application
GUIDE

BASremote — Versatile BACnet/IP Controller/Gateway

The BASremote series provide the system integrator a flexible building block when integrating diverse building automation protocols or when expanding the number of points in a building automation system. By supporting open system protocols such as BACnet®, Modbus and Sedona Framework SOX, the BASremote series is easily adaptable. For small systems, it can operate stand-alone. For larger systems, it can communicate to supervisory controllers over Ethernet. Depending upon the model, the BASremote has the flexibility to provide the following:

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 Framework*™ Controller
- Power over Ethernet (PoE)
- Customisable webpages

Flexible Input/Output — expandable by adding modules

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

BASautomation®

BASremote Master — Versatile Web Appliance

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 capabilities address unique integration needs where more than one communications protocol is involved. It can operate as a function block programmable controller with its resident Sedona Framework Virtual Machine. Powered by a Linux engine, the **BASremote Master** can operate as BACnet/IP and Modbus TCP remote I/O, Sedona Framework controller, Modbus Serial to Modbus TCP router, Modbus Serial to BACnet gateway, and Modbus master to attached Modbus slaves all at the same time. 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. The **BASremote Master** also allows you to install custom web pages so you can view the status of your system in a convenient manner.

Additional universal I/O can be achieved with the simple addition of **BASremote Expansion** modules. The **BASremote PoE** has the same capabilities as the **BASremote Master** except it is powered over the Ethernet connection thereby providing a “One Cable Solution”.

Universal I/O

Using web pages, six points can be configured as either inputs or outputs, analog or digital. In addition to being discoverable as BACnet objects, these same points can be assigned Modbus addresses.

- Analog inputs: 0–10 VDC, 0–20 mA but scalable to 0–5 VDC and 4–20 mA
- Temperature inputs: Type II or Type III thermistors
- Contact closure or Pulse inputs: Free-voltage, 40 Hz maximum
- Analog outputs: 0–10 VDC, 0–20 mA

All field connectors are removable.

Auxiliary Power Output

24 VDC @ 150 mA for powering field devices such as 4–20 mA transmitters.

Ethernet

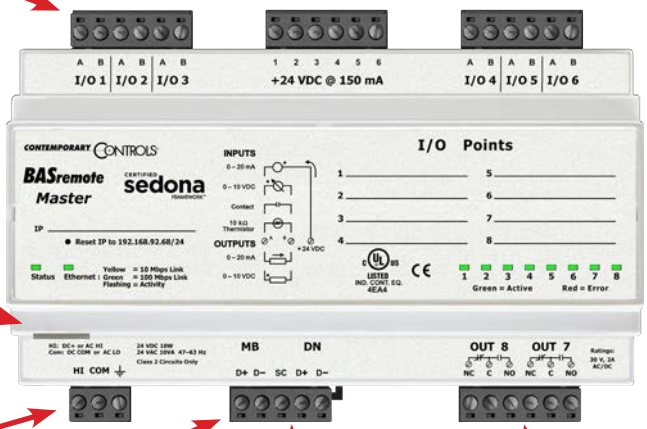
10/100 Mbps Ethernet with auto-negotiation and Auto-MDIX. Protocols supported include HTTP, IP, UDP, TCP, SOAP, BACnet/IP, Modbus TCP, and Sedona SOX.

Power Input

24 VAC/VDC 17 VA half-wave regulated allows power sharing with other half-wave devices.

Modbus Serial Bus

RTU or ASCII master, 2.4 – 115.2 kbps, 2-wire non-isolated, up to 31 full-load EIA-485 devices



Expansion Port

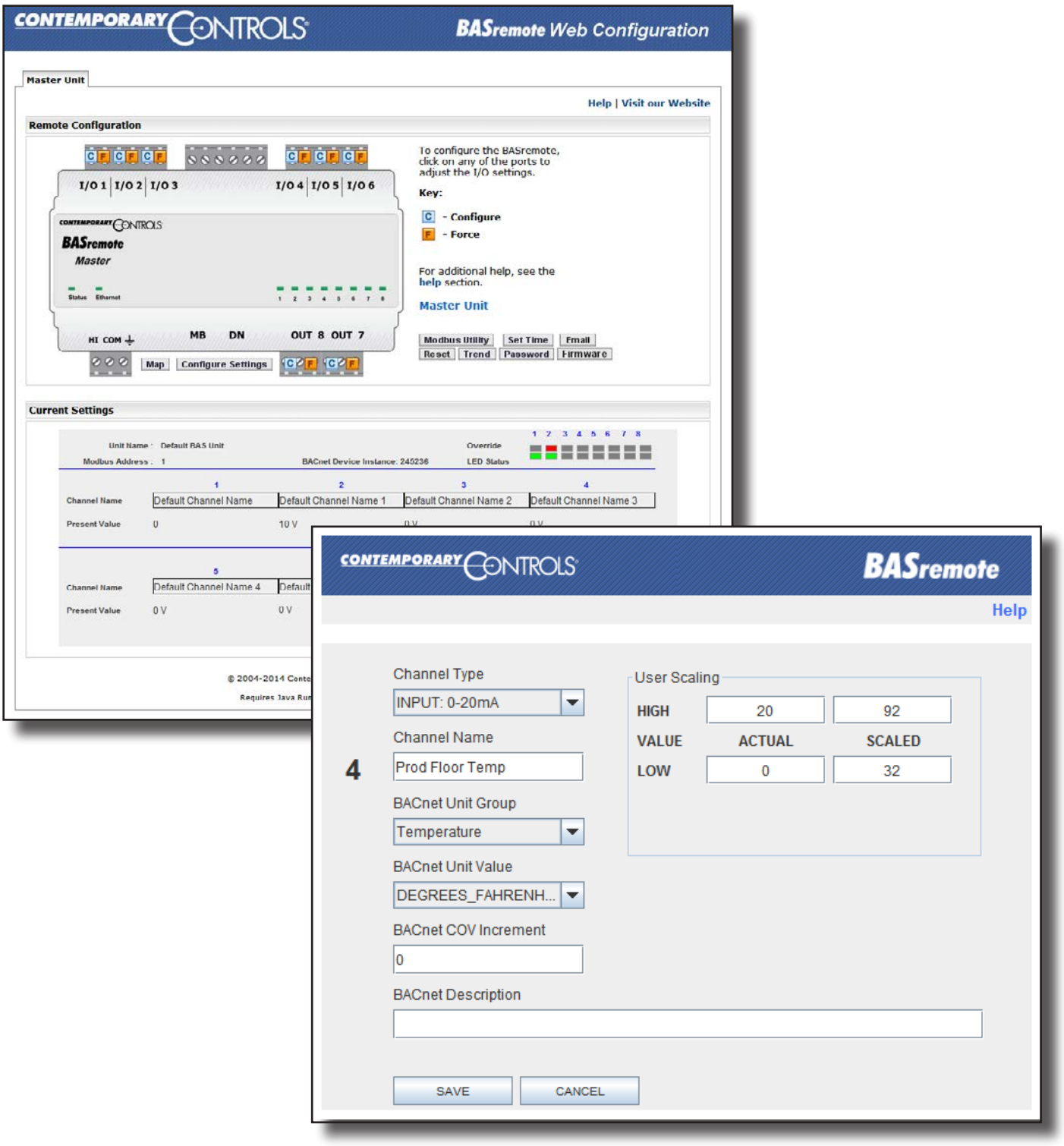
Proprietary bus supporting up to three expansion modules requiring no configuration.

