OE377-26-00060-1
(AAON Part No. V82790)
MODGAS-XWR Controller
Technical Guide
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<td>V82790</td>
</tr>
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<td>MODGAS-XWR Controller</td>
<td>V20780</td>
</tr>
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<td>V07150</td>
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<tr>
<td>12-Relay E-BUS Expansion Module</td>
<td>R69180</td>
</tr>
<tr>
<td>Supply Air Temperature Sensor</td>
<td>P87140</td>
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Overview

The OE377-26-00060-1 MODGAS-XWR Controller (AAON Part No. V82790) is designed to be used with White-Rogers® valves only. It will modulate up to two (2) White-Rogers® gas valves to maintain a desired Discharge (Supply) Air Temperature (up to four (4) modulating gas valves may be controlled when a second MODGAS-XWR Controller configured as a slave module). The MODGAS-XWR Controller also controls the speed of the induced draft fan to maintain proper combustion in the heat exchanger. See Figure 1, page 4.

The controller can be used as a stand-alone unit or be connected to a 12 Relay E-BUS Expansion Module (stand-alone only) or VCM-X E-BUS (FC) Controller, VCB-X Controller, or VCCX2 Controller using a modular cable.

The MODGAS-XWR Controller can be configured for: one (1) modulating valve with one ignitor as one stage, two (2) modulating valves with one ignitor as one stage, two (2) modulating valves with two ignitors as one stage, and two (2) modulating valves, with two ignitors as two stages.

Two MODGAS-XWR Controllers (Primary/Secondary) may be configured to control four (4) modulating valves as one stage - two valves with one ignitor on each board. In addition, two Controllers may be configured to control four (4) modulating valves with two ignitors on each board. The first valve on each board is stage one and the second valve on each board is stage two. NOTE: Primary/Secondary configuration is not supported using FC communications (VCM-X E-BUS).

The MODGAS-XWR Controller can also control or effect control of additional fixed valves for additional stages of heat by using the additional Heat Relays on the board itself. When the MODGAS-XWR is attached to one of the listed Unit Controllers, these additional stages are affected through the Unit Controller. In stand-alone mode, these additional fixed heat stages can be increased by attaching a 12 Relay E-BUS Expansion Module. And in communicating mode, additional fixed heat stages can be increased by attaching a 12 Relay E-BUS Expansion Module to the Unit Controller.

Features

The MODGAS-XWR Controller provides the following:

- Can control two (2) Gas Valves using input from Proof of Ignition Modules
- A second MODGAS-XWR Controller can be added as a slave to allow control of 4 modulating gas valves.
- Monitors Supply Air Temperature and Supply Air Reset and modulates gas valves to maintain Setpoint
- Provides active relays to control the Fan, Fan Speed, and Heat Stages
- Controls up to 4 stages of Heat with one Controller
- Contains a 2 x 8 LCD character display and 4 buttons that allow for status display, setpoint changes, and configuration changes

NOTE: The MODGAS-XWR Controller contains no user-serviceable parts. Contact qualified technical personnel if your MODGAS-XWR Controller is not operating correctly.
Important Wiring Considerations

Please read carefully and apply the following information when wiring the MODGAS-XWR Controller. The MODGAS-XWR Controller requires the following electrical connections:

1. 18 gauge minimum wire unless otherwise noted
2. 24 VAC power connection with an appropriate VA rating
3. Supply Air Temperature Sensor and Heat Enable must have 24 gauge minimum wire
4. All 24 VAC wiring must be connected so that all ground wires remain common. Failure to follow this procedure can result in damage to the module and connected devices
5. All wiring is to be in accordance with local and national electrical codes and specifications
6. Check all wiring leads at the terminal block for tightness. Be sure that wire strands do not stick out and touch adjacent terminals. Confirm that all transducers required for your system are mounted in the appropriate location and wired into the correct terminals

WARNING: Observe polarity! All boards must be wired GND-to-GND and 24 VAC-to-24 VAC. Failure to observe polarity could result in damage to the board.

WARNING: Attach all valves to header before supplying power to the board.

Figure 1: MODGAS-XWR-1 Controller Dimensions (in inches)

Note: Overall Depth is 1.49 inches.
One Modulating Valve, One Ignitor, One Stage (1V1IGN1S) - Stand-Alone Wiring

This configuration operates as Stand-Alone (Figure 2, below) or communicating with an AAON Unit Controller (Figure 9, page 12).

This configuration is used to control one modulating valve, which must be placed on the gas valve 1 header (attached to Heat 1 Relay).

NOTE: Up to 3 additional fixed heat stages can be used by using Heat Relays 2, 3 & 4 below and up to 12 more additional fixed stages can be added by using the 12-Relay E-BUS Expansion Module. (Figure 8, page 11).

If using a MHGRV-X Controller along with the MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the MODGAS-XWR Controller.
2 Modulating Valves, 2 Ignitors, 2 Stages (2V2IGN2S) - Stand-Alone Wiring

This configuration operates as Stand-Alone (Figure 3, below) or communicating with an AAON Unit Controller (Figure 11, page 14).

This configuration is used to control two modulating gas valves (one on each header), in which the first valve is modulating stage 1 (valve 1 header) and the second valve is modulating stage 2 (valve 2 header).

The first valve is attached to Heat Relay 1 and the second valve is attached to Heat Relay 2.

**NOTE:** Up to 2 additional fixed heat stages can be used by using Heat Relays 3 & 4 below and up to 12 more additional fixed stages can be added by using the 12-Relay E-BUS Expansion Module. (Figure 8, page 11).

If using an MHGRV-X Controller along with the MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the MODGAS-XWR Controller.

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**Figure 3:** 2 Modulating Valves, 2 Ignitors, 2 Stages Stand-Alone Wiring Diagram
Secondary Board (2V2IGN2S) - Stand-Alone Wiring

In this configuration, the Two Modulating Valves wiring on the facing page is the Primary portion and Figure 4, below is the Secondary portion, thus creating four modulating valves as 2 stages.

This configuration operates as Stand-Alone (Figure 4, below) or communicating with an AAON Unit Controller (Figure 12, page 15).

NOTE: Up to 2 additional fixed heat stages can be used by using Heat Relays 3 & 4 below and up to 12 more additional fixed stages can be added by using the 12-Relay E-BUS Expansion Module. (Figure 8, page 11).

If using a MHGRV-X Controller along with the secondary MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the Primary MODGAS-XWR Controller.

Figure 4: Secondary Board 2V2IGN2S Stand-Alone Wiring Diagram
2 Modulating Valves, 1 Ignitor, 1 Stage (2V1IGN1S) - Stand-Alone Wiring

This configuration operates as Stand-Alone (Figure 5, below) or communicating with an AAON Unit Controller (Figure 13, page 16).

This configuration is used to control two modulating gas valves (one on each header), in which the first and second valves operate together for one modulating stage. Both valves are connected to Heat 1 Relay.

NOTE: Up to 3 additional fixed heat stages can be used by using Heat Relays 2, 3 & 4 below and up to 12 more additional fixed stages can be added by using the 12-Relay E-BUS Expansion Module. (Figure 8, page 11).

If using an MHGRV-X Controller along with the MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the MODGAS-XWR Controller.

Figure 5: 2 Modulating Valves, 1 Ignitor, 1 Stage Stand-Alone Wiring Diagram
Secondary Board (2V1IGN1S) - Stand-Alone Wiring

In this configuration, the Two Modulating Valves wiring on the facing page is the Primary portion and Figure 6, below is the Secondary portion, thus creating four modulating valves as one stage.

