BASR

Versatile BACnet/IP Controller/Gateway

BASremote

User Manual

TD040300-0MH

(for firmware version 3.7.x)

CONTEMPORARY CONTROLS®

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> **WARNING — This is a Class A product as defined in EN55022.**
> **In a domestic environment this product may cause radio interference**
> **in which case the user may be required to take adequate measures.**

TD040300-0MH

1 Table of Contents

2 Introduction

The **BASremote Master** provides the ultimate in flexibility. It can be used for Expansion I/O at remote locations where an Ethernet connection exists. Its built-in router and gateway capability addresses unique integration needs where more than one communications protocol is involved. It can function as a controller with its resident Sedona Virtual Machine. Powered by a Linux engine, the **BASremote Master** can operate as BACnet/IP or Modbus TCP remote I/O, Sedona controller, Modbus Serial to Modbus TCP router, Modbus Serial to BACnet gateway, and Modbus master to attached Modbus slaves – all at the same time. You can customize the unit via custom web pages that utilize special java applets provided in the device. A 10/100 Mbps Ethernet port allows connection to IP networks and popular building automation protocols such as Modbus TCP, BACnet/IP, and Sedona SOX. Six universal I/O points and two relay outputs can be configured through resident web pages using a standard web browser and without the need of a special programming tool. A 2-wire Modbus serial port can greatly expand the I/O count with built-in routing to Modbus TCP clients. If BACnet mapping is preferred, the unit incorporates a Modbus serial to BACnet/IP gateway. Additional universal I/O can be achieved with the simple addition of **BASremote Expansion** modules. **The BASremote Master PoE** has the same capabilities as the **BASremote Master** except it is powered over the Ethernet connection — thereby providing a "One Cable Solution."

Both the **BASremote Master** and **BASremote Expansion** modules have the same I/O capability. Six universal input/output points are provided on each module. Depending upon configuration, each unit can accommodate a contact closure from a digital point, a thermistor, voltage or current analog input from a field transmitter or supervisory controller. Analog inputs can range from 0–5 VDC, 0–10 VDC or 0–20 mA. Inputs can be scaled to accommodate ranges such as 1–5 VDC, 2–10 VDC, and 4–20 mA. Input point resolution is 10-bits.

Type II and III 10 kΩ thermistor calibration curves are resident in the BASremote. Single-point calibration of temperature is accomplished using the internal web server. Inputs can accept pulse trains in the range of 0–40 Hz (50% duty cycle) to measure flow rates.

Analog outputs can be 0–10 VDC or 0–20 mA. However, scaling for 2–10 V, 0–5 V, 1–5 V and 4–20 mA is possible. LED indicators identify the state of I/O points. Output point resolution is 12 bits.

There are two relay outputs available with both normally open (NO) and normally closed (NC) contacts. The relay output rating is 30 VAC/VDC, 2A.

There are two non-isolated 2-wire EIA-485 Expansion ports on the Master module. The downstream port (DN) is intended for Expansion modules while the Modbus (MB) port functions as either a Modbus TCP router or Modbus serial to BACnet gateway — allowing for the attachment of Modbus 2-wire or 3-wire EIA-485 serial devices. On BASremote Expansion modules, the two ports are marked UP and DN, and are dedicated for communication with the **BASremote Master** module and other Expansion modules.

All field connectors are removable — making field replacement of units quick and simple.

A single RJ-45 shielded connector provides the 10/100 Mbps twisted-pair Ethernet connection. The unit supports auto-negotiation of data rate and duplex. A resident web server facilitates commissioning and troubleshooting. Configuration is accomplished via Ethernet. Java must be enabled in the browser used to access the BASremote.

Power for the **BASremote** can be derived from a 24 VAC Class 2 transformer capable of delivering 17 VA or from a 24 VDC power supply capable of at least 10 W. Since the unit incorporates a half-wave rectified power supply, attached I/O points and the power supply can share a common ground. Therefore, the **BASremote** can be powered by the same control transformer used to power other half-wave rectified control equipment. The **BASremote** can be DIN-rail mounted into a control panel. If panel mounting is required, use the supplied mounting tabs.

The **BASremote** conforms to the BACnet/IP standard and therefore allows field I/O to be directly accessed via Ethernet without the need of a router. A standard web browser with Java enabled is used for commissioning and troubleshooting. The **BASremote** adheres to the BACnet Application Specific Controller (B-ASC) profile.

The Sedona application can send emails when a specific event occurs in the Sedona application. These contain text to describe alarms and component input values. Different emails can be sent to different email addresses.

The **BASremote Master** includes a trending feature for all channels including connected **BASremote Expansion** units and any mapped Modbus devices (Serial or Modbus TCP).

The **BASremote Master** firmware can be upgraded via a webpage screen. Use the *Browse* button to select the firmware file supplied by Contemporary Controls to upload, and then press *Upload*.

2.1 Features and Benefits

Versatile Control Device — remote I/O, router, gateway and controller

- Web-page configuration
- BACnet/IP Remote I/O
- Modbus TCP Remote I/O
- Modbus Serial to Modbus TCP Router
- Modbus Serial to BACnet/IP Gateway
- Modbus Master to Attached Modbus Slaves
- *Powered by Sedona* Controller
- Power over Ethernet (PoE)
- Java Applets for customisable web pages
- Trending for all onboard and attached channels

Flexible Input/Output — expandable by adding modules

- Six universal input/output points — web-page configurable
- Two relay outputs
- Thermistor, voltage, current, contract closure and pulse inputs
- Voltage, current and relay outputs
- 2-wire Modbus Serial Expansion port
- 2-wire Expansion port for up to three Expansion modules

2.2 Product Image (Master Module)
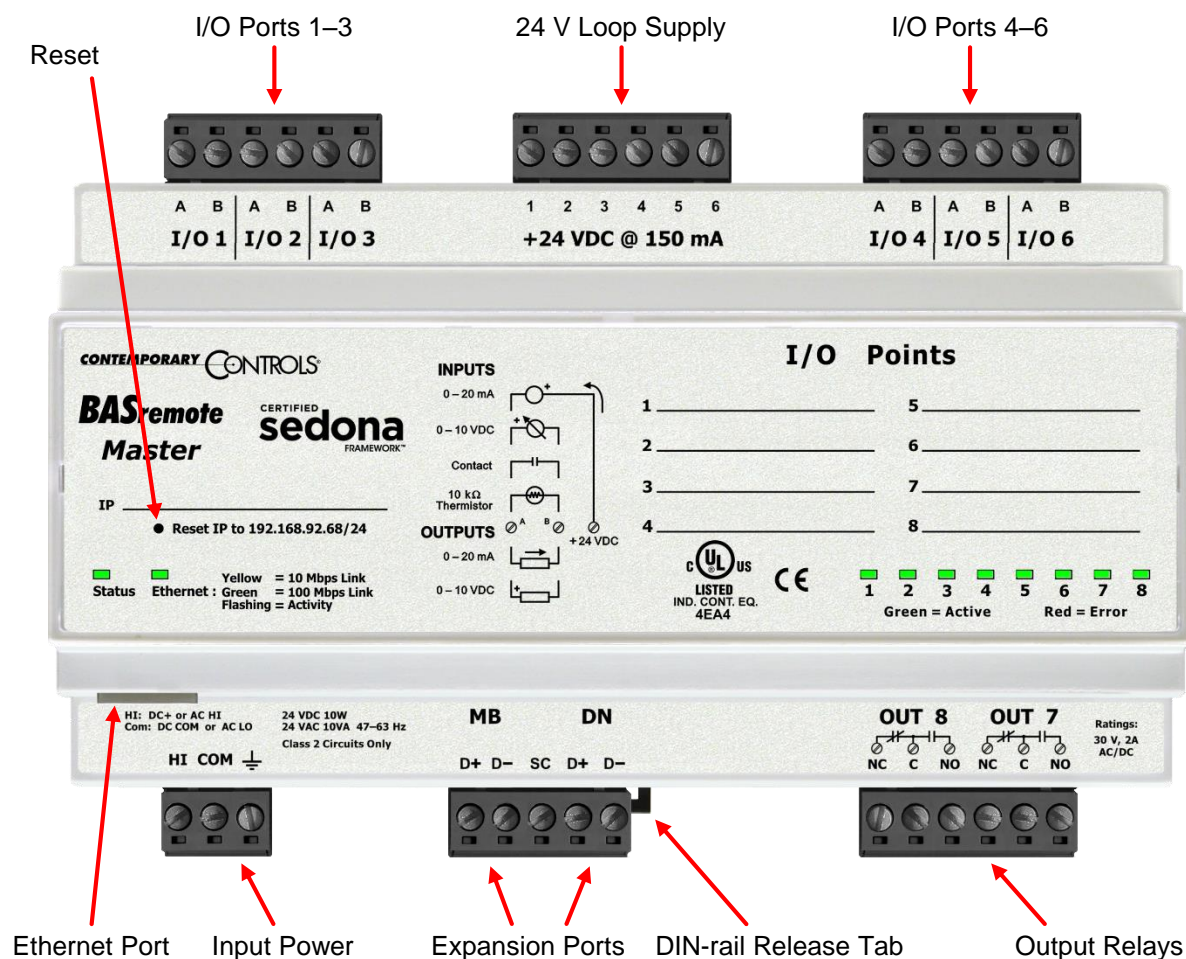
Figure 1 — BASremote Master Module Main Features

3 Specifications

3.1 Universal Input/Outputs — Channels 1–6

Configured As	Limits
Analog Input	0–5 VDC, 0–10 VDC or 0–20 mA scalable by user. 10-bit resolution. Input impedance 100 kΩ on voltage and 250 Ω on current.
Temperature Input	Type II or Type III thermistors +40°F to +110°F (+4.4°C to +44°C)
Contact closure input	Excitation current 2 mA. Open circuit voltage 24 VDC. Sensing threshold 0.3 VDC. Response time 20 ms.
Pulse input	0–10 VDC scalable by user. User adjustable threshold. 40 Hz maximum input frequency with 50% duty cycle.
Analog Output	0–10 VDC or 0–20 mA scalable by user. 12-bit resolution. Maximum burden 750 Ω when using current output.

3.2 Relay Outputs — Channels 7–8

Limits
Form "C" contact with both NO and NC contacts available. 30 VAC/VDC 2 A. Class 2 circuits only.

3.3 Communications

Protocol	Data Link and Physical Layers
BACnet/IP — Master only	ANSI/IEEE 802.3 10/100 Mbps Ethernet. 10BASE-T, 100BASE-TX, auto-negotiation of speed and duplex. Auto-MDIX. 100 m maximum segment length. Default IP address is 192.168.92.68/24.
Modbus TCP — Master only	
Expansion Bus (UP/DN)	Modified Modbus serial protocol. 2-wire non-isolated EIA-485 57.6 kbaud. Maximum segment length 100 m.
Modbus Serial — Master only (MB Bus)	Modbus serial ASCII or RTU protocol. 2-wire non-isolated EIA-485. 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbps. Max segment length 100 m. Jumper selectable bias and termination.

3.4 Protocol Compliance

Protocol	Compliance
BACnet/IP	ASHRAE 135-2008 annex J. Application specific controller device profile B-ASC.
Modbus TCP	Modbus Application Protocol Specification V1.1b Dec. 28, 2006, Modbus.org. Modbus Messaging on TCP/IP Implementation Guide V1.0b October 24, 2006, Modbus.org.
Modbus serial	Modbus over Serial Line Specification and Implementation Guide V1.02 December 20, 2006, Modbus.org.

3.5 Power Requirements

Item	Limits
Input power	Master module: 24 VAC/VDC ± 10%, 47–63 Hz, 17 VA Master PoE module: 48 VDC ± 10% 10 W Expansion module: 24 VAC/VDC ± 10%, 47–63 Hz, 17 VA
Loop supply	+24 VDC nom, 150 mA maximum

3.6 General Specifications

Item	Description
Protection	All inputs and outputs (except for relay outputs and communications ports) are over-voltage protected up to 24 VAC and short-circuit protected.
Environmental	Operating temperature 0° to +60°C. Storage temperature –40°C to +85°C. Relative humidity 10 to 95%, non-condensing.
Weight	0.6 lbs. (0.27 kg).

3.7 LED Indicators

LED Indicator	Indication
I/O 1–6 configured as Analog input	Green: > 1% of range, otherwise off
I/O 1–6 configured as Temperature input	Green: sensor detected Red: open
I/O 1–6 configured as Contact input	Green: contact closed, otherwise off
I/O 1–6 configured as Pulse input	Green: pulse sensed, otherwise off
I/O 1–6 configured as Analog output	Green: commanded output Red: expected output not within 40 mV on voltage or 0.2 mA on current
Status	Red: device in reset Green flashing: booting up Green: running application
Ethernet — Master module only	Yellow: 10Mbps; flashes with activity Green: 100 Mbps; flashes with activity
Network — Expansion module only	Green flashing: Expansion bus activity

3.8 Electromagnetic Compatibility

Standard	Test Method	Description	Test Levels
EN 55024	EN 61000-4-2	Electrostatic Discharge	6 kV contact
EN 55024	EN 61000-4-3	Radiated Immunity	10 V/m, 80 MHz to 1 GHz
EN 55024	EN 61000-4-4	Fast Transient Burst	1 kV clamp & 2 kV direct
EN 55024	EN 61000-4-5	Voltage Surge	1 kV L-L & 2 kV L-Earth
EN 55024	EN 61000-4-6	Conducted Immunity	10 V (rms)
EN 55024	EN 61000-4-11	Voltage Dips & Interruptions	1 Line cycle, 1–5 s @100% dip
EN 55022	CISPR 22	Radiated Emissions	Class A
EN 55022	CISPR 22	Conducted Emissions	Class B
CFR 47, Part 15	ANSI C63.4	Radiated Emissions	Class A

3.9 Field Connections

Terminal	Universal I/Os 1 – 3
I/O 1 A	Universal I/O point 1 high
I/O 1 B	Universal I/O point 1 low
I/O 2 A	Universal I/O point 2 high
I/O 2 B	Universal I/O point 2 low
I/O 3 A	Universal I/O point 3 high
I/O 3 B	Universal I/O point 3 low

Terminal	Universal I/Os 4 – 6
I/O 4 A	Universal I/O point 4 high
I/O 4 B	Universal I/O point 4 low
I/O 5 A	Universal I/O point 5 high
I/O 5 B	Universal I/O point 5 low
I/O 6 A	Universal I/O point 6 high
I/O 6 B	Universal I/O point 6 low

Terminal	Relay Outputs
OUT 8 NC	Output 8 normally-closed contact
OUT 8 C	Output 8 common
OUT 8 NO	Output 8 normally-open contact
OUT 7 NC	Output 8 normally-closed contact
OUT 7 C	Output 8 common
OUT 7 NO	Output 8 normally-open contact

Terminal	+24 VDC @ 150 mA Loop Supply
1	+24 VDC
2	+24 VDC
3	+24 VDC
4	+24 VDC
5	+24 VDC
6	+24 VDC

Terminal	Expansion Ports — Master Module
MB-D+	Modbus Serial Bus positive terminal
MB-D–	Modbus Serial Bus negative terminal
SC	Modbus signal common
DN-D+	Downstream Expansion positive terminal
DN-D–	Downstream Expansion negative terminal

Terminal	Expansion Ports — Expansion Module
UP-D+	Upstream Expansion positive terminal
UP-D–	Upstream Expansion negative terminal
SC	Not used
DN-D+	Downstream Expansion positive terminal
DN-D–	Downstream Expansion negative terminal

