# BAPI-Stat 4MB Modbus Temp or Temp/Humidity Sensor

*Installation & Operating Instructions*

34350_ins_BS4_modbus rev. 02/24/15

## *Product Identification and Overview*

The BAPI-Stat 4MB Modbus room temperature or temperature/ humidity sensor is available with optional large-format LCD, pushbutton setpoint, override and fan speed adjustments.

The available (and enabled) process variables are available via standard RS485 network using an industry standard Modbus RTU protocol.

Communications parameters and user limits are set up through an included Page parameter adjustment system.

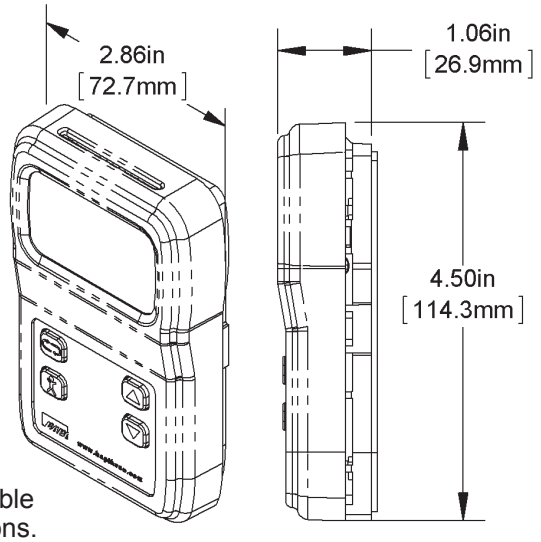


**Fig. 1:** BAPI-Stat 4MB Modbus unit with Display, Setpoint and Override.

**Note:** Unit is also available without display and buttons.

## *Mounting*

### JUNCTION BOX

1. Pull the wire through the wall and out of the junction box, leaving about 6 inches free. Pull the wire through the hole in the base plate.
2. Secure the base to the box using the #6-32 x 1/2 inch mounting screws provided.
3. Terminate the unit according to the guidelines in the **Termination** section.
4. Attach Cover by latching it to the top of the base, rotating the cover down and snapping it into place.
5. 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. Mark the two mounting holes and the area where the wires will come through the wall.
2. Drill two 3/16” holes in the center of each marked mounting hole. Insert a drywall anchor into each hole.
3. Drill one 1/2” hole in the middle of the marked wiring area.
4. Pull the wire through the wall and out the 1/2” hole, leaving about 6 inches free. Pull the wire through the hole in the base plate.
5. Secure the base to the drywall anchors using the #6 x 1 inch mounting screws provided.
6. Terminate the unit according to the guidelines in the **Termination** section.
7. Attach Cover by latching it to the top of the base, rotating the cover down and snapping it into place.
8. 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.

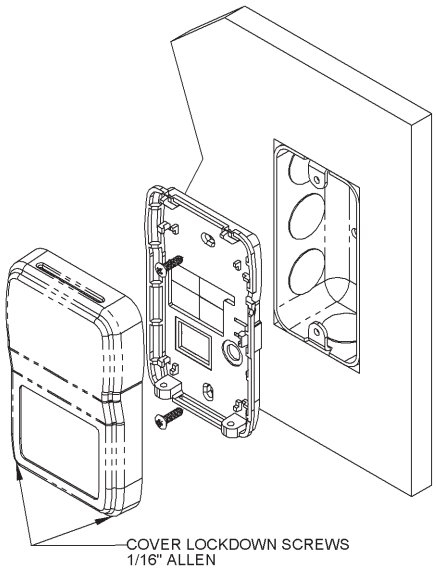


**Fig. 2:** Mounting hardware is provided for both junction box and drywall installation (junction box installation shown).

**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.*



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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 that fluctuating and inaccurate signal levels are possible when AC power wiring is present in the same conduit as the signal lines. If you are experiencing any of these difficulties, please contact your BAPI representative.

BAPI does not recommend wiring the sensor with power applied as accidental arcing may damage the product and will void the warranty.

