

BAC-RI Room Interface Modules with BACnet

BAC-RI are room interface modules designed to provide room control interface the building management systems.

BAC-RI units have built-in (backlit) display that shows the system status. Depending on the model two, three or four push buttons can be used to change the setpoint, the system mode and the fan speed.

The BAC-RI modules have built-in temperature measurement.

The BAC-RI units have modern sleek design and they can be wall mounted.

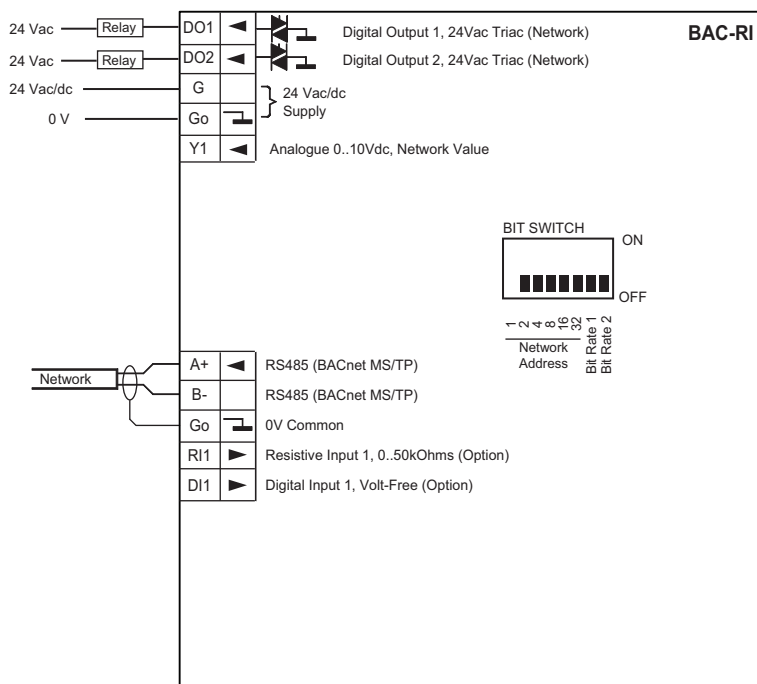
The BAC-RI units have BACnet MS/TP RS485 communication interface that allows them to be used with the most BMS systems and other products with BACnet MS/TP Client.



Model Type	Model	Description
	BAC-RI	BACnet Room Interface Module with LCD, built-In temperature, 1DI, 1RI, 2DO and 1AO, No Buttons
	BAC-RI-2B	BACnet Room Interface Module with LCD, built-In temperature, 1DI, 1RI, 2DO and 1AO, 2 Buttons (Setpoint)
	BAC-RI-3B	BACnet Room Interface Module with LCD, built-In temperature, 1DI, 1RI, 2DO and 1AO, 3 Buttons (Setpoint and Fan Speed)
	BAC-RI-4B	BACnet Room Interface Module with LCD, built-In temperature, 1DI, 1RI, 2DO and 1AO, 4 Buttons (Setpoint, Fan Speed and Day/Night)
	-RH	2%rH Relative Humidity Option
	-CO2	CO Measurement Option
Technical Data		
Power Supply	Power supply	24Vac/dc -10%/+15%
Displays and Interfaces	LCD	LCD Display for Showing Plant Status (Heating/Cooling Mode, Current Temperature, Humidity, Fan Speed, Setpoint)
Signal Outputs (network write)	Analogue Outputs	1 x 0..10V < 5mA; 100k min impedance for 1% accuracy
	Digital Outputs	2 x 24Vac Triacs; 1A maximum; requires 24Vac Power Supply
Signal Inputs (network read)	Resistive Input	1 x Resistive Input, NTC10/0..50kOhms (network read)
	Digital Input	1 x Digital Input, Volt-Free Contact, Impedance <1KOhm
Sensing Characteristics	Temperature	
	Range	0..50°C (32..122°F)
	Accuracy	±0.3°C
	Humidity; Option -RH	
Range	0..100%rH	
Accuracy	±2% rH (within 0..90% rh)	