Relay Outputs

Two form “C“ contacts for 30 VAC/VDC 2 A loads. Class 2 circuits only.

Web Page Configuration

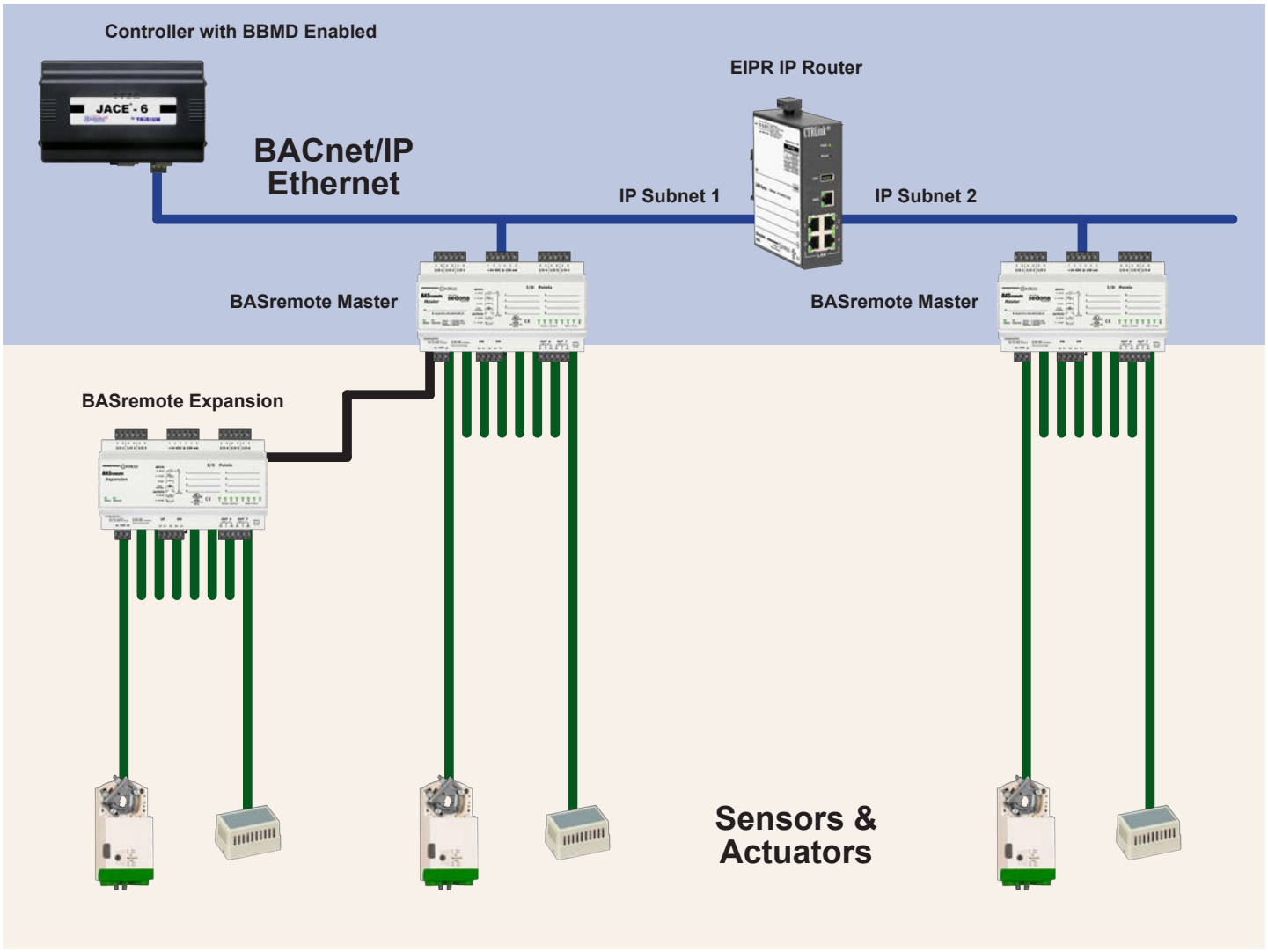
Web Server Screen



Typical I/O Point Configuration Screen

Application #1 — BACnet/IP or Modbus TCP Remote I/O

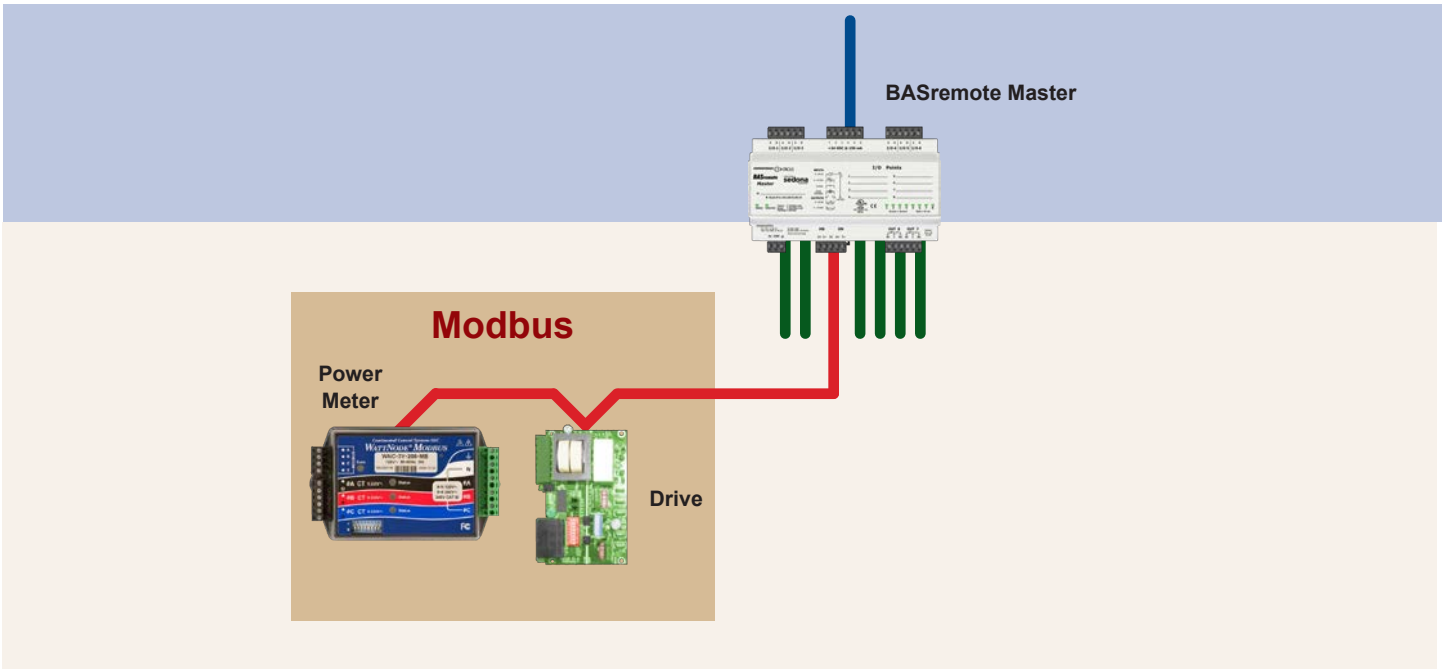
Assume that someone forgot to pull MS/TP twisted-pair wiring to a distant part of the building or that the specification calls for only CAT 5 structured wiring cable, a connection can still be made to the BACnet network. Since the **BASremote Master** is BACnet/IP compliant, a simple 10/100 Mbps Ethernet connection to the IP infrastructure is all that is needed. If the **BASremote Master** is located on a separate subnet from the other BACnet equipment, the unit can register as a foreign device with a BACnet/IP Broadcast Management Device (BBMD) located on another subnet in order to initiate and receive all BACnet broadcasts. If the Modbus protocol is of more interest, the **BASremote Master** supports Modbus TCP as well. If more I/O points are required, a **BASremote Expansion** module can be connected to the **BASremote Master** DN port. Up to three **BASremote Expansion** modules can be attached in a daisy-chain wiring fashion.



Application #2 — Modbus Serial to BACnet Gateway for Unifying Data

Although BACnet is quite popular, there is an abundance of Modbus Serial equipment that needs to attach to the building automation system. There are two approaches to the problem. The first is to route Modbus Serial messages from the **BASremote Master** MB port to Modbus TCP clients residing on Ethernet. This is the simplest approach requiring minimal configuration. The **BASremote Master** would act as a proxy for a Modbus TCP client, initiating a command to a connected Modbus Serial slave. When the slave responds, the message is forwarded to the Modbus TCP client. The resident **BASremote Master** I/O can be queried in a similar fashion.

The second approach is to utilize the gateway capability within the **BASremote Master**. Using an off-line spreadsheet, Modbus registers and slave addresses are mapped along side BACnet object instances. The spreadsheet creates a CSV file which is downloaded into the **BASremote Master** for periodic scanning. The result is that attached Modbus Serial devices can be viewed as BACnet objects.