This configuration operates as Stand-Alone (Figure 6, below) or communicating with an AAON Unit Controller (Figure 14, page 17).

NOTE: Up to 3 additional fixed heat stages can be used by using Heat Relays 2, 3 & 4 below and up to 12 more additional fixed stages can be added by using the 12-Relay E-BUS Expansion Module. (Figure 8, page 11).

If using a MHGRV-X Controller along with the secondary MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the Primary MODGAS-XWR Controller.

Figure 6: Secondary Board 2V1IGN1S Stand-Alone Wiring Diagram
2 Modulating Valves, 2 Ignitors, 1 Stage (2V2IGN1S) - Stand-Alone Wiring

This configuration operates as Stand-Alone (Figure 7, below) or communicating with an AAON Unit Controller (Figure 10, page 13).

This configuration is used to control two modulating gas valves (one on each header), in which the first and second valves operate together for one modulating stage. One valve is connected to Heat 1 Relay and the second valve is connected to Heat 2 Relay.

NOTE: Up to 2 additional fixed heat stages can be used by using Heat Relays 3 & 4 below and up to 12 more additional fixed stages can be added by using the 12-Relay E-BUS Expansion Module. (Figure 8, page 11).

If using an MHGRV-X Controller along with the MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the MODGAS-XWR Controller.

Figure 7: 2 Modulating Valves, 2 Ignitors, 1 Stage Stand-Alone Wiring Diagram

NOTE:
1.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2.) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.
12 Relay E-BUS Expansion Module

The 12-Relay E-BUS Expansion Module can be used to provide additional fixed heat stages for all Stand-Alone wiring. See Figure 8, below.

In order for the 12 Relay E-BUS Expansion Module to operate, the Stand-Alone setting in the LCD Configuration Screens must be set to Forced.

If communication is lost to the 12-Relay E-BUS Expansion Module, the 12-Relay E-BUS Expansion Module will turn off its relays and the MODGAS-XWR Controller will alarm and fall back to using only its onboard stages. If communications is restored, the MODGAS-XWR Controller will begin staging up if needed.

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.
One Modulating Valve, One Ignitor, One Stage (1V1IGN1S) - Communicating Wiring

This configuration operates as Stand-Alone (Figure 2, page 5) or communicating with an AAON Unit Controller (Figure 9, below).

This configuration is used to control one modulating valve, which must be placed on the gas valve 1 header (attached to Heat 1 Relay).

For VCM-X Controllers, use an I2C Cable connecting to the appropriate I2C port on the controller.

For all other controllers, use an E-BUS cable connecting to an E-BUS port on the controller.

**NOTE:** Up to 3 additional fixed heat stages can be used by using Heat Relays 2, 3 & 4 below. If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller’s relays.

---

**Figure 9: One Modulating Valve, One Ignitor, One Stage Communicating Wiring Diagram**
2 Modulating Valves, 2 Ignitors, 1 Stage (2V2IGN1S) - Communicating Wiring

This configuration operates as Stand-Alone (Figure 7, page 10) or communicating with an AAON Unit Controller (Figure 10, below).

This configuration is used to control two modulating gas valves (one on each header), in which the first and second valves operate together for one modulating stage. One valve is connected to Heat 1 Relay and the second valve is connected to Heat 2 Relay.

For VCM-X Controllers, use an I2C Cable connecting to the appropriate I2C port on the controller.

For all other controllers, use an E-BUS cable connecting to an E-BUS port on the controller.

**NOTE:** Up to 2 additional fixed heat stages can be used by using Heat Relays 3 & 4 below. If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller’s relays.

---

**Figure 10:** 2 Modulating Valves, 2 Ignitors, 1 Stage Communicating Wiring Diagram
2 Modulating Valves, 2 Ignitors, 2 Stages (2V2IGN2S) - Communicating Wiring

This configuration operates as Stand-Alone (Figure 3, page 6) or communicating with an AAON Unit Controller (Figure 11, below).

This configuration is used to control two modulating gas valves (one on each header), in which the first valve is modulating stage 1 (valve 1 header) and the second valve is modulating stage 2 (valve 2 header). The first valve is attached to Heat Relay 1 and the second valve is attached to Heat Relay 2.

For VCM-X Controllers, use an I2C Cable connecting to the appropriate I2C port on the controller.

For all other controllers, use an E-BUS cable connecting to an E-BUS port on the controller.

NOTE: Up to 2 additional fixed heat stages can be used by using Heat Relays 3 & 4 below. If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller’s relays.

---

**Figure 11: 2 Modulating Valves, 2 Ignitors, 2 Stage Communicating Wiring Diagram**
Secondary Board (2V2IGN2S) - Communicating Wiring

In this configuration, the Two Modulating Valves wiring on the facing page is the Primary portion and Figure 12, below is the Secondary portion, thus creating four modulating valves as two stages.

This configuration operates as Stand-Alone (Figure 4, page 7) or communicating with an AAON Unit Controller.

NOTE: Up to 3 additional fixed heat stages can be used by using Heat Relays 3 & 4 below. If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller's relays.

NOTE: The Four Modulating Valves Primary/Secondary configuration is not supported when using I2C communications.
2 Modulating Valves, 1 Ignitor, 1 Stage (2V1IGN1S) - Communicating Wiring

This configuration operates as Stand-Alone (Figure 5, page 8) or communicating with an AAON Unit Controller (Figure 13, below).

This configuration is used to control two modulating gas valves (one on each header), in which the first and second valves operate together for one modulating stage. Both valves are connected to Heat 1 Relay.

**NOTE:** Up to 3 additional fixed heat stages can be used by using Heat Relays 2, 3 & 4 below. If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller’s relays.

For VCM-X Controllers, use an I2C Cable connecting to the appropriate I2C port on the controller.

For all other controllers, use an E-BUS cable connecting to an E-BUS port on the controller.

---

![Diagram of MODGAS-XWR-1 Controller](image)

**Figure 13:** 2 Modulating Valves, 1 Ignitor, 1 Stage Communicating Wiring Diagram
Secondary Board (2V1IGN1S) - Communicating Wiring

In this configuration, the Two Modulating Valves wiring on the facing page is the Primary portion and Figure 14, below is the Secondary portion, thus creating four modulating valves as one stage.

This configuration operates as Stand-Alone (Figure 6, page 9) or communicating with an AAON Unit Controller.

NOTE: Up to 3 additional fixed heat stages can be used by using Heat Relays 3 & 4 below. If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller’s relays.

NOTE: The Four Modulating Valves Primary/Secondary configuration is not supported when using I²C communications.
Inputs and Outputs

I/O Map

The following inputs and outputs are available on the MODGAS-XWR Controller. See Table 1 below to reference the Input/Output Map.

