



TECHNICAL GUIDE · CN-IC2E-17 · EXTERNAL

i-Controller 2.0e (6–70 Ton)

MUA

Sequence of Operation Revision 301 MUA

Document: CN-IC2e-17

Title: i-Controller 2.0e (6–70 Ton) MUA Sequence Of Operations REV.301

Table of Contents

Unit Configurations	3
Sequence of Operation (No Comms – VCCX Only)	3
Make-Up Air Sequence of Operation	3
Network Communication	4
Smoke Detection and Unit Shutdown	4
A2L Mitigation/Leak Detection	5
Normal	5
Alarm	5
Lockout	5
Supply Fan Strategy	5
Variable Frequency Drive(s) (VFD)	5
Airflow Switches and Fan Proof	6
Airflow Dampers	6
Outdoor Air Damper(s) (OAD)	6
Compressors	7
Compressor Staging	7
Dehumidification	9
Comfort Cooling	9

Dehumidification and Cooling Compressor Safeties	10
Heating	10
Heating Safeties	11
Reheat Coil (if equipped)	11
Reheat Safeties	11
Condenser Control (Head Pressure Control)	11
Air Cooled Condenser – Modulating	11
Air Cooled Condenser – Safeties	12
MUA Safeties	12
Compressor Equipped Unit Safeties	12
Safeties Included with All Units	12
MUA Alarms and Notices	13
Compressor Alarms for Digital and 2-Stg Compressor Types	14
Additional Functionality	16
Set Point Limits and Adjustments	16
Sensor Offsets and Limits	16
Run-Time Delays (Equipment Timers)	17
Controller Outputs	17

Unit Configurations

	(If Equipped)	(Air-Cooled)		(Refrigerant/ Water)	
6, 7, 8, 10	1	1	1	Single	1
9, 11, 13, 15	2	2	1	Single	1
14, 16, 18, 20	2	2	1	Single	1
25, 30	2	3	1	Single	1
40 - 70	4	6	2	Split	2 (Parallel)

Table 1. Unit Configuration Table

Sequence of Operation (No Comms – VCCX Only)

In the event a loss of BACnet communication occurs between the i-Controller and the VCCX controller, the following sequence will take place.

- The Outdoor Air Damper will close, and the unit will shutdown.

Make-Up Air Sequence of Operation

****Highlighted Values in this document are configurable parameters, adjustable and set as needed on a site-by-site basis. The configuration values of these properties are stored in the i-Controller Config file.**

The Make-Up Air (MUA) sequence follows a single mode of operation. The mode of operation is based on the exhaust fan interlock and/or exhaust fan ratio inputs.

- Exhaust interlock dry contact will enable the unit.
- Exhaust Ratio Only (2-10VDC) will enable the unit. (Greater than 2VDC to enable unit)
- Exhaust Ratio (0-10) plus Exhaust interlock dry contact will enable the unit.

Network Communication

The i-Controller supports BACnet and Modbus protocols to communicate with the Building Management System (BMS). Modbus is the default communication protocol. If a BMS connection is not available, the FLō MUA is fully functional in stand-alone mode.

If a BMS connection is desired, the i-Controller will accept exhaust interlock, and cooling/heating setpoint signals from the BMS master controller. Other optional values from the BMS include:

- Network outdoor air temperature
- Network outdoor humidity temperature
- Network enable/disable
- Exhaust fan interlock signal

Smoke Detection and Unit Shutdown

A closed smoke detector input is required for MUA operation. When the input is closed, the unit will operate normally. When the input opens, the MUA will shut down. The opening of this input indicates an Emergency Shutdown condition has occurred. During an Emergency Shutdown an advisory entry will be generated and displayed in the alarm log.

In the event of a unit shutdown, all mechanical equipment (compressors, fans, heating module) will be disabled, and the outdoor air damper(s) will be closed.