Terminal	Power — Master Module*
HI	High AC or DC +
COM	AC or DC common
Earth	Optional earthing connection

Terminal	Power — Expansion Module*
HI	High AC or DC +
COM	AC or DC common
Earth	No connection

* BASR-M model only

3.10 Ordering Information

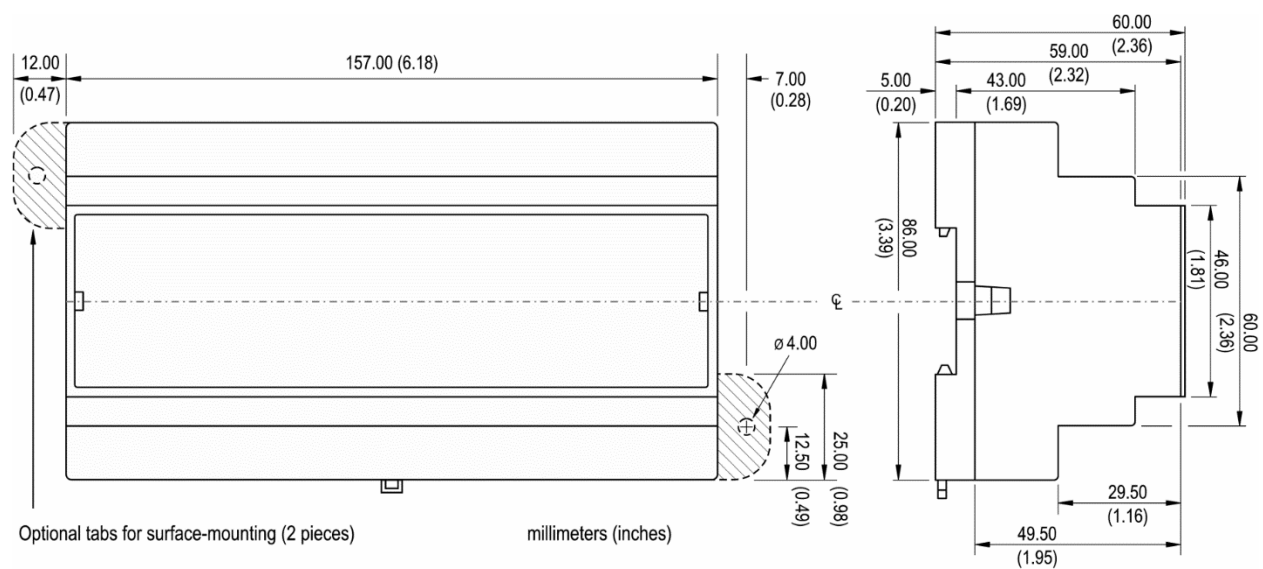| Model	Description
BASR-8M	**BASremote Master** with eight I/O points
BASR-8X	BASremote Expansion with eight I/O points
BASR-8M/P	**BASremote Master** PoE with eight I/O points

3.11 Dimensional Drawing

Figure 2 — BASremote Dimensions

3.12 PICS Statement

CONTEMPORARY CONTROLS®

BASremote
Versatile BACnet/IP Controller/Gateway

BACnet Protocol Implementation Conformance Statement (Annex A)

Date:	October 24, 2013
Vendor Name:	Contemporary Controls
Product Name:	BASremote
Product Model Number:	BASR-8M

Applications Software Version: 3.7.0   **Firmware Revision:** 3.7.0   **BACnet Protocol Revision:** 2

Product Description: BACnet/IP compliant 8-point Sedona Framework controller with Modbus Gateway.

BACnet Standardized Device Profile (Annex L):
- ☐ BACnet Operator Workstation (B-OWS)
- ☐ BACnet Advanced Operator Workstation (B-AWS)
- ☐ BACnet Operator Display (B-OD)
- ☐ BACnet Building Controller (B-BC)
- ☐ BACnet Advanced Application Controller (B-AAC)
- ☒ BACnet Application Specific Controller (B-ASC)
- ☐ BACnet Smart Sensor (B-SS)
- ☐ BACnet Smart Actuator (B-SA)

List all BACnet Interoperability Building Block Supported (Annex K):
DS-RP-B Data Sharing — ReadProperty – B
DS-WP-B Data Sharing — WriteProperty – B
DS-RPM-B Data Sharing — ReadPropertyMultiple – B
DS-COV-B Data Sharing — ChangeOfValue – B
DM-DDB-B Device Management — Dynamic Device Binding – B
DM-DOB-B Device Management — Dynamic Object Binding – B
DM-DCC-B Device Management — Device Communication Control – B
DM-TS-B Device Management — Time Synchronization – B

Segmentation Capability:
- ☐ Able to transmit segmented messages   Window Size:
- ☐ Able to receive segmented messages   Window Size:

Standard Object Types Supported:

Object Type Supported	Can Be Created Dynamically	Can Be Deleted Dynamically
Analog Input	No	No
Analog Output	No	No
Analog Value	No	No
Binary Input	No	No
Binary Output	No	No
Device	No	No

No optional properties are supported.

Data Link Layer Options:
- ☒ BACnet IP, (Annex J)
- ☒ BACnet IP, (Annex J), Foreign Device
- ☐ ISO 8802-3, Ethernet (Clause 7)
- ☐ ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
- ☐ ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s):
- ☐ MS/TP master (Clause 9), baud rate(s):
- ☐ MS/TP slave (Clause 9), baud rate(s):
- ☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):
- ☐ Point-To-Point, modem, (Clause 10), baud rate(s):
- ☐ LonTalk, (Clause 11), medium:
- ☐ BACnet/Zigbee (Annex O)
- ☐ Other:

Device Address Binding:
Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.)   ☐ Yes   ☒ No

Networking Options:
- ☐ Router, Clause 6 – List all routing configurations, e.g., ARCNET-Ethernet-MS/TP, etc.
- ☐ Annex H, BACnet Tunnelling Router over IP
- ☐ BACnet/IP Broadcast Management Device (BBMD)
  - Does the BBMD support registrations by Foreign Devices?   ☐ Yes   ☐ No
  - Does the BBMD support network address translation?   ☐ Yes   ☐ No

Character Sets Supported:
Indicating support for multiple character sets does not imply that they can all be supported simultaneously.
- ☒ ISO 10646 (UTF-8)
- ☐ ISO 10646 (UCS-2)
- ☐ IBM™/Microsoft™ DBCS
- ☐ ISO 10646 (UCS-4)
- ☐ ISO 8859-1
- ☐ JIS X 0208

If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports:
Modbus gateway support.

Network Security Options:
- ☒ Non-secure Device — is capable of operating without BACnet Network Security
- ☐ Secure Device — is capable of using BACnet Network Security (NS-SD BIBB)
- ☐ Key Server (NS-KS BIBB)

October 24, 2013   TD040301-0XF

4 Installation

The BASremote is intended to be mounted in an industrial enclosure or wiring closet on 35-mm DIN-rail or panel-mounted with screws (not provided). The panel-mounting tabs are packaged in a plastic bag within the shipping box. To use these tabs, Figure 3 illustrates how the two studs of each tab are press fitted into their respective holes in opposing corners of the case.
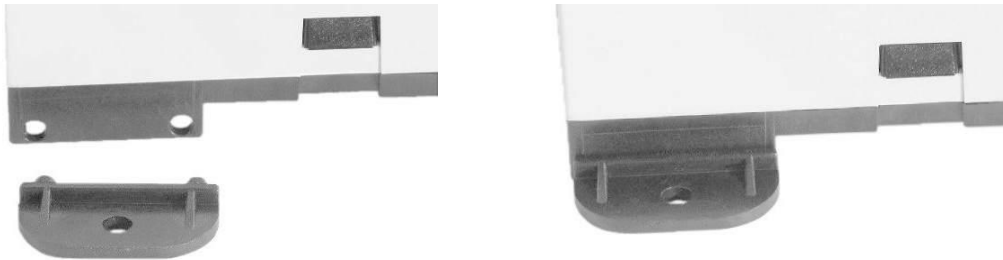

Figure 3 — Attaching Panel-Mounting Tabs

4.1 Power Supply

The power source for the internal supply is applied via the three terminals labelled *Earth*, *COM*, and *HI*. *Earth* allows external connection to earth if better EMC compliance is needed. *COM* is for the power source return and also serves as the BASremote common ground connection. Primary 24 VAC/VDC (± 10%) power is applied to *HI* and *COM*. *HI* connects to a diode accomplishes half-wave rectified power — while providing reverse input voltage protection.

Internally, the BASremote provides the 24 VDC loop supply to power external devices attached as inputs to the BASremote — you do not need a separate loop supply. Since the BASremote can source current via its analog outputs, an internal source of 24 VDC is provided for powering outputs. Collectively, the sum of input and output power cannot exceed 150 mA.

Maximum current draw for any I/O channel is 20 mA — yielding a total draw of 120 mA for all six channels. Analog output current sources from the same internal supply, so an external source of 24 VDC is unneeded — ***but a return common is***. Six +24 VDC pins are present to serve external transmitters, so they do not need a separate loop supply. However, the power supply must serve only its own BASremote module.

The BASremote requires 24 VDC or VAC from a source via a three-pin removable keyed connector. The proper connections for various power options are shown in Figure 4. Note that the **BASremote Master PoE** derives its power from the Ethernet cable and therefore no internal connection exists for the HI pin on the input power connector.

The recommended size for power conductors is 16–18 AWG (solid or stranded). Ground is directly connected to zero volts. Input connections are reverse-polarity protected.

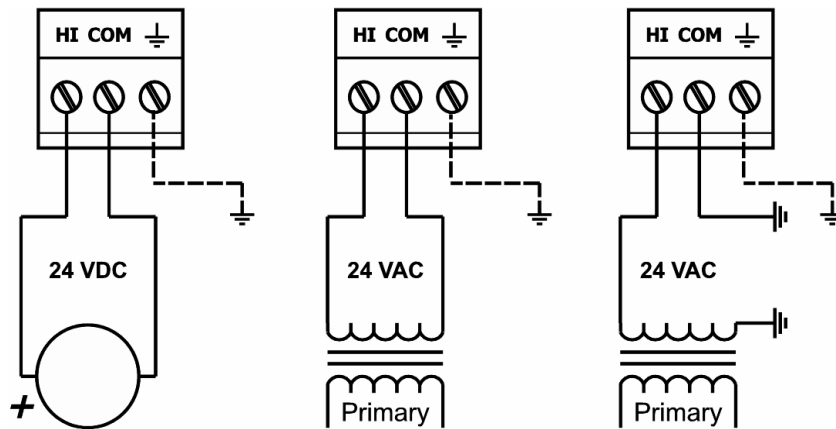**NOTE:** **This device is intended for use with Class 2 circuits.**

Figure 4 — Power Options

WARNING: Powering devices can present hazards. Read the next two sections carefully.

4.1.1   Power Supply Precautions

Internally, the BASremote utilizes a half-wave rectifier and therefore can share the same AC power source with other half-wave rectified devices. Sharing a common DC power source is also possible. Sharing AC power with full-wave rectified devices is NOT recommended. Full-wave rectified devices usually require a dedicated AC power source that has a secondary elevated above ground. Both secondary connections are considered HOT. AC power sources that power several half-wave devices have a common secondary connection called COMMON, LO, or GROUND. This connection might be tied to earth. The other side of the secondary is considered the HOT or HI side of the connection. Connect the HOT side of the secondary to the *HI* input on the BASremote and the LO side to *COM* on the BASremote. All other half-wave devices sharing the same AC power source need to follow the same convention. When using a DC power source, connect its positive terminal to the *HI* input on the BASremote and the negative terminal to *COM* on the BASremote. Reversing polarity to the BASremote will not damage the BASremote.

WARNING: Devices powered from a common AC source could be damaged if a mix of half-wave and full-wave rectified devices exist. If you are not sure of the type of rectifier used by another device, do not share the AC source with it.

4.1.2   Limited Power Sources

The BASremote should be powered by a limited power source complying with the requirements of the National Electric Code (NEC) article 725 or other international codes meeting the same intent of limiting the amount of power of the source. Under NEC article 725, a Class 2 circuit is that portion of the wiring system between the load side of a Class 2 power source and the connected equipment. For AC or DC voltages up to 30 volts, the power rating of a Class 2 power source is limited to 100 VA. The transformer or power supply complying with the Class 2 rating must carry a corresponding listing from a regulatory agency such as Underwriters Laboratories (UL).

4.2 Connecting Expansion Equipment

Input/output points beyond those available from the **BASremote Master** module can be increased by adding BASremote Expansion modules or by attaching Modbus serial devices to the MB bus. The *MB* port is used for connecting to 2-wire Modbus serial devices while the *DN* port is used for connecting to BASremote Expansion modules. Both ports are non-isolated EIA-485 compatible.

When installing equipment, make a record that identifies the power source, equipment locations, IP and MAC ID numbers, protocol in use, baud rate, cable colour coding, etc. — anything that will be helpful for future staff.

4.2.1 BASremote Expansion Module Connections

Expansion modules are intended to occupy positions to the right or left of the Master module on the same DIN-rail or on additional DIN-rails within the same control panel. In this situation only a short 2-wire twisted-pair cable is needed for making connections between *DN* on the Master module and *UP* on the first Expansion module. Up to three Expansion modules can attach to the Master module using a daisy-chain wiring scheme. The second Expansion module has its *UP* port connected to the preceding Expansion module's *DN* port. The last Expansion module will have a vacant *UP* port. The *D+* terminal on one device must attach to the *D+* terminal on the other. The same applies to the *D–* terminals. Bias and termination exists on the *UP* terminals. See Figure 6 for wiring details. For short connections, unshielded cable can be used. Expansion modules are automatically assigned Modbus addresses beginning with 2 based upon its position to the Master within the daisy-chain wiring.

4.2.1.1 Bias and Termination

Each Master and Expansion module has two Expansion ports. The Master ports are labelled *MB* and *DN*; the Expansion ports are *UP* and *DN*. These are shared buses where only one device drives the bus at any one time. When no device is driving the bus, the bus floats. To prevent noise from being interpreted as data, the bus must be biased to a valid state. (The Modbus Serial specification calls this polarization.) With no data on the bus, the *D+* pin is biased to be more positive than the *D–* pin. Bias is applied at only one point on the bus: the Master provides bias internally on its *MB* port, the Expansion does so on its *UP* port.

4.2.1.2 Communicating from Master to Expansion Modules

The Master uses the downstream port *DN* to communicate to the upstream port *UP* on the Expansion. If additional Expansion modules are used, they are cascaded such that the *DN* port of the Expansion module nearest the Master is connected to the *UP* port on the added Expansion module. Commands received by an Expansion module's *UP* port are relayed to its *DN* port while being read by the module itself. Similarly, a response received at the *DN* port is transferred to the *UP* port — eventually arriving at the Master. Thus all connections (Master-Expansion and Expansion-Expansion) are point-to-point with termination and bias in each *UP* transceiver. *DN* ports have termination only.

