USER MANUAL

BACnet MS/TP

Channel types, wiring specifications, instance numbers, probing and third-party device programming for BACnet integration in CBAS.

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2520 Belle Chasse Highway, Gretna, Louisiana 70053
504.529.1413 · www.computrols.com

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CHAPTER 1

Quick Start Guide

Print these two pages to use for documentation.

1. Verify all mounting screws are tight.
2. Verify all terminations are tight.
3. Verify the brain board is seated and the thumb screw is tight.
4. Verify the transformer is sized properly.
5. Verify the power at the 24vac terminal block is 24 Volts.
6. Verify 24vac power is on and secondary is grounded.
7. Verify you have a good ethernet connection.
8. Verify all communications trunks are labeled and wired to the terminal blocks provided.
9. Use the Handheld to set the address of the controller.
10. Use the Handheld to set up a Secure Connection if applicable. See Secure Controller Manual for instructions.

Model: 8 16 32 64 SC

DHCP: Yes / No

Secure Connection: Yes / No

MAC Address: 00:09:14:_____:_____:_____

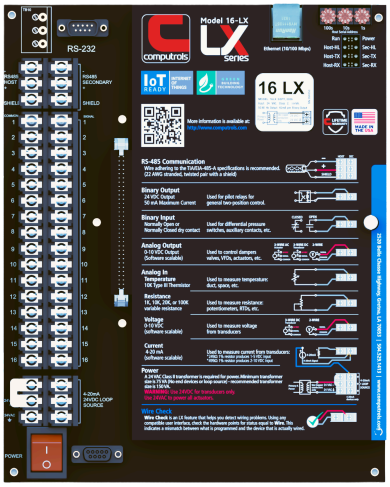
IP Address: _____. _____._____._____

Subnet Mask: _____. _____._____._____

Default Gateway: _____. _____._____._____

Firmware Version & Date: _____

Host Protocol: _____



Secondary Protocol: _____

Ethernet Alternate: _____

RS-232: _____

BACnet Router / Server Setup

☐ BACnet Server: Exposes all LX controller points, all Computrols Opto RS485 controller points, and all Computrols BASnet RS485 controller points via BACnet IP Read/Write.

☐ BACnet Protocol Server: Exposes all RS485 controller points, both open and proprietary, via BACnet IP Read/Write.

☐ BACnet Router: Exposes RS485 BACnet controllers using BACnet Routing features vis BACnet IP Read/Write.

Instance, Port, and Network Number Requirements:

These are required if Router or Server is selected

_____ Instance Number: Default (4194303) (Range: 0 - 4,194,302, Must be unique)

_____ Port Number: 47808 (BACnet default: 47,808. Do not change unless necessary.)

_____ Ethernet Network Number: 10 (Range: 10 - 250. Must be unique, and there should only be 1 Ethernet network.)

☐ Yes, the HOST channel is BACnet, and messages will be routed to it if the Router is selected.

_____ **Serial Address:** Default (126)

_____ **Host 485 Network Number:** Default (1) (DNET) (Range: 1 - 9 or 246 - 65,000. Must be unique.)

☐ Yes, the SECONDARY channel is BACnet, and messages will be routed to it if the Router is selected.

_____ **Serial Address:** Default (126)

_____ **Secondary 485 Network Number:** Default (**2**) (DNET) (Range: 1 - 9 or 256 - 65,000. Must be unique.)

Understanding This Guide:

This manual provides a basic overview of the ASHRAE BACnet standards and is not a comprehensive guide. This manual will focus on channel selection, development, implementation, and troubleshooting basics.

Where do I start?

To guide you in the direction you need to take to accomplish your goals, you must answer some questions.

1. Do you want to add an MS/TP device to CBAS?
2. Do you want to convert Legacy Over IP to On Controller channels?
3. Do you want to configure the LX BACnet Router to communicate with VAV-B-BACnet devices?
4. Do you want to add a single BACnet IP device to CBAS?
5. Do you want to add BACnet IP devices (BACnet Router) to CBAS?
6. Do you want to move a BACnet IP channel from the DPU to an SC or LX controller?

If you answered 'yes' to questions 1, 2, or 3, then continue here, in the Computrols BACnet MS/TP Manual.

If you answered yes to questions 4, 5, or 6, then proceed to the Computrols BACnet IP Manual.

CHAPTER 2

What is BACnet?

BACnet specifies six network types to accommodate different projects and system requirements. These six widely accepted LAN networks are in use today.

1. Ethernet (IEEE 802.3/ISO 8802-3)
2. ARCNET (ANSI/ATA 878.1)
3. Master Slave/Token Passing - (MS/TP, a twisted-pair RS-485 network created by BACnet)
4. Point-to-Point (PTP, also created by BACnet)
5. LonTalk
6. BACnet/IP – This was added later to allow BACnet messages to be transported across the Internet and other IP-based wide area networks.

These are the two types of non-IP-based forms of BACnet Computrols uses.

1. MS/TP
2. PTP. The PTP version can only be used via the RS232 interface on our LX line of controllers.

CHAPTER 3

BACnet Channel Types and Locations

CBAS Specific Options:

These BACnet Channels are not only in the DPU but also live in the Hardware View.

Channel Name	Channel Type
Workstation Channel	TCP/IP for Workstations
Controller Channel	TCP/IP for Controllers
BACnet IP	BACnet IP

BACnet 485 over TCP/IP is a head-end-dependent channel. CBAS contains the software points with logic, alarms, schedules, and other functions. BACnet 485 over TCPIP is a protocol that was used at the beginning of

Computrol's adoption of the BACnet Protocol. The protocol name should be interpreted as “I want CBAS to communicate with the BACnet devices over TCP/IP to the host controller, and I want the Host controller to communicate with the RS-485 wiring of the field devices.”

This protocol exists because, early on, when Computrols began integrating with BACnet devices, the parent controllers, the X-Line, preferred to let CBAS handle the load that the BACnet database required. The host controller acts only as a pass-through device, and all database and subsequent logic reside in CBAS.

The introduction of the LX line of parent controllers in 2017 removed the requirement for using BACnet 485 over TCP/IP.

Computrols recommends this protocol only when legacy X-Line controllers are used. Otherwise, use the OnController version of the BACnet protocol for all BACnet channels on LX controllers.

⚠️ IMPORTANT ⚠️

⚠The Write Property Multiple is only available on **interface channels**, not On Controller channels. Do not enable these features if the BACnet device doesn't support them. On Controller BACnet scans faster.

Host - LX Controller Specific Options:

BACnet OnController is a channel where points with logic, alarms, schedules, and other functions of a BACnet Controller are stored in the database of the Host Controller. The field controllers communicate directly with software and hardware points on the Host controller, eliminating the need to communicate with the head-end computer.

Where Should I Define My BACnet Channel and Why?

All BACnet MSTP channels should be defined as OnController. This means the channel will be defined on the controller the channel is wired to.

The only reason BACnet 485 over TCPIP should be used is if your CBAS network does not have any LX controllers or the devices and control sequence need to be able to support Write Multiple Properties. This should be a limited use case and will be head-end dependent.

CHAPTER 4

Wiring Specifications

Building automation communications are built on BACnet MS/TP® networks. This protocol standard, implemented by ASHRAE, states that the MS/TP network shall use a shielded, twisted pair cable. The wire's capacitance shall be less than 30 pF per foot. It also recommends that the impedance be between 100 and 130 ohms.

Many projects involve full-scale retrofits, and legacy RS-485 networks often utilize a #18 TWSP cable for communication. If installed properly, this wiring will likely work without performance issues. It is recommended to use the lowest speed possible, evaluate performance, and speed up if necessary.

The maximum length of any MS/TP network is 4000 Feet or 1219 Meters. For any network over 4,000 feet, a repeater must be wired in series on the trunk. Although RS-485 MS/TP networks can have up to 127 controllers, approximately 32 is an industry-standard number of controllers per network.

CHAPTER 5

Computrols Vendor ID

ASHRAE will assign a vendor ID for each company that uses the BACnet standard in its equipment. This will help identify vendors and ensure interoperability across multiple manufacturers.

Computrols Vendor ID is: **225**

CHAPTER 6

Instance Numbers

The BACnet standard combines the Vendor ID and the controller's MAC address. You can define your instance number formula. CBAS is indifferent.

Device ID aka Instance # = Vendor ID X 1000 + MAC Address

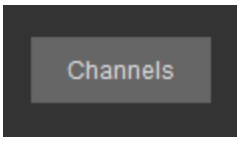
For a controller with address 10, the device ID would be 225 x 1000 + 10 = **225010**

The Computrols Standard for assigning instance numbers when using our VAV line of products is that the instance number defaults to the value of the MAC address. CBAS does not need to know the instance number for proper communication, but it becomes important when serving information to third parties.

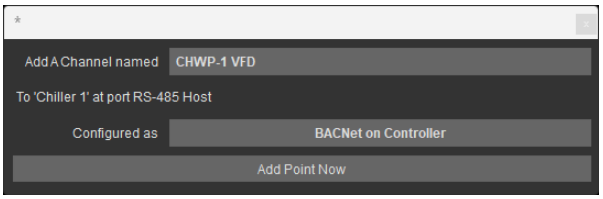
If you anticipate that your site will someday serve up BACnet points, it is recommended that all Computrols VAV box controllers that communicate via BACnet have a unique instance number.

Computrols further recommends that you list all Host Controller IP addresses, DADR addresses, box addresses, and instance numbers. See the BACnet router reference sheet.

