BASpi – 12-point BACnet/IP Sedona Expansion Board

The BASpi I/O board is a 12-point BAS expansion board for Raspberry Pi. The I/O board, plus the firmware files provided by Contemporary Controls turn your Raspberry Pi into a BACnet-networked, Sedona-programmable controller with 6 Universal Inputs and 6 Relay Outputs. All 12 physical I/O points, in addition to 24 Virtual Points are served up over BACnet/IP using Ethernet or Wi-Fi. BASpi is web page configurable over Ethernet or Wi-Fi

connections. The Sedona Application Editor (SAE) is offered as part of the free BAScontrol Toolset. This programming tool is used to create control applications by linking graphical components on a wiresheet. In addition to SAE, BASemulator gives you BASpi software emulation for PC and BASbackup allows you to backup and restore your entire BASpi project to a zip file.

Versatile Control Device

- BACnet/IP Server - 12 physical points and 24 virtual points
- BACnet/IP over Ethernet or Wi-Fi
- Resident Sedona Virtual Machine (SVM)
- Graphically programmable with free Sedona Application Editor
- Email alarms/notifications triggered by Sedona logic
- Weekly schedule with exceptions/holidays
- Free project backup and restore utility - BASbackup and free software emulator for PC - BASemulator
- Web page configurable with a common web browser over Ethernet or Wi-Fi (2.4GHz 802.11b/g/n)
- NTP server or manually-settable clock

Flexible Input/Output — 12-points of physical I/O

- Six configurable Universal Inputs:Analog Input (0-10V), Binary Input, Resistance, Thermistor (10KT2, 10KT3, 20K), Pulse Input max (40Hz)
- Six Relay Outputs (2A max current)
- 24 Virtual Points used to read or write data to/from wiresheet by a BACnet client/supervisor station
- 48 Web Components allow live monitoring and forcing of wiresheet points from the BASpi's web page
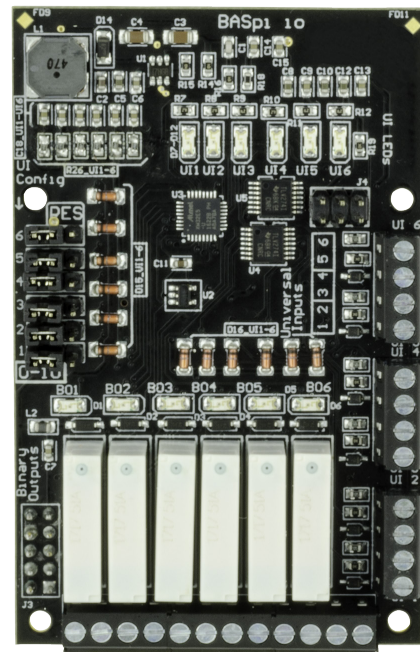
ASHRAE **BACnet**™

Sedona

BASpi I/O board is compatible with Raspberry Pi 3 or 4 and requires a Raspbian with Desktop installation, as well as firmware files provided by Contemporary Controls. The firmware will only run if the BASpi-IO board hardware is installed on the Raspberry Pi. There are two installation options for the BASpi I/O board firmware:

- The entire Raspbian image (Raspbian with Desktop + BASpi firmware files) provided by Contemporary Controls as a download. All you would need to do is download it from www.baspi.io, write it to an 8GB or larger SD card, and power it up.

- The BASpi stand-alone firmware files can be downloaded and copied to a USB drive, transferred, and installed onto your existing Raspbian system.

BASpi-IO is supported by the free BAScontrol Toolset including Sedona Application Editor used to create graphical wire sheet programs for sequence of operation, BASbackup project archiving and restore utility, and BASemulator which provides BASpi emulation on your PC. All BASpi downloads can be freely accessed at www.baspi.io