### Analog Inputs

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<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Reset Signal (RST IN)</td>
</tr>
<tr>
<td>2</td>
<td>Supply Temperature (SAT)</td>
</tr>
<tr>
<td>3</td>
<td>(AUX AIN) - Not Used</td>
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</tbody>
</table>

### Binary Inputs

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<tr>
<td>1</td>
<td>(AUX BIN) - Not Used</td>
</tr>
<tr>
<td>2</td>
<td>Heat Enable (HEAT EN)</td>
</tr>
<tr>
<td>3</td>
<td>Proof of Ignition 1 (PO-IGN1)</td>
</tr>
<tr>
<td>4</td>
<td>Proof of Ignition 2 (PO-IGN2)</td>
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### Communicating Outputs

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<th>Description</th>
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<tr>
<td>1</td>
<td>Gas Valve 1</td>
</tr>
<tr>
<td>2</td>
<td>Gas Valve 2</td>
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<table>
<thead>
<tr>
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<tbody>
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<td>1</td>
<td>Fan (RLY1)</td>
</tr>
<tr>
<td>2</td>
<td>Low Speed Fan (RLY2)</td>
</tr>
<tr>
<td>3</td>
<td>Heat 1 (RLY3)</td>
</tr>
<tr>
<td>4</td>
<td>Heat 2 (RLY4)</td>
</tr>
<tr>
<td>5</td>
<td>Heat 3 (RLY5)</td>
</tr>
<tr>
<td>6</td>
<td>Heat 4 (RLY6)</td>
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Table 1: MODGAS-XWR Controller Inputs & Outputs

### Proof of Ignition 1 (PO-IGN1)

The Proof of Ignition input is activated by a 24VAC signal supplied from the Ignition Module to enable the modulating Gas Valve 1 (and the modulating Gas Valve 2 in the 2V1IGN1S configuration). If the flame does not ignite, the Ignition Module will turn off this enable. The MODGAS-XWR Controller will then turn on the “No Proof of Flame” alarm.

### Proof of Ignition 2 (PO-IGN2)

The Proof of Ignition input is activated by a 24VAC signal supplied from the Ignition Module to enable the modulating Gas Valve 2. If the flame does not ignite, the Ignition Module will turn off this enable. The MODGAS-XWR Controller will then turn on the “No Proof of Flame” alarm.

### Gas Valve Outputs

**Gas Valve Output 1**

This communicating output will control the modulating gas valve. It can detect if the valve is connected and can verify the valve position.

**Gas Valve Output 2**

This communicating output will control the modulating gas valve. It can detect if the valve is connected and can verify the valve position.

### Relay Outputs

**Relay #1 - Fan Enable**

This relay works in conjunction with the Low Speed Fan Relay to control the speed of the induced draft blower motor. When the MODGAS-XWR Controller has heat enabled, this relay closes to bring the induced draft blower on at high speed. The controller will activate the Low Speed Fan Relay to reduce the induced draft blower speed as the gas valve modulates closed.

**Relay #2 - Low Speed Fan**

Depending on the gas valve position, this relay will close to switch the induced draft blower to low speed. The controller automatically switches the blower to low speed as the gas valve modulates closed in order to maintain proper fuel to air ratios.

**Relay #3 - Heat 1**

Once the MODGAS-XWR Controller brings on heat, Heat 1 Relay is the first stage of heat. **NOTE:** In the 2 modulating valve, 2 ignitors, 1 stage configuration, Heat Relays #1 & #2 are one stage.

**Relay #4 - Heat 2**

Once the MODGAS-XWR Controller brings on heat, Heat 2 Relay is the second stage of heat if the MODGAS-XWR is configured for two stages of heat. Will either be a modulating heat stage or fixed heat stage. **NOTE:** In the 2 modulating valve, 2 ignitors, 1 stage configuration, Heat Relays #1 & #2 are one stage.

**Relay #5 - Heat 3**

Once the MODGAS-XWR Controller brings on heat, Heat 3 Relay is the second or third stage of heat if the MODGAS-XWR is configured for three stages of heat. Will be a fixed heat stage.

**Relay #6 - Heat 4**

Once the MODGAS-XWR Controller brings on heat, Heat 4 Relay is the third or fourth stage of heat if the MODGAS-XWR is configured for four stages of heat. Will be a fixed heat stage.
Operation Modes

The MODGAS-XWR Controller can be used stand-alone or connected to a Main Controller using a modular cable (communicating).

Stand Alone Mode

When used in a stand-alone application (not connected to a Main Controller via a modular cable), the MODGAS-XWR Controller will modulate the gas valve(s) to maintain the DISCHARGE setpoint configured on the MODGAS-XWR Controller LCD display. The MODGAS-XWR Controller is activated by a 24V AC signal to the HEAT EN input.

The following describes the setpoints available in stand-alone mode for adjustment using the LCD display on the MODGAS-XWR Controller:

- Supply Air Temperature Setpoint
- Supply Air Reset Temperature Setpoint

Communicating Mode

When the MODGAS-XWR Controller is connected to a Main Controller via a modular cable, the necessary information will be passed between the MODGAS-XWR and the Main Controller to properly operate in the Heating Mode.

If the communication is interrupted between the MODGAS-XWR Controller and the Main Controller, both boards will show an alarm. When communication is restored, the alarms will go away.

In this configuration, the Supply Air Temperature Setpoint is set using the Main Controller and the Supply Air Temperature Reset (if used) is calculated by the Main Controller. The Supply Air Temperature is sent to the MODGAS-XWR from the Main Controller.

MODGAS-XWR Staging Configurations

The MODGAS-XWR can be configured for various Staged Heat configurations. These configurations can be used in conjunction with the VCM-X E-BUS Controller, VCB-X Controller, VCCX2 Controller, or 12 Relay E-BUS Expansion Module.

MODGAS-XWR Stand-Alone Configuration

The first and second configuration screens designate the Primary and Secondary boards if using two MODGAS-XWR-1’s.

The third configuration screen allows selection of Stand-Alone Auto (no 12 Relay board) or Stand-Alone Forced (using the 12 Relay board).

The fourth configuration screen allows selection of the Total Stages, which is the number of Heat Stages installed in the unit (note that if there are two heat units to be operated in a primary/secondary arrangement, this is considered 1 stage of heat).

If more stages of heat are needed besides the MODGAS-XWR and the main control board’s configurable relays, a 12 Relay E-BUS Expansion Module or an additional expansion board can be connected to the Main Controller and heat stages can be configured for the 12 Relay board from the Main Controller. If using the 12 Relay board, the third configuration screen must be set at Stand-Alone Forced.

The fifth configuration screen selects the configuration. The options for Stand-Alone operation are (1) 1 modulating, 1 ignitor, 1 stage, (2) 2 modulating, 2 ignitors, 1 stage, (3) 2 modulating, 2 ignitors, 2 stages (which allows a secondary MODGAS-XWR-1), and (4) 2 modulating, 1 ignitor, 1 stage (which allows a secondary MODGAS-XWR-1).

NOTE: The Primary/Secondary configuration is not supported when using the VCM-X E-BUS Controller.

The status screen displaying the stage status will show the current heat stage of all heat stages on the unit. For example, if two stages are active on the MODGAS-XWR and two stages are active on the main control board, the current heat stage displayed will show HEAT STAGE 4.

MODGAS-XWR Stand-Alone with 12-Relay E-BUS Expansion Module

In order for the MODGAS-XWR to communicate properly to the 12 Relay Expansion Module, “S/A MODE” needs to be configured to “FORCED”. This configuration will make the MODGAS-XWR initiate communications with the 12 Relay Expansion Module through the E-BUS cable.

MODGAS-XWR Communicating with AAON Unit Controller

The first and second configuration screens designate the Primary and Secondary boards if using two MODGAS-XWR-1’s.

The fourth configuration screen allows selection of the Total Stages, which is the number of Heat Stages installed in the unit (note that if there are two heat units to be operated in a primary/secondary arrangement, this is considered 1 stage of heat).

If more stages of heat are needed besides the MODGAS-XWR and the main control board’s configurable relays, a 12 Relay E-BUS Expansion Module or an additional expansion board can be connected to the Main Controller and heat stages can be configured for the 12 Relay board from the Main Controller. If using the 12 Relay board, the third configuration screen must be set at Stand-Alone Forced.