The following events will cause a unit shutdown:

- Smoke Detection (Wet to controller & safety circuit)
- Phase Loss Detection (Dry to controller / Wet on safety circuit)
- Drain Pan Overflow Detection (Wet on safety circuit)
- A2L Leak Detection Lockout (Wet to controller & safety circuit)
- Absence of a Digital Airflow Proof (Wet to controller. Supply fan will continue to operate for 10 minutes before shutting down.)
- Simultaneous Space and Return Temperature Sensor Failure
- Network Disable Signal Initiated by the Building Management System
- Breaching Low and High Supply Temperature Limits
- Supply Temperature Sensor Failure

A2L Mitigation/Leak Detection

The MUA is equipped with an A2L Mitigation controller as part of the Refrigerant Detection System designed to detect A2L refrigerant leaks in the airstream and/or cabinet.

For the first five seconds after power up, the output for alarms is disabled and compressors are locked out until the sensors can give a valid reading. The controller has 3 modes of operation: Normal, Alarm, Lockout.

Normal

Normal operation has zero sensor faults or leaks detected and all four relays are activated. This is the only state where the relays are activated. Any sensor inputs not populated with a sensor connection must have a G145190 Sensor bypass plug installed.

Alarm

Alarm mode is triggered when any one or more sensors detects an A2L refrigerant leak or by the controller not detecting a sensor connection. In alarm mode, the controller will enable the supply fan, disable the compressors, enable the alarm and signal any external VAV systems. In the event of a cabinet leak, the heat will be shut off immediately. In the event of an airstream leak, the supply fan will ramp up to 100%. The A2L controller will remain in alarm mode for five minutes after the sensor is cleared before returning to normal operation.

Lockout

Lockout mode is activated if the controller does not receive proof of flow within 2.5 minutes of enabling the supply fan in the alarm state. The controller will remain in alarm state and must be power cycled to return to normal operation or by using the keypad and display on the VCCX-454.

Supply Fan Strategy

Variable Frequency Drive(s) (VFD)

The MUA is equipped with a Variable Frequency Drive (VFD) to control total air flow via the draw-through supply fan. The VFD runs continuously and can modulate between [50]–100% depending on the enable methods listed below

- Exhaust interlock (Dry Contact ONLY): When the dry contact is closed, the supply fan will run at 100% and, when open, the unit will shutdown, outdoor air damper will close, and fan will stop.

- **Exhaust Ratio Only (2–10VDC):** If exhaust ratio is enabled, fan will modulate [50]–100% based on the 2–10 VDC exhaust ratio input. Voltage below 2 VDC will trigger a shutdown; outdoor air damper will close, and fan will stop.
- **Exhaust Ratio (0–10VDC) & Exhaust interlock:** If exhaust ratio is enabled, unit can be enabled by the exhaust interlock and fan will modulate [50]–100% based on the 0–10 VDC exhaust ratio input. Once exhaust interlock is opened, the unit will shutdown, outdoor air damper will close, and fan will stop.

Airflow Switches and Fan Proof

The MUA is equipped with a single airflow switch:

- **Digital Airflow Switch:** Provides a wet contact closure connected to the VCCX controller and indicates airflow within the unit's airstream. A fan 'proof' occurs when the input is closed. This switch is normally open (NO).

NOTE: If a Fan Failure advisory is generated via the digital 'proof' input, all cooling and heating will be disabled and the controller waits up to 10 minutes for proof to be restored. If proof is restored within 10 minutes, the advisory will automatically reset and the MUA will resume normal operation. If proof is not restored within 10 minutes, a Fan Fail alarm will be generated, a unit shutdown will occur, and the alarm must be manually cleared on the i-Controller display before the MUA will resume normal operation.

**

**

Airflow Dampers

The MUA without return damper has a single airstream configuration of operation. When the exhaust interlock is "Closed", the unit will operate in a 100% outdoor air configuration. When the exhaust interlock is "Open", the unit will shutdown.

