AAON®

HB Controller
Technical Guide

HB Controller Code: SS1019
HB MHGR Controller: SS1020
HB Processor Board: SS1021
Requires HB Service Tool Code: SS1100
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General

The HB Controller (Orion Part No. OE377-00-00046; AAON Part No. R29280) is designed to work with a normal 24 VAC Thermostat and Dehumidistat. Single or Multi-stage Thermostats can be used. When a Single-Stage Thermostat is used, an auto-staging feature is built-in for Multi-stage HB units. Fan speed can be adjusted for both high and low speeds by way of an interface when the HB unit is equipped with an adjustable speed controller. Dehumidification is optimized by use of a Return Air Bypass damper. Modulating Hot-Gas Reheat can be used to reheat the Supply Air during Dehumidification.

A CO₂ sensor can be connected through the wiring harness when IAQ control is desired. Also, two damper positions are available when using Two-Speed Supply Fans, thus providing enhanced IAQ control.

The HB Controller also monitors equipment safeties, logs information, and locks out the equipment in the event of multiple failures. All sensors are needed in order to provide all modes of operation. However, to prevent a potential freeze condition, Heating Mode will still operate if all sensors have failed or are missing.

Terminal block style connections are provided for field wiring of the Thermostat, Dehumidistat, and Supply Air Temperature Sensor wires. All other inputs and outputs are connected via a wiring harness on the HB unit. A list of all available inputs and outputs follows.

The HB Controller is programmed using the HB Modular Service Tool (Orion Part No. OE391-12-HB; AAON Part No. V97740). Programming instructions start on page 16 of this manual. This manual also includes instructions for programming the HB Processor and the MHGR Controller.

Inputs

- G, Y1, Y2, W1, W2, W3
- RH: Dehumidistat
- SAT: Supply Air Temperature Sensor
- MHGRV Reset: Modulating Hot-Gas Reheat Signal (0-10VDC)
- RAB: Return Air Bypass Damper Actuator (by others)
- ECS: (Enthalpy Changeover Switch)
- Econo Pos: Economizer Control (by others)
- Carbon Dioxide Sensor
- Outdoor Air Temperature Sensor
- Liquid Line Temperature Sensor (currently not used)
- Heat Safety Monitor (monitors main and auxiliary limit thermostats)
- High-Pressure Switch
- Low-Pressure Switch
- Clogged Filter Switch

Outputs

- Supply Fan High-Speed Relay
- Supply Fan Low-Speed Relay
- Cool-1 Relay
- Cool-2 Relay
- Heat-1 Relay
- Heat-2 Relay
- Heat-3 Relay
- Condenser Fan Relay
- AUX: Currently used for an exhaust fan relay
- Modulating Hot-Gas Reheat Signal (from HGR controller)
- Adjustable Two-Speed Fan Signal (0-10VDC)
- Return Air Bypass Damper Actuator (0-10VDC)
- Economizer Damper Actuator (2-10VDC)
- Modulating Hot-Gas Reheat Reset Signal (0-10 VDC)
- A1, A2: Economizer 24 VAC Power Supply Jumper Terminals
- C1, C2: Clogged Filter Switch 24 VAC Output Terminals
Figure 1: HB Controller Dimensions
Controller Sequence of Operations

Fan Mode

The HB Controller supports 2 different Supply Fan configurations. It can be configured for Adjustable Two-Speed Fan or Two-Speed Fan. On a call for “G,” the Supply Fan runs at Low Speed. Minimum on and off times are maintained in the event of a short cycled call for “G.”

Heating Mode

On a call for “W1,” the Supply Fan runs at High speed (maintained during the Heating mode), and Heat Stage 1 is energized. On a call for “W2,” Heat Stage 2 is energized after the Stage-Up delay. If “W2” is called without “W1,” Heat Stage 1 is energized, and then Heat Stage 2 is energized after the Auto Stage-Up Delay period. On a call for “W3,” Heat Stage 3 is energized after the Stage-Up delay. If “W3” is called without “W1” or “W2,” Heat Stages 1, 2, and 3 will energize based on Auto Stage-Up Delays.

Cooling Mode

If the HB Controller is configured for 1 stage of Cooling, on a call for “Y1,” the Supply Fan runs at High speed, and Cool Stage 1 will energize. If the HB Controller is configured for 2 stages of Cooling, on a call for “Y1,” the Supply Fan runs at Low speed, and Cool Stage 1 is energized. On a call for “Y2,” the Supply Fan runs at High Speed, and Cool Stage 2 is energized after the Stage-Up Delay. If “Y2” is called without “Y1,” Cool Stage 1 is energized, and then Cool Stage 2 is energized after the Auto Stage-Up Delay.

Economizer Cooling

General Economizer Operation

If the Outdoor Air Temperature is below the Economizer Enable Setpoint and there is a call on “Y1,” the compressors will be locked out, and the Economizer will modulate to achieve a 55°F Supply Air Temperature. If the HB Controller is configured for 1 stage of Cooling, on a call for “Y1,” the Supply Fan will run at High Speed. If the HB Controller is configured for 2 stages of Cooling, on a call for “Y1,” the Supply Fan will run at low speed. When “Y2” is called, the Supply Fan will go to high speed.

Economizer Operation with ECS Control

If the Enthalpy Changeover Switch (ECS) is closed and the outdoor air temperature is below the ECS, OAT Enable setpoint (default 65°F), the economizer will modulate and attempt to achieve 55°F supply air temperature. If the outdoor air temperature is above 55°F, the economizer will generally open to 100%. Mechanical cooling can be used to supplement the economizer if the outdoor air temperature is above the ECS OAT Enable setpoint and the economizer signal is at 100%. Once mechanical cooling is activated to supplement the economizer, the economizer will remain at 100% until the cooling call is satisfied.

Mechanical Cooling Staging with ECS Control

If the HB Controller is configured for 1 stage of Cooling, on a call for “Y1,” the Supply Fan will run at High Speed. Cool Stage 1 will activate after the Cooling Auto Stage-Up Delay. If the HB Controller is configured for 2 stages of Cooling, on a call for “Y1,” the Supply Fan will run at Low Speed. Cool Stage 1 will activate after either the Cooling Auto Stage-Up Delay Expires or a call for “Y2” is made. When “Y2” is called, Cool Stage 2 will activate after the Cooling Auto Stage-Up Delay. After Cool Stage 2 is activated, the Supply Fan will switch to High-Speed operation.

Economizer IAQ Control

The economizer is also used for CO₂ control. If the CO₂ level is above the Minimum CO₂ PPM setpoint, the Economizer Minimum Position will be reset proportionally between the Minimum CO₂ PPM and Maximum CO₂ PPM setpoints. When the CO₂ level is above the Maximum CO₂ PPM setpoint, the Economizer will open as far as the Maximum Damper Adjustment Position setpoint setting. There are two Minimum and two Maximum Economizer Damper Positions depending on the Supply Fan speed. These are the Maximum Damper Position with Low-Speed Fan, the Minimum Damper Position with Low-Speed Fan, the Maximum Damper Position with High-Speed Fan, and the Minimum Damper Position with High-Speed Fan. The air balancing contractor should determine these settings in order to maintain the proper amount of fresh air being supplied to the building.

Economizer Dehumidification

1-or 2-Stage Cooling Units with Adjustable Two-Speed or Two-Speed Supply Fan Control

If the Outdoor Air Temperature is below the Economizer Enable Setpoint and there is a call for Dehumidification on “RH,” the compressors will be locked out, and the Economizer will modulate to achieve 55°F Supply Air Temperature. The Supply Fan will run at Low Speed, and the Return Air Bypass will be closed.

For 1 stage Cooling units, on a call for “Y1,” the HB Controller will enter the Cooling Mode, and the Supply Fan will run at High Speed. The Cooling Mode will be maintained until “Y1” is satisfied. As long as there is still a call for “RH,” the Dehumidification Mode will remain.

For 2 stage Cooling Units, “Y1” is ignored during this mode to extend Dehumidification. On a call for “Y2,” the HB Controller will enter the Cooling mode, and the Supply Fan will run at High Speed. The Cooling Mode will be maintained until both “Y2” and “Y1” are satisfied. As long as there is still a call for “RH,” the Dehumidification Mode will remain, and the Supply Fan will run at Low Speed.

If the HB Controller is configured for 1 stage of Heating, on a call for “W1,” the mode changes to Heating. The Economizer will close to its Minimum Position, Heat Stage 1 will energize, and the Supply Fan will run at High Speed.
HB Controller Technical Guide

Sequence of Operations

Controller Sequence of Operations

If the HB Controller is configured for 2 or 3 stages of Heating, on a call for “W1,” the Economizer will be locked at its current position, attempting to deliver 55°F Supply Air to the heating section. Heat Stage 1 is energized, and the Supply Fan will run on High Speed. On a call for “W2,” the HB Controller will enter the Heating Mode. The Economizer will move to its Minimum Position, and Heat Stage 2 will energize after the Stage-Up Delay. The Heating Mode will be maintained until both “W2” and “W1” are satisfied. W3 is also available for 3 Stage Electric Heating Units. As long as there is still a call for “RH,” the Dehumidification Mode will resume, and the Supply Fan will run at Low Speed.

Dehumidification Mode (No Reheat)

NOTE: If the HB Controller is configured for 1 stage of Cooling, regardless of the Supply Fan configuration, the Dehumidification call on “RH” is ignored during this mode.

On a call for “RH,” Cooling Stage 1 is energized and the Supply Fan runs at Low Speed. The Return Air Bypass Damper will open to 100%. “Y1” is ignored during this mode. On a call for “Y2,” the HB Controller will enter the Cooling Mode, and the Supply Fan will run at High Speed. The Cooling Mode will be maintained until both “Y2” and “Y1” are satisfied. As long as there is still a call for “RH,” the Dehumidification Mode will resume, and the Supply Fan will run at Low Speed.

If the HB Controller is configured for 1 stage of Heating, on a call for “W1,” the mode changes to Heating. Cool Stage 1 will de-energize, the Return Air Bypass will close, Heat Stage 1 will energize, and the Supply Fan will run at High Speed.

If the HB Controller is configured for 2 or 3 stages of Heating, a “W1” call will be delayed to extend Dehumidification. On a call for “W2,” the HB Controller will enter the Heating Mode. Cool Stage 1 will de-energize, the Return Air Bypass will close, Heat Stage 1 will energize, and the Supply Fan will run at High Speed. Heat Stage 2 will energize after the Auto Stage-Up Delay. The Heating Mode will be maintained until both “W2” and “W1” are satisfied. W3 is also available for 3 Stage Electric Heating Units. As long as there is still a call for “RH,” the Dehumidification Mode will resume, and the Supply Fan will run at Low Speed.

