open
Control is in anti-short cycle delay - With active communication	Very Slow Flash	On	Open
Control is currently in Fault-Retry mode or in anti-short cycle delay	Slow Flash	–	Open
Control is currently locked out	Fast Flash	–	Closed
(ESD) Emergency shutdown condition recognized	–	Flashing Code 3	–
Invalid thermostat input combination	–	Flashing Code 4	–
CXM2 Fault LED and Status Operation with Test Mode Active	Fault LED (Red)	Status LED (Green)	Alarm Relay
No fault since power up in memory	Flashing Code 1	–	Cycling Code 1
High-pressure fault in memory	Flashing Code 2	–	Cycling Code 2
Low-pressure fault in memory	Flashing Code 3	–	Cycling Code 3
Low-temperature protection 1 fault in memory	Flashing Code 4	–	Cycling Code 4
Low-temperature protection 2 fault in memory	Flashing Code 5	–	Cycling Code 5
Condensate-overflow fault in memory	Flashing Code 6	–	Cycling Code 6
Over-/Under-voltage shutdown in memory	Flashing Code 7	–	Cycling Code 7
UPS warning in memory	Flashing Code 8	–	Cycling Code 8
UPT fault in memory / swapped LT1 and LT2 thermistors	Flashing Code 9	–	Cycling Code 9
Low water flow/flow controller fault	Flashing Code 13	–	Cycling Code 13
Leaving water temperature low	Flashing Code 14	–	Cycling Code 14
RDS fault in memory	Flashing Code 15	–	Cycling Code 15

- Fast Flash = 2 flashes every 1 second
- Slow Flash = 1 flash every 2 seconds
- Very Slow Flash = 1 flash every 5 seconds
- Numeric Codes = On pulse 1/3 second; Off pulse 1/3 second followed by a 10 second delay
- Alarm Relay Open = alarm signal off
- Alarm Relay Closed = alarm signal on

Fault Codes

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Fault Code 13 – Low Water flow: The control recognizes a low water flow fault if:

In applications with vFlow®

- When operating an internal flow center, the CXM2 monitors the pump feedback signal and may detect one of several pump faults. The control may detect locked rotor, low voltage, no flow, or bad pump sensor conditions that result in an internal flow center fault. When the test mode is active, the Fault LED displays a fault code of 13 for any of these flow center faults.

TRL only

The flow switch indicates there is no water flow. This triggers a lockout condition.

Fault Code 14 – Low Leaving Water Temperature (TRL only): The control recognizes a low leaving water temperature fault if the leaving water temperature is out of range.

Fault Code 15 – RDS Sensor Fault: A Refrigerant Detection System (RDS) sensor fault exists if the CXM2 loses communication with a refrigeration-detection sensor, or a refrigeration-detection sensor detects a refrigeration leak. In Refrigerant-Leak-Detection Mitigation mode, the Fault LED begins fast flashing. All outputs are turned off immediately and the fan output is turned on for a minimum of 5 minutes. If communication with the sensor is re-established or the RDS stops sensing a refrigerant leak, the unit resumes normal operation 5 minutes after the RDS stops sensing a refrigeration leak. The fault code is stored in nonvolatile memory that is displayed by the Fault LED. When Test mode is active, the Fault LED displays a fault code of 15 for a RDS sensor fault. For additional information on RDS fault codes, see Table 3. For additional information on RDS Fault Codes, see Table 4 on page 12.

Emergency Shutdown – ESD: You can enable ESD mode from an external common signal to terminal ESD. For WSHP rooftop products, ESD Mode is utilized when the ERV (Energy Recovery Ventilator) option is applied to a ST series rooftop unit to indicate an ERV fault. A contact closure at the ERV unit connects common to the ESD terminal, which shuts down the rooftop/ERV units. The green Status LED flashes code 3 when the unit is in ESD Mode. (See Thermostat Inputs section for details.)

Diagnostic Features: The green Status LED and red Fault LED on the CXM2 advise service personnel of the current status of the CXM2. The LEDs indicate the current operating status of the CXM2, as well as the LAST fault in memory. If there is no fault in memory and the fault display is selected, the Fault LED flashes Code 1. See Table 2 for a complete listing of codes.

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Refrigerant Detection System Fault Codes

The Refrigerant Detection System (RDS) monitors the status of the refrigerant sensor(s) in the unit. If refrigerant is detected above the maximum threshold, the control enables the unit blower, disables the compressor(s), and enables the pilot relay on the RDS control board.

If a fault event occurs, the below chart provides guidance on diagnosing the issue:

Table 3: RDS Fault Codes

Fault Code	Fault LED	Fault	Possible Causes
160	Flashing Code 2	Loss of RDS Control Communication	• Control wiring issue between the unit's control and the RDS • RDS board failure
161	Flashing Code 3	RDS Control Test Fault	The RDS control in Test mode
162	Flashing Code 4	Loss of RDS Sensor Communications	• Control wiring issue between the RDS and the sensor • RDS sensor failure - replace RDS sensor
163	Flashing Code 5	RDS Sensor Fault	RDS sensor failure - replace RDS sensor
164	Flashing Code 6	RDS Sensor Over Threshold	Leak in regrigerant system
170	N/A	Loss of 2nd Control Communications	• Control wiring issue between controls • 2nd control failure • Main control failure
171	N/A	Loss of 3rd Control Communications	• Control wiring issue between controls • 2rd control not properly addressed • 3rd control failure • Main CXM2 failure
172	N/A	Loss of AXM Control Communications	• Control wiring issue between controls • AXM control failure • CXM2 failure

Operating Descriptions

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Power Up: The unit will not operate until all the inputs and safety controls are checked for normal conditions.

