Specification AY1014

ELECTRONIC CONTROLLER

ICM Controls

Revision Date 1/22/2014

Modified by:

Arthur Stolz

Embedded Product Test Technician

Table of Contents

1.0 **Scope and Application**

2.0 **Inputs**

2.0.1 Low voltage thermostat and transformer input terminals

2.0.2 Low voltage switch input terminals.

3.0 **Outputs**

3.0.1 Low voltage relay output terminals

3.0.2 Low voltage external switch output terminals

3.0.3 Low voltage output terminals

4.0 **Operation**

**4.1 Heat Mode**

4.1.1 Thermostat calls for Heat (24vac on W terminal)

4.1.2 The thermostat is satisfied

4.1.3 AQ Input terminal

4.1.4 FP Input/Output Operation

4.1.5 PR Input/Output operation

4.1.6 W2 Operation

**4.2 Fan Mode (G)**

4.2.1 The thermostat calls for Fan (24VAC on G terminal)

4.2.2 The thermostat is satisfied

4.2.3 Indoor Fan Time Delays

**4.3 Cool Mode (Y)**

4.3.1 The thermostat calls for Cool (24VAC on Y terminal)

4.3.2 Compressor Lockout Sensor/Switch

**4.4 RH/W2 Input Operation**

4.4.1 RH/W2 in cool mode

4.4.2 RH/W2 in standby mode

**4.5** **Automatic Pump cycle**

**4.6 DHM Input**

**4.5 Future Expansion**

4.4.1 Diagnostics

4.4.2 Blower Constant Circulation Mode

**5.0 Operation Description**

5.1 3 Amp “ATO” Automotive Blade Type Fuse

5.2 Freeze Sensor/Switch (FS)

5.3 Condenser Lockout Sensor/Switch (CL)

**1.0 SCOPE AND APPLICATION:**

The board provides microprocessor control which controls the motor, pump, valve and boiler.

**2.0 INPUTS:**

**2.0.1 Table #1 Line voltage Input and Transformer Terminals**

**Description Purpose/Rating**

L1 120VAC, 50/60HZ

LINE XFMR Transformer primary, 120VAC, 50/60 Hz

N/L2 Line Neutral, 120VAC, 50/60 Hz

**2.0.2 Table #2 Low Voltage Thermostat and Transformer Input Terminals**

**Description Purpose/Rating**

R Transformer secondary, 24 VAC Hot

COM Transformer secondary, 24 VAC Common

W Thermostat - Monitored Input – Heating Mode – 24 VAC

G Thermostat - Monitored Input – Fan Mode– 24 VAC

DHM Thermostat - Monitored Input - Dehumidification Mode – 24 VAC

RH/W2 Thermostat - Monitored Input – Reheat Mode – 24 VAC

Y Thermostat Cool Input – 24 VAC

**2.0.3 Table #3 Low Voltage External Switch Input Terminals**

PRin Priority Switch 24 VAC Monitored Input from Switch to Control

FPin Freeze Protection 24 VAC Monitored Input from Switch to Control

CLin Compressor Lockout 24 VAC Input From Switch to Control

AQin Aquastat 24 VAC Monitored Input from Switch TO Control

**3.0 OUTPUTS:**

**3.0.1 Table #4 Low Voltage Relay Output Terminals**

**Description Purpose/Rating**

BOILER “T” 24 VAC, 1A Resistive Load Output to Boiler Control T’stat Term

BOILER “T” 24 VAC, 1A Resistive Load Input from Boiler Control T’stat Term

VALVE 24 VAC, 1A Resistive Load Output to Zone Valve

VALVE 24 VAC Common Terminal to Zone Valve

**3.0.2 Table #5 Low Voltage External Switch Output Terminals**

**Description Purpose/Rating**

PRout Priority Switch 24 VAC Output from Control to Switch

FPout Freeze Protection 24 VAC Output From Control to Switch

CLout Compressor Lockout 24 VAC Output From Control to Switch

AQout Aquastat 24 VAC Output From Control to Switch

**3.0.3 Table #6 Low Voltage Output Terminal**

CC Compressor Contactor - Output 24 VAC to Condenser

**3.0.4 Table #7 Line Voltage Relay Output Terminals**

**Description Purpose/Rating**

PUMP Circulating Pump Output, 120VAC, 1.5A, 50/60 Hz

FAN HEAT Blower Motor Low Speed Output, 120VAC, 13A Max, 50/60 Hz

FAN DHM Blower Motor Medium Speed Output, 120VAC, 10A Max, 50/60 Hz

FAN COOL Blower Motor High Speed Output, 120VAC, 13A Max, 50/60 Hz

‘

**4.0 OPERATION:**

**4.1 Heat Mode (W):**

**4.1.1 Thermostat calls for Heat (24 VAC on W terminal):**

The control energizes the relays for the Pump, Valve and Boiler. The control will energize the FAN HEAT relay after the control has completed the required ON delay that was selected by the jumper pin setting.

**4.1.2 The thermostat is satisfied:**

The control de-energizes the relays for the Pump, Valve and Boiler. The control will de-energize the FAN HEAT relay after the control has completed the required OFF delay that was selected by the jumper pin setting.

**4.1.3 AQ Input/Output Operation:**

The control AQ function has selectable ON/OFF. If the AQ is selected to “ON” the indoor blower will remain OFF until the aquastat switch closes, or the on delay time passes. When the aquastat switch closes the indoor blower will start with no delays. When the W call ends, if the aquastat switch opens the indoor blower will stop with no delays. If the selected time off delay passes, the blower will turn off even if the AQ input is still active.