Dehumidification Mode with Hot-Gas Reheat

1-Stage Cooling with Adjustable Two-Speed or Two-Speed Supply Fan Control

On a call for “RH,” Cool Stage 1 is energized, and the Supply Fan runs at High Speed. The Return Air Bypass is opened to 100%. The hot-gas reheat will then modulate the valves to achieve the Supply Air setpoint DIP switch setting. On a call for “Y1,” the Supply Air setpoint on the reheat controller is lowered 10° F, and the Return Air Bypass will close. On a call for “Y2,” the HB Controller will enter the Cooling Mode. Cool Stage 1 will de-energize, the return Air Bypass will close, Heat Stage 1 will energize, and the Supply Fan will run at High Speed. Heat Stage 2 will energize after the Auto Stage-Up Delay. The Heating Mode will be maintained until both “W2” and “W1” are satisfied. W3 is also available for 3 Stage Electric Heating Units. As long as there is still a call for “RH,” the Dehumidification Mode will resume, and the Supply Fan will run at Low Speed.

2-Stage Cooling with Adjustable Two-Speed or Two-Speed Supply Fan Control

On a call for “RH,” Cool Stage 1 is energized, and the Supply Fan runs at low speed. The Return Air Bypass is opened to 100%. The hot-gas reheat will then modulate the valves to achieve the Supply Air setpoint DIP switch setting. On a call for “Y1,” the Supply Air setpoint on the reheat controller is lowered 10° F, and the Return Air Bypass will close. On a call for “Y2,” the HB Controller will enter the Cooling Mode. The Supply Fan will switch to high speed, and Cool Stage 2 is energized. The modulating hot-gas reheat valves will move to the full Cooling position. The Cooling mode will be maintained until both “Y2” and “Y1” are satisfied. As long as there is still a call for “RH,” the Dehumidification mode will resume.

If the HB Controller is configured for 1 stage of Heating, on a call for “W1,” the mode changes to Heating, and the Supply Fan will run at High Speed. Cool Stage 1 will de-energize, the Return Air Bypass will close, Heat Stage 1 will energize, and the Supply Fan will run at High Speed. If the HB Controller is configured for 2 or 3 stages of Heating, on a call for “W1,” the mode changes to Heating, and the Supply Fan will run at High Speed. Cool Stage 1 will de-energize, the Return Air Bypass will close, Heat Stage 1 will energize, and the Supply Fan will run at High Speed. If the HB Controller is configured for 2 or 3 stages of Heating, on a call for “W1,” the mode changes to Heating, and the Supply Fan will run at High Speed. Cool Stage 1 will de-energize, the Return Air Bypass will close, Heat Stage 1 will energize, and the Supply Fan will run at High Speed. If the HB Controller is configured for 2 or 3 stages of Heating, on a call for “W1,” the mode changes to Heating, and the Supply Fan will run at High Speed.

Lockout Modes

Heating Mode is locked out if the HSM (Heat Safety Monitor) trips 3 times during a call for Heating. To reset the lockout condition, either remove the call for Cooling or cycle power to the HB Controller. Heating Mode is also locked out if the Outdoor Air Temperature is above the OAT Heat Lockout setpoint temperature.

Cooling Mode is locked out if the LPS (Low Pressure Switch) trips 3 times during a call for Cooling or Dehumidification. To reset the lockout condition, either remove the call for Cooling or Dehumidi-


Sequence of Operations

Controller Sequence of Operations

Modification or cycle power to the HB Controller. Cooling Mode is also locked out if the Outdoor Air Temperature is below the OAT Cool Lockout setpoint temperature or if the OAT Sensor is bad or missing.

Economizer and Reheat during Dehumidification modes are locked out if the SAT sensor is missing.

NOTE: The Cooling OAT Lockout must be set less than the Economizer Enable.

SAT Lockout Modes

NOTE: The SAT Lockout Modes only apply if a Supply Air Temperature Sensor is installed on the HB unit.

SAT High Temperature Limit Cut Off Mode
During the Heating Mode, if the Supply Air Temperature rises above the Supply Air High Temperature Limit Cut Off (150° F), the Heating will stage off, but the main Supply Fan will remain on in Low-Speed operation. If this occurs, the Supply Air Temperature must fall below 80° F in order for the Heating to stage back on. If this condition occurs 2 times consecutively during a Heating call, the HB Controller will lockout in Supply Air High Temperature Limit Cut Off. To restore normal operation, either remove the call for Heating or cycle power to the HB Controller.

SAT Low Temperature Limit Cut Off Mode
During the Heating Mode, if the Supply Air Temperature falls below the Supply Air Low Temperature Limit Cut Off (40° F), the Outdoor Air Damper will close. If the Supply Air Temperature is still too cold and remains there for 15 minutes, the Heating and the Supply Fan will be turned off and locked out. This condition can only happen once, and then the HB Controller will lockout in Supply Air Low Temperature Limit Cut Off. To restore normal operation, either remove the call for Heating or cycle power to the HB Controller.

Exhaust Fan Control
The Exhaust Fan is energized via the Auxiliary Relay. The Exhaust Fan has two Economizer Position Activation points based on the Low- and High-Speed Supply Fan condition. The air balancing contractor should determine these settings for proper Building Pressure Control.

HB Processor Board
When the HB Controller has the optional HB Processor board installed, a Space Temperature Sensor can be connected to it for HVAC Mode Control. When the Space Temperature Sensor is used, the Push-Button Override and Slide Adjust options are also available. Occupied and Unoccupied Modes are available during week scheduling, force schedule, and a broadcast schedule. The HB Processor board also provides communication with other HB controllers. Up to 60 other controllers can be connected together via the RS-485 loop.

Space Temperature Control Sequence
When the Space Temperature Sensor is configured for control, Cooling and Heating setpoints are used to activate the HVAC Modes of operation. An HVAC Mode Deadband setpoint is used to determine the temperature at which the Cooling and Heating Modes are activated above or below the setpoints. Once in the Cooling Mode, the Space Temperature must drop below the Cooling setpoint minus the deadband to enter the Vent Mode. The same is true for the Heating mode; the Space Temperature must rise above the Heating setpoint plus the deadband to enter the Vent Mode. An additional Cooling Stage is activated for each 1° F rise of the Space Temperature above the Cooling Setpoint up to the maximum number of Cooling Stages available. In like manner, an additional Heating Stage is activated for each 1° F drop of the Space Temperature below the Heating Setpoint up to the maximum number of Heating Stages available.

When the Space Temperature rises above the Cooling setpoint plus the deadband, the HB Controller enters the Cooling Mode, and Cooling Stage 1 is activated. Cooling Stage 2 is activated if the Space Temperature rises by another 1° F above the Cooling setpoint. Cooling Stage 2 deactivates when the Space Temperature drops below the Cooling setpoint. Cooling Stage 1 deactivates when the Space Temperature drops below the Cooling setpoint minus the deadband.

When the Space Temperature drops below the Heating setpoint minus the deadband, the HB Controller enters the Heating Mode, and Heating Stage 1 is activated. Heating Stage 2 is activated if the Space Temperature drops by 1° F. Heating Stage 3 is activated if the Space Temperature drops by another 1° F below the Heating setpoint. Heating Stage 3 and Heating Stage 2 both deactivate when the Space Temperature rises above the Heating setpoint. Heating Stage 1 deactivates when the Space Temperature rises above the Heating setpoint plus the deadband.

The Slide Adjust feature on the Space Temperature Sensors that are equipped with this option allows the user to change the Heating and Cooling setpoints up or down by the Slide Adjust setpoint value. If 3° F is entered as the Slide Adjust setpoint, when the slider is all the way up, the Heating and Cooling setpoints will be raised by 3° F. When the slider is all the way down, the Heating and Cooling setpoints will be lowered by 3° F. The Override Button feature on Space Temperature sensors that are equipped with this option allows the user to force the HB Controller into the Occupied Mode. The time the controller is in Occupied Mode is determined by the Override Time Setpoint. Once this time is expired, the HB Controller will follow its normal schedule. A momentary push of the Override Button will activate the Override. Once in the Override Mode, pushing down and holding the Override Button for 5 seconds will deactivate the Override Mode.
Controller Mounting

It is important to mount the controller in a location that is free from extreme high or low temperatures, moisture, dust, and dirt. Be careful not to damage the electronic components when mounting the controller. The HB controller mounts in the HB unit control panel using the 4 plastic standoffs located on the HB control enclosure mounting base.

Important Wiring Considerations

Please carefully read and apply the following information when wiring the HB controller.

1. 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 controller and connected devices.

2. All wiring is to be in accordance with local and national electrical codes and specifications.

3. Minimum wire size for 24 VAC thermostat wiring should be 22 gauge.

4. Minimum wire size for all sensors should be 24 gauge.

5. Be sure that all wiring connections are properly inserted and tightened into the terminal blocks. Do not allow wire strands to stick out and touch adjoining terminals which could potentially cause a short circuit.

6. Be sure all modular wiring harness connectors are seated firmly in their respective modular connectors on the HB circuit board.
Single Stage T-stat Wiring For HB Units With 1 Stage Cooling & 1 Stage Heating

Single-Stage Thermostat (24VAC) 1-Cool / 1-Heat

Dehumidistat (24VAC)

Normally Open

HB Controller Terminal Block

24VAC Power Supply

24VAC to Economizer

Clogged Filter Indicator (Outputs 24VAC)

Note:
The economizer will not have 24VAC to the actuator without installing a jumper wire between A1 and A2. If a device needs to disable the economizer, install a normally closed contact between A1 and A2. If a device needs to enable the economizer, install a normally open contact between A1 and A2.

Figure 3: Single-Stage T-Stat Wiring for HB Unit with 1-Stage Cooling & 1-Stage Heating
Figure 4: Single-Stage T-Stat Wiring for HB Units with 2-Stage Cooling & 2-Stage Heating

Note:
The economizer will not have 24VAC to the actuator without installing a jumper wire between A1 and A2. If a device needs to disable the economizer, install a normally closed contact between A1 and A2. If a device needs to enable the economizer, install a normally open contact between A1 and A2.
Single Stage T-stat Wiring For HB Units With 2 Stage Cooling & 3 Stage Heating

Single-Stage Thermostat (24VAC) 1-Cool / 1-Heat

Dehumidistat (24VAC)

Note:
The economizer will not have 24VAC to the actuator without installing a jumper wire between A1 and A2. If a device needs to disable the economizer, install a normally closed contact between A1 and A2. If a device needs to enable the economizer, install a normally open contact between A1 and A2.

HB Controller Terminal Block

Figure 5: Single-Stage T-Stat Wiring for HB Units with 2-Stage Cooling & 3-Stage Heating
Multi-Stage T-stat Wiring For HB Units With 2 Stage Cooling & 2 Stage Heating

- Multi-Stage Thermostat (24VAC) 2-Cool / 2-Heat
- Dehumidistat (24VAC)

**Note:**
The economizer will not have 24VAC to the actuator without installing a jumper wire between A1 and A2.
If a device needs to disable the economizer, install a normally closed contact between A1 and A2.
If a device needs to enable the economizer, install a normally open contact between A1 and A2.