BASpi – Overview

The BASpi IO board utilizes the powerful 64-bit CPU in the Raspberry Pi as well as its Ethernet and Wi-Fi adapters for network connectivity. The board is powered through the 10-pin header which mates with the Raspberry Pi GPIO Header pins 1 through 10. By operating at the BACnet/IP level, the BASpi can share the same Ethernet or Wi-Fi network with BACnet supervisory controllers and operator workstations. The BASpi's Sedona Virtual Machine can be accessed over wired Ethernet IP connection, or wirelessly over Wi-Fi. The BACnet server can be operational on one physical layer at a time only, either wired over Ethernet, or wireless over Wi-Fi. You can select which layer you want BACnet /IP to be served on from System Configuration page (WIRED or WIRELESS). The unit can be configured for a fixed IP address or can operate as a DHCP client receiving its IP address from a DHCP server. An NTP or manually-configurable clock allows for creating a local schedule. The weekly schedule is web page configurable and allows for entry of special event/holiday schedule exceptions. A schedule Sedona component is used to trigger logic. The BASpi can send email alarms/ otifications. Email alarms are web page configurable and allow for multiple point or wire sheet values to be included in the sent email. Emails can be sent to multiple recipients. An email Sedona component is used to trigger the alarms/notifications. Universal input channels are set for 0-10V input by default. Channel configuration is accomplished using the web page and setting the channel type using a 3-pin jumper. Type II and type III 10 kΩ thermistor curves and a 20 kΩ thermistor curve are resident in the unit. Pulse inputs with or without pull up are supported at up to 40Hz. Contact closure inputs require a voltage-free source.

Binary Outputs
Six form "A" relays for
30 VAC/VDC 2 A loads.
Class 2 circuits only.

Point LEDs
for all 12 points

Universal Inputs
Six input channels can be configured — all discoverable as BACnet objects.

- Analog inputs: 0–10 VDC, (+/- 1% precision)
- Temperature inputs: Type II or Type III 10 kΩ thermistors; 20 kΩ thermistor
- Resistance inputs range of: 1 kΩ to 100 kΩ

- Pulse input: accommodates active or passive sources (40 Hz max)
- Binary Input: voltage-free contact closure

BASpi Software Tools

The BAScontrol Toolset is offered as a free download. A link to obtain the free toolset is available at www.baspi.io. Refer to the Quick Start Guide for more information on getting started with the toolset. For complete details on Sedona operation and components see the Sedona Open Control Reference Manual at: https://www.ccontrols.com/tech/sedona.htm The BAScontrol Toolset consists of:

Sedona Application Editor (SAE) – used to connect to Sedona devices, write/edit graphical Sedona wiresheet control applications and saving local wiresheet application (SAX file) copies to a Windows PC/laptop.

BASemulator – is a software emulator for the BAScontrol series which runs on Windows. This controller emulator allows you to write your Sedona wiresheet application and fully configure all parameters such as I/O Channel configuration, BACnet settings, and Network settings before deploying onto real controllers.

BASbackup – allows you to backup and restore Sedona wiresheet applications and/or complete device configuration between real controllers or emulated controllers (using BASemulator). In addition, it allows you to create a transferrable backup file which can be used to clone controllers or reproduce controllers with slightly altered settings.
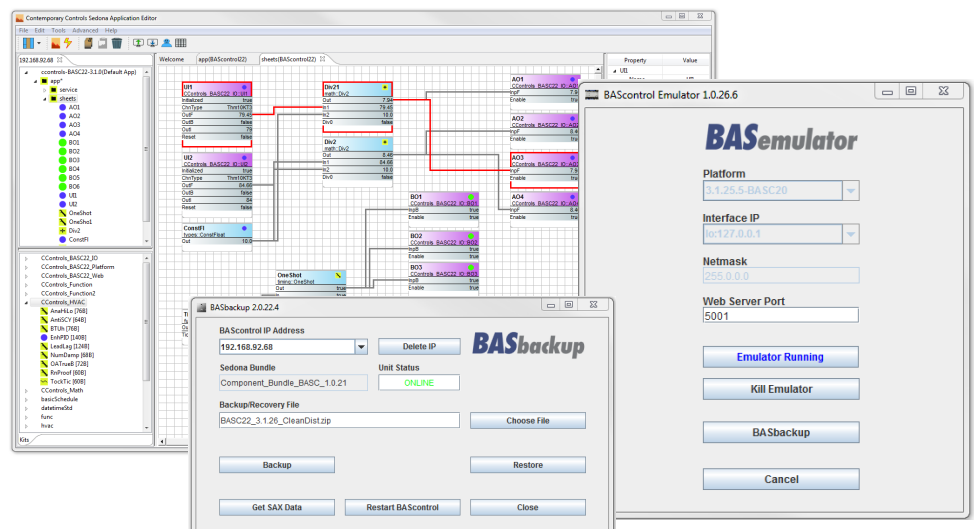
Configuring the Universal Inputs

The BASpi is web page configurable over wired Ethernet IP connection, or wirelessly over Wi-Fi. The web page allows for easy configuration, live monitoring, and forcing of physical points, virtual points, and web components. All points are accessible from the BASpi web page, BACnet /IP clients, and the Sedona wiresheet.

