

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

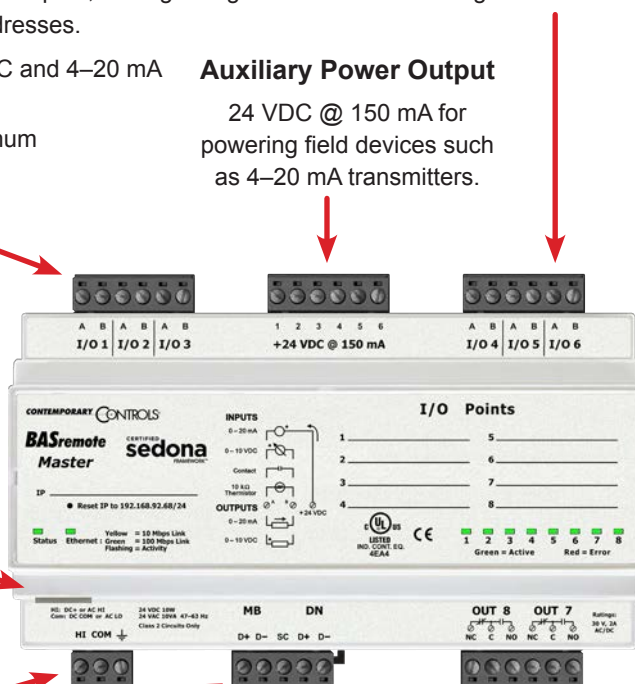
RTU or ASCII master, 2.4–115.2 kbps, 2-wire non-isolated, up to 31 full-load EIA-485 devices