Figure 6: Multi-Stage T-Stat Wiring for HB Units with 2-Stage Cooling & 2-Stage Heating
Multi-Stage Wiring with 2 Stage Cooling & 3 Stage Heating

Multi-Stage T-stat Wiring For HB Units
With 2 Stage Cooling & 3 Stage Heating

Note:
The economizer will not have 24VAC to the actuator without installing a jumper wire between A1 and A2. If a device needs to disable the economizer, install a normally closed contact between A1 and A2. If a device needs to enable the economizer, install a normally open contact between A1 and A2.

Figure 7: Multi-Stage T-Stat Wiring for HB Units with 2-Stage Cooling & 3-Stage Heating
Optional Jumper Locations For External Control

Note:
The factory jumpers are located on the bottom two pins for each 3-pin header. For field control of either the Economizer and/or the Return Air Bypass, move their respective jumpers to the “External” position on the jumper pins as shown.

0-10VDC Input Signal for Modulating Hot-Gas Reheat
2-10VDC Economizer Signal
0-10VDC Return Air Bypass Signal
Common Ground for External Signals

External Control Inputs

Figure 8: Field Wiring & Jumper Settings for Mod Hot Gas Reheat, Economizer & Return Air Bypass
HB Modular Service Tool

The OE391-12-HB Modular Service Tool is a system operator interface that provides a direct link to enable the system operator to view the status, configure, and adjust the setpoints of the HB Controller. See Figure 9 for dimensions.

The Modular Service Tool is housed in an attractive black plastic enclosure. The display area is covered with a clear plastic bezel for protection of the display screen. The Modular Service Tool has a 4-line-by-20-character display panel with adjustable contrast control and a 27-key membrane keypad for data selection and entry. All keypad operations are simple and straightforward, utilizing non-cryptic plain English language messages. Menu-driven programming allows for easy setup and operation without the need for specialized training. The Modular Service Tool is supplied with (4) AA 1.5 V batteries, a wall mount, a DC power supply, and an E-BUS to HSS communication cable. The E-BUS to HSS communication cable allows you to connect the HB Modular Service Tool to the HB Controller for programming, monitoring, and troubleshooting purposes.

The Modular Service Tool is designed to be hand-carried. Its rugged plastic housing provides superior protection for the electronic components housed inside. The Modular Service Tool is a top-quality service tool that will stand up to the demands of the typical job site environment for many years.

Figure 9: HB Modular Service Tool Dimensions
**HB Service Tool Connection**

The HB Modular Service Tool connects to the HB controller via a prefabricated cable that is supplied with the service tool. The Modular Service Tool cable is terminated on one end with an EBC E-BUS cable and ends with an HSS connector. Attach one end to the HB Modular Service Tool and the other end to the HSS connector on the controller. See Figure 10 for wiring.

Be sure that the Modular Service Tool has fresh batteries installed or that it is connected to a power source using the supplied power pack before attempting any programming of the controller.

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**Figure 10: HB Service Tool Connection & Wiring**

The Modular Service Tool Connects To The HB Controller By Plugging One End Of The Supplied Cable Into the Modular Service Tool E-BUS Connector And The Other End Into The HSS Connector On The Controller.

Be Sure The Modular Service Tool Is Connected To The Supplied Power Pack Or Has Fresh Batteries Installed Before Attempting Programming Of The Controller. Be Sure The Power Is Turned Off On The Modular Service Tool Before Connecting The Cable To The Controller.
Selection Buttons

The buttons below in Table 1 are found on the left side of the Service Tool. See Figure 11 for locations.

<table>
<thead>
<tr>
<th>Button Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESC</td>
<td>Use this key to go to the previous menu.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Use this key to have the service tool accept the value that you entered.</td>
</tr>
<tr>
<td>CLEAR</td>
<td>This key turns off the Service Tool.</td>
</tr>
<tr>
<td>MINUS</td>
<td>Press this key to decrease number values or back up through the alphabet when entering a passcode.</td>
</tr>
<tr>
<td>DEC</td>
<td>Press this key to increase number values or advance through the alphabet when entering a passcode.</td>
</tr>
<tr>
<td></td>
<td>Use these keys to move left and right through a value on a screen.</td>
</tr>
<tr>
<td></td>
<td>Use these keys to step backward or forward through the screens or move the cursor to select an item from a screen.</td>
</tr>
</tbody>
</table>

Table 1: Button Descriptions

Display Screens & Data Entry Keys

See the Table 2 below for a list of the keypad descriptions and functions. See Figure 11 for locations.

<table>
<thead>
<tr>
<th>Keypad Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESC</td>
<td>Use this key to go to the previous menu.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Use this key to have the service tool accept the value that you entered.</td>
</tr>
<tr>
<td>CLEAR</td>
<td>This key turns off the power to the Service Tool.</td>
</tr>
<tr>
<td>MINUS</td>
<td>Press this key to decrease number values or back up through the alphabet when entering a passcode.</td>
</tr>
<tr>
<td>DEC</td>
<td>Press this key to increase number values or advance through the alphabet when entering a passcode.</td>
</tr>
<tr>
<td></td>
<td>Use these keys to move left and right through a value on a screen.</td>
</tr>
<tr>
<td></td>
<td>Use these keys to step backward or forward through the screens or move the cursor to select an item from a screen.</td>
</tr>
</tbody>
</table>

Table 2: Keypad Descriptions
Passcode Procedures

The HB Service Tool is equipped with passcode levels based on operator status. The available passcodes are:

- "AAAA" = The default level is 0 for Status
- "OPER" = The Operator is at level 1 for Status and Setpoints
- "CONT" = The Contractor is at level 2 for Status, Setpoints, and Force Modes

If you only want to view status, a passcode is not required. Proceed to the next section General Procedures.

If you want to change the passcode in order to change setpoints or Force modes, press the <CONFIGURATION> key twice at the initial software version screen or once at the Device Address Screen and the Passcode Screen will be displayed.

The passcode entry screen uses a four-digit alpha passcode. Position the cursor under the first letter field. To select the desired letter, use the <DEC> and <MINUS> buttons. The <DEC> button increases through the alphabet and the <MINUS> button decreases. When the desired letter appears, press the right arrow key to advance to the next letter field. Once all four letter fields spell the desired passcode, press <ENTER>.

Again, if no passcode is entered, the default level is 0 and only allows viewing of the status screens.

General Procedures

The HB Service Tool is used to program setpoints and view the status of the HB controller. It is connected to the HB controller by means of an E-BUS to HSS cable that is supplied with the Service Tool. The cable is connected between the HB Service Tool and the HB controller board. The HB controller must be powered in order for the HB Service Tool to function.

When the HB Service Tool is initially powered up, the program version and the time and date the software was created will be displayed. After the initial power up, this screen only appears when the HB power is removed and then reapplied.

Press <ENTER> to proceed to the next screen which is the Device Address Screen.

Line #2 displays the default address for the HB Controller. If equipped with a MHGRV Controller, adjust the address to 065 using the <DEC> key. Then proceed to the MHGR programming section on page 38. If equipped with the HB Processor, adjust the address to 066 using the <DEC> key. Then proceed to the HB Processor programming section on page 34.

HB Controller Module Selection Screens

At the Device Address Screen with the default 064 address, press <ENTER> and the HB Service Tool will check all current parameters. When it has finished this checking procedure, the Device Name Screen will be displayed.

Line #2 displays HB for the HB Controller. Press <ENTER> to advance. All of the HB controller Status and Setpoint Screens are grouped in specific modules designated by a specific function name.

Using the Up and Down arrows, scroll to select the desired module on line #1 and press <ENTER>. Factory Options should not be accessed without contacting AAON® or WattMaster.

Warning: The Factory Options settings should only be applied when authorized by AAON® or WattMaster Technical Support personnel. Serious damage to the controller and/or HVAC unit could result from improper use of the Factory settings.
HB Controller Status & Setpoints

The Status and Setpoint screens for the various modules are accessed by selecting a specific module and pressing <ENTER>. Press <ESC> to return to the Module Selection Screens.

Main Status Screens

The Main Status Screens are accessed by selecting the Main Status Module and pressing <ENTER>. This screen, as its name indicates, allows you to view the Main Status screens for the HB controller. Press the down arrow key or up arrow key to move forward or backward through the Main Status Screens.

HVAC Mode

Line #2 displays one of the following HVAC Modes:
- Idle
- Cooling
- Heating
- Econo Dehumidify
- Force
- Venting
- Econo Cooling
- Dehumidify
- Fault

OAT Heat Lockout

Line #2 displays “YES” if the Outdoor Air Temperature is above the Heating Lockout Temperature Setpoint.

OAT Cool Lockout

Line #2 displays “YES” if the Outdoor Air Temperature is below the Cooling Lockout Temperature Setpoint.

OAT Temperature

Line #2 displays the current Outdoor Air Temperature.

SAT Temperature

Line #2 displays the current Supply Air Temperature.

Alarms

Line #2 displays “YES” if an alarm is active. To identify the active alarm(s), press <ESC> to return to the Module Selection Screens, select the Alarm Module, and scroll through the available alarms using the up and down arrow keys. Please see page 30 for the Alarm Status Screens.

Program Date

Line #2 displays the Month/Day/Year that the HB Controller software was created.

Program Time

Line #2 displays the time, in 24-hour (military) format, that the HB Controller software was created.

Program Version

Line #2 displays the HB Controller software version number.

Reset Count

Line #2 displays the total number of times the HB Controller has been reset or has had its power cycled.

Press <ESC> to return to the Module Selection Screens.
**Fan Module Status Screens**

The Fan Module Status Screens are accessed by navigating to the Fan Module and pressing <ENTER>. The following screen will then appear:

Select “Status” by pressing <ENTER>. Press the up and down arrow keys to move forward and backward through the Fan Module Status Screens.

**Fan Terminal Active**

Line #2 displays “YES” if there is a 24 VAC signal connected to the “G” Fan terminal on the HB controller.

**Fan Status**

Line #2 displays the current Supply Fan Status. If the Supply Fan is on, line #2 displays either “Fan Low Speed” or “Fan High Speed.” Line #2 displays “ON” if the High Speed Fan Relay is active.

**Supply Fan Analog Output Signal**

Line #2 displays the current Supply Fan Analog Output Signal in DC Volts.

Press <ESC> to return to the Fan Module Selection Screens.

**Fan Module Setpoint Screens**

The Fan Module Setpoint Screens are accessed by navigating to the Fan Module and then pressing <ENTER>. You must have passcode clearance to access setpoints. The following screen will then appear:

Press the down arrow key until “Setpoints” is on the top line of the screen and then press <ENTER>. Press the up and down arrow keys to move forward and backward through the Fan Setpoint Screens.