4.2.2 Modbus Serial Bus Connections

The Modbus serial Expansion port (MB) on the **BASremote Master** module is non-isolated EIA-485 compatible. When connecting to other non-isolated devices, care must be exercised to ensure that all non-isolated Modbus devices share the same ground reference (*COM*) with the **BASremote Master** module. This is usually accomplished by sharing the same power source. Configure the Modbus baudrate and protocol using the BASremote Modbus port web page.
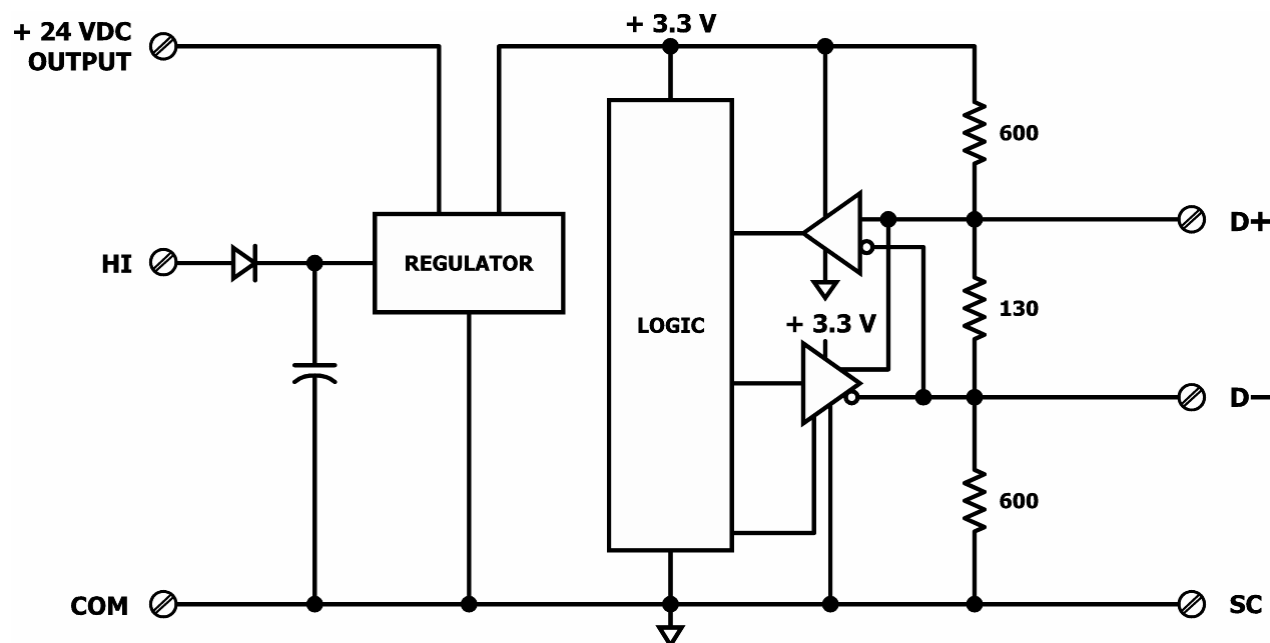

Figure 5 — Internal Termination and Bias

When connecting to an isolated 3-wire Modbus device, the signal common of the isolated device must be connected to the *SC* pin between the *MB* and *DN* ports. This ties the two reference points together for reliable communications. Refer to Figure 6 for wiring details.

Modbus serial device can only be attached to the *MB* port on the Master module. Refer to Figure 5 for details on the bias and termination network present on the *MB* port. Together, these resistors approximate one 120 Ω terminating resistor. Terminal *D+* represents the more positive connection for the EIA-485 Modbus serial network while *D–* represents the less positive connection. Make corresponding connections to Modbus serial devices. The last device on the bus should have applied bias and termination or just termination. A shielded twisted-pair cable should be used with interconnecting devices. Connect the shields together and attached to chassis at only one point. Refer to Figure 6 for wiring details.

4.2.3   Cabling Considerations

When attaching cables to the BASremote, Table 1 should be considered.

Function	Signalling and Data Rate	Minimum Required Cable	Maximum Segment Distance
Ethernet	10BASE-T 10 Mbps	Category 3 UTP	100 m (328 ft)
Ethernet	100BASE-TX 100 Mbps	Category 5 UTP	100 m (328 ft)
I/O	Unspecified	Solid: 16–22 AWG Stranded: 16–18 AWG	Unspecified
Expansion	Unspecified	Belden® 9841 or equivalent*	100 m (328 ft)
Modbus	Varied	Belden® 3106A or equivalent*	100 m (328 ft)

Table 1 — Cabling Considerations

* If using shielded cable, connect to chassis at only one point.

NOTE: Wire size may be dictated by electrical codes for the area where the equipment is being installed. Consult local regulations.

Observe in Table 1 that 10BASE-T segments can successfully use Category 3, 4 or 5 cable — but 100BASE-TX segments *must* use Category 5 cable. Category 5e cable is highly recommended as the minimum for new installations.

The Ethernet port of the BASremote employs Auto-MDIX technology so that either straight-through or crossover cables can be used to connect to the network.

5 Field Connections
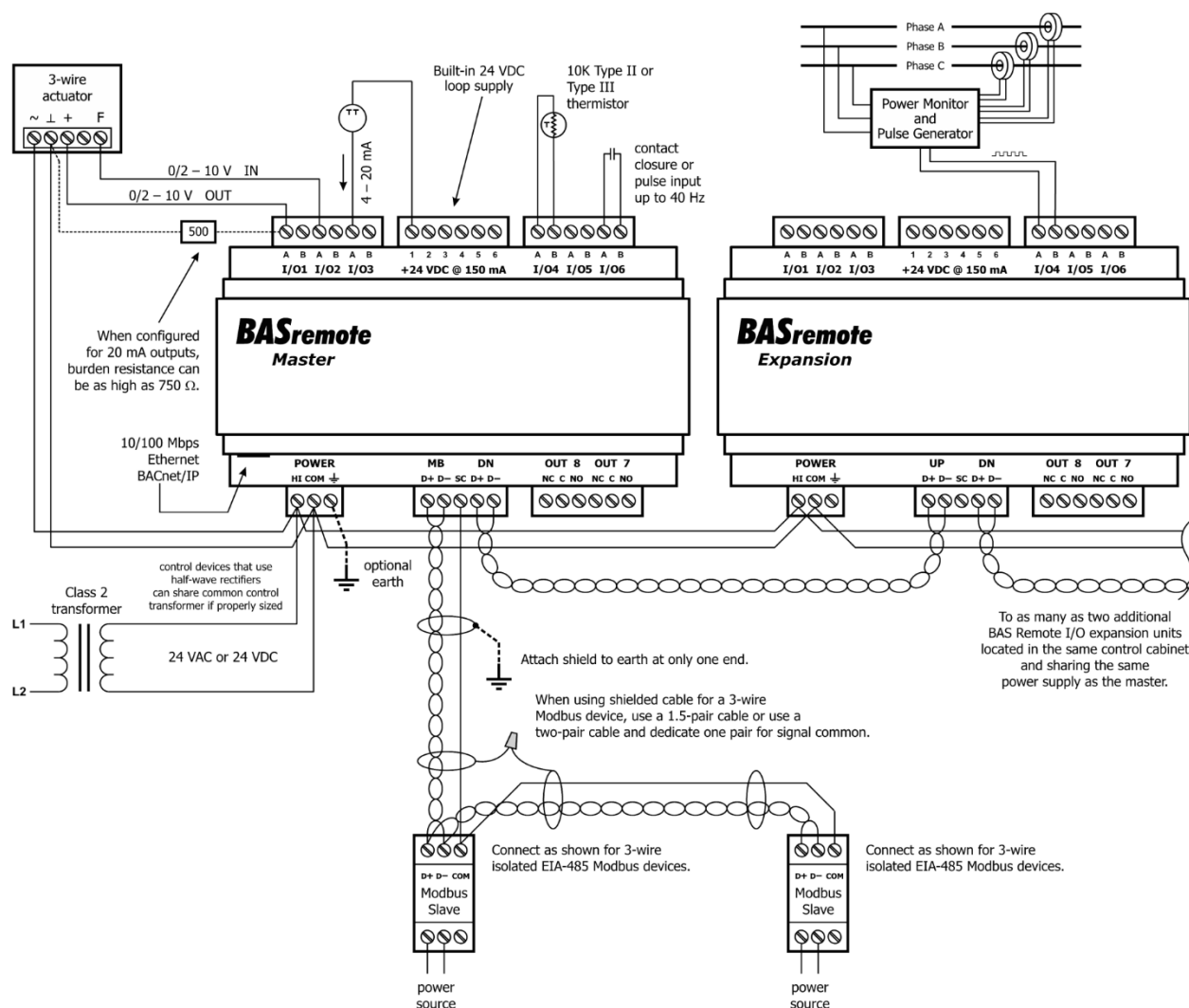
5.1 Sample BASremote Wiring Diagram

Figure 6 — Sample BASremote Wiring Diagram

Wire Channels 1–6 so the most positive wire goes to the "A" terminal and the most negative wire to the "B" terminal.

The wiring options for Channels 1–6 are shown in Figure 7. For each case in which polarity matters, proper polarity is indicated.

Considerations in making field connections for various types of input and output devices are discussed in the following pages.
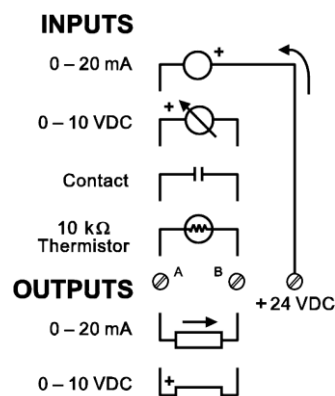

Figure 7 — I/O Options (Channels 1–6)

5.2 Thermistors

The BASremote has built-in calibration curves for 10 kΩ Type II or Type III thermistors. These devices have a non-linear with a negative coefficient of resistance to temperature and provide a nominal resistance of 10 kΩ at 25°C. Using the web server, configure an input for either Type II or Type III thermistor. As shown in Figure 8 (using an Expansion module), connect the two-wire thermistor to points A and B. Polarity is not an issue. If averaging of temperature is desired, connect multiple thermistors in a series-parallel combination so that the nominal resistance remains at 10 kΩ as shown. Make sure that all devices are of the same type. The effective range of temperature measurement is from +40° to +110°F (+4.4° to +44°C). An open input results in a fault condition that produces a red LED indication for that channel.
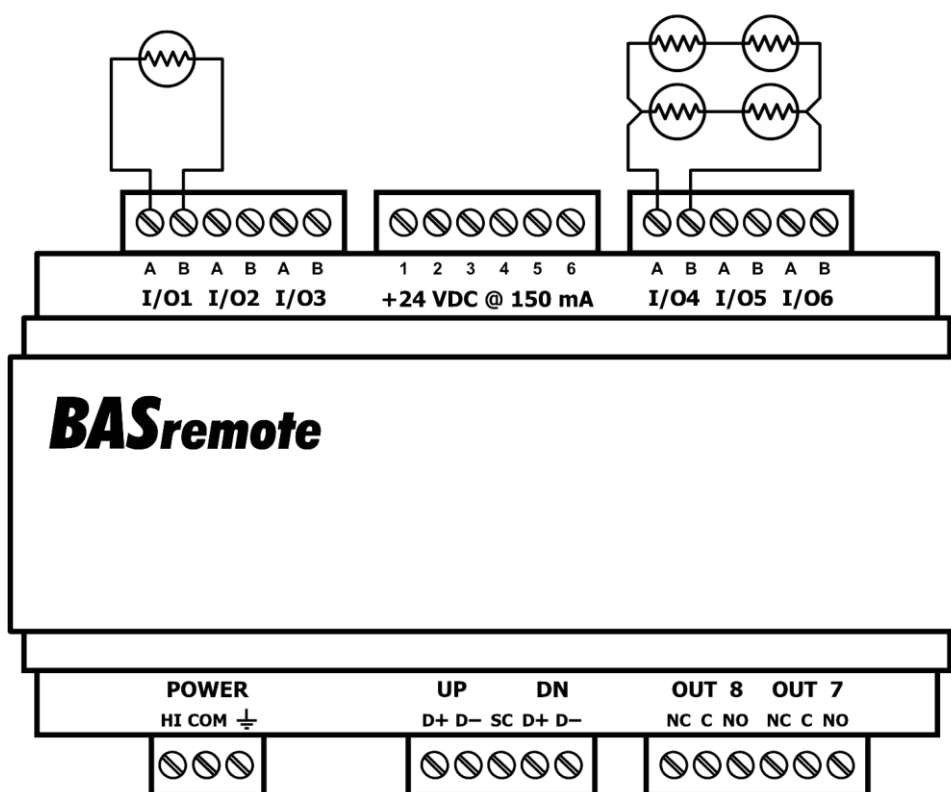

Figure 8 — Thermistor Connections

5.3 Contact Closure

The BASremote can sense the make or break of a contact from a relay or push-button. The contacts being sensed must be absent of any applied source of energy, and be rated for low-voltage, low-current switching. The BASremote will provide the electrical energy to be sensed. Using the web server, configure an input for contact closure. As shown in Figure 9 (using an Expansion module), simply connect the contacts between points *A* and *B*. For common mechanical contacts, polarity is not an issue. The open-circuit voltage is 24 VDC and the short-circuit current is 2 mA.
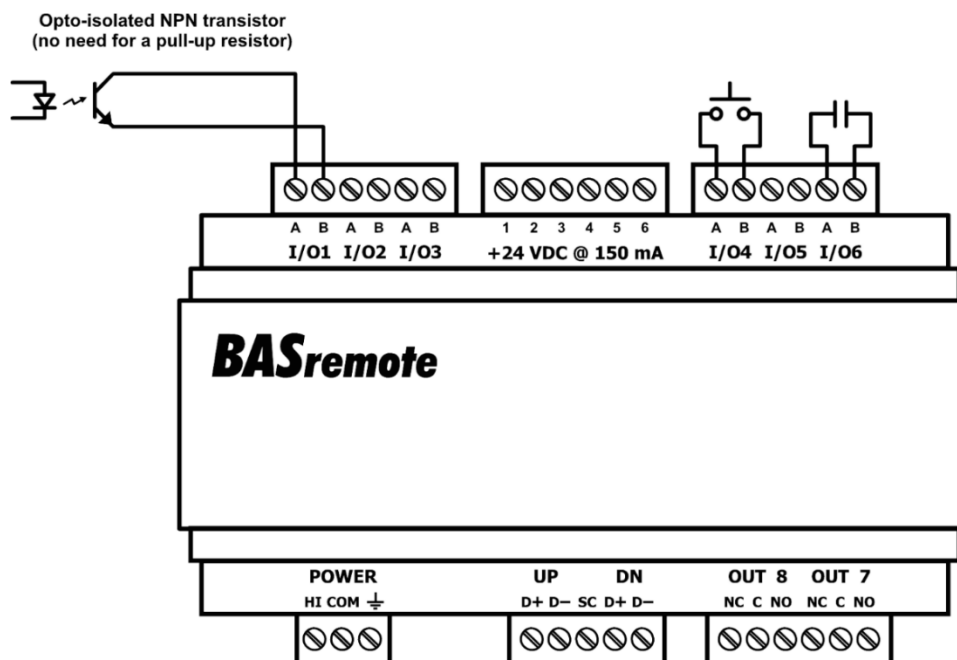

Figure 9 — Contact Closure Connections

For solid-state switches, there are further concerns. It is recommended that a solid-state device have an opto-isolated open-collector NPN transistor output stage with a collector-emitter output voltage (Vce) of at least 30 V. Output sinking current should be greater than 5 mA. The collector-emitter saturation voltage should be less than 0.2 V when sinking 2 mA. The emitter should be connected to point *B* and the collector to point *A* which is the more positive point. This polarity must be observed when using solid-state devices. When an input is configured for a contact closure, the BASremote sets the low-threshold to 2 V and the high-threshold to 3 V. When a contact is made or the solid-state switch is on (resulting in a saturated output), the voltage at point *A* is close to zero volts. The corresponding LED for that channel will be on. If the contact is opened or the solid-state switch is turned off, the voltage at point B will quickly begin to rise towards 24 V. Once the voltage passes the 3 V high-threshold, the input channel will sense the "off" state. To return to the "on" state, this voltage needs to return to 2 V. The one-volt difference is called *hysteresis*. There is no need to add an external pull-up resistor when using a contact closure input.