NOTE: The compressor has a 7-minute anti-short cycle delay at power-up.

Standby/Fan Only: In Standby mode, the compressor is off. The fan output and RV relay may be on if appropriate inputs are present. If there is demand for constant fan, the fan output is activated for constant fan airflow.

The RV relay does not directly track the input demands for RV, the CXM2 uses smart RV control. This ensures that the RV only switches positions if the thermostat has called for a Heating/Cooling Mode change.

Compressor Heating: In Compressor Heating mode, the selected Fan output and the compressor relay are turned on immediately. If configured as Stage 2 (DIP 2.2 = off), then the compressor and fan do not turn on until there is Stage 2 demand. The compressor relay is turned off immediately when the compressor-heating demand is removed. The selected Fan output turns off after the selected heating blower-off delay, and the control then reverts to Standby mode. If there is a client/server configuration or a dual-compressor configuration, all compressor relays and related functions track with their associated DIP 2.2.

Supplemental Heating: In Supplemental Heating mode, the selected Fan output and Compressor relays remain on. The EH1 output turns on immediately. With continuing supplemental-heating demand, EH2 turns on after 10 minutes. EH1 and EH2 are turned off immediately when the supplemental-heating demand is removed, and the control reverts to Compressor Heating mode. During Supplemental Heating mode, EH2 is off (or turns off if already on) if:

a. LT1 is greater than 45°F AND

b. LT2 is greater than 110°F (LT2 greater than 110°F includes the condition that LT2 is shorted). This condition has a 30-second recognition time.

Emergency Heat: In Emergency Heat mode, the selected fan output is activated and EH1 is turned on immediately. With continuing Emergency Heat demand, EH2 turns on after 5 minutes. EH1 and EH2 are turned off immediately when the Emergency Heat demand is removed. The selected fan output turns off after the selected heating blower-off delay and the control reverts to Standby mode.

Cooling: In Cooling mode, the selected fan output, compressor, and RV relays are turned on immediately. If configured as Stage 2 (DIP 2.2 = off), then the compressor and fan does not turn on until there is Stage-2 demand. The Compressor relay is turned off immediately when the cooling demand is removed. The selected Fan output turns off after the selected cooling blower-off delay, and the control then reverts to Standby mode. The RV relay remains on until there is a Heating demand. If there is a client/server configuration or a dual-compressor configuration, all compressor relays and related functions track with their associated DIP 2.2.

Blower Configurations: The CXM2 may be configured to operate several different blowers and blower configurations. The configurations include:

a. **Single-Speed Blower:** If the CXM2 is configured for a single-speed PSC blower, the K1 relay operates as the blower relay.

b. **No Blower:** If the CXM2 is configured for no blower (split-system compressor sections), the K1 relay operates as a loop-pump relay.

c. **VFD Blower or Plug EC fan:** If the CXM2 is configured for a VFD blower or Plug EC, the CXM2 directly controls a VFD or Plug EC to achieve a target Leaving Air Temperature (LAT) or at discrete speeds depending on the selected blower control mode. When operating a VFD or Plug EC, the K1 relay becomes the VFD or Plug EC enable relay. When the VFD or Plug EC is off, the output is set to **0VDC**. If configured for fixed-speed blower control, there are maximum and minimum operating speeds for each operating mode unique to each unit size.

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Special CXM2 Application Note and Other Outputs

SPECIAL CXM2 APPLICATION NOTES

ESD: ESD is the input for Emergency-Shutdown mode. When the ESD input is connected to Ground C, all inputs are ignored and all outputs are turned off. There is a random-start timer when coming back from ESD.

NOTE: For 3-phase applications, the power input for all controls with daisy-chained ESD input signals must be in-phase (i.e. control transformers across L1 and L2 with same polarity) for each control to correctly recognize the state of the ESD signal. If the power phasing cannot be matched between units sharing the external signal, use a shared external signal to control an added relay that connects the ESD and C terminals on each control.

OTHER OUTPUTS

Electric Heat: Outputs EH1 and EH2 turn on whenever the CXM2 is in the following modes: Heating Stage 2 and Emergency Heat.

Status LED: The Status LED is green. The Status LED indicates the operating status of the CXM2. See Table 2.

Fault LED: The Fault LED is red. The Fault LED displays the current operating status of the control, or flashes the corresponding code for the last fault that occurred if the test mode is active. If there is no fault in memory, then the Fault LED flashes Code 1. If the Fault type is Primary (HP, LP, LT1, LT2, or CO) then the Fault type is always retained in memory (Primary faults overwrite Secondary faults). If the Fault type is Secondary (Over/Under Voltage, UPS or Swapped LT1/LT2), then the Fault type is only retained if there are no Primary faults in memory. The Secondary Fault types do not overwrite the Primary fault memory. See Table 2.

Communications: The CXM2 has a single RS-485 communications port that provides communication capabilities for communicating thermostats or connecting with other communicating controls.

Pressure Switches: All pressure switches are designed to be normally closed during normal-operating conditions, and to open upon fault.