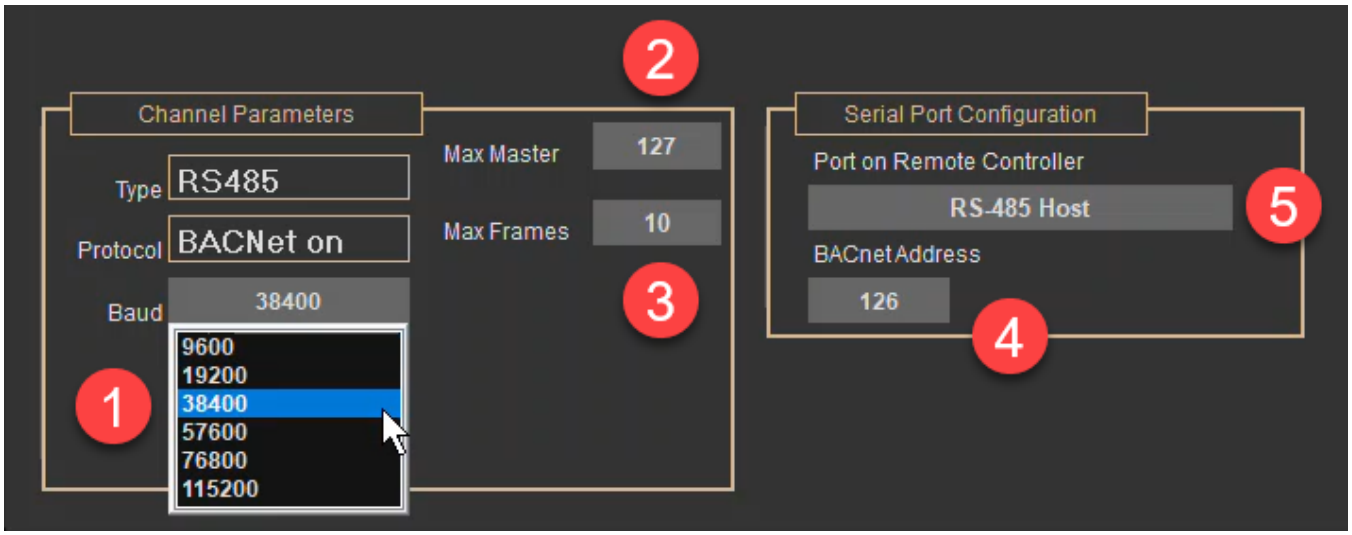
Adding a BACnet On Controller Channel (Preferred)



1. In editor mode, add your parent controller. This can be an X, LX, or SC controller.
2. Click your controller and click the Channels button.
3. Click the channel you would like to add a protocol to.
4. Name and select your protocol; in this case, it will be BACnet onController.

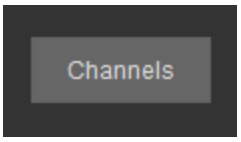


5. Once you have added the channel. Click the channel and click the Program button.
    1. Choose your Baud Rate.
    2. Select your MAX Master address. The default is 127.
    3. Select your max Frames. The default is 10.
    4. Select your BACnet Address for this channel. The default is 126. This should always be below the Max Master.
    5. If you want to change from the defined channel to a different location, click here and pick where to move the channel. The receiving channel must not have anything configured.

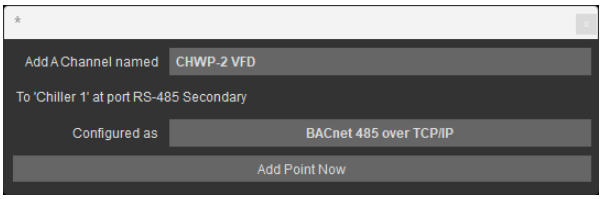


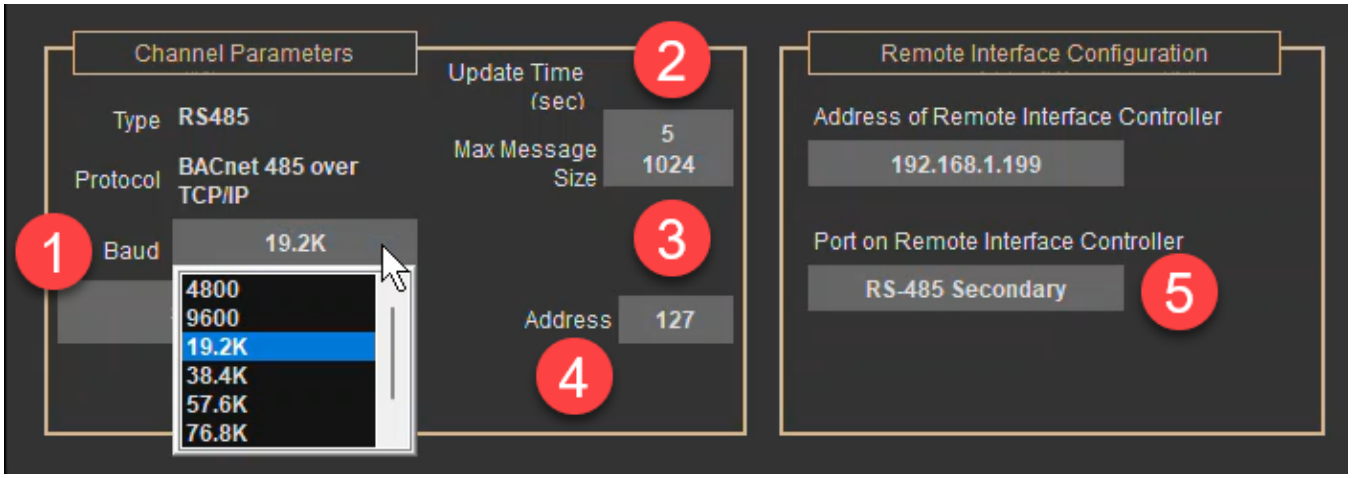
CHAPTER 8

Adding a BACnet 485 over TCP/IP Channel



1. In editor mode, add your parent controller. This can be an X, or LX controller. This cannot be added to a Serial Connector.
2. Click your controller and click the Channels button.
3. Click the channel you would like to add a protocol to.
4. Name and select your protocol, in this case it will be BACnet 485 over TCP/IP..
5. Once you have added the channel. Click the channel and click the Program button.
    1. Choose your Baud Rate.
    2. Select your update time in seconds. The default is 5.
    3. Select your Max Message Size. The default is 1024.
    4. Select your BACnet Address for this channel. The default is 126.
    5. If you want to change from the defined channel to a different location, click here and pick where to move the channel. The receiving channel must not have anything configured.





CHAPTER 9

Importing Computrols VAV Controller Export Files

Once you have configured your Computrols VAV-x-xx BACnet controller using our VAV Utility software, you can export your configuration file.

Locating Your Exported Files

CBAS saves the exported files in the following directory:
C:\CBAS20\Sites\Personalities\[Controller Name].xxx

Within this folder, you will find four files:

1. [Controller Name].bin – This is the export file from VAV Utility with all of the configuration details of your controller. This is the file that can be used to import and duplicate the controller.
2. [Controller Name]_BACnet.txt – Use this file to import this VAV box into CBAS via a BACnet channel.
3. [Controller Name]_OPTO.txt – Use this file to import this VAV box into CBAS via an OPTO channel.
4. [Controller Name]_Teletrol.txt – Use this file to import this VAV box into CBAS via an OPTO channel.

Importing Your Computrols BACnet VAV-B

1. Within your BACnet channel, you will define your controllers as BACnet Generic.
2. When prompted to import the newly added panel, select 'Yes'.
3. Navigate to the [Controller Name]_BACnet.txt.
4. At this screen, you can import, Find – Replace, or add a Prefix.
5. When you are finished, click the Import button.

All your BACnet points will be imported. You will need to add more points as needed.

CHAPTER 10

Probing and Why It Is Important

When setting up 485 communications to a BACnet device, such as an AHU, it is crucial to probe it. This provides critical information, enabling you to quickly import all the found data.

1. The instance number is beneficial because it allows the program screen of the controller to connect much faster when CBAS is restarted. The instance is usually provided in the Probe file but can sometimes have a different name.
2. Perhaps the most significant advantage of probing is that it automatically configures a few features for use by CBAS, which can enhance performance. The best of those features are COV and Read Multiple.
3. COV is Change of Value, and if it is available, it sends any changes in value to the host.
4. Read Multiple reads up to 14 points at a time. By default, CBAS only reads one point at a time unless the Read Multiple is set.

CHAPTER 11

Probing explained

When establishing 485 communications with a BACnet network, it is vital to probe each device. Probing provides a file containing all the information on the device, which facilitates setting up the device in CBAS. Using the probe file to import the device's data will populate the device's BACnet services, points, and instance number.

In our shortened probe file of a BACnet relay, you will see all the information that the device provided. The information CBAS needs is the MAC address, instance number, Read Property Multiple, and COV-Notification.

Since RPM is supported, CBAS will enable the RPM service for this device.

The COV-Notification service is shown in red, as this device does not support that BACnet service. CBAS recognizes this and will not enable that service on this device.

The Read and Write Property services are supported, which is a minimum that CBAS needs to read from and command this BACnet relay.

What is also vital to record are the MAX Master, Instance number, MAX Info Frames, MAX ADPU Length, and BAUD Rate, if shown. If the baud rate is not displayed, obtain it from the device. This might be a dip switch, as in this case, or a setting in the device's menu.

```
OBJECT NAME           DEV277002
OBJECT TYPE           8
OBJECT IDENTIFIER     DEV 277002
SYSTEM STATUS         OPERATIONAL
VENDOR NAME           [redacted]
VENDOR IDENTIFR       277
MODEL NAME            [redacted]
FIRMWARE REV          2.04
SOFTWARE VER          1.5
PROTOCOL VERSION      1
PROTOCOL REVISION     12
OBJECT COUNT          5
MAX APDU LENGTH       480
SEGMENTATION SUPPORT NONE
APDU TIMEOUT          3000
APDU RETRIES          0
MAX MASTER            127
MAX INFO FRAMES       1
BACNet SERVICES Supported
                      Acknowledge-Alarm
                      COV-Notification
SUPPORTED             Read-Property
SUPPORTED             Read-Property-Multiple
SUPPORTED             Write-Property
BACNet OBJECT TYPES Supported
SUPPORTED             Analog Input
SUPPORTED             Analog Output
SUPPORTED             Binary Input
SUPPORTED             Binary Output
SUPPORTED             Device
OBJECT                        DEV 277002
OBJECT                        AI 1
OBJECT                        BI 1
OBJECT                        BO 1
OBJECT                        AO 1
ANALOG INPUT        1  Name=AI1
Value=   0.0  Units=no-units
ANALOG OUTPUT       1  Name=AO1
Value=   0.0  Units=percent
BINARY INPUT        1  Name=BI1
Value=   OFF  Polarity=0
BINARY OUTPUT       1  Name=BO1
Value=   OFF  Polarity=0
```

Perhaps the most significant advantage of probing is that it automatically configures a few features for use by CBAS, thereby enhancing performance. The best of those features is COV and Read Multiple.