The BASpi universal inputs can be configured for several different channel types. There are two circuits on the six Universal Inputs which are jumper-selectable (UI config diagram). **RES** circuit utilizes a pull-up and the **0-10** does not. Depending on your input type, select pull up or no pull up for each channel by moving the jumpers accordingly.

First configure the jumper on the board:

1. For resistance or thermistor inputs and binary or pulse inputs which require a pull up, set the config jumper to "RES"

After configuring the jumper, select an appropriate channel type from the web page:

- Therm 10KT2
- Therm 10KT3
- Therm 20K
- Resistance
- Binary Input
- Pulse Input

2. For analog, pulse, and binary input (which do not require pull up), set the config jumper to "0-10"
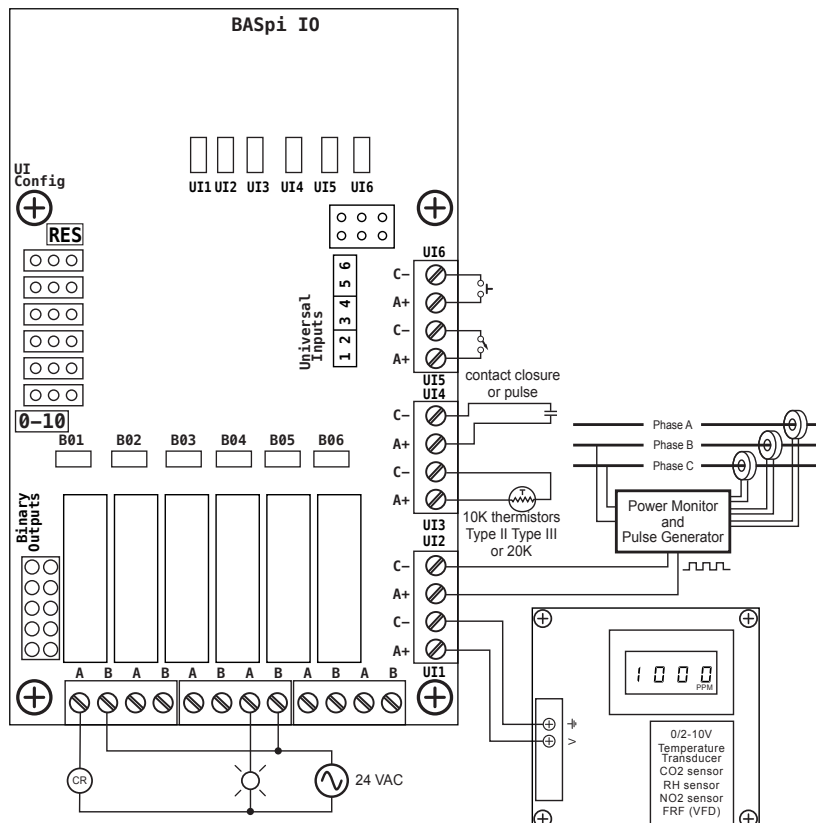
   After configuring the jumper, select an appropriate channel type from the web page:

   - Analog Input
   - Binary Input
   - Pulse Input
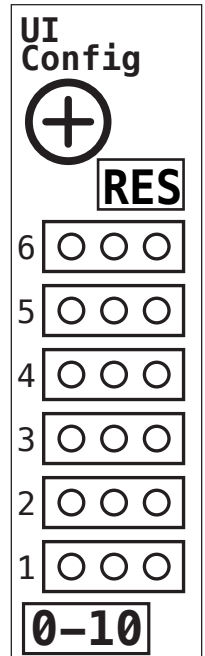
(see next section - Web page configuration for more web page detail).