	Carbon Dioxide (CO ₂); Option -CO2	
	Range	0...5000ppm CO ₂ (Range Adjustable)
	Accuracy	± 50ppm + 3% of the reading @ 25°C (@77°F)
	Technology	Auto Calibrating; Patented Non-Dispersive Infrared (NDIR)
	Non-Linearity	<1% FS
	Warm-Up Time	<20 seconds
	Response Time	2 minutes
Communication	BACnet Communications	
	Protocol	BACnet MS/TP
	Interface	RS485; maximum 63 devices
	MAC Addressing	0..63 via a bit switch; 0..127 via tool / network
	Communication	9k6/19k2/38k4/76k8 Baud; Parity None/Even/Odd, 1 or 2 Stop Bits (baud rate adjustable through bit switch)
Connections	Terminal Connections	Solid and Stranded Cable; 55° Angle for Wiring Maximum Size: 0.05 to 1.5mm ² (EN ISO) / 14 to 30 AWG (UL) Rising Clamp: Size 2.5 x 1.9mm
Environmental Conditions	Operating	
	Temperature	0°C...+50°C (32..122°F)
	Humidity	0...95%rh (non-cond.)
	Storage	
	Temperature	-30°C...+70°C (-22..158°F)
	Humidity	0...95%rh (non-cond.)
Standards	CE Conformity	CE Directive 2004/108/EY EN61000-6-3: 2001 (Generic Emission) EN61000-6-1: 2001 (Generic Immunity).
	Degree of Protection	IP20
Housing	Housing Material	ABS Plastics, Self Extinguishing
	Mounting	Wall or Junction Box Mounting, RAL9010 Pure White
	Dimensions	W86 x H120 x D29mm
	Weight	180g

Wiring Terminals



DO2

Digital Output; 24Vac Triac Switching to 0V; max. 2A

DO1	Digital Output; 24Vac Triac Switching to 0V; max. 2A
G	24Vac/dc Power Supply
G0	0V Common
Y1	0..10Vdc Analogue Output (Network Write)
A+	RS485 A+ Connection (BACnet)
B-	RS485 B- Connection (BACnet)
G0	0V Common
RI1	Resistive Input 0..50kOhms
DI1	Digital Input; Volt-Free

Wiring Precautions

Switch off the power before any wiring is carried out. If the sensor has the LCD display fitted, unplug the LCD display and then wire the power supply and the analogue output, if relevant.

After the wiring has been completed; plug-in the display and power up the device.

The analogue output Y1 value can be set over the BACnet MS/TP network.

The digital outputs DO1 and DO2 can be set over the BACnet MS/TP network.

The resistive input is configured as default to read NTC10k3 sensor and the reading is available over the Modbus network. Using SW-DCT-USB tool it is also possible to configure the input to read resistance.

The volt-free digital input DI1 status is available over the BACnet MS/TP network. The digital input has adjustable off delay (default 0 seconds).

The devices measures room temperature and this reading is displayed on the LCD screen and it is available over the BACnet network as a BACnet MS/TP value.

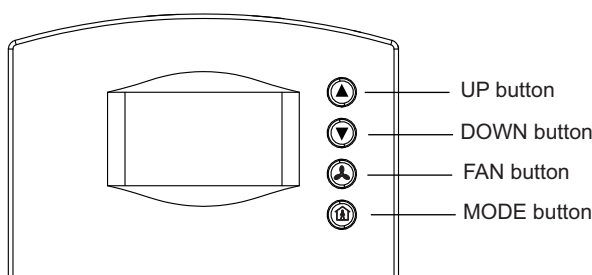
The temperature reading can be calibrated using single point calibration field.

By pressing the UP and DOWN buttons the current setpoint can be adjusted. The UP and DOWN buttons have autorepeat function making adjustment faster and easier. The setpoint is shown on the display when it is adjusted (backlight is switched temporarily on). The device has two network variables for the setpoint; the nominal setpoint and the current adjusted setpoint.

The current adjusted setpoint shows the last written value i.e.

- if the user adjusted the setpoint via the buttons, the current adjusted setpoint reflects the nominal setpoint +/- the user adjustment

- if the base setpoint is written via the network, then the current adjusted setpoint reflects the last written network setpoint.



It is possible to configure the current adjusted setpoint to reflect only the user adjusted setpoint. In this case set the network nominal setpoint to 0.

By pressing the FAN button, the current fan speed is displayed (and the backlight is switched on), then by pressing the UP and DOWN buttons is possible for the user to adjust the fan speed. After setting the fan speed, the user-set fan speed is activated for the time set in the fan override delay parameter, or until the fan speed is re-set over the BACnet MS/TP network.

If the user set fan speed is active the fan button backlight is ON. The button backlight can be enabled/disabled through the configuration tool.

By setting the fan override delay to 0, the user set fan speed is active until to the next network write. Otherwise the fan speed is overridden to user defined value only the time set in the fan override delay parameter. After this time the fan speed returns to previously set network ("automatic") value.