Outdoor Air Damper(s) (OAD)

- During operation mode, the OAD damper(s) will open 100%.
- The OAD will close completely in the event of a unit shutdown (see *Smoke Detection and Unit Shutdown*), or a controller power reboot.
- The OAD is equipped with a limit switch. Switch must be closed before supply fan will start.

Compressors

Compressor Staging

Compressor configuration and staging vary based on the unit size. Below illustrates compressors availability and staging based on unit size.

Single Compressor Units (7 & 10 Ton)

Compressor A1 is the *sole* compressor in the associated suction group. Digital compressor will start at 100% for 30 seconds and then ramp down and begin to modulate. Compressor A1 will initiate when there is a call for cooling or dehumidification. Staging down, compressor A1 will modulate down until there is no call for cooling or dehumidification.

Two Compressor Units (15–30 Ton)

Compressor A1 is the *lead* compressor (Digital) in the associated suction group, while compressor A2 is the *lag* compressor (2-Step) in the suction group. Digital compressor will start at 100% for 30 seconds and then ramp down and begin to modulate. Two stage compressors will start at 67% and will stage up to 100% and then stage back to 67% before turning off.

No Reheat Equipped

Compressor A1 will initiate first when there is a call for cooling or dehumidification. Compressor A2 will activate once the associated *lead* compressor has reached 100% capacity and the RUN time delay has expired.

Staging down, compressor A1 will modulate down to, 10% in cooling mode or 70% in dehumidification mode, then compressor A2 will stage down to 67% and once the run time delay has expired compressor A2 will be turned off. Compressor A1 will continue to modulate until there is no call for cooling or dehumidification.

Lag Circuit Reheat Equipped

In dehumidification mode, compressor A2 will initiate first when there is a call for dehumidification. Compressor A1 will activate once the associated *lag* compressor has reached 100% capacity and the RUN time delay has expired.

Staging down, compressor A1 will modulate down to 70%, and once the run time delay has expired compressor will be turned off. Compressor A2 will then stage down to 67% and continue to run until there is no call for dehumidification.

In cooling mode, compressor A1 will initiate first when there is a call for cooling. Compressor A2 will activate once the associated *lead* compressor has reached 100% capacity and the RUN time delay has expired.

Staging down, compressor A1 will modulate down to, 10%, and compressor A2 will be then stage down to 67% and once the run time delay has expired compressor will be turned off. Compressor A1 will continue to modulate until there is no call for cooling.

Four Compressor Units (40–70 Ton)

Compressors A1 and A2 are the *lead* compressors (Digital) in the associated suction group, while compressors B1 and B2 are the *lag* compressors (2-Step) in the suction group. Digital compressors will start at 100% for 30 seconds and then ramp down and begin to modulate. Two stage compressors will start at 67% and will stage up to 100% and then stage back to 67% before turning off.

No Reheat Equipped

Compressors A1 & A2 will both initiate first when there is a call for cooling or dehumidification. Compressors B1 & B2 will activate once the associated *lead* compressor has reached 100% capacity and the RUN time delay has expired. Compressors B1 & B2 will both start at 67% and the digital compressors A1 & A2 will be turned off. On increasing demand, compressors B1 & B2 will stage up to 100%, then A1 & A2 will turn back on with B1 & B2 returning to 67% and final stage will be all compressors on at 100%.

Staging down, compressors A1 and A2 will modulate down to, 10% in cooling mode or 70% in dehumidification mode, then compressors B1 and B2 will stage down to 67% and once the run time delay has expired compressors A1 & A2 will be turned off. B1 & B2 will then stage to 100% then to 67% before being turned off. Once compressors B1 & B2 are off, compressors A1 & A2 will restart and continue to modulate until there is no call for cooling or dehumidification.

Lag Circuit Reheat Equipped

In dehumidification mode, compressors B1 and B2 will both initiate first at 67% when there is a call for dehumidification. Compressors B1 & B2 will stage to 100% before compressors A1 & A2 are activated. Compressors A1 and A2 will activate once the associated *lag* compressor has reached 100% capacity and the RUN time delay has expired.