Modbus 2 BACnet Device Profiling

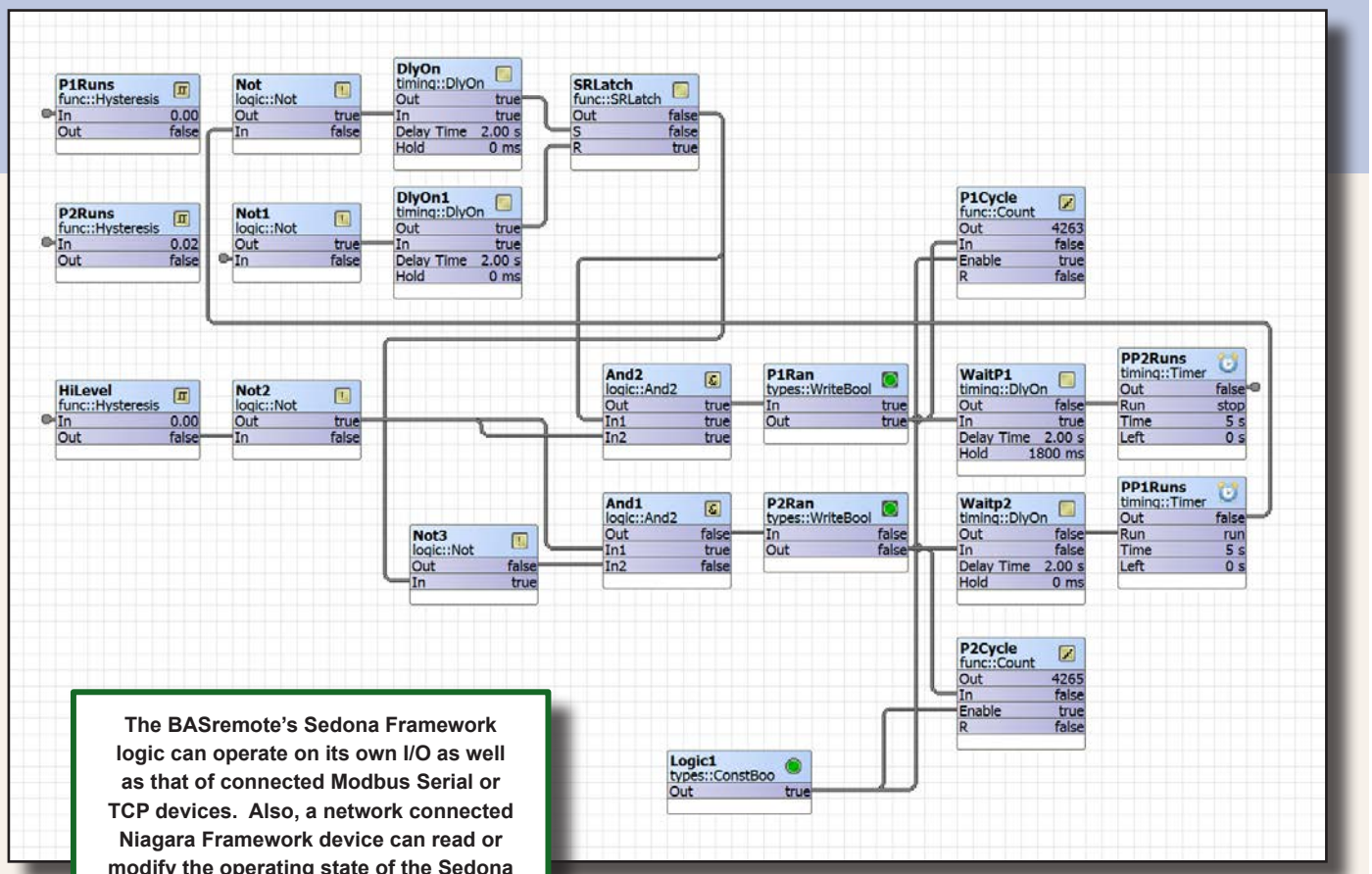
Load Target Device with poll data | Veris H8436-FDS | Modbus 2 BACnet Device Profile from CONTEMPORARY CONTROLS | Help

Enable Poll	BACnet Object Name	Info	BACnet Instance		Units
TRUE	Real Energy Consumption		AI	1001	KILOWATT_HOURS
FALSE	Total Instantaneous Real Power (3 Phase Total)		AI	1002	KILOWATTS
FALSE	Total Instantaneous Apparent Power (3 Phase Total)		AI	1003	KILOVOLT_AMPERES
TRUE	Total Instantaneous Reactive Power (3 Phase Total)		AI	1004	KILOVOLT_AMPERES_REACTIVE
FALSE	Total Power Factor (Total KW / Total KVA)		AI	1005	NO_UNITS
FALSE	Voltage, L-L, Average of 3 Phases		AI	1006	VOLTS
FALSE	Voltage, L-N, Average of 3 Phases		AI	1007	VOLTS
TRUE	Current, Average of 3 Phases		AI	1008	AMPERES
FALSE	Real Power, Phase A		AI	1009	KILOWATTS
FALSE	Real Power, Phase B		AI	1010	KILOWATTS
FALSE	Real Power, Phase C		AI	1011	KILOWATTS
FALSE	Power Factor, Phase A		AI	1012	NO_UNITS
FALSE	Power Factor, Phase B		AI	1013	NO_UNITS

Application #3 — Certified Sedona Framework for Implementing Control

The **BASremote Master** incorporates Sedona Virtual Machine (SVM) technology developed by Tridium and compatible with their Niagara Framework™. Using established Tridium tools such as Workbench, a system integrator can develop a control application using Workbench's powerful drag-and-drop visual programming methodology. Once developed, the program remains stored in the **BASremote Master** and executes by way of the SVM. The application can run standalone in the **BASremote Master** or interact with a program in a Tridium JACE supervisory controller over Ethernet. The number of potential applications is only limited by the imagination of the system integrator.

Tridium's Niagara Workbench or a similar tool can be used to program Sedona running in the BASremote.



The BASremote's Sedona Framework logic can operate on its own I/O as well as that of connected Modbus Serial or TCP devices. Also, a network connected Niagara Framework device can read or modify the operating state of the Sedona Framework function blocks.

CERTIFIED sedona FRAMEWORK™

BASremote Services
Sedona Components

Input Boolean	BASremote binary input
Input Float	BASremote analog input or value
Output Boolean	BASremote binary output
Output Float	BASremote analog output
Output Float Conditional	BASremote conditional analog output
Send Email	BASremote email alert

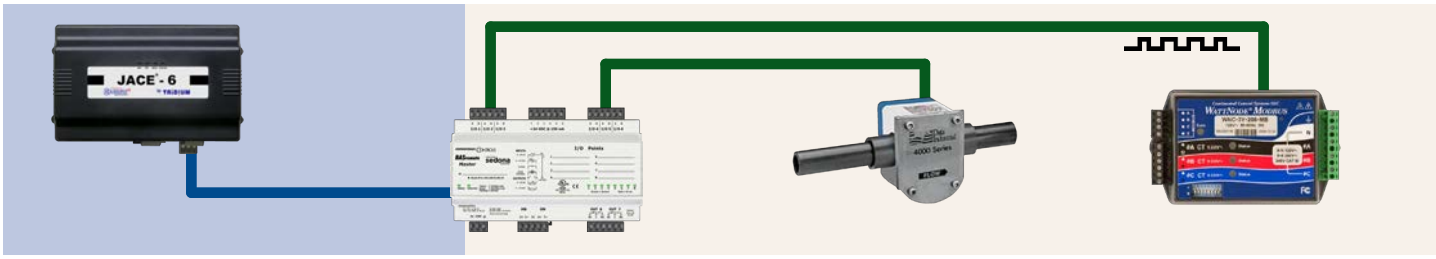
Common Components Used In Function Block Programming

