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

Installation & Operating Instructions

34350_ins_BS4_modbus rev. 05/17/19

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.

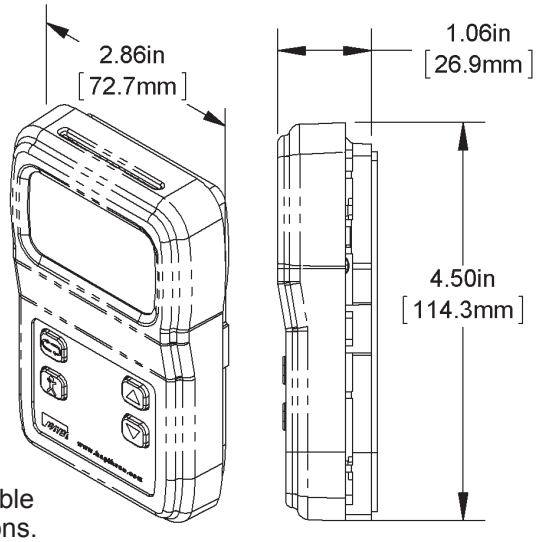

Fig. 1: BAPI-Stat 4MB Modbus unit with Display, Setpoint and Override.

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.

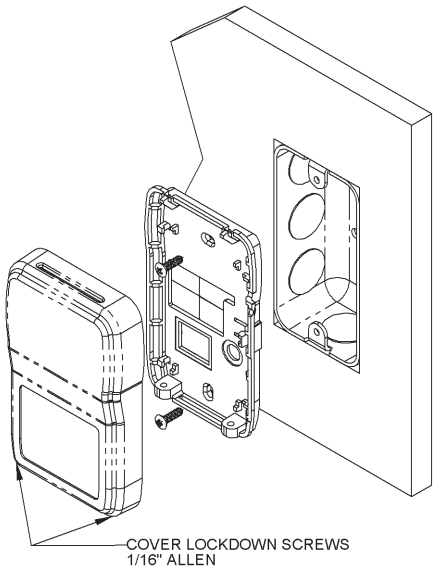

Fig. 2: Mounting hardware is provided for both junction box and drywall installation (junction box installation shown).

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 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.

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

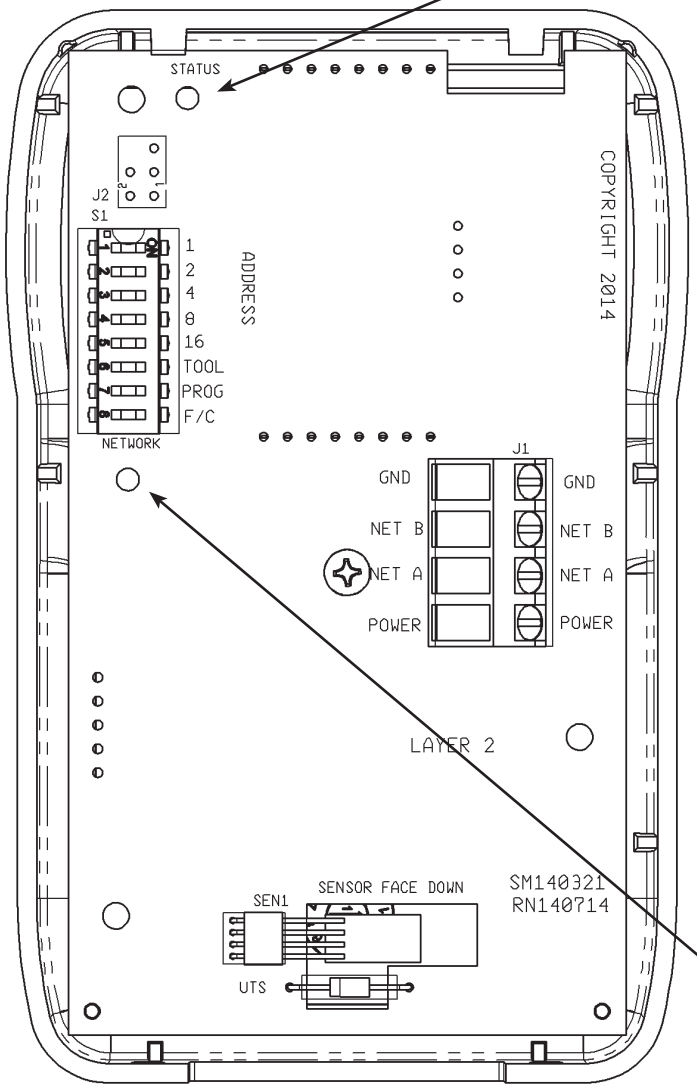


Fig. 3:
BAPI-Stat 4MB Modbus
Sensor Circuit Board

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.