The fifth configuration screen selects the configuration. The options for Stand-Alone operation are (1) 1 modulating, 1 ignitor, 1 stage, (2) 2 modulating, 2 ignitors, 1 stage, (3) 2 modulating, 2 ignitors, 2 stages (which allows a secondary MODGAS-XWR-1), and (4) 2 modulating, 1 ignitor, 1 stage (which allows a secondary MODGAS-XWR-1).
**Heating Mode**

**Ignition Sequence for each Valve Configuration**

After Heat is enabled, the modulating valve(s) will move into the ignition sequence. As long as there is a call for Heat, at least one stage will be on. Despite the Supply Air Temperature relation to the Supply Air Temperature Setpoint, the controller will continue heating as long as Heat is enabled (through either binary enable or Modbus enable).

Here is what the ignition sequence looks like for each valve configuration:

- **1V1IGN1S**: Valve 1 moves to the valve start position (set in the hidden screen configuration and defaulted to 70% modulation) and Heat 1 Relay is flipped on. The valve will remain at this position until the proof of ignition time is satisfied. In order to establish proof of ignition, the binary input used for the proof of ignition must remain high for 20 seconds.

- **2V2IGN2S**: Refer to 1V1IGN1S.

- **2V1IGN1S**: Valve 1 & 2 move to the valve start position (set in the hidden screen configuration and defaulted to 70% modulation) and Heat 1 Relay is flipped on. Both valves are connected to the same relay. The valve will remain at this position until the proof of ignition time is satisfied. In order to establish proof of ignition, the binary input used for the proof of ignition must remain high for 20 seconds.

- **2V2IGN1S**: Valve 1 & 2 move to the valve start position (set in the hidden screen configuration and defaulted to 70% modulation) and Heat 1 & 2 Relay are flipped on. The valve will remain at this position until the proof of ignition time is satisfied. In order to establish proof of ignition, the binary input used for the proof of ignition must remain high for 20 seconds.

**Modulating Modes for each Valve Configuration**

After a configuration has completed its ignition sequence, then it moves into a modulating mode. Here’s what the modulating modes look like for each valve configuration:

- **1V1IGN1S**: The PID loop runs every 10 seconds and determines the modulation percentage for the one variable valve. Then, the valve moves to the correct position. During the stage up delay requirement has been met will the board stage up and open the second variable valve. After this, both valves will move simultaneously to the same percent modulations. During the modulation sequence, if the valve position is below 55%, the low speed fan relay will energize as long as it remains below 55%. Once it goes above 55%, the relay will de-energize and move the fan back into high speed.

- **2V2IGN2S**: The PID loop runs every 10 seconds and determines the modulation percentage for the one variable valve. Then, the valve moves to the correct position. Only after the stage up delay requirement has been met will the board stage up and open the second variable valve. After this, both valves will move simultaneously to the same percent modulations. During the modulation sequence, if the valve position is below 55%, the low speed fan relay will energize as long as it remains below 55%. Once it goes above 55%, the relay will de-energize and move the fan back into high speed.

- **2V1IGN1S**: The PID loop runs every 10 seconds and determines the modulation percentage for both variable valves. Then, the valves move to the correct position. During the modulation sequence, if the valve position is below 55%, the low speed fan relay will energize as long as it remains below 55%. Once it goes above 55%, the relay will de-energize and move the fan back into high speed.

- **2V2IGN1S**: Refer to 2V1IGN1S.

**Additional Staging Information for each Valve Configuration**

During the heating sequence, if it is determined that there is currently not enough/too many stages, then a stage up/down will occur, respectively. For a stage up to occur, the valves that are currently in modulating mode must be fully open (100% modulation) for the stage up time, and the current supply air temperature must be at least two degrees below the supply air setpoint. For a stage down to occur, the valves must be closed as much as possible (35% modulation) and the current supply air temperature must be at least 6 degrees above the supply air setpoint. Additionally, all stages must stage down in the reverse order they staged up (i.e. the first one to stage down is the last one to stage up). Below is additional staging information for each of the configurations:

- **1V1IGN1S**: The first stage up will turn on the fixed stage attached to Heat 2 Relay. Stage three would be configured on Heat 3 Relay and stage four on Heat 4 Relay. Additional stages must be off board.

- **2V2IGN2S**: Both on-board heat relays are used for modulating valves, so the first stage up (i.e. turning on stage 2) turns on the second modulating valve. Stage three would be configured on Heat 3 Relay and stage four on Heat 4 Relay. Additional stages must be off board.

- **2V1IGN1S**: Refer to 1V1IGN1S.

- **2V2IGN1S**: Both on-board heat relays are used for modulating valves (stage 1), Stage two would be configured on Heat 3 Relay and stage three on Heat 4 Relay. Additional stages must be off board.
Valve Failure

If a valve failure occurs, the board fails that stage and then continues to the next available stage. This is to make sure that if there is a call for heat, heat is being supplied. A valve failure consists of either a valve no detect or a proof of flame fail. Here is what valve failures look like for each configuration:

1V1IGN1S / 2V1IGN1S: If the modulating valve fails, Heat 1 Relay is turned off and the board then moves to the fixed stages (if available). If the valve fails when there is first a call for heat, then the first fixed stage will come on immediately. Every ignition retry period (set in the hidden configurations menu), the board will re-attempt to detect the valve(s) and retry the ignition process.

2V2IGN2S: If the first stage (the first modulating valve) fails when there is first a call for heat, Heat Relay 1 is turned off and the board immediately moves to the second stage (the second modulating valve). If the second stage fails when the board is in MODULATE_MODE, then normal board operation continues. If the second stage fails, Heat Relay 2 is turned off and the board continues normal operation and moves to the fixed stages next. Every ignition retry period (set in the hidden configurations menu), the board will re-attempt to detect the valve(s) and retry the ignition process.

Force Mode

This mode is used to test that the valve firing sequence is functioning. This mode is NOT meant to replace heating mode by any means. There is no staging in this mode, and there is no PID Loop running in this mode. Once a stage is forced on through the Force Screen, the board will enter Force Mode and will not leave this mode until all the stages that were forced on have been turned off or 10 minutes pass with no user input to the board. Here is what force mode looks like for each configuration:

1V1IGN1S: Forcing stage 1 forces Heat Relay 1 on, and then the next screen allows the option to select the modulation percentage for the valve. Forcing stages 2-4 on forces Heat Relays 2-4 on, respectively.

2V2IGN2S: Forcing stage 1 & 2 on forces Heat Relays 1 & 2 on, respectively, and the screens following each force screen allow you to select the percent modulation for each valve. The valves are able to modulate at different percentages, but keep in mind that bringing one below the low speed cutoff and another above it will cause low speed relay difficulties. Forcing stages 2-4 on forces Heat Relays 2-4 on, respectively.

2V1IGN1S: Forcing stage 1 on forces Heat Relay 1 on, and the next screen allows the option to select the modulation percentage (since both valves are one stage, they both modulate at the same percentage). Forcing stages 2-4 on forces Heat Relays 2-4 on, respectively.

Master vs. Normal

In order to help clarify operating modes, master and normal are used to denote two Modgas XWR boards that are communicating with one another (i.e. one board is a Modbus master and the other is a Modbus slave). With one Modgas XWR board, the maximum number of modulating valves is 2, but with two boards the maximum is 4 (2 for each board). In a master/normal operation, the secondary board is a slave board to the master board.

To configure a master board, put the “S/A MODE” for the board to “FORCED” and put “OPERATION” to “MASTER” (both configurations found in the hidden screens).