Condensate Sensor: The Condensate Sensor input faults upon sensing impedance less than 100,000 Ohms for 30 continuous seconds. The recommended design uses a single wire terminated with a male ¼-inch quick connect located in the drain pan at desired trip level. Upon a high-condensate level, the water shorts between the air coil and the quick connect producing a resistance less than 100,000 Ohms. Since condensate is free of impurities, it has no conductivity. Only the impurities from the drain pan and coil dust or dirt create the conductance. To replace the air coil ground path, use a second ground wire with the appropriate terminal to the drain pan with the control. The Condensate Sensor can also essentially be any open contact that closes upon a fault condition.

Thermistor-Temperature Sensors: The thermistors used with the CXM2 are NTC (negative temperature coefficient) type. The sensors have a 1% tolerance and follow the characteristics shown in Table 5. Use Table 6 to find the nominal resistance at any given temperature and for field-service reference. The sensor uses a minimum of 24 AWG wire.

Thermostat Inputs with Resulting Demands and Sensor Calibration

Models:
CXM2

Table 4: Thermostat Inputs with Resulting Demands

Thermostat Operating Modes								
Mode	Input				Output			
	O	G	Y	W	RV	Fan	H/C	AUX
No Demand	ON/OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF	OFF
Fan Only	ON/OFF	ON	OFF	OFF	ON/OFF	ON	OFF	OFF
Cooling	ON	ON	ON	OFF	ON	ON	ON	OFF
Heating	OFF	ON	ON	OFF	OFF	ON	ON	OFF
Heating 2nd Stage	OFF	ON	ON	ON	OFF	ON	ON	ON
Emergency Heat	OFF	ON	OFF	ON	OFF	ON	OFF	ON

1 ON/OFF = Either ON or OFF; H/C = Either Heating or Cooling.

Table 5: 1% Sensor Calibration Points

Temp (°F)	Minimum Resistance (Ohm)	Maximum Resistance (Ohm)	Nominal Resistance (Ohm)
78.5	9523	9715	9619
77.5	9650	9843	9746
76.5	10035	10236	10135
75.5	10282	10489	10385
33.5	30975	31598	31285
32.5	31871	32512	32190
31.5	32653	33310	32980
30.5	33728	34406	34065
1.5	80624	82244	81430
0.5	83327	85002	84160
0.0	84564	86264	85410

Models:
CXM2

Nominal Resistance per Temperature

Table 6: Nominal Resistant per Temperature

Temp (°C)	Temp (°F)	Resistance (kOhm)
-17.8	0.0	85.34
-17.5	0.5	84.00
-16.9	1.5	81.38
-12.0	10.4	61.70
-11.0	12.2	58.40
-10.0	14.0	55.30
-9.0	15.8	52.38
-8.0	17.6	49.64
-7.0	19.4	47.05
-6.0	21.2	44.61
-5.0	23.0	42.32
-4.0	24.8	40.15
-3.0	26.6	38.11
-2.0	28.4	36.18
-1.0	30.2	34.37
0.0	32.0	32.65
1.0	33.8	31.03
2.0	35.6	29.50
3.0	37.4	28.05
4.0	39.2	26.69
5.0	41.0	25.39
6.0	42.8	24.17
7.0	44.6	23.02
8.0	46.4	21.92
9.0	48.2	20.88
10.0	50.0	19.90
11.0	51.8	18.97
12.0	53.6	18.09
13.0	55.4	17.26
14.0	57.2	16.46
15.0	59.0	15.71
16.0	60.8	15.00
17.0	62.6	14.32
18.0	64.4	13.68
19.0	66.2	13.07
20.0	68.0	12.49
21.0	69.8	11.94
22.0	71.6	11.42
23.0	73.4	10.92
24.0	75.2	10.45
25.0	77.0	10.00
26.0	78.8	9.57
27.0	80.6	9.16
28.0	82.4	8.78
29.0	84.2	8.41
30.0	86.0	8.06
31.0	87.8	7.72
32.0	89.6	7.40
33.0	91.4	7.10
34.0	93.2	6.81
35.0	95.0	6.53
36.0	96.8	6.27
37.0	98.6	6.01
38.0	100.4	5.77
39.0	102.2	5.54
40.0	104.0	5.33
41.0	105.8	5.12
42.0	107.6	4.92
43.0	109.4	4.72
44.0	111.2	4.54
45.0	113.0	4.37
46.0	114.8	4.20
47.0	116.6	4.04
48.0	118.4	3.89
49.0	120.2	3.74
50.0	122.0	3.60
51.0	123.8	3.47
52.0	125.6	3.34
53.0	127.4	3.22
54.0	129.2	3.10
55.0	131.0	2.99
56.0	132.8	2.88
57.0	134.6	2.77
58.0	136.4	2.67
59.0	138.2	2.58
60.0	140.0	2.49
61.0	141.8	2.40
62.0	143.6	2.32
63.0	145.4	2.23
64.0	147.2	2.16
65.0	149.0	2.08
66.0	150.8	2.01
67.0	152.6	1.94
68.0	154.4	1.88
69.0	156.2	1.81
70.0	158.0	1.75
71.0	159.8	1.69
72.0	161.6	1.64
73.0	163.4	1.58
74.0	165.2	1.53
75.0	167.0	1.48
76.0	168.8	1.43
77.0	170.6	1.39
78.0	172.4	1.34
79.0	174.2	1.30
80.0	176.0	1.26
81.0	177.8	1.22
82.0	179.6	1.18
83.0	181.4	1.14
84.0	183.2	1.10
85.0	185.0	1.07
86.0	186.8	1.04
87.0	188.6	1.01
88.0	190.4	0.97
89.0	192.2	0.94
90.0	194.0	0.92
91.0	195.8	0.89
92.0	197.6	0.86
93.0	199.4	0.84
94.0	201.2	0.81
95.0	203.0	0.79
96.0	204.8	0.76
97.0	206.6	0.74
98.0	208.4	0.72
99.0	210.2	0.70
100.0	212.0	0.68
101.0	213.8	0.66
102.0	215.6	0.64
103.0	217.4	0.62
104.0	219.2	0.60
105.0	221.0	0.59
106.0	222.8	0.57
107.0	224.6	0.55
108.0	226.4	0.54
109.0	228.2	0.52
110.0	230.0	0.51
111.0	231.8	0.50
112.0	233.6	0.48
113.0	235.4	0.47
114.0	237.2	0.46
115.0	239.0	0.44
116.0	240.8	0.43
117.0	242.6	0.42
118.0	244.4	0.41
119.0	246.2	0.40
120.0	248.0	0.39
121.0	249.8	0.38
122.0	251.6	0.37
123.0	253.4	0.36