COV-Notification is Change of Value, and if it is available, it sends any changes in value to the host.

⚠️ IMPORTANT ⚠️

⚠️ CBAS does not support Write Property Multiple. It only commands one point at a time, and commands take precedence over statuses.
⚠️ If you have a few or many commands going out, it will take some time to receive status changes. If the commands are being sent out constantly, and you have a slow scan rate, you may not receive any status updates. This is why it's essential to utilize Probe to enable COV-Notification and Read Property Multiple, if available. Do not set them manually unless they are available.
⚠️ It is also advisable to keep commands to a minimum by slowing down the Logic Evaluate time.

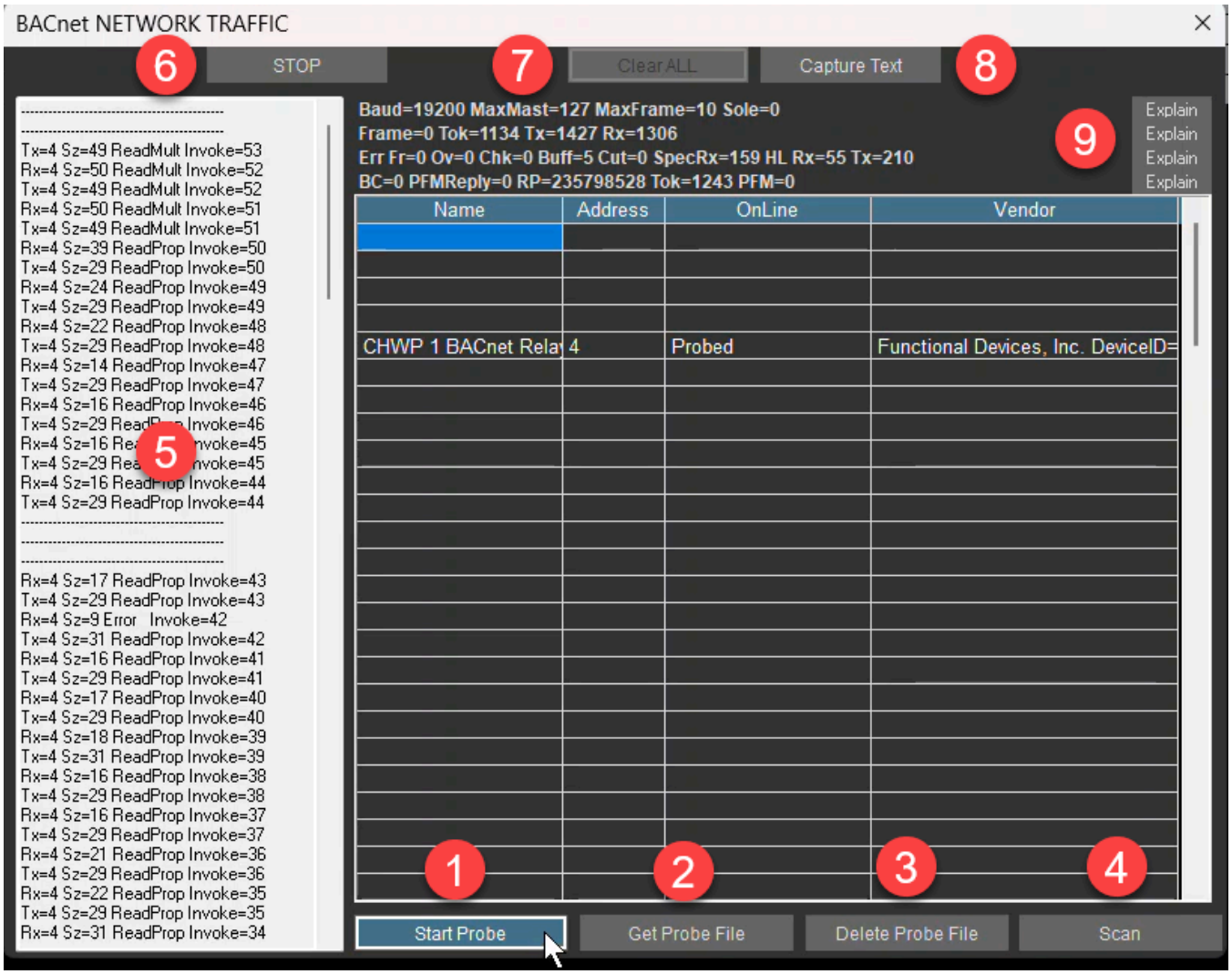
CHAPTER 12

How to Probe a Device

Once you have the BACnet device online, you can perform the following steps to probe it successfully.

1. Click the BACnet Channel the device resides on.
2. Click Diags

A screen will pop up similar to the image shown below:



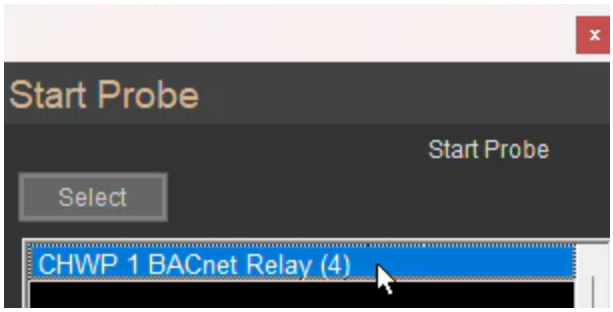
This is only available for OnController Channels. The rows contain all of the controllers you have defined in CBAS. These columns will show you the name, the address, status (online or not), and the Vendor information. If the device is online and not probed CBAS will say “YES” and not probed as in our example.

To begin the probe, you will:

3. Click the “Start Probe” #1 button.

Another window will pop up.

4. Click on Select, then the device you want to probe.



Escape/ Close the window.

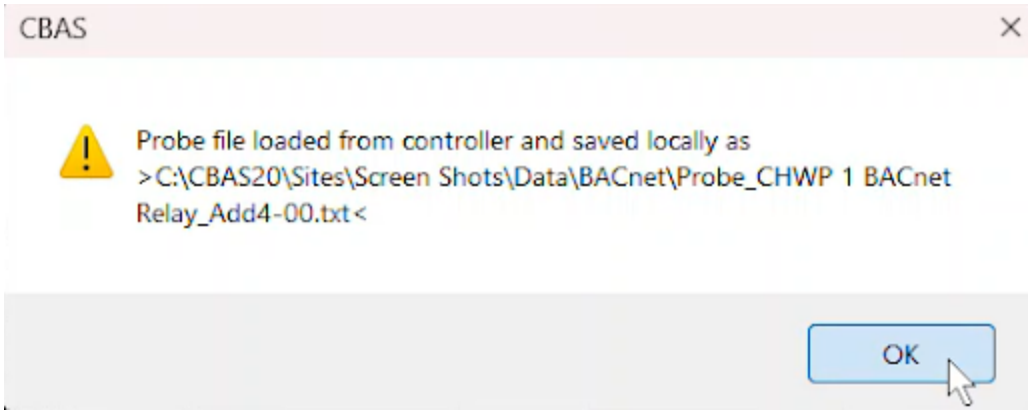
The window will go away, and you will see the original Diag screen. Look in the OnLine column, and if the probing has commenced, you will see something similar to our example, which says “**Probing 3 of 41**”. Once completed, the OnLine column will say Probed(x).

CHWP 1 BACnet Rela	4	Probed	Functional Devices, Inc. DeviceID=

The probe file is stored in the LX controller only. To save to the hard drive, you will need to tell CBAS to

5. Click “Get Probe File” #2

When you click button #2, the probe file will be retrieved, and a pop-up will give you the path to the file.



The probe file will be saved to “CBAS20\Sites\Database Name\Data\Probe_device name_Addx-xx.txt”.

The file name explained: The Add4-01 (-xx 01.txt in this case is incremented based on how many times you probe, but only one time should be necessary).

To delete the Probe file from the LX controller, click the “Delete Probe File” #3 button and select the file. “

CHAPTER 13

Programming 3rdParty BACnet Controllers in CBAS

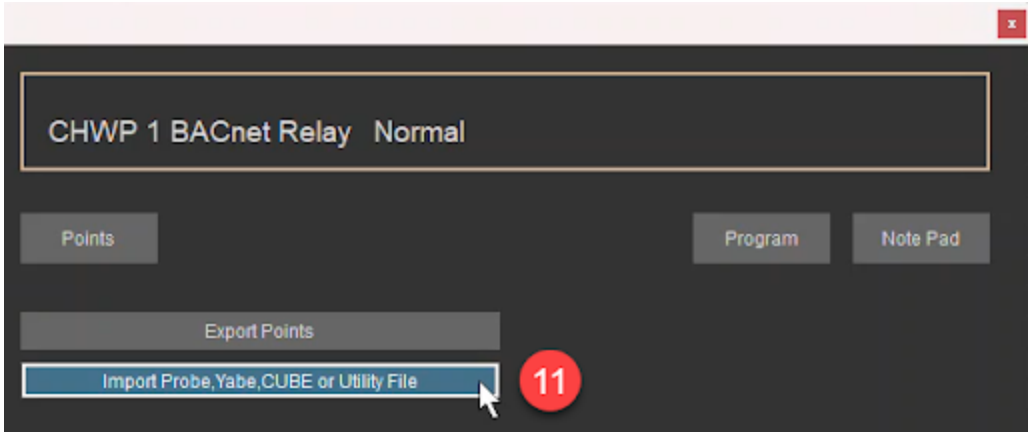
We will assume that you are adding the channel for the first time, have read the CBAS Manual(s), and understand how to program controllers, channels, and points.