Please see the Appendix section in the back of this manual for tables listing the minimum, maximum, and default setpoints for all of the setpoint screens.

**Supply Fan Configuration**

Select the appropriate Supply Fan Configuration by using the up and down ADJUST arrow keys and then pressing <ENTER>. Available options are Two-Speed or Adj. Two-Speed.

**Adjustable Two-Speed Supply Fan Low-Speed Signal**

Adjust the desired Low-Speed Output Signal for Adjustable Two-Speed Fan configurations by pressing the <DEC> or <MINUS> key until the desired value is displayed and then pressing <ENTER>. Settings are in DC Volts.

**Adjustable Two-Speed Supply Fan High Speed Signal**

Adjust the desired High-Speed Output Signal for Adjustable Two-Speed Fan configurations by pressing the <DEC> or <MINUS> key until the desired value is displayed and then pressing <ENTER>. Settings are in DC Volts.

Press <ESC> twice to return to the Main Module Selection Screens.
Cooling Module Status Screens

The Cooling Module Status Screens are accessed by navigating to the Cooling Module Screen from the Main Module Selection Screens and pressing <ENTER>. The following screen will then appear:

Select “Status” by pressing <ENTER>. Press the up and down arrow keys to move forward and backward through the Cooling Module Status Screens.

Cooling Stage 1 Energized

![Y1-Active NO](image)

Line #2 displays “YES” if there is a 24 VAC signal on HB Controller terminal “Y1.”

Cooling Stage 2 Energized

![Y2-Active NO](image)

Line #2 displays “YES” if there is a 24 VAC signal on HB Controller terminal “Y2.”

Fan Status

![Fan Status Fan Off](image)

Line #2 displays the current Supply Fan Status. If the Supply Fan is on, line #2 displays either “Fan Low Speed” or “Fan High Speed.”

Fan Signal

![Fan Signal XX.XX V](image)

Line #2 displays the current Supply Fan Analog Output Signal in DC Volts.

Cooling Relay #1

![Cool 1 Relay OFF](image)

Line #2 displays “ON” if Cooling Relay #1 is active.

Cooling Relay #2

![Cool 2 Relay OFF](image)

Line #2 displays “ON” if Cooling Relay #2 is active.

Liquid Line Temperature

![LLT XX F](image)

Line #2 displays the current Liquid Line Temperature.

Condenser Fan Relay

![Cond Fan Relay OFF](image)

Line #2 displays “ON” if the Condenser Fan Relay is active.

Low Pressure Switch

![LPS OPEN](image)

Line #2 displays the current status of the Low Pressure Switch. It will only display “CLOSED” when Cooling Relay #1 is active and the Low Pressure Switch is operating correctly.

High Pressure Switch

![HPS OPEN](image)

Line #2 displays the current status of the High Pressure Switch. It will only display “CLOSED” when Cooling Relay #1 relay is active and the High Pressure Switch is operating correctly.

Press <ESC> to return to the Cooling Module Screens.
Cooling Module Setpoint Screens
The Cooling Module Setpoint Screens are accessed by navigating to the Cooling Module screen and then pressing <ENTER>. You must have passcode clearance to access setpoints. The following screen will then appear:

Press the down arrow key until “Setpoints” is on the top line of the screen and then press <ENTER>. Press the up and down arrow keys to move forward and backward through the Cooling Module Setpoint Screens.

Cooling Stages Quantity

Adjust the quantity of Cooling Stages or Steps of Cooling by pressing the <DEC> or <MINUS> key and then press <ENTER>.

Condenser Fan Control

Select “YES” for Condenser Fan Control if you are using a Liquid Line Temperature Sensor by pressing the <DEC> or <MINUS> key and then press <ENTER>.

Outdoor Air Temperature Cooling Lockout

Adjust the Outdoor Air Temperature Cooling Lockout by pressing the <DEC> or <MINUS> key and then press <ENTER>.

Low Supply Air Temperature Cutoff

Adjust the Low Supply Air Temperature Cutoff by pressing the <DEC> or <MINUS> key and then press <ENTER>. The value must be below the Economizer Oat Enable.

Cooling Minimum Off Time

Adjust the desired Cooling Minimum Off Time by pressing the <DEC> or <MINUS> key and then press <ENTER>.

Cooling Minimum On Time

Adjust the desired Cooling Minimum On Time by pressing the <DEC> or <MINUS> key and then press <ENTER>.

Cooling Stage-Up Delay

Adjust the desired Cooling Stage-Up Delay time by pressing the <DEC> or <MINUS> key and then press <ENTER>.
**Cooling Stage Down Delay**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staging Down Delay Interval</td>
<td>60 Sec</td>
<td>60 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

Adjust the desired Cooling Stage-Down Delay time by pressing the <DEC> or <MINUS> key and then press <ENTER>.

**Low Pressure Switch Delay**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Pressure Delay Period</td>
<td>5 Sec</td>
<td>30 Sec</td>
<td>60 Sec</td>
</tr>
</tbody>
</table>

The Low Pressure Switch Delay time is a factory setting and should not be changed unless authorized to do so by WattMaster or AAON® Technical Support.

**Low Pressure Switch Safety Delay**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Pressure Safety</td>
<td>5 Sec</td>
<td>5 Sec</td>
<td>30 Sec</td>
</tr>
</tbody>
</table>

The Low Pressure Switch Safety Delay time is a factory setting and should not be changed unless authorized to do so by WattMaster or AAON® Technical Support.

**LPS Maximum Trips**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Pressure Max. Trip Point</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

The Low Pressure Switch Max Trips is a factory setting and should not be changed unless authorized to do so by WattMaster or AAON® Technical Support.

**Cooling Fan Off Delay**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Off Delay Period</td>
<td>1 Sec</td>
<td>45 Sec</td>
<td>120 Sec</td>
</tr>
</tbody>
</table>

The Cooling Fan Off Delay is a factory setting and should not be changed unless authorized to do so by WattMaster or AAON® Technical Support.

**Condenser Fan Activation Temperature**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cond Fan On</td>
<td></td>
<td>XXX F</td>
<td></td>
</tr>
</tbody>
</table>

The Condenser Fan Activation Temperature is a factory setting and should not be changed unless authorized to do so by WattMaster or AAON® Technical Support.

**Condenser Fan Deactivation Temperature**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cond Fan Off</td>
<td></td>
<td>XXX F</td>
<td></td>
</tr>
</tbody>
</table>

The Condenser Fan Deactivation Temperature is a factory setting and should not be changed unless authorized to do so by WattMaster or AAON® Technical Support.

**Auto Stage-Up Time**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Staging Up Delay</td>
<td>180 Sec</td>
<td>600 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

The Auto Stage-Up Time can be adjusted on this screen when you are using a single-stage thermostat with a multi-stage HB unit. Adjust the value by pressing the <DEC> or <MINUS> key and then press <ENTER>.

Press <ESC> twice to return to the Main Module Selection Screens.
Heating Module Status Screens
The Heating Module Status Screens are accessed by navigating to the Heating Module screen and pressing <ENTER>. The following screen will then appear:

Select “Status” by pressing <ENTER>. Press the up and down arrow keys to move forward and backward through the Heating Module Status Screens.

Heating Stage 1 Energized
W1-Active
NO
Line #2 displays “YES” if there is a 24 VAC signal on HB Controller terminal “W1.”

Heating Stage 2 Energized
W2-Active
NO
Line #2 displays “YES” if there is a 24 VAC signal on HB Controller terminal “W2.”

Heating Stage 3 Energized
W3-Active
NO
Line #2 displays “YES” if there is a 24 VAC signal on HB Controller terminal “W3.”

Fan Status
Fan Status
Fan Off
Line 2 displays the current Supply Fan Status. If the Supply Fan is on, line #2 displays either “Fan Low Speed” or “Fan High Speed.”

Fan Signal
Fan Signal
XX.XX V
Line #2 displays the current Supply Fan Analog Output Signal in DC Volts.

Heating Relay #1

Heating Relay #2

Heating Relay #3

Heat Safety Monitor

Press <ESC> to return to the Heating Module Selection Screen.

Heating Module Setpoint Screens
The Heating Module Setpoint Screens are accessed by navigating to the Heating Module and then pressing <ENTER>. The following screen will then appear:

Press the down arrow key until “Setpoints” is on the top line of the screen and then press <ENTER>. Press the up and down arrow keys to move forward and backward through the Heating Module Setpoint Screens.

Heating Stages Quantity

Adjust the quantity of Heating Stages by pressing the <DEC> or <MINUS> key and then press <ENTER>. 
### Programming

**HB Controller Heating Module Setpoint Screens**

#### Outdoor Air Temperature Heating Lockout

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Lockout Temperature</td>
<td>40°F</td>
<td>80°F</td>
<td>120°F</td>
</tr>
</tbody>
</table>

Adjust the Outdoor Air Temperature Heating Lockout by pressing the <DEC> or <MINUS> key and then press <ENTER>.

#### Low Supply Air Temperature Cutoff

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Air Low Temperature Limit Cut Off</td>
<td>32°F</td>
<td>40°F</td>
<td>80°F</td>
</tr>
</tbody>
</table>

Adjust the Low Supply Air Temperature Cutoff by pressing the <DEC> or <MINUS> key and then press <ENTER>.

#### High Supply Air Temperature Cutoff

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Air High Temperature Limit Cut Off</td>
<td>120°F</td>
<td>150°F</td>
<td>170°F</td>
</tr>
</tbody>
</table>

Adjust the High Supply Air Temperature Cutoff by pressing the <DEC> or <MINUS> key and then press <ENTER>.

#### Heating Minimum Off Time

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Off Time</td>
<td>60 Sec</td>
<td>60 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

Adjust the desired Heating Minimum Off Time by pressing the <DEC> or <MINUS> key and then press <ENTER>.

#### Heating Minimum On Time

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum On Time</td>
<td>120 Sec</td>
<td>120 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

Adjust the desired Heating Minimum On Time by pressing the <DEC> or <MINUS> key and then press <ENTER>.

#### Heating Stage-Up Delay

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staging Up Delay Interval</td>
<td>180 Sec</td>
<td>180 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

Adjust the desired Heating Stage-Up Delay time by pressing the <DEC> or <MINUS> key and then press <ENTER>.

#### Heating Stage Down Delay

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staging Down Delay Interval</td>
<td>60 Sec</td>
<td>60 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

Adjust the desired Heating Stage Down Delay time by pressing the <DEC> or <MINUS> key and then press <ENTER>.

#### Heat Safety Monitor Maximum Trips

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Safety Maximum Count</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

The Heating Safety Maximum Trips is a factory setting and should not be changed unless authorized to do so by WattMaster or AAON® Technical Support.

#### Heating Fan Off Delay

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Off Delay Period</td>
<td>1 Sec</td>
<td>120 Sec</td>
<td>180 Sec</td>
</tr>
</tbody>
</table>

The Heating Fan Off Delay is a factory setting and should not be changed unless authorized to do so by WattMaster or AAON® Technical Support.