Expansion Port

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

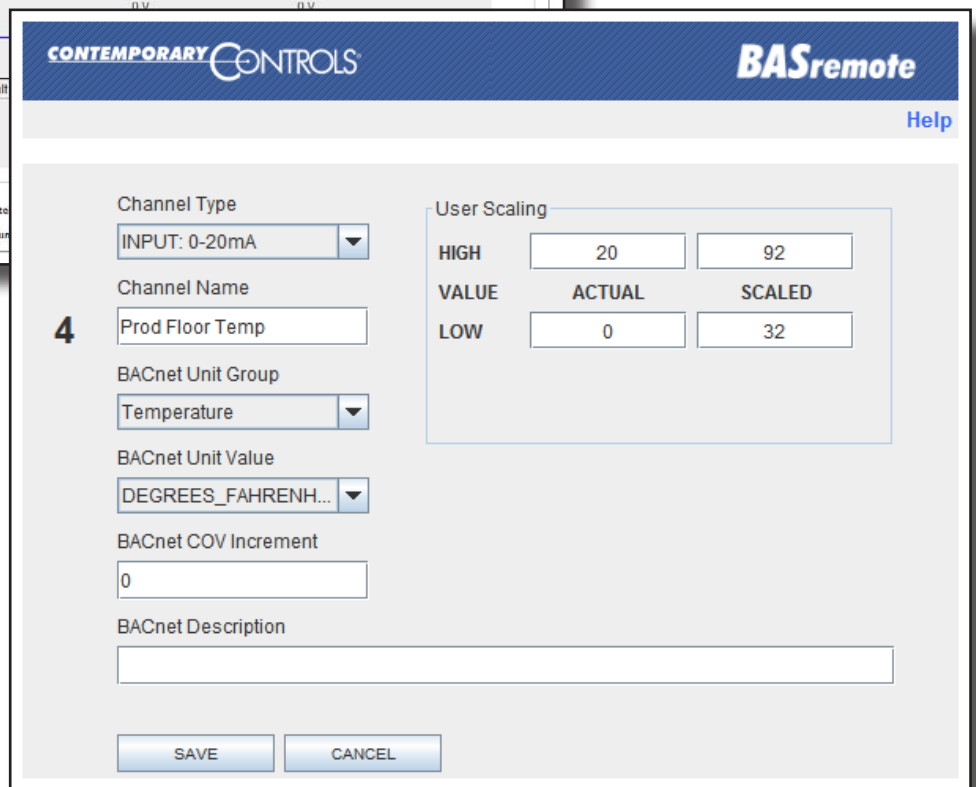
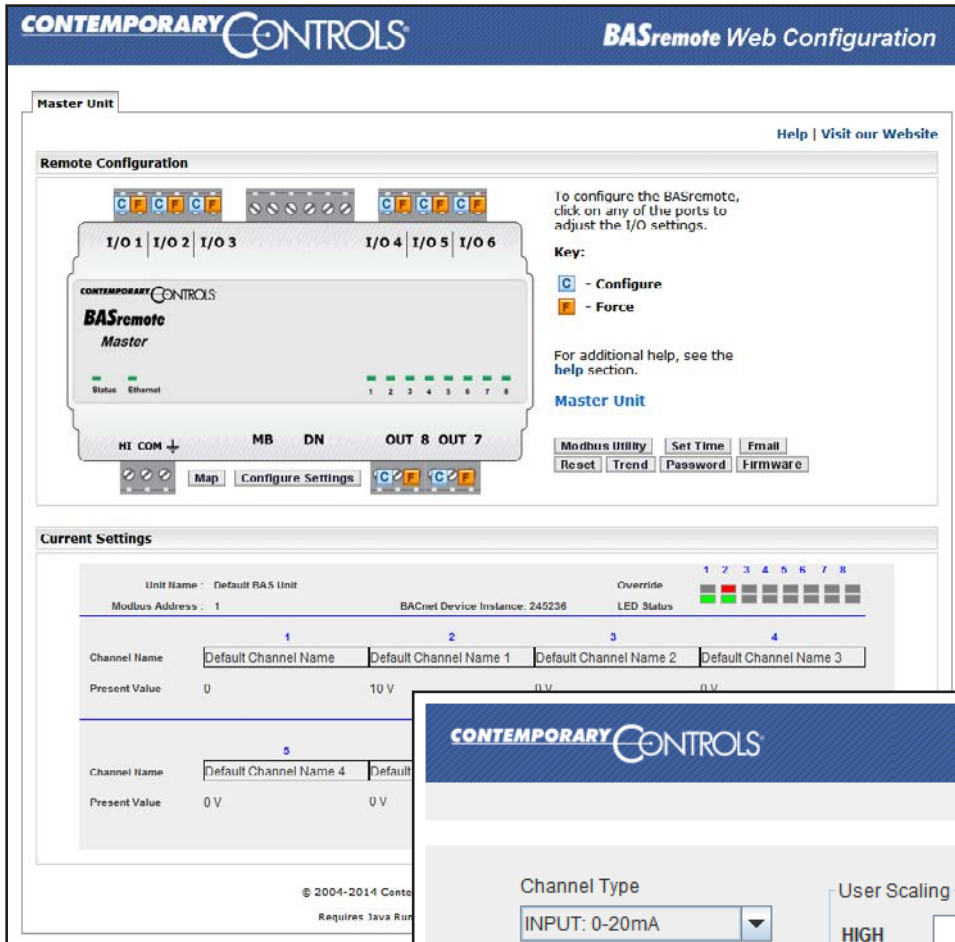
Relay Outputs