Staging down, compressors A1 and A2 will modulate down to 70%, and once the run time delay has expired compressors will be turned off. Compressors B1 & B2 will then stage down to 67% and continue to run until there is no call for dehumidification.

In cooling mode, compressors A1 & A2 will both initiate first when there is a call for cooling. Compressors B1 & B2 will activate once the associated *lead* compressor has reached 100% capacity and the RUN time delay has expired. Compressors B1 & B2 will both start at 67% and the digital compressors A1 & A2 will be turned off. On increasing demand, compressors B1 & B2 will stage up to 100%, then A1 & A2 will turn back on with B1 & B2 returning to 67% and final stage will be all compressors on at 100%.

Staging down, compressors A1 and A2 will modulate down to, 10% in cooling mode or 70% in dehumidification mode, then compressors B1 and B2 will stage down to 67% and once the run

time delay has expired compressors A1 & A2 will be turned off. B1 & B2 will then stage to 100% then to 67% before being turned off. Once compressors B1 & B2 are off, compressors A1 & A2 will restart and continue to modulate until there is no call for cooling or dehumidification.

Dehumidification

Dehumidification takes PRIORITY OVER Comfort Cooling. Dehumidification is enabled based on the space dew point setpoint. Space dew point set point can be set locally on the i-Controller or sent over the BMS network.

- Space Dew Point > Dewpoint Set Point $[-0.5^{\circ}\text{F}]$ = DEHUM ENABLE
- Space Dew Point < Dewpoint Set Point $[-1.25^{\circ}\text{F}]$ = DEHUM DISABLE

The suction pressure setpoint is reset based on the space dew point behavior and distance from space dew point setpoint. The suction pressure setpoint will be set to the maximum [109 psig] of the scale upon initiation of dehumidification mode and will float towards the minimum of the scale [98 psig] as the space dew point increases above set point. For units greater than 26 tons with multiple suction groups, both suction groups will be controlled to the same set point.

To maintain control of the space when the MUA is not running in a dehumidification mode, Preemptive Dehumidification will enable dehumidification based on elevated outdoor humidity and space conditions. The Suction pressure setpoint is set to [109 psig] during Preemptive Dehumidification.

- Outdoor Dewpoint > 60 °F = Preemptive DEHUM ENABLE
- Outdoor Dewpoint < 56 °F = Preemptive DEHUM DISABLE
- Space Dewpoint < Dewpoint setpoint - 2 °F = Preemptive DEHUM DISABLE

Comfort Cooling

Comfort cooling is enabled based on the space temperature setpoint. The cooling set point can be set locally on the i-Controller, or sent over the BMS network.

NOTE: Dehumidification takes PRIORITY OVER comfort cooling.

- Space Temp > Cool Set Point $[+0.25^{\circ}\text{F}]$ = COOL ENABLE
- Space Temp < Cool Set Point $[-0.75^{\circ}\text{F}]$ = COOL DISABLE

During operation mode, the suction pressure setpoint is reset based on the space temperature behavior and distance from cooling setpoint. The suction pressure setpoint will be set to the maximum [139 psig] of the scale upon initiation of cool mode and will float towards the minimum of the scale [111 psig] as the space temperature increases above set

point. For units greater than 26 tons with multiple suction groups, both suction groups will be controlled to the same set point.

To maintain control of the space when the MUA is not running in a cooling mode, Preemptive Cool will enable cooling based on elevated outdoor temperature and space conditions. The suction pressure setpoint is set to [139 psig] during Preemptive cooling.

- Outdoor Temp > 76 °F and Space Temp > Reheat Setpoint = Preemptive COOL ENABLE
- Outdoor Temp < 73 °F = Preemptive COOL DISABLE
- Space Temp < Reheat Setpoint = Preemptive COOL DISABLE

Dehumidification and Cooling Compressor Safeties

Suction Pressure Transducer Failure: In the event of a suction pressure transducer failure, all associated compressors will be turned off and an alarm will be generated. Alarms will automatically clear once the suction pressure transducer failure is repaired.