The HVAC Group operations that facilitate control	**LSeq**	Linear Sequencer — bar graph representation of input value
	ReheatSeq	Reheat sequence — linear sequence up to four outputs
	Reset	Reset — output scales an input range between two limits
	Tstat	Thermostat — on/off temperature controller
The Scheduling Group scheduling operations based upon time of day	**DailySc**	Daily Schedule Boolean — two-period Boolean scheduler
	DailyS1	Daily Schedule Float — two-period float scheduler
	DateTime	Time of Day — time, day, month, year
The Function Group convenient functions for developing control schemes	**Cmpr**	Comparison math — comparison (<=>) of two floats
	Count	Integer counter — up/down counter with integer output
	Freq	Pulse frequency — calculates the input pulse frequency
	Hysteresis	Hysteresis — setting on/off trip points to an input variable
	IRamp	IRamp — generates a repeating triangular wave with an integer output
	Limiter	Limiter — Restricts output within upper and lower bounds
	Linearize	Linearize — piecewise linearization of a float
	LP	LP — proportional, integral, derivative (PID) loop controller
	Ramp	Ramp — generates a repeating triangular or sawtooth wave with a float output
	SRLatch	Set/Reset Latch — single-bit data storage
	TickTock	Ticking clock — an astable oscillator used as a time base
	UpDn	Float counter — up/down counter with float output
The Priority Group prioritizing actions of Boolean, Float and Integer variables	**PrioritizedBool**	Prioritized boolean output — highest of sixteen inputs
	PrioritizedFloat	Prioritized float output — highest of sixteen inputs
	PrioritizedInt	Prioritized integer output — highest of sixteen inputs
The Types Group variable types and conversion between types	**B2F**	Binary to float encoder — 16-bit binary to float conversion
	ConstBool	Boolean constant — a predefined Boolean value
	ConstFloat	Float constant — a predefined float variable
	ConstInt	Integer constant — a predefined integer variable
	F2B	Float to binary decoder — float to 16-bit binary conversion
	F2I	Float to integer — float to integer conversion
	I2F	Integer to float — integer to float conversion
	L2F	Long to float — long integer to float conversion
	WriteBool	Write Boolean — setting a writable Boolean value
	WriteFloat	Write Float — setting a writable float value
	WriteInt	Write integer — setting an integer value
The Logic Group logical operations using Boolean variables	**ADemux2**	Analog Demux — Single-input, two-output analog de-multiplexer
	And2	Two-input Boolean product — two-input AND gate
	And4	Four-input Boolean product — four-input AND gate
	ASW	Analog switch — selection between two float variables
	ASW4	Analog switch — selection between four floats
	B2P	Binary to pulse — simple mono-stable oscillator (single-shot)
	BSW	Boolean switch — selection between two Boolean variables
	DemuxI2B4	Four-output Demux — integer to Boolean de-multiplexer
	ISW	Integer switch — selection between two integer variables
	Not	Not — inverts the state of a Boolean
	Or2	Two-input Boolean sum — two-input OR gate
	Or4	Four-input Boolean sum — four-input OR gate
	Xor	Two-input exclusive Boolean sum — two-input XOR gate
The Timing Group extended Boolean logic	**DlyOff**	Off delay timer — time delay from a “true” to “false” transition of the input
	DlyOn	On delay timer — time delay from an “false” to “true” transition of the input
	OneShot	Single Shot — provides an adjustable pulse width to an input transition
	Timer	Timer — countdown timer
The Math Group operations on Float, Integer and Boolean variables	**Add2**	Two-input addition — results in the addition of two floats
	Add4	Four-input addition — results in the addition of four floats
	Avg10	Average of 10 — sums the last ten floats while dividing by ten thereby providing a running average
	AvgN	Average of N — sums the last N floats while dividing by N thereby providing a running average
	Div2	Divide two — results in the division of two float variables
	FloatOffset	Float offset — float shifted by a fixed amount
	Max	Maximum selector — selects the greater of two inputs
	Min	Minimum selector — selects the lesser of two inputs
	MinMax	Min/Max detector — records both the maximum and minimum values of a float
	Mul2	Multiply two — results in the multiplication of two floats
	Mul4	Multiply four — results in the multiplication of four floats
	Neg	Negate — changes the sign of a float
	Round	Round — rounds a float to the nearest N places
	Sub2	Subtract two — results in the subtraction of two floats
	Sub4	Subtract four — results in the subtraction of four floats
	TimeAvg	Time average — average value of float over time

Application #4 — Energy Usage Sub-metering

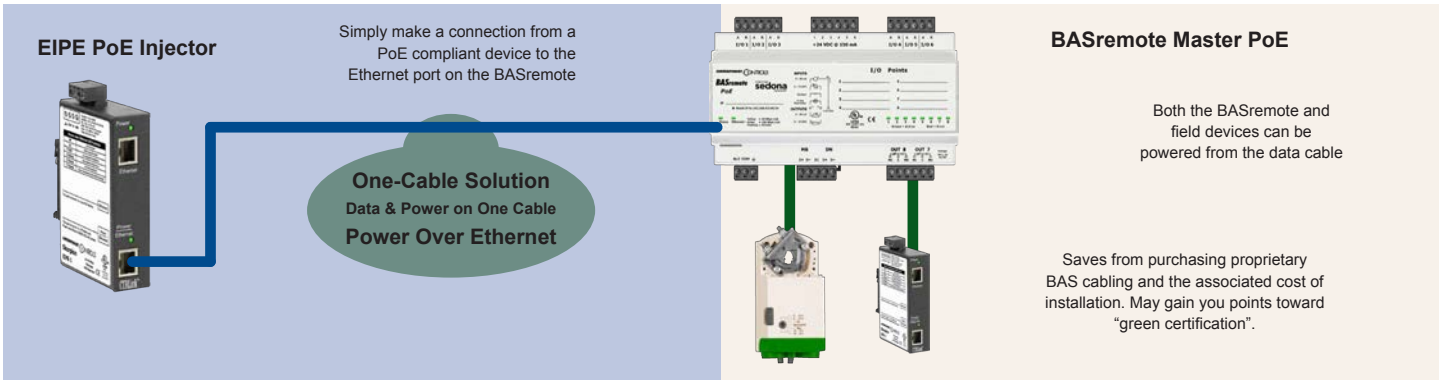
The BASremote Master can be used as a data concentrator for sub-metering applications. With sub-metering, tenants can be billed a portion of the actual energy usage based upon individual usage. Sub-metering can also verify actual energy savings from “green” initiatives. Usually a pulse is generated from natural gas, water, or electrical meters which need to be captured and accumulated in order to determine energy usage. One pulse represents a unit of energy usually requiring a scaling factor to be applied. The BASremote Master can be configured through web pages to handle up to six pulse inputs with independent threshold settings in order to adapt to different styles of meters. For convenience, both pulse rate (power) and accumulation (energy) can be displayed on a BASremote Master web page after applying a meaningful scaling factor to the raw data. Sedona Framework can also be used to calculate beyond simple scaling. Internally, pulses are accumulated indefinitely until reset by a supervisory controller or through a protected web page. Pulse data cannot be lost due to inadvertent power loss because it is stored in nonvolatile memory. If special energy demand monitoring is required, this can be accomplished using a Sedona Framework program in the BASremote Master or with a program in a supervisory controller.