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



Web Page Configuration

Web Server Screen

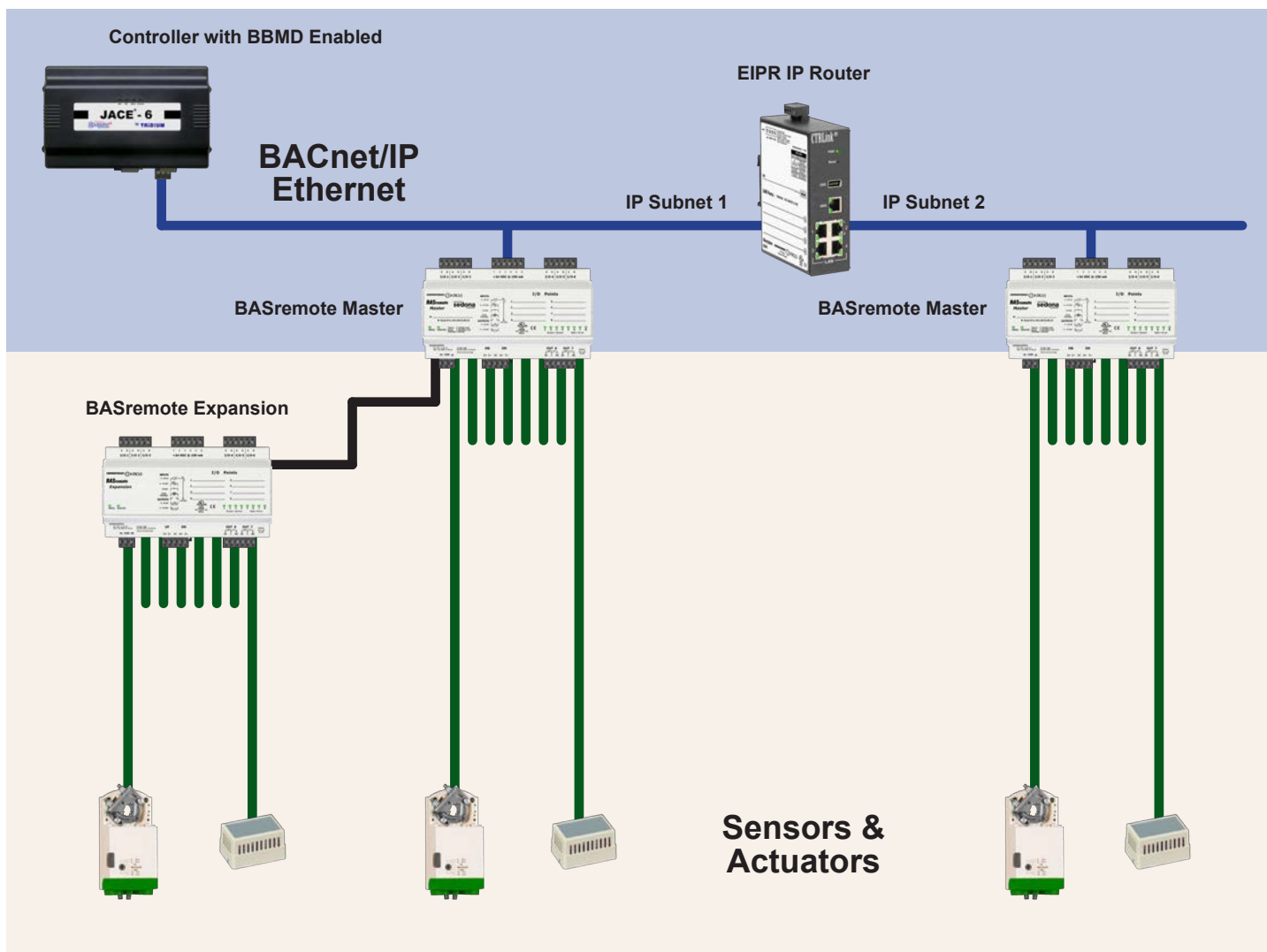


Typical I/O Point Configuration Screen

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.