Ambient Compressor Lockout: Dehumidification, Cooling and Compressors will be disabled if the Outdoor air temperature is below 42°F, and will remain locked out until the outdoor air temperature rises above 50°F.

NOTE: Compressors will not be locked out on Heat Pump units.

Heating

Heating is enabled solely upon space temperature setpoint. The heating setpoint can be set locally on the i-Controller, or set over the BMS network. When heating is enabled, heating stages are sequenced ON/OFF to maintain the space temperature to the heating set point.

NOTE: Heat Stage 1 will remain active throughout heat mode.

- Space Temp < Heat Set Point [– 1.0°F] = HEAT ENABLE
- Space Temp > Heat Set Point [+ 1.0°F] = HEAT DISABLE

To maintain control of the space when the MUA is not running in a heating mode, Preemptive Heat will enable heating based on outdoor temperature and space conditions.

- Outdoor Temp < 56 °F and Space Temp < Reheat Setpoint = Preemptive HEAT ENABLE
- Outdoor Temp > 58 °F = Preemptive HEAT DISABLE
- Space Temp > Reheat Setpoint = Preemptive HEAT DISABLE

Heating Safeties

High Supply Temperature: If supply temperature is $> [130^{\circ}\text{F}]$, no additional stages of heating will be enabled.

Reheat Coil (*if equipped*)

The reheat coil(s) utilize compressor discharge heat to reheat the supply airstream throughout dehumidification. The coil(s) will only be enabled during dehumidification when the space temperature meets the following conditions:

Reheat Enable:

- Space Temp $< [\text{Reheat Set Point}] = \text{REHEAT ENABLE}$
- Space Temp $> \text{Reheat Set Point} [+ 1.0^{\circ}\text{F}] = \text{REHEAT DISABLE}$

Once enabled, a reheat flush will occur. During flush, the reheat valve will open to approximately 90% for 30 seconds to flush the length of the reheat coil. Then, reheat coil valve will open to 40% and the valve will modulate from 40 – 85% based on space temperature requirements. Reheat mode has a minimum run time of 8-minutes. As a default, the Reheat set point is set to the midpoint between the Occupied Heating and Cooling set point and can be adjusted if necessary.

Reheat Safeties

If the compressor associated with the reheat circuit has been enabled and running in cooling mode for 60 consecutive minutes, a reheat flush will occur. If the compressor has been enabled and running in dehumidification mode for 20 consecutive minutes and the reheat valve has been less than 70%, a reheat flush will occur. During reheat flush the reheat valve will open to approximately 90% for 30 seconds to flush the length of the reheat coil.

Condenser Control (*Head Pressure Control*)

Air Cooled Condenser – Modulating

The refrigeration system module will monitor a head pressure transducer and control a condenser fan to maintain a head pressure setpoint. A condenser relay is commanded on when the first compressor is enabled, and the condenser fan will be controlled with a 0–10 VDC output signal. When the condenser fan is first enabled, it will maintain 100% speed for 10 seconds then ramping down and begin modulating to maintaining setpoint. Condenser fan signal will modulate between 15% and 100%.

Air Cooled Condenser – Safeties

- If the head pressure exceeds 470 PSIG, the condenser fan will immediately go to 100% speed and an alarm will be generated. Alarm will be reset once head pressure drops below 460 PSIG.
- If no head pressure sensor is detected, the condenser fan will go to 100% speed and an alarm will be generated. Alarm will automatically clear once the head pressure transducer failure is repaired.

MUA Safeties

Compressor Equipped Unit Safeties

- Low suction pressure mechanical cut-out at 60 psig
- High discharge pressure mechanical cut-out at 600 psig
- Compressor anti-short cycling timer of 3 minutes when suction group is enabled
- Compressor discharge temperature monitoring with condenser fast recovery. The fast recovery is both electromechanical and an application within the controller.