Tranquility Fluid Cooler and CXM2 Field Wiring/Installation

Models: CXM2

Figure 1: TFC Control Field Wiring

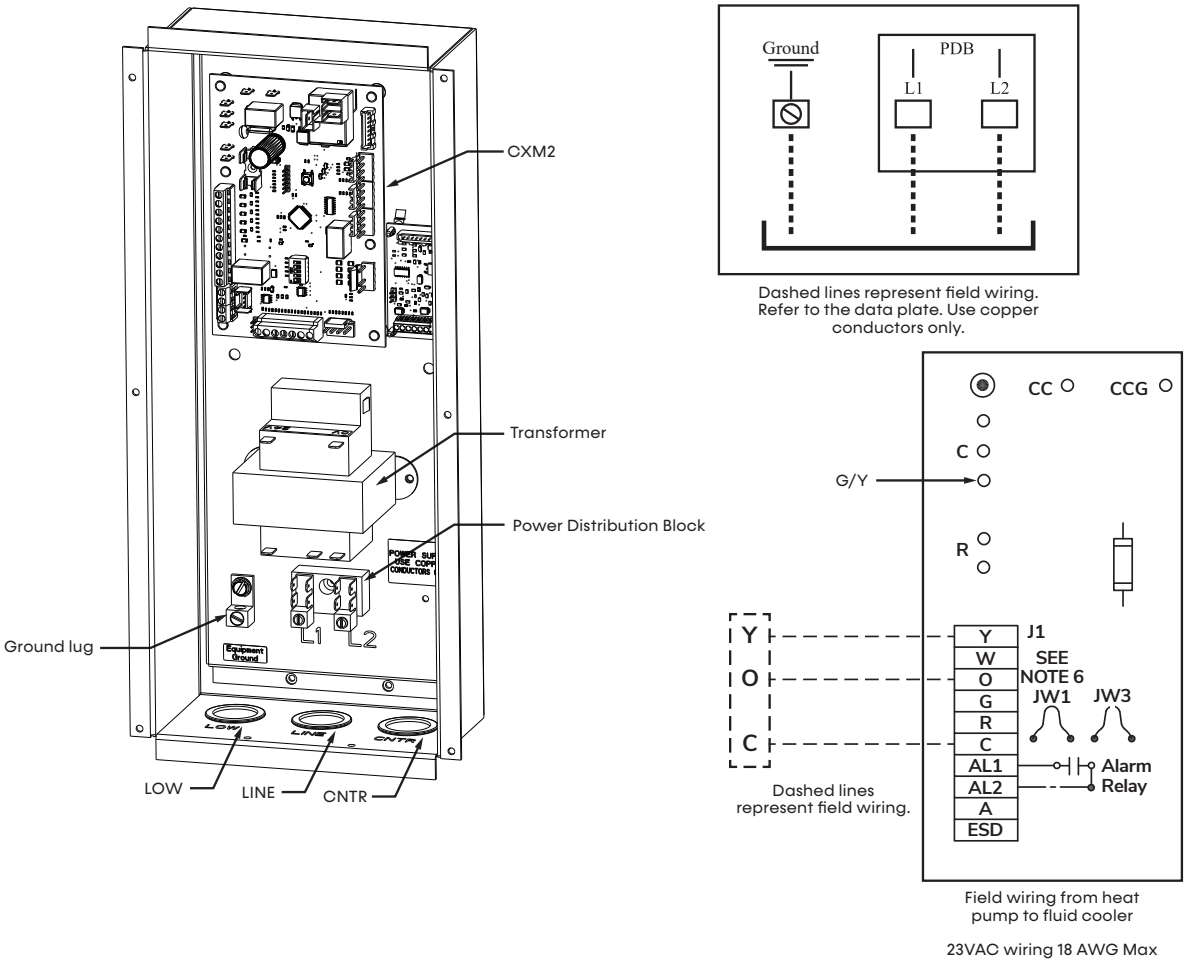


Table 7: TFC LED Descriptions

Description of Operation	Status LED	Fault LED
TFC Control is non-functional	Off	Off
Normal Operation - no active communications with blower	On	On
Normal Operation - active communications with blower	On	Very Slow Flash
EWT out of range	Off	Fast Flash
EAT out of range	Off	Fast Flash
Blower Fault	Off	Fast Flash
Low Temperature Protection Active	Fast Flash	On

- Very Slow Flash – 1 flash every five seconds (1 second on, 4 second off)
- Slow Flash – 1 flash every two seconds (1 second on, 1 second off)
- Fast Flash – 2 flashes per second (¼ second on, ¼ second off)

Models:
CXM2

Tranquility Fluid Cooler Operation with CXM2

The TFC is equipped with a CXM2 to control pump and fan operation. Unit configuration settings are set at the factory for the unit size and pump option. Find the dip switch settings below.