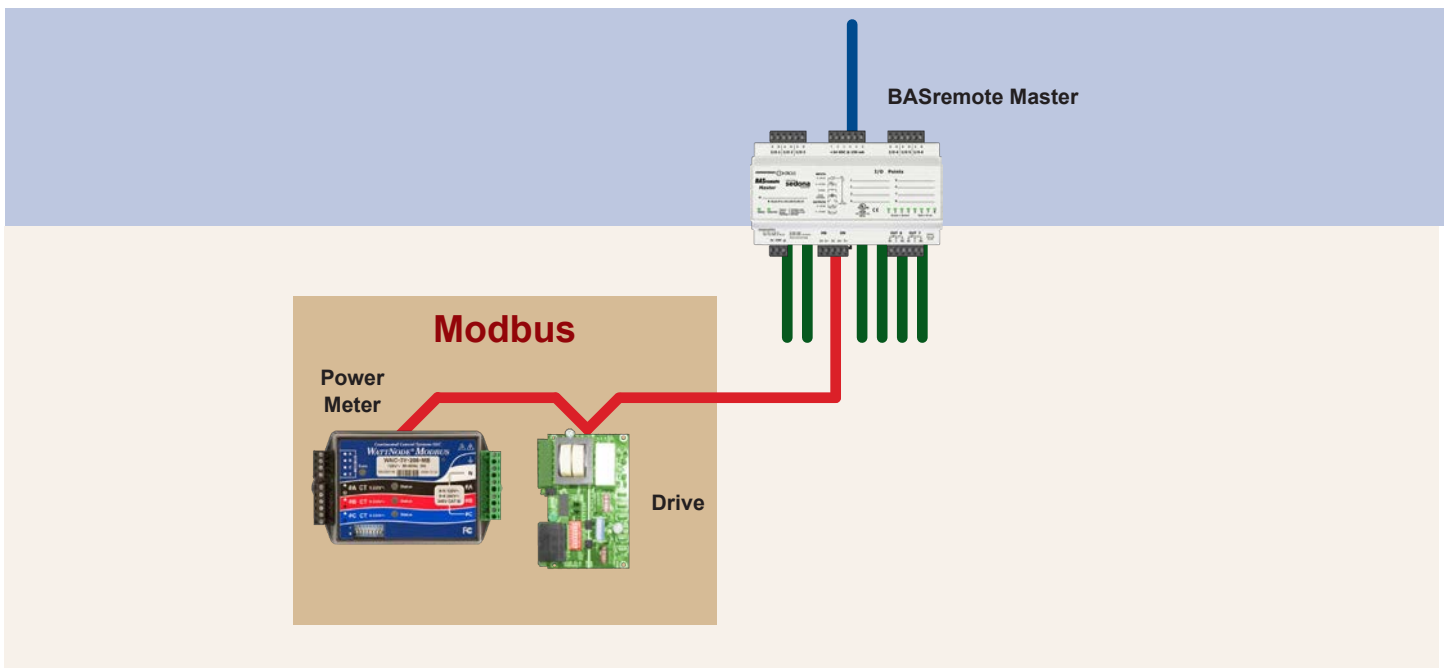


Application #2 — Modbus Serial to BACnet Gateway for Unifying Data

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

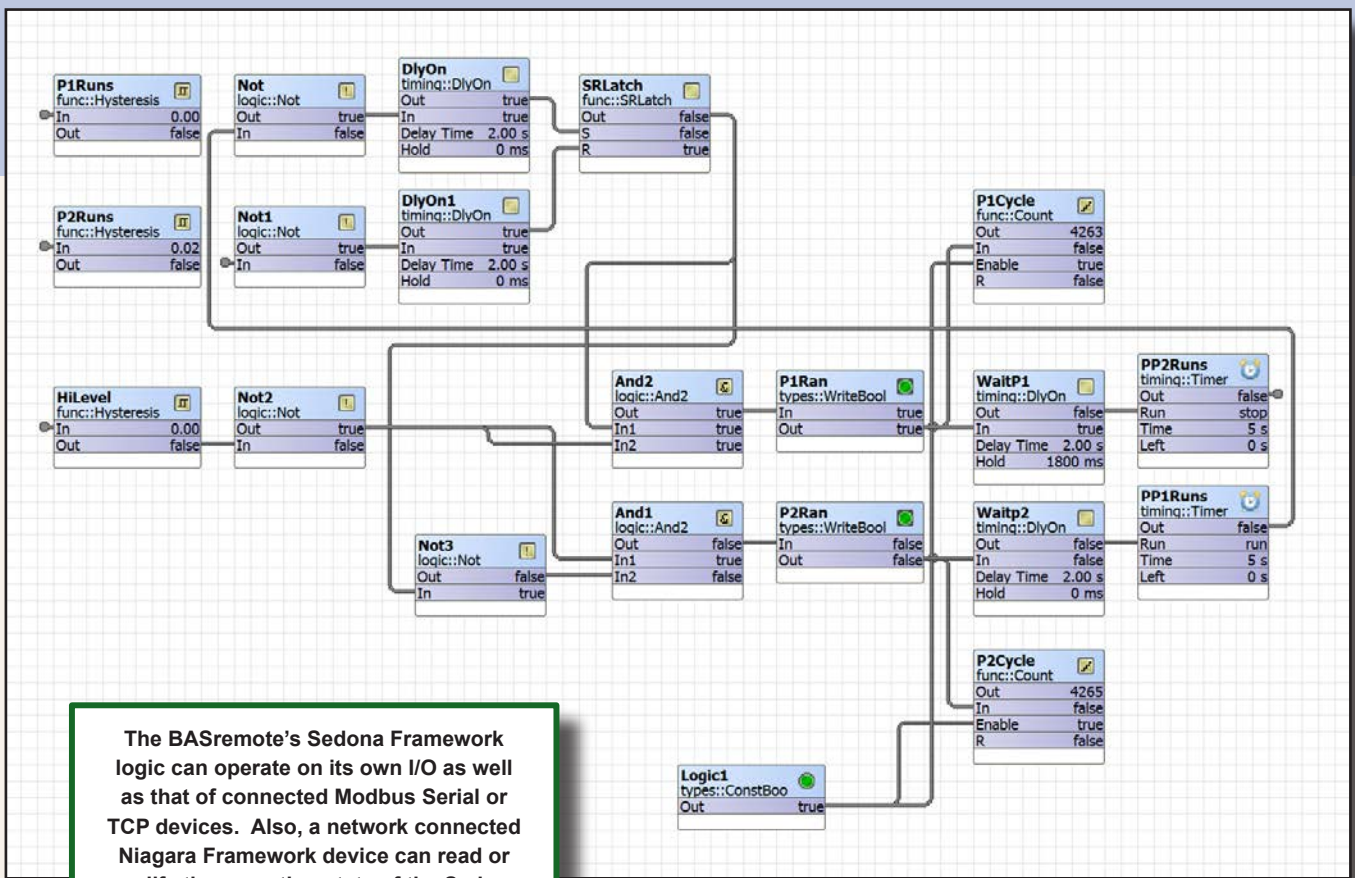
Enable Poll	BACnet Object Name	Info	BACnet Instance	Units
TRUE	Real Energy Consumption		AI 1001	KILOWATT_HOURS
FALSE	Total Instantaneous Real Power (3 Phase Total)		AI 1002	KILOWATTS
FALSE	Total Instantaneous Apparent Power (3 Phase Total)		AI 1003	KILOVOLT_AMPERES
TRUE	Total Instantaneous Reactive Power (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.



