



BAPI-Stat 4 Sensor, w/Display, Button Setpoint, Fan or System Mode Control BA/BS4M Temperature Sensor

Installation & Operating Instructions

25188_ins_BS4M

rev. 01/18/16

Product Identification and Overview

The BAPI-Stat 4M room temperature sensor features a large format LCD and pushbutton setpoint adjustment. Additional options include pushbutton override, fan speed and mode adjustments.

The setpoint is available as a resistance or voltage output. The override is a momentary closure signal that can be configured in parallel with the sensor or setpoint, or as a separate momentary or latching contact output. A 3.5mm (1/8"), RJ11 or RJ22 communication jack can also be mounted in the unit's base to provide direct access to the network.

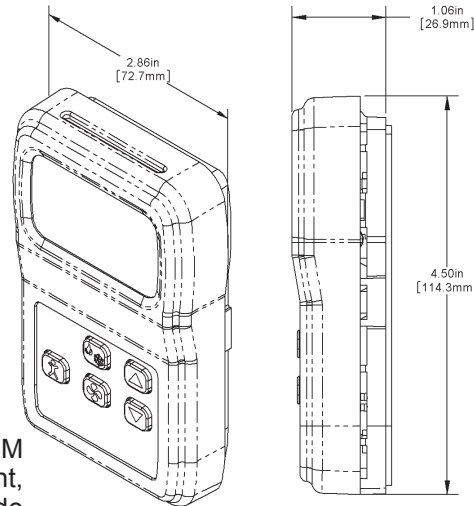


Fig. 1: BAPI-Stat 4M with optional Setpoint, Override, Fan and Mode Control.



Fig. 2: 2 Button Unit

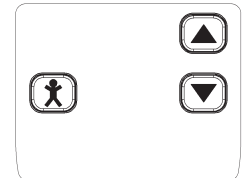


Fig. 3: 3 Button Unit

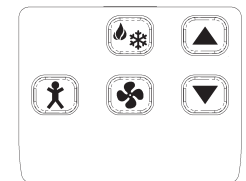


Fig. 4: 5 Button Unit

Note: BAPI-Stat 4M shown with five buttons. Two, three or five buttons may be present. See "Front Panel & Control" section.

Mounting

JUNCTION BOX

1. Pull the wire through the wall and out of the junction box, leaving about 6 inches free.
2. Pull the wire through the hole in the base plate.
3. Secure the base to the box using the #6-32 x 1/2 inch mounting screw provided.
4. Terminate the unit according to the guidelines in the **Termination** section.
5. Attach Cover by latching it to the top of the base, rotating the cover down and snapping it into place.
6. Secure the cover by backing out the lock-down screws using a 1/16" Allen wrench until they are flush with the bottom of the cover.

DRYWALL MOUNTING

1. Place the base plate against the wall where you want to mount the sensor.
2. Using a pencil, mark out the two mounting holes and the area where the wires will come through the wall.
3. Drill two 3/16" holes in the center of each marked mounting hole. Insert a drywall anchor into each hole.
4. Drill one 1/2" hole in the middle of the marked wiring area.
5. Pull the wire through the wall and out the 1/2" hole, leaving about 6" free.
6. Pull the wire through the hole in the base plate.
7. Secure the base to the drywall anchors using the #6 x 1 inch mounting screws provided.
8. Terminate the unit according to the guidelines in the **Termination** section.
9. Attach Cover by latching it to the top of the base, rotating the cover down and snapping it into place. Secure the cover by backing out the lock-down screws using a 1/16" Allen wrench until they are flush with the bottom of the cover.

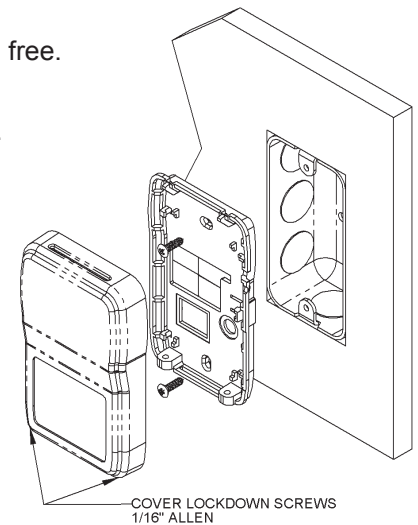


Fig. 5: Mounting hardware is provided for both J-Box and drywall installation (J-Box installation shown)

NOTE: In a wall-mount application, the mixing of room air and air from within the wall cavity can lead to erroneous readings, condensation, and premature failure of the sensor. To prevent this condition, plug the conduit hole with insulation in the junction box.