To configure a slave, put “OPERATION” to “NORMAL” (found in the hidden screens).

Here are the possible modulation configurations that can be used with a master/slave operation:

2V2IGN2S: In this configuration, both boards utilize both heat relays for a modulating gas valve. Stage 1 is the valve attached to Heat 1 Relay for both boards, and stage 2 is the valve attached to Heat 2 Relay for both boards. The valves on both boards are always modulated to the same position, and both boards stage up (i.e. turn on Heat 2 Relay) at the same time.

2V1IGN1S: In this configuration, both boards utilize Heat 1 Relay to turn on 2 modulating gas valves (a total of 4 for the two boards). This means that each board has an open relay (Heat 2 Relay) for an additional on board fixed stage. The two valves on both boards (i.e. all of the 4 valves) are always at the same modulation position. The first stage up (i.e. stage 2) will flip on the Heat 2 Relay on the master board, and the second stage up (i.e. stage 3) will flip on the Heat 2 Relay on the secondary board.
LCD DISPLAY SCREENS

Navigation Keys

LCD Display Screen & Navigation Keys

The MODGAS-XWR Controller allows you to make configuration changes, view status, change setpoints, create force modes, and perform diagnostics using the keypad next to the LCD display. See Figure 15 and refer to Table 2 for descriptions.

![Figure 15: LCD Display and Navigation Keys](image)

Table 2: Navigation Key Functions

<table>
<thead>
<tr>
<th>NAVIGATION KEY</th>
<th>KEY FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENU</td>
<td>Use the MENU key to navigate through the Main Menu Screens.</td>
</tr>
<tr>
<td>M</td>
<td>Use this key to adjust setpoints and change configurations. This key is also used to turn Valve Force Mode on.</td>
</tr>
<tr>
<td>UP</td>
<td>Use this key to adjust setpoints and change configurations. This key is also used to turn Valve Force Mode off.</td>
</tr>
<tr>
<td>DOWN</td>
<td>Use the Enter key to move through screens within Main Menu categories. Also, use this key to save setpoints and configuration changes.</td>
</tr>
</tbody>
</table>

Main Screens Map

Refer to the following map when navigating through the LCD Main Screens. The first screen is an initialization screen. To scroll through the rest of the screens, press the <MENU> button.

![Diagram of Main Screens Map](image)

NOTE: This screen only displays if secondary board is present.
Protected Screens Map

Refer to the following map when navigating through the LCD Protected Screens. From the MGAS XWR Screen, press the <ENTER> twice until you get to the SOFTWARE Screen. Then hold the <UP> button for 5 seconds and then release the <UP> button to have the Configuration Menu appear. To scroll through the rest of the screens, press the <MENU> button.

Main MODGAS Screens

Refer to the following map when navigating through the Main Screens. From the MGAS XWR Screen, press <ENTER> to scroll through the screens.

This screen displays the Communications Control State of the MODGAS-XWR Controller. The Control States are:

**AUTO_STAND_ALONE:** This is the automatic stand-alone mode that the board moves into on startup. While in this mode, the Controller listens on the E-BUS and I2C communication lines. If communication is detected from either communication form, the Controller moves into the corresponding state (E-BUS or I2C). In the AUTO_STAND_ALONE mode, a supply air temperature sensor is connected to the board.

**COMM_E-BUS:** After startup, if there are requests via E-BUS for data, then the Controller moves from STAND_ALONE into COMM_E-BUS. In this mode, the Controller continually accepts communication via E-BUS to obtain status information and setpoints (e.g. supply air temperature and supply air temperature setpoint). It will not move out of this mode without specific configuration changes or a power cycle.

**COMM_I2C:** After startup, if there are requests via I2C for data, then the Controller moves from STAND_ALONE into I2C_MODE. In this mode, the Controller continually accepts communication via I2C to obtain status information and setpoints. It will not move out of this mode without specific configuration changes or a power cycle.

**COMM_TIMEOUT:** If there is a loss of communication for either E-BUS (master or slave) or I2C, the Controller moves into this mode. This state re-initializes communications and then puts the Controller into COMM_RECOVER mode. Normal board operations do not continue in this mode (e.g. you cannot go into Heat mode).

**COMM_RECOVER:** After the Controller moves into COMM_TIMEOUT, the Controller is then put into this mode. The Controller will not leave this mode until E-BUS or I2C communication returns. Normal Controller operations do not continue when in this mode (e.g. you cannot go into Heat mode). If communication resumes, the Controller moves into the previous communication state.

**FORCED_STAND_ALONE:** In this mode, the Controller acts as a Modbus master communicating to either another MODGAS-XWR Controller or a 12 Relay Controller for additional fixed stages. The only way to leave this control state is to change the “S/A MODE” configuration from “FORCED” to “AUTO” in the Configuration screens.

**SLAVE_MODE:** If the Controller is acting as a Modbus slave to another MODGAS-XWR Controller, then it operates in this control state. This mode limits many Controller operations (e.g. the PID Loop does not run in this mode). In this mode, the board essentially mimics the operation of the MASTER Modgas XWR board.
LCD DISPLAY SCREENS

Main Menu and Status Screens

FAIL_STATE: FAIL_STATE occurs when the supply air temperature rises above the high temperature cutoff in any of the operating modes or when the supply air temperature sensor cannot be detected while in either stand-alone mode. The Controller will exit FAIL_STATE when the supply air temperature drops 10ºF below the supply air setpoint or when the SAT Sensor is reattached or detected again. Heat mode cannot be entered while in this state.

This screen displays the current mode of operation. They are as follows:

OFF_MODE: This mode will display when there is no call for Heat and Heating has been disabled. All relays are off, all fixed stages are off, and the valves are moved to the home position. This is the default mode.

IGNITE_MODE: Each time Heat is activated, the unit will first go into Ignition Mode. During this mode, the valve moves to the start position and Stage 1 is ignited. Once Proof of Flame (POF) is established, the unit will go into Heat. Proof of Flame is established when the POF signal has been present for the ignition hold time. The ignition position and proof of flame time can both be set in the hidden configuration screen.

FORCE_MODE: If the valves are being forced for testing, the board moves into this mode. This mode maintains the normal heating sequence for each modulation configuration, but instead of using the PID Loop it uses the forced position (set from either the Force Menu or through Modbus). After 10 minutes of no keypad input, the Force Mode will disengage.

VCMX_EOL: If the Controller is being tested for the VCM-X via I2C communications, then the Controller moves into this mode.

MOD HEAT STAGE ##: After Ignition Mode, the unit will enter the Heat Mode and will begin to modulate the gas valve(s) to maintain the Heating Supply Air Setpoint (SAT). Once the call for heat goes away, the unit will leave the Heat Mode.

SLAVE HEATING: If the Controller is a Modbus slave to another MODGAS-XWR, then this mode replaces Modulate Mode. If the board is in this mode, then that means there is a MASTER XWR board running the PID Loop control. A board in this mode simply mimics the operation of the MASTER XWR board.

TEST_MODE: If the Controller is being tested through Prism, the Controller will move into this mode to operate (e.g. turn relays on/off).

Status Screens

Refer to the following map when navigating through the Status Screens. From the STATUS Screen, press <ENTER> to scroll through the screens.
SA TEMP
XX.X

SUPPLY AIR TEMPERATURE
40ºF to 150ºF or 4ºC to 65ºC.
If no sensor is detected, screen will display “NO SENSR”

ACTIV SP
XX.X

ACTIVE SUPPLY AIR SETPOINT
Calculated from SAT Setpoint and Reset Setpoint in stand-alone mode.
In communicating mode, the Main Controller sends the setpoint.
The SAT Setpoint is set by the LCD Display in stand-alone mode and is set by the Main Controller in communicating mode.