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

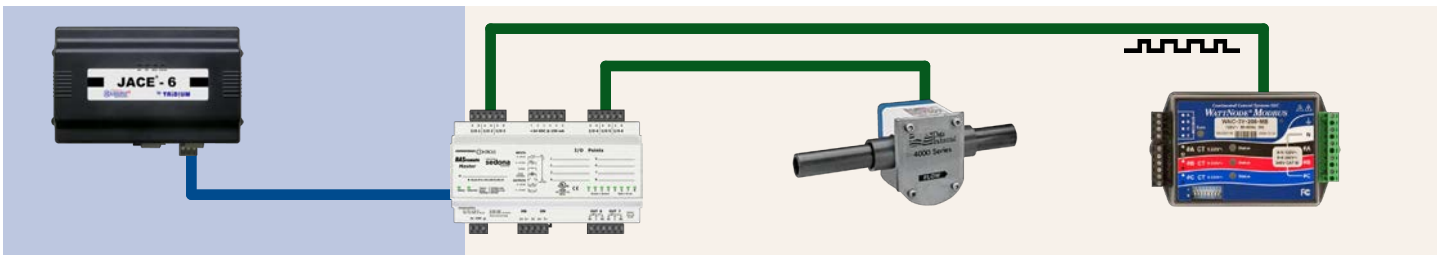
<p>The HVAC Group operations that facilitate control</p>	<p>LSeq ReheatSeq Reset Tstat</p>	<p>Linear Sequencer — bar graph representation of input value Reheat sequence — linear sequence up to four outputs Reset — output scales an input range between two limits Thermostat — on/off temperature controller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

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.