Safeties Included with All Units

- **Phase and brown-out protection:** Upon detection of a phase issue, the monitor opens the secondary 24VAC circuit, disables the control circuit and causes a unit shutdown. If the condition clears, the phase monitor will auto-reset.
- **Emergency Shutdown:** A 24VAC wet contact input is available to be used with a normally closed safety circuit. If this contact opens, it will immediately shut down the unit and generate an alarm. Alarm will automatically reset once the contacts are closed. Used for smoke detection and drain pan overflow.
- **Air Flow Switch:** A proof of flow switch provides a 24VAC wet contact closure when the supply fan is in operation. If this contact is open during a fan call, all cooling and heating are disabled, the outdoor air damper is closed, and an alarm will be generated. If the contact is closed within 10 minutes, the alarm will automatically reset, and the unit will restart. If the

contact is open longer than 10 minutes, the unit will lockout on fan failure and require a manually reset of the alarm.

- **Supply Temperature Failure:** Upon detection of an open or shorted supply temperature sensor the unit will be completely shut down and an alarm will be generated. Alarm will automatically reset once the sensor failure is repaired.
- **Supply Temperature High Limit:** When the supply air temperature rises above the supply air high temperature cutoff, 150°F, the unit will immediately shut down and an alarm will be generated. Alarm will clear and unit will restart once the supply air temperature is 5 degrees below the supply air high temperature cutoff.
- **Supply Temperature Low Limit:** When the supply air temperature drops below the supply air low temperature cutoff, 40°F, for 10 minutes, the unit will completely shut down and an alarm will be generated. Alarm will clear and unit will restart once the supply air temperature is 5 degrees above the supply air low temperature cutoff.

MUA Alarms and Notices

The following alarms when detected, will be displayed in the i-Controller alarm log. All alarm timers are reset when alarms are manually cleared.

- **Clogged Filter Notice:** Alarm activated when the filters in the unit need to be replaced. Activated via a closure of the normal open clogged filter switch.
- **Fan Fail Alarm:** Alarm activated when the fan proof has not been made for more than 10 minutes. This alarm will cause a unit shutdown and must be manually reset in the display.
- **Emergency Shutdown Alarm:** Alarm activated when a smoke detection or drain pan overflow occurs. This alarm will cause the unit to shut down. Alarm is activated via an opening of the normal closed smoke detector input or the opening of the normally closed drain pan float switch and is automatically reset upon closure of both inputs.
- **Phase Loss Alarm:** Alarm activated when the digital phase monitor detects a fluctuation in the main unit power outside of the acceptable limits. This alarm will cause the unit to shut down after a 30-second delay. Alarm is activated via an opening of the normal closed phase loss input and is automatically reset upon closure of the input.

- **Heat Alarm:** Alarm is activated if the supply temperature has not increased at least 5°F with at least 2-heat stages activated for [30] minutes. Alarm is automatically reset upon heat mode disable.
- **Reheat Notice*:** Alarm is activated if the supply temperature has not increased at least 5°F after heat reclaim has been enabled for [30] minutes. Alarm is automatically reset upon heat reclaim disable.
- **Heat Reheat/Reclaim Temperature Latch*:** Alarm is activated if reheat (or reclaim*) inlet temperature has not decreased by 10°F (20°F for reclaim*) within 10 minutes of reheat/reclaim* disable. Alarm will automatically reset when reheat/reclaim* inlet temperature falls into the acceptable range.
- **High and Low Supply Temperature Alarm:** When the supply air temperature rises above the supply air high temperature cutoff, 150°F, the unit will immediately shut down and an alarm will be generated. Alarm will clear and unit will restart once the supply air temperature is 5 degrees below the supply air high temperature cutoff. When the supply air temperature drops below the supply air low temperature cutoff, 40°F, for 10 minutes, the unit will completely shut down and an alarm will be generated. Alarm will clear and unit will restart once the supply air temperature is 5 degrees above the supply air low temperature cutoff.
- **Sensor Failure Alarm:** Alarm is activated when one or more of the temperatures, transducer, humidity, or CO2* sensors fail.
- **A2L Airstream Leak Alarm:** Alarm is activated when a refrigerant leak is detected in the unit airstream. Once active, compressors will be locked out and the supply fan will be commanded per the A2L mitigation sequence. After the sensor is cleared, the A2L controller will remain in alarm mode for five minutes before returning to normal operation. The alarm log entry must be manually cleared on the VCCX display or by power cycling the VCCX controller.
- **A2L Cabinet Leak Alarm:** Alarm is activated when a refrigerant leak is detected in the unit cabinet. Once active, gas heating and compressors will be locked out and the supply fan will be commanded per the A2L mitigation sequence. After the sensor is cleared, the A2L controller will remain in alarm mode for five minutes before returning to normal operation. The alarm log entry must be manually cleared on the VCCX display or by power cycling the VCCX controller.