⚠️ Before Getting Started ⚠️

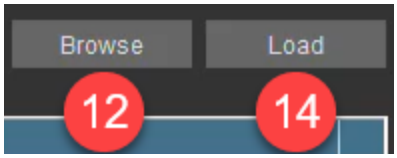
⚠️ Once you add your first BACnet Channel and your first controller. Erase and download your controller. Upon startup, the controller executes critical BACnet code. Failure to restart may prevent your third-party devices from coming online. If your devices do not begin communicating, power-cycle the HOST controller.
⚠️ While editing points in Real Mode, if you change point addresses, change point types, add points, or change the controller address or the baud rate, CBAS MUST BE RESTARTED.

1. Program a BACnet Generic controller on the channel at the address to which the device is set. (0 is NOT a valid address)
2. When you are asked if you want to import the points, answer No. (First time only)
3. Using the manufacturer's documentation, program one point you are sure about on the controller. If you do not program a point on the controller, it will not stay communicating. This is because CBAS has nothing to poll, so you will get no response.
4. Once you add the point, you have to go to the program screen on the point, then click the BACnet button (bottom left), and set the address. Also make sure the point type is correct.
5. Go to Real Mode and wait for the Host controller to come Online. Erase the Database and let it download again so that the controller knows it has a new Channel.
6. When the device is Normal, Escape and navigate to the DIAG of the channel.
7. Click the Probe button to start the Probe. Once you select the
8. The device and its points should turn Normal (Blue) if it is correct.
9. If the Probe was successful, you can import the points from the host controller. Just click the controller and click Get Probe File . That should open a window to "
10. "CBAS20\Sites\Database Name\Data\Probe_device name_Addx-xx.txt". Point to the last probe file by date and follow directions.

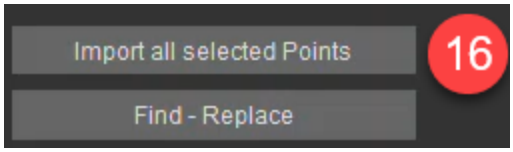
11. Click the BACnet device. Import, Probe, Yabe or CUBE File.



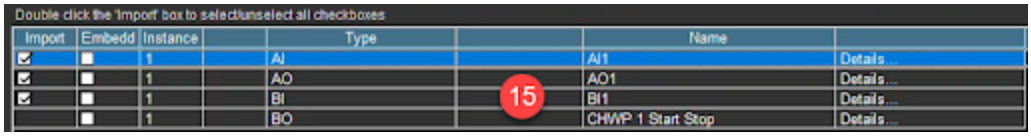
12. Click Load in the upper right corner of the BACnet Probe/Yabe Point Importer screen.
13. A Window should open up and select your Probe file. Click OK.
14. Click the Load Button



15. CBAS will load the Probe file and here you can do a number of things.
    a. You will notice that BO 1 does not have an Import check box since the point already exists in the database. This was used to bring the point online before the probe.
    b. Review the points the probe identified and only verify the ones that are necessary.
    c. You can find and replace verbiage to make the points specific
    d. You can add a Prefix to each point to make the point specific.
    e. You can click on any point and rename that point.
16. Once you have made all changes, click Import all selected Points.



Once the points are imported, you can view them by clicking on the controller and selecting Points.



Duplicating controllers

Additional controllers can be added easily once the first one is programmed and working. Once you have verified that all points are correct on the first controller, you can click the controller and then click Export Database. (In older versions of CBAS, Export to OPTO/BACnet)

1. Follow onscreen prompts to complete the export.
2. The export file will be saved to C:\CBAS\Bin\BACNET as BacnetGeneric.txt.
3. If you save multiple point configurations, you must rename the file to reflect the configuration, or it will be overwritten.
4. When you add subsequent Generic BACnet controllers, you will be prompted to import the points.
5. Answer YES, and you will be taken to the same folder to select the proper file.
6. When adding the points, you will be prompted to add a prefix to the point names.
7. If the point names don't turn out the way you want them, they can be changed one at a time through the Point Program screen, or through Global Name Change at Database\Database Maintenance.

⚠ IMPORTANT ⚠

⚠ If you get error messages when you export and the export file saves as 0 bytes size, then you need to scale the General Purpose Table of the Host controller. See the last section of this manual for instructions on scaling.
⚠ To avoid problems when naming points and adding prefixes, make the point names generic on the controller that you are exporting from. Example: instead of naming points such as RM 1 SPACE TEMP, add them as SPACE TEMP. You can add the RM 1 part using the prefix feature when adding from the export file.

Embedded Points

When speaking about Computrols line of hardware such as 8, 16, 32, or 64 LX, SC controllers they are commonly referred to as Host or Child controllers.

When a Child controller Hosts one or more RS-485 channels as "On-Controller" channels. All of the hardware and software points on the Host controller and the field controller residing on the RSS-485 network are considered child points.

If an LX or SC is a child controller, what is its parent? CBAS is considered the Parent to all Child controllers, and its database of information is considered a Parent Database. Each Child controller's database is considered a child database.

Now that we have established definitions, in order to make things easier to read, we will refer to Child controllers as Host controllers.

What is a Child Point? A Child point is a hardware or software point that not only lives in a Host Controller but also lives within CBAS. When a point is defined within a Host controller, CBAS makes allowances for this point within its Parent Database. These Child Points can use resources such as Attributes, Graphics, Logic, PID, and Schedules.

Functions	Child Points	Embedded Points
Alarms	Yes	No
Attributes	Yes	No
Graphics	Yes	No
Logic	Yes	No
PID	Yes	No
Histories	Yes	No
Schedules	Yes	No

What is an Embedded Point? *Embedded points are a special class of points that live exclusively in the Host Controller.* These points do not live in CBAS anywhere. The Embedded points cannot be used in Alarms, Attributes, Graphics, Logic, PID , and Schedules as CBAS has does not know they exist.

Embedded points are a special class of points exclusive to BACnet© controllers.

Why would I want to have Embedded Points? CBAS has a point limit of 65,000 points. This includes all hardware and software points that are defined within CBAS.

Many large sites need a way to decrease their point counts in order to be able to continue their expansion of their Computrols network. By changing many of their points from Child Points to Embedded points, they are able to free up valuable space within CBAS.

Which points are usually chosen to be Embedded Points? Although there is no standard for what should be considered an Embedded point, here are some examples of what customers have done.

Monitored points only Points that can be used to help with troubleshooting efforts. These are points that do not need to be alarmed, have historical records, logic, PID's or have a need to be scheduled.

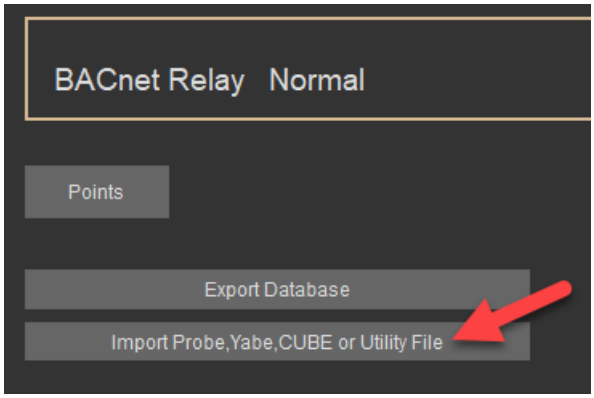
Configuration points These are the points used to set up a device locally. These might be password levels of a programmable thermostat, their sequence number or internal software points within the thermostat that have no real value even though they are discoverable.

⚠️ IMPORTANT ⚠️
⚠️ When changing a standard Child Point to an Embedded Point and then later change it back to a Child Point again, the point will most likely not be in the same position in the database anymore. This means you should check the point position in All Points. ⚠️ When Hardware View for a BACnet controller is opened, the Embedded Points will start loading 25 at a time from the LX or SC every 2-3 seconds. For a controller with 300 Embedded Points it will take ~30 seconds to load all the values and display them to the user. ⚠️ Embedded Points **DO** count towards the maximum point count within each controller. This means each controller may need its Scaling adjusted if large numbers of points are used.

Embedded Points and their Values – Child Only points will always show their current real-time status and values within the Host controller and HandHeld device. Whenever CBAS opens a Hardware view of the Host controller, CBAS will retrieve the current status and value from the Host controller.