**Status LED**
**Green - Indicates that the unit is operating propertly.**
**Red - Indicates that there is a problem with the unit.**

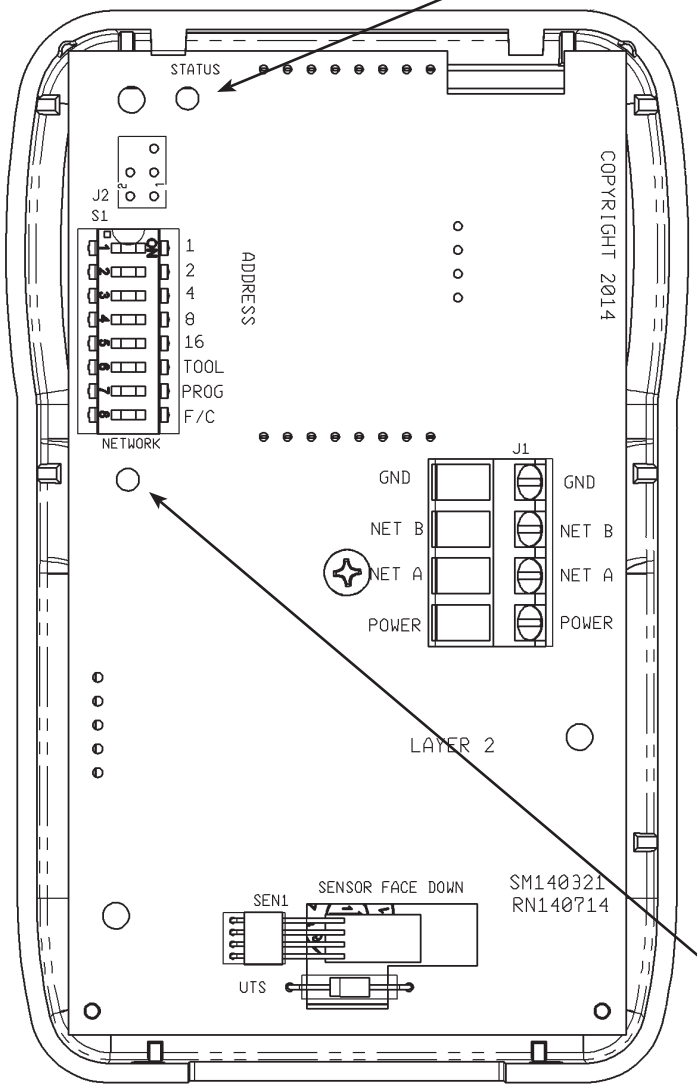


**Fig. 3:**
BAPI-Stat 4MB Modbus
Sensor Circuit Board

| Terminal | Description |
|---|---|
| GND..... | Power Supply Ground (Common to the controller) |
| Net B..... | RS485 network connection (Data -) |
| Net A..... | RS485 network connection (Data +) |
| Power ..... | Power Supply Hot (See specifications on page 5 for full voltage details.) |

**Network LED**

**Flashing Red Slowly - Indicates that there has been no communications for 60 seconds.**

**Flashing Green Slowly - Indicated that there have been normal communications within the last 60 seconds.**

**Flashing Green Slowly with Quick Red Flashes - The quick red flashes indicate active communications.**

## *Front Panel & Control Descriptions*

The BAPI-Stat 4MB is available without display and without buttons, or with display and with four buttons - Setpoint Up/Down, Scroll and Override. Fig. 4 shows a fully featured unit. Individual LCD icons can be controlled via specific Modbus Registers.