BASpi Wiring Diagram

Web Page Configuration – Main Page and System Configuration

The BASpi is web page configurable over wired 10/100Mbps IP Ethernet connection, or wirelessly over Wi-Fi (2.4GHz 802.11b/g/n). The web page allows for easy system and channel configuration, live monitoring, and forcing of physical points, virtual points, and web components. Initially, the BASpi can be accessed over Ehternet cable at its default IP address of 192.168.92.68 with a subnet mask of 255.255.255.0 or it can be accessed internally

(from the Raspberry Pi web browser itself) at its local host address of 127.0.0.1.

The web page requires login authentication:
user name: admin
password: admin

The main web page provides an overview of all real points plus access to other web pages. To configure a point, click on the point name (a) and a configuration page will appear. To observe the updated data for each point, click Auto Refresh button to ON (b). Point values can be temporarily forced by checking the box adjacent to the point

(c), entering a value into the point's text box and clicking outside the box. The value will remain forced until the box is unchecked or the unit power cycled. Care must be exercised when forcing values into points. The BASpi unit can be restarted using the Restart Controller button (d).

System Configuration page allows you to easily set up the Ethernet and Wi-Fi network adapters, BACnet server configuration, and credentials authorization. Changes to this page will not take effect until the device has been rebooted.

The BASpi can operate on both network adapters concurrently with the exception of the BACnet server which will only operate on the selected adapter. The IP settings can be changed to the desired values. Either DHCP or a static IP address can be selected. If a static address is desired, enter the value along with the network mask and gateway address. If domain address is required, enter in the Primary and Secondary DNS addresses.

BACnet device data must be entered when using BACnet. Make sure the Device Instance (0-65536) is unique over the complete BACnet Internetwork. Device Object Name is the name which BACnet clients will see when the BASpi is discovered and/or trended into the BACnet client database. The BACnet UDP port is set to 47808 as a decimal value, also equivalent to BAC0 in hexadecimal by default. This UDP port number is used by BACnet clients when doing a discovery of the BACnet network. This port number can be changed as long as it is the same in both the client and server BACnet devices. BBMD feature requires a BACnet router with BBMD capability.

Either BACnet or Sedona protocols or both can be selected. BACnet checkmark enables the BACnet /IP server and the Sedona checkmark enables the Sedona Virtual Machine. Once satisfied with System Configuration, click Submit, then Close, and Restart Controller for changes to be applied on next bootup of BASpi.

Admin	Wired	Wi-Fi	BACnet	Close	Submit

Enable Protocol

BACnet/IP ☑   Sedona ☑

Authentication

User Name	admin	Password	•••••

Admin	Wired	Wi-Fi	BACnet	Close	Submit

IP Configuration

IP Mode	STATIC
Address	10.0.13.203
Netmask	255.255.240.0
Gateway	10.0.0.3

DNS Configuration

DNS1	8.8.8.8
DNS2	8.8.4.4

Admin	Wired	Wi-Fi	BACnet	Close	Submit

Wi-Fi Configuration

IP Mode	OFF
Address	192.168.2.157
Netmask	255.255.255.0
Gateway	192.168.2.1
SSID	ssid
Password	••••

Admin	Wired	Wi-Fi	BACnet	Close	Submit

BACnet Configuration

Device Name	BASpi 6U/6R
Device Instance	213203
UDP Port	47808
BBMD IP Address	0.0.0.0
BBMD Reg Time	100
Interface	WIRED

Web Page Configuration – Channel, Time and Web Components

Channel Configuration

After you have configured the 3-position jumper on the BASpi board, you can select the channel type for each of the six channels from the web page. For resistance or thermistor inputs and binary or pulse inputs with pull up, set the config jumper to "RES". After configuring the jumper, select an appropriate channel type from the web page:

- Therm 10KT2
- Therm 10KT3
- Therm 20K
- Resistance
- Binary Input
- Pulse Input

For analog, pulse, and binary input (without pull up), set the config jumper to "0-10"

After configuring the jumper, select an appropriate channel type from the web page:

- Analog Input
- Binary Input
- Pulse Input

BACnet channel configuration allows you to specify how the point is served to BACnet clients. Object Name is the name the channel will appear as when discovered by a BACnet client. Object Description allows you to give more information about the point. Units parameter allows you to specify the units for the channel value. COV Increment is the change-of-value increment used by BACnet clients which support this service. COV only reports changes in value instead of continuously serving the point. You do not need to set up COV unless the BACnet client you are using supports this service.

