

Make-Up Air (MUA) Systems

Start-Up Guide



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MUA System Start-Up Guide

Read O&M before beginning the start up process.

For this unit to function properly, follow all the following steps in this startup check sheet. This is to be done after all the electrical, refrigerant and gas connections have been completed.



Be sure that there is adequate building relief to not over pressurize the building when the heating system is operating at its rated capacity. This can be accomplished by considering, standard engineering methods, the structure's designed infiltration rate; by providing properly sized relief openings; or by interlocking a powered exhaust system; or by a combination of these methods.

Check the gas tightness of the main gas safety shutoff valve.

1. The heater inlet shall be in accordance with the applicable building code provisions for ventilation air.
2. Field constructed intake accessories should be properly designed to minimize the entry of snow and rain.
3. All air to the heater must be ducted from the outdoors. Recirculation of room air is not permitted.
4. If the failure or malfunction of this heater creates a hazard to other fuel burning equipment in the building (e.g. when the heater is providing the replacement air to a boiler room), the unit is to be interlocked to open inlet dampers or other similar devices.

Tools required:

- Multimeter (Voltage/Amperage/Continuity)
- Manometer
- Tachometer
- Temperature probe/thermocouple device
- Anemometer
- Other standard hand tools as required

1. If Unit has Gas Heat verify gas pressure. Must be within the following Gas Pressure range.
 - a. Direct Fired Units – **8 to 14in H2O**
 - b. Indirect Fired Units – **7 to 14in H2O**

2. Verify all main and controls electrical connections are made. (Refer to Wiring Diagram for exact configuration and all required external wiring. Below are all possible options for remote wiring, some may not be needed in your configuration).
 - a. Main Unit Power
 - b. Remote Start Stop (Typically from Hood System to MUA to enable the MUA unit Fan)
 - c. Air Proving Switch (Generally runs from MUA unit to M.A.R.V.E.L. Control Panel or other external control panel) Provides feedback to hood and/or MUA that air is proved
 - d. Condensing Unit Power
 - i. Current Transducers (1x on Single Compressor Units, 2x on Dual Compressor Units). Shipped loose on Remote Cooling Systems
 - ii. Condensing Unit Control Wires (See Electrical Wiring Diagram for connection terminals)
 - e. Remote Temperature Control
 - i. Unitouch (Cat 5 cable from MUA to desired location in Space, not present on Heat Only Direct Gas units)
 - ii. RDU (Direct Gas Heat Remote Display unit, from MUA terminals to desired location into space)
 - f. If Indirect Gas unit, verify the connections to each burner are made. (This is done at the factory, but connector could become loose in shipping)

3. Once unit has been installed, gas pressure has been verified to the unit and all required electrical connections have been made. The unit can be powered on. Turn on the Main Disconnects to the unit and give the unit approximately 2-5min to power up and PLCs to boot.

4. After unit is on and booted it will now be possible to enable the fan.
 - a. If the fan has a remote start stop or air proving requirement, ensure those are enabled or jumped out (for testing purposes only).
 - b. The VFD can also be operated in "Hand Mode" for startup purposes only. See VFD guide in O&M for more information.
 - c. If starting up before an Air Balancer has set the VFD it may be necessary to revisit the site to properly adjust direct gas units.
 - d. Once the unit fan is set and running it is now possible to set up the Direct Gas Heat.

Direct Gas Heat Set-Up

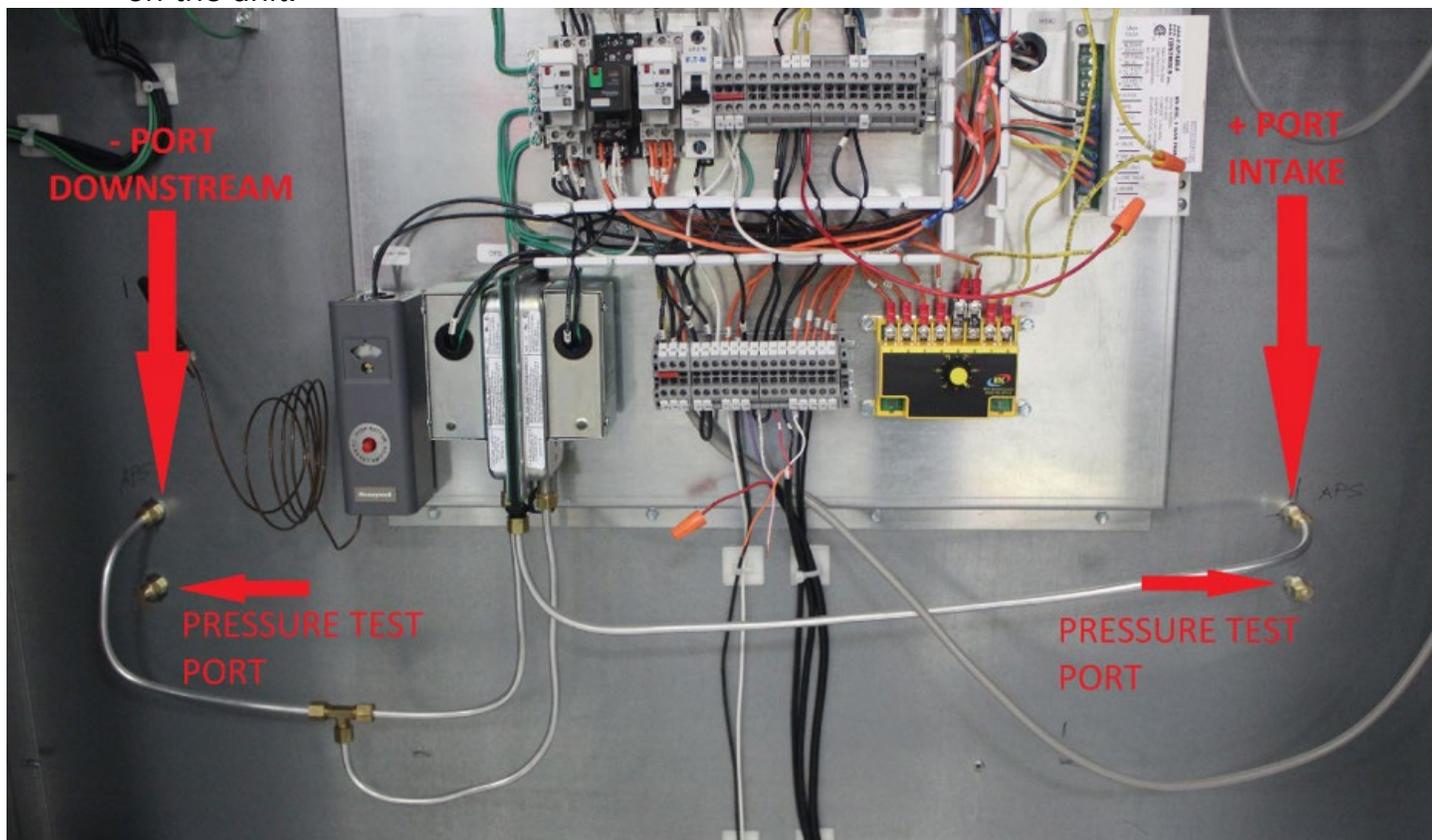
- A. After verifying inlet gas pressure is between 8-14" H2O and the unit is on/Fan is on, you can now setup the direct gas heat.
- B. If setting up in winter conditions, and all electrical connections are made. It is likely the burner has begun or finished the ignition process.
 - 1. If not setting up in winter conditions, you can manually turn on CR02 (call for heat relay on wiring diagram) to initiate the gas heat start up process (**WARNING: Turn off relay override after testing is complete**):
 - i. If you have a direct spark unit; You should see a green light on the Capable Controls Ignition module for a successful ignition or red flash code for unsuccessful ignition. (See APPENDIX A)
 - ii. If the unit is Piloted; You should see a series of P## on the digital display of the Siemens LME7 control as the unit goes through the ignition cycle. If the ignition cycle is unsuccessful or there is an error the display will show LOC#. (See APPENDIX B)
 - 1. If the burner lit successfully then the next step is to check the flame through the sight glass on the burner cabinet on the side opposite the control panel. The flame should be stable, blue and run the entire length of the burner.
 - 2. If the burner did not light successfully look to the ignition control module for a flash code (Direct Spark) or LOC# (Piloted). (See APPENDIX A/B)
- C. If the burner lit successfully and the flame is stable, you can now move onto dialing in the profile plates.
 - i. NOTE: If the Call for Heat relay (CR02) is on and the unit has airflow but the ignition process did not start, proceed to IOM troubleshooting guide. It may be necessary to reach out to Halton Service Network for assistance.