#### Auto Stage-Up Time

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Staging Up Delay</td>
<td>180 Sec</td>
<td>600 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

The Auto Stage-Up Time can be adjusted on this screen when you are using a single-stage thermostat with a multi-stage HB unit.
Economizer Module Status Screens
The Economizer Module Status Screens are accessed by navigating to the Economizer Module and pressing <ENTER>. The following screen will then appear:

<table>
<thead>
<tr>
<th>Status</th>
<th>Setpoints</th>
</tr>
</thead>
</table>

Select “Status” by pressing <ENTER>. Press the up and down arrow keys to move forward and backward through the Economizer Module Status Screens.

Economizer Current Position

| Economizer | XXX % |

Line #2 displays the current Economizer Position as a percent open value.

Supply Air Temperature

| SAT        | XXX F |

Line #2 displays the current Supply Air Temperature.

Outdoor Air Temperature

| OAT        | XX F  |

Line #2 displays the current Outdoor Air Temperature.

Fan Status

| Fan Status | Fan Off |

Line #2 displays the current Supply Fan status. If the Supply Fan is on, line #2 displays either “Fan Low Speed” or “Fan High Speed.”

Fan Signal

| Fan Signal | XX.XX V |

Line #2 displays the current Supply Fan Analog Output Signal in DC Volts.

Exhaust Fan Relay

| Exhaust Fan Rly | OFF |

Line #2 displays “ON” when the Exhaust Fan Relay is active.

Carbon Dioxide Level

| CO2        | XXXX ppm |

Line #2 displays the Current Carbon Dioxide levels, given in parts per million.

Economizer Change Over Switch

| ECS        | OPEN |

Line #2 displays “CLOSED” if there is a 24 V AC signal on the Economizer Changeover Switch input. This signal is provided by an Enthalpy controller to enable the economizer for free Cooling.

Press <ESC> to return to the Economizer Module Selection Screen.

Economizer Module Setpoint Screens
The Economizer Module Setpoint Screens are accessed by navigating to the Economizer Module and then pressing <ENTER>. The following screen will then appear:

| Status     | Setpoints |

Press the down arrow key until “Setpoints” is on the top line of the screen and then press <ENTER>. You must have passcode clearance to access setpoints. Press the up and down arrow keys to move forward and backward through the Economizer Module Setpoint Screens.

Economizer Configuration

| Econo Config | Has Economizer |

Select either “Has Economizer” or “No Economizer” and then press <ENTER>. The value must be greater than the OAT Lockout.

Outdoor Air Temperature Enable

| OAT Enable | XX F |

Adjust the Outdoor Air Temperature to enable Economizer Free Cooling by pressing the <DEC> or <MINUS> key and then press <ENTER>.
# PROGRAMMING

## HB Controller Economizer Module Setpoint Screens

### OAT Changeover to Mechanical Cooling

**ECS OAT Enable**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECS OAT Enable Temp</td>
<td>55°F</td>
<td>65°F</td>
<td>75°F</td>
</tr>
</tbody>
</table>

Adjust the Outdoor Air Temperature that will allow supplemental Mechanical Cooling during ECS Economizer operation by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

### CO₂ Minimum Position with Low-Speed Fan

**CO₂ MinPosLSpdFan**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. with Low-Speed Fan</td>
<td>0%</td>
<td>10%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Adjust the Economizer Minimum Position during Low-Speed Supply Fan operation when CO₂ levels are below the Minimum CO₂ setpoint by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

### CO₂ Minimum Position with High-Speed Fan

**CO₂ MinPosHSpdFan**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. with High-Speed Fan</td>
<td>0%</td>
<td>5%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Adjust the Economizer Minimum Position during High-Speed Supply Fan operation when CO₂ levels are below the Minimum CO₂ setpoint by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

### CO₂ Maximum Position with Low-Speed Fan

**CO₂ MaxPosLSpdFan**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. with Low-Speed Fan</td>
<td>0%</td>
<td>50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Adjust the Economizer Maximum Position during Low-Speed Supply Fan operation when CO₂ levels are above the Maximum CO₂ setpoint by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

### CO₂ Maximum Position with High-Speed Fan

**CO₂ MaxPosHSpdFan**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. with High Speed Fan</td>
<td>0%</td>
<td>30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Adjust the Economizer Maximum Position during High-Speed Supply Fan operation when CO₂ levels are above the Maximum CO₂ setpoint by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

### Exhaust Fan On with Low-Speed Fan

**ExFanOnEco%@LFan**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Speed Supply Fan</td>
<td>0%</td>
<td>50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Adjust the Economizer Position during Low-Speed Supply Fan operation that will activate the Exhaust Fan by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

### Exhaust Fan On with High-Speed Fan

**ExFanOnEco%@HFan**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Speed Supply Fan</td>
<td>0%</td>
<td>30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Adjust the Economizer Position during High-Speed Supply Fan operation that will activate the Exhaust Fan by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

### CO₂ Level Economizer Opens Above Minimum

**Min CO2**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. CO₂</td>
<td>0 PPM</td>
<td>900 PPM</td>
<td>2000 PPM</td>
</tr>
</tbody>
</table>

Adjust the Minimum CO₂ Level that will allow the Economizer to Modulate above its minimum position by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

### CO₂ Level Economizer Opens to Economizer Maximum

**Max CO2**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. CO₂</td>
<td>0 PPM</td>
<td>1100 PPM</td>
<td>2000 PPM</td>
</tr>
</tbody>
</table>

Adjust the Maximum CO₂ Level that will allow the Economizer to Modulate open to its maximum position by pressing the `<DEC>` or `<MINUS>` key and then press `<ENTER>`.

Press `<ESC>` twice return to the Main Module Selection Screens.
Dehumidify Module Status Screens

The Dehumidify Module Status Screens are accessed by navigating to the Dehumidify Module and pressing <ENTER>. Setpoints are not available for the Dehumidify Module. After pressing <ENTER>, the following screen will appear:

RH Terminal Active

Line #2 displays “YES” if there is a 24 VAC signal on the “RH” terminal.

Fan Status

Line #2 displays the current Supply Fan Status. If the Supply Fan is on, Line #2 displays either “Fan Low Speed” or “Fan High Speed.”

Fan Signal

Line #2 displays the current Supply Fan Analog Output Signal in DC Volts.

RAB Position

Line #2 displays the current Return Air Bypass damper position.

Cooling Relay #1

Line #2 displays “ON” if Cooling Relay #1 is active.

Cooling Relay #2

Line #2 displays “ON” if Cooling Relay #2 is active.

OAT Temperature

Line #2 displays the current Outdoor Air Temperature.

Economizer Current Position

Line #2 displays the current Economizer Position as a percent open value.

Supply Air Temperature

Line #2 displays the current Supply Air Temperature.

Liquid Line Temperature

Line #2 displays the current Liquid Line Temperature.

Condenser Fan Relay

Line #2 displays “ON” if the Condenser Fan Relay is active.

Press <ESC> twice to return to the Main Module Selection Screens.
# HB Controller Alarm Module Status Screens

### Alarm Module Status Screens

The Alarm Module Status Screens are accessed by navigating to the Alarm Module and then pressing `<ENTER>`. Setpoints are not available for the Alarm Module. After pressing `<ENTER>`, the following screen will appear:

<table>
<thead>
<tr>
<th>Module</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSM Lockout</td>
<td>NO</td>
</tr>
</tbody>
</table>

Line #2 displays “YES” when the Heat Safety Monitor has tripped more than the HSM Max Trips setpoint.

<table>
<thead>
<tr>
<th>Module</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPS Fault</td>
<td>NO</td>
</tr>
</tbody>
</table>

Line #2 displays “YES” when the High Pressure Switch is open and a Cooling Relay is active.

<table>
<thead>
<tr>
<th>Module</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPS Lockout</td>
<td>NO</td>
</tr>
</tbody>
</table>

Line #2 displays “YES” when the Low Pressure Switch has tripped more than the LPS Max Trips setpoint.

<table>
<thead>
<tr>
<th>Module</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad OAT Sensor</td>
<td>NO</td>
</tr>
</tbody>
</table>

Line #2 displays “YES” when the Outdoor Air Temperature Sensor is bad or missing.

<table>
<thead>
<tr>
<th>Module</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad SAT Sensor</td>
<td>NO</td>
</tr>
</tbody>
</table>

Line #2 displays “YES” when the Supply Air Temperature Sensor is bad or missing.

<table>
<thead>
<tr>
<th>Module</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad LLT</td>
<td>NO</td>
</tr>
</tbody>
</table>

Line #2 displays “YES” when Condenser Fan Control is configured and the Liquid Line Temperature Sensor is bad or missing.

### High SAT Cutoff

Line #2 displays “YES” when the HB Controller is locked out in High Supply Air Temperature Cutoff.

<table>
<thead>
<tr>
<th>Module</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAT Cooling Lockout</td>
<td>NO</td>
</tr>
</tbody>
</table>

Line #2 displays “YES” if the Outdoor Air Temperature is below the Cooling Lockout Temperature setpoint.

### Low SAT Cutoff

Line #2 displays “YES” if the HB Controller is locked out in Low Supply Air Temperature Cutoff.

### OAT Heating Lockout

Line #2 displays “YES” if the Outdoor Air Temperature is above the Heating Lockout Temperature setpoint.

### Clogged Filter

Line #2 displays “YES” if there is a 24 V AC signal on the Clogged Filter Input.

*Press `<ESC>` twice return to the Main Module Selection Screens.*
**Force Mode Screens**

The Force Mode Screens are accessed by navigating to the Force Mode Module Screen and pressing <ENTER>. The following screen will appear:

```
Force
Setpoints
```

Press the down arrow key until “Force” is on the top line of the screen and then press <ENTER>. You must have pass-code clearance to access force modes. Press the up and down arrow keys to move forward and backward through the Force Mode Screens.

**Force Time Limit**

```
Force Time Limit
XXX Min
```

Adjust the desired time needed for forcing the HB Controller into the Force Module Mode by pressing the <DEC> or <MINUS> key and then press <ENTER>.

**Force Mode**

```
Force Mode
Stop
```

Use the <DEC> or <MINUS> key to adjust to select “Start” and then press <ENTER> to enter Force Mode. Use the <DEC> or <MINUS> key to adjust to select “Stop” and then press <ENTER> to end Force Mode.

**Fan Speed Force**

```
Fan Speed
Low Speed
```

Use the <DEC> or <MINUS> key to select “Low Speed” and then press <ENTER> to place the Supply Fan in Low-Speed operation. Use the <DEC> or <MINUS> key to select “High Speed” and then press <ENTER> to place the Supply Fan in High-Speed operation.

**Fan Signal Force**

```
Force Fan Signal
XX.XX V
```

Use the <DEC> or <MINUS> key to adjust the Fan Signal Voltage signal up or down to speed up or slow down the Supply Fan and then press <ENTER>.