Contact closure inputs are sampled every 10 ms and for a change of state to be recognized, the input state must be stable for two consecutive samples. Therefore, contact closure response is from 20–30 ms.

5.4 Pulse Inputs

A variation on contact closure inputs is pulse inputs. In this situation speed is critical so the input filtering that limits the time response is removed. When an input is configured for Pulse Input, a pulse rate up to 40 Hz can be measured, assuming a 50% duty cycle. The pulse device could have an opto-isolated open-collector NPN transistor output stage like the one identified under Contact Closure, or it could provide an active sinusoidal output signal that needs to be detected. Data can be in the form *pulse count*.

The Pulse Input voltage range is 0–10 VDC and the installer can set both the low-threshold and high-threshold on the Pulse Input web page. The difference in the two thresholds is the hysteresis. You can detect *sinusoidal* input signals by setting the high threshold below the positive peak and the low threshold above the negative peak. Setting the two thresholds well toward the centre of the sinusoidal waveform (rather than near its peaks) offers some noise immunity. It is not necessary for the input signal to swing from zero to 10 V. Any substantial swing within this range can be detected. The input impedance using Pulse Input is 100 kΩ. Connect the output of the pulse device to point *A* and the common to BASremote common as shown in **Error! Reference source not found.** (using an Expansion module).
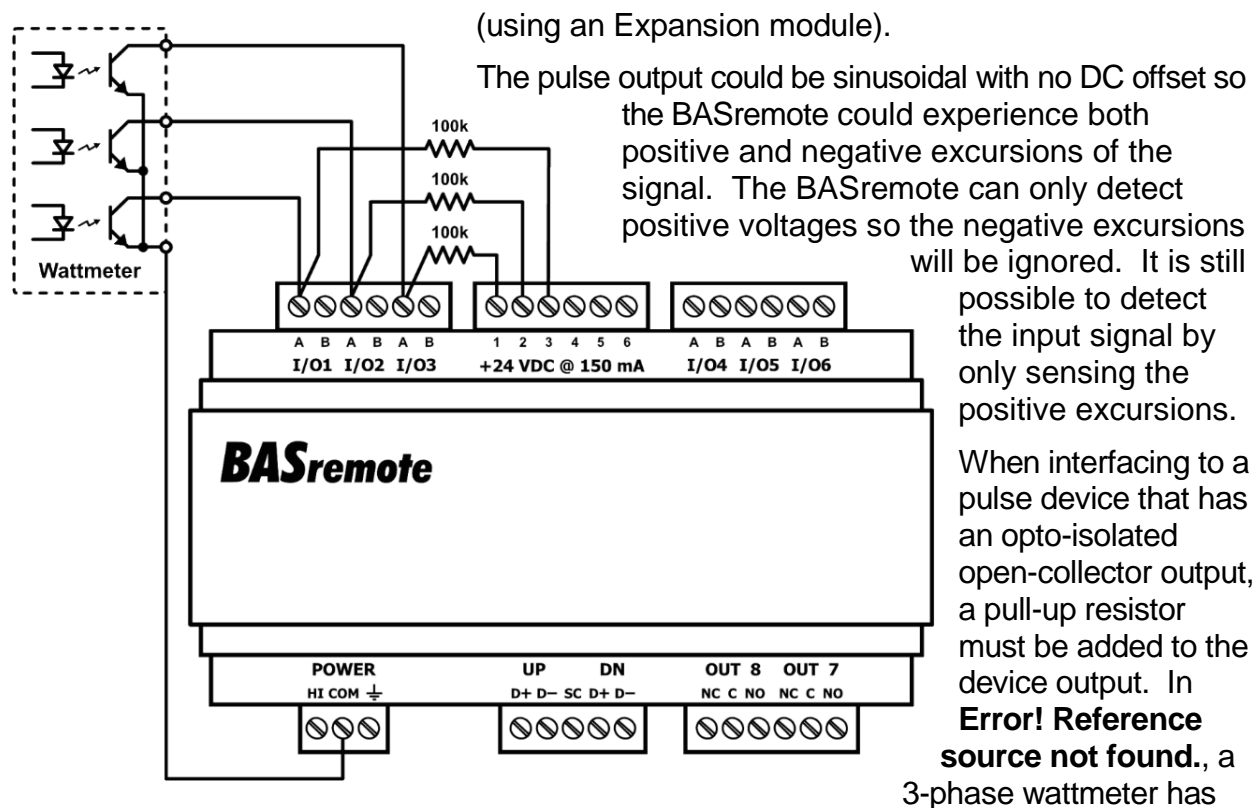

The pulse output could be sinusoidal with no DC offset so the BASremote could experience both positive and negative excursions of the signal. The BASremote can only detect positive voltages so the negative excursions will be ignored. It is still possible to detect the input signal by only sensing the positive excursions.

When interfacing to a pulse device that has an opto-isolated open-collector output, a pull-up resistor must be added to the device output. In **Error! Reference source not found.**, a 3-phase wattmeter has three opto-isolated open-collector outputs, each requiring an external pull-up resistor. Since each of the opto-isolators is rated for 60 VDC, install a 100 kΩ pull-up resistor between each output and the +24 V loop supply. The common of the opto-isolators connects to the common of the BASremote. Since each BASremote input has a 100 kΩ input impedance, the resulting voltage divider sets the off-state voltage to 12 V. Even though the BASremote input range is 0–10 VDC, this will not harm it. Set

Figure 10 — Pulse Input Connections

the two thresholds to 2 V and 3 V. The threshold points on digital signals are not critical. Consult the pulse device manual for more guidance.

5.5 Analog Input

An analog input can measure voltage in the range of 0–5 VDC or 0–10 VDC or it can measure current in the range of 0–20 mA. Transmitters that produce an elevated "zero" such as 1–5 VDC, 2–10 VDC or 4–20 mA can be measured as well. Using the web page, configure the input for either voltage or current and select an appropriate range. Scaling the input is accomplished by assigning the low and high points to engineering units. When set as a voltage input, the input impedance is 100 kΩ and for a current input, the impedance is 250 Ω.

With voltage measurement, connect the more positive voltage to point *B* and the less positive to BASremote common as shown in **Error! Reference source not found.** (using a Master module). On three-wire devices such as damper actuators, the output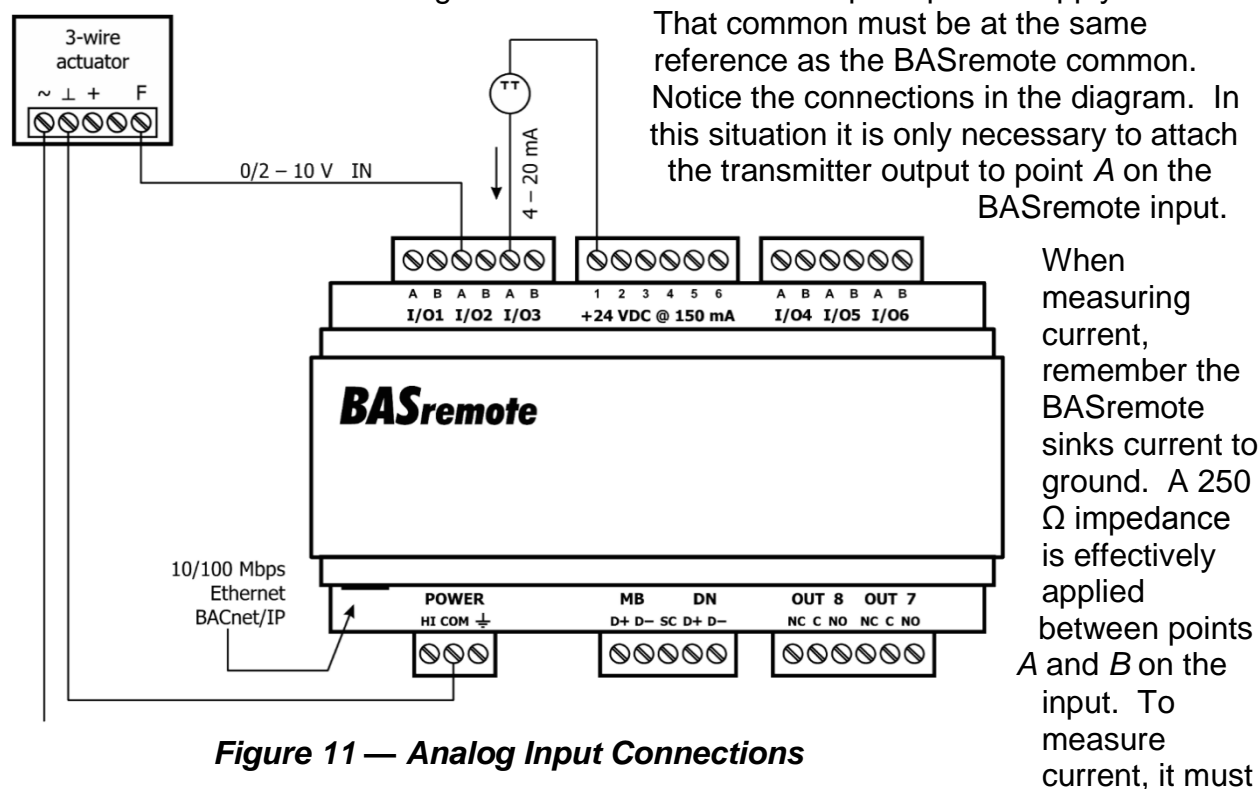 signal is referenced to the damper's power supply common. That common must be at the same reference as the BASremote common. Notice the connections in the diagram. In this situation it is only necessary to attach the transmitter output to point *A* on the BASremote input.

When measuring current, remember the BASremote sinks current to ground. A 250 Ω impedance is effectively applied between points *A* and *B* on the input. To measure current, it must

Figure 11 — Analog Input Connections

be driven into point *A* with respect to point *B*. For two-wire current transmitters, the more positive point on the transmitter attaches to the +24 V on the BASremote loop supply or it can attached to an external loop supply as long as that loop supply has a common connection with the BASremote. The less positive connection is made to point *A* on the input.

Care should be exercised when connecting to a three-wire current transmitter. These are usually non-isolated devices between the power source and signal output. The BASremote will sink current from its input to ground so the transmitter must source current from a positive potential to ground. If the three-wire transmitter works in this manner, it can be accommodated.

Four-wire transmitters usually have isolation between power supply and signal output so their output stage can usually be treated as a two-wire transmitter.

5.6 Analog Output

Either voltage in the range of 0–10 VDC or current in the range of 0–20 mA can be outputted by assigning analog outputs. Configure an output using a web page. Select the appropriate range. For DC voltage, the output voltage is applied to point A with respect to common. For DC current, the output current is sourced from point A to common so there is no need for a loop supply. A current output can source up to 20 mA into a resistive load not exceeding 750 Ω. Verify the burden that a current output device will present. The BASremote cannot generate enough voltage to drive loads with higher resistance.
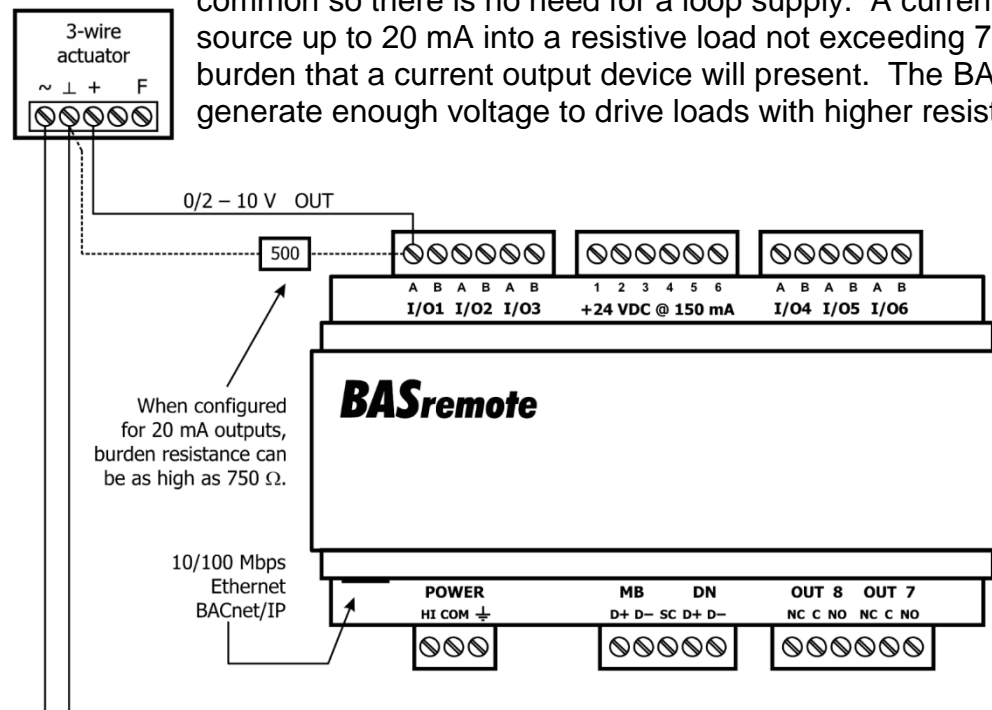
Figure 12 — Analog Output Connections

Figure 12 (using a Master module) illustrates connections to a three-wire damper actuator. The damper requires a 0–10 V command signal which can easily be accomplished by the BASremote. However, if a current output is desired it is possible to set the BASremote analog output to 4–20 mA and install an external 500 Ω resistor that will convert the 4–20 mA signal to 2–10 V.

6 Operation

6.1 General Considerations

Configuration is accomplished while the unit is connected to a computer running a web browser (Java-enabled) that accesses the unit's built-in web server.

6.1.1 Ethernet Port on the Master Module

Auto-Negotiation

The Ethernet port on the **BASremote Master** unit offers full auto-negotiation. A single cable links two Ethernet devices. When these devices auto-negotiate, the data rate will be 100 Mbps only if both are capable of that speed. Likewise, full-duplex will only be selected if both can support it. If only one device supports auto-negotiation, then it will default to half-duplex mode and match the data rate of the non-auto-negotiating device.

Auto-MDIX   (Auto-Crossover)

The Ethernet port offers Auto-MDIX. When interconnecting two Ethernet devices, a straight-through cable or crossover cable can be used — but if one device uses Auto-MDIX, the cable wiring does not matter; Auto-MDIX adjusts for either type.

Reset Switch

To reset the Master module to its default values of the IP address (192.168.92.68), gateway address (192.168.92.1) and netmask (/24 or 255.255.255.0), use a paperclip or similar tool to press the reset switch (see Figure 1 for location) while the unit is repowered and until the reboot is complete. Once the *Status* LED stops flashing, release the reset switch. The unit will now use the default values.