Profile Plates

If setting up the profile plates while the burner is running skip to step 3.

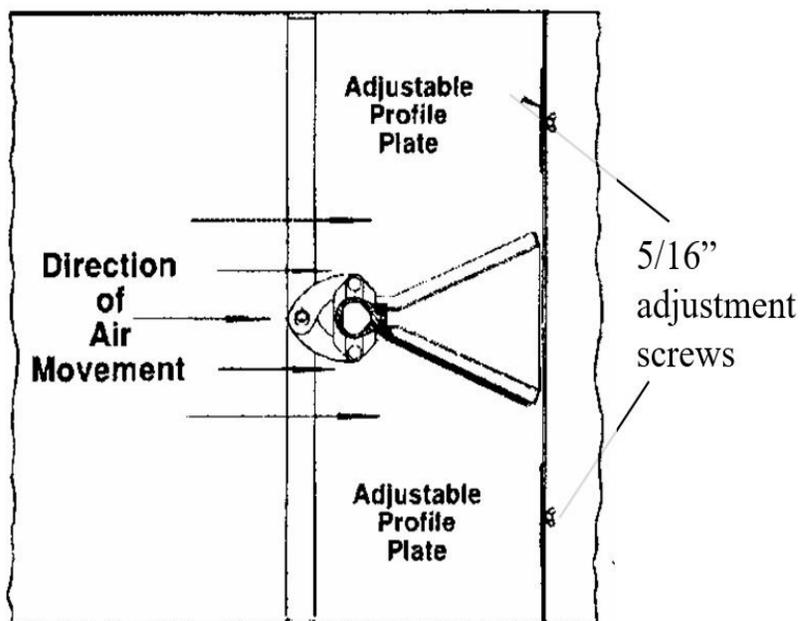
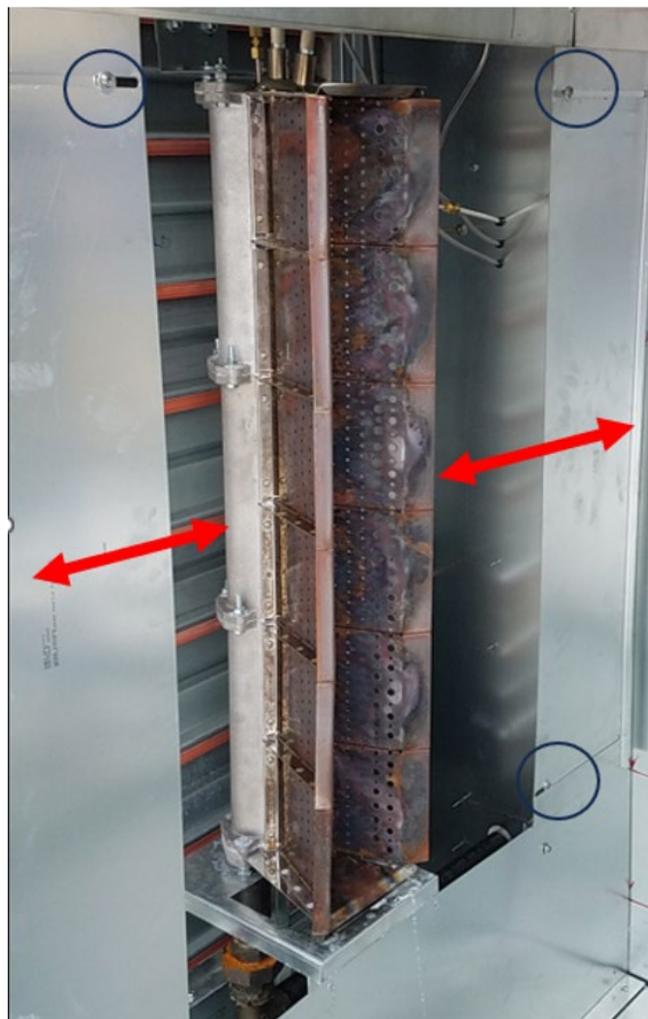
- E. If setting up during summer conditions, OR If you got a LOC3 error on the Siemens controller or APS error flash code (6x red) on the Capable controls. You will need to adjust the profile plates cold. The following steps will detail this process however you may need to compensate for the current temperature outside. In general, for non-variable airflow units; **If the air temperature outside is greater than >70°F then the target pressure for max airflow is 0.65. If the air temperature less than <65°F then the closer to design day conditions (see submittal drawing for design Winter Dry Bulb) the outside air temperature is then the closer the pressure should be to 0.8".**

- i. In order to set the plates, first an initial pressure reading must be taken across the burner profile plates while the unit is in the picture below indicates the pressure ports on the unit.



