SystemVu™ Controller Networking Guide

CONTENTS

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all local building codes and appropriate national electrical codes (in USA, ANSI/NFPA 70, National Electrical Code (NEC); in Canada, CSA C22.1) for special requirements. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

It is important to recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ DANGER

ELECTRICAL SHOCK HAZARD

Failure to follow this warning will result in personal injury or death.

Before performing service or maintenance operations on unit, turn off main power switch to unit and install lock(s) and lockout tag(s). Ensure electrical service to rooftop unit agrees with voltage and amperage listed on the unit rating plate. Unit may have more than one power switch.

⚠ CAUTION

UNIT DAMAGE HAZARD

This unit uses a microprocessor-based electronic control system. Do not use jumpers or other tools to short out components or to bypass or otherwise depart from recommended procedures. Any short-to-ground of the control board or accompanying wiring may destroy the electronic modules or electrical components.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could cause personal injury, death and/or equipment damage.

R-454B is an A2L refrigerant. All service equipment or components must be A2L refrigerant rated. Do not use non-A2L rated equipment or components on R-454B refrigerant equipment.

⚠ WARNING

PROPERTY OR PERSONAL INJURY HAZARD

Risk of fire. Flammable refrigerant used.

To be installed and/or repaired only by trained service personnel. Do not puncture refrigerant tubing.

Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than the auxiliary devices listed for use with the specific appliance, See instructions.

Dispose of refrigerant properly in accordance with federal or local regulations.

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could cause personal injury or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Wear safety glasses and gloves when handling refrigerants. Keep torches and other ignition sources away from refrigerants and oils.

⚠ WARNING

RISK OF FIRE OR EXPLOSION

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Leave the building immediately.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

⚠ AVERTISSEMENT

RISQUE D´INCENDIE OU D´EXPLOSION

Si les consignes de sécurité ne sont pas suivies à la lettre, cela peut entraîner la mort, de graves blessures ou des dommages matériels.

Ne pas entreposer ni utiliser d´essence ni autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.

QUE FAIRE SI UNE ODEUR DE GAZ EST DÉTECTÉE

- Ne mettre en marche aucun appareil.
- Ne toucher aucun interrupteur électrique; ne pas utiliser de téléphone dans le bâtiment.
- Quitter le bâtiment immédiatement.
- Appeler immédiatement le fournisseur de gaz en utilisant le téléphone d´un voisin. Suivre les instructions du fournisseur de gaz.
- Si le fournisseur de gaz n´est pas accessible, appeler le service d´incendie.

L´installation et l´entretien doivent être effectués par un installateur ou une entreprise d´entretien qualifié, ou le fournisseur de gaz.

PURPOSE

The Purpose of this document is to give a general overview of the SystemVu controller (see Fig. 1) and to provide guidance for integration with various other devices and systems. The focus in this document will be networking practices with BACnet®[1] and Rnet. For CCN practices follow the Carrier Comfort Network® guide.

What is a SystemVu Controller

SystemVu is a factory installed integrated HVAC unit controller utilized in a variety of Carrier Light Commercial products.

The SystemVu controller is fully communicating and cable ready for connection to Carrier Comfort Network (CCN) or BACnet MS/TP building systems. The SystemVu controller can also communicate with Rnet Sensors, Equipment Touch™ devices, and System Touch™ devices.

1. Third-party trademarks and logos are the property of their respective owners.

Protocols Supported by SystemVu

The SystemVu controller supports the following Building Automation System (BAS) protocols.

- CCN (Carrier's Comfort Network)
- BACnet over MS/TP

Please note that the default BAS Protocol setting (BMS_CFG) for SystemVu is configured as "None".

PROTOCOL CONFIGURATION

Set the Communication protocol using UI (user interface) as shown in Fig. 2.

Configuring SystemVu BAS Protocol to CCN

For Configuring the SystemVu Communication Protocol to CCN (Carrier Comfort Network®), Navigate to "Network Settings" in User Interface using Menu/Settings/Network Settings/ BAS PROTOCOL. Controller will Prompt for "ENTER PASSWORD", Type in "1111" as password and select "1 – CCN" as shown in Fig. 2.