Some channel configuration options allow for additional settings.

- The Thermistor curves allow for positive or negative offset adjustment.
- Resistance channel types allow to specify an open circuit value.
- Pulse input channel types allow for Maximum Value of pulses counted (max setting by default), as well as High and Low thresholds for active inputs.

BAS Channel Configuration

UI6

Channel Type	Therm 10KT3
Temperature Offset	0
Temperature Units	Fahrenheit
Out of Bounds Value	77

BACnet Object Configuration

Object Instance	6
Object Name	Zone Temperature
Object Type	Analog Input
Object Description	Zone Temperature
Units	VOLTS
COV Increment	0

Close   Submit

BAS Channel Configuration

UI1

Channel Type	Resistance
Open Circuit Value	100000

BAS Channel Configuration

UI3

Channel Type	Pulse Input		
Maximum Value	16777215	High Threshold	7.5
Pull Up Resistor	Enabled	Low Threshold	2.5

Time Configuration

Time and date can be set manually or automatically with the help of an NTP server if access to the Internet is possible over Ethernet or Wi-Fi. Daylight Savings Time can be enabled and configured accordingly. If accessing an NTP server using domain names, make sure the DNS servers are specified in the System Configuration screen.

Setting the correct geolocation allows the Sunrise Sedona component to calculate minutes to sunrise/sunset.

System Time		NTP Configuration	
Year	2019	☐ NTP Enabled	
Month	October	NTP Server	pool.ntp.org
Day	18	Time Zone	Central:UTC-6
Hour	4 PM	Refresh (Days)	1
Minute	22		
	Manual Time Set	DST Configuration	
	Refresh ON	☐ DST Enabled	
Sunrise/Sunset		DST ON	DST OFF
Latitude	41.808919	Month: March	November
Longitude	-88.011175	Day of Month: 2nd SUN	1st SUN
Sunrise	6:07 AM	Hour: 2 AM	2 AM
Sunset	5:06 PM		
	Close		Submit

Web Components Configuration

Web Components allow you to read/write Sedona logic data from the BASpi web page. These points are served up to the BASpi's web page. You can configure up to 48 web components. These components provide a means to write and read data to and from Sedona wire sheets without the need of a Sedona Editor tool. A web component configured as a wire sheet input can have its input range restricted to minimum and maximum values eliminating the need to add limit detection within the wire sheet logic. Web components are ideal for simplified control logic configuration. Web Components are not served up over BACnet.

Web Components

	Description	Value	Wire Sheet	Min	Max
WC01	Switch Status	0.000000	Output		
WC02	Default Web Component 2	0.000000	Input	0.000000	100.000000
WC03	Default Web Component 3	0.000000	Input	0.000000	100.000000
WC04	Default Web Component 4	0.000000	Input	0.000000	100.000000
WC05	Default Web Component 5	0.000000	Input	0.000000	100.000000
WC06	Default Web Component 6	0.000000	Input	0.000000	100.000000
WC07	Default Web Component 7	0.000000	Input	0.000000	100.000000
WC08	Default Web Component 8	0.000000	Input	0.000000	100.000000

Auto Refresh ON   NOTE: A GREEN label indicates that the component has been placed on the wire sheet.   Close   Submit

Virtual Points Configuration

Virtual Points allow you to read/write Sedona logic data from a BACnet client. These points are served up over BACnet. You may use a tool such as the free BDT (BACnet Discovery Tool) from Contemporary Controls to discover, read and write points on the BASpi. The Virtual points web page is accessible from the main page by clicking the "Virtual Points" button. Virtual Points can be configured and forced in the same manner as the physical IO channels. All 24 Virtual Points are served up over BACnet.