6.1.2 LEDs

To aid in troubleshooting, several LEDs have been provided.

The **Status LED** flashes green during boot. After boot-up, the LED on a Master module then glows solid green if operation is fault-free; on an Expansion module, it then glows solid green if a valid link to a Master exists. On all units, if a fault occurs this LED glows solid red.

The Master module has an **Ethernet LED** that glows green if a valid link exists to equipment operating at 100 Mbps (yellow for 10 Mbps) and indicates activity by flashing.

The Expansion module has a **Network LED** that flashes green to indicate data transfers.

I/O LEDs 1–8 follow the behaviour described in the chart below :

If the I/O channel is …	Green indicates …	Red indicates …
a **Relay** output	the coil is energized.	*(not used for relay output.)*
an **Analog** output	the command is greater than zero.	10% deviation from command
a **Contact** input	the contact is made.	*(not used for contact input.)*
a **Pulse** input	the input state changed.	*(not used for pulse input.)*
a **Thermistor**	current flow is detected	No current flow detected
an **Analog** input	the signal is greater than 1% of span.	*(not used for analog input.)*

6.1.3 Accessing and Configuring the Web Server on the Master Unit

6.1.3.1 Web Browser

The Master contains an interactive web server, accessible from any Internet-compatible PC on the local network. It is compatible with recent versions of Internet Explorer (5.0 or later, suggested) or Netscape Navigator (7.1 or later, required). It is factory-programmed with a default IP address of 192.168.92.68 and a Class C subnet mask of 255.255.255.0. Once configured, changing the BASremote IP address is strongly encouraged.

6.1.3.2 Initial Access

The hardware arrangement for initially setting the Master IP address appears in Figure 13. The PC should be temporarily disconnected from the Ethernet LAN in case the Master's default address matches that of a device on the existing LAN. The procedure for altering the IP address creates a *temporary LAN* composed of nothing but the Master, the PC used to configure it and a CAT5 cable connecting the two. Since the Master supports Auto-MDIX, either straight-through or crossover cable can be used.
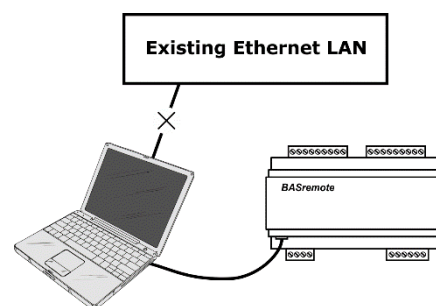
Figure 13 — Setup for Initial IP Address Configuration by Web Browser

For initial configuration, the PC chosen for the procedure should temporarily have its IP address modified as shown in Figure 14 — which employs a Windows® 7 example.
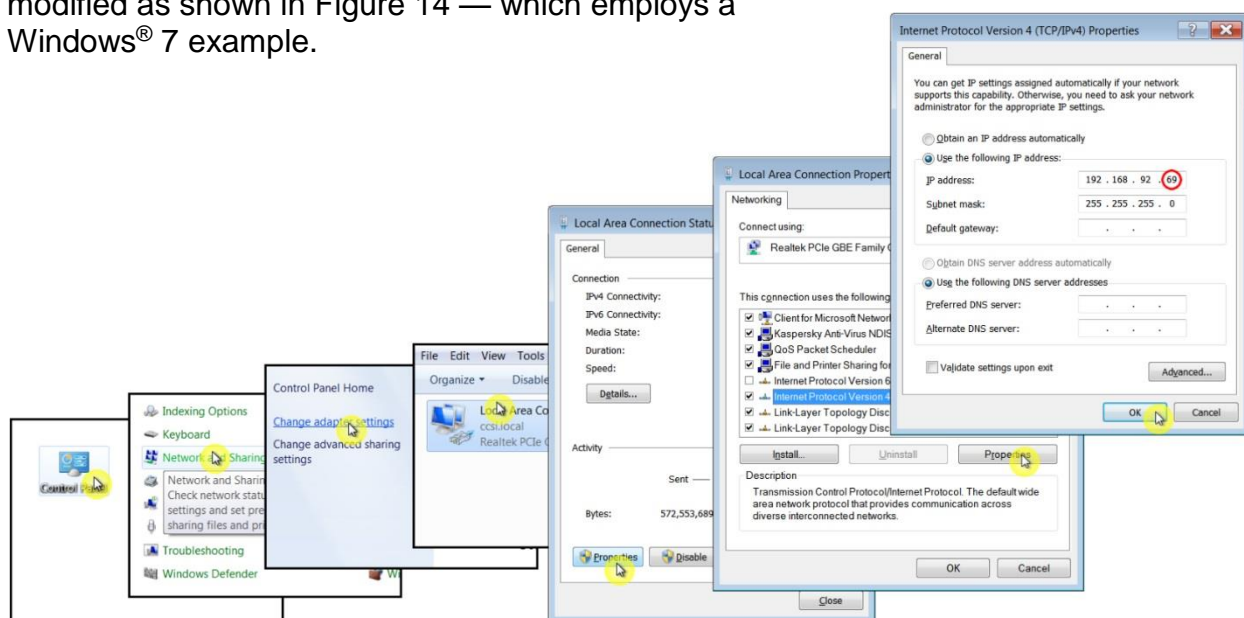
Figure 14 — Steps for Changing the IP Address of the PC Used for Setup

Figure 14 suggests an IP address for the PC of 192.168.92.**69**, but the final quad of the address could be any value from 1 to 254 — **except for 68** which is used by the Master. After the IP address of the PC has been set to the same LAN as the Master, a browser can access the Master's default IP address. The Master does **not** support DHCP.

Figure 15 displays just the *relevant upper portion* of the screen that appears when you access the Master. Just beneath the device image is a link named "Configure Settings". Clicking this link opens another window where you can configure the values discussed in the next four sections (see Figures 17–20).
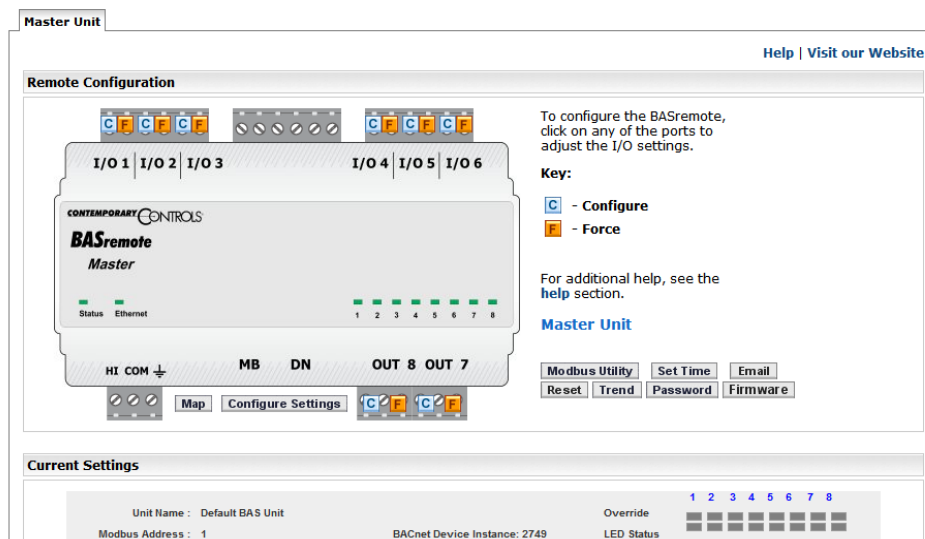
Figure 15 — Master Main Page (Partial View)
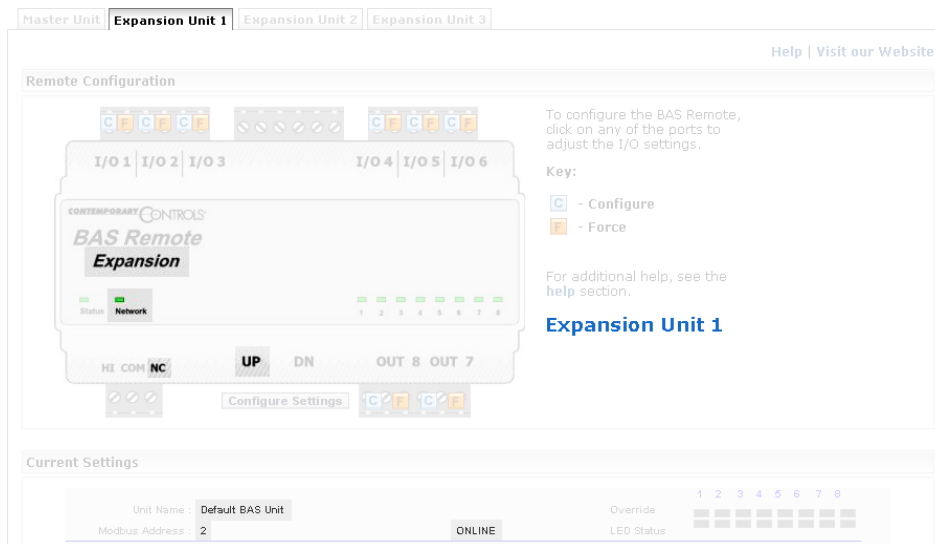
Figure 16 — Expansion Main Screen (Partial View)

Figure 16 displays a view of a main screen (for one of three Expansion units) that is faded — *except* for those elements that *differ* from the Master screen.

6.1.3.3   System Configuration

Four tabs exist on the configuration screen. Select System if it is not already highlighted.

System Name   BACnet device object name which must be unique network-wide.

IP Address   Changing the default value of 192.168.92.68 is recommended.

Subnet Mask   The default value of 255.255.255.0 is adequate for most users.

Gateway Address   If your Ethernet LAN has a gateway (router), enter its address here.

DNS 1   Enter the IP address of the DNS for your system.

DNS 2   Enter the IP address of an alternate DNS, if desired.

Main Unit Name   Give your Master module any name you wish.

Expansion Units   Choose from the default of 0 to as many as 3 units. This value will set the number of tabs that you see atop the main screen.

> **NOTE:** Whether you are configuring *System, BACnet, Modbus or Virtual* values, clicking "UPDATE" will **save** your values to internal memory, but you must **reboot** the Master module by clicking **Reset** before the new values will **apply**!

After the Master has been given its initial configuration, it will be ready for use in the full original Ethernet network. The temporary Ethernet network constructed in Figure 13 should be dismantled and the PC re-configured to restore its original IP address.
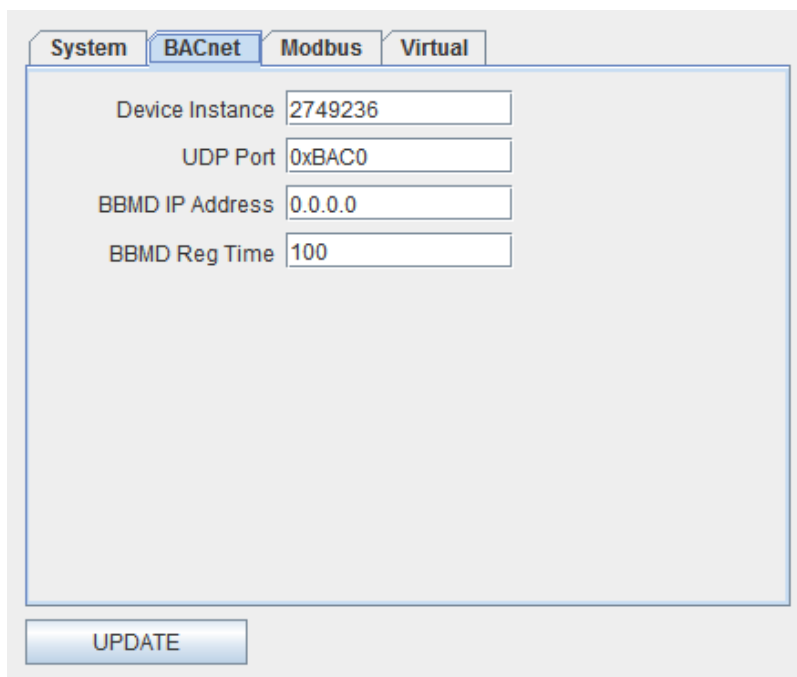
Figure 17 — Configuring System in the Master Module

6.1.3.4 BACnet Configuration

Device Instance   This is a 22-bit value (0–4,194,302). Each BACnet network device must have a unique device instance. The default value is 2749.

UDP Port   The default value of 0xBAC0 should usually not be changed.

BBMD IP Address   Enter the address of the BBMD with which the BASremote will perform Foreign Device Registration (FDR) if the BBMD is not located on the same subnet as the BASremote.

BBMD Reg Time   Enter the interval (in seconds) between successive foreign device registrations. The default is 100.

Figure 18 — Configuring BACnet in the Master Module

6.1.3.5   Modbus Configuration

Modbus configuration (see Figure 19) is only required if Modbus serial devices are attached to the MB bus. Communication settings between the Master module and the Expansion modules are preset and cannot be changed.

Modbus Address	Address 1 is pre-assigned to the Master module while Expansion modules are assigned addresses 2, 3 and 4 assuming Expansion units exist. The actual Expansion address depends upon the order of cabling to the Master. In addition to address 1, the Master module is also pre-assigned addresses 8 and 9 for internal functions. It is best to assume that addresses 1 through 9 are reserved for BASremote equipment so assign addresses from 10 to 247 to attached Modbus devices.
Baudrate	All Modbus devices attached to the MB bus must have the same baud rate. Baud rates range from 2,400 to 115,200. The default is 19,200.
Protocol	All Modbus devices attached to the MB bus must use the same protocol. The choices are RTU and ASCII. The default is RTU.
Parity	All Modbus devices attached to the MB bus must use the same parity. The choices are NONE, ODD or EVEN. The default is EVEN.
Command Timeout	Set how long the Master will wait for a slave to respond. The range is 50 to 3000 ms with a default of 1,000. If a device fails to respond, it is placed into an offline queue. Devices in this queue are checked every offline poll period.
Inter Scan Delay	Set the desired delay between each poll cycle from 100 to 30,000 ms*.* The default is 2,000 ms.
Offline Poll Period	Set how often the Master will check to see if a slave device is back online. The range is 2,000 to 30,000 ms. The default is 15,000 ms.
Consecutive RD Delay	Sets the delay between back-to-back accesses of the same slave device. The default is 10 ms.
Max Consecutive RD	The largest group read requested. The range is 1 to 24 ms and the default is 24 ms.

Figure 19 — Configuring Modbus in the Master Module

6.1.3.6 Virtual Point Configuration

The BASremote can store data independent of I/O Channel values. These stored values are called *Virtual Points* because they are not required to be related to physical I/O points. These virtual points can be treated as Modbus registers, BACnet objects or Sedona Framework™ components. See Section 7.6.2 for more information.