**

**

Compressor Alarms for Digital and 2-Stg Compressor Types

NOTE: Suction and Discharge Alarms are only present when the MUA is equipped with compressors.

NO SUCTION PRESSURE SENSOR DETECTED: This alarm indicates the Suction Pressure Sensor is not detected by the system. There is no compressor failure from this alarm. The failure will be unsafe suction pressure.

NO HEAD PRESSURE SENSOR DETECTED: This alarm indicates the Head Pressure Sensor is not detected by the system. This will cause the condenser fan/valve to go to 100%.

HIGH HEAD PRESSURE DETECTED: This indicates a High Head Pressure Alarm condition which is activated when the Head Pressure rises above 470 PSIG. This will cause the condenser to go to 100%.

LOW SUCTION PRESSURE FAILURE: This alarm will occur if suction pressure stays below the low suction pressure setpoint for 1 minute or falls below 40 psi for 5 seconds. This alarm will shut down the system. Alarm will auto reset after the suction pressure has been above the low suction pressure setpoint for 5 minutes.

LOW SUCTION PRESSURE DETECTED: This alarm will occur if suction pressure falls below the low suction pressure setpoint for 20 seconds. The system will try to protect by lowering compressor modulation percentage.

COMPRESSOR FAULT: This alarm will occur if the compressor fails to run 45 seconds after the relay is activated or if the signal is lost after activation. This will cause an alarm and will shut down the compressor (relay). The system will retry after 5 minutes.

COMPRESSOR BAD TEMPERATURE: This alarm will occur if the discharge temp sensor measures less than -40 degrees F or more than 356 degrees F. This will cause an alarm and will shut down the compressor (relay). The system will retry after 5 minutes.

COMPRESSOR CUTOFF: This alarm will occur if the discharge temp sensor measures more than 265 degrees F. This will cause an alarm and will shut down the compressor (relay). The system will can be restarted after 30 minutes.

COMPRESSOR LOCKOUT: If active cutoff occurs 5 times within a 4-hour period, the compressor will be locked out. Must cycle power to RSMD to clear the alarm.

- If the Suction Pressure falls below the Unsafe Suction Setpoint for 5 seconds, that circuit's compressor will be locked out. Power will need to be cycled to restart the unit

COMPRESSOR ENVELOPE FAULT: This alarm will occur if circuit is running outside of the compressor envelope for one minute. Compressor will turn off and restart after a five minute off delay.

Additional Functionality

Additional features available in the i-Controller that are not included in the core sequence of operation.

Set Point Limits and Adjustments

The local heating, cooling, and dehumidification set points are subject to the limits and requirements listed below.