- ii. Using a manometer hook the negative side to the downstream port and the positive side to the upstream port.
- iii. Knowing what pressure is good is **dependent upon the operating conditions of the unit**. If the unit is **constant** airflow, meaning there will be no modulation of the airflow via a DCKV, VAV or other type system that can affect the airflow, then the pressure should be approximately 0.4"-0.6" (if the burner is not running and the air temperature is higher than 70°F, target pressure should be on the lower side of this range). If the unit is to be ran on a M.A.R.V.E.L. system or other variable flow application, then this process must be done for both minimum and maximum airflow points. **The minimum pressure must not drop below 0.2" and the maximum pressure must not exceed 0.8"**. Steps for adjusting the plates and pressure are below.
- iv. If the reading was too low or too high based on the above information, then you will need to physically adjust the plates.
1. Shut the unit off.
 2. Open the burner access door.
 3. Using a Phillips head screwdriver loosen the screws holding the sliding plates to the mounting frame (see below picture)
 4. If the pressure reading was too high, open the plates by sliding them outwards. Typically, above 1/4" of movement of both plates will see ~0.05" of H2O change. Airflow/temperature/unit size affect this. **So multiple adjustments may be required.**

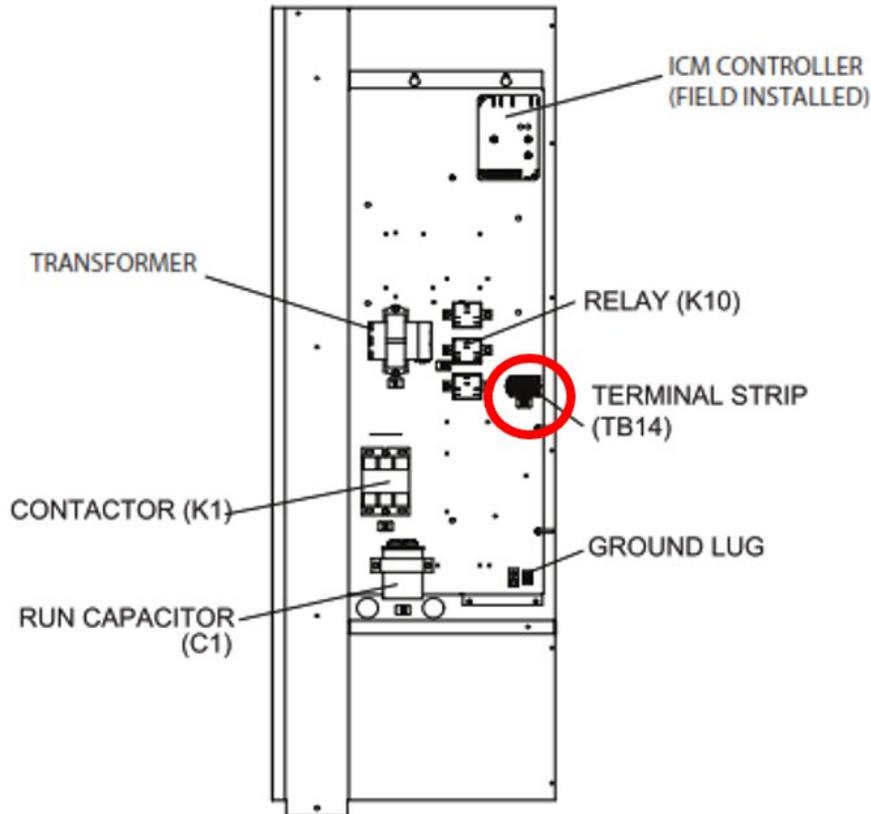
5. If the pressure reading was too low, close the plates by sliding them closer together. If the pressure was too high, open the plates by moving them farther apart.



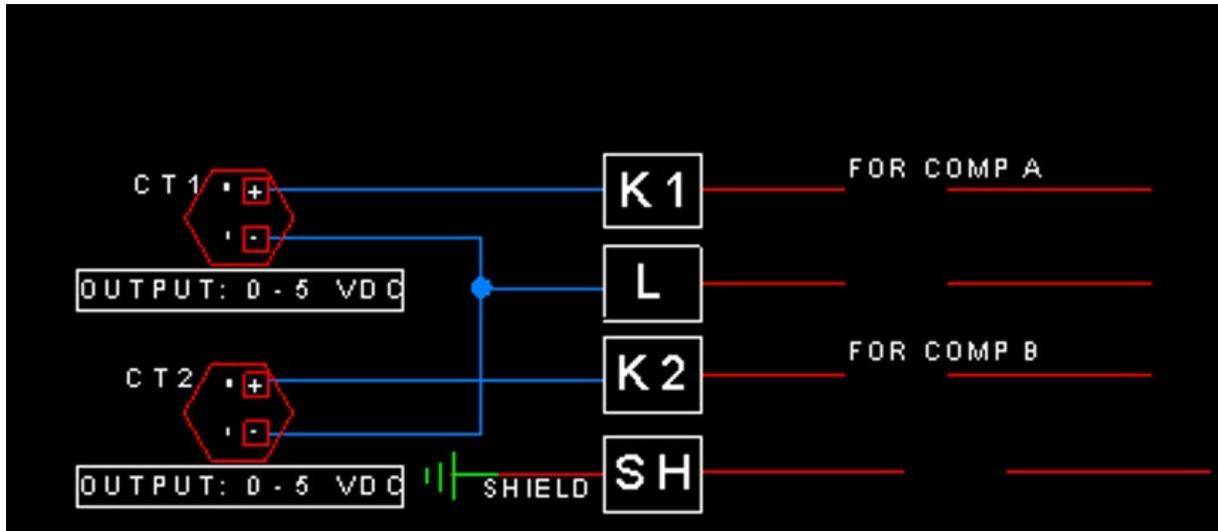
- v. Retighten the screws on the plates, close the burner access door and restart the unit.
 - vi. After the unit is stabilized remeasure the pressure across the plates. Repeat above steps for plate adjustment as needed.
 - vii. If the unit is variable flow, repeat this process for both upper and lower limits of airflow range. **Lower pressure limit is 0.2', Upper Pressure Limit is 0.8"**.
- F. Now that the profile plates and all other items have been set. Observe the unit in operation. Ensure flame is stable and no error codes are present.