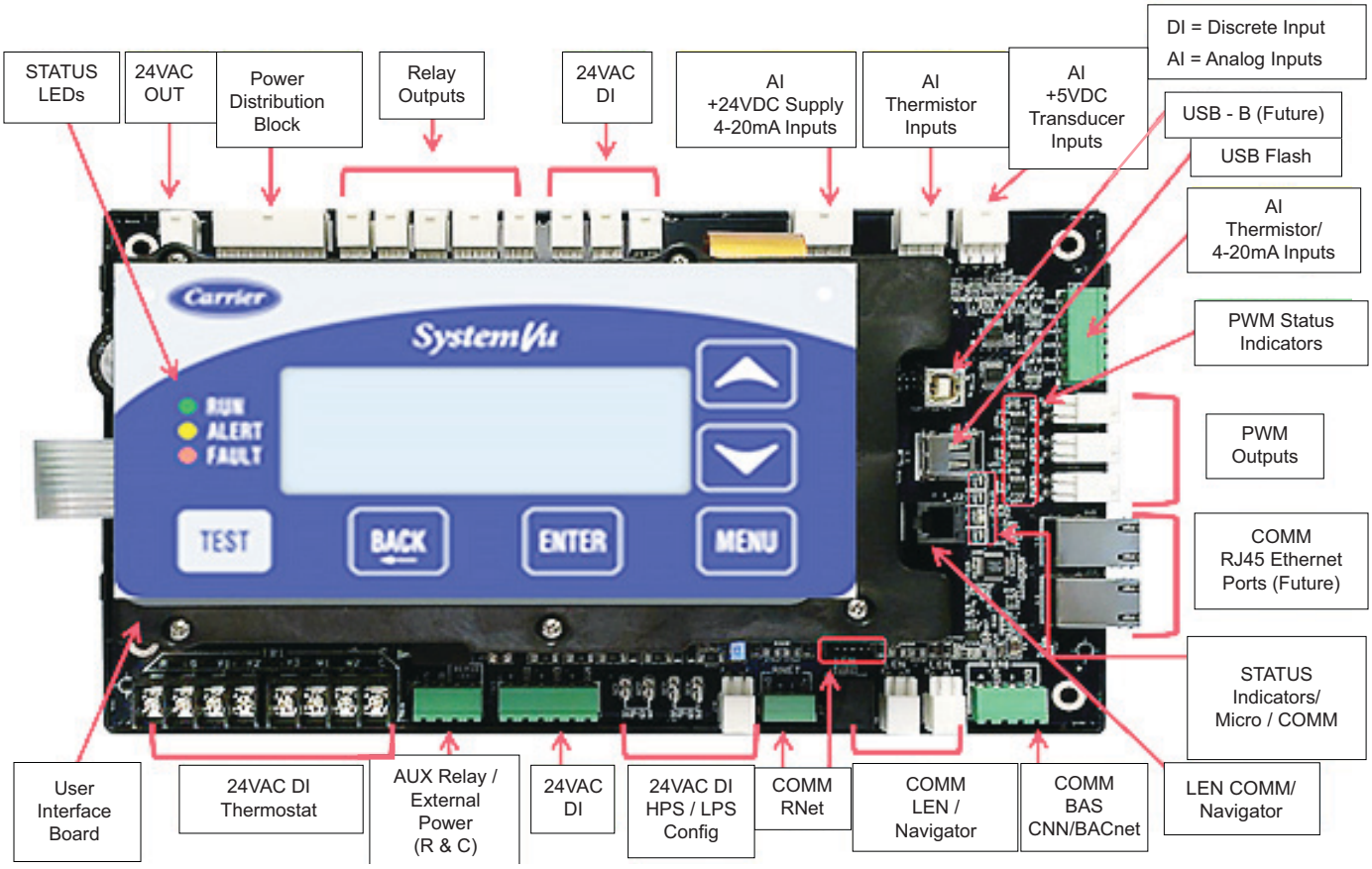

Fig. 1 — SystemVu I/O Ports

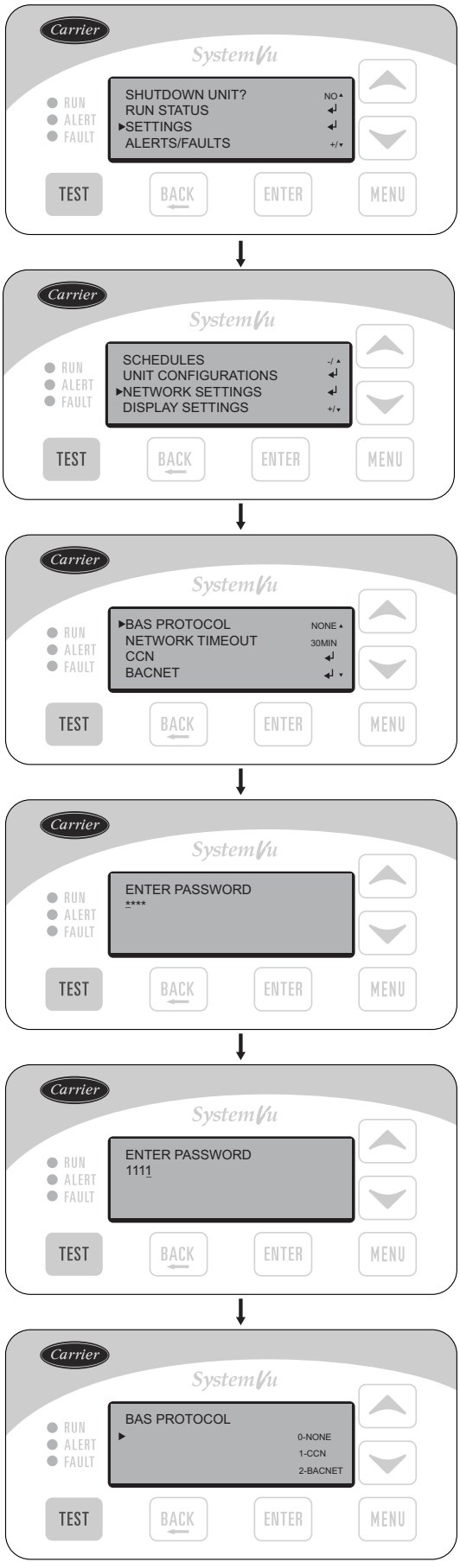

Fig. 2 — Navigation Path for BAS PROTOCOL Settings

Configuring SystemVu to BACnet

For Configuring the SystemVu Communication Protocol to 'BACnet', Navigate to "Network Settings" in UI using Menu/Settings/Network Settings/BAS PROTOCOL and select BACNET. Controller will Prompt for "ENTER PASSWORD", Type in "1111" as password.

SystemVu BACnet Configuration Settings

SystemVu supports the following Baud rates for BACnet MS/TP.

- 9600
- 19200
- 8400
- 57600
- 76800
- 115200

NOTE: 115,200 baud rate can only be used with certain devices such as the iVu® XT-RB router. It can NOT be used on the same MS/TP network with devices such as RTU Open controllers as they do not support this baud rate.

For configuring the Baud Rate and MAC Address, navigate to BAS Settings in User Interface using Menu/Settings/Network Settings/BACNET. See Fig. 3.