Specifications subject to change without notice.



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Termination

BAPI recommends using twisted pair of at least 22AWG and sealant filled connectors for all wire connections. Larger gauge wire may be required for long runs. All wiring must comply with the National Electric Code (NEC) and local codes. Do NOT run this device's wiring in the same conduit as AC power wiring. BAPI's tests show fluctuating and inaccurate signals are possible when AC power wiring is in the same conduit as the signal lines. If you are experiencing any of these difficulties, please contact your BAPI representative.



BAPI recommends wiring the product with power disconnected. Proper supply voltage, polarity and wiring connections are important to a successful installation. Not observing these recommendations may damage the product and void the warranty.

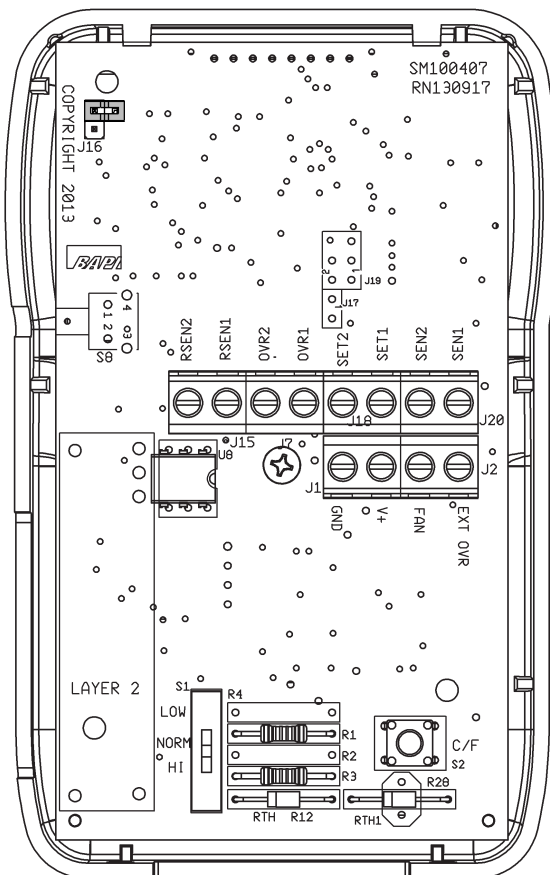


Fig. 6: BAPI-Stat 4M Circuit Board

TERMINAL

DESCRIPTION

- GND..... Power Supply Ground (Common to the controller)
- V+ Power Supply Hot (See specifications for voltage details)
- FAN..... Fan Speed/System Mode (Resistive Output)
- EXT OVR..... BAPI-Man Occ/Un-Occ indicator Input. Ground terminal to fill in the BAPI-Man icon for Occupied.
- SEN1 & SEN2 Sensor output per order (resistive). No polarity. *If the unit is a common ground configuration (-CG), see "Grounding Note" below.
- SET1 & SET2 A) Setpoint output per order (resistive). *If the unit is a common ground configuration (-CG), see "Grounding Note" below.
B) Setpoint output per order (voltage). SET1 is "+", SET2 is "-". *If the unit is a common ground configuration (-CG), see "Grounding Note" below.
- OVR1 & OVR2..... Override output (Dry contact) The contact can be ordered as a momentary shunt across the sensor (-N) or as a momentary shunt across the setpoint (-P) or as a separate momentary contact (-J) or as a separate latching contact (-L#). *If the unit is a common ground configuration (-CG), see "Grounding Note" below.
- RSEN1 & RSEN2 ... Remote sensor option (-ES). No polarity. *If the unit is a common ground configuration (-CG), see "Grounding Note" below. A 10K-2 thermistor sensor must be ordered separately and the temperature value is displayed on the LCD. Note: If a temperature reading is needed at the controller, then a second sensor must be ordered and wired independently.