Cooling Start-Up

6. A Certified HVAC technician is required to charge the system with refrigerant and set any refrigerant lines. This guide assumes this has been done by a professional technician according to the condensing unit manufacturers specifications and in accordance with standard industry practices
7. After unit is charged and ready to be tested, before starting the unit:
- a. Ensure that the current transducer(s) are connected to the Line voltage leg of each compressor contactor and wired back to the MUA controls cabinet. (Typically terminals K1/K2 & L), with K being + and L being the -. The Current Transducers have labeled terminals so make sure they are wired to the correct Poles.
 - i. **For Dual Compressor Units, K1 should go to Compressor 1 or A circuit, and K2 should go to Compressor 2 or the B Circuit.**
 - b. Check that the Evaporator temperature thermistors are secured to the inlet and outlet of each circuit of the evaporator coil. Verify they are plugged into the correct connector located at the thru hole of the evaporator coil cabinet. These are labeled **Evap A Inlet / Evap A outlet/ Evap B Inlet / Evap B Outlet**. Inlets should be located on the liquid lines while outlets are located on the suction lines..
 - c. If not done already run the control lines to the condensing unit. R/C1/C2 (for Lennox) / R/Y1/Y2 (for Trane). Ensure that they are wired to the proper terminals. The terminal strip is shown in a red circle below.



- d. Visibly inspect refrigerant lines for any unsightly or poor brazing. Verify the TXV and Sight glass are installed in the correct location and show no signs of heat damage from brazing.
 - e. Verify the Unitouch touchscreen display is either mounted and connected inside the control's cabinet, or it has been remotely mounted and is functioning properly. The Unitouch should display a temperature and next to it will be a vertical line for adjusting the discharge air temperature setpoint.
8. Cooling controls are programmatically controlled by Halton PLC's by sending dry contact signal to the terminals on the condensing unit. The outside air temperature must typically be above 70F before cooling can be enabled. **The Unitouch controls discharge air temperature, which is the air temperature leaving the unit, it does not change the cooling mode setpoint. The Cooling Mode setpoint is the temperature the outside or incoming air must be for cooling to be enabled.**
 9. **If Testing during a time when outside air is greater than 70°F skip to step 12.**
 10. If in winter months or off cooling season, the condensing unit function can be tested by jumping the terminals R and C1/C2 at the control panel for Lennox Units, R and Y1/Y2 on Trane Units. Or utilizing the test start function on the condensing unit (follow Lennox/Trane Symbio installation instructions for this option).
 11. Start by turning on C1 (compressor 1). Then test that the current transducers are wired properly and functioning.
 - a. After overriding the 1st compressor (in step 9). Using a multimeter measure, the voltage across each current transducer. The voltage should be higher than 2v across K1 and L for compressor 1. Next turn on Compressor 2 (R/C2) and measure the voltage across K2 and L, it should also be greater than 2V. 12.



12. After verification of all connections, start the unit up by turning on the power and ensuring a start/stop signal has been closed or jumped. If the air temperature is above 70°F the condensing and evaporator fans on the condensing unit will come on.
13. If only 1 compressor comes on decrease the discharge air temperature on the Unitouch touchscreen to increase the cooling load. Q1
14. Go to Step 11 and verify the current transducers are wired correctly.

After Direct Gas Heat and Cooling Have been started up successfully, proceed to additional startup options (Indirect, Heat Reclaim, Evaporative Cooling).

Indirect Gas Heat Start-Up

1. Ensure all connections have been made and correct gas pressure is at the inlet of the unit. Read through gas fittings installation guide in manual. If this is an indoor unit, ensure vent terminals have been installed and flue gas is being vented outside of the space.
2. The indirect gas heat units are controlled similarly to cooling. The Unitouch inside the unit or remote mounted provides discharge air temperature control.
3. For startup please see included Beckett Indirect Furnace manual first.
4. The unit cannot be fired out of season or when outside air temperatures are higher than 60°F.
5. If starting up in season, and all connections have been verified turn the unit on, provide any necessary external start signal and the unit will initiate.
6. The fan will come on first. If the outside air temperature is 60°F or below a call for heat will be sent to the burner(s).
7. Remove the door on the controls side of the burner cabinet to observe the burner control. The control board will go through a purge cycle and ignite.
8. Using the Unitouch touch screen controller you can adjust the discharge air temperature. If there are more than one burner present it may be necessary (depending on outside air temperature) to temporarily increase the discharge air temperature to get the additional burner to turn on.
9. Once the burner(s) have ignited, verify there is no abnormal flame (yellow/smoke/or flame outside the burner tube).
10. Last, measure discharge temperature to ensure it is within 5 degrees of the setpoint temperature.

Evaporative Cooling 1st Start-Up and Rinsing

Before executing the first startup of the Evaporative cooling system, please read the MUA system manual carefully. The evaporative system should be flushed from any residual material from the manufacturing processes. Adhere to the steps below in the order given when the system is ready for initial startup. Water supply pressure should not be less than 20 psi at the unit.

1. Remove the screws that secure the side access door. The door has a bottom straight edge, wear gloves and exercise caution. Being careful, pull the bottom edge slightly out to clear the bottom edge from the opening while holding the recessed grip on in the center of the door with the other hand. The door slides down and clears the opening. Lift the door and set aside.
2. Check the condition of the sump and remove any packaging material or other items that may have been left inside. Check the insulation around the lines to make sure they are secure.
3. Reinstall the side access door and turn on the system.
4. Open the drain bypass valve and set the thermostat setpoint to 50 degrees F (50°F)
5. Allow the system to run for 15-minutes. If the system fails to start, refer to the troubleshooting chart in the Manual.
6. Turn off the system and let the sump drain empty.
7. Remove the side access door and check the water distribution over the pads by observing that the pads are wet with no dry streaks. Refer to troubleshooting guide if dry streaks are observed.
8. Repeat steps 3 through 7 if necessary.
9. Close the drain bypass valve.
10. Reinstall the access door in reverse order of step 1.
11. Set the thermostat to desired temperature setpoint and the system is now ready.