The more sophisticated electrical meters have a Modbus Serial interface which can be attached to the BASremote Master MB port. Using either the router or gateway functionality of the BASremote, energy usage data can be presented to a supervisory controller over Ethernet.



Application #5 — Power over Ethernet (PoE) for a “One Cable Solution”

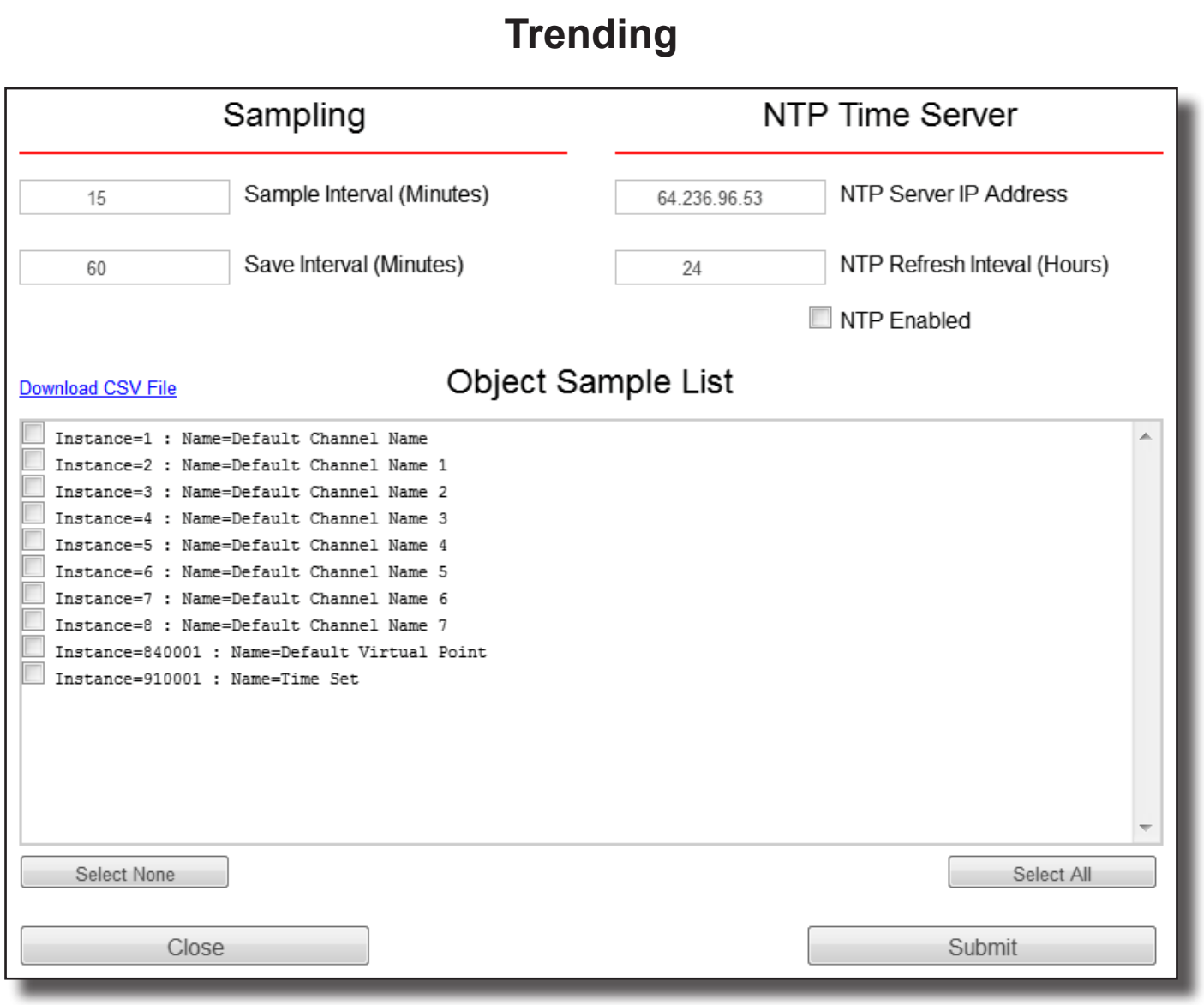
The Power over Ethernet standard (IEEE 802.3af) gives the system integrator another opportunity to be imaginative. With PoE, both 48 VDC power and Ethernet communication reside on the same cable. PoE power is derived from Power Sourcing Equipment (PSE). This could be an Ethernet switch, a multi-port mid-span PSE, or a single-port PSE commonly referred to as a Power Injector. Regardless of the PSE, the BASremote PoE performs the duties of a Powered Device (PD) in that it can still communicate over Ethernet while powering its own electronics plus any devices connected to its auxiliary 24 VDC power supply. The BASremote PoE has identical capabilities as the BASremote Master but without the need for a power input connection. By using an uninterruptable power supply (UPS) at the PSE source, it is possible to guard the BASremote PoE against any power failures. This arrangement could be attractive in critical control or security applications.