*Grounding Note:

Common Ground (-CG) or Differential Ground (-DF) configurations are selected per order. The Differential Ground configuration (-DF) indicates that SEN2, SET2, OVR2 and RSEN2 must all be wired separately (No internal common connection). The Common Ground configuration (-CG) indicates that SEN2, SET2, OVR2 and RSEN2 are connected to GND internally (All internally common). This is true of all Common Ground units except when ordered with the Override as a Latching Switch option (-L#). In this case, OVR2 is isolated and not internally connected to SEN2, SET2 and RSEN2.

Specifications subject to change without notice.



Optional Communication Jack Wiring

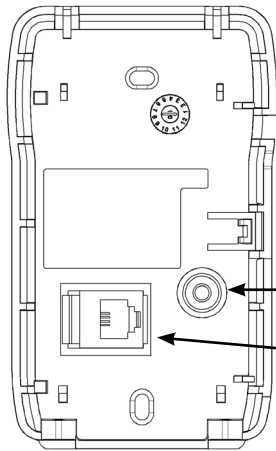
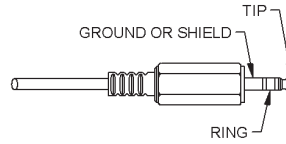


Fig. 7:
Back Plate
Comm.
Jack
Locations

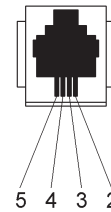
C35L
C11L/
C22L

Fig. 8: C35L
Comm. Jack
(3.5mm plug
shown for
clarity)



| C35L Comm. Jack Wiring | |
|------------------------|------------|
| Location | WIRE COLOR |
| Ground | Black |
| Tip | White |
| Ring | Red |

Fig. 9:
C11/C22
Comm.
Jack



| C11L/C22L Comm. Jack Wiring | |
|-----------------------------|---------------|
| PIN # | WIRE COLOR |
| 1 | Not Connected |
| 2 | Black |
| 3 | Red |
| 4 | Yellow |
| 5 | Green |
| 6 | Not Connected |

Optional Test and Balance Switch (S1)

On the Test and Balance Switch, the NORM position allows the real sensor to be monitored. The HIGH position forces the output to a very hot reading and the LOW position forces a very cold reading (see Table below).

Test and Balance Switch (S1)

LOW: Sets the sensor value low

NORM: Sensor operates normally

HIGH: Sets the sensor value high

| Sensor Type | Low Temp (40°F) Resistance Value | High Temp (105°F) Resistance Value |
|-----------------------|-------------------------------------|---------------------------------------|
| 1000Ω RTD | 1.02KΩ (41.20°F) | 1.15KΩ (101.5°F) |
| 3000Ω Thermistor | 7.87KΩ (39.8°F) | 1.5KΩ (106.8°F) |
| 10K-2 Thermistor | 30.1KΩ (34.9°F) | 4.75Ω (109.1°F) |
| 10K-3 Thermistor | 26.7KΩ (35.9°F) | 5.11KΩ (108.4°F) |
| 10K-3(11K) Thermistor | 7.32KΩ (43.7°F) | 3.65Ω (105.2°F) |

Optional Fan Speed and System Mode Control

The unit is available with optional Fan Speed and System Mode Control. The resistive outputs for the various options is shown in the table at right. The option is selected at the time of order and the resistive value is output to the FAN terminal.

| Option | Heat/Auto | Off /Auto | Cool/Auto | Heat/On | Off/On | Cool/On |
|--------|-----------|-----------|-----------|---------|--------|---------|
| HCF | 5KΩ | 10KΩ | 15KΩ | 20KΩ | 25KΩ | 30KΩ |
| H01 | 0Ω | 2KΩ | 4KΩ | 6KΩ | 8KΩ | 10KΩ |

| Option | Heat | Cool | Auto | Off |
|--------|------|------|------|------|
| H02 | 5KΩ | 10KΩ | 15KΩ | 20KΩ |