FAN SPEED
LOW, HIGH, OFF

FAN SPEED STATUS
Low, High, Off

SAT FAIL ERROR: The Supply Air Temperature sensor has been disconnected for more than 60 seconds. This will cause the Heat to be disabled. This alarm will be disabled when the sensor is reconnected or detected.

COMM LOSS: Communications have been lost with the main controller. This alarm will disable when communications resume.

12 RELAY BOARD COMM LOSS: Communications have been lost with the 12 Relay Expansion Board. This alarm will disable when communications resume.

STAGE 1 FAILURE: Indicates a failure to ignite Stage 1 Heat.

STAGE 2 FAILURE: Indicates a failure to ignite Stage 2 Heat.

Alarms Menu and Slave Alarms
The alarm screens will display automatically when alarms are present.
NOTE: The Slave Alarms Screen will only display on the primary board if a secondary board is present.

NO ALARMS: This will be shown if there are no current alarms.
V1 NO DETECT: Gas Valve 1 is not detected.
V2 NO DETECT: Gas Valve 2 is not detected.
V1 NO PO FLAME: No Proof of Flame Ignition Module input is detected.
V2 NO PO FLAME: No Proof of Flame Ignition Module input is detected.
SAT CUTOFF: This indicates a Supply Air Temperature Cutoff Alarm condition which is activated if the SAT has risen above 200ºF. The alarm will go away if after a fixed delay period the SAT has dropped below 200ºF.

Setpoint Screens
Refer to the following map when navigating through the Setpoint Screens. From the SETPOINT Screen, press <ENTER> to scroll through the screens and change setpoints. Use the <UP> and <DOWN> arrow keys to change your selections. Then press <ENTER> to save the new setpoint.

WARNING: The <ENTER> key must be pressed after changing setpoints for your entries to be saved for subsequent power-ups.

NOTE: When the MODGAS-XWR is operating in Communications Mode, these setpoints screens will not appear on the LCD display because they are controlled by the Main Controller.

HEATING SUPPLY AIR TEMPERATURE SETPOINT
This is the target temperature while the heating is enabled. If you are using the reset signal, this is the setpoint it will calculate to at zero volts. The Setpoint Screen will display only in stand-alone mode.

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Default</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°F</td>
<td>120°F</td>
<td>200°F</td>
</tr>
<tr>
<td>5ºC</td>
<td>49ºC</td>
<td>93ºC</td>
</tr>
</tbody>
</table>

MODGAS-XWR-1 Technical Guide 25
**Setpoint & Force Valve Screens**

Refer to the following map when navigating through the Force Valve Screens. From the FORCE VALVE Screen, press <ENTER>. At the V1 and V2 FORCE ON/OFF screens, press the <UP> arrow key to turn the FORCE MODE on and press the <DOWN> arrow key to turn the FORCE MODE off. Use the <UP> and <DOWN> arrow keys to increase and decrease the percentage.

### FORCE VALVES

Press the <UP> button to turn the Force Mode on. Press the <DOWN> button to turn the Force Mode off.

### STAGE 1 FORCE ON/OFF

This screen only appears when Stage 1 Force is on. Press the <UP> button to increase the percentage. Press the <DOWN> button to decrease the percentage.

### STAGE 2 FORCE ON/OFF/DISABLED

Press the <UP> button to turn the Force Mode on. Press the <DOWN> button to turn the Force Mode off. If the screen says disabled, on/off selection is not possible.

### FORCE VALVE 1 PERCENTAGE

This screen only appears when Stage 1 Force is on. Press the <UP> button to increase the percentage. Press the <DOWN> button to decrease the percentage.

**NOTE:** When you turn the Force Mode back off or after 10 minutes of no keypad input, the valve will go to zero and the relays will turn off.

### STAGE 2 POSITION

This screen only appears when Valve 2 Force is on.

### STAGE 3 & 4 FORCE ON / OFF

The Stages Force Screens will allow you to force each stage on or off.

### STAGE 3 FORCE ON/OFF

Press the <UP> button to turn the Force Mode on. Press the <DOWN> button to turn the Force Mode off.

### STAGE 4 FORCE ON/OFF

Press the <UP> button to turn the Force Mode on. Press the <DOWN> button to turn the Force Mode off.

### RESET SP

40°C - 200°F
5°C - 93°C

**RESET HEATING SUPPLY AIR SETPOINT**

This is maximum temperature at which the Supply Air Temperature will reset to. The Setpoint Screen will display only in stand-alone mode.

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Default</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°F</td>
<td>120°F</td>
<td>200°F</td>
</tr>
<tr>
<td>5°C</td>
<td>49°C</td>
<td>93°C</td>
</tr>
</tbody>
</table>

### FORCE VALVE 2 PERCENTAGE

This screen only appears when Valve 2 Force is on. Press the <UP> button to increase the percentage. Press the <DOWN> button to decrease the percentage.
Configuration Screens

Refer to the following map when navigating through the Configuration Screens. From the CONFIG Screen, press <ENTER> to scroll through the screens and change setpoints. Use the <UP> and <DOWN> arrow keys to change your selections. Press <ENTER> to save any changes.

CONFIG

ADDRESS

1 (138)

CURRENT BOARD ADDRESS

The first number is the board address. The number in parentheses is the E-BUS address. Use this screen to set the Address for a Slave board. Set the Address to 2 for a Slave board. Default is 1(138).

STAGES

TOTAL 1 TO 19

NUMBER OF TOTAL STAGES

Range is 1 to 19. Default is 2.

MODULATION CONFIGURATION

Values are in the format xVyIGNzS, where x is the number of valves (V), y is the number of ignitors (IGN) and z is the number of stages (S).

Values are 1V1IGN1S, 2V2IGN2S, 2V1IGN1S, and 2V2IGN1S. Default is 1V1IGN1S.

The four configurations are explained in detail as follows:

1V1IGN1S: Valve configuration used to control one modulating gas valve, which must be placed on the gas valve 1 header (attached to Heat 1 Relay). Additional stages may be added to Heat Relays 2, 3 & 4, or off board if in a communication mode.

2V1IGN1S: Valve configuration used to control two modulating gas valves (one on each header), in which the first and second valves operate together for one modulating stage. Both valves are connected to Heat 1 Relay, therefore, an additional fixed stage may be added on board at the Heat 2 Relay. Additional stages may be added on Heat Relays 3 & 4 or off board for this configuration if it is in a communicating mode. **NOTE:** Since both valves are attached to Heat 1 Relay, only one proof of flame is required for both valves.

2V2IGN1S: Valve configuration used to control two modulating gas valves (one on each header), in which the first valve is modulating stage 1 (valve 1 header) and the second valve is modulating stage 2 (valve 2 header). Additional stages may be added to Heat 3 & 4 Relays or off board if it is in a communicating mode.

2V2IGN2S: Valve configuration used to control two modulating gas valves (one on each header), in which the first and second valves operate together for one modulating stage. One valve is connected to Heat 1 Relay and the second valve is connected to Heat 2 Relay. Additional stages may be added to Heat Relays 3 & 4 or off board if it is in a communicating mode.

OPERATION

NORMAL OR MASTER

This screen is used to set a Primary MODGAS-XWR board as a Master board. If only using one MODGAS-XWR board, this should be set to Normal.

S/A MODE

AUTO or FORCED

STAND ALONE MODE

Auto or Forced. Default is Auto.