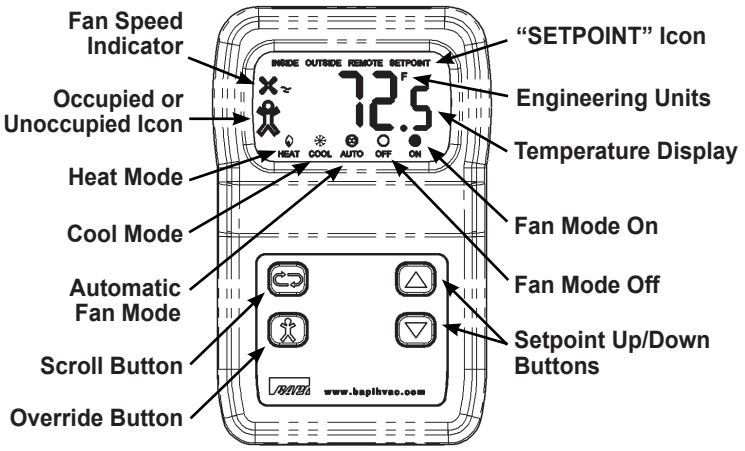


**Fig. 4:** BAPI-Stat 4MB Modbus Unit with Override, Setpoint and Scroll Buttons

### Scroll Button Function and Flow

The default display shows current process value or a rotation of process values based on the Page 6 menu value. Use the Scroll button to index through the enabled sensor parameters. (See the Register Map on the last page for a list of allowable display parameters.) Parameters with the "SETPOINT" icon displayed are editable. Use the Up/Down buttons to change them, and use the Scroll button to view the next parameter or return to the normal display mode. When in the Pages mode, the Scroll button becomes the Enter button for entering a page and accepting changes within a page.

### BAPI-Man Icon

The BAPI-Man Icon can be used to show the zone status (see Fig. 5). The first Modbus write to Register 40, bit 0 (set to true) after power up will latch the BAPI-Man outline on. Future writes or button presses will only affect the interior of the BAPI-Man. Cycling power will reset the outline.

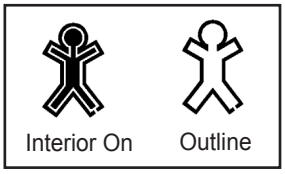


**Fig. 5:** BAPI-Man Icon

### Up/Down Buttons

The Up/Down buttons are used to adjust editable parameters whether in the Page or Parameter/Setpoint modes.

### Override Button:

If the Override feature is enabled then the BAPI-Man outline will be latched on and any Override button push will do the following. An Override button press will toggle both the inner portion of the BAPI-Man icon (Fig. 5) for 10 seconds and Register 20, bit 0. This bit and the icon are toggled again after 10 seconds. A Modbus write to Register 40, bit 0 can confirm the Override status and keep the BAPI-Man icon turned on (true) or off (false). If the Override feature is not enabled, setting Register 40, bit 0 to true will turn on the BAPI-Man icon, inner and outer. Setting the bit to false will clear the icon, inner and outer.

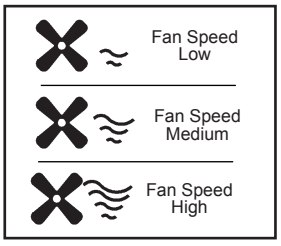


**Fig. 6:** Fan Speed Indicator

### Dip Switch Options (see Fig. 7 on next page)

- **Switches 1 through 5** - Sets the binary Address for the device. Units are shipped with the Address set to 1. An Address of 0 is invalid. Additional Addresses are available using the Page 1 Menu (see pg 4).
- **Switch 6 (TOOL)** - Sets the unit in a Listen-Only Mode when set to On and returns the unit to Normal Operation when set to Off. The Firmware Version and Address are displayed (on LCD units) for a short period after the switch is set to Off.
- **Switch 7 (PROG)** - Sets the unit in Program Mode to access the PAGE Menus.
- **Switch 8 (F/C)** - Sets the display reading and the output temperature values to °F or °C.

### Status and Network LEDs (see Fig. 3 on pg 2)

- **Status LED -** Green indicates that the unit is operating properly. Red indicates that there is a problem with the unit.
- **Network LED -** Flashing Red Slowly indicates that there has been no communications for 60 seconds. Flashing Green Slowly indicated that there have been normal communications within the last 60 seconds. Flashing Green Slowly with Quick Red Flashes indicates active communications.