| Option | OFF | AUTO | LO | MED | HI | ON |
|--------|---------|---------|---------|---------|--------|---------|
| XLD | 5KΩ | 10KΩ | 15KΩ | 20KΩ | 25KΩ | |
| X01 | 4.89KΩ | 2.33KΩ | 10.63KΩ | 13.24KΩ | 16.33K | |
| X02 | 2KΩ | 4KΩ | 6KΩ | 8KΩ | 10KΩ | |
| X03 | 5KΩ | 10KΩ | | | | 15KΩ |
| X05 | 4.89KΩ | 2.33KΩ | | | | 15.8KΩ |
| X06 | 6.5KΩ | | 8.5KΩ | 10.5KΩ | 12KΩ | |
| X07 | 5KΩ | | | | | 15KΩ |
| X08 | 12.68KΩ | 11.86KΩ | | | | 13.86KΩ |

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Front Panel & Control Descriptions

A display is standard for all BA/BS4M units. It is available with an optional override button, setpoint buttons, fan control or system control buttons or any option combination. Fig. 10 shows a fully featured sensor.

NUMERICAL DISPLAY:

The default display shows current temperature. When the up/down buttons are pushed, then the display will show and adjust the current setpoint and hold the display for 3 to 4 seconds. The unit can also be set up to display setpoint only or for setpoint lockout. See "Optional Technicians Adjustments" section.

BAPI-MAN ICON:


The BAPI-Man Icon shows the status of the room – Solid for Occupied, Hollow for "Unoccupied" (Fig. 11).

Note: The unit must receive a confirmation (ground) signal on the "EXT OVR" terminal for the BAPI-Man to remain visible on the screen. Pressing the Override button will light the BAPI-Man icon; however, if no confirmation signal is received, then the BAPI-Man will go blank (disappear) after 5 seconds.

Upon receiving a first confirmation (ground) signal on the "EXT OVR" terminal, the BAPI-Man will show occupied (Solid). The BAPI-Man will then show unoccupied (Hollow) whenever the confirmation signal is removed and occupied when the signal is returned. The only way to blank the BAPI-Man from the display at this point is to cycle power.

FRONT PANEL BUTTONS


SETPOINT:

When pressed, the setpoint will display for three to four seconds. When pressed again, the setpoint will change   in one degree increments. It will only change within the setpoint range that was ordered.

OVERRIDE:

When the override button is pressed, the BAPI-Man will be displayed as "Solid" for 3-5 seconds and the override output will shunt or short for 3 seconds depending on the override option selected. (-N Option = Momentary Temperature Sensor Shunt to <math><15\Omega</math>, -P Option = Momentary Setpoint Shunt to <math><15\Omega</math>, -J Option = Momentary Override as a Separate Shorting Contact Output, -L# Option = Override as a Latching Switch, See "Latching Override Operation" on pg. 5.) If the occupied input (EXT OVR) terminal is grounded, then the BAPI-Man will stay filled in, indicating an occupied state. If the input is open, then the BAPI-Man will revert to hollow, indicating unoccupied (or the icon will disappear completely if there has never been a ground on the EXT OVR terminal).

MODE:

Cycles through 'HEAT', 'OFF' and 'COOL'. 

FAN:

Cycles through 'AUTO', 'ON' and Fan Speed (see Fig. 12). 

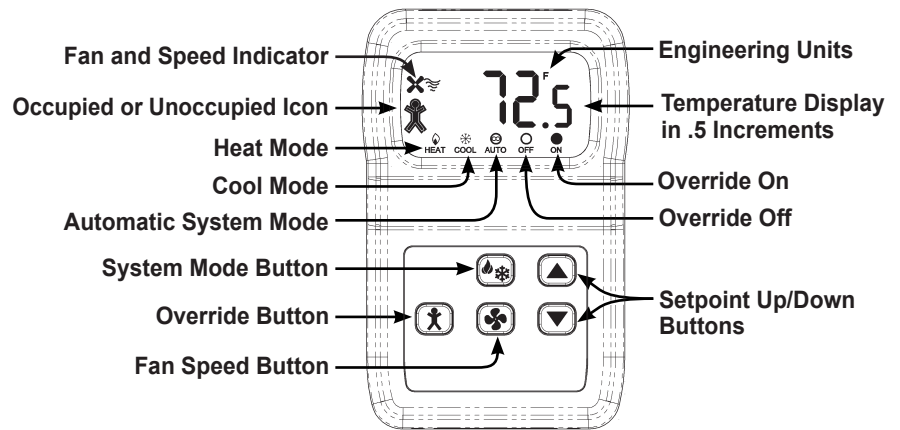


Fig. 10: BAPI-Stat 4M unit with Override, Setpoint, Fan & System Buttons.