Virtual Points

VT01	Zone Temp / 85.270	VT09	Virtual Point 9 / 0.000	VT17	Virtual Point 17 / 0.000
VT02	Wiresheet BACnet Status / 0.000	VT10	Virtual Point 10 / 0.000	VT18	Virtual Point 18 / 0.000
VT03	Virtual Point 3 / 0.000	VT11	Virtual Point 11 / 0.000	VT19	Virtual Point 19 / 0.000
VT04	Virtual Point 4 / 0.000	VT12	Virtual Point 12 / 0.000	VT20	Virtual Point 20 / 0.000
VT05	Virtual Point 5 / 0.000	VT13	Virtual Point 13 / 0.000	VT21	Virtual Point 21 / 0.000
VT06	Virtual Point 6 / 0.000	VT14	Virtual Point 14 / 0.000	VT22	Virtual Point 22 / 0.000
VT07	Virtual Point 7 / 0.000	VT15	Virtual Point 15 / 0.000	VT23	Virtual Point 23 / 0.000
VT08	Virtual Point 8 / 0.000	VT16	Virtual Point 16 / 0.000	VT24	Virtual Point 24 / 0.000

Auto Refresh ON

Schedule Configuration

The weekly schedule is web page configurable and allows for entry of special event/holiday schedule exceptions. A schedule Sedona component is used to trigger logic. Default schedule tab displays the default weekly schedule for weeks with no special events/holidays. The Events tab allows entry of special event/holiday schedule exceptions.

The Current Schedule tab shows the current schedule with any special events/holidays for that week. A Sedona schedule component is used to trigger control logic.
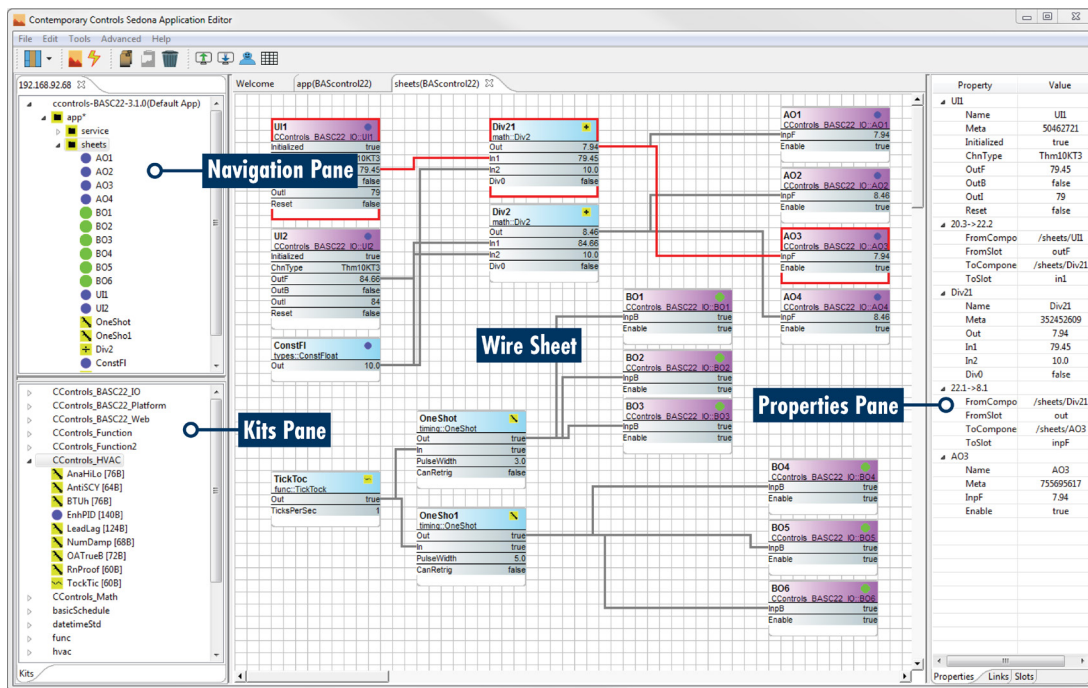

Email Configuration

Email alarms are web page configurable and allow for multiple point or wire sheet values to be included in the sent email. Emails can be sent to multiple recipients. An email Sedona component is used to trigger the alarms/notifications.