Table 8: Dip Switch Settings

S1 Dip Switch	On	Off
S1-1	Server	Client
S1-2	Stand-Alone	Hybrid
S1-3	N/A	N/A
S1-4	N/A	N/A

STAND-ALONE OPERATION

If DIP1-2 is in the **ON** position for Standalone operation: If the system is configured with an internal pump and has demand or has flow and the entering air is above the minimum entering air temperature (EAT):

When the system is in cooling:

- When the entering water temperature (EWT) is below the minimum EWT for cooling, the unit runs at the designated minimum blower speed.
- When the EWT is above the maximum EWT for cooling, the unit runs at the occupied or unoccupied maximum blower speed depending on occupancy status.
- When the EWT is between the minimum and the maximum EWT for cooling, the blower modulates its blower speed in a linear relation between EWT and the effecting minimum and maximum blower speeds.

When the system is in heating:

- When the EWT is below the minimum EWT for heating, the unit runs at the occupied or unoccupied maximum blower speed depending on occupancy status.
- When the EWT is above the maximum EWT for heating, the unit runs at the designated minimum blower speed.
- When the EWT is between the minimum and the maximum EWT for heating, the blower modulates its blower speed in a linear relation between EWT and the effecting minimum and maximum blower speeds. Modulation is limited to a field-determined duration which has a default of 15 seconds.

LOOP-CONDITION OPERATION

If DIP1-2 is in the OFF position for Hybrid operation:

- If the system is configured with an internal pump or has sensed flow, the entering air temperature is above the minimum EAT value, the EWT is above the target entering water value, and the delta between entering water and EAT is greater than the target delta:
- If the leaving water temperature (LWT) is above the target LWT value, the system operates at the occupied or unoccupied maximum blower speed depending on occupancy status.
- In Hybrid operation, any time the blower is operating and enabling an internal pump (if configured), a bypass value option is activated on the CC output.

Low Water Temperature operation:

- If the LWT is below the target LWT value, the system reduces the blower speed. A reduction of 1% occurs every cycle with a field-determined duration (default to 15 seconds). If the system is operating in Low Water Temperature Operation and the LWT goes above the target LWT value, the blower speed continues to reduce until the LWT is 1°F (0.6°C) above the target LWT value. After the LWT is 1°F (0.6°C) above the target LWT, the system increases by 1% every cycle until blower speed is restored to the maximum blower speed. If the system has been restoring the blower speed and the LWT drops below the 1°F (0.6°C) (target LWT offset, the unit holds at the current blower speed until the LWT either increases 1°F (0.6°C) above the target LWT or falls below the target LWT.

Low Ambient Air operation:

- The operation for low ambient air monitors the EAT sensor. When the ambient temperature measured by the EAT sensor is below the current minimum entering air protection setpoint, the outdoor fan operation stops. If the unit comes with the loop pump option, the loop pump output operates based on the ambient temperature, measured using the EAT sensor (T4).

Basic Troubleshooting Information and Service and Application Notes

Models: CXM2

GENERAL TROUBLESHOOTING

Basic CXM2 troubleshooting in general is best summarized as simply verifying inputs and outputs. After this process is verified, confidence in board operation is confirmed, and the trouble must be elsewhere. Below are some general guidelines required for developing training materials and procedures when applying the CXM2.

CXM2 Field Inputs:

All conventional inputs are 24VAC from the thermostat and can be verified using a voltmeter between C and Y, W, O, and G.

Sensor Inputs:

All sensor inputs are paired wires connecting each component with the board; therefore, continuity on pressure switches can be checked at the board connector.

Measure thermistor resistance with the connector removed so that only the impedance of the thermistor is measured. If desired, compare this reading to the chart shown in the thermistor section of this manual based upon the actual temperature of the thermistor clip (See Table 5 and Table 6 for thermistor-temperature and resistance values). Use an ice bath to check calibration of a thermistor if needed.

CXM2 Outputs:

To verify the 24VAC compressor relay, use a voltmeter. The Alarm Relay can either be 24VAC as shipped or dry contacts (measure continuity during fault) for use with DDC by clipping the JW1 jumper. Electric heat outputs are 24VDC and require a voltmeter set for VDC to verify operation. When troubleshooting, measure from 24VDC terminal to EH1 or EH2 terminals.

Test Mode:

To enter Test mode for 30 minutes, press the Test button. For diagnostic ease at a conventional thermostat, the Alarm Relay cycles during Test mode. The Alarm Relay cycles on and off in sync with the Fault LED to indicate a code representing the last fault at the thermostat. Alternatively, enter and exit Test mode by cycling the G input three times within 60 seconds.