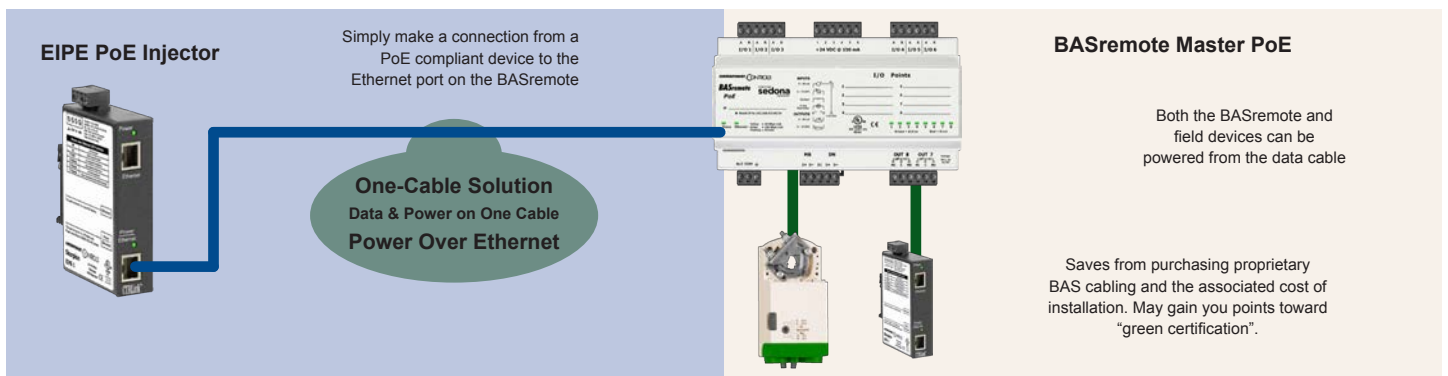
The more sophisticated electrical meters have a Modbus Serial interface which can be attached to the BASremote Master MB port. Using either the router or gateway functionality of the BASremote, energy usage data can be presented to a supervisory controller over Ethernet.



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.

Trending

Sampling	NTP Time Server
<input type="text" value="15"/> Sample Interval (Minutes)	<input type="text" value="64.236.96.53"/> NTP Server IP Address
<input type="text" value="60"/> Save Interval (Minutes)	<input type="text" value="24"/> NTP Refresh Interval (Hours)
	<input type="checkbox"/> NTP Enabled

[Download CSV File](#)

Object Sample List

- Instance=1 : Name=Default Channel Name
- Instance=2 : Name=Default Channel Name 1
- Instance=3 : Name=Default Channel Name 2
- Instance=4 : Name=Default Channel Name 3
- Instance=5 : Name=Default Channel Name 4
- Instance=6 : Name=Default Channel Name 5
- Instance=7 : Name=Default Channel Name 6
- Instance=8 : Name=Default Channel Name 7
- Instance=840001 : Name=Default Virtual Point
- Instance=910001 : Name=Time Set

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

The screenshot shows the 'Email Server Setup' configuration window. The title bar includes 'CONTEMPORARY CONTROLS' and 'BASremote'. Below the title bar is a 'Help' link. The main area is titled 'Config ID:1' and contains the following fields and controls:

- Server: Local
- From:
- Port: (Use TLS Security if 465)
- Security: (dropdown menu)
- User Name:
- Password:
-

At the bottom of the window are three buttons: , , and .

The screenshot shows the 'Individual Email Setup' configuration window. The title bar includes 'CONTEMPORARY CONTROLS' and 'BASremote'. Below the title bar is a 'Help' link. The main area is titled 'Config ID:1' and contains the following fields and controls:

- ID#:
- To:
- CC:
- Subject:
- Body:
-
- Test Value:
-

At the bottom of the window are three buttons: , , and .