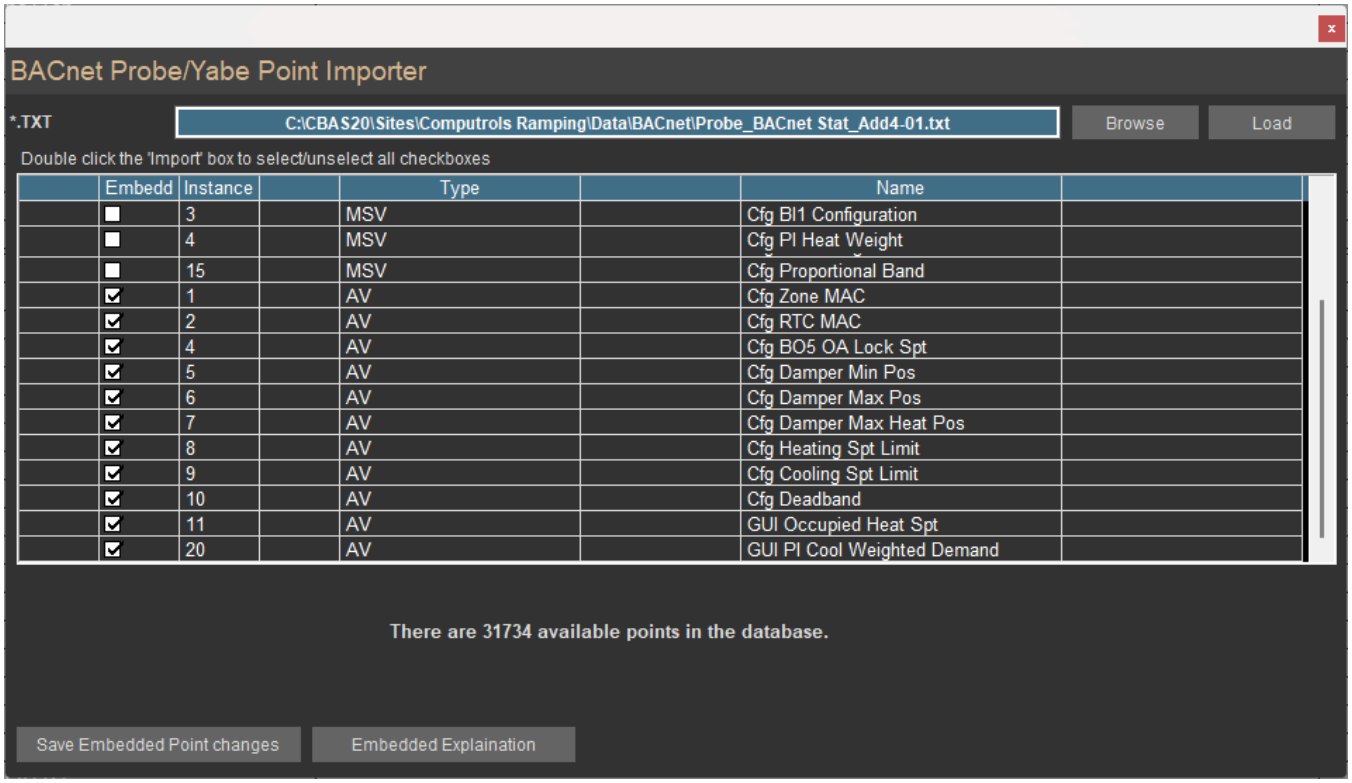
When Embedded points are offline or in editor they may show a status value of **failed**. When the BACnet© device comes online the status value will be updated.

How do I convert Child points into Embedded Points? Whenever a BACnet© device is added to CBAS there is the option to import the device's points with a Import Probe, YABE, CUBE or Utility File button.



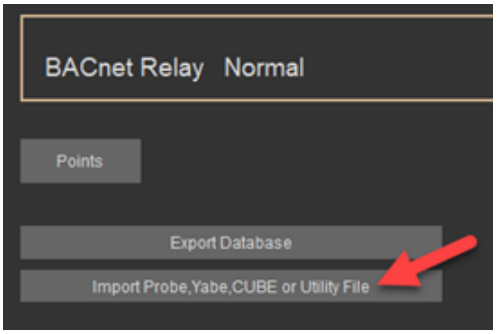
Within the importer screen there are two columns with checkboxes for each point. You have the option to Import a point or not. You also have the ability to make the point an Embedded point.

For the point to be imported, one of the boxes must be checked. If the point isn't to be imported, make sure both boxes are UNCHECKED. The default is to import all points. If you would like to batch-select or deselect points, you can double-click the words Import and/or Embed.



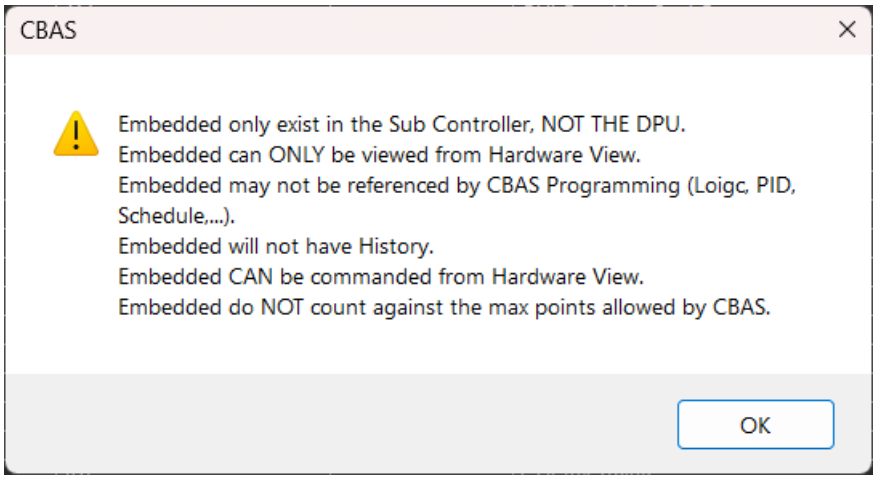
⚠ IMPORTANT ⚠

⚠ Once the points have been imported and Child Points are changed to Embedded Points, the Embedded points will always show up in the Point Importer list after the Child Points.



What if I do not have a file to import ? If you are adding points manually for a BACnet© device you will still be able to make your points Embedded. Once your points have been added click on the device. Then you will click on the Import Probe, YABE, CUBE or Utility File button. This will bring up the BACnet© Probe/Yabe Point Importer screen. From here you will be able to change the point to an Embedded point. Save Child Only button. Once your changes have been made you will need to click the changes button on the bottom right of the menu.

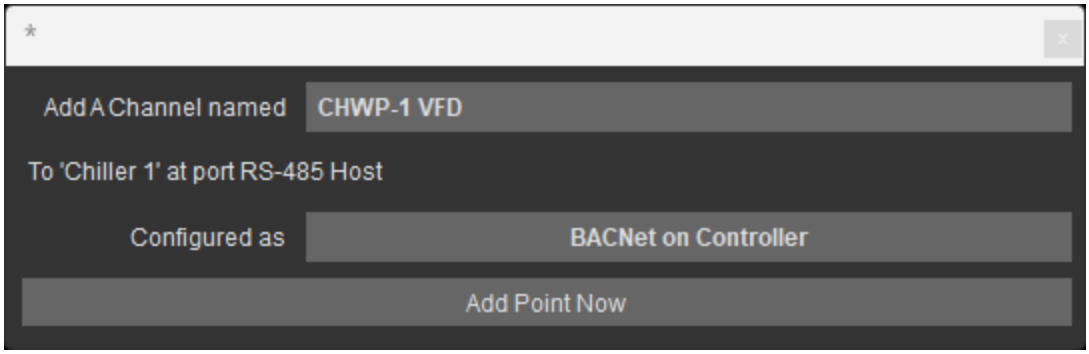
What is the Embedded Explanation Button? Clicking this button will open a pop up explaining what an Embedded point is.



How many points are in CBAS? It is important to know how many points CBAS has within its database. This is why within the BACnet© Probe/Tabe Point Importer screen shows the number of available points there are left.

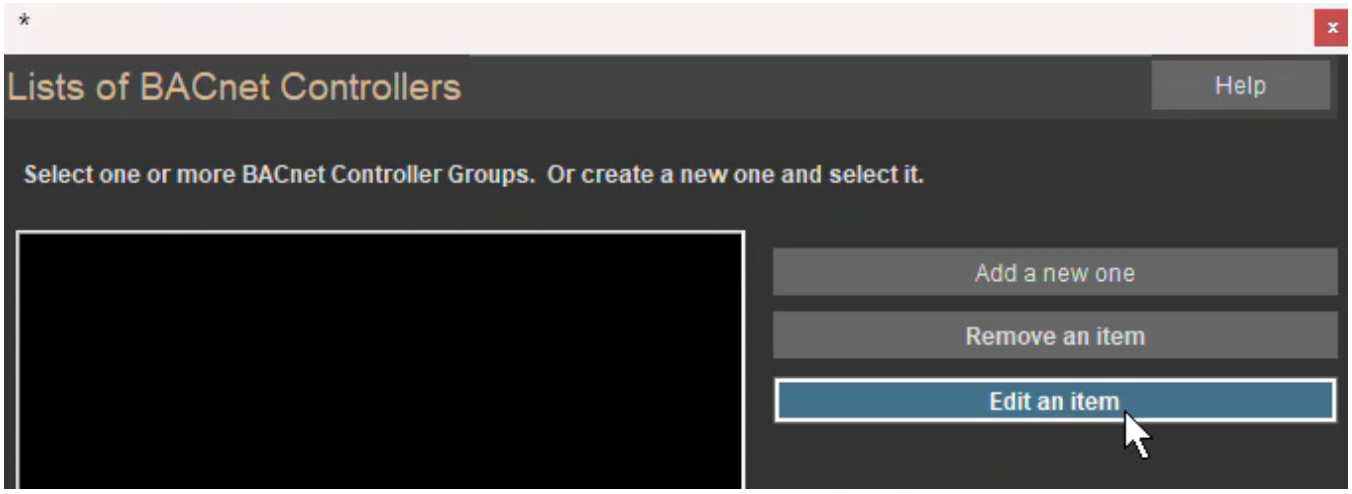
How do I batch change multiple points on multiple controllers? To make batch changes to Child or Embedded points first you first must make sure that the points you are working on are all exactly the same.

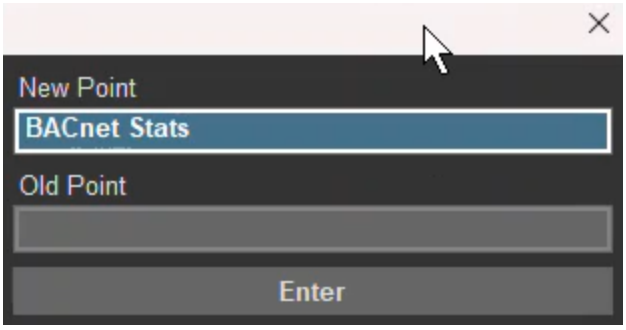
The multiple points to be changed are matched by filtering the BACnet point types and positions. For example, if you selected AV65 to be an Embedded point then selected a BACnet Controller group then the AV65 point in each controller selected will be set to Embedded. This can also work in reverse to make multiple Embedded point regular Child Points.



What is a BACnet© Controller Group? This is a group of controllers you will name and select within the BACnet© Probe/Yabe Point Importer screen. When a point is selected and you click the Save Embedded point changes button, a window will pop up. When Yes is clicked the List of BACnet© Controllers will appear. There are no groups by default.