When the fan speed is changed over the BACnet MS/TP network, the local user setting is re-set to the network value.

Analogue Output Y1 Operation

DO1/DO2 Digital Output Operation

Resistive Input Operation

Digital Input Operation

Temperature Measurement and Single Point Calibration

Setpoint Buttons (2B/3B/4B Models)

Fan Speed Button (BAC-RI-3B and BAC-RI-4B)

The fan speed display / operation can have the following configurations that are set during the commissioning.

Fan Speed Mode	Description
0	0..100% Modulating Fan Speed
1	0 - 1- 2 Two Speed Fan
2	0 - 1 - 2- A Two Speed Fan with Auto Option
3	0 - 1 - 2 - 3 Three Speed Fan
4	0 - 1 - 2 -3- A Three Speed Fan with Auto Option

Operating Mode Button (BAC-RI-4B Only)

By toggling the operating MODE button, the current operating mode can be changed between day and night. When the button is pressed the display backlight is also switched on. The unit remains in the day/night mode set by the user for the time specified in the mode override delay parameter (max 7,200 seconds). After this time the mode returns to the mode before the manual setting (i.e. if the mode was night and the user sets it to day, the unit returns to night mode after the delay setting). The user set condition can be removed also any time by writing to the network parameter.

By setting the mode override delay to 0, the user set mode remains until it is re-set over the communication network.

If enabled, the mode button backlight is switched on to indicate the user set condition. The button backlight switches off when the unit returns to "automatic mode" (network setting).

It is also possible to disable the day and night button operation.

LCD Display


The LCD display shows the current temperature (in Celsius/Fahrenheit) and the optional humidity reading.

The display can also show the following additional information:-

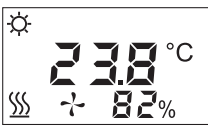
- current setpoint when the setpoint is adjusted (network +/- user adjustment)
- current fan speed with animated fan icon (set by network and/or by the fan button with MOD-RI2 model)
- day and night mode (set by network and/or by the mode button with MOD-RI2 model)
- heating and cooling icons (set by network)
- open and close icons (set by network)
- alarm code display

When any of the buttons is pressed, the white LCD backlight is switched temporarily on.


DISPLAY EXAMPLES




TEMPERATURE DISPLAY WITH OPTIONAL HUMIDITY DAY MODE ICON HEATING ICON




TEMPERATURE DISPLAY MODULATING FAN SPEED DISPLAY DAY MODE ICON HEATING ICON



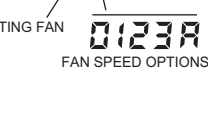
TEMPERATURE DISPLAY WITH OPTIONAL HUMIDITY NIGHT MODE ICON COOLING ICON




TEMPERATURE DISPLAY (FAHRENHEIT) 3-SPEED FAN SPEED DISPLAY DAY MODE ICON HEATING ICON



CURRENT ADJUSTED SETPOINT SHOWN WHEN BUTTONS PRESSED UP & DOWN



ANIMATING FAN FAN SPEED OPTIONS



CURRENT TEMPERATURE WITH OPEN AND CLOSE ICONS DISPLAYED

Alarm Display

The LCD can be configured to show alarm conditions on the display. The alarm condition includes a Code value display together with backlight (white/amber/red, permanent or flashing). The alarm condition display alternates between the normal temperature sensor reading display and the alarm display.



Using the Code value and describing this in the customer hand-out documentation it is possible to communicate various fault conditions from the building management system to the building users.

Network Alarm Value	Description
0	No Alarm
1	Red Backlight Flashing
2	Red Backlight Permanent
3	Amber Backlight Flashing
4	Amber Backlight Permanent
100-199	Display Code + Flashing Red Backlight
200-299	Display Code + Permanent Red Backlight
300-399	Display Code + Flashing Amber Backlight
400-499	Display Code + Permanent Amber Backlight
500-599	Display Code + No Backlight
600-999	Display Code + White Backlight at Installer Configured Level (None, 10 to 100%)

CO2 Measurement Enable

CO2 measurement is enabled by inserting CO2 link jumpers (two) on the Conn1.