CXM2 THERMOSTAT DETAILS

Anticipation Leakage Current:

Maximum leakage current for Y is 50mA and for W is 20mA. You can use triacs if leakage current is less than above. Thermostats with anticipators can be used if anticipation current is less than that specified above.

Thermostat Signals:

- Y, W, O, and G have a 1-second recognition time when being activated or removed.
- H is for future use
- R and C are from the transformer.
- AL1 and AL2 originate from the Alarm Relay.
- A is paralleled with the compressor output for use with motorized-water valves.

Safety Listing:

The CXM2 is listed under UL 60730, and is CE listed under IEC 60730.

Models:
CXM2

Configuration and Advanced Troubleshooting

GENERAL

To properly configure and troubleshoot advanced control features, and to aid in troubleshooting basic control features, a communicating thermostat or diagnostic tool with similar capabilities should be used.

SYSTEM CONFIGURATION

All factory-installed CXM2 have their basic configuration parameters set as part of the factory-manufacturing and test process. The System Configuration option provides the installer with the ability to set control options, setup the loop configuration, parameters, and configure field replacement controls.

NOTE: A communicating thermostat or a configuration/diagnostic tool is required to configure systems. For CXM2 applications and CXM replacements, configuring the product series, size, and options is not required for functionality. The system functions without being configured from a communicating device.

Heating/Cooling Off Delays: The heating- and cooling-mode blower-off delay times may be independently adjusted by the user. Each delay time may be set between 0 and 255 seconds.

Option Selection: The Option Selection menu allows the installer to set selected control options.

LT2 Setpoint: The LT2 setpoint should be set to **ANTI-FREEZE ONLY** when the unit is configured as a water-to-water unit with antifreeze in the load-side loop. For ALL other unit configurations, the LT2 setpoint should be set to **WATER**.

Motorized Valve: The Motorized Valve option should be set to **ON** when a motorized-water valve with end switch wired to the CXM2 Y is used with a communicating thermostat. For all other system configurations, the Motorized Valve option should be set to **OFF**.

Unit Configuration: Selections under the Unit Configuration menu are set at the factory as a normal part of the manufacturing and test process. This menu allows the configuration to be modified for special applications, or to configure field-replacement controls. The Unit Configuration menu provides the ability to select the Heat Pump Family, Unit Size, Blower Type, and Loop Type. Making these selection configurations is not required. This is an optional step only.

Heat Pump Family: When replacing a control in the field, you can select the Heat Pump Family. The valid unit family values are available for the user to scroll through to select the proper value. This step is not required.

Heat Pump Size: When replacing a control in the field, you can select the Heat Pump Size. The valid Heat Pump Size values are available for the user to scroll through to select the proper value. This step is not required.

Blower Type: When replacing a control in the field, you can select the Blower Type. The valid Blower Type values are available for the user to scroll through to select the appropriate value for No Blower or Single-Speed configurations. This step is not required.

SERVICE MODE

Service Mode provides the installer with several functions for troubleshooting, including Manual Operation, Control Diagnostics, Control Configuration, and Fault History.

Manual Operation: Manual Operation mode allows the installer to bypass normal thermostat timings and operating modes, to directly activate the thermostat inputs to the CXM2, activate the CXM2 Test mode, and directly control the internal-flow center and proportional valve.

Configuration and Advanced Troubleshooting

Models:
CXM2

Control Diagnostics: The Control Diagnostics menus allow the installer to see the current status of all CXM2 switch inputs, values of all temperature sensor inputs, control voltage, internal-flow center, and proportional valve-operating status or parameters.

DIP Switch Configuration: The DIP Switch Configuration menu allows the installer to easily see the current CXM2 configuration.

Fault History: In addition to the fault code, the CXM2 stores the status of all control inputs and outputs when a fault condition is detected. The fault history covering the last five lockout conditions is stored and may be retrieved from the CXM2. After a specific fault in the fault history is selected, the operating mode and time when the fault occurred are displayed with options to select specific control status values when the lockout occurred.

Fault Temp Conditions: This option displays the CXM2 temperature and voltage values when the lockout occurred.

Fault I/O Conditions: This option displays the status of the CXM2 physical and communicated inputs and the relay outputs when the lockout occurred.

Fault Configuration Conditions: This option displays the status of the CXM2 option selections when the lockout occurred.

Fault Possible Causes: This option displays a list of potential causes of the stored fault.

Clear Fault History: This option allows you to clear the fault history stored in the non-volatile CXM2 memory.

CXM2 CLIENT/SERVER ADDRESSING

Up to three controls may be controlled from a single communicating thermostat.