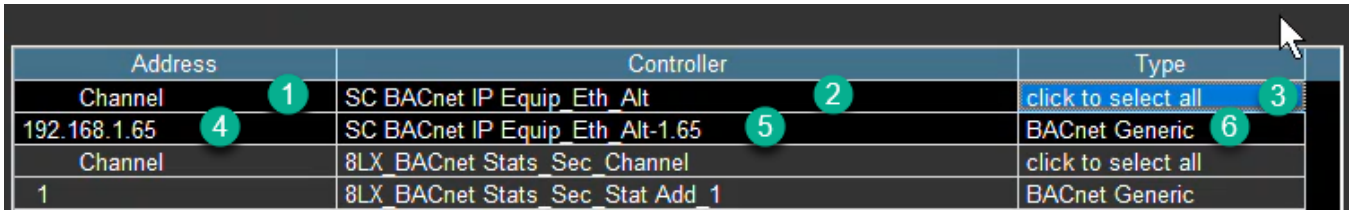
To add a group, click on the "Add a new one" button.





Click on New Point box and name your Group.

Once you name your group the Select Controllers window will pop up and you will select the (BACnet©) Controller at the IP address of the Computrols Host controller.



The filtering and sorting for this menu will:

1. Show any BACnet© channels first and
2. Show the BACnet© channel's name.
3. Allow the user to select the entire channel.
4. Show any BACnet© controllers that are within the channel right above it.
5. Show the BACnet© controller's name.
6. Show the controller type.

⚠ IMPORTANT ⚠

⚠ When selecting the entire channel if there is a controller that does not have any similar BACnet© point number and types like the point you will be making changes to, it will not affect those controllers. Only controllers that have the exact same BACnet© point number and type will be affected.

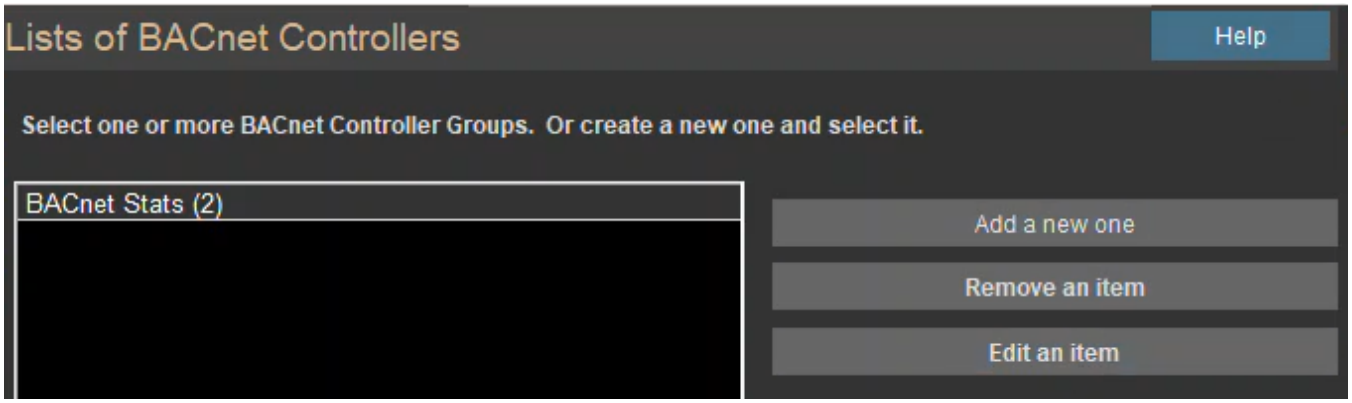
Within this pop-up you will be shown all available BACnet© channels and controllers separately. By showing a full channel and its controllers beneath it, you will be able to select from one whole channel or one or multiple controllers within the channel.

Address	Controller	Type
Channel	SC BACnet IP Equip_Eth_Alt	click to select all
192.168.1.65	SC BACnet IP Equip_Eth_Alt-1.65	BACnet Generic
Channel	8LX_BACnet Stats_Sec_Channel	click to select all
1	8LX_BACnet Stats_Sec_Stat Add_1	BACnet Generic

Above the BACnet© IP channel on this SC is on its Ethernet Alternate channel. On that channel there is only one Ip controller addresses 192.168.1.65. By selecting the Channel CBAS also selects the one IP controller too and adds them both to the group. If the IP controller was selected by itself, only the IP controller would be highlighted grey, not the entire channel.

Once you select all of the controllers you would like to be in a group and then exit out of the window you will see the name of the group that contains the controllers that were just added.

In our example, the name is BACnet© Stats (2). The two (2) represent the number of BACnet© controllers that are in that group.



You can have different groups to represent multiple types of points and controllers. One group might consist of room pressure controllers, BACnet© relays, thermostats or any other BACnet© device.

Requires two functions. When the button is clicked, CBAS will allow the group to be renamed every time the edit an item button is clicked.

This does not mean or require that the group's name to be changed. If you want to rename the group this is where you would do it.

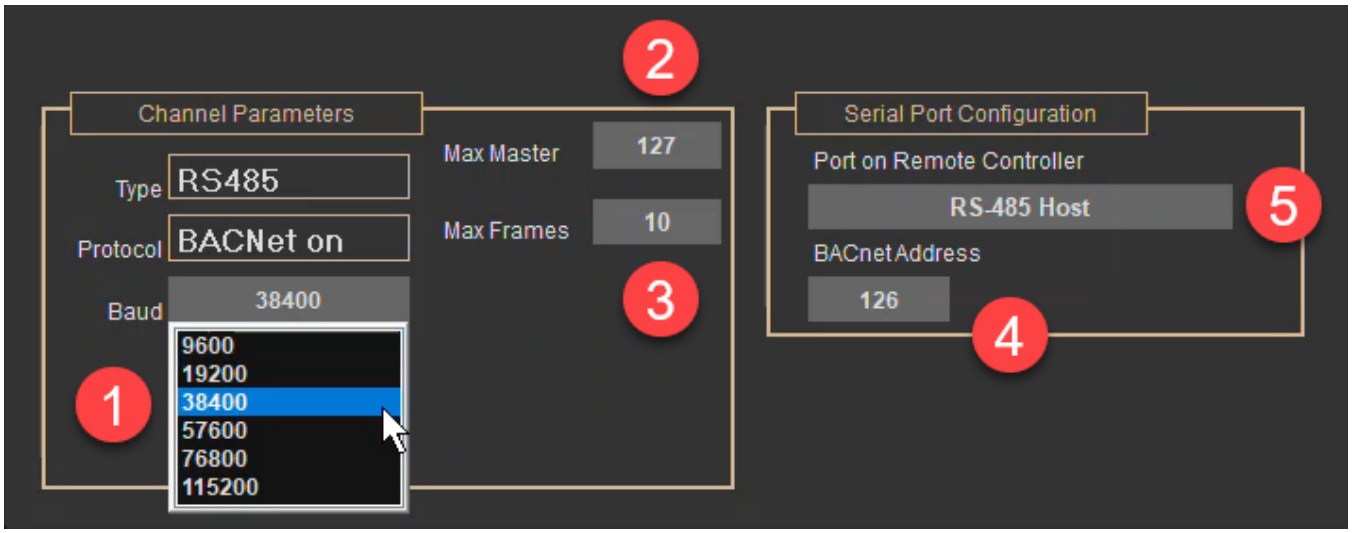
If you do not want to rename the group simply press enter and the next screen will allow you to choose the devices and channels you would like to be a part of the group.

Can I save a BACnet© controller as a CBAS template? Yes, when you work to get one controller perfectly setup, you can export the controller and then import it over and over again. You can do this so that you do not have to go through the steps of converting Child Points to Embedded points for every controller.

CHAPTER 14

BACnet OnController – Channel Programming Details

When a BACnet OnController Channel is programmed on a Host controller, the Generic BACnet Controller database is stored within the Host controller's database. The BACnet points communicate directly with software and hardware points on the Host, eliminating the need to communicate with the head-end computer. Statuses and changes of state are then relayed to the head end.



1. Baud Rate: Use the slowest speed possible which will provide the best facility performance.
2. Max Master: This value is the upper limit of the highest MAC address to which a token can be passed. It should be set to 5-10 addresses above the highest MAC address on the BACnet network.
3. Max {Info}Frames: This value represents the maximum number of messages a device can send before it has to pass the token. Each device will have a Max Frames value as seen in this probe file. This OEM of a BACnet thermostat only allows one message to be sent when it has the token.
4. BACnet Address: This address MUST be below the Max Master setting, or the channel will not work. The BACnet Channel Address is an address on the BACnet channel and the only way it can pass the token with other controllers is to be below the channel Max Master setting. So, if Max Master is 60 and you have the BACnet Address (of the Channel) set to 126, your channel will not work.
5. Port on Remote Controller: You can change the channel's physical location to another port on the Host controller. It is usually done if a port no longer works or can be changed to help diagnose channel issues.