Application #6 — Trending

The new trending feature will allow the trending of the BASremote's 8 channels, any connected expansion unit's channels and those of any mapped Modbus devices (RTU or Modbus TCP). The trend data will be stored within the BASremote. You can select the frequency of trending and the frequency of storage.

After the trend file is filled, it will discard the oldest trend data. The trend data is available via the BASremote webpage in a simple CSV format. The BASremote can store up to about 150,000 entries. The trend feature also supports an NTP feature for accurately setting the time within the trend.

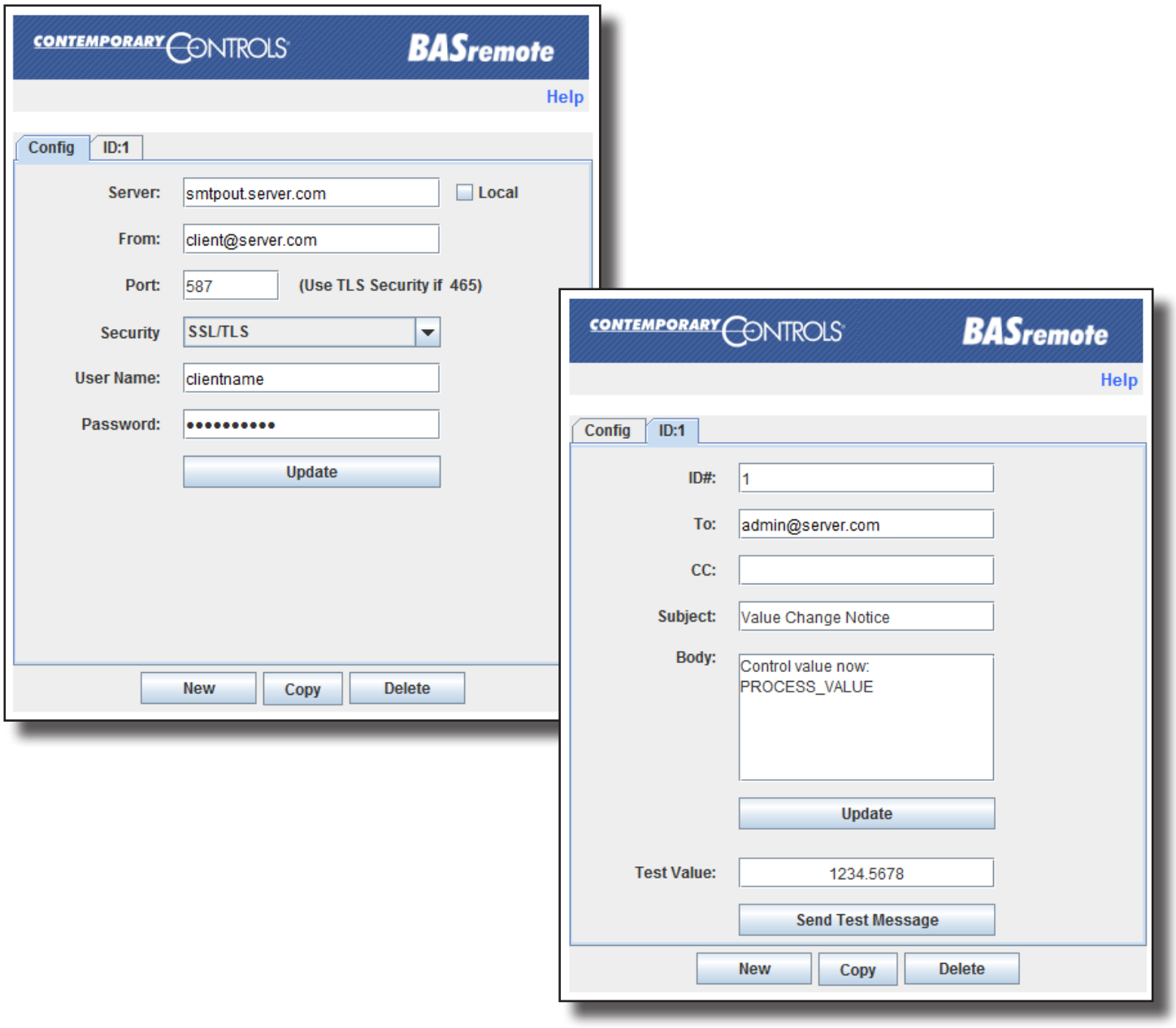


Application #7 — Email

SendEmail allows the Sedona application to send emails when a specific event has occurred in the Sedona application. This can be a good way to send alarm alerts to the maintenance personal. The email will also carry the value which is passed into the component.

The email also contains text which can be used to describe the alarm condition, along with the component input value. Many different emails can be sent by the BASremote to many different email addresses.

Email Server Setup



Individual Email Setup

BACnet Protocol Implementation Conformance 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

Specifications

Universal Inputs/Outputs (Channels 1–6)

Configured As	Characteristics
Analog input	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 Ohms when using current output.

Relay Outputs (Channels 7 and 8)

Form “C” contact with both NO and NC contacts. 30 VAC/VDC 2 A. Class 2 circuits only.

Regulatory Compliance

CE Mark; CFR 47, Part 15 Class A; RoHS; UL 508, C22.2 No. 142-M1987

c UL us LISTED IND. CONT. EQ. 4EA4

Functional

	Ethernet (BASremote Master Only)	Modbus Serial
Compliance	IEEE 802.3	V1.02
Protocols supported	Modbus TCP BACnet/IP SOX	RTU master ASCII master
Data rate	10 Mbps, 100 Mbps	2.4 to 115.2 kbps
Physical layer	10BASE-T, 100BASE-TX	EIA-485, 2-wire, non-isolated
Cable length	100 m (max)	100 m (max)
Port connector	Shielded RJ-45	3-pin terminal
Flow control	Half-duplex (backpressure)	