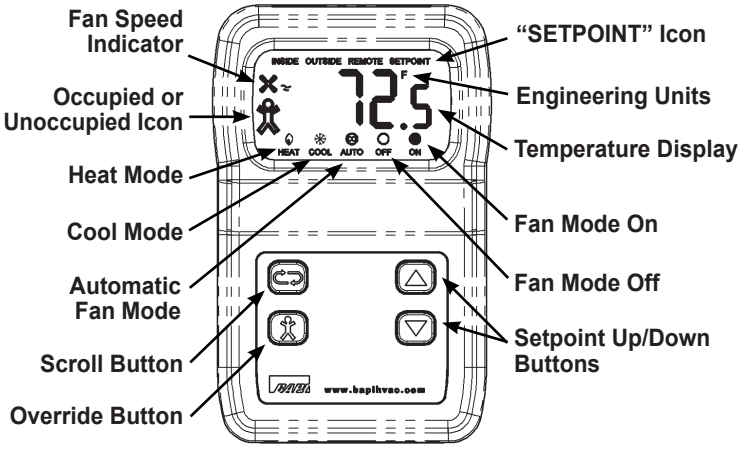


Fig. 4: BAPI-Stat 4MB Modbus Unit with Override, Setpoint and Scroll Buttons

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.

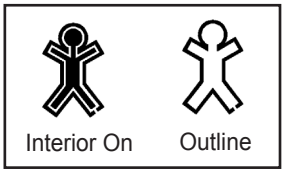


Fig. 5: BAPI-Man Icon

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.

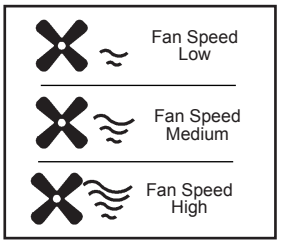


Fig. 6: Fan Speed Indicator

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.

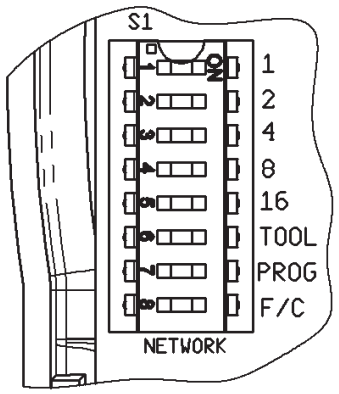


Fig. 7: Dip Switches

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 Allowed values are (0, 32, 64, 96, 128, 160 and 192) Unit address is this value plus DIP switch setting.
P2	Temperature Setpoint Low:	Sets the lowest value that can be set by the user. Units (°C or °F) are selected via the DIP switch position 8 °F (-40 to 185), °C (-40 to 85)
P3	Temperature Setpoint High:	Sets the highest value that can be set by the user. Units (°C or °F) are selected via the DIP switch position 8 °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. Non – Blank LCD t - Room temperature value only rH - Room relative humidity value only rHt - Room RH and room temperature value alternating
P7	LCD Resolution:	Selects the resolution for the LCD. 01 - Selects a 0.1 resolution. (xx.1). 05 - Selects a 0.5 resolution. (xx.5). 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. (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. - 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: .... ±0.3°C @ 20 to 40°C (68 to 104°F)
%RH: ..... ±2%RH @ 25°C (77°F), 20 to 80%RH

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

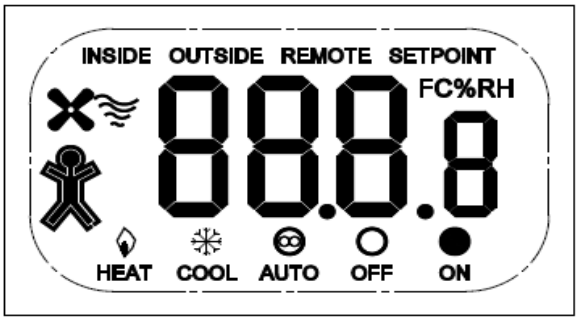
Specifications subject to change without notice.