🧐 Nugget of Info 🧐

🤔 Why is 127 the default number for Max Master? The binary for 127 is 01111111(7 bits). This is the highest MAC address reserved for all master devices. 128 to 255 are for slave devices.

```
MAX MASTER          127
MAX INFO FRAMES     1
```

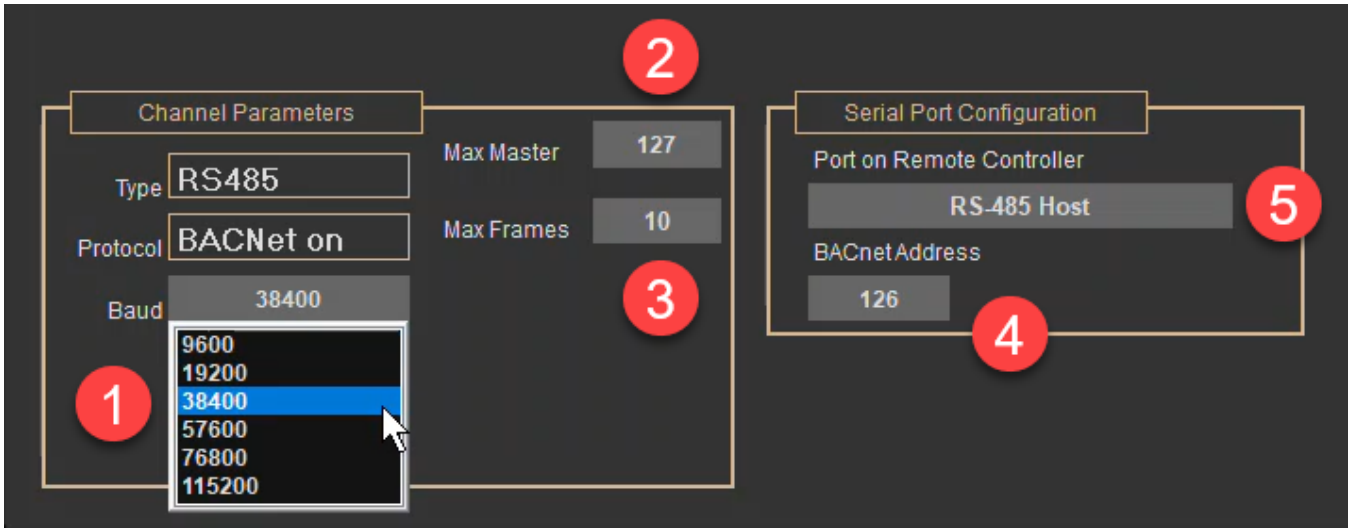
⚠️ IMPORTANT ⚠️

⚠️ Higher values allow a device to send more data at once, reducing token overhead, but can lead to increased latency for other devices. Lower values make token passing more frequent, improving responsiveness but increasing token-related traffic.

CHAPTER 15

Real World Examples

Changing the BACnet Channel Address (4)



The way a BACnet device knows who to pass the token to is that every few seconds, that address sends a CALL message to an address that is not online. If something at that address responds then it comes online and will join the Token passing group. Remember that a BACnet device can ONLY talk if it is passing the token. So, in this site's database, the last BACnet address programmed on this channel is address 36. The Host is programmed as address 1 (Address field on Program screen of Channel) instead of the default 127. So if for any reason we no longer are part of the Token passing group then it is up to address 36 to CALL us so we can rejoin the Token passing. So how that works is address 36 calls address 37.

A few seconds later it will call address 38. ... Probably about 1 minute into this address 36 will call address 128. 128 is the maximum allowed address so it rolls over to 0. So then a few seconds later it will call address 0. Then a few seconds after that it will call address 1!!! Finally, we can respond to the CALL and rejoin the Token passing group. So the fact that we are address 1, which is the farthest possible address away from 36 means that it takes us minutes to rejoin the Token passing group after losing the token. So what the technician did was we changed the CBAS BACnet address from 1 to 22. The last VFD drive is address 20. So now if the token is lost we are only 2 addresses away (only 2 CALL messages away) from a previous address and we should get back online MUST faster. When we were at address 1 we were 94 addresses away from a previous address. So making a

good choice for our BACnet address has a BIG impact on how fast we can rejoin the conversation after a token loss.

Yes, lowering it to 2 after the last address is a good idea if you have a channel that loses the token a lot. On a good BACnet channel it should not be an issue since the token should never be lost in the first place.

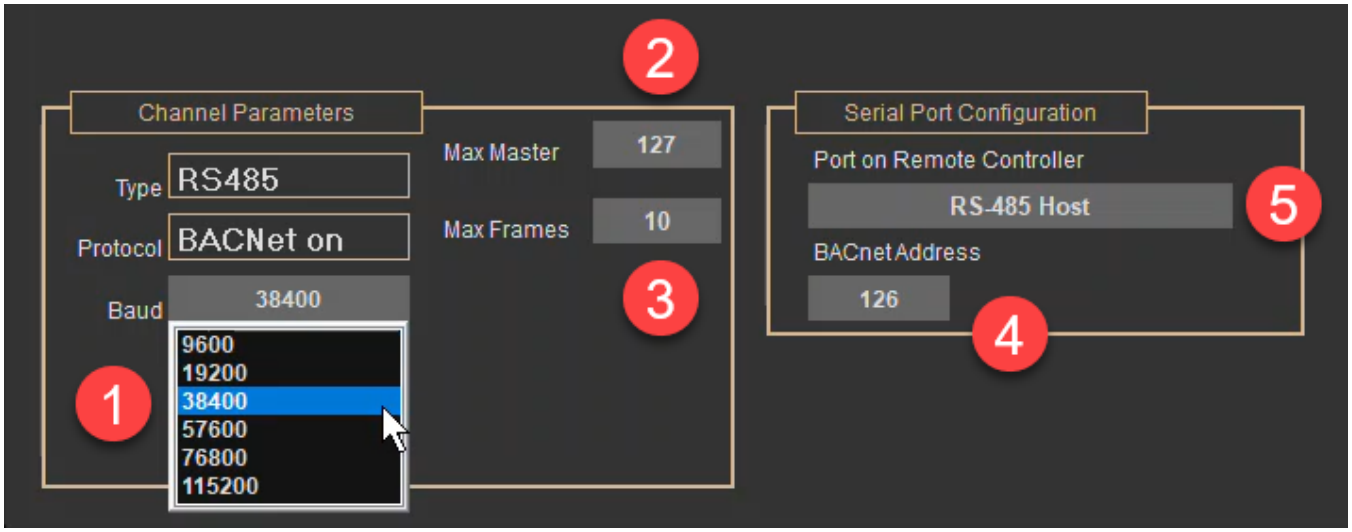
They have all the BACnet addresses set to 1 at this site's database, from 127. There were 11 addresses from 2 to 36 that were used. There was a gap from 20 to like 30 that were not used so we just put it in the middle. Actually, since the issue was with the ABB drives passing token to BTU meters we put our address in between them. So now the ABB drive talks to US and then we talk to BTU meters. So that could have been part of the solution. It seemed like the ABB drives had trouble understanding messages from BTU meters.

Max Master & Max Frames

I understand setting the Max Master to the highest used MAC/serial number on the channel. Say I have VAV #s 1-27. Set the BACnet address on the channel to 28 and Max Master to 28. This value of 28 for Max Master also needs to be set in the side of VAV 27, correct?

Also, Max Frames—I've seen values from 1 to 2 to 63. Do you have any recommendations to keep things consistent here?

Answer



If VAV-27's Max Master is set to 28 than it will not look for any addresses above that. So if it was left at 127, then it is going to look for all addresses all the way to 127 and then back to 0. When set to 28 it will look for 28 than back to 0. So the BACnet protocol will still work if different controllers have different values for Max Master, but controllers could come online much faster if set correctly. I guess there is an instance where setting Max Master incorrectly would prevent controllers from coming online. If 27 has Max Master set to 28 and we are still at 127, then 27 would never look for address 127, and so it would never start passing the token and come online. But yes, you are correct. If the last controller is 27 and we are 28, then set Max Master to 28.

Max Frames is just the number of messages a controller can send before it MUST pass the token to the next guy. We recommend setting all controllers to a low number, which limits them from using too much of the bandwidth. Then, set CBAS to the highest number possible. Previously, I had the LX set to 8, but I changed it to 100 when testing a job I am working on. So now, when I get the token, I will send 100 messages before I pass the token on to the next guy. That is, if I have 100 messages ready to send. So, I use all the bandwidth. But I don’t want the field controllers to use much bandwidth at all so that I would set field devices to 4. CBAS defaults to 10 for Max Frames.

CHAPTER 16

Best Practices

Design:

1. Decide on device segmentation.
2. Pick a maximum number of controllers.
3. Select a Max Master & Channel Address.
4. Start MAC addressing as low as possible.
5. Pick unique instance numbers.
6. Pick a Baud rate to accommodate all devices.
7. Provide device startup information to set the baud, max master, address, and instance numbers.

Installation:

8. Begin and end your trunk runs at your host controller's panel. Take this EOL and terminate it to a terminal block, and clarify that this is the EOL for your communications trunk.
9. Install a dedicated communications pipe coming out of your control panels. RS-485 protocols operate from -7 and +12 volts DC and should not be installed within the same conduit as your power trunks, digital outputs, and any other devices powered or signaled with AC voltages.
10. Use fewer controllers on each trunk.
11. Perform a continuity check on your trunk. If any unwanted continuity is detected, you can fix the problem before plugging in each controller.
12. Verify that your terminations to the channel terminals are as short as possible. Long twisted or untwisted wires leaving the cable jacket can cause the BACnet conductors to act as antennas.
13. When inspecting your installation, verify that all field devices are grounded with a good earth ground.

    Having the command and hot of your 24vac swapped can cause significant communication issues. This is very common in multiple devices powered by multiple different power sources.

Start-up:

14. Make necessary changes to the baud rate, max master, address, and instance number for each device.
15. Verify all BACnet Network settings in each device by using YABE or CUBE.

CBAS:

16. Define as few points as possible from each controller.
17. Use a unique Device ID/Instance numbering for all devices.
18. Use a unique MAC (device) address for each controller on individual channels..
19. Use the slowest speed available that provides the best performance for your facility.

CHAPTER 17

Troubleshooting BACnet

BACnet MS/TP

These are questions to ask yourself first.

- Has there been any general construction lately?
- Have you had any devices go bad lately that have not been unwired from the BACnet network?
- Has a controls or HVAC technician done any work recently?
- Has there been a Windows update recently?
- Are you licensed for the proper BACnet License?
- Have you made changes to the BACnet settings to the controller?
  - If yes, check all BACnet Settings for COV & RPM.
- Is a Serial Connector the HOST controller?
  - Update the firmware version to a build date of 3.27.25 or later.
- Do you have the latest firmware on the controller?
  - Erase the database and download. If this does not solve the issue, set the controller back to the factory default and reprogram the address and download.
- Do you have any spare controllers?
- Have you cycled power on the HOST controller?
  - Cycling power forces the controller to execute BACnet initialization instructions.
- Do you have the latest CBAS version for which you are licensed?
- Have there been any IP upgrades or changes to the IP network?