- Heating set point limit: $50^{\circ}\text{F} - \text{Cool SP} - 4^{\circ}\text{F}$
- Cooling set point limit: $\text{Heat SP} + 4^{\circ}\text{F} - 85^{\circ}\text{F}$
- Dehumidification set point limit: $48^{\circ}\text{F} - 60^{\circ}\text{F}$

A minimum difference of 4°F between the heating and cooling set points is required to prevent the short cycling of operation modes. If the difference is less than 4°F , the set points will automatically adjust per the following rules:

- Outdoor Air Temp $> 60^{\circ}\text{F}$: Heating Set Point = Cooling Set Point $- 4^{\circ}\text{F}$
- Outdoor Air Temp $< 50^{\circ}\text{F}$: Cooling Set Point = Heating Set Point $+ 4^{\circ}\text{F}$

Reheat setpoints must be less than 2°F below the cooling set point, and 1°F above the heating set point. The Reheat/Reclaim disable point (cutout) must also occur no greater than 1°F below the cooling set point. If the inputted set point or cutout is not within these limits, the values will be automatically adjusted as follows:

- Reheat/Reclaim SP $\geq \text{Cool SP} - 1^{\circ}\text{F}$: Reheat/Reclaim SP = $\text{Cool SP} - 2^{\circ}\text{F}$
- Reheat/Reclaim SP $< \text{Heat SP} + 1^{\circ}\text{F}$: Reheat/Reclaim SP = $\text{Heat SP} + 1^{\circ}\text{F}$
- Reheat/Reclaim SP + Cutout $> \text{Cool SP} - 1^{\circ}\text{F}$: Cutout = $\text{Cool SP} - 1^{\circ}\text{F}$
 - Reheat/Reclaim SP

Sensor Offsets and Limits

A minor offset may be used to calibrate a sensor and improve its accuracy. However, if a sensor requires an offset outside the allowable range, the sensor must be replaced.

The allowable offset range for each sensor type is:

- Temperature Sensors: $\pm 3^{\circ}\text{F}$
- Pressure Transducers: $\pm 5 \text{ psig}$
- Humidity Sensor: $\pm 3\%$
- Dew Point Sensor: $\pm 3^{\circ}\text{F}$

Run-Time Delays (*Equipment Timers*)

Mechanical equipment within the unit may require safety time delays to protect against erratic behavior and preserve the life of the equipment. Time delays can be implemented as a minimum run time delay, meaning the minimum amount of time the equipment is required to run before it can be disabled. The delays can also be implemented as an ON delay, meaning the minimum amount of time required before the equipment is activated. Below is a list of equipment time delays.

- Compressor Stage Up Delay: 3 minutes
- Compressor Stage Down Delay: 1 minute
- Compressor Minimum Run Time: 5 minutes
- Compressor Minimum Off Time: 3 minutes
- Heat/Cool changeover delay: 5 minutes
- Reclaim Minimum Run: 15 minutes
- Reheat Minimum Run: 8 minutes
- Heat Stage 2, 3, 4 On Delay: 5 minutes
- Heat Stage Minimum Run Time: 5 minutes

Controller Outputs

There is one digital output, DO6, for general controller alarm. The following will activate the general alarm output.

- Unit shutdown event. See “Smoke Detection and Unit Shutdown” section above for additional details.
- Fan Fail Alarm. See “MUA Alarms and Notices” section above for additional details.
- Compressor Alarm. See “Compressor Alarms” section above for additional details.
- Heat Alarm. See “MUA Alarms and Notices” section above for additional details.

This document is intended to provide a basic overview of the FLō unit operation and features. It does not include detailed explanations of all operational sequences or control parameters. The information included in this document is proprietary, confidential and is the property of FLō Energy Solutions. FLō Energy Solutions accepts no responsibility or liability for any damage to property, equipment or personal injury as a result of using this documentation or FLō products.

~~

~~

REVISION HISTORY

Revision (n-ddmonthyyyy)	Modification
d1-06September 2022	Initial Draft
1-15FEB2023	Released
1-04JUNE2026	Updated to REV.301: Added A2L Leak Detection; added A2L Leak Alarm; updated psig/°F/VDC/%RH formatting; i-Controller 2.0 → 2.0e

APPROVALS

Approvals | | |

----- | ----- | |

Author | Manager | |

Adam Pflanzner | Laura Semidey | |