**Economizer Force**

```
Force Economizer
X %
```

Use the <DEC> or <MINUS> key to adjust the Economizer percentage up or down to position the Economizer where needed and then press <ENTER>.

**Return Air Bypass Force**

```
Force RAB
X %
```

Use the <DEC> or <MINUS> key to adjust the Return Air Bypass Damper percentage up or down to position the Return Air Bypass where needed and then press <ENTER>.

**Exhaust Fan Relay Force**

```
Ex Fan Relay
OFF
```

Use the <DEC> key to select “ON” to activate the Exhaust Fan Relay and then press <ENTER>.

**Condenser Fan Relay Force**

```
Cond Fan Relay
OFF
```

Use the <DEC> key to select “ON” to activate the Condenser Fan Relay and then press <ENTER>.

**Cooling Relay #1 Force**

```
Cool 1 Relay
OFF
```

Use the <DEC> key to select “ON” to activate Cooling Relay #1 and then press <ENTER>.

**Cooling Relay #2 Force**

```
Cool 2 Relay
OFF
```

Use the <DEC> key to select “ON” to activate Cooling Relay #2 and then press <ENTER>.
Heating Relay #1 Force

Use the <DEC> key to select “ON” to activate Heating Relay #1 and then press <ENTER>.

Heating Relay #2 Force

Use the <DEC> key to select “ON” to activate Heating Relay #2 and then press <ENTER>.

Heating Relay #3 Force

Use the <DEC> key to select “ON” to activate Heating Relay #3 and then press <ENTER>.

Press <ESC> to return to the Force Mode Screen.

CO₂ Minimum Position with Low-Speed Fan

Use the <DEC> or <MINUS> key to adjust the economizer minimum position during Low-Speed Supply Fan operation when CO₂ levels are below the Minimum CO₂ setpoint and then press <ENTER>.

CO₂ Minimum Position with High-Speed Fan

Use the <DEC> or <MINUS> key to adjust the economizer minimum position during High-Speed Supply Fan operation when CO₂ levels are below the minimum CO₂ setpoint and then press <ENTER>.

CO₂ Maximum Position with Low-Speed Fan

Use the <DEC> or <MINUS> key to adjust the Economizer Maximum Position during Low-Speed Supply Fan operation when CO₂ levels are above the Maximum CO₂ setpoint and press <ENTER>.

CO₂ Maximum Position with High-Speed Fan

Use the <DEC> or <MINUS> key to adjust the Economizer Maximum Position during High-Speed Supply Fan operation when CO₂ levels are above the Maximum CO₂ setpoint and press <ENTER>.
HB Controller Factory Options Screens

Exhaust Fan On with Low-Speed Fan

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Speed Supply Fan</td>
<td>0%</td>
<td>50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Use the <DEC> or <MINUS> key to adjust the Economizer position during Low-Speed Supply Fan operation that will activate the Exhaust Fan and then press <ENTER>.

Exhaust Fan On with High-Speed Fan

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Speed Supply Fan</td>
<td>0%</td>
<td>30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Use the <DEC> or <MINUS> key to adjust the Economizer position during High-Speed Supply Fan operation that will activate the Exhaust Fan and then press <ENTER>.

Press <ESC> twice return to the Main Module Selection Screens.

Factory Options Module Screens

Factory Options should not be accessed without contacting AAON® or WattMaster.

**Warning:** The Factory Options settings should only be applied when authorized by AAON® or WattMaster Technical Support personnel. Serious damage to the controller and/or HVAC unit could result from improper use of these settings.

The Factory Options Module Screens are accessed by navigating to the Factory Option Screen and then pressing <ENTER>. The following screen will then appear:

**Force Time Limit**

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force Mode Timer</td>
<td>1 Min</td>
<td>60 Min</td>
<td>240 Min</td>
</tr>
</tbody>
</table>

Use the <DEC> or <MINUS> key to adjust the desired time needed for forcing the HB Controller into the Force Mode and then press <ENTER>.

**Force No Limit**

Use the <DEC> key to adjust this setting to “Yes” to override all factory limits to timers, etc. and then press <ENTER>. This function requires high-level passcode access. This passcode can only be obtained by calling AAON or WattMaster Technical Support.

**Force Defaults**

Use the <DEC> key to adjust this setting to “Yes” to restore all factory limits to timers, etc. and then press <ENTER>. This function requires high-level passcode access. This passcode can only be obtained by calling AAON or WattMaster Technical Support.
PROGRAMMING

HB Processor Main Selection & Status Screens

HB Processor Board

HB Processor Main Selection Screens
If your HB Controller is equipped with the HB Processor board, you can access the available Status and Setpoint screens by using the programming directions that follow.

At the Device Address Screen with the default 064 address, use the <DEC> key to change the device address to 066 to access the HB Processor screens.

Press <ENTER> and the HB Service Tool will check all current parameters. When it has finished this checking procedure, the Device Name Screen will be displayed.

Line #2 displays the HB Processor name. Press <ENTER> to advance to the HB Processor Main Selection Screens. All of the HB Processor Status and Setpoint Screens are grouped in specific modules designated by a specific function name. Certain screens need passcode clearance to access them.

NOTE: The Week Schedule, Holiday Schedule, and Real Time Clock need to be configured using Prism 2 software.

Using the Up and Down arrows, scroll to select the desired menu on line #1 and press <ENTER>.

HB Processor Main Status Screens
Select “Main Status” by pressing <ENTER>. Press the up and down arrow keys to move forward and backward through the Main Status Screens.

Date and Time

| 01/16/17 Mon |
| 09:50:24 |

Line #1 displays the current date inside the HB Processor. Line #2 displays the current time of day inside the HB Processor in 24-hour format. Press <ENTER> to continue to the next screen.

Schedule Mode

| Schedule Mode |
| Occupied |

Line #2 displays the current Schedule Mode. Options that may be displayed are Occupied, Unoccupied, Force Occupied, Force Unoccupied, Global Occupied, Global Unoccupied, or Override Occupy. Press <ENTER> to continue to the next screen.

HVAC Mode

| HVAC Mode |
| Cooling |

Line #2 displays the current HVAC Mode when Space Temperature Control is configured. Options that may be displayed are Idle, Venting, Heating, or Cooling. Press <ENTER> to continue to the next screen.

Space Temperature

| Space Temp |
| XX.X °F |

Line #2 displays the current Space Temperature. Press the ENTER key to continue to the next screen.

Cooling Setpoint

| Cooling Setpoint |
| XX.X °F |

Line #2 displays the current Cooling Setpoint. Press <ENTER> to continue to the next screen.

Heating Setpoint

| Heating Setpoint |
| XX.X °F |

Line #2 displays the current Heating Setpoint. Press <ENTER> to continue to the next screen.
HB Processor Status & Setpoint Screens

**H/C Demand**

Line #2 displays the demand for Heating or Cooling based on the Space Temperature in reference to the Heating or Cooling setpoint. Press <ENTER> to continue to the next screen.

**Override Left**

Line #2 displays the Override Time remaining once the Push-Button Override on the Space Temperature Sensor has been activated. Press <ENTER> to continue to the next screen.

**Slide Adjust**

Line #2 displays the current Slide Adjust value based on the slide position on the Space Temperature Sensor. Press <ENTER> to continue to the next screen.

**Bad Room Temp**

Line #2 displays “YES” if Space Temperature control has been configured and the Space Temperature Sensor has failed. Press <ENTER> to continue to the next screen.

**Program Date**

Line #2 displays the Date the current Software in the controller was created. Press <ENTER> to continue to the next screen.

**Program Time**

Line #2 displays the Time of Day the current Software in the controller was created. Press <ENTER> to continue to the next screen.

**Program Version**

Line #2 displays the Version of Software in the controller. Press <ENTER> to continue to the next screen.

**Reset Count**

Line #2 displays the number of times the controller has had its power cycled or has restarted. Press <ENTER> to continue to the next screen.

Press <ESC> to return to the Main Selection Screens.

**HB Processor Setpoint Screens**

The HB Processor Setpoints Screens are accessed by navigating to the Setpoints Screen. Press the down arrow key until “Setpoints” is on the top line of the screen and then press <ENTER>. Press the up and down arrow keys to move forward and backward through the HB Processor Setpoint Screens. Some of the Setpoint screens require passcode clearance.

Please see the Appendix in the back of this manual for tables listing the minimum, maximum, and default setpoints for all of the setpoint screens.

**FRC Schedule**

Use the <DEC> or <MINUS> key to adjust for FRC Occupied, FRC Unoccupied, or No FRC, and press <ENTER>. If you need 24-hour continuous operation, toggle to FRC Occupied and then press <ENTER>.

**Space Sensor Control**

Use the <DEC> key to adjust for “YES” if a Space Temperature Sensor will be used to activate the HVAC Modes of Operation and then press <ENTER>.

**Cooling Setpoint**

Use the <DEC> or <MINUS> key to adjust for the desired Space Cooling Setpoint and then press <ENTER>. 
**PROGRAMMING**

**HB Processor Setpoint & Week Schedule Screens**

### Heating Setpoint

![Heating Setpoint XX F]

Use the `<DEC>` or `<MINUS>` key to adjust up or down for the desired Space Heating Setpoint and then press `<ENTER>`.

### Cooling Setback

![Cooling Setback XX F]

Use the `<DEC>` or `<MINUS>` key to adjust up or down for the desired Night Setback for Cooling and then press `<ENTER>`.

### Heating Setback

![Heating Setback XX F]

Use the `<DEC>` or `<MINUS>` key to adjust up or down for the desired Night Setback for Heating and then press `<ENTER>`.

### HVAC Mode Deadband

![HVAC Mode Dbd X.X F]

Use the `<DEC>` or `<MINUS>` key to adjust up or down for the desired HVAC Mode activation point above the Cooling Setpoint and below the Heating Setpoint and then press `<ENTER>`.

### Fan Cycle Config

![Fan Cycle Config NO]

Use the `<DEC>` key for “YES” if the Supply Fan should only run during a call or Heating or Cooling and then press `<ENTER>`.

### Override Time

![Override Time X Hr]

Use the `<DEC>` or `<MINUS>` key to adjust up or down for the desired Override Duration when using the push-button on the Space Temperature Sensor and then press `<ENTER>`.

### Slide Adjust

![Slide Adjust X F]

Use the `<DEC>` or `<MINUS>` key to adjust up or down for the desired Heating and Cooling Setpoints Adjustment when using the slide adjustment on the Space Temperature Sensor and then press `<ENTER>`.

### Space Sensor Calibration

![Space Sensr Cal XX.X F]

Use the `<DEC>` or `<MINUS>` key to adjust up or down for the desired Space Temperature Sensor Calibration Offset and then press `<ENTER>`.

Press `<ESC>` to return to the Main Selection Screens.