Instance	This read-only number is created from the *BACnet Type*. It is of the form ***8xyyyy***, where the ***x*** defaults to ***4*** (register) but after the *Apply Object Changes* button is clicked it will become ***0*** if the Type is *Binary Output* or ***1*** if the Type is *Binary Input*. The value of ***yyyy*** is automatically incremented as objects are added to the list of Virtual Points in the left side of Figure 20. This virtual object can be written or read via its Modbus/TCP address. Its address will be 8 and the register number will be YYYY. The binary input/output can be written/read via 0YYY or 1YYY. This is also the instance value for the Sedona component which represents this virtual point.
Object Name	Give the Virtual Point any name you wish, but it must be unique within the BASremote. This will be the BACnet object name for this virtual object.
BACnet Description	Give the BACnet virtual point any name you wish.
BACnet Type	Select the Type from the drop-down menu. Below, check the "Retentive" box to preserve counts despite a power failure. "Float" indicates how this virtual object will be accessed via Modbus/TCP. If checked, this object will be accessed as a 32-bit float value. If unchecked, it will be accessed as a 16-bit register. **NOTE:** Analog Value, Analog Input and Binary Input types will not be writeable via BACnet. Analog output and Binary Output can be written via BACnet.
BACnet Unit Group	Select the Unit Group from the drop-down menu.
BACnet Unit Value	Select the Unit Value from the drop-down menu.
BACnet COV Increment	Once the channel value changes by this amount (up or down), a COV message is sent to subscribers.

Figure 20 — Configuring Virtual Points in the Master Module.

This example virtual point is preconfigured as shown with the BASremote.

6.1.4   Web Server Main Screen Overview

From the **Web Server Main Screen** (Figure 21) you can configure all I/O channels, view their status or force them as part of a commissioning process. (The figure uses the Master unit as an example, but the Expansion unit appears very similar and functions the same.) Immediately beneath the right side of the banner, the following links are displayed:
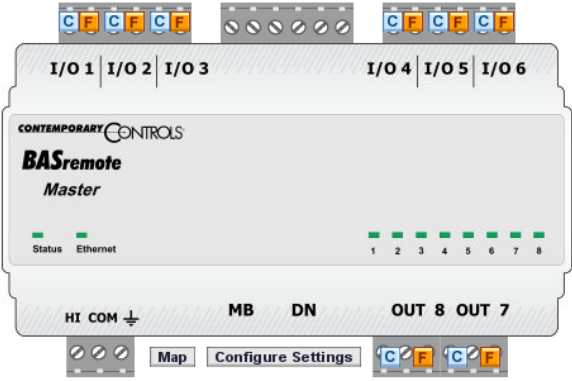
Help displays a new window (Figure 23) with context-sensitive information.

Visit Our Website links to our WWW home page for further helpful information.

Figure 21 — Web Server Main Page

The *Configure Settings* button (just below the device image) provides access to the basic device configuration fields already discussed (Figure 17).

The BASremote image includes graphic representations of each I/O Channel. Each of the 8 channels has two icons (**C** and **F**) that open additional windows used for *configuring*

TD040300-0MH

or *forcing* each Channel. The use of these links is discussed in Section 6.3. Other buttons located beneath and to the right of the device image are:

Map	This displays the status of all points in the **BASremote**, including mapped points (Section 7.6.3).
Modbus Utility	This accesses the **Modbus Utility** function (Section 7.4).
Set Time	This accesses the **Set Time** window and its NTP function (Section 6.7).
Email	This accesses the **Email** window (Section 6.8).
Trend	This accesses the **Trending** function (Section 6.9).
Password	This accesses the **Authentication** feature (Section 6.10).
Firmware	This accesses the **Firmware Upload Screen** (Section 6.11).

The large grey section at the bottom of the screen labelled *Current Settings* is the device "Monitor" — a read-only display of information for the **BASremote** module currently selected. The tab in **bold face** near the top of the screen indicates the module selected. Figure 22 below is an example in which **Expansion Unit 2** has been selected.

<p align="center">**NOTE:** **The number of tabs displayed is determined by the number of Expansion Units specified in the Master Configuration Screen (Figure 17).**</p>
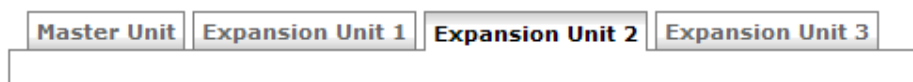

<p align="center">*Figure 22 — The Tab in Bold Face Indicates the Selected Module*</p>

In the upper-left portion of the Monitor shown in Figure 21, two values (*Unit Name* and *Modbus Address*) are displayed for the currently selected module.

To the right of the *Modbus Address* value is a box which reports one of two possible pieces of information — depending on the type of **BASremote** module currently selected. When the **Master** is selected, the box displays the *BACnet Device Instance* of the **Master**. If an **Expansion** module is selected, the box reports the module's status: *ONLINE* if its connection to the **Master** is valid or *OFFLINE* if is invalid. An *OFFLINE* report usually indicates a failure to communicate due to a cabling issue.

In the upper-right portion of the Monitor, the status of each channel (point) is reported with the *Override* indicators and the *LED Status* indicators. These are refreshed each second.

The lower portion of the Monitor displays the *Channel Names* and their *Present Values*.

6.1.5   On-Screen Help

The BASremote has many screens. The upper-right portion of each displays a ***Help*** option. Clicking this launches a new window of information about the current screen.
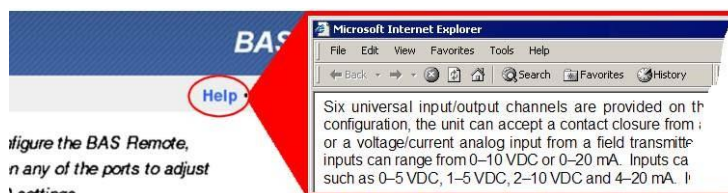

<p align="center">*Figure 23 — Help Window*</p>

6.2 Input/Output Channels (I/O)

6.2.1   Universal I/Os

Six identical universal I/O channels allow any mix of inputs and outputs requiring only two connections labelled **A** and **B**. Pin **A** is always more positive than pin **B**. Channels are labelled *I/O 1* through *I/O 6* and are divided equally between two six-pin terminal blocks. One terminal block is for I/O 1–3 and the other is for I/O 4–6. Configuring is done via the built-in web server. Input resolution is 10 bits; output resolution is 12 bits.

Schottky barrier diodes protect the electronics from over-voltage faults on inputs **A** and **B**. Also, a PPTC (*p*olymeric *p*ositive *t*emperature *c*oefficient) resettable fuse protects terminal **B** from over-voltage when driven to ground.

Pin **A** can be an input or output. Pin **B** can be an input or ground. A D/A converter is used for generating analog voltage or current outputs, and for providing excitation current for contact closure sensing and for thermistor measurement.

In current output mode, pin **B** is grounded. The output burden applied to pins **A** and **B** can range from 0 to 750 Ω. Since the internal burden is 250 Ω, the output voltage at pin **A** can range from 0–20 volts when driving 20 mA.

When measuring input voltages, pin **A** receives input while pin **B** is held at ground. Any DC voltage in the range of 0–5 V or 0–10 V can be measured.

When measuring current, pin **B** is unused and the input on pin **A** sees a 250 Ω load.

To sense contact closure, 2 mA is output at pin **A** while pin **B** is grounded. Then the voltage at pin **A** is measured. Any value below 0.3 volts (150 Ω) is considered a closed circuit. Dry-contact or solid-state switches being sensed must withstand an open-source voltage of 24 VDC and a current of 2 mA. For solid-state switches, the most positive connection is at pin **A** and a saturation voltage under 0.3 V is required.

A 10 kΩ thermistor is applied between pins **A** and **B**. Thermistors are non-linear heat sensing devices with a negative temperature coefficient of resistance. At nominal room temperature (77 °F), the resistance of a Type II or Type III thermistor is 10 kΩ. Both have curves with an accuracy of ±0.36 °F from 32 °F to 158 °F. Because higher resistance thermistors (such as 10 kΩ) introduce error due to the self-heating effect, lower thermistor current is used — thus minimizing self-heat and measurement inaccuracy.

6.2.2   Relay Outputs

There are two independent SPDT relay outputs. For each output, both the **NO** and **NC** contacts are brought out to a six-pin terminal block. Contacts are rated at *2A* at *30 VAC* and *2A* at *30 VDC.* Wiring to the BASremote should only be Class 2. To control higher voltages, the safer approach is to connect the coils of Class 2 interposing relays to the contacts of the BASremote and have the contacts of the interposing relays connect to the Class 1 circuits. These interposing relays should be further from the BASremote and closer to the Class 1 equipment.
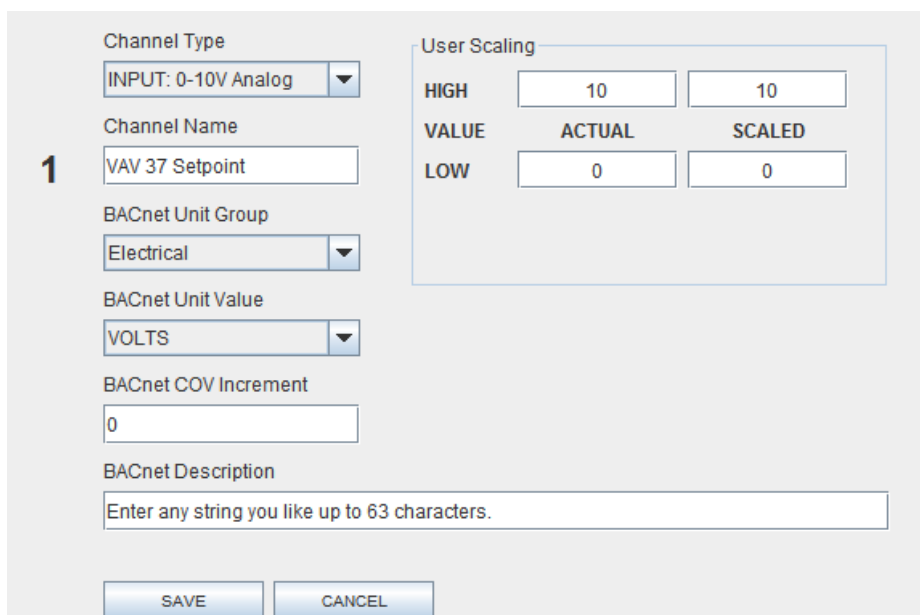
6.3 Channel Configuring

To configure a channel, access the Web Server Main Page, click on the [C] icon for the channel of interest and make adjustments in the new screen that appears. Your selected channel is confirmed by the large number on the left side of the new screen. As Figure 24 shows, clicking on the *Save* button is confirmed by the button briefly changing from light blue to dark blue. If you attempt to set an illegal value, the button will not change colour.

6.3.1 Analog Voltage Input Configuring

You can define any channel 1–6 as "*INPUT: 0–10V Analog*" or "*INPUT: 0–5V Analog*" (As an example, Figure 24 uses Channel 1 and 0–10V). Such a channel can accept an input voltage in the range of 0–10 volts or 0–5 volts. The channel BACnet type will be Analog Input. On this screen, you can adjust these parameters:

Channel Name	You can rename the channel using no more than 63 characters. This will be the object name for this channel (followed by the channel number). For example, "Analog Input-1".
BACnet Unit Group	The *Electrical* default can be set to any option in the list.
BACnet Unit Value	The *VOLTS* default can be set to any option in the list. The available options depend on the BACnet Unit Group you specify.
BACnet COV Increment	Once the channel value changes by this amount (up or down), a COV message is sent to subscribers.
BACnet Description	You can enter any string using no more than 63 characters.
ACTUAL HIGH	This specifies the highest value within the range.
ACTUAL LOW	This specifies the lowest value within the range.
SCALED HIGH	You can set a physical value corresponding to the high value.
SCALED LOW	You can set a physical value corresponding to the low value.

Figure 24 — Analog Input Configuration

6.3.2   Analog Voltage Output Configuring

You can set any channel 1–6 as type "*OUTPUT: 0–10V Analog*" as shown in Figure 25, using Channel 1 as an example. Such a channel can supply an output voltage in the range of 0–10 V. The channel BACnet type will be Analog Output. On this screen, you can adjust any of the following parameters.

Channel Name	You can rename the channel using no more than 63 characters. This will be the object name for this channel (followed by the channel number). For example, "Analog Output-1".
BACnet Unit Group	The *Electrical* default can be set to any option in the list.
BACnet Unit Value	The *VOLTS* default can be set to any option in the list. The available options depend on the BACnet Unit Group you specify.
BACnet COV Increment	Once the channel value changes by this amount (up or down), a COV message is sent to subscribers.
BACnet Description	You can enter any string using no more than 63 characters.
ACTUAL HIGH	This specifies the highest value within the range.
ACTUAL LOW	This specifies the lowest value within the range.
SCALED HIGH	You can set a physical value corresponding to the high value.
SCALED LOW	You can set a physical value corresponding to the low value.
Initial Value (Scaled)	The *Off* default outputs 0, but you can preset a *Scaled* value.

Figure 25 — Analog Output Configuration

6.3.3   Binary Input Configuring

You can define any channel 1–6 as type "*INPUT: Binary*" as shown in Figure 26 which uses Channel 1 as an example. The channel BACnet type will be Binary Input. On this screen, you can adjust the following parameters.

Channel Name   You can name the channel using no more than 63 characters. This will be the object name for this channel (followed by the channel number). For example, "Binary Input-1".

BACnet Unit Group   The *Others* default can be set to any option in the list.

BACnet Unit Value   The *NO_UNITS* default can be set to any option in the list. The available options depend on the **BACnet Unit Group** you specify.

BACnet Description   You can enter any string using no more than 63 characters.

Figure 26 — Binary Input Configuration

6.3.4   Current Input Configuring

You can define any channel 1–6 as type "*INPUT: 0–20 mA*" as shown in Figure 27 which uses Channel 1 as an example. Such a channel accepts an input current in the range of 0–20 mA. The channel BACnet type will be Analog Input. On this screen, you can adjust any of the following parameters.

Channel Name	You can rename the channel using no more than 63 characters. This will be the object name for this channel (followed by the channel number). For example, "Current Input-1".
BACnet Unit Group	The *Electrical* default can be set to any option in the list.
BACnet Unit Value	The *MILLIAMPERES* default can be set to any option in the list. The available options depend on the BACnet Unit Group you specify.
BACnet COV Increment	Once the channel value changes by this amount (up or down), a COV message is sent to subscribers.
BACnet Description	You can enter any string using no more than 63 characters.
ACTUAL HIGH	This specifies the highest value within the range.
ACTUAL LOW	This specifies the lowest value within the range.
SCALED HIGH	You can set a physical value corresponding to the high value.
SCALED LOW	You can set a physical value corresponding to the low value.

Figure 27 — Current Input Configuration

6.3.5   Current Output Configuring

You can define any channel 1–6 as type "*OUTPUT: 0–20 mA*" as shown in Figure 28 which uses Channel 1 as an example. Such a channel provides an output current in the range of 0–20 mA. The channel BACnet type will be Analog Output. On this screen, you can adjust any of the following parameters.

Channel Name   You can rename the channel using no more than 63 characters. This will be the object name for this channel (followed by the channel number). For example, "Current Input-1".

BACnet Unit Group   The *Electrical* default can be set to any option in the list.

BACnet Unit Value   The *MILLIAMPERES* default can be set to any option in the list. The available options depend on the BACnet Unit Group you specify.

BACnet COV Increment   Once the channel value changes by this amount (up or down), a COV message is sent to subscribers.

BACnet Description   You can enter any string using no more than 63 characters.
ACTUAL HIGH   This specifies the highest value within the range.

ACTUAL LOW   This specifies the lowest value within the range.

SCALED HIGH   You can set a physical value corresponding to the high value.

SCALED LOW   You can set a physical value corresponding to the low value.