LEDs

Ethernet **(master only)**	**Green:** 100 Mbps link — **Yellow:** 10 Mbps link — **Flashing:** link activity
Status **(all units)**	**Green solid:** unit operational — **Green flashing:** unit booting — **Red:** unit in fault state
I/O channels **(all units)**	**Unlit:** channel inactive — **Green:** channel active — **Red:** channel fault (detailed in manual)
Network **(expansion only)**	**Green:** valid link to master — **Flashing:** data exchange with master

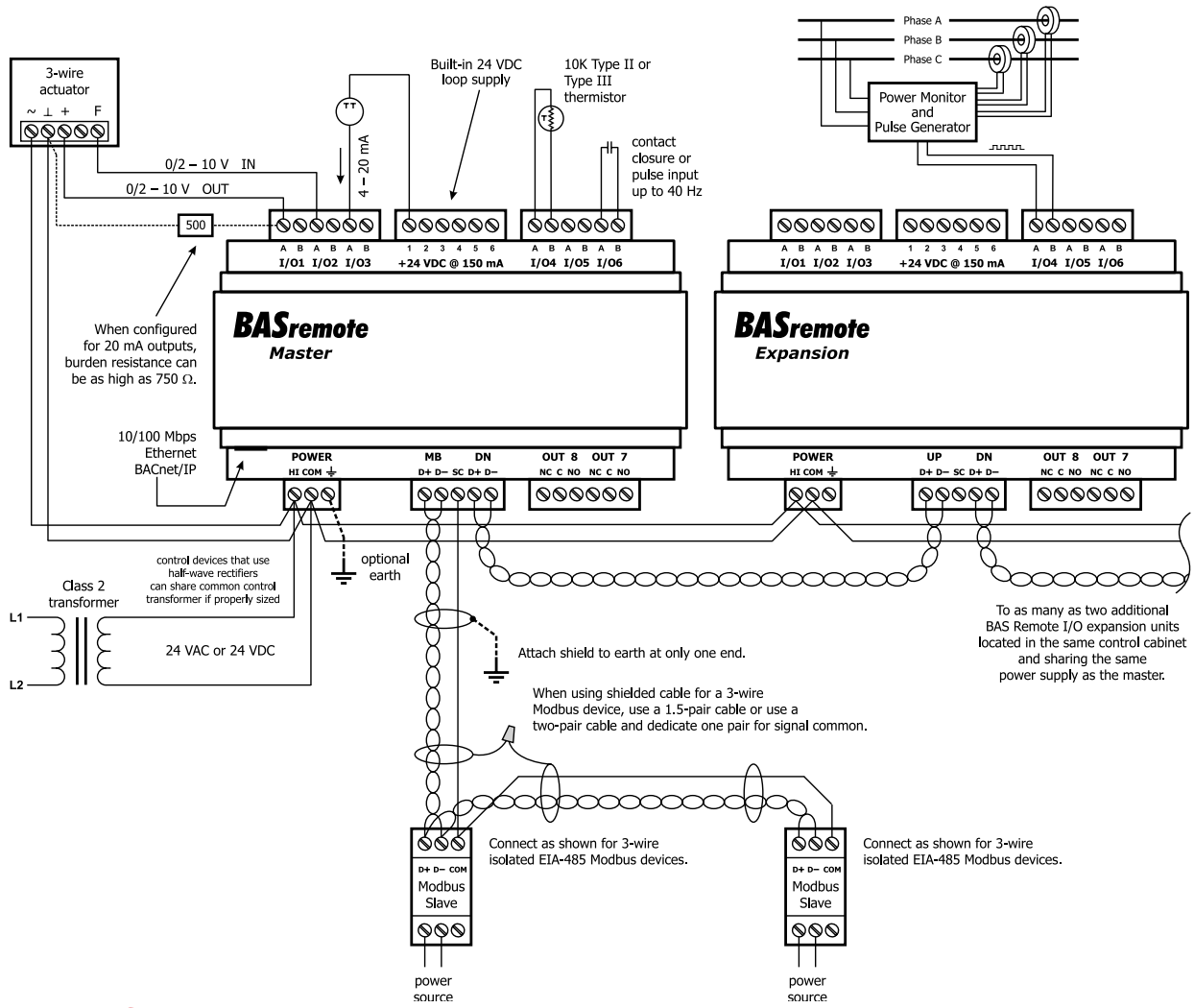
Electrical

	Master		Expansion		Master/PoE
Input (DC or AC)	DC	AC	DC	AC	DC
Voltage (V, ± 10%)	24	24	24	24	48
Power	10 W	17 VA	8 W	17 VA	10 W
Frequency	N/A	47–63 Hz	N/A	47–63 Hz	N/A
Loop supply (24 VDC nom.)	150 mA (max)		150 mA (max)		150 mA (max)

Environmental/Mechanical

Operating temperature	0°C to 60°C
Storage temperature	–40°C to +85°C
Relative humidity	10–95%, noncondensing
Protection	IP30
Weight	0.6 lbs. (.27 kg)

Wiring Diagram



Ordering Information

Model	*RoHS*	*Description*
BASR-8M	✔	BASremote Master with 8 I/O points
BASR-8X	✔	BASremote Expansion with 8 I/O points
BASR-8M/P	✔	BASremote Master with 8 I/O points and PoE

United States
Contemporary Control Systems, Inc.
2431 Curtiss Street
Downers Grove, IL 60515
USA

Tel: +1 630 963 7070
Fax:+1 630 963 0109

info@ccontrols.com
www.ccontrols.com

China
Contemporary Controls (Suzhou) Co. Ltd
11 Huoju Road
Science & Technology Industrial Park
New District, Suzhou
PR China 215009

Tel: +86 512 68095866
Fax: +86 512 68093760

info@ccontrols.com.cn
www.ccontrols.asia

United Kingdom
Contemporary Controls Ltd
14 Bow Court
Fletchworth Gate
Coventry CV5 6SP
United Kingdom

Tel: +44 (0)24 7641 3786
Fax:+44 (0)24 7641 3923

ccl.info@ccontrols.com
www.ccontrols.eu

Germany
Contemporary Controls GmbH
Fuggerstraße 1 B
04158 Leipzig
Germany

Tel: +49 341 520359 0
Fax: +49 341 520359 16

ccg.info@ccontrols.com
www.ccontrols.eu