Heat Reclaim Start-Up

Filling the System

1. To fill the system, open the lid on the Glycol Make-up Tank (if applicable).
2. Drop supply water hose into glycol tank and fill with water and add glycol according to ratio's required.
3. Ensure all valves are open on both units. And open the valve between the make up tank and the expansion tank.
4. Unscrew the cap on the needle valve located on the top of the air separator. Connect provided schrader valve hose to the air separator and let the hose hang loose. As the system gets closer to full water will run from this hose. When it does just drop into make up tank and stop the glycol pump.
5. Plug in glycol tank.
6. Turn on glycol tank pump
7. Adjust the pressure regulator on the glycol pump to approximately 10psi.
8. When water starts coming out of the schrader valve hose, stop the glycol pump and drop the hose in the tank.
9. Next turn the main pump on, so that it is running at approximately 50% speed. (either with VFD if it is a VFD model or with the potentiometer on board the pump if it is a EC model pump).
10. Let the pump run for a couple of minutes then shut off
11. turn the make up tank pump back on. Set to 20psi.
12. Observe the schrader valve hose as the glycol tank runs. If there are no longer air bubbles coming out the system is likely full.
13. If bubbles continue. Repeat steps 7-13 as necessary. Increasing the glycol pump regulator and cycling the main pump to push air through the system.

Heat Reclaim Start-Up



Pressurize the pump body slowly while you check for leaks at all joints with gaskets. Failure to follow these instructions can result in serious personal injury and/or property damage.

Before you start the pump, you must perform these tasks:

Since it is closed loop system ensure all valves are open.

1. Fully open the 4 valves on PST and HRU unit.
2. Start the motor. (If VFD, operate in manual Hand mode).
3. Slowly open the discharge valve until the pump reaches the desired flow.
4. Immediately check the pressure gauge to ensure that the pump quickly reaches the correct discharge pressure.
5. If the pump fails to reach the correct pressure, perform these steps:
 - a) Stop the motor.
 - b) Restart the motor.
6. Monitor the pump while it is operating:
 - a) Check the pump for bearing temperature, excessive vibration, and noise.
 - b) If the pump exceeds normal levels, then shut down the pump immediately and correct the problem.
7. Repeat steps 5 and 6 until the pump runs properly.
8. While system is running, check for leaks and any vibrations in piping that may need further support or fixing.

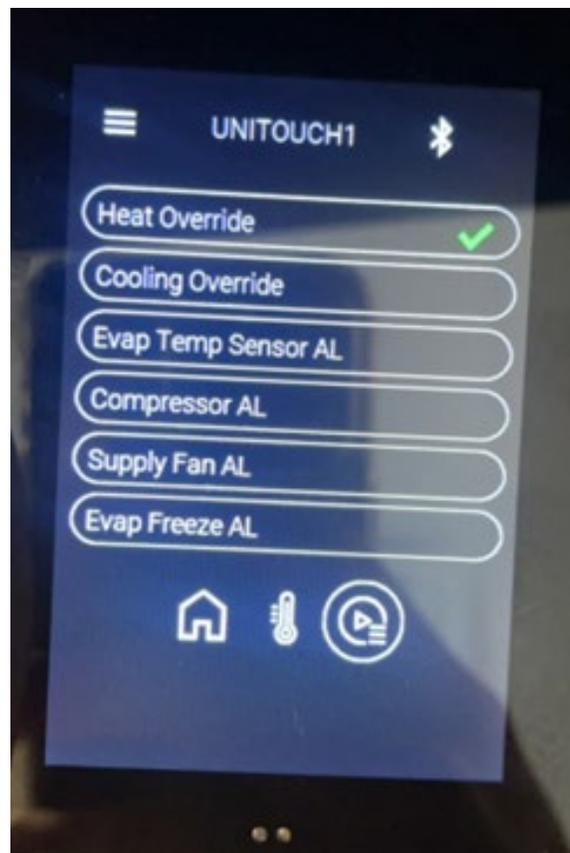
The unit should now be ready to operate automatically through the PLC.

Unit Overrides for Troubleshooting

Caution : Overrides are to be used with supervision of Halton Service Network technicians or by licensed HVAC technicians only

Display Screen Overview

- This screen shows alarms and allows the ability to override certain functions of the unit.
- A flashing check mark next to an alarm indicates it is active.
- All alarms will remain active for a minimum of 10 seconds once triggered.
- To activate an override simply click on the corresponding custom action. A solid check mark next to an override indicates it is active. Overrides will reset after 10 minutes. Below are descriptions of each custom action.



Functions and Troubleshooting with Touchscreen

- **Heat Override**

- Function
 - Turns on the Supply fan and turns on the call for heat
 - This should be used to test the function of the heat in off season conditions as well as troubleshoot the heat function.
- Troubleshooting
 - If heat override is selected and the call for heat relay is on (CR2) and heat is still not functioning. Look at the ignition controller for error codes. Follow the startup guidelines for troubleshooting via the spark or pilot ignition controller error code.

- **Cooling Override**

- Function
 - Turns on the supply fan and overrides the Cooling mode. Compressor 1 will activate for 120 seconds then compressor 2 will activate and will remain on till the 10 minute timer has expired or turned off by the user
 - This action can be used to verify cooling function during offseason conditions.
- Troubleshooting
 - Follow startup guide procedure and troubleshooting for any alarms present on Unitouch
 - If cooling override is on and outputs on PLC for the compressors (C1/C2) are lit indicating they are active. Ensure that wires to the condensing unit have been connected properly and there are no breaks in connection. Ensure evap temperature sensors are connected and if current transducers are required, they are connected to the correct compressor.

- **Evap Temp Sensor AL**

- Function
 - This indicates that there is a problem with one of the evaporator temperature sensors.