Figure 28 — Current Output Configuration

6.3.6   Thermistor Input Configuring

You can define any channel 1–6 as a Type II or III thermistor input as shown in Figure 29 which uses a Type 3 thermistor and Channel 1 as an example. The channel BACnet type will be Analog Input. On this screen, you can adjust any of the following parameters.

Channel Type   You can select a Type II or Type III thermistor profile.

Channel Name   You can name the channel using no more than 63 characters. This will be the object name for this channel (followed by the channel number). For example, "Thermistor Input-1".

BACnet Unit Group   The *Temperature* default can be set to any option in the list.

BACnet Unit Value   Set the *DEGREES_FAHRENHEIT* default to any option in the list. Available options depend on the BACnet Unit Group you specify.

BACnet COV Increment Once the channel value changes by this amount (up or down), a COV message is sent to subscribers.

BACnet Description   You can enter any string using no more than 63 characters.

Offset   You can specify a (+) or (–) number of degrees offset — if, for example, the thermistor in use is known to be delivering an inaccurate reading. Either type of thermistor can normally measure from 40º and +110º Fahrenheit.

Temp Units   The *Fahrenheit* default scale can be changed to *Celsius*.

Figure 29 — Thermistor Input Configuration

6.3.7   Pulse Input Configuring

You can define any channel 1–6 as type "*INPUT: Pulse*" as shown in Figure 30 which uses Channel 1 as an example. Such a channel can accept a pulse train in the range of 0–40 Hz. The channel BACnet type will be Analog Value.

NOTE: The value reported by this channel via BACnet will be a 32-bit float as this is an Analog Value. To provide accurate values when counting input pulses, this value will rollover at 2^{24}–1.

To reset the pulse input value, you can (via BACnet) take the channel out of service and write a desired value — such as 0 — then put the channel back in service to allow pulse counting to continue. This value can also be reset by writing a new value to it with of the following three methods:

- via the map web page — displayed by clicking the *Map* button (Figure 15)
- via Modbus/TCP
- via a custom webpage (which can write to the instance associated with this channel)

On the screen of Figure 30 you can adjust any of the following parameters.

Channel Name	You can rename the channel using no more than 63 characters. This will be the object name for this channel (followed by the channel number). For example, "Pulse Input-1".
BACnet Unit Group	The *Others* default can be set to any option in the list.
BACnet Unit Value	Set the *NO_UNITS* default to any option in the list. The available options depend on the BACnet Unit Group you specify.
BACnet COV Increment	Once the channel value changes by this amount (up or down), a COV message is sent to subscribers.
BACnet Description	You can enter any string using no more than 63 characters.
ACTUAL HIGH	This specifies the highest value within the range.
ACTUAL LOW	This specifies the lowest value within the range.
SCALED HIGH	You can set a physical value corresponding to the high value.
SCALED LOW	You can set a physical value corresponding to the low value.
High Level (V)	You can specify a value from 10 down to (but more than) the "Low Level".
Low Level (V)	You can specify a value from 0 up to (but less than) the "High Level".

Figure 30 — Pulse Input Configuration

TD040300-0MH

6.3.8 Relay Output Configuring

Channels 7 and 8 are fixed as type "*OUTPUT: Relay*" as shown in Figure 31 which uses Channel 8 as an example. Each channel provides a relay contact rated at 30 VAC/DC, 2A. Each relay has a normally-open and a normally-closed set of contacts. The channel BACnet type will be Binary Output. On this screen, you can adjust the following parameters.

Channel Name
You can name the channel using no more than 63 characters. This will be the object name for this channel (followed by the channel number). For example, "Relay Output-1".

BACnet Unit Group
The *Others* default can be set to any option in the list.

BACnet Unit Value
The *NO_UNITS* default can be set to any option in the list. The available options depend on the BACnet Unit Group you specify.

BACnet Description
You can enter any string using no more than 63 characters.

ACTUAL HIGH
The default value of *1* is unchangeable.

ACTUAL LOW
The default value of *0* is unchangeable.

SCALED HIGH
The default value of *1* is unchangeable.

SCALED LOW
The default value of *0* is unchangeable.

Initial Value (Scaled)
The *Off* default outputs 0, but you may set a *0* or a *1*.

Figure 31 — Relay Output Configuration

6.4 Channel Forcing

To force a channel, access the Web Server Main Page, click on the [F] icon for the channel of interest and make adjustments in the new screen that appears. Your selected channel is confirmed by the large number on the left side of the new screen. If you apply an override value, the override condition will be indicated by a simulated LED on the Web Server Main Screen — as described in Section 6.1.4. Also the BACnet status flag overridden will be true for the BACnet object which represents this channel. A forced channel will show up as "offline" in Sedona.
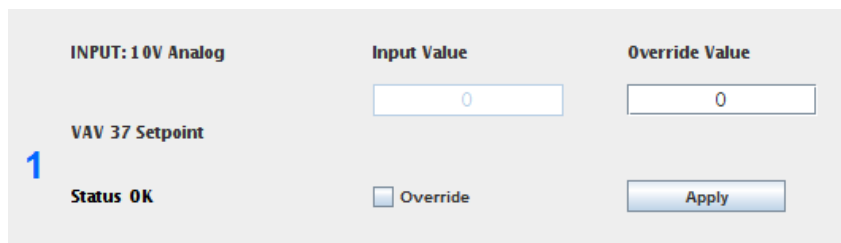
For any channel type selected, the "Forcing" screen reports information for the following read-only fields:

Channel Type   This reports the type that you have defined for this channel.

Channel Name   This reports the name that you have specified for this channel. This will be the object name for this channel (followed by the channel number). For example, "Analog Input-1".

Status   This reports any of the following conditions:

Status OK	**Input Shorted or Open**	**Range High**
Settings Applied	**Input Open**	**Range Low**
Output Overload	**Input Shorted**	

6.4.1   Analog Input Forcing

In addition to *type*, *name* and *status* — this screen displays the following fields.

Input Value   This reports the *Input Value* (read-only).

Override Value   You can specify an *Override Value*.

Override   Checking this box will put the *Override Value* in effect — after the *Apply* button is clicked. To remove the *Override Value*, uncheck the *Override* checkbox and click the *Apply* button.

Figure 32 — Analog Input Forcing

6.4.2   Analog Output Forcing

In addition to *type*, *name* and *status* — this screen displays the following fields.

Output Value   This reports the *Output Value* (read-only).

Override Value   You can specify an *Override Value*.

Override   Checking this box will put the *Override Value* in effect — after the *Apply* button is clicked. To remove the *Override Value*, uncheck the *Override* checkbox and click the *Apply* button.

Figure 33 — Analog Output Forcing

6.4.3   Binary Input Forcing

In addition to *type*, *name* and *status* — this screen displays the following fields.

Input Value   This reports the *Input Value* (read-only) as *ON* or *OFF*.

Override Value   You can specify an *Override Value* as *ON* or *OFF*.

Override   Checking this box will put the *Override Value* in effect — after the *Apply* button is clicked. To remove the *Override Value*, uncheck the *Override* checkbox and click the *Apply* button.

Figure 34 — Binary Input Forcing

6.4.4 Current Input Forcing

In addition to *type*, *name* and *status* — this screen displays the following fields.

Input Value   This reports the *Input Value* (read-only).

Override Value   You can specify an *Override Value*.

Override   Checking this box will put the *Override Value* in effect — after the *Apply* button is clicked. To remove the *Override Value*, uncheck the *Override* checkbox and click the *Apply* button.

Figure 35 — Current Input Forcing

6.4.5 Current Output Forcing

In addition to *type*, *name* and *status* — this screen displays the following fields.

Output Value   This reports the *Output Value* (read-only).

Override Value   You can specify an *Override Value*.

Override   Checking this box will put the *Override Value* in effect — after the *Apply* button is clicked. To remove the *Override Value*, uncheck the *Override* checkbox and click the *Apply* button.

Figure 36 — Current Output Forcing

6.4.6   Thermistor Input Forcing

In addition to *type*, *name* and *status* — this screen displays the following fields.

Input Value   This read-only temperature value will be meaningless if no thermistor is connected as in Figure 8 (and *Status* will report *Range LOW*).

Override Value   You can specify an *Override Value*.

Override   Checking this box will put the *Override Value* in effect — after the *Apply* button is clicked. To remove the *Override Value*, uncheck the *Override* checkbox and click the *Apply* button.

Figure 37 — Thermistor Input Forcing

6.4.7   Relay Output Forcing

In addition to *type*, *name* and *status* — this screen displays the following fields.

Output Value   This reports the *Output Value* (read-only) as *ON* or *OFF*.

Override Value   You can specify an *Override Value* as *ON* or *OFF*.

Override   Checking this box will put the *Override Value* in effect — after the *Apply* button is clicked. To remove the *Override Value*, uncheck the *Override* checkbox and click the *Apply* button.

Figure 38 — Relay Output Forcing

6.5 Instance Numbers

Several locations in the manual mention the use of instance numbers. The instance numbers of the 8 channels of I/O within the BASremote will equal their channel numbers. The instance number of the 1st connected expansion module will be 9. The last instance number of channel 8 be 32 (assuming three expansion modules are connected). The instance numbers of virtual objects will be provided in the configuration screen. The instance number of Modbus mapped I/O will be provided in the project.

6.6 Flash File System and Custom Web Pages

An onboard 1 MB of Flash is set aside for your use. Using the default IP address as an example, your Flash area is accessible at **http://192.168.92.68/user/**. A User ID of "admin" and Password of "ctrlink" allow you to access the user folder, but you cannot create subfolders within the user folder.

Upload your custom webpage files to the BASremote by placing them in the folder named:

/data/user

The names of your html files must be **user.html**, **user1**.**html** ... **user9**.**html**. The other file names can be whatever you want (up to 255 characters).

By uploading web pages and images to your Flash space, you can view the BASremote status in a graphical format of your own design. Via these custom webpage Java applets, you can access the current status of a channel, virtual object or mapped Modbus variable. **NOTE:** The part of each applet file name shown below in red *will vary by release date*.

- The **Binary Applet** displays status by a coloured square which will be red for a value of 0 and green for a value of 1. The size of the displayed square in pixels is specified in your HTML code — with a maximum size of 500 x 500. The applet has two parameters: *Instance* (the instance number of the object to be read) and *TimerMsDelay* (the time between reads of this value on the BASremote). The applet file name is:

binary-applet-2014.07.02.17.10.51.jar

- The **Channel Set Applet** writes to a channel or instance using the value specified in the text box. The applet has one parameter: *Instance*. The applet file name is:

channel-set-applet-2014.07.02.17.10.51.jar

- The **Channel View Applet** reads a channel or instance. The applet has two parameters: *Instance* and *TimerMsDelay*. The applet file name is:

channel-view-applet-2014.07.02.17.10.51.jar

After studying an example web page (**http://192.168.92.68/user.html**) that shows you how to use the three applets, you can erase it and replace it with your own design.

6.7 Set Time

System Time can be set manually or automatically using an NTP (Network Time Protocol) server — assuming Internet access. NTP is enabled by default and a default NTP server is provided. With NTP enabled, you cannot manually set the time, but you can observe it. You must set your Time Zone. **Refresh Time** should remain at 1. Make sure the DNS settings are proper in your Configuration Settings in order to reach the NTP server. If changes are made to the NTP configuration, click **Update Configuration**.

If you lack Internet access, manually set the time. First disable NTP, then click **Update Configuration** and manually set the time, then click **Manual Time Set**.

Figure 39 — Set Time Screen

A third approach is to use BACnet's Time Synchronization service. The BASremote will automatically respond to this service if it exists on the connected BACnet network. If this mode is to be used, NTP should be disabled.

Daylight Savings Time (DST) is supported. Make the appropriate settings to the changeover times and click **Update Configuration**. DST works independently of manual time set and NTP.

6.8 Email   (For Sedona, see Section 7.6.2)

Email alarms or events can be initiated in the Sedona logic but they must first be configured using a web browser. Click the *Email* button on the BASremote main web page and you will be taken to the Email configuration page as shown in Figure 40.

The left tab is for configuring the SMTP (simple mail transfer protocol) server. You would need an account with a service that allows you to send and receive emails. Enter the **Server** address such as *smtp.gmail.com* or *smtp.mail.yahoo.com.* In the **From** field enter the email address of this account such as me@gmail.com or me@yahoo.com.   You will need to enter a port number. Use either 465 or 587. Next you must enter the **Security** level. The choices are *NONE, SSL/TLS, STARTTLS* or *TLS.* If you are using port 465, use TLS. If you are using port 587, use SSL/TLS or STARTTLS. Finally, you will need to enter your credentials for the email account selected by indicating **User Name** and **Password**. Click on **Update** to save.
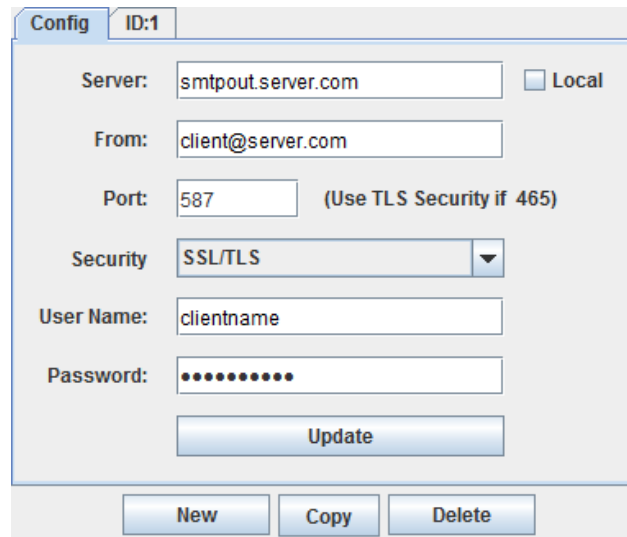
Figure 40 — Sedona Email Configuration

If you are using a local Microsoft Exchange Server, a different configuration is required which may require help from an IT professional. Check the **Local** box. Enter the server address. This may be a private IP address or a domain name. In the **From** field use an account name the Exchange server recognizes. The Port number has been entered for you (25 for SMTP). However, this can be changed. The **Security** setup is bypassed. You do not need to enter **User Name** or **Password** because authentication is not required. Click on **Update** to save the results.

You will notice a single tab to the right of the **Config** tab. This is a recipient tab. If it is not already assigned a number, enter one in the **ID#** field. The ID# you assign must eventually match the number entered in the Sedona Email component. Enter the recipient email address. You are allowed a second address in the CC field. You can change the **Subject** line which is helpful when creating more meaningful notifications involving binary variables such as Sump Pump 2 – High Level. You can change the entire text in the **Body**. PROCESS_VALUE will be replaced by a float from the Sedona email component. If you erase this, no value will be transferred. You can also change the test value which is only sent if you send a test

Figure 41 — Sedona Email Detail Screen

message to see how your notification will look. Make sure you save your work by clicking **Update**. Send a test message by simply clicking on **Send Test Message**.

You have three choices at the bottom of the email configuration screen — **New**, **Copy** and **Delete**. By clicking on **New**, you create another tab with default data. Assign a different ID# and enter the data for this new email notification. However, if you click on **Copy**, you will see a clone of the email notification currently being viewed less ID#. This allows you to do simple edits of the data when much of the information remains the same from the original email notification. Make sure you assign a different ID#. Finally, the **Delete** button deletes the email notification you are currently viewing.

Remember that you must match the ID# of each email notification with corresponding numbers in the Sedona email components.