In order for the MODGAS-XWR to communicate with another MODGAS-XWR or 12 Relay Expansion board, the MODGAS-XWR must be put in Forced Stand-Alone Mode.
**Configuration Screens**

- **STG DOWN DELAY**
  - Range: 1 to 10 minutes. Default is 1.

- **STG UP DELAY**
  - Range: 1 to 10 minutes. Default is 3.

- **IGN RTRY DLY**
  - Range: 1 to 60 minutes. Default is 30.

- **TEMP SCL**
  - Fahrenheit (default) or Celsius.
  - Used in stand-alone mode only.

- **VLV STRT POS**
  - Range: 55-100% in 5% steps. Default is 70%.

- **LOSAT SU**
  - Range: 0 - 45°F. Default is 40°F.
  - If the Supply Air Temperature is 40°F (adjustable) or less, the stage up delay is reduced from 3 minutes to 1 minute.

- **STG DOWN**
  - DLY 1 TO 10 m

- **STG UP**
  - DLY 1 TO 10 m

- **VALVE START POSITION**
  - Range is 55-100% in 5% steps. Default is 70%.

- **LOW SUPPLY AIR TEMPERATURE START-UP**
  - Range: 0 - 45°F. Default is 40°F.
  - If the Supply Air Temperature is 40°F (adjustable) or less, the stage up delay is reduced from 3 minutes to 1 minute.
LED Diagnostics

The MODGAS-XWR Controller is equipped with LEDs that can be used to verify operation and perform troubleshooting. There are LEDs for communication, operation modes, and diagnostic codes. The module has 14 LEDs—12 used for operation & status, and 2 used for alarms.

See Figure 16, page 30 for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

Operation LEDs

POWER - This green LED will light up to indicate that 24 VAC power has been applied to the controller.

STATUS - This green LED will blink every 5 seconds according to what mode the controller is in. See Table 3.

<table>
<thead>
<tr>
<th>No. of Blinks</th>
<th>STATUS LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off Mode</td>
</tr>
<tr>
<td>2</td>
<td>Heating Mode (Heat Enable Signal and No Alarms)</td>
</tr>
</tbody>
</table>

Table 3: STATUS LED Blink Codes

Diagnostic LEDs

ALARM - The red LED located on the MODGAS-XWR Controller’s cover above the LCD display will blink to indicate an alarm. Alarms can be viewed on the LCD Display in the ALARMS Menu.

The ALARM LED located above the COMM LED on the MODGAS-XWR board will blink an alarm code every 10 seconds when an alarm(s) occurs. The highest priority failure code will be indicated first. You must correct the highest priority alarm before other problems will be indicated. See Table 4.

<table>
<thead>
<tr>
<th>No. of Blinks</th>
<th>ALARM LED (Blinks every 10 seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valve 1 Proof of Flame Failure</td>
</tr>
<tr>
<td>2</td>
<td>Valve 1 Not Detected</td>
</tr>
<tr>
<td>3</td>
<td>Valve 2 Proof of Flame Failure</td>
</tr>
<tr>
<td>4</td>
<td>Valve 2 Not Detected</td>
</tr>
<tr>
<td>5</td>
<td>SAT Not Detected (Stand-Alone Mode)</td>
</tr>
<tr>
<td>6</td>
<td>SAT Cutoff</td>
</tr>
<tr>
<td>7</td>
<td>Relay 12 Communication Failure</td>
</tr>
<tr>
<td>8</td>
<td>Communication Failure</td>
</tr>
<tr>
<td>9</td>
<td>Stage 1 Failure</td>
</tr>
<tr>
<td>10</td>
<td>Stage 2 Failure</td>
</tr>
</tbody>
</table>

Table 4: ALARM LED Blink Codes

Communication LED

COMM - This yellow LED will light up and blink when communications are detected. If this LED never blinks, then there is no communication.

Relay LEDs

RLY1 - This green LED will light up and stay lit as long as the Fan relay is active.

RLY2 - This green LED will light up and stay lit as long as the Low Speed Fan relay is active.

RLY3 - This green LED will light up and stay lit as long as the Heat Enable 1 relay is active.

RLY4 - This green LED will light up and stay lit as long as the Heat Enable 2 relay is active.

RLY5 - This green LED will light up and stay lit as long as the Heat Enable 3 relay is active.

RLY6 - This green LED will light up and stay lit as long as the Heat Enable 4 relay is active.

Binary Input LEDs

AUX BIN - Not used.

HEAT EN - This green LED will light up when Heat Enable signal is activated.

PO-IGN1 - This green LED will light up when the Proof of Flame input from the first Ignition Module is enabled.

PO-IGN2 - This green LED will light up when the Proof of Flame input from the second Ignition Module is enabled.

Analog Output LEDs

GAS VALVE 1 - This red LED will do the following:
- If the valve is detected and not modulating, then the valve LED is solid.
- If the valve is modulating, then it will blink while it is moving.
- If the valve is not detected, the valve LED will continuously blink.
- If there shouldn’t be a modulating valve attached to the valve header, then the valve LED remains off.

GAS VALVE 2 - This red LED will do the following:
- If the valve is detected and not modulating, then the valve LED is solid.
- If the valve is modulating, then it will blink while it is moving.
- If the valve is not detected, the valve LED will continuously blink.
- If there shouldn’t be a modulating valve attached to the valve header, then the valve LED remains off.
Figure 16: MODGAS-XWR Controller LED Locations and Descriptions
Troubleshooting Alarms

Mechanical Failure:

- Check relay outputs on the MODGAS-XWR for 24 VAC output.
- Verify the SAT OPTIONS jumper settings on the MODGAS-XWR for Supply Air Temperature Sensor.
- Verify gas valve LED is solid. Try forcing valves (refer to Force Screens in this guide).
- Verify that the Supply Air Temperature Sensor is connected to SAT and GND on the MODGAS-XWR (stand-alone mode) or to AI2 (VCM-X or VCB-X) or to AI3 (VCCX2) and GND on the Main Controller (communicating mode).
- Verify Supply Air Temperature Sensor probe is mounted correctly in supply duct.
- Remove SAT and GND wiring from the MODGAS-XWR and ohm sensor out (this may indicate open or failed wiring). Refer to chart on pages 32-33 of this guide for readings.

Fail Mode - Supply Air Temperature Sensor Failure:

- Verify that the Supply Air Temperature Sensor is connected to the SAT and GND on the MODGAS-XWR (stand-alone mode) or to AI2 (VCM-X or VCB-X) or to AI3 (VCCX2) and GND on the Main Controller (communicating mode).
- Remove SAT and GND wiring from MODGAS-XWR and ohm sensor out (this may indicate open or failed wiring). Refer to chart on pages 30-31 of this guide for readings.
- Verify the SAT OPTIONS jumper settings on the MODGAS-XWR for the Supply Air Temperature Sensor.

Fail Mode - SAT Cutoff:

- Remove SAT and GND wiring from the MODGAS-XWR and ohm sensor out (this may indicate open or failed wiring). Refer to chart on pages 32-33 of this guide for readings.
- With Supply Air Sensor disconnected from the MODGAS-XWR, set volt meter to DC volts and measure voltage between SAT and GND on board. Refer to chart on page 32 of this guide for readings.
- Verify Supply Air Temperature Sensor reading in duct with 3rd party temperature testing device.