Modbus Register Allocation and Map

BAPI Modbus Register allocation and MAP Revision 01.06

Name/Description	Network Register HEX	DEC	Size		Data Format	Application Units	Read/Write	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Device ID	0	0	1		Bit Flags (See bit definition)		R															Humidity	Temperature	If flag is set then sensor active
Device Status	1	1	1		Bit Flags (See bit definition)		R															Humidity	Temperature	If flag is set then sensor is unreliable
Temperature config	2	2	1		Bit Flags (See bit definition)		R/W									RESERVED	RESERVED	RESERVED	RESERVED	Heat	Cool	Base	RESERVED	If flag is set then value is enabled
Humidity Config	3	3	1		Bit Flags (See bit definition)		R/W															RH SP	RH	If flag is set then value is enabled
Occupancy Config	7	7	1		Bit Flags (See bit definition)		R/W																OVR	If flag is set then value is enabled
Fan Config	8	8	1		Bit Flags (See bit definition)		R/W													FAN(3)	FAN(2)	FAN(1)	FAN(0)	If flag is set then function/mode is enabled
Mode Config	9	9	1		Bit Flags (See bit definition)		R/W																HCA(0)	If flag is set then function/mode is enabled
Digital IN Value (1)	20	32	1		Bit Flags (See bit definition)		R															C or F	OVR	
Digital Out Value (1)	40	64	1		Bit Flags (See bit definition)		R/W														RHsp LO	Tsp LO	OVR	
Temperature (1)	60	96	1		short xxx.xx	Degrees	R/W																	
	61	97	1				R/W	No Functional use currently																
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.																
	65-68						R/W	No Functional use currently																
User Set-Point limit Low in °F	69	105	1		short xxx.xx	Degrees	R/W																	
User Set-Point limit High in °F	6A	106	1		short xxx.xx	Degrees	R/W																	
User Set-Point limit Low in °C	6B	107	1		short xxx.xx	Degrees	R/W																	
User Set-Point limit High in °C	6C	108	1		short xxx.xx	Degrees	R/W																	
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																
Humidity Set-Point Limit Low	82	130	1		ushort xxx.xx	Percent	R/W																	
Humidity Set-Point Limit High	83	131	1		ushort xxx.xx	Percent	R/W																	
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	See Details page for ENUM definitions																
Mode Status	141	321	1		enum		R/W	See Details page for ENUM definitions																
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		BS4MBHn38973sMOD790126Pv01.40.01	ascii	R	Example shown																

Fan Status and Fan Display Icon Values



FAN Mode

FAN(0)	Fan Status Value	LCD INFO
	0	FAN, 1st Wave, OFF
	1	FAN, 1st and 2nd Waves
	2	FAN, 1st, 2nd and 3rd Waves
	3	FAN, 1st, 2nd, 3rd and 4th Waves

MODE mode

HCA(0)	Mode Status Value	LCD INFO
	0	HEAT
	1	COOL
	2	AUTO

FAN(1)	Fan Status Value	LCD INFO
	0	FAN, 1st Wave, OFF
	1	FAN, 1st and 2nd Waves
	2	FAN, 1st, 2nd and 3rd Waves
	3	FAN, 1st, 2nd, 3rd and 4th Waves
	4	FAN, 1st, 2nd, 3rd, 4th Waves and ON
	5	FAN, 1st, 2nd, 3rd, 4th Waves and AUTO

Fan Mode

FAN(2)	Fan Status Value	LCD INFO
	0	No FAN icon
	1	FAN, 1st Wave
	2	FAN, 1st and 2nd Waves
	3	FAN, 1st, 2nd and 3rd Waves
	4	FAN, 1st, 2nd, 3rd and 4th Waves

FAN(3)	Fan Status Value	LCD INFO
	0	No FAN icon
	1	FAN, 1st Wave
	2	FAN, 1st and 2nd Waves
	3	FAN, 1st, 2nd and 3rd Waves
	4	FAN, 1st, 2nd, 3rd and 4th Waves
	5	FAN, 1st, 2nd, 3rd, 4th Waves and AUTO

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