Powered by a Sedona Virtual Machine – for Implementing Control

The BASpi incorporates Sedona Virtual Machine (SVM) open source technology, originally developed by Tridium. Using tools such as the free Sedona Application Editor, or Tridium established tools such as Niagara Workbench AX, the user can develop a control application using powerful dragand-drop visual programming methodology. Once developed, the program remains stored in the BASpi and executes by way of the SVM. The application can run standalone in the BASpi, or it can interact with a program in a supervisory BACnet controller over Ethernet or Wi-Fi. The number of potential applications is unlimited. The BASpi includes Tridium's Sedona 1.2 kits of components — and Contemporary Controls' enhanced product-specific and non-product-specific kits. The BASpi IO Kit components provide 12 physical points, 24 BACnet Virtual Points, and 4 Universal Counters. BASpi Web Kit has 48 components which share data with web pages. Input web components receive data from hosted web pages. Output web components send data to hosted web pages. The Contemporary Controls' Function, Function2, HVAC, and Math kits provide additional components for increased flexibility. A set of kits is pre-installed on the BASpi. In order to install additional compatible kits, use the Kit Manager in Sedona Application Editor (SAE). For complete details on Sedona Framework, SAE, and Sedona component functionality refer to the Sedona Open Control Reference Manual.

Contemporary Controls' Developed Sedona Components

|		
BASpi I/O Kit **BASpi platform specific components**	**UI1 – UI6** **BO1 – BO6** **ScanTim** **Sunrise** **UC1 – UC4** **VT01 – VT24**	Universal input – binary, analog voltage, thermistor, resistance or pulse input Binary output – binary output point Scan time monitor – records the min, max and average scan times Calculates minutes to sunrise/sunset based on configured geolocation Universal counters – up/down counters Virtual points – share wire sheet data with BACnet/IP clients
BASpi Web Kit **BASpi platform specific components**	**WC01 – WC48**	Web components – share wire sheet data with the BASpi web pages
Contemporary Controls Email Kit **Common to Sedona 1.2 compliant controllers with web page support for e-mail alarms**	**Email**	Email - triggered by binary wire sheet logic to send a specified alarm/notification with point values
Contemporary Controls Schedule Kit **Common to Sedona 1.2 compliant controllers with web page support for scheduling**	**Sched**	Schedule - binary trigger for wire sheet logic based on web page configured weekly schedule with exceptions
Contemporary Controls Function Kit **Common to Sedona 1.2 compliant controllers**	**Cand2** **Cand4** **Cand6** **Cand8** **Cmt** **Cor2** **Cor4** **Cor6** **Cor8** **CtoF** **Dff** **FtoC** **HLpre** **PsychrE** **PsychrS** **SCLatch**	Two-input Boolean product – two-input AND/NAND gate with complementary outputs Four-input Boolean product – four-input AND/NAND gate with complementary outputs Six-input Boolean product – six-input AND/NAND gate with complementary outputs Eight-input Boolean product – eight-input AND/NAND gate with complementary outputs Comment – comment field up to 64 characters Two-input Boolean sum – two-input OR/NOR gate with complementary outputs Four-input Boolean sum – four-input OR/NOR gate with complementary outputs Six-input Boolean sum – six-input OR/NOR gate with complementary outputs Eight-input Boolean sum – eight-input OR/NOR gate with complementary outputs °C to °F – Celsius to Fahrenheit Temperature Conversion "D" Flip-Flop – D-style Edge-triggered Single-bit Storage °F to °C – Fahrenheit to Celsius Temperature Conversion High – Low Preset – defined logical true and false states Psychrometric Calculator – English Units Psychrometric Calculator – SI Units Set/Clear Latch – single-bit level-triggered single-bit data storage
Contemporary Controls HVAC Kit **Common to Sedona 1.2 compliant controllers**	**AnaHiLo** **AntiSCY** **BTUh** **EnhPID** **LeadLag** **NumDamp** **OATrueB** **RnProof** **TockTic**	Initiate an alarm or event for an analog point, or limit the output range of an analog point Protect mechanical equipment from running for too short of a time or restarting without a sufficient delay Calculate the amount of heating or cooling of water that is occurring by Monitor the temperature differential across a piece of equipment and the flow rate in BTU per hour Enhanced PID Loop Controller - if Enable slot becomes false, proportional control ceases and the internal timers and accumulators for integral and derivative action are cleared Monitors and controls up to four devices (usually pumps) dedicated to one critical process Functions as a digital filter to dampen the volatility of an input signal by creating an output version of the input signal but with modifications to the signal's rate-of change and amplitude change Makes a dynamic calculation of the percentage opening of an outside air damper One device (pump or motor) is commanded on and proven to be on otherwise a failure is noted Active counter with clock frequency set in steps per second
Contemporary Controls Math Kit **Common to Sedona 1.2 compliant controllers**	**Add** **Div** **Mul** **Sub**	Add the values of two input slots Divide the values of two input slots Multiply the values of two input slots Subtract the values of two input slots