Note: BAPI-Stat 4M shown with five buttons. Two, three or five buttons may be present.

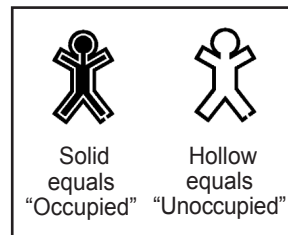


Fig. 11: BAPI-Man Icon

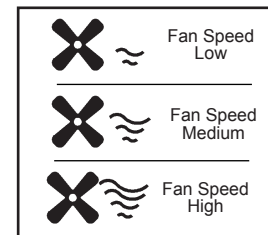


Fig. 12: Fan Speed Indicator

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Optional Technician Adjustments (The sensor set-up is factory set per your order. Set-up adjustments are not required)

The unit is shipped ready to install per the order and does not require any special setup or programming. The following Setup or Program Menu Changes are available if the installer decides to change the factory settings. Pushing the button (S2) on the lower right side of the termination board allows the user to change the display from Celsius to Fahrenheit and back again (See Fig. 6).

ENTERING PROGRAM MODE AND MAKING CHANGES:

1. Remove cover and install the shunt jumper across the J16 pins (see Fig. 13).
2. Use the Up and Down Setpoint Pushbuttons on the front of the sensor to advance to the parameter you wish to adjust. (Moves up or down from page to page or from setting to setting.)
3. Push the Override Pushbutton on the front of the unit to select the menu adjust parameter. This selects the currently displayed menu.
4. Use the Up and Down pushbuttons to adjust the parameter.
5. Push the Override Pushbutton to select the newly adjusted parameter value.
6. You can quit by removing J16 or move to the next parameter using the Up/Down Setpoint buttons.

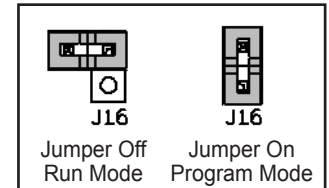


Fig. 13: J16 Program Jumper

Note: If your unit does not have the necessary front Up/Down/Override buttons for adjustment you can remove the board from the housing and use the three buttons that are on the back of the board. Removing the board requires removing the centered board mounting screw. The buttons are identified as S3 = Enter (Override), S5 = Up Adjust and S6 = Down Adjust. (See Fig. 14) After adjustment, place the board back into the cover and insert the center mounting screw. Do not over tighten.

MODE MENUS:

The setup mode consists of menu pages P1 through P6 for configuring the sensor. The following adjustments can be done with the program jumper J16 installed.

P1 = Temperature offset: Adjust Up or Down, -5 to 5° in 0.1° increments

P2 = Setpoint Lockout: Adjust the value to define the Setpoint mode

- 0 = Enable Setpoint adjustment (Normal mode)
- 1 = Disable Setpoint adjustment (No setpoint adjust)
- 2 = Display Setpoint Only (No room temperature displayed)
- 3 = No Setpoint Displayed (Rarely used with pushbutton setpoint units)

P3 = Latching Display (see Fig. 15)

- 1 = Override Disabled
- 0 = Momentary Contact, Hollow Man/Solid Man (Typically the normal setting)
- 1 = Latching Contact: Off/On, No Fan/Fan, Solid Man
- 2 = Latching Contact: Off/On, No Fan/Fan, No BAPI-Man
- 3 = Latching Contact: Off/On, Solid Man
- 4 = Latching Contact: Off/On, No BAPI-Man
- 5 = Latching Contact: On/Off, Fan/No Fan, Solid Man
- 6 = Latching Contact: On/Off, Fan/No Fan, No BAPI-Man
- 7 = Latching Contact: On/Off, Solid Man
- 8 = Latching Contact: On/Off, No BAPI-Man
- 9 = Latching Contact: Hollow Man/Solid Man
- 10 = Non-Latching

See "Latching Override Operation" and "Momentary Override Operation" descriptions for further details.