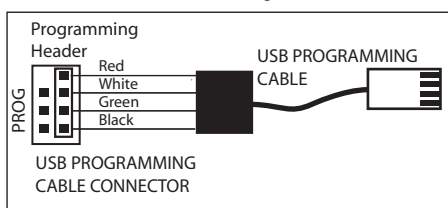
CO2 Measurement Auto-Calibration

The CO2 sensor has automatic auto-calibration feature. This feature monitors the background CO2 level over the calibration period (8 days), and calibrates the CO2 level to the lowest point measured during this period. The sensors are supplied as factory calibrated to the typical background levels. After powering up the sensor, the sensor carries out initial calibration within 1 day after which the CO2 level is calibrated every 8 days automatically. The auto calibration logic virtually eliminates the need for manual calibration in applications where the indoor CO2 drops to outside levels during unoccupied periods.

NOTE: If the CO2 sensor is fitted in spaces where the background level does not drop close to the typical background level (= fresh air) of 400ppm (e.g. greenhouses) it is essential that the auto-calibration feature is disabled during the commissioning. This can be done using CO2 tool.

Configuration Parameters and Programming

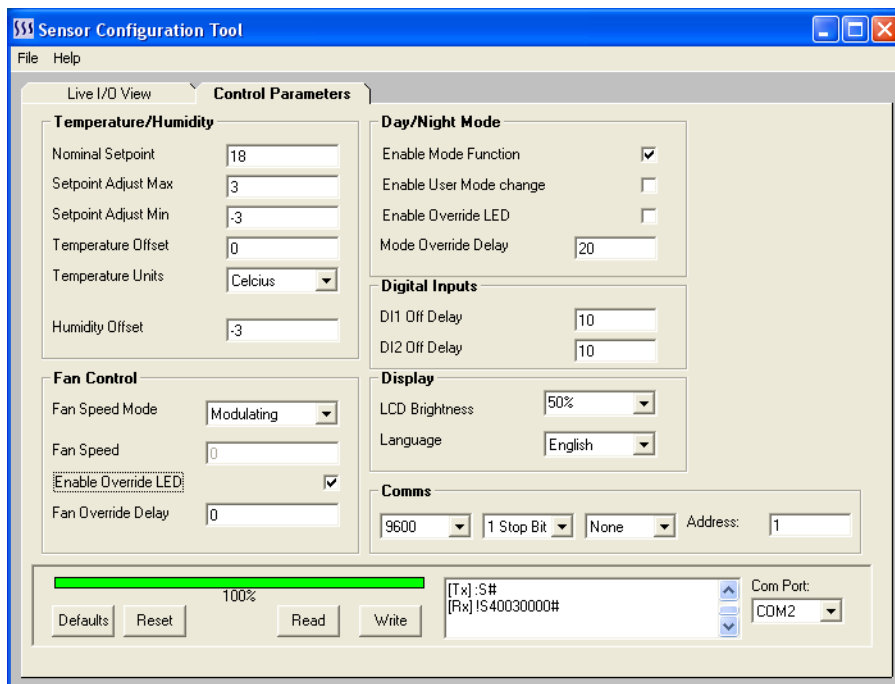
The parameter options can be configured using the DCT Device Configuration Tool software; or over the BACnet MS/TP (few advanced settings are available only through the configuration tool). The DCT Configuration software is connected via the PC USB cable to the programming header of the device as shown on the image below.



The correct process for connecting the room interface via the USB is as follows:-

- Disconnect USB Connector from PC
- Power Down the Room Interface
- Plug-In the 4-Way Connector to the Room Interface Unit
- Connect the USB to the PC
- Power Up the Room Interface Unit

NOTE: Always disconnect USB from PC before plugging the cable into the Room Interface Unit.



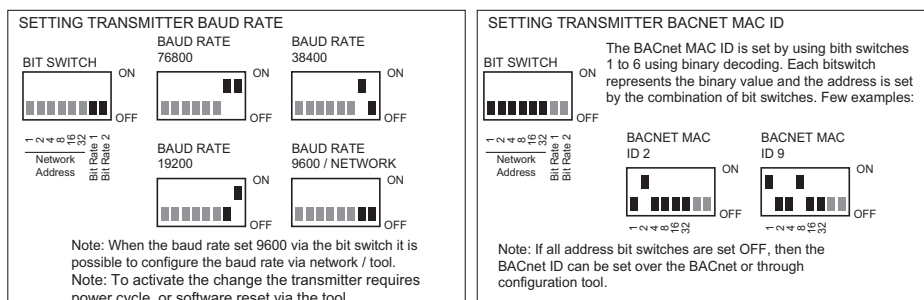
Parameter Storage

The configuration parameters are stored in the non-volatile memory. When the changes are carried out over the BACnet MS/TP network, then "NonVol Update" flag is required to be forced on to save the changes. The NonVol Update parameter returns automatically to the off state once the values have been stored. The DCT tool applies automatically the non-volatile memory save when configuration changes are applied. An additional configuration parameter is available to store the parameters & user adjustment to the non-volatile after every setpoint adjustment of the unit.