## *Optional Technician Adjustments*

The unit is shipped ready to install per the order but may require some additional setup depending on the network and communications parameters used. The following Setup or Program Menu Changes are available if the installer decides to change the factory settings. **Note: For units without display and without pushbuttons, only Page Menus 1, 11, 12 and 13 are adjustable, and they are accessed through Modbus communications.**

### ENTERING PROGRAM MODE TO ACCESS THE PAGE MENUS:

1. Remove cover and set DIP Switch #7 (PROG) to On (see Fig. 7).
2. Use the Up/Down buttons to advance to the parameter you wish to adjust.
3. Push the Scroll button to select the Page you want to view.
4. Use the Up/Down buttons to adjust the parameter
5. Push the Scroll button to select the newly adjusted parameter value.
6. To exit Program Mode, set DIP Switch #7 to Off.

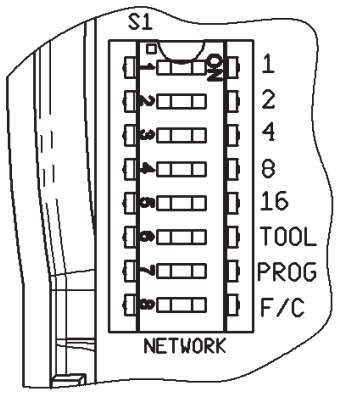


**Fig. 7:** Dip Switches

### QUICK VIEW PAGE MENUS:

| Menu | Title | Defaults |
|---|---|---|
| Page 1 | Unit Address Offset | 0 |
| Page 2 | Temperature Setpoint Low Limit | 60°F |
| Page 3 | Temperature Setpoint High Limit | 80°F |
| Page 4 | Humidity Setpoint Low limit | 0% |
| Page 5 | Humidity Setpoint High Limit | 100% |
| Page 6 | LCD Mode | t |
| Page 7 | LCD Resolution | 0.1 |
| Page 8 | LCD Cycle Rate | 5 |
| Page 9 | Temperature Offset Adjustment | 0.0 |
| Page 10 | Humidity Offset Adjustment | 0.0 |
| Page 11 | Baud | 57600 |
| Page 12 | Stop | 1 |
| Page 13 | Parity | None |
| Page 14 | Firmware Version | |

### EXPANDED PAGE MENU DEFINITIONS AND LIMITS:

| Menu | Parameter | Description |
|---|---|---|
| P1 | Unit Address Offset: | Selects the address offset for the unit<br>Allowed values are (0, 32, 64, 96, 128, 160 and 192)<br>Unit address is this value plus DIP switch setting. |
| P2 | Temperature Setpoint Low: | Sets the lowest value that can be set by the user.<br>Units (°C or °F) are selected via the DIP switch position 8<br>°F (-40 to 185), °C (-40 to 85) |
| P3 | Temperature Setpoint High: | Sets the highest value that can be set by the user.<br>Units (°C or °F) are selected via the DIP switch position 8<br>°F (-40 to 185), °C (-40 to 85) |
| P4 | Humidity Setpoint Low: | Sets the lowest value that can be set by the user. (0 to 100%) |
| P5 | Humidity Setpoint High: | Sets the highest value that can be set by the user. (0 to 100%) |

***Continued on next page...***

## *Optional Technician Adjustments continued...*

| Menu | Parameter | Description |
|---|---|---|
| P6 | LCD Mode: | Sets the type of values shown on the LCD.<br>Non – Blank LCD<br>t - Room temperature value only<br>rH - Room relative humidity value only<br>rHt - Room RH and room temperature value alternating |
| P7 | LCD Resolution: | Selects the resolution for the LCD.<br>01 - Selects a 0.1 resolution. (xx.1).<br>05 - Selects a 0.5 resolution. (xx.5).<br>10 - Selects whole numbers for the resolution. (xx.0). |
| P8 | LCD Cycle Rate: | Sets the cycle time for the LCD. (3 to 10 seconds) |
| P9 | Temperature Offset: | Adjusts the measured temperature value. (-9.5° to +9.5° in 0.1° increments) |
| P10 | Humidity Offset: | Adjusts the measured humidity value.(-9.5% to +9.5% in 0.1% increments) |
| P11 | Baud: | Sets the communications speed for the RS485 network.<br>(9600, 19200, 57600) shown as 96, 192 or 576 |
| P12 | Stop Bits: | Sets the number of stop bits required. (1 or 2) |
| P13 | Parity: | Sets the type of parity used. (None, Odd or Even) shown as non, odd or EEn |
| P14 | Sensor Firmware Version: | Indicates the current loaded firmware in this sensor. (Readable only) |