P4 = Temperature Display: Adjust value to the display increments desired

- 0 = Display in whole digits only
- 1 = Display in 0.5° increments, F or C as chosen on switch S2
- 2 = Display in 0.1° increments, F or C as chosen on switch S2

P5 = Setpoint Display Low: Adjust the Low temperature of the desired setpoint range between -9 to 99°.

P6 = Setpoint Display High: Adjust the High temperature of the desired setpoint range between -9 to 99°.

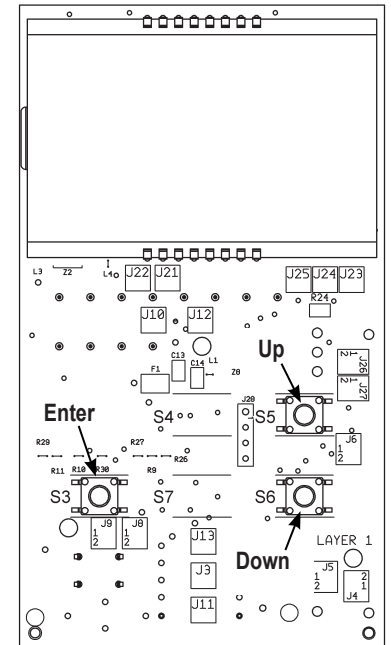


Fig. 14: Setup Switch locations on the circuit board.



Latching Override Operation

The unit can be ordered with an “Override as a Latching Switch” by selecting the -L# option. The # (1-10) represents the display the user may want to use and is shown below. This can be changed by a technicians adjustment.

In the “Override as Latching Switch” Option, pressing the Override button closes the override relay contacts (Terminals OVR1 & OVR2). They will remain closed until the “Override” button is pressed again, then they will open and remain open until the Override button is pressed again. See Fig. 16 below for examples of “Override as a Latching Switch” circuits.

Ten display options (Fig. 15) are available to indicate when the latching relay is open and when the latching relay is closed. Note: If one of the “Fan Speed/Mode” options is selected from the ordering grid, then you MUST use the latching display Option 9.

BAPI-MAN ICON

On **Options 2, 4, 6, 8 & 10**, the BAPI-Man Icon is disabled and will not show on the display, even when the Override button is pushed.

On **Options 1, 3, 5 & 7**, the BAPI-Man Icon is filled or solid for 3 to 5 seconds after the Override button is pushed, but it will only remain solid or filled when there is a ground signal to the EXT OVR terminal of the unit.

For **Option 9**, the BAPI-Man Icon stays filled or solid when the relay is closed and hollow when the relay is open.

For **Option 10**, the BAPI-Man Icon is disabled but the “ON” or “OFF” Dot on the display is controlled by the EXT OVR terminal. When there is a ground signal at the EXT OVR terminal, the “ON” dot is lit. Otherwise the “OFF” and hollow dot are lit. **Note: The Override Terminals OVR1 and OVR2 are NOT latching in Option 10. These terminals close MOMENTARILY in this option.**

| Option | Override Relay Open | Override Relay Closed |
|--------|---------------------|-----------------------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |

Fig. 15: Latching Switch Display Options

The 10 “Override as a Latching Switch” display options are shown above for when the relay is open and when the relay is closed.

Note 1: If the unit is ordered with “Fan Speed/Mode” Options, then you must use the latching display Option 9.

Note 2: On Options 1, 3, 5 & 7, the BAPI-Man Icon is filled or solid for 3 to 5 seconds after the Override button is pushed, but it will only remain solid or filled when there is a ground signal to the EXT OVR terminal of the unit.