Individual Email Setup

BACnet Protocol Implementation Conformance Statement



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)
- IBM™/Microsoft™ DBCS
- ISO 8859-1
- ISO 10646 (UCS-2)
- ISO 10646 (UCS-4)
- 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



Functional

	Ethernet <small>(BASremote Master Only)</small>	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

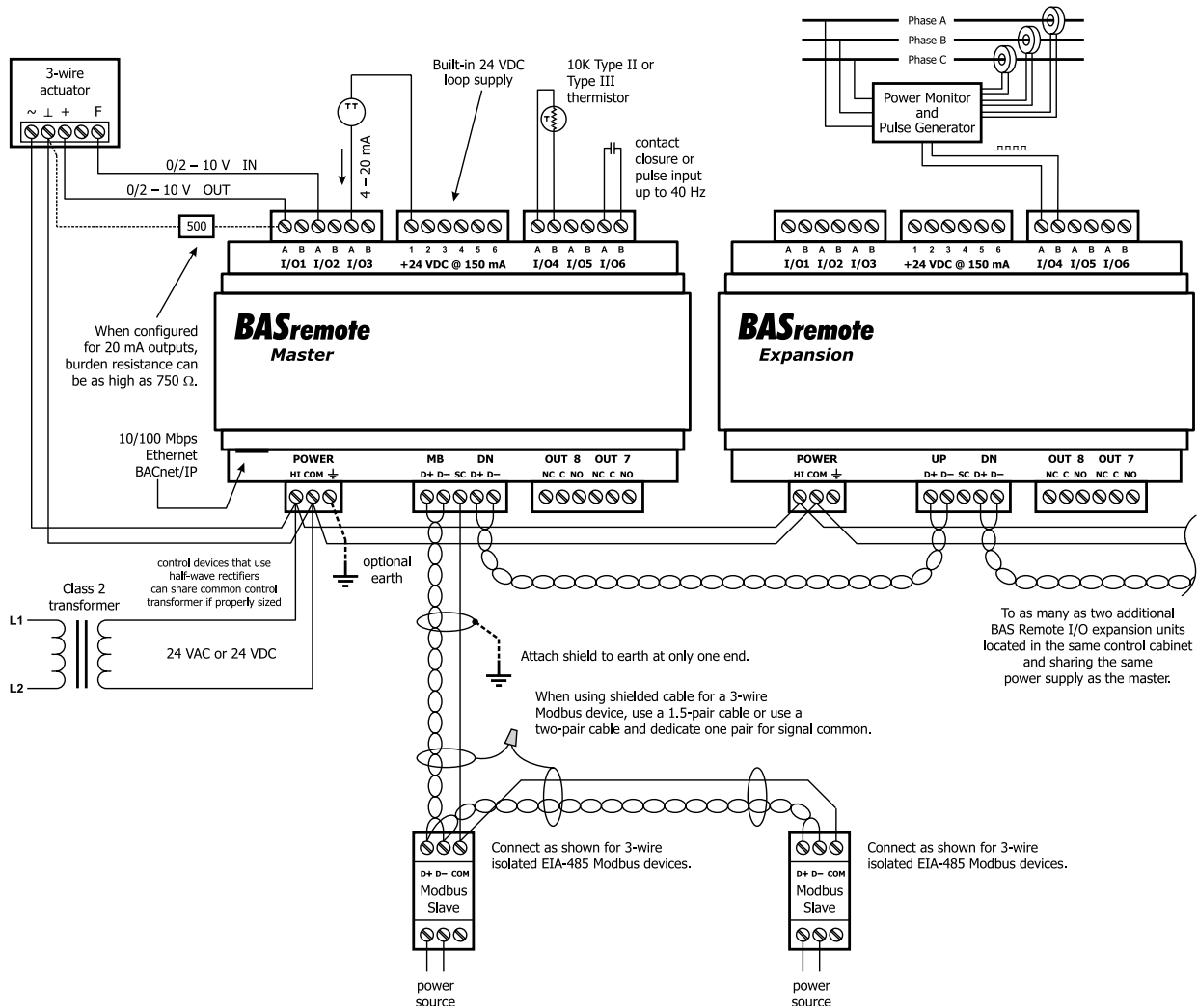
Electrical

	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

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