## *General Diagnostics*

| POSSIBLE PROBLEM: | POSSIBLE SOLUTIONS: |
|---|---|
| No Communications | - Check and verify sensor address, Baud, stop bits, parity and address offset.<br>- Check wiring polarity |
| Temperature Value Incorrect | - Check internal offset |
| Humidity Value Incorrect | - Check internal offset |
| No Setpoints | - Check enable flags |

## *Specifications*

**Power:**
9 to 40 VDC (24 VDC nominal)
24 VAC +20%/-30%.

Note: AC power requires a separate pair of shielded wires.

**Power Consumption:** 7 mA max DC; .28 VA max AC

**Sensing Element:** Thermistor or Semiconductor

**Wiring:** See Termination Section

**Terminals:** 22 to 14AWG

**Mounting:** Standard 2 x 4" box or drywall direct (Screws provided)

**User Interface:**
Setpoint ..... Up & Down buttons
Override..... Pushbutton
Scroll..... Display of additional Sensor Parameters

**Sensor Accuracy:**
Temperature: .... ±0.2ºC from 32 to 122ºF (0 to 50°C)
%RH: ..... ±2.0%RH (0 to 80%)

**Display:** LCD, 2"W x 1.1"H Overall, 3.5 Digits@0.6"H
ICONs..... BAPI-Man, Heat, Cool, Inside, Outside, Auto, Off , On , Fan, Remote
Resolution..... Whole, Half or Tenths (Process variables)
Setpoints ..... 0.5ºF, 0.1°C or 1.0% steps
Range ..... -40 to 185°F (-40 to 85°C), 0 to 100%

**Setup Options:**
See "Optional Technician's Adjustments" section

**Environmental Ambient:**
Temperature..... 32 to 122ºF (0 to 50ºC)
Humidity..... 0 to 95% RH Non-condensing
Storage ..... 32 to 158°F (0 to 70°C)

**Material:** ABS Plastic, UL94V-0

**Agency:** RoHS and CE

Specifications subject to change without notice.