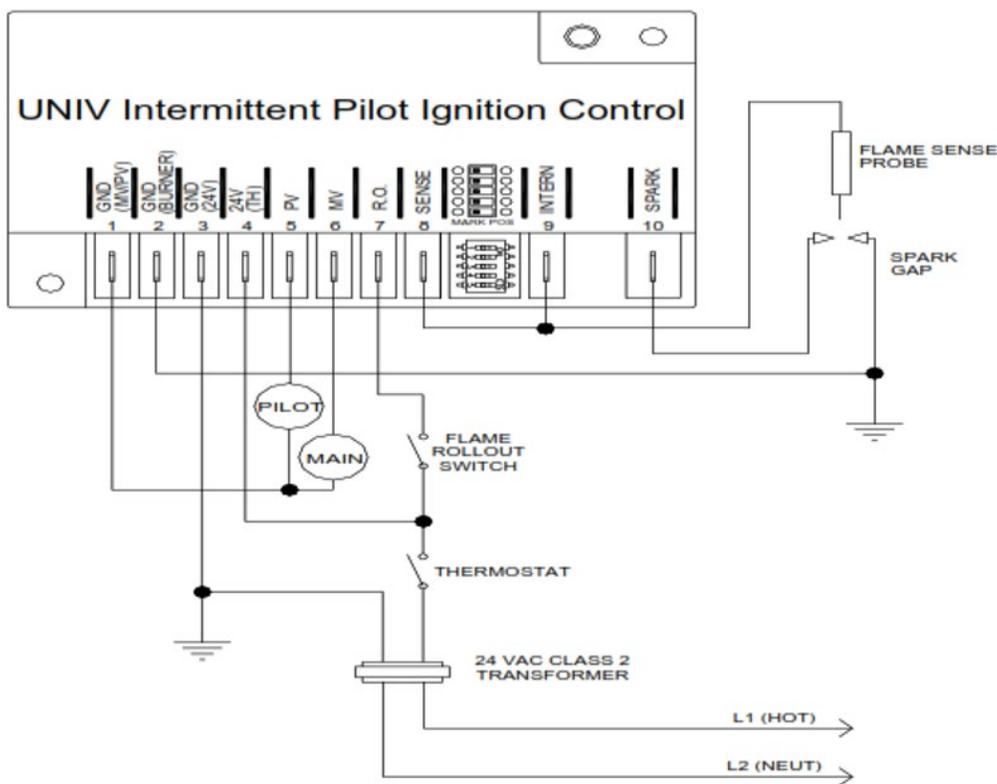
- Troubleshooting
 - Check that each sensor is connected and installed in the proper position (inlet sensors on the liquid line, outlet sensors on the suction lines)
 - Verify sensor wiring back to the control panel is not broken or miswired
 - Verify that the pressure transducer tubes connected to the fan are connected and free of kinks.
- **Evap Freeze AL**
 - Function
 - Indicates that one of the evaporator lines going into or out of the coil has hit 32 degrees or below.
 - Troubleshooting
 - Check that there is sufficient airflow across coils.
 - Ensure intake filters are clean.
 - Verify refrigerant charge amount per condensing unit manufactures specifications.

Direct Gas Heat Reference

A. Direct Spark Controls

Halton Direct Spark MUA uses a Capable Controls DSP module as an ignition module. Below is the basic wiring diagram and error codes.

The Air Pressure Switch (APS) and High Temperature Limit Switch must be made before the ignition process is initiated. To Maintain ignition the valve signal and flame sense signal from the burner must be made. To reset the controls a new call for heat must be established or the power must be cycled. Typically cycling the call for heat or power supply relay to the DSP will suffice.



ERROR CODES

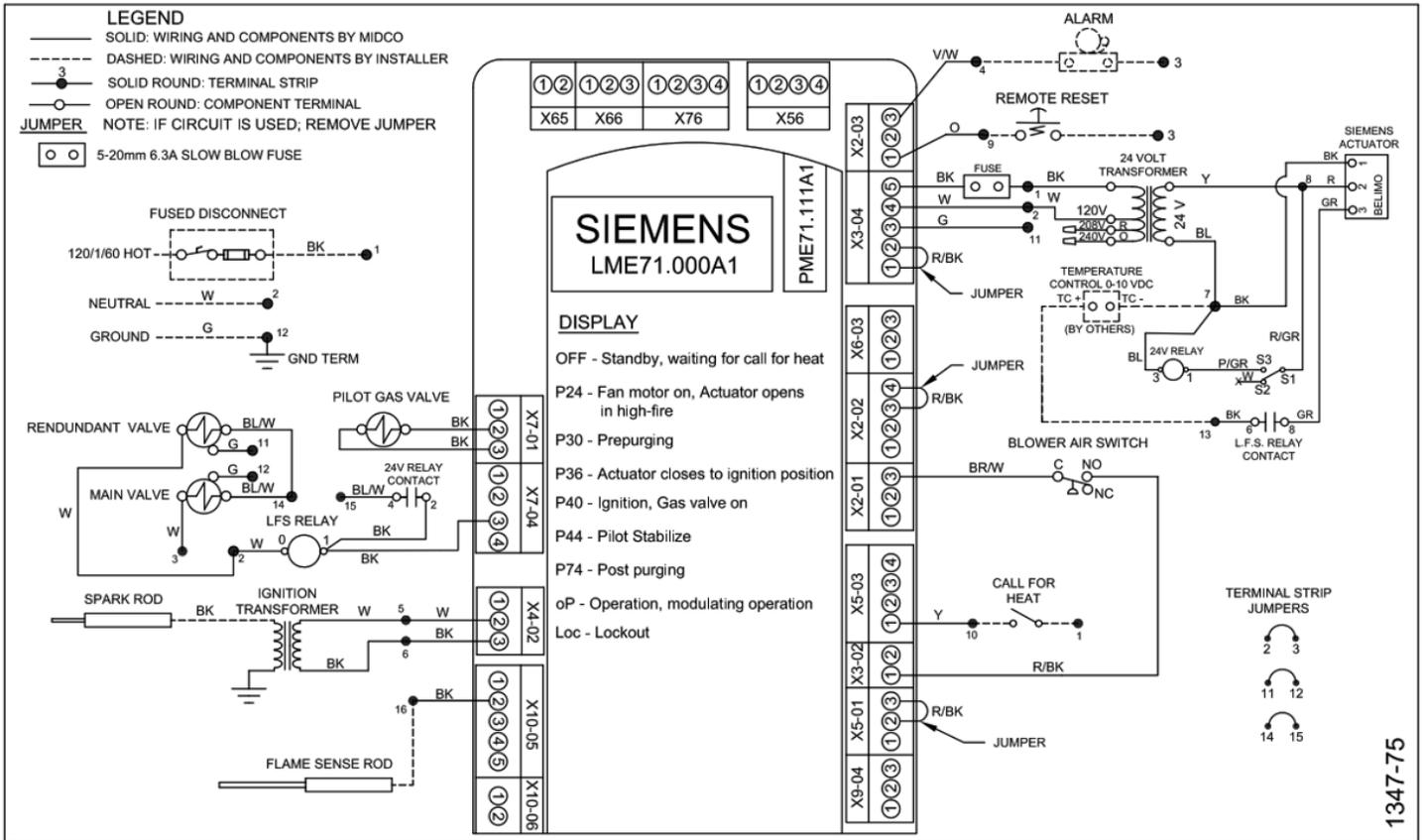
Table 3.