BACnet MS/TP - Things to Check

- ☐ Check to make sure the power is properly terminated. Verify that the grounded conductor is on the negative side. This has caused issues with some OEM devices.
- ☐ Check for Max Master on all devices.
  - › Max Master set correctly in CBAS
  - › Set correctly in field devices.
  - › Make sure the BACnet channel address is less than the max master.
    - – The BACnet Channel Address MUST be below the Max Master setting or things will not work right. The BACnet Channel Address is an address on the BACnet channel and the only way it can pass the token with other controllers is to be below the channel MaxMaster setting.
    - – Check the controller defined in CBAS has the correct Instance number programmed in the field controller.
- ☐ Verify there are no duplicate addresses and instance numbers.
- ☐ Check all the wiring and verify
- ☐ Polarity
  - › Shielding – Ensure you have a good ground on the shield at the host controller only. Grounding the shield at other locations can cause ground loops and cause issues. You also need to ensure the shield is contiguous from the host controller to the last controller and NOT terminated anywhere on any field device or other ground. The shield should ONLY be grounded at the Host Controllers Channel. Also make sure the foil surrounding the conductors is not exposed and grounded.
  - › Grounding – Each control transformer for each VAV controller MUST be grounded to a good earth ground.
  - › EOL – if you have the EOL checked in the CBAS Channel Program Screen. You may have to uncheck this.
  - › Check for EOLs or EOL jumpers on field controllers; do not use them if the controller is not the last one on the channel.
- ☐ Is there only one single channel in the license?
  - › When there is only one single channel in a license, you may have to assign the license to the channel manually. See a real-world JCI Metasys License example
    - – Go to Database/License/Channels and then click on the 'Johnson Controls Metasys N2' channel, the 8-LX Host is listed under Unlicensed Channels. Click the double left arrows and you will get a box that you have to say YES to. Then it goes to Licensed. Normally, when you have unlimited licenses, you don't have to single license each channel. But when you only have a few licenses, they are not automatically installed. You must pick which channels you want to use them on. Once a license is assigned, you can NOT move it to any other channel.

- [ ] Check Scan times of Code.
  - Having fast execution times of the Logic can cause issues when commanding points on the network. Commands take priority over all other BACnet services.
- [ ] Check COV on points
  - Example - Check Amp transducer points. Look for a very low change of values such as 0.01. Increase this value to the absolute minimum value needed for performance.
- [ ] Check on the number of Max Msg Size in Bytes each controller can handle & RPM
  - Example – Some BACnet controllers have a Max Msg Size of 244 bytes. The typical Max Msg BACnet size is 480 bytes. So even though these controllers support RPM (Read Property Multiple) you can't turn it on because it creates larger messages than the controller can handle. In this real-world example, each point took 12 seconds to update. This meant it was taking 10 minutes per controller to update 50 points.
- [ ] Check for Baud Rate Mismatch
  - Auto Discover is a feature some manufacturers have set as the default baud rate. Change this
  - Power Cycle
- [ ] Check to see if the controller has been probed. If, for some reason, RPM and COV are checked and they are not actually supported, you can uncheck them and restart CBAS. If they are on an “on controller” BACnet channel, erase the Host Controller database. Time and QuickStart are also checked by default. If you are having trouble with controllers going in and out of Normal comm, try unchecking COV. Some manufacturers' versions of COV can cause problems.

Q & A

Q: My BACnet© point is not reading correctly. What can I do?

A: If your point has a slope and intercept built into the point, then make sure the Scale Factor and Intercept are 1 & 0, respectively. Here's how y = mx + b works:

y = the adjusted value of the point to be shown in CBAS.

m = the value of the slope, aka **scale factor.**

x= the value of the point being sent to CBAS via the interface.

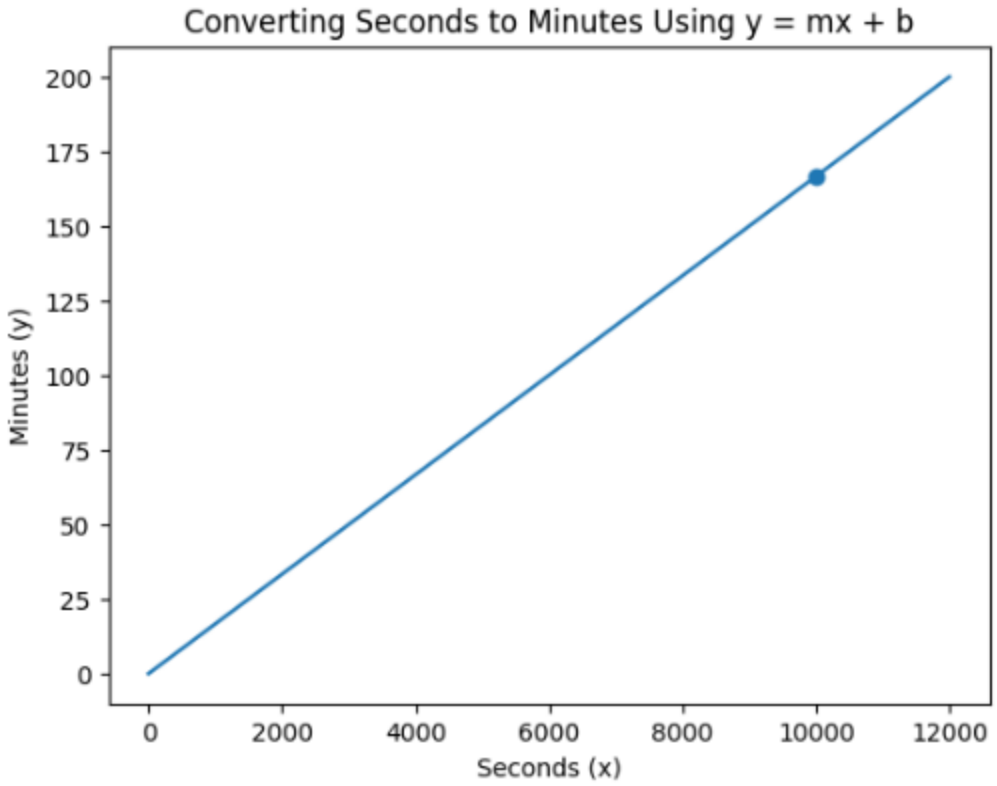
b = intercept, aka **offset.**

One example of using the slope function for a floating-point value is if you wanted to offset a temperature point by 0.5 degrees, you would enter 0.5 for the intercept (b).

(Calibrated Value) y = (1)m * (72.5)x + (0.5)b

y = 1 * 72.5 + 0.5

y = 73



Another example is converting a value from seconds to minutes. A site had a UPS integrated via BACnet© IP, and the remaining battery power was being reported in seconds. The owner wanted minutes so they could be alerted when needed and be read as a recognizable standard number. There was no way to change the units in the UPS, so the scale factor (m) from the slope-intercept equation in CBAS was used to convert seconds to minutes. Here is how we accomplished this:

1 min / 60 seconds per min = 1/60 = 0.0167 minutes; read as 1 second is 0.0167 minutes.

(Minutes Value) y = (.0167)m * (10000 seconds)x + 0(b)

(Minutes Value) y = 167 minutes

CHAPTER 18

Contacting Technical Support

Tips for contacting Computrols Technical Support

At some point, we've all found ourselves in a situation where we desperately need assistance, feeling like we're sitting on a metaphorical bucket with our heads in our hands. To streamline the tech support process and get the help you need more efficiently, we've compiled a few tips to help you get the most out of your interaction with Computrols Technical Support.

Hours of Operation: Technical Support phones are staffed Monday through Friday from 8a-5p CST. Any calls outside those hours will be held until the next business day. After-hours Emergency calls should be directed to our main line: 504.529.1413.

Your Contact Information: Please let us know the best way to reach you should the call get disconnected, as well as an email address in case we need to send you links or files via email.

Site Info: Sites may be referred to by different names or consist of multiple buildings. If unsure, please have the site address handy – this helps us track issues by site.

Hardware Product Name: All Computrols hardware products should have a label or sticker with a part number – having this info during your call will allow the support team to identify steps in the troubleshooting process more quickly and ensure proper handling if an RMA is deemed necessary.

Software Version: Knowing which "major" version of CBAS (CBAS19, CBAS20, etc.) can also help the support team understand your issue and provide guidance more quickly. You can find examples of how to find this information at this link.

Tips for Emailing Computrols Technical Support

In addition to the above tips for Phone Calls, email allows for an even greater range of support options. Some additional notes:

Your Contact Information: Please let us know of a good number to reach you in the event an issue can be best resolved with a telephone call. Please be sure to note any office hours or preferred times for a call.

Backup Database: Create a backup copy of the database and attach it to your email. This creates a great "restore point" before making any changes and also allows the support team to review your database on their workstations.

Remote Access: Remote access tools can be a great way for the support team to "see" what you're seeing at the site. LogMeIn access is included along with many of our service agreements, and other remote access methods can be supported. Please be sure to include any necessary credentials or login information.

Capture Tools: If remote access can not be arranged, screen capture tools such as Windows Snip to take screenshots or Windows Game Bar to capture videos can be a great alternative to help convey something you see.

History Graphs/Reports: To reduce file size, CBAS Database backups do not contain historical data. If relevant to your issue, you can generate history charts or reports that can be conveniently attached to your email.

At Computrols, Free Technical Support is one of the many benefits we offer our valued customers and partners. By following the above tips, we hope to make your interaction with our support team as efficient as possible and get you a quick resolution to your issue.

techsupport@computrols.com

504.365.1163 x245 (Direct) (M-F, 8a-5p CST)

504.529.1413 (Main Line)

https://www.computrols.com/resources/

CHAPTER 19

Management Of Change Log

Date:	Responsible	Subject	Description
10.7.26	KV	Publish	Release of the BACnet MS/TP User Manual
2.21.25	KV	Initial Consolidation	Initial consolidation of many writeups from everyone.