### HB Processor Week Schedule Screens

Access the HB Processor Week Schedule Screens by navigating to the Week Schedule in the Main Selection Screens and pressing `<ENTER>`. You must have passcode clearance to access these screens.

#### Day of Week

**Sunday**

**Monday**

Using the arrow keys, toggle for the desired day to enter the occupied schedule and then press `<ENTER>`.

#### Start Time

**Mon Start Time 1**

**08:00**

Press the left arrow key once for the hours and the right arrow key once for the minutes. Use the `<DEC>` or `<MINUS>` key to adjust up or down for the correct Start Time for Event #1 and then press `<ENTER>`.

**NOTE:** Time must always be entered in 24-Hour format. The example shows how an 8:00 A.M. (08:00 Hrs) start time for Event One on Monday would be set.

#### Stop Time

**Mon Stop Time 1**

**17:00**

Press the left arrow key once for the hours and the right arrow key once for the minutes. Use the `<DEC>` or `<MINUS>` key to adjust up or down for the correct Stop Time for Event #1 and then press `<ENTER>`.

**NOTE:** Start Time #1 and Stop Time #1 are used only when you have one Start/Stop event per day. In most cases, this is all that will be needed. If a second Start/Stop Event is required for any day(s), follow the same procedure as you did for Start/Stop Event #1, but advance to the Start or Stop Time #2 for the day(s) that require the second event.
**HB Processor Real Time Clock Screens**

Access the HB Processor Real Time Clock Screens by navigating to the Real Time Clock in the Main Selection Screens and then pressing **<ENTER>**. You must have passcode clearance to access these screens.

**Day of Week**

Week Day
Monday

Using the arrow keys, toggle for the correct Day of the week and then press **<ENTER>**.

**Hour**

Hour
15

Use the **<DEC>** and **<MINUS>** keys to adjust up or down for the correct Hour for the time of day and then press **<ENTER>**. As explained earlier, time is always entered in 24-hour format, so 3:00 P.M. would be entered as 15 as shown. Press **<ENTER>** to proceed to the next screen.

**Minute**

Minute
19

Use the **<DEC>** and **<MINUS>** keys to adjust up or down for the correct Minutes for the time of day and then press **<ENTER>**.

**Month**

Month
1

Use the **<DEC>** and **<MINUS>** keys to adjust up or down for the correct Month and then press **<ENTER>**.

**Day**

Day
16

Use the **<DEC>** and **<MINUS>** keys to adjust up or down for the correct Day of the week and then press **<ENTER>**.

**Year**

Year
17

Use the **<DEC>** and **<MINUS>** keys to adjust up or down for the correct year and then press **<ENTER>**.

Press **<ESC>** to return to the Main Selection Screens.

**NOTE:** To view the new current time and date after setting the real time clock, you will need to navigate back to the HB Processor Status Screens. The Date and Time Screen will be displayed after selecting Main Status for the HB Processor board and pressing **<ENTER>**.
PROGRAMMING

MHGR Controller Status Screens

Hot Gas Reheat Controller

Hot Gas Reheat Status Screens
If your HB Controller is equipped with the HGR Controller board, you can access the Status Screens by using the programming directions that follow. Setpoints and Factory settings are only accessible by the factory.

At the Device Address Screen with the default 064 address, use the <DEC> key to change the device address to 065 to access the MHGR screens.

Press <ENTER> and the HB Service Tool will check all current parameters. When it has finished this checking procedure, the Device Name Screen will be displayed.

Press <ENTER> and the HB Service Tool will check all current parameters. When it has finished this checking procedure, the Device Name Screen will be displayed.

Line #2 displays the HGR controller name. Press <ENTER> to advance. The following screen will then appear:

Setpoints are only accessible by the factory for the HGR. Select Status by pressing <ENTER>, and the following screen will be displayed. Press the up and down SELECT arrow keys to move forward and backward through the HGR Status screens.

Activate Reheat

Line #2 displays “YES” when the HB Controller has requested the Hot-Gas Reheat Controller to run.

HGR Valve Position

Line #2 displays the current opening position of the Hot Gas Reheat Valve from 0 to 100%.

Supply Air Temperature

Line #2 displays the current Supply Air Temperature.

HGR Supply Air Temperature Setpoint

Line #2 displays the active Supply Air Temperature setpoint set on the Modulating Hot Gas Reheat controller. During some modes, the SAT Setpoint will be higher or lower than the DIP switch settings.

HGR Supply Air Temperature Reset Signal

Line #2 displays the current 0-to-10 VDC Supply Air Temperature Reset Input Signal.

HGR Program Date

Line #2 displays the Month, Day, and Year that the HGR Controller Software was created.

HGR Program Time

Line #2 displays the time that the HGR Controller Software was created in military time or 24-hour format.

HGR Controller Program Version

Line #2 displays the HGR Controller software version number that is currently installed on the controller.

HGR Controller Reset Count

Line #2 displays the total number of times the HGR Controller has been reset or has had its power cycled.
Supply Air Temperature

You can set the desired Discharge Air Temperature Setpoint using the DIP Switch labeled SETPOINT on the MHGRV Module. See Figure 12 for location and DIP Switch setting instructions. The MHGRV Module will allow you to set a Supply Air Temperature Setpoint between 50°F and 100°F. If a value of less than 50°F is set, the controller will default to a 50°F Supply Air Temperature Setpoint. A value greater than 100°F will cause the unit to default to a 100°F Supply Air Temperature Setpoint.

Supply Air Temperature Reset Limit

You can reset the Supply Air Temperature Setpoint by supplying a 0-10 VDC control signal to the Reset Input (MHGRV RESET) terminal on the HB controller board. The reset range is determined by the setting configured on the DIP Switch labeled “RESET LIMIT.” See Figure 12 for location and setting instructions. The controller will reset the Supply Air Temperature Setpoint from the value set on the SETPOINT DIP Switch to the value set on the RESET LIMIT DIP Switch as the Reset Input (RST IN) signal is increased from 0 Volts to 10 Volts.

Example:
We want the Discharge Air Temperature Setpoint to increase from 55°F when the Reset Input signal is at 0 Volts to 75°F when the Reset Input signal is at 10 Volts.

- Set the SETPOINT DIP Switch to 55°F
- Set the RESET LIMIT DIP Switch to 75°F

The discharge air temperature will now increase from 55°F to 75°F as the Reset Input voltage signal ramps from 0 Volts to 10 Volts.

NOTE: It is possible to create a “reverse acting” control sequence. Using the temperatures from the example above by setting the SETPOINT DIP Switch to 75°F and the RESET LIMIT DIP Switch to 55°F, the reset would be reverse acting. In this case, the controller will maintain a 75°F discharge temperature when the Reset Input signal is at 0 Volts and will reduce to 55°F when the Reset Input signal is at 10 Volts.
MHGRV MODULE SETTINGS

Optional MHGRV Module Settings

When a change is made to the DIP Switch settings for either the setpoint or reset, power does not have to be cycled in order for the controller to read their values. The DIP Switch settings and their corresponding setpoints can be changed while power is applied, and the new settings will be accepted. The same is true for entering or leaving the force mode DIP Switch settings.

The modulating reheat system on the HB Unit is comprised of two valves, one for the condenser coil and one for the reheat coil. The valves operate directly opposite of each other. The MHGRV Controller will move the valves to the full Cooling position on power up after valve calibration. The condenser valve will be fully opened, and the reheat valve will be fully closed. This is the default configuration when no reheat is required.

For field-testing purposes, the modulating hot-gas valves can be forced to full Cooling or full Reheat via DIP Switch settings on the MHGRV Controller. See Table 3 for mode of operation and valve position during force modes.

<table>
<thead>
<tr>
<th>MHGRV Valve - Position &amp; Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Setpoint Value</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

Table 3: MHGRV Valve Position & Operation

**NOTE:** For a value of 1, only turn on DIP Switch labeled 1. For a value of 3, turn on DIP Switches 1 and 2. The DIP Switches are added together to complete a specific value.

**WARNING:** When force mode testing is complete, reset the DIP Switch settings to a valid temperature setting. Do not leave the MHGRV DIP Switches set in force mode when leaving the job site.
Using LEDs To Verify Operation

The HB controller is equipped with LEDs that can be used as very powerful troubleshooting tools. The HB controller circuit board has three differently colored LEDs. See Figure 13 for the various LED locations. The Red LED is used to indicate fault conditions. The Yellow LED indicates the mode of operation the HB controller is currently operating in. The Green LED indicates the power and communications status of the HB controller.

![HB Controller Board](image)

**Figure 13: HB Board LED Locations**

One LED blink is defined as a 1-second LED ON period immediately followed by a 1-second LED OFF period. After each series of blinks is completed, the LED will power off for 3 seconds and then repeat the series of blinks. The various blink codes and their meanings are defined in the tables that follow.

### Red LED

<table>
<thead>
<tr>
<th>LED Blinks</th>
<th>Fault Condition Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heat Safety Lockout</td>
</tr>
<tr>
<td>2</td>
<td>High Pressure Fault</td>
</tr>
<tr>
<td>3</td>
<td>Low Pressure Lockout</td>
</tr>
<tr>
<td>4</td>
<td>Bad Supply Air Temperature Sensor</td>
</tr>
<tr>
<td>5</td>
<td>Bad Outdoor Air Temperature Sensor</td>
</tr>
<tr>
<td>6</td>
<td>Bad Liquid Line Temperature Sensor</td>
</tr>
<tr>
<td>7</td>
<td>Clogged Filter Switch</td>
</tr>
</tbody>
</table>

Notes:
1. When no fault exists, the red LED will be off.
2. Heat Safety Lockout (1 blink) is the highest priority. Clogged Filter Switch (7 blinks) is the lowest priority.

Table 4: Red LED Blink Codes

### HB Controller Fault Condition Operation

If the Red LED indicates a Bad Outdoor Air Temperature Sensor, Heating Mode will operate, but Cooling Mode will be disabled until the sensor problem is fixed.

If the Red LED indicates a Bad Supply Air Temperature Sensor, Heating and Cooling Modes will continue to operate, but all Reheat functions will be disabled during Dehumidification and Economizer Modes.

If the Red LED indicates a Bad Liquid Line Temperature Sensor, the Condenser Fan will run continuously any time the Cooling Relays are energized.