6.9 Trending

Trending allows you to periodically store values (in CSV format) in your Master module. The trended values can be:

- the 8 internal channels of the Master module
- up to 24 additional channels provided by up to 3 expansion modules
- any virtual points you create
- any RTU or Modbus TCP points mapped by the Modbus device profile stored in your Master module
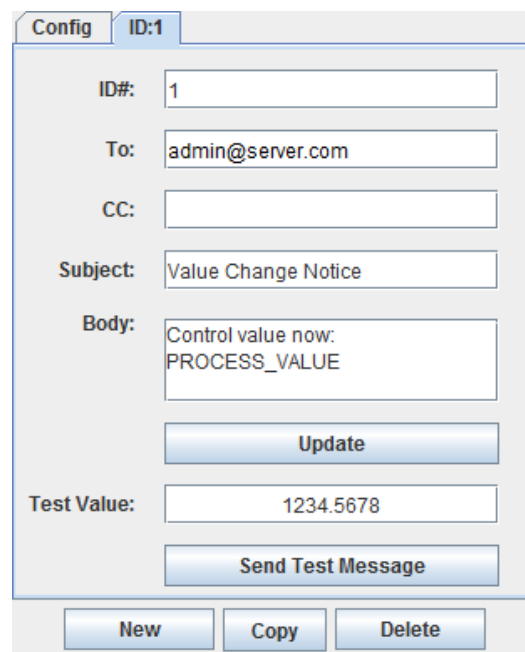
In the **Trend** screen (Figure 42**Error! Reference source not found.**), check points you wish to trend. *Sample Interval* controls how often these are sampled and *Save Interval* determines how often they are written to the Master module internal Flash memory. We recommend a Save Interval no less than 5 minutes. Values are held in RAM until saved. **NOTE:** The trend file will be cleared if you change which points are being trended.

6.9.1   Trending Sampling

Samples are time stamped with the Master module internal time unless you enable and properly configure NTP time.

6.9.2   Trending Inactive and Trending Screen Unavailable

After selecting at least one point to be trended, clicking the *Submit* button enables the trend server — which then *reboots*. Until this reboot completes (or if you reboot the Master module), **no trending occurs** and **you cannot reopen the trending screen**. This typically lasts 10–20 seconds — but can take up to **several minutes** if you have a large number of points. After a reboot, the trend server begins trending the selected points and there should be no loss of trend data.

6.9.3   Trending CSV File

Press the "Download CSV File" link (on the left side of Figure 42**Error! Reference source not found.**) to view the trend data acquired by the BASremote. Save this file to

your PC and open it with a CSV viewing tool such as ***Microsoft Excel***®. Each line of the CSV file will contain the values for each point during one acquisition period.

After the trend file is filled, each new data line is written to the top (beginning) of the file and *overwrites* the oldest data line. Thus, when overwriting occurs, your oldest data will be somewhere in the middle of the file. The trend file has a maximum length of 2 MB. The length of time (CSV file capacity) before overwriting occurs is shown by the **logread** section at:

http://**Your_IP_Address**/cgi-bin/diagnostic.cgi

Figure 42 — Trending Screen

6.10 Authentication

An authentication feature allows the BASremote's webpages to be password protected. You can set the **Username** and **Password** as shown in Figure 43. This page can be accessed by clicking the *Password* button on the **Main Page**. For Username/Password, only alpha-numeric characters are allowed and they should be minimum 5 characters long.

Figure 43 — Authentication Screen

6.11 Firmware Upload Screen

When available, new **BASremote Master** firmware can be downloaded from:

www.ccontrols.com/support/basremote.htm

Upload the new firmware to your unit by pressing the *Firmware* button on the **Main Page** — then following the provided instructions (see Figure 44). From this page, select the firmware file by clicking on the *Browse* button and then click the *Upload* button. The firmware file name should be used as-is provided by Contemporary Controls and should not be renamed.

Figure 44 — Firmware Upload Screen

7 Appendix

7.1 Troubleshooting Ethernet Connectivity of the Master Unit

When troubleshooting Ethernet connectivity for the **BASremote Master** unit, as with any IP device, first try pinging the IP address of the Master. The *ping* function is typically run as a command line operation in a Command window. This simple test, performed from any IP-enabled end station, quickly determines if the unit is accessible via the TCP/IP protocol. The ping result (positive or negative) will guide the nature of subsequent troubleshooting efforts.

7.2 [intentionally left blank]

7.3 Modbus Server Operation

The **BASremote Master** functions as a Modbus TCP server accepting commands from a Modbus TCP client through reserved port 502. As a Modbus TCP server, the **BASremote Master** and its attached Expansion modules appear as Modbus serial devices with each module assigned a unique Modbus device address from 1 through 4 with addresses 8 and 9 reserved for the Master. In a similar fashion, third-party Modbus serial devices can be attached to the **BASremote Master**'s MB port allowing these devices the ability to be accessed by a Modbus TCP client. All attached serial devices must be assigned unique valid Modbus addresses that do not conflict with those assigned to the BASremote modules.

From a Modbus serial point-of-view, the BASremote is the Modbus master within the system, but it actually functions as a proxy to Modbus TCP clients. Since the **BASremote Master** has its own I/O points, it functions as both the Modbus master and Modbus slave. All BASremote Expansion modules function as Modbus slaves as do devices attached to the **BASremote Master**'s MB Expansion port. Enabling the **BASremote Master** to function as a Modbus TCP server does not preclude the **BASremote Master** and its Expansion modules to simultaneously function as BACnet devices.

The easiest way to understand Modbus server operation is to consider the **BASremote Master** as also functioning as the Modbus master for attached Modbus slaves. As a master, it does not require a Modbus address. Only Modbus slaves have addresses. The **BASremote Master**, receives requests from one or more Modbus TCP clients attached to the Ethernet network. The **BASremote Master** receives these requests and sends them to the attached Modbus slave devices as commands. From the Modbus slave's point-of-view, these commands came from the **BASremote Master**, and the slave is unaware that a Modbus TCP server even exists.

The **BASremote Master** also has some I/O points that are considered Modbus slave points at Modbus address 1. Each of the attached BASremote Expansion modules require a single Modbus slave address. If a Modbus command is addressed to any of the BASremote modules, it is sent to the appropriate module for execution. If the address is outside the range of BASremote module addresses, the command is then sent to the MB port assuming that the intended Modbus slave is connected to this serial

Expansion bus. The command is unmodified as it passes through the **BASremote Master**. If there is no response from the slave, the **BASremote Master** will send a GATEWAY_TIMEOUT message to the Modbus TCP client. It should be remembered that the **BASremote Master** utilizes slave addresses 8 and 9 for internal functions and should not be used by any attached Modbus serial devices.

7.3.1   Modbus Register Organization

While the Modbus Data model consists of four types – discrete input, coils, input registers and holding registers, the BASremote I/O points appear as holding registers with four holding registers assigned to each channel beginning with register location 40001. For each point there is status, two inputs, and one output register. There are eight points of I/O per module, and the register locations are the same in both the Master and Expansion modules. It is the Modbus device address that distinguishes points on one module versus another. Holding registers represent 16-bit read/write words, but in the Modbus application protocol they are sent as two-byte transfers. However, the input data registers for each I/O point are represented as 32-bit registers regardless if they represent an analog or digital point. On input registers, the least significant word occupies the odd address while the most significant word occupies the even address. Output data registers require only one register per point. What follows are the register locations for universal I/O points 1–6 and for relay outputs 7 and 8.

Channel	Status	Input	Output
1	40001	40101–40102	40201
2	40002	40103–40104	40202
3	40003	40105–40106	40203
4	40004	40107–40108	40204
5	40005	40109–40110	40205
6	40006	40111–40112	40206
7	40007	40113–40114	40207
8	40008	40115–40116	40208

Table 2 — Register Mapping for Input/Output Channels 1–8

7.3.1.1   Status Registers

Each of the eight BASremote I/O points has one 16-bit status register. Register location 40001 corresponds to channel 1 while register 40008 corresponds to channel 8. The value of the status register depends upon how the I/O point is configured. For example, an out-of-range indication only applies to those channels configured for thermistor inputs. A similar situation applies to analog voltage outputs and analog voltage inputs. All channels operating within their limits will report a 0x00 when reading the lower 8-bits of the status register.

Register	Bits	Value	Description
4000X	0:7	0	Channel operating within limits
4000X	0:7	2	Analog current output has no load
4000X	0:7	6	Thermistor value out of range

4000X	0:7	9	Analog output deviates by ±60 mV
4000X	8:11	1	Channel LED is red
4000X	8:11	2	Channel LED is green
4000X	8:11	3	Channel LED is off
4000X	12:15	0	Channel is in automatic operation
4000X	12:15	2	Channel value is being overridden

Table 3 — Status Registers
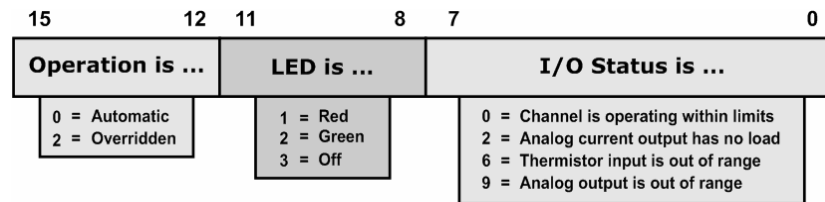
Figure 45 — Status Register Depicted Graphically

7.3.1.2   Read Channel Data Registers

Two 16-bit registers are assigned to each of the eight channels for reading input data. Adding an extra register was done to accommodate accumulator values when measuring pulse inputs. The least significant word resides at the register base address while the most significant word resides one register location above the base address. The base register address for channel 1 is 40101 so its most significant word is at 40102. Similarly, channel 8's base address is at 40115 so its most significant word is at 40116.

Register	Bits	Value	Description
401YX	0:15	0x0000 to 0x1388	0–5000 mV on 0–5 V scale*
401YX	0:15	0x0000 to 0x2710	0–10000 mV on 0–10 V scale*
401YX	0:15	0x0000 to 0x07D0	0–2000 hundredths of mA on current
401YX	0:15	0xFEA2 to 0x044C	−350 to 1110 tenths of °F (2's comp.)
401YX	0:15	0xFE8E to 0x01B8	−370 to 440 tenths of °C (2's comp.)
401YX	0:15	0x0000	Contact off (relay de-energized)
401YX	0:15	0x0001	Contact on (relay energized)

* Resolution on 0–5 V scale is 5 mV, and on the 0–10 V scale 10 mV.

Table 4 — Read Channel Data Registers Least Significant Word

Register	Bits	Value	Description
401YX	0:15	0x0000 to 0xFFFF	0–16,777,215 counts
401YX+1	0:15	0x0000 to 0x00FF	

Table 5 — Read Channel Data Registers Accumulator

7.3.1.3   Write Channel Data Registers

Unlike input data registers, output data registers only require one register per channel. Output channel 1 is located at register location 40201 and output channel 8 is located at

register location 40208. Since channel 8 is a relay output, outputting a 0x0001 to register 40208 will energize the relay coil.

Register	Bits	Value	Description
4020X	0:15	0x0000 to 0x2710	0-10000 mV on voltage
4020X	0:15	0x0000 to 0x07D0	0-2000 tenths of mA on current
40207	0:15	0x0000	De-energize channel 7 relay
40207	0:15	0x0001	Energize channel 7 relay
40208	0:15	0x0000	De-energize channel 8 relay
40208	0:15	0x0001	Energize channel 8 relay

Table 6 — Write Channel Data Registers

7.3.2   Modbus Function Codes

There are many Modbus function codes but the BASremote only responds to three which involve holding registers. These function codes are described below. If other than one of these three function calls are received from the Modbus TCP client, an ILLEGAL_FUNCTION error message is returned by the BASremote. The **BASremote Master** does not monitor the function calls sent to the MB Expansion bus.

7.3.2.1   03 (0x03) Read Holding Registers

This function code is used to read the contents of a contiguous block of holding registers within the **BASremote Master** or BASremote Expansion module.

7.3.2.2   06 (0x06) Write Single Register

This function code is used to write a single holding register to the **BASremote Master** or BASremote Expansion module.

7.3.2.3   16 (0x10) Write Multiple Registers

This function code is used to write a block of contiguous registers (1 to 123 registers) to a **BASremote Master** or BASremote Expansion module.

7.4 Mapping Modbus Variables to BACnet/IP

The BASremote is capable of providing gateway functionality between Modbus and a BACnet/IP host by executing a Modbus device profile. Modbus device profiles are developed as a service to Contemporary Controls' customers and need to be customized to a particular job. For those interested in learning on how to specify and maintain a Modbus device profile, an in-depth application note entitled Mapping Modbus to BACnet with the BASremote can be found at

www.ccontrols.com/support/basremote.htm

Contact the company's sales department regarding your interest in obtaining a device profile for a particular Modbus device.

7.5 Modbus Utility

As a convenience to the installer, a resident Modbus Utility (Java applet) is available to verify BASremote communication to attached Modbus serial devices. This utility is best used BEFORE entering device profiles. It is useful in confirming the data structure of Modbus registers within each device.

Slave Address: (1 by default.) Enter the slave address of the Modbus serial device to be accessed (1–247).

Register Number: (1 by default.) Enter only the 5-digit register address but not the

Figure 46 — Modbus Utility Screen

leading 1-digit memory block address. This will be specified in the **Value Format** field. For example, to read register 400001, enter the register number 1 and click holding register 4X in the **Value Format** field. Notice that PLC addressing is being used.

Value Format: This reads or writes values for the register in the **Register Number** field. Select one of the memory blocks as follows:

0X: Coil: Check this if the addressed device is a Coil or Binary Output (0 or 1).

1X: Input Coil: Use this to read a Binary Input (0 or 1).

TD040300-0MH

3X: Input Reg: Use this to read a 16-bit register.

4X: Holding Reg: Use this to read or write a 16-bit register.

32-Bit: This displays a 32-bit value of a register pair and enables these four buttons:

- **Integer:** Use this for a value with no fractional content.

- **Float:** Use this for a single-precision floating-point value.

- **LOW: HIGH:** Use this for Little Endian format (low word is in the base register and high word is in the next-higher register).

- **HIGH: LOW:** Use this for Big Endian format (high word is in the base register and low word is in the next-higher register).

Click on **Read** and the result will appear in the **Value** field. For a write operation, enter the proper value in the **Value** field and click **Write**.

Scaled: This displays the engineering units if the specified register represents a BASremote I/O point. But if the register is not one of the BASremote I/O points, an error will result.

Status: If you read or write a register successfully, "Success" appears here and **Value** shows the result. If a register access is unsuccessful, the error is reported in the **Value** field.

7.6 Online Resources

7.6.1   BACnet Object Model

The **BASremote** complies with ANSI/ASHRAE Standard 135-2008. To learn more about BACnet, go to www.ccontrols.com/tech/bacnet.htm.

7.6.2   Sedona for Control

The **BASremote** can execute Tridium's Sedona Virtual Machine (SVM) for control schemes designed with Niagara Workbench or similar tool and downloaded to the **BASremote**. To learn more about Sedona, go to www.ccontrols.com/tech/sedona.htm.

7.6.3   Mapping Modbus Variables to BACnet/IP

This shows the status of all mapped objects — including mapped Modbus variables, virtual objects and all points within the **BASremote**. To learn more about Modbus, go to www.ccontrols.com/tech/modbus.htm.

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