## *Modbus Register Allocation and Map*

BAPI Modbus Register allocation and MAP Revision 01.04

| Name/Description | Network Register HEX | DEC | Size | Data Format | Application Units | Read/Write | Bits 15-8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Device ID | 0 | 0 | 1 | TBD | | R | | | | | | | | | |
| Device Status | 1 | 1 | 1 | Bit Flags {See bit definition} | | R | | Occupancy | Light | Pressure | Altitude | VOC | CO2 | Humidity | Temperature |
| Temperature config | 2 | 2 | 1 | Bit Flags {See bit definition} | | R/W | | RESERVED | RESERVED | RESERVED | RESERVED | Heat | Cool | Base | RESERVED |
| Humidity Config | 3 | 3 | 1 | Bit Flags {See bit definition} | | R/W | | | | | | | | RH SP | RH |
| Occupancy Config | 7 | 7 | 1 | Bit Flags {See bit definition} | | R/W | | | | | | | | | OVR |
| Fan Config | 8 | 8 | 1 | Bit Flags {See bit definition} | | R/W | | | | | | | | FAN(1) | FAN(0) |
| Digital IN Value (1) | 20 | 32 | 1 | Bit Flags {See bit definition} | | R | | | | | | | | C or F | OVR |
| Digital IN Value (2) | 21 | 33 | 1 | Bit Flags {See bit definition} | | R | | | | | | | | | |
| Digital Out Value (1) | 40 | 64 | 1 | Bit Flags {See bit definition} | | R/W | | | | | | | RHsp LO | Tsp LO | OVR |
| Digital Out Value (2) | 41 | 65 | 1 | Bit Flags {See bit definition} | | R/W | | | | | | | | | |
| Temperature (1) | 60 | 96 | 1 | short xxx.xx | Degrees | R/W | | | | | | | | | |
| Temperature Set-Point BASE | 62 | 98 | 1 | short xxx.xx | Degrees | R/W | If enabled this 'temperature set-point' will display in rotation during the 'Scroll' button sequence. | | | | | | | | |
| Temperature Set-Point COOL | 63 | 99 | 1 | short xxx.xx | Degrees | R/W | If enabled this 'temperature set-point' will display in rotation during the 'Scroll' button sequence. | | | | | | | | |
| Temperature Set-Point HEAT | 64 | 100 | 1 | short xxx.xx | Degrees | R/W | If enabled this 'temperature set-point' will display in rotation during the 'Scroll' button sequence. | | | | | | | | |
| Humidity | 80 | 128 | 1 | ushort xxx.xx | Percent | R/W | If disabled in the PAGE mode then if enabled via flag 'humidity' will display in 'Scroll' button sequence | | | | | | | | |
| Humidity Set-Point | 81 | 129 | 1 | ushort xxx.xx | Percent | R/W | If enabled this 'Humidity set-point' will display in rotation during the 'Scroll' button | | | | | | | | |
| LCD Mode Status | C0 | 192 | 1 | enum | | R/W | | | OFF | ON | | AUTO | COOL | HEAT | Enabled |
| LCD Fan Status | C1 | 193 | 1 | enum | | R/W | | AUTO | OFF | ON | FAN | HIGH | MED | LOW | Enabled |
| LCD Status | C2 | 194 | 1 | enum | | R/W | | | OFF | ON | | REMOTE | OUTSIDE | INSIDE | Enabled |
| Fan Status | 140 | 320 | 1 | enum | | R/W | FAN(0) Flag enabled - (0 = OFF, 1 = LO, 2 = MED, 3 = HIGH), FAN(1) Flag Enabled - (0 = OFF, 1 = LO, 2 = MED, 3 = HIGH, 4 = ON, 5 = AUTO) | | | | | | | | |
| Diagnostic Flag Register | 200 | 512 | 1 | | | R | | | | | | | | | |
| Network Message Counter Value | 201 | 513 | 1 | | | R | | | | | | | | | |
| CRC Error Counter Value | 202 | 514 | 1 | | | R | | | | | | | | | |
| Slave Exception Counter Value | 203 | 515 | 1 | | | R | | | | | | | | | |
| Slave Message Counter Value | 204 | 516 | 1 | | | R | | | | | | | | | |
| Slave NoResponse Counter Value | 205 | 517 | 1 | | | R | | | | | | | | | |
| Framing and Overrun Counter Value | 206 | 518 | 1 | | | R | | | | | | | | | |
| Autotest/Reset/etc | 207 | 519 | 1 | Factory use only | | R/W | | | | | | | | | |
| Address Bank Offset | 20A | 522 | 1 | Integer (0-6) Allowed | | R/W | 0 = 0, 1 = 32, 2 = 64, 3 = 96, 4 = 128, 5 = 160, 6 = 192 | | | | | | | | |
| Baud | 20B | 523 | 1 | Integer (0-2) Allowed | | R/W | 0 = 9600, 1 = 19200, 2 = 57600 | | | | | | | | |
| Stop Bits | 20C | 524 | 1 | Integer (1,2) Allowed | | R/W | 1 = 1, 2 = 2 | | | | | | | | |
| Parity | 20D | 525 | 1 | Integer (0,1,2) Allowed | | R/W | 0 = none, 1 = odd, 2 = even | | | | | | | | |
| Register TOP | FFF | 4095 | | | | | | | | | | | | | |
| Reserved | 1000 | 4096 | | 0x1000 through 0xEFFF reserved | | | | | | | | | | | |
| Reserved | EFFF | 61439 | | 0x1000 through 0xEFFF reserved | | | | | | | | | | | |
| Moniker, Name ID, Serial #, Revision | F000 | 61440 | 16 | BS3IAQn26181sIAQ1A0002Pv07.15.02 | ascii | R | Example shown | | | | | | | | |