### Yellow LED

<table>
<thead>
<tr>
<th>LED Blinks</th>
<th>Mode Indication Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vent Mode (Fan Only)</td>
</tr>
<tr>
<td>2</td>
<td>Heating Mode</td>
</tr>
<tr>
<td>3</td>
<td>Cooling Mode</td>
</tr>
<tr>
<td>4</td>
<td>Economizer Mode</td>
</tr>
<tr>
<td>5</td>
<td>Dehumidification Mode</td>
</tr>
<tr>
<td>6</td>
<td>Economizer Dehumidification Mode</td>
</tr>
</tbody>
</table>

Table 5: Yellow LED Blink Codes

### Green LED

<table>
<thead>
<tr>
<th>LED Blinks</th>
<th>Power/Communications Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Indicator (No Communications)</td>
</tr>
<tr>
<td>2</td>
<td>HSS Communications</td>
</tr>
<tr>
<td>3</td>
<td>MHGRV Communications</td>
</tr>
<tr>
<td>4</td>
<td>MHGRV/HSS Communications</td>
</tr>
</tbody>
</table>

Table 6: Green LED Blink Codes

### HB Controller Setpoint Ranges

The HB controller has many setpoints that are user-adjustable. This adjustability allows the installer complete control of all major unit operating characteristics during the setup and commissioning phase of the HB unit installation. It also gives a service technician the ability to change setpoints in order to monitor and record unit operation to determine if the unit is functioning as specified. The tables that follow show the available setpoints for each classification or control group provided on the HB controller.
## APPENDIX

### HB Controller Setpoint Ranges

#### Supply Fan Control Setpoints

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj. Two-Speed Fan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two-Speed Fan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-Speed Fan Signal</td>
<td>1.0 VDC</td>
<td>3.0 VDC</td>
<td>10.0 VDC</td>
</tr>
<tr>
<td>High-Speed Fan Signal</td>
<td>1.0 VDC</td>
<td>10.0 VDC</td>
<td>10.0 VDC</td>
</tr>
</tbody>
</table>

Table 7: Supply Fan Control Setpoints

#### Cooling Control Setpoints

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Stages</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Minimum Off Time</td>
<td>180 Sec</td>
<td>180 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Minimum On Time</td>
<td>300 Sec</td>
<td>300 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Staging Up Delay Interval</td>
<td>180 Sec</td>
<td>180 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Staging Down Delay Interval</td>
<td>60 Sec</td>
<td>60 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Low Pressure Delay Period</td>
<td>5 Sec</td>
<td>30 Sec</td>
<td>60 Sec</td>
</tr>
<tr>
<td>Low Pressure Safety</td>
<td>5 Sec</td>
<td>5 Sec</td>
<td>30 Sec</td>
</tr>
<tr>
<td>Low Pressure Max. Trip Point</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Fan Off Delay Period</td>
<td>1 Sec</td>
<td>45 Sec</td>
<td>120 Sec</td>
</tr>
<tr>
<td>Auto Staging Up Delay</td>
<td>180 Sec</td>
<td>600 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Dehumidify Staging Up Delay</td>
<td>180 Sec</td>
<td>600 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

Table 8: Cooling Control Setpoints

#### Heating Control Setpoints

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating Stages</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Minimum Off Time</td>
<td>60 Sec</td>
<td>60 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Minimum On Time</td>
<td>120 Sec</td>
<td>120 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Staging Up Delay Interval</td>
<td>180 Sec</td>
<td>180 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Staging Down Delay Interval</td>
<td>60 Sec</td>
<td>60 Sec</td>
<td>900 Sec</td>
</tr>
<tr>
<td>Heat Safety Maximum Count</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Fan Off Delay Period</td>
<td>1 Sec</td>
<td>120 Sec</td>
<td>180 Sec</td>
</tr>
<tr>
<td>Auto Staging Up Delay</td>
<td>180 Sec</td>
<td>600 Sec</td>
<td>900 Sec</td>
</tr>
</tbody>
</table>

Table 9: Heating Control Setpoints

#### Temperature Control Setpoints

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Lockout Temperature</td>
<td>32ºF</td>
<td>40ºF</td>
<td>80ºF</td>
</tr>
<tr>
<td>Heating Lockout Temperature</td>
<td>40ºF</td>
<td>80ºF</td>
<td>120ºF</td>
</tr>
<tr>
<td>Supply Air High Temperature Limit Cutoff</td>
<td>120ºF</td>
<td>150ºF</td>
<td>170ºF</td>
</tr>
<tr>
<td>Supply Air Low Temperature Limit Cutoff</td>
<td>32ºF</td>
<td>40ºF</td>
<td>80ºF</td>
</tr>
</tbody>
</table>

Table 10: Temperature Control Setpoints

#### Economizer Control Setpoints

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Econo Config</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. CO₂</td>
<td>0 PPM</td>
<td>1100 PPM</td>
<td>2000 PPM</td>
</tr>
<tr>
<td>Min. CO₂</td>
<td>0 PPM</td>
<td>900 PPM</td>
<td>2000 PPM</td>
</tr>
<tr>
<td>Outdoor Air Enable Temp</td>
<td>33ºF</td>
<td>55ºF</td>
<td>65ºF</td>
</tr>
<tr>
<td>ECS OAT Enable Temp</td>
<td>55ºF</td>
<td>65ºF</td>
<td>75ºF</td>
</tr>
</tbody>
</table>

Table 11: Economizer Control Setpoints

#### Exhaust Fan Control Setpoints

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Speed Supply Fan</td>
<td>0%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>High-Speed Supply Fan</td>
<td>0%</td>
<td>30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 12: Exhaust Fan Control Setpoints

#### Min. Damper Reset Position Setpoints For Adjustable Two-Speed Fan/CO₂

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. with Low-Speed Fan</td>
<td>0%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>Min. with Low-Speed Fan</td>
<td>0%</td>
<td>10%</td>
<td>100%</td>
</tr>
<tr>
<td>Max. with High-Speed Fan</td>
<td>0%</td>
<td>30%</td>
<td>100%</td>
</tr>
<tr>
<td>Min. with High-Speed Fan</td>
<td>0%</td>
<td>5%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 13: Minimum Damper Reset Setpoints

#### Condenser Fan Control Setpoints

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Line Cut Out Temp</td>
<td>75ºF</td>
<td>85ºF</td>
<td>95ºF</td>
</tr>
<tr>
<td>Liquid Line Cut In Temp</td>
<td>95ºF</td>
<td>105ºF</td>
<td>115ºF</td>
</tr>
</tbody>
</table>

Table 14: Condenser Fan Control Setpoints

#### Miscellaneous Control Setpoints

<table>
<thead>
<tr>
<th>Description</th>
<th>Min.</th>
<th>Default</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force Mode Timer</td>
<td>1 Min</td>
<td>60 Min</td>
<td>240 Min</td>
</tr>
</tbody>
</table>

Table 15: Miscellaneous Control Setpoints
### Temperature to Resistance/Voltage Chart

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>93333</td>
<td>2.98</td>
</tr>
<tr>
<td>-5</td>
<td>80531</td>
<td>2.94</td>
</tr>
<tr>
<td>0</td>
<td>69822</td>
<td>2.89</td>
</tr>
<tr>
<td>5</td>
<td>60552</td>
<td>2.83</td>
</tr>
<tr>
<td>10</td>
<td>52500</td>
<td>2.77</td>
</tr>
<tr>
<td>15</td>
<td>45902</td>
<td>2.71</td>
</tr>
<tr>
<td>20</td>
<td>40147</td>
<td>2.64</td>
</tr>
<tr>
<td>25</td>
<td>35165</td>
<td>2.57</td>
</tr>
<tr>
<td>30</td>
<td>30805</td>
<td>2.49</td>
</tr>
<tr>
<td>35</td>
<td>27140</td>
<td>2.41</td>
</tr>
<tr>
<td>40</td>
<td>23874</td>
<td>2.33</td>
</tr>
<tr>
<td>45</td>
<td>21094</td>
<td>2.24</td>
</tr>
<tr>
<td>50</td>
<td>18655</td>
<td>2.15</td>
</tr>
<tr>
<td>52</td>
<td>17799</td>
<td>2.11</td>
</tr>
<tr>
<td>54</td>
<td>16956</td>
<td>2.08</td>
</tr>
<tr>
<td>56</td>
<td>16164</td>
<td>2.04</td>
</tr>
<tr>
<td>58</td>
<td>15385</td>
<td>2.00</td>
</tr>
<tr>
<td>60</td>
<td>14681</td>
<td>1.96</td>
</tr>
<tr>
<td>62</td>
<td>14014</td>
<td>1.93</td>
</tr>
<tr>
<td>64</td>
<td>13382</td>
<td>1.89</td>
</tr>
<tr>
<td>66</td>
<td>12758</td>
<td>1.85</td>
</tr>
<tr>
<td>68</td>
<td>12191</td>
<td>1.81</td>
</tr>
<tr>
<td>69</td>
<td>11906</td>
<td>1.79</td>
</tr>
<tr>
<td>70</td>
<td>11652</td>
<td>1.78</td>
</tr>
<tr>
<td>71</td>
<td>11379</td>
<td>1.76</td>
</tr>
<tr>
<td>72</td>
<td>11136</td>
<td>1.74</td>
</tr>
<tr>
<td>73</td>
<td>10878</td>
<td>1.72</td>
</tr>
<tr>
<td>74</td>
<td>10625</td>
<td>1.70</td>
</tr>
<tr>
<td>75</td>
<td>10398</td>
<td>1.68</td>
</tr>
<tr>
<td>76</td>
<td>10158</td>
<td>1.66</td>
</tr>
<tr>
<td>78</td>
<td>9711</td>
<td>1.63</td>
</tr>
<tr>
<td>80</td>
<td>9302</td>
<td>1.59</td>
</tr>
<tr>
<td>82</td>
<td>8893</td>
<td>1.55</td>
</tr>
<tr>
<td>84</td>
<td>8514</td>
<td>1.52</td>
</tr>
<tr>
<td>86</td>
<td>8153</td>
<td>1.48</td>
</tr>
<tr>
<td>88</td>
<td>7805</td>
<td>1.45</td>
</tr>
<tr>
<td>90</td>
<td>7472</td>
<td>1.41</td>
</tr>
<tr>
<td>95</td>
<td>6716</td>
<td>1.33</td>
</tr>
<tr>
<td>100</td>
<td>6047</td>
<td>1.24</td>
</tr>
</tbody>
</table>

### Table 16, continued: Temperature Sensor - Voltage & Resistance for Type III Sensors

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>5453</td>
<td>1.16</td>
</tr>
<tr>
<td>110</td>
<td>4923</td>
<td>1.09</td>
</tr>
<tr>
<td>115</td>
<td>4449</td>
<td>1.02</td>
</tr>
<tr>
<td>120</td>
<td>4030</td>
<td>.95</td>
</tr>
<tr>
<td>125</td>
<td>3656</td>
<td>.88</td>
</tr>
<tr>
<td>130</td>
<td>3317</td>
<td>.82</td>
</tr>
<tr>
<td>135</td>
<td>3015</td>
<td>.76</td>
</tr>
<tr>
<td>140</td>
<td>2743</td>
<td>.71</td>
</tr>
<tr>
<td>145</td>
<td>2502</td>
<td>.66</td>
</tr>
<tr>
<td>150</td>
<td>2288</td>
<td>.61</td>
</tr>
</tbody>
</table>

**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.*
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