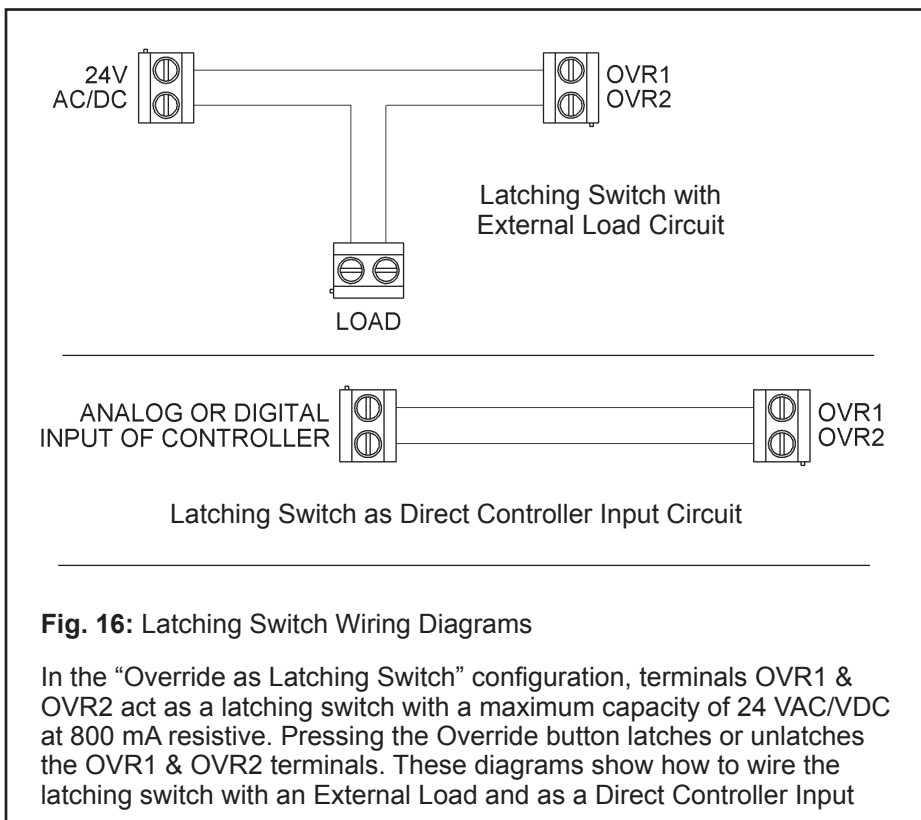


Fig. 16: Latching Switch Wiring Diagrams

In the “Override as Latching Switch” configuration, terminals OVR1 & OVR2 act as a latching switch with a maximum capacity of 24 VAC/VDC at 800 mA resistive. Pressing the Override button latches or unlatches the OVR1 & OVR2 terminals. These diagrams show how to wire the latching switch with an External Load and as a Direct Controller Input



Momentary Override Operation (Non-Latching)

When the Override pushbutton is pressed, the BAPI-Man (Fig. 11) will be displayed as “Solid” for 3-5 seconds and the override output will shunt or short for 3 seconds depending on the override option selected. The various options are described below.

- N Option = Momentary Temperature Sensor Shunt to $< 15\Omega$
- P Option = Momentary Setpoint Shunt to $<15\Omega$
- J Option = Momentary Override as a Separate Shorting Contact Output on OVR1 & OVR2

BAPI-MAN ICON:

The BAPI-Man Icon shows the status of the room – Solid for Occupied, Hollow for “Unoccupied” (Fig. 11). The unit must receive a confirmation (ground) signal on the “EXT OVR” terminal for the BAPI-Man to remain visible on the screen. Pressing the Override button will light the BAPI-Man icon; however, if no confirmation signal is received, then the BAPI-Man will go blank (disappear) after 5 seconds. Upon receiving a first confirmation (ground) signal on the “EXT OVR” terminal, the BAPI-Man will show occupied (Solid). The BAPI-Man will then show unoccupied (Hollow) whenever the confirmation signal is removed and occupied when the signal is returned. The only way to blank or remove the BAPI-Man from the display after receiving a confirmation signal is to cycle power.

General Diagnostics

POSSIBLE PROBLEM:

Temperature reading is incorrect

POSSIBLE SOLUTIONS:

- Verify that the input is set up correctly in the controller’s and building automation software.
- Check wiring for proper termination and check for opens or shorts.
- Measure the room temperature at the sensor’s location using an accurate temperature standard. Disconnect the temperature sensor wires and measure the temperature sensor’s resistance across the sensor output pins with an ohmmeter. Compare the temperature sensor’s resistance to the appropriate temperature sensor table on the BAPI website. If the measured resistance varies by more than 5% from the temperature table, call BAPI technical support. To view the temperature table, go to the BAPI website (www.bapihvac.com), click on “Resource Library” and “Sensor Specs”, then click on the type of sensor you have.
- If the unit has a test and balance switch, make sure that it is in the correct position.