Setting Up BACnet Address and Baud Rate

The BACnet address and the baud rate is normally set through the bit switch. It is also possible to set the address and baud rate over the configuration tool or over the BACnet communication network.

NOTE: From software version 1.43 onwards the new settings are activated automatically after the bit switches have been altered. The earlier versions require software reset or power down/up cycle.



BACnet Interoperability Building Blocks Supported (Annex K)

Application Service	Initiate	Execute	BIBB
ReadProperty		Yes	DS-RP-B
ReadPropertyMultiple		Yes	DS-RPM-B
WriteProperty		Yes	DS-WP-B
ReinitializeDevice		Yes	
Who-Is		Yes	DM-DDB-B
I-Am	Yes		
Who-Has		Yes	DM-DOB-B
I-Have	Yes		
DeviceCommunicationControl		Yes	DM-DCC-B

BACnet Standard Object Types Supported

No dynamic Creation or Deletion supported. Objects, and object instances, are assigned to fixed functions within the proprietary control application of the product as follows:

Object	Number Of Instances	Instance Assignments
Device Object	1	
Analog Input	6	AI(0) – Temperature Sensor AI(1) – Current Setpoint Adjust AI(2) – Humidity Sensor AI(3) – R11 AI(4) - User Fan Speed AI(5) - CO2 Sensor
Analog Output	3	AO(0) – Y1 Output
Analogue Value	3	AV(0) – Temperature Setpoint AV(1) – Fan Speed AV(2) – Alarm Code
Binary Input	2	BI(0) – DI1 input BI(1) - Day/Night Mode Status
Binary Output	8	BO(0) – DO1 Output BO(1) – DO2 Output BO(2) = Heating Symbol BO(3) = Cooling Symbol BO(4) = Open Arrow Symbol BO(5) = Close Arrow Symbol BO(6) = Day/Night Model BO(7) - SPA Reset

Device Object Properties (Required Object Properties)

Property Name /ID	Attributes	Range	Default
Object Identifier	R/W		MAC_Address + 651000 (adjustable)
Object Name	R/W	32 Characters Max	Concatenation of product type and MAC address i.e. "RIU_001"
Object Type	R		8
System Status	R		STATUS_OPERATIONAL
Vensor Name	R		SyxthSense
Vendor Identifier			651
Model Name	R		URD
Protocol Version	R		1
Protocol Revision	R		10
Max APDU Length	R		480
Segmentation Support	R		No
APDU Timeout	R		3000 ms
Number APDU Retries	R		3
MaxMaster	R		127
Max_Info_Frames	R		1
Database Revision	R		0

Analogue Input Objects

	Property Name /ID	Attributes	Range	Default
Required Object Properties	Object Identifier	R		
	Object Name	R		AI(0): "Sensor_Temperature" AI(1): "Setpoint Adjust" AI(2): "Sensor_Humidity" AI(3): "R1" AI(4): "User Fan Speed"
	Object Type	R		0
	Present Value	R/W	AI(0): 0..150 AI(1): 0..150 AI(2): 0..100 AI(3): 0..50000 AI(4): 0..100	
	Status Flag	R		
	Event State	R		
	Out-Of-Service	R/W		FALSE
	Units	R		AI(0): UNITS_DEGREES_CELCIUS or UNITS_DEGREES_FAHRENHEIT AI(1): UNITS_DEGREES_CELCIUS or UNITS_DEGREES_FAHRENHEIT AI(2): UNITS_PERCENT AI(3): UNITS_OHMS AI(4): NO_UNITS AI(5): PARTS_PER_MILLION
Optional Properties	None			
Proprietary Properties	None			

Analogue Output Objects

	Property Name /ID	Attributes	Range	Default
Required Object Properties	Object Identifier	R		
	Object Name	R		AO(0) = "Y1"
	Object Type	R		1
	Present Value	R/W	0..100	
	Status Flag	R		
	Event State	R		
	Out-Of-Service	R/W		FALSE
Units	R		UNITS_PERCENT	
Optional Properties	None			
Proprietary Properties	None			