RED FLASHES	ERROR DEFINITION	ERROR TYPE
1 flash, then pause	No flame in trial time	Lockout
2 flashes, then pause	Flame sense stuck on	Lockout
3 flashes, then pause	Pilot/Main relay failure	Lockout
4 flashes, then pause	Repetitive flame loss error	Lockout
5 flashes, then pause	Rollout error	Lockout
6 flashes, then pause	APS Airflow error	Lockout
7 flashes, then pause	Internal control error	Lockout
On Solid Red	Line Voltage/Freq. Error	Standby

B. Direct Gas Piloted Controls

The piloted gas trane of Halton Direct Gas MUA's utilize a Siemens LME7 PLC to control the ignition process. Below is the basic wiring diagram and error code list.

Similar to the Direct Spark, APS & Hight Temp limit switch are required to start the process. However the flame sense rod is on the pilot flame instead of the main burner flame. **To Reset** the unit during lockout. Hold the Info Button for ~5s, "RESET" will appear on the display, release the button to reset the controller. Alternatively, press the info button 10x quickly if the first method does not work.



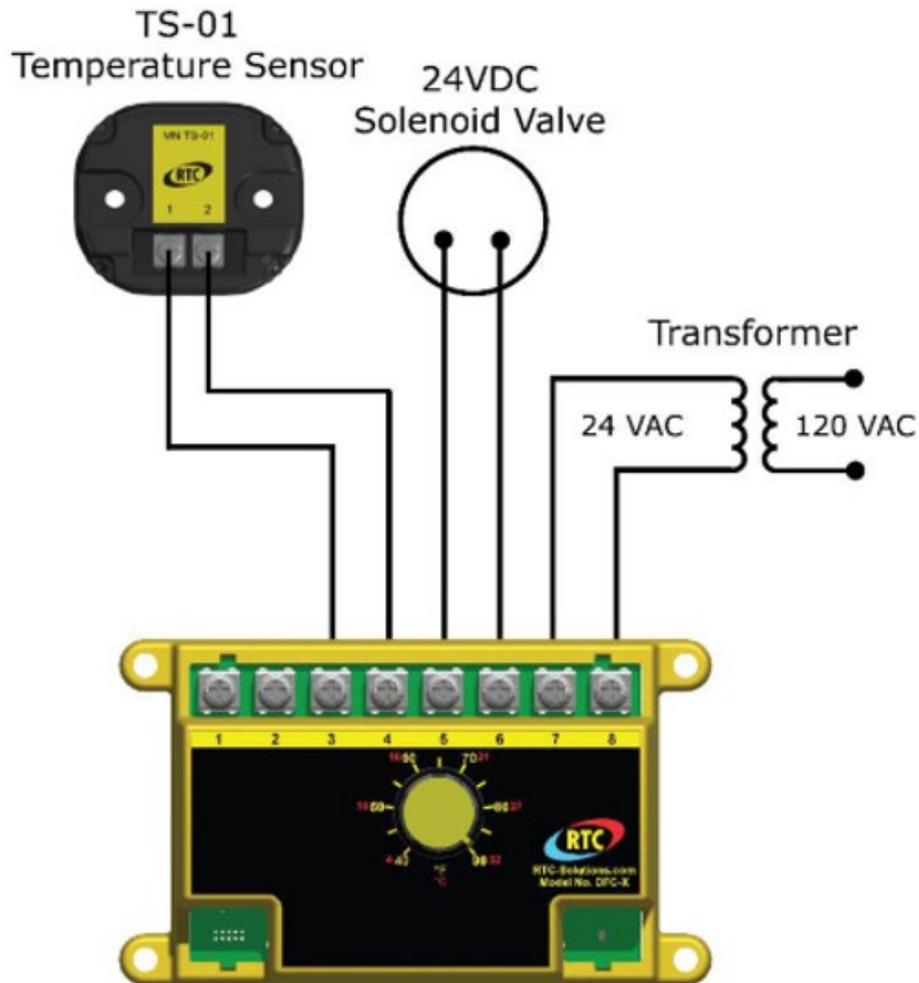
Loc: 2	No establishment of flame at the end of safety time	<ul style="list-style-type: none"> - Faulty or soiled fuel valves - Faulty or soiled flame detector - Poor adjustment of burner, no fuel - Faulty ignition equipment
Loc: 3	Air pressure faulty (air pressure switch welded in no-load position, decrease to specified time (air pressure switch response time))	<ul style="list-style-type: none"> Air pressure switch faulty - Loss of air pressure signal after specified time - Air pressure switch has welded in no-load position
Loc: 4	Extraneous light	Extraneous light during burner startup
Loc: 5	Air pressure faulty, air pressure switch welded in working position	<ul style="list-style-type: none"> Timeout air pressure switch - Air pressure switch has welded in working position
Loc: 6	Fault of actuator	<ul style="list-style-type: none"> - Actuator faulty or blocked - Faulty connection - Wrong adjustment
Loc: 7	Loss of flame	<ul style="list-style-type: none"> Too many losses of flame during operation (limitation of repetitions) - Faulty or soiled fuel valves - Faulty or soiled flame detector - Poor adjustment of burner
Loc: 8	---	Free
Loc: 9	---	Free
Loc: 10	Error not relatable (application), internal error	Wiring error or internal error, output contacts, other faults
Loc: 12	Valve proving	Fuel valve 1 leaking
Loc: 13	Valve proving	Fuel valve 2 leaking
Loc: 14	POC error	Error valve closure control POC
Loc: 20	Gas pressure switch-min open	Gas shortage
Loc: 22	Safety loop open	<ul style="list-style-type: none"> - Gas pressure switch-max open - Safety limit thermostat cut out
Loc: 60	Analog power source 4...20 mA, I <4 mA	Wire breakage
Loc: 83	PWM fan faulty	<ul style="list-style-type: none"> - PWM fan does not reach the target speed within the preset period of time, or - After reaching the target speed, the PWM fan leaves the tolerance band again (parameter 650) for a time exceeding the tolerance time speed deviation (parameter 660)
Loc: 138	Restore process successful	Restore process successful
Loc: 139	No program module detected	No program module plugged in
Loc: 167	Manual locking	Manual locking
Loc: 206	AZL2 incompatible	Use the latest version

C. Direct Gas Heat Controls

To control discharge air temperature for Direct Gas Heating, a variety of RTC options are used.