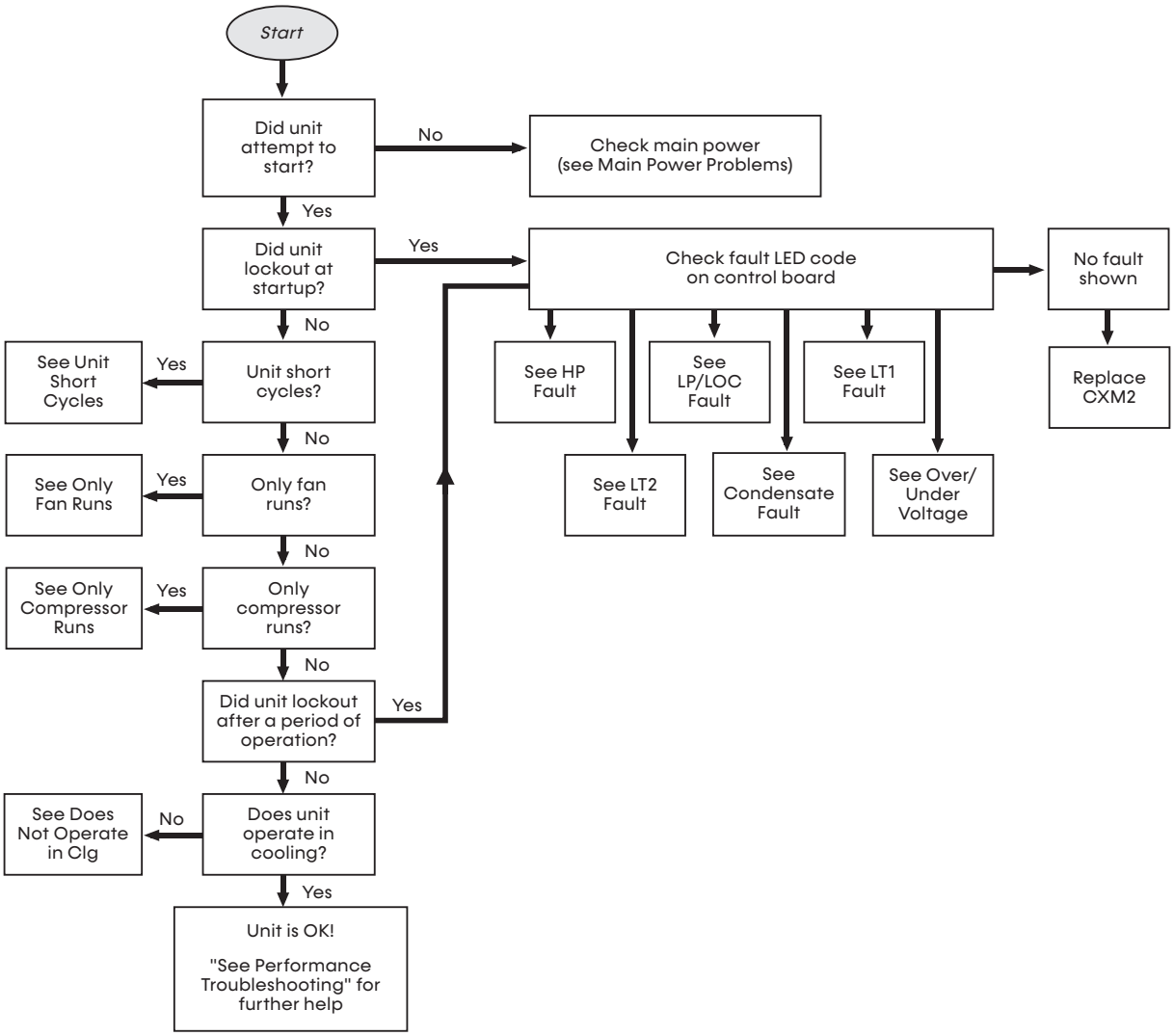
When configuring multiple units for control by the same thermostat, complete the following steps before applying power:

1. Connect the thermostat to each CXM2 normally, using the A+ and B- connections (daisy-chain wiring so all CXM2 share the communication port).
2. Next, confirm that the DIP switch S2-3 is in the ON position for only the server CXM2, and S2-3 is in the OFF position for all client CXM2.
3. Apply power to the server unit and one of the unaddressed client units that is to be controlled by the same thermostat.
4. After applying unit power, press and hold the TEST button on the CXM2 of the client unit. After several seconds, the Fault and Status LEDs flash. Release the TEST button. When both LEDs are flashing rapidly, the client is assigned an address and is controlled by the same thermostat-demand messages as the server CXM2.
5. Repeat steps 3 and 4 for each additional unit to be added to the system (the server CXM2 unit and addressed clients should remain powered).

Models:
CXM2

CXM2 Functional Troubleshooting Flow Chart

Use the following troubleshooting flow chart and tables on the following pages to find the appropriate troubleshooting strategies for the CXM2 and most water source heat pump applications.



Functional Troubleshooting

Models:
CXM2

⚠ CAUTION

Do not restart units without inspection and remedy of faulting condition. Equipment damage may occur.

Fault	Htg	Clg	Possible Cause	Solution
Main power problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24VAC between R and C on CXM2.
				Check primary/secondary voltage on transformer.
HP Fault Code 2 High Pressure		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow adjust to proper flow rate.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty Air Coil - construction dust etc.
				Too high of external static? Check static vs blower table.
	X		Air temperature out of range in heating	Bring return air temp within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace.
LP/LOC Fault Code 3 Low Pressure / Loss of Charge	X	X	Insufficient charge	Check for refrigerant leaks.
	X		Compressor pump down at startup	Check charge and startup water flow.
LT1 Fault Code 4 Water coil low-temperature limit	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use.
	X		Water Temperature out of range	Bring water temp within design parameters.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
LT2 Fault Code 5 Air coil low-temperature limit		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
		X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.

Table continued on next page.

Models:
CXM2

Functional Troubleshooting

Table continued from previous page.