Tridium's Sedona 1.2 Components

Group	Component	Description
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 time-based components	**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 math-based components	**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

BACnet Protocol Implementation Conformance (PIC) Statement

CONTEMPORARY CONTROLS®

BASpi-IO and BASpi-SYS
BACnet/IP Sedona Field Controller
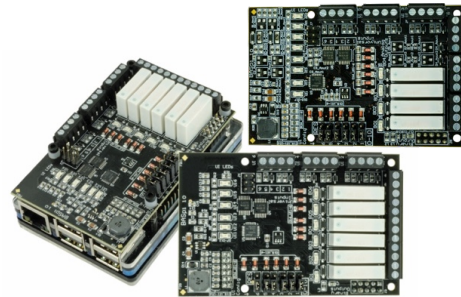
BACnet Protocol Implementation Conformance Statement (Annex A)

Date: October 22, 2019

Vendor Name: Contemporary Controls

Product Name: BASpi-IO and BASpi-SYS

Product Model Number: BASPI-IO6U6R, BASPI-IO6U4R2A, and BASPI-SYS6U6R

Applications Software Version: 1.2.28   **Firmware Revision:** 1.0.31   **BACnet Protocol Revision:** 3

Product Description: BACnet/IP compliant 12-point field controller or remote I/O that allows a direct connection to Ethernet or WiFi.

BACnet Standardized Device Profile (Annex L):
- ☐ BACnet Operator Workstation (B-OWS)
- ☐ 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 Value	No	No
Binary Input	No	No
Binary Output	No	No
Binary Value	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)
- ☐ ANSI/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:
- ☐ 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

Character Sets Supported:
Indicating support for multiple character sets does not imply that they can all be supported simultaneously.
- ☒ ANSI X3.4
- ☐ IBM™/Microsoft™ DBCS
- ☐ ISO 8859-1
- ☐ ISO 10646 (UCS-2)
- ☐ ISO 10646 (UCS-4)
- ☐ JIS C 6226

If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports:
No gateway support.

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Specifications

Universal Inputs

Configured As	Characteristics
Analog input	0–10 VDC (+/− 1% precision)
	Input impedance 1 MΩ on voltage
Temperature input	Type II 10 kΩ thermistors: −10º to +190 ºF (−23.3º to +87.8ºC)
	Type III 10 kΩ thermistors: −15º to +200 ºF (−26.1º to +93.3ºC)
	20 kΩ thermistors: 15º to 215º F (−9º to +101º C)
Contact closure input	Excitation current 0.5 mA. Open circuit voltage 10 VDC.
	Sensing threshold 3 VDC (low) and 7 VDC (high). Response time 20 ms.
Pulse input	0–10 VDC for active output devices
	0–10 VDC for passive devices (configured for internal pull-up resistor)
	40 Hz maximum input frequency with 50% duty cycle.
	Web page adjustable high and low thresholds.
Resistance	1 kΩ -100 kΩ range

Binary Outputs

Binary output	Normally open relay contacts. 30VAC/VDC 2A max
	Excitation current 1.2 mA. Open circuit voltage 12 VDC
	Sensing threshold 3 VDC (low) and 7 VDC (high). Response time 20 ms

Storage

Storage	micro SD card (pSLC industrial grade cards recommended for maximum system stability)

Functional

	Ethernet/Wi-Fi
Protocols supported	BACnet/IP, Sedona SOX, HTTP, SMTP (BASpi firmware)

Electrical

Input

Voltage	5 VDC
Power	4 W (with all IO, BASpi firmware, and both networks adapters engaged)

Ordering Information

Model	Description
BASPI-IO6U6R	Raspberry Pi Daughterboard 6UI/6 Relay