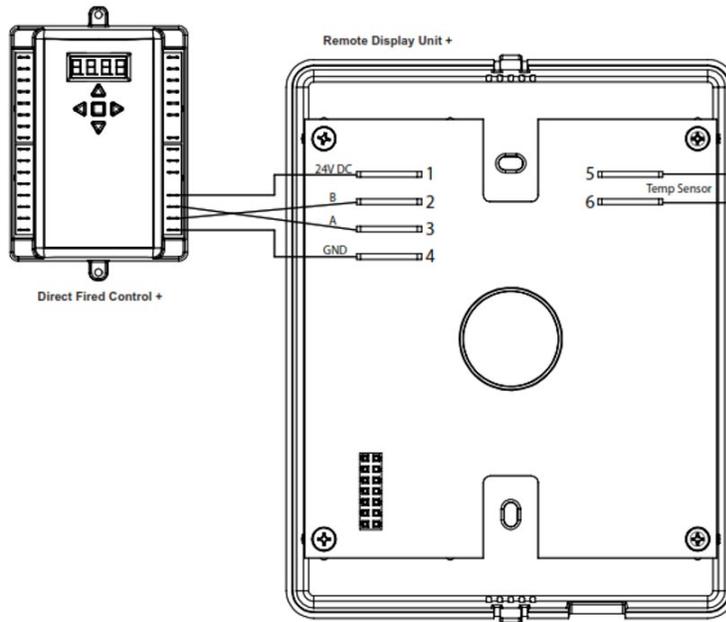
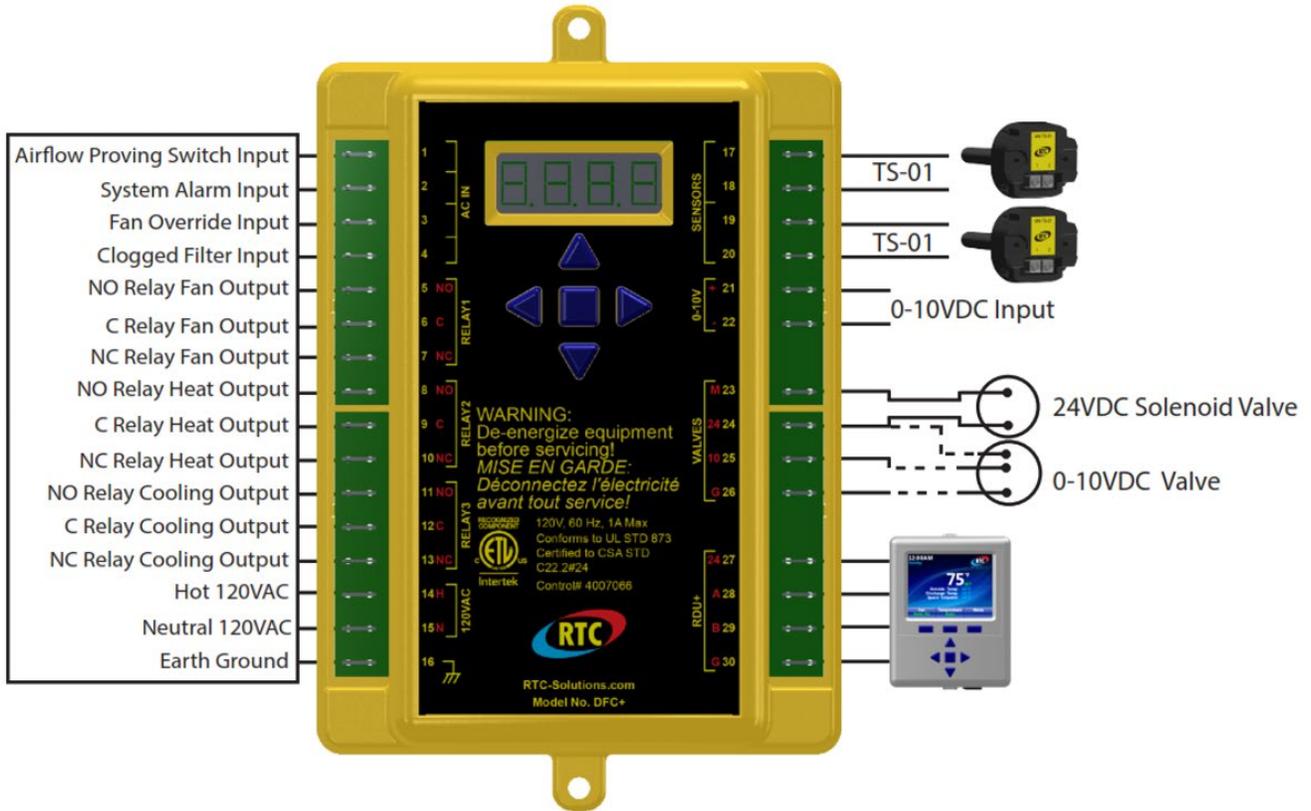
Unit Mounted

The below image shows the unit Mounted Direct gas controls scheme. It consists of a dial to adjust the discharge air temperature setpoint and temperature sensor to measure the discharge air temperature. This device feeds a 0-10V signal to the Orange actuator on the gas train to open/close the gas ball valve.



Remote Mounted

For Remote Mounted units a RTC DFCX+ is used to manage all the inputs and outputs while a Remote Display unit (shown in the bottom right corner of the image) is mounted in a remote location to control the Discharge air temperature of the unit. Below is the wiring configuration for this option.



Cooling/Heat Pump Reference

- A. Unitouch Controller – Controls discharge air temperature setpoint for cooling/indirect heat/heat pump units. Connects via CAT 5 to PLC1 on MUA control panel. Can be mounted remotely. Does not change cooling or heating mode setpoint, only Discharge Air Temperature setpoint.