Fault	Htg	Clg	Possible Cause	Solution
Condensate Fault Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting? Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
	X	X	Plugged air filter	Replace air filter.
	X	X	Restricted Return Airflow	Find and eliminate restriction. Increase return duct and/or grille size.
Over/Under Voltage Code 7 (Auto resetting)	X	X	Under Voltage	Check power supply and 24VAC voltage before and during operation.
				Check power supply wire size.
				Check compressor starting. Need hard start kit?
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
Unit Performance Sentinel Code 8	X		Heating mode LT2>125°F [52°C]	Check for poor airflow or overcharged unit.
		X	Cooling Mode LT1>125°F [52°C] OR LT2< 40°F [4°C])	Check for poor water flow or airflow.
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors
Low Water Flow Code 13	X	X	Reduced or no water flow	Check pump or valve operation setting.
				Check water flow and adjust to proper flow rate.
				Clogged Y strainer, replace mesh.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X	X	Bad flow switch	Confirm applied flow to looks vs minimum flow siwtch setpoint on label.
Leaving Water Temperature Low Code 14	X		Reduced or no water flow in heating	Check pump or valve operation setting.
				Check water flow and adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 15°F [-1°C vs -9°C]	Clip JW3 jumper for antifreeze (15°F [-9°C]) use.
	X		Water temperature out of range	Bring water temperature within design parameters.
	X	X	Bad thermistor	Check temperature impedence correlation per chart.
Refrigerant and RDS Code 15	X	X	Refrigerant Leak	Check refrigerant charge. If the charge is low, identify and repair the leak.
			Faulty RDS sensor	Check refrigerant charge. If the charge is not low, replace the RDS sensor.
No Fault Code Shown	X	X	No compressor operation	See "Only Fan Runs".
	X	X	Compressor overload	Check and replace, if necessary.
	X	X	Control board	Reset power and check operation.

Table continued on next page.

Functional Troubleshooting

Models: CXM2

Table continued from previous page.

Fault	Htg	Clg	Possible Cause	Solution
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in "test mode"	Reset power or wait 30 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace, if necessary.
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor Overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X		Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across BR contacts.
	X	X		Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil and at CXM2.
		X		If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'click'.
		X		Put thermostat in cooling mode. Check 24VAC on O (check between C and O); check for 24VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Models:
CXM2

Performance Troubleshooting

Symptom	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers. If significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling per chart.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind stat.
	X	X	Unit undersized	Recheck loads & sizing. Check sensible cooling load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow. Adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Re-weigh in charge.
	X	X	Non-condensables in system	Vacuum system and re-weigh in charge.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
Low Suction Pressure	X		Reduced water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Water temperature out of range	Bring water temperature within design parameters.
		X	Reduced airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs. blower table.
		X	Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low Discharge Air Temperature in Heating	X		Too high of airflow	Check fan motor speed selection and airflow chart.
	X		Poor performance	See 'Insufficient Capacity'
High humidity		X	Too high of airflow	Check fan motor speed selection and airflow chart.
		X	Unit oversized	Recheck loads & sizing. Check sensible cooling load and heat pump capacity.

Table continued on next page.

Performance Troubleshooting

Models:
CXM2

Table continued from previous page.

Symptom	Htg	Clg	Possible Cause	Solution
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across blower relay contacts.
				Check fan power. Enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check thermostat wiring at CXM2. Put in Test Mode and then jumper Y1 and W1 to R to give call for fan, compressor and electric heat.
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil.
				If RV is stuck, run high pressure up by reducing water flow and, while operating, engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for "O' RV setup, not "B".
		X	Thermostat wiring	Check O wiring at heat pump. CXM2 requires call for compressor. You should hear a "click" sound from the reversing valve.
Modulating Valve Troubleshooting	X	X	Improper output setting	Verify the AO-2 jumper is in the 0-10V position.
	X	X	No valve output signal	Check DC voltage between AO2 and GND. Should be O when valve is off and between 3.3V and 10V when valve is on.
	X	X	No valve operation	Check voltage to the valve.
				Replace valve if voltage and control signals are present at the valve and it does not operate.

Models:
CXM2

Revision History

Date	Section	Description
02/05/25	Refrigerant Detection System Fault Codes	Added RDS LED flash codes
01/06/25	All	Updated verbiage for client/server configurations throughout
12/16/24	Refrigerant Detection System Fault Codes	Added content concerning RDS fault codes
12/11/24	Physical Dimensions and Layout	Added callout descriptors for T1, T2, T3, T4, and T5
	Operating Descriptions	Updated anti-short cycle period from 5 minutes to 7 minutes
	Tranquility Fluid Cooler and CXM2 Field Wiring/Installation	Added field-wiring graphics and LED Descriptions table for the Tranquility Fluid Cooler
	Tranquility Fluid Cooler Operation with CXM2	Added content detailing CXM2 operation with the Tranquility Fluid Cooler
07/24/24	Field Selectable Inputs and DIP Switches, Basic Troubleshooting	Updated Test mode duration from 20 to 30 minutes
05/24/24	All	Updated document design and added CXM2 Board Identification section
01/25/24	Field-selectable Inputs and DIP Switches	Added a note on wiring in certain use-cases
	Fault Codes	Updated LED and Alarm Relay Output table options
03/08/23	Functional Troubleshooting	Removed non-applicable faults from the Functional Troubleshooting table
10/18/22	All	First published

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