Setpoint reading is incorrect

- Make sure that the setpoint output is correct. Remove the setpoint output wire and check the output for the correct resistance or voltage output. See the product label for your specific range.

Override is not working correctly

- Check that the resistance across the override output is less than 5Ω when the override is pushed.

Fan Mode not correct

- Make sure that the fan mode output is correct. Remove the fan mode output wire and check the output for the correct resistance. See the product label for your specific range and compare it to the resistance chart at the bottom of page 3. Don’t forget to reconnect the wire.

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Specifications

Power for 5 VDC Power Units:

0 to 5 VDC Setpoint or Resistive Setpoint5V \pm 1% (5 VDC nominal, Input regulation affects accuracy)

Power for 24 VDC Power Units:

0 to 5 VDC Setpoint or Resistive Setpoint ...9 to 40 VDC (24 VDC nominal)

0 to 10 VDC Setpoint or Resistive Setpoint ..15 to 40 VDC (24 VDC nominal)

Any Allowed Setpoint 15 to 28 VAC (24 VAC nominal)

Note: AC power requires a separate pair of shielded wires

Power Consumption:7 mA max DC; .17 VA maximum AC

Wiring: See Wiring & Termination Section, 22 to 14AWG

Mounting: Standard 2 x 4" box or drywall direct, Screws provided

Outputs:

Passive Sensor.... See order grid for thermistor or RTD

Thermistor, \pm 0.36°F (\pm 0.2°C), [XP] \pm 0.18°F (\pm 0.1°C)

Platinum RTD, \pm 0.12%, [A] \pm 0.06%

Nickel RTD, 1000Ω @70°F, JCI curve

External Sensor... 10K-2 thermistor (-ES), (Purchased separately) Wired 25' maximum from sensor

Setpoint Resistive per order or voltage (0 to 10VDC limit per order)

Isolated Contact .. 24VDC @500mA resistive

Inputs:..... Dry contact (24V, <1mA)

Occupied EXT OVR "Grounded"

Unoccupied EXT OVR "Open to Ground"

Display: LCD, Overall, 2"W x 1.1"H (Temp/Setpoint/Occupied)

LCD 3.5 Digits @0.6"H

Occ/Unocc BAPI-Man Icon, (Filled in man is occupied)

Display Limits 1.0°, 0.5° and 0.1° (F/C) increments, Setpoints in 1° steps

Range -40 to 185°F (-40 to 85°C)

Display Setup Temp. & Setpoint, Temp. only, or Setpoint only, °F or °C

Optional Fan Speed, System Mode, Override

Button Options: Factory set options

Setpoint Up & Down buttons

Override Pushbutton

Override Factory set to Momentary shunt across sensor, Momentary shunt across setpoint, Momentary isolated contact or Latching isolated contact

Fan Speed..... Off, Auto, Lo, Med, Hi

System Mode Heat/Off/Cool, Auto/On Fan

Setup Options:

Offset..... \pm 5°

Temp Display..... Display in °F or °C

Setpoint Disabled or Setpoint display only

Resolution Display in 1.0°, 0.5° or 0.1° increments

Other Options:

Comm. jack 3.5mm phone jack, 3 wires (-C35) • RJ11 jack, 4 wires (-C11) • RJ22 jack, 4 wires (-C22)

Test & Balance Three position switch (-TB), (High Temp/Normal/Low Temp)

Common Ground. Internal common connection (-CG)

Differential GND. . Each output terminal is isolated (-DF)

Environmental Ambient:

Temperature 32 to 122°F (0 to 50°C)

Humidity 0 to 95% RH Non-condensing

Storage..... 32 to 185°F (0 to 85°C)

Encl. Material: ABS Plastic, UL94V-0

Agency: RoHS, CE* (*Units with passive Thermistors 20KΩ and smaller are CE compliant.)

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