**4.1.4 FP Input/Output Operation:**

The Freeze Protection Sensor/Switch is a normally open switch that closes when the temperature at the switch falls below 38°F. When the switch closes the Boiler, Pump and Valve relays are energized. The Fan Heat relay will remain de-energized. When the FP switch opens the control returns to normal operation imediately. The Freeze Protection takes priority over the “W” and “Priority” inputs. Y and G will operate normally.

**4.1.5 PR Input/Output Operation:**

The Priority Switch closes on a call for domestic hot water and will override the call for heat on the thermostat “W” terminal. The BOILER, PUMP, VALVE and FAN HEAT relays will de-energize while the Priority Switch is closed. When the Priority Switch opens the control will resume normal operation.

**4.1.6 W2 Terminal:**

If the DHM terminal is inactive the control will ignore a signal on the W2 terminal.

**4.2 Fan Mode (G):**

**4.2.1 The thermostat calls for Fan Operation (24VAC on G terminal):**

When 24 VAC is switched on the G terminal the control energizes the FAN COOL relay after the selected ON delay.

**4.2.2 The thermostat is satisfied:**

The 24 VAC signal is removed from the G terminal the control de-energizes the FAN COOL relay and the fan will de-energize after the selected OFF delay has concluded.

**4.2.3 Indoor Fan Time Delays:**

**Heating / Cooling:** The indoor blower ON/OFF time delays shall be

selectable with a jumper pin for 0 seconds, 15 seconds and 30 seconds with the default being 0 seconds.

**4.3 Cool Mode (Y) and (CC):**

**4.3.1 The thermostat calls for Cool (24VAC on Y terminal):**

The Y terminal is a thermostat input on the control and the control does not monitor the Y terminal. The Y terminal is connected to the CC terminal via the compressor lockout switch. If the compressor lockout switch is closed the signal will be passed from the Y terminal to the CC terminal. If Y and G call are both present, the high speed blower will run after the selected on delay setting. When the call ends, the high blower will turn off after the selected off delay setting.

**4.3.2 Compressor Lockout Sensor/Switch:**

The Compressor Lockout sensor/Switch (CL) is connected between the CLin terminal and the CLout terminal. When the Compressor Lockout Switch opens, the circuit is broken between the Clout and CLin terminals removing 24 VAC from the CC terminal.

**4.4 RH/W2 Input Operation**

**4.4.1 When operating in the Cooling mode:**

The thermostat has a Reheat function and it is set to the ON position. The thermostat is operating in the cooling mode when a call for dehumidification occurs the thermostat will energize the DHM and W2 terminals which will energize BOILER, PUMP and VALVE relays. If the G terminal is active then de-energize The FAN COOL relay and energize the FAN DHM (fan medium) relay without any delays. When dehumidification has been satisfied the control will resume normal operation.

**4.4.2 RH/W2 Input Operation from the standby mode:**

If the thermostat has a Reheat function and it is set to the ON position, the thermostat will energize the DHM and W2 terminals with a call for dehumidification which will energize BOILER, PUMP and VALVE relays. Energize the FAN DHM relay after the selected ON time delay. When satisfied the control will resume normal operation.

**4.5 Automatic Pump Cycle:**

When there is no Pump activity for 6 hours, energize pump for 60 seconds. The Pump will automatically energize for 60 seconds then de-energize for 6 hours. The automatic pump timer is reset to six (6) hours after call for heat, or any other time the pump is run.

**4.6 DHM Input**

By itself, a DHM call will not do anything. However if the high speed fan is running, the fan will switch to medium speed.

**4.6 Future Expansion**

**4.4.1: Diagnostics:**

The control board should be designed for expansion by adding diagnostics to the control. This will include an LED that will flash a diagnostic code

**4.4.2: Blower Constant Circulation:**

A relay called FAN CIR that will be controlled by the “G” input from the thermostat. The control software will be modified so the FAN COOL relay will be energized and de-energized thru the thermostat “Y” call. During a call from the thermostat “W”, “Y” or “DHM” the control will de-energize FAN CIR relay and energize the relay associated with “W”, “Y” or “DHM. When the thermostat call is complete the control will default back to the FAN CIR relay if there is a call for “G” from the thermostat.

**5.0 Operation Description**

**5.1 3 Amp Fuse “ATO” Automotive Blade Type:**

Fuse is located on the control board in series with the “R” terminal and the “R” trace on the board.

**5.2 Freeze Sensor/Switch:**

The control has the FPin and FPout terminals. If the temperature of the hot water coil falls below 38°F, the freeze sensor will close the normally open switch. 24VAC will be placed on the FPout terminal and the control will energize the Boiler, Circulating Pump and Valve. The indoor fan blower will remain de-energized. When the water coil temperature rises above 42°F the freeze sensor switch opens removing the 24 VAC from the FPout terminal and de-energizing the boiler, pump and valve imediately. The control then resumes normal operating mode.

**5.3 Compressor Lockout Sensor/Switch:**

If the temperature of the hot water coil falls below 38°F, the compressor sensor/switch will open the normally closed switch. The 24 VAC signal is removed from the CLout terminal and the CC terminal. When the water coil temperature rises above 42°F the freeze sensor switch closes, the control then resumes normal operating mode.