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Analogue Value Objects

	Property Name /ID	Attributes	Range	Default
Required Object Properties	Object Identifier	R		
	Object Name	R		AV(0) = "Setpoint_Temperature" AV(1) = "Fan Speed" AV(2) = "Alarm Code"
	Object Type	R		2
	Present Value	R/W	AV Instance 0: 0..150 AV(6): 0..10	
	Status Flag	R		
	Event State	R		
	Out-Of-Service	R/W		FALSE
	Units	R		AV(0) = UNITS_DEGREES_CELSIUS or UNITS_DEGREES_FAHRENHEIT AV(6) = NO_UNITS
	Priority Array	R		
	Relinquish Default	R/W		AV(0) = Nonvol Temperature Setpoint
Optional Properties	None			
Proprietary Properties	None			

Binary Input Objects

	Property Name /ID	Attributes	Range	Default
Required Object Properties	Object Identifier	R		
	Object Name	R		BI(0) = "D11" BI(1) = "Operating Mode"
	Object Type	R		3
	Present Value	R/W	0..1	
	Status Flags	R		
	Event State	R		
	Out-Of-Service	R/W		FALSE
	Polarity	R/W		POLARITY_NORMAL
	Active Text	R		"on"
	Inactive Text	R		"off"
Optional Properties	None			
Proprietary Properties	None			

Binary Output Objects

	Property Name /ID	Attributes	Range	Default
Required Object Properties	Object Identifier	R		
	Object Name	R		BO(0) = "DO1" BO(1) = "DO2" BO(2) = "Heating Symbol" BO(3) = "Cooling Symbol" BO(4) = "Open Arrow Symbol" BO(5) = "Close Arrow Symbol" BO(6) = "Day/Night Model" BO(7) = "SPA Reset"*1
	Object Type	R		4
	Present Value	R/W	0..1	
	Status Flags	R		
	Event State	R		
	Out-Of-Service	R/W		FALSE
	Polarity	R/W		POLARITY_NORMAL
	Priority Array	R		
	Relinquish Default	R/W		BINARY_INACTIVE
	Active Text	R		"on"
Inactive Text	R		"off"	
Optional Properties	None			
Proprietary Properties	None			

Note 1: Setting "SPA Reset" to true, disables the user setpoint adjustment.

Proprietary Object Types

No dynamic Creation or Deletion supported

Object	Number Of Instances	Instance Assignments
Application Configuration Object	1	Provides a container for all the proprietary application specific properties. Proprietary Property Id's within the object have been deliberately chosen to correspond to the equivalent Modbus register addresses for this product.

App_Config Object

	Property Name /ID	Attributes	Range	Default
Required Object Properties	Object Identifier	R		MAC_Address + 651000
	Object Name	R		"App_Config"
	Object Type	R		128
Optional Properties	None			

	Property ID	Description	BACnet Data Type	Range
Proprietary Properties	30100	Firmware Version	Unsigned	Read Only
	40004	Output Y1 Mode	Unsigned	0 = Network Value
	40005	Output Y2 Mode	Unsigned	0 = Network Value
	40008	DO 1 Mode	Unsigned	0 = Network Value
	40009	DO 2 Mode	Unsigned	0 = Network Value (Default)
	40015	Temperature Control Setpoint	Unsigned	0.0...150.0°C/°F (Default 20°C)

40034	Delay Time Setting for Fan Override	Unsigned	1..7200 Seconds
40035	Delay Time Setting for Mode Override	Unsigned	1..7200 Seconds
40036	Setpoint Adjuster / Potentiometer Low Position	REAL	-500.0..0 (-3.0) Default
40037	Setpoint Adjuster / Potentiometer High Position	REAL	0..+500.0 (3.0) Default
40039	Temperature Unit Selection	Unsigned	0 = Celsius 1 = Fahrenheit
40047	One Point Temperature Calibration Field	REAL	-3.0..+3.0°C/°K (Default 0°C)
40050	MAC Address	Unsigned	0..255
40051	Baud Rate	Unsigned	0 = 9600 (Default) 1 = 19200 2 = 38400 3 = 57600
40067	Hold On Delay Setting for Digital Input 1	Unsigned	1..7200 Seconds
40068	Hold On Delay Setting for Digital Input 2	Unsigned	1..7200 Seconds
40100	Force Reset	Unsigned	0 = Normal 1 = Force Reset
40101	Non Volatile Memory Update	Unsigned	0 = Normal 1 = Update
40103	Force Factory Defaults	Unsigned	0 = Normal 1 = Force Defaults

Dimensions

