

## Building Management Signal/0-10VDC or 4-20mA Signal Conditioner/Blower-Heat Relays

### Description of Temperature Control

- Signal conditioner for temperature control
- Conditioner accepts 0-10 VDC or 4-20mA signal from BAS System
- Discharge Sensor Mounted in Blower
- All necessary safeties provided integral to the unit

### Applications

Where tempered make-up air is required for a building with a Building Automation System and the controller is provided by others.

### Heater Type

100% Outside Air Single Speed or Variable Air Volume (VAV) Industrial Unit

### Sequence of Operations

With the disconnect in ON position and contact closure from an external source to the blower on-off relay (RE-55), power is supplied to the damper motor (MT-02), if equipped.

When the damper motor approaches the OPEN position (approximately 70%), the damper-end switch (SW-07) closes energizing the blower motor starter contactor (ST-01) and powering the blower motor (MT-01). The blower motor can also be energized from the service switch (SW-05).

*If the unit is equipped with the low-temperature limit control (TS-07), after ten minutes, the low-temperature limit control shuts down the unit if the discharge temperature does not reach the minimum set-point on the low-temperature limit control.*

*If the unit is equipped with a smoke detector (AL-02), the smoke detector will shut down the unit if smoke is detected.*

*If an exhaust fan starter coil is tied into the exhaust fan interlock (C1-01), the exhaust fan will turn on.*

*If the unit is equipped with a firestat (TS-22), the unit will shut down if the temperature exceeds the control's setting.*

*If the unit is equipped with a clogged filter switch (PS-02), the pressure drop across the filters will be monitored.*

When the low airflow switch (PS-01) is proven, the high temperature limit control (TS-04) is energized. The high temperature limit control will monitor the air temperature and shut down the burner if the temperature set point is exceeded. The high temperature limit will require a manual reset.

*If equipped, the optional low and high gas pressure switches (PS-03 & PS-04) will be energized. If the gas pressure is not between the set-points the burner will turn off and require a manual reset.*

The burner on-off relay (RE-56) must be energized from a contact closure and the burner ON/OFF intake air stat (TS-06) must call for heat for the flame safety controller (RE-07) to be energized. The pilot valve (VA-03) opens, and the ignition transformer (TR-03) energizes, providing a signal to spark the spark rod.

After the flame rod (SN-02) proves flame, the main valves (VA-01 & VA-02) open, and the ignition transformer de-energizes. The burner can also be energized from the service switch (SW-06). If the flame rod does not prove after 3 ignition cycles, the burner will shut off. The pilot valve (VA-03) stays energized.

*If the unit is equipped with dual flame rods (SN-03), timer (T1-11) is energized. After the timer's set point is exceeded, the flame sensing is switched from SN-02 to SN-03 (SN-03 is located at the opposite end of the burner) for continual flame monitoring during unit operation.*

The temperature control system's amplifier (AM-01) receives two signals; one from the discharge sensor and one from an external 0-10 VDC or 4-20mA signal from the Building Automation System. The amplifier continually compares these signals and when heat is required the amplifier will send a DC voltage to the modulating valve (VA-05). As the DC voltage from the amplifier increases the modulating valve will open, allowing more gas to flow. By comparing the two signals the amplifier will maintain the discharge temperature by sending a signal to the modulating gas valve.

### Additional Sequence of Operation for VAV units

#### VAV with Static Pressure Control

The VFD will be energized in place of the blower motor starter contactor (ST-01) listed above.

The photohelic, used to monitor the indoor air pressure, sends a signal to the VFD proving that the indoor pressure is either satisfied, positive, or negative. Based on this signal, the VFD alters the HZ to the blower and sends an output signal to the VAV damper motor (MT-08), which is used to control the pressure drop across the burner for the entire airflow range. Depending on the signal from the photohelic, the VFD will do the following:

- If the space is satisfied, the VFD will maintain current operation
- If the space is negative, the VFD will ramp up to rebuild the pressure in the space
- If the space is positive, the VFD will modulate down to reduce the pressure in the space

The high airflow switch (PS-10) is energized at the same time the low airflow switch (PS-01) is energized above. The high airflow switch will ensure that the pressure drop across the burner does not exceed 0.65" w.c.

The flame limiting potentiometer (PO-02) is energized with the modulating gas valve (VA-05) listed in the sequence above. The flame limiting potentiometer limits the voltage to the modulating gas valve to prevent over-firing in low speed.

#### VAV with Manual Potentiometer

The VFD will be energized in place of the blower motor starter contactor (ST-01) listed above.

The manual potentiometer alters the speed of the VFD. The VFD controls the HZ to the blower and sends an output signal to the VAV damper motor (MT-08), which is used to control the pressure drop across the burner for the entire airflow range.

The high airflow switch (PS-10) is energized at the same time the low airflow switch (PS-01) is energized above. The high airflow switch will ensure that the pressure drop across the burner does not exceed 0.65" w.c.



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The flame limiting potentiometer (PO-02) is energized with the modulating gas valve (VA-05) listed in the sequence above. The flame limiting potentiometer limits the voltage to the modulating gas valve to prevent over-firing in low speed.

### **VAV with Constant Speed Control or Analog Input Control**

The VFD will be energized in place of the blower motor starter contactor (ST-01) listed above.

The VFD can operate by either an analog input or preset speeds.

If analog input is required, an analog input signal is sent to the VFD by an external source, which will directly control the signal to the blower and VAV damper motor (MT-08). The VAV damper motor is used to control the pressure drop across the burner for the entire airflow range.

If preset speeds are required, an external switch can be used to manually adjust between programmed speeds in the VFD. The VFD will send a signal to the blower and VAV damper motor (MT-08) based on the selected speed. The VAV damper motor is used to control the pressure drop across the burner for the entire airflow range.

The high airflow switch (PS-10) is energized at the same time the low airflow switch (PS-01) is energized above. The high airflow switch will ensure that the pressure drop across the burner does not exceed 0.65" w.c.

The flame limiting potentiometer (PO-02) is energized with the modulating gas valve (VA-05) listed in the sequence above. The flame limiting potentiometer limits the voltage to the modulating gas valve to prevent over-firing in low speed.