Communications Loss:

- Check COMM LED on MODGAS-XWR.
- Verify 24 VAC power to all interconnected AAON controllers.
- Verify E-BUS connection between the MODGAS-XWR and associated AAON controllers.
- In communication mode (connected to an AAON unit Controller with modular cable), confirm that Main MODGAS screens shows COMM MODE that Main Controller’s MODGAS status screen displays MODGAS-XWR’s Position %.
Other Checks

0-3.3V (SAT OPTIONS Jumper Setting 1) & 0-5V (SAT OPTIONS Jumper Setting 2) Supply Air Temperature Sensor

If you suspect the Supply Air Temperature Sensor is not reading correctly, make sure the wiring terminal connections are tight and that any wiring splices are properly connected. You can check the operation of the Supply Air Temperature Sensor by measuring the resistance or voltage using a digital multimeter. Set the meter to DC Volts. Place the positive probe on the AIN terminal and the negative probe on the GND terminal. Read the DC Volts and find that voltage in Tables 5 & 6.

Read the temperature corresponding with that voltage and determine if this is close to the actual temperature the sensor is exposed to. If the temperature from the chart is different by more than a few degrees, you probably have a defective or damaged sensor. You can also check the sensor resistance to determine correct operation. To read the resistance, set the meter to Ohms. Unplug the sensor connector from the board and measure the resistance across the disconnected wires. This resistance should match the corresponding temperature from Tables 5 & 6.

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Temp (°C)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>-23.3</td>
<td>93333</td>
<td>2.98</td>
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<td>-5</td>
<td>-20.6</td>
<td>80531</td>
<td>2.94</td>
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<td>69822</td>
<td>2.89</td>
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<td>52500</td>
<td>2.77</td>
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<td>45902</td>
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<td>1.85</td>
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</table>

Table 5, continued: 0-3.3 V Temperature Sensor - Voltage & Resistance for Type III Sensors

Thermistor Sensor Testing Instructions

1.) Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

2.) Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 3.3 VDC, the sensor or wiring is “open.” If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.
## Thermistor Sensor Testing Instructions

1. Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

2. Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 5.08 VDC, the sensor or wiring is “open.” If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.

### Table 6, cont.: 0-5V Temperature Sensor - Voltage & Resistance for Type III Sensors

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Temp (°C)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
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<td>6716</td>
<td>2.055</td>
</tr>
</tbody>
</table>

Table 6: 0-5V Temperature Sensor - Voltage & Resistance for Type III Sensors
Supply Air Temperature Sensor Installation

Mounting the Supply Air Temperature Sensor

- The Supply Air Temperature (SAT) Sensor should be located in the duct-work downstream of the unit supply air connection.
- Locate the sensor in the center of the widest part of the duct. Use the supplied template and a 5/16” drill to make a hole for the sensor.
- Install the gasket over the probe and mount securely to the duct using the supplied sheet metal screws. Be sure the gasket is compressed to provide an air tight seal.
- For best accuracy, apply insulation on the outside of the duct, over the sensor. This will help prevent thermal gradients from affecting the sensor.

**WARNING:** Make sure your Supply Air Temperature Sensor is mounted and wired according to these instructions prior to testing the unit or else the modulating valve will not control properly and may damage your equipment.

Stand-Alone Mode

In Stand-Alone Mode, the SAT Sensor is connected to the MODGAS-X Controller. If, in Stand-Alone Mode, the MODGAS-X Controller is used in conjunction with a Stand-Alone MHGRV Controller, the SAT sensor is shared between the two controllers and always attaches to the MODGAS-X Controller.

See Table 8, page 35 for SAT Options Jumper Settings and see Figures 2, 3, 5 & 7 for wiring. See Table 7, page 35 for details about retrofit applications.

Communication Mode

When communicating with AAON Unit Controllers, the SAT Sensor will be connected to the Main Controller. The exception would be in retrofit applications with older controllers. See Table 9, page 35 for SAT Options Jumper Settings and see Figures 9, 10, 11 & 13 for wiring. See Table 7, page 35 for details about retrofit applications.
SAT Wiring Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>MODGAS-XWR ONLY</th>
<th>MODGAS-XWR &amp; MHGRV-X</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAND-ALONE</td>
<td>Install Supply Air Sensor in MODGAS-XWR.</td>
<td>Install Sensor in MODGAS-XWR and daisy-chain it to the MHGRV-X. Set “SAT Options” Jumpers to “MODGAS X”. If connected to a MODGAS II Retrofit, Set “SAT Options” Jumpers to “MODGAS”.</td>
</tr>
<tr>
<td>VCB-X, VCCX2</td>
<td>Install Supply Air Sensor in VCB-X or VCCX2. Connect to VCB-X or VCCX2 using E-BUS cable.</td>
<td>Install Supply Air Sensor in VCB-X or VCCX2. Connect to VCB-X or VCCX2 using E-BUS cable.</td>
</tr>
<tr>
<td>VCM-X, SA, RNE</td>
<td>Install Supply Air Sensor in Main Controller. Connect to Main Controller using I2C cable.</td>
<td>Install Supply Air Sensor in Main Controller. Connect to Main Controller using I2C cable.</td>
</tr>
<tr>
<td>VCM, VAV/CAV, MUA, MUA II, MUA IID</td>
<td>Install Supply Air Sensor in MODGAS-XWR. Connect to Main Controller using I2C cable.</td>
<td>Install Supply Air Sensor in MODGAS-XWR. Connect to Main Controller using I2C cable.</td>
</tr>
</tbody>
</table>

Table 7: SAT Wiring Conditions

SAT Options Jumper Settings

Refer to Tables 8 & 9 to determine the settings. See Figure 2, page 5 for jumper locations.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAT Options Jumper Settings</td>
<td></td>
</tr>
</tbody>
</table>

Table 8: Stand-Alone Mode SAT OPTIONS Jumper Settings

<table>
<thead>
<tr>
<th>Condition</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCM-X / RNE / SA*</td>
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</tr>
<tr>
<td>VCM, MUA, MUA II, MUA IID VAV/CAV**</td>
<td>1</td>
</tr>
<tr>
<td>VCB-X / VCCX2*</td>
<td>1</td>
</tr>
</tbody>
</table>

* For SAT Sensor testing, use Table 5, page 32 for jumper setting 1. SAT should be connected to the Main Controller.
** For SAT Sensor testing, use Table 5, page 32 for jumper setting 1. SAT should be connected to the MODGAS-XWR Controller.

Table 9: Communications Mode SAT OPTIONS Jumper Settings

** In this situation, also set MHGRV-X SAT Option to MODGAS-X. See the MHGRV-X Technical Guide for more information.
*** The MHGRV II must have PU resistor installed.
Replacing the MODGAS-XWR with the MODGAS-XWR-1

The retrofit replacement involves a few easy steps. Refer to Figure 18, below.

**Step 1:** Disconnect power from the MODGAS-XWR Controller.

**Step 2:** Set the SAT Options Jumper to the same settings as before.

**Step 3:** The Supply Air Temperature Sensor needs to remain installed on whatever controller it is currently on.

**Step 4:** Unplug the TB2 Input Terminal Block from the MODGAS-XWR and replug it into the MODGAS-XWR-1 board.

**Step 5:** Unplug the Ignition blocks and Valve headers from the MODGAS-XWR and replug them into the MODGAS-XWR-1 board.

**Step 6:** Wire the MODGAS-XWR-1 relays according to the valve configuration you will be using.

**Step 7:** Connect power to the MODGAS-XWR-1 Controller.

**Step 8:** Configure the MODGAS-XWR-1 Controller using the LCD Display Screens.

---

**Figure 18: MODGAS-XWR-1 Controller**

1.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.

2.) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.