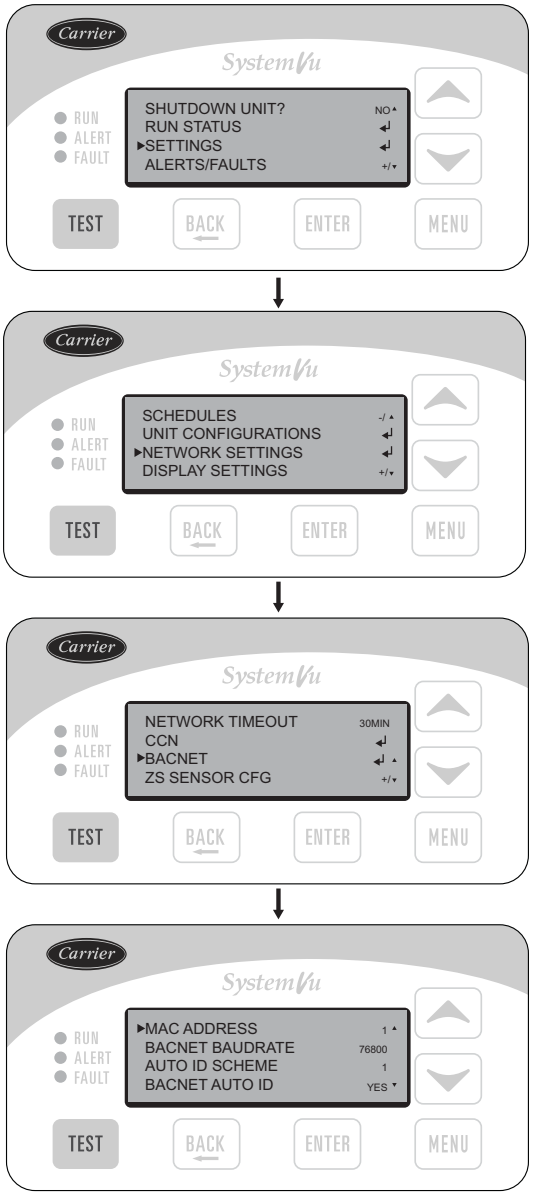

Fig. 3 — BACnet Configuration Settings

NOTE: You must cycle power after changing any Network Settings.

SystemVu can be connected to the following devices

- All i-Vu BACnet MS/TP routers
- All current i-Vu CCN devices
- Third party BACnet MS/TP routers
- System Touch over MS/TP
- Equipment Touch over Rnet
- Carrier Rnet Zone Sensors

NOTE: SystemVu is a BACnet MS/TP master controller. Valid MAC addresses for master nodes are 0 – 127.

NOTE: If SystemVu cannot be communicated with over BACnet then ensure that the protocol has been correctly set and the controller has been power cycled if the protocol settings were changed.

INTEGRATION OVER BACNET MS/TP

In general, all wiring and installation techniques should follow the Open Controller Network Wiring Guide, Catalog No. 11-808-461-01, instructions. However, please note the following details and exceptions that MUST be observed on networks containing SystemVu controllers.

Communication Cable and Wire

The communication cable and wire used in networking can greatly impact the performance of the network communication over that wire. Follow the details shown in Table 1 as best practice with wiring on MS/TP BACnet networks.

Table 1 — BACnet MS/TP Wiring Specification

DESCRIPTION	Single twisted pair, low capacitance, CL2P, 22 AWG (7x30), TC foam FEP, plenum rated cable
CONDUCTOR	22 or 24 AWG stranded copper (tin plated)
INSULATION	Foamed FEP
COLOR CODE	Black/White
SHIELDING	Aluminum/Mylar shield with 24 AWG TC drain wire
JACKET	**SmokeGard**[a] (SmokeGard PVC) • 0.021 in. (0.5334 mm) wall • 0.175 in. (4.445 mm) O.D. **Halar**[a] (E-CTFE) • 0.010 in. (0.254 mm) wall • 0.144 in. (3.6576 mm) O.D.
RATING	CMP rated
TEMPERATURE	SmokeGard: 167°F (75°C) Halar: –40 to 302°F (–40 to 150°C)
VOLTAGE	300 vac, power limited
DC RESISTANCE	15.2 Ohms/1000 feet (50 ohms/km) nominal
CAPACITANCE	12.5pF/ft (41 pF/meter) nominal conductor to conductor
CHARACTERISTIC IMPEDANCE	100 ohms nominal

NOTE(S):

a. Third-party trademarks and logos are the property of their respective owners.

TO WIRE THE COMMUNICATION CABLE

1. Partially cut, then bend and pull off 1 in. of the outer jacket of the cable(s). Do not nick the inner insulation. See Fig. 4.
2. Strip about 0.25 in. (0.6 cm) of the inner insulation from each wire. See Fig. 4.
3. If wiring two cables to the controller, twist together the shield wires from both cables.
4. Insert the wires into the appropriate terminal block (see Fig. 7 and 8 on page 6). Take care the drain wire is electrically isolated, where exposed.
5. All connections should be made with power turned off to all the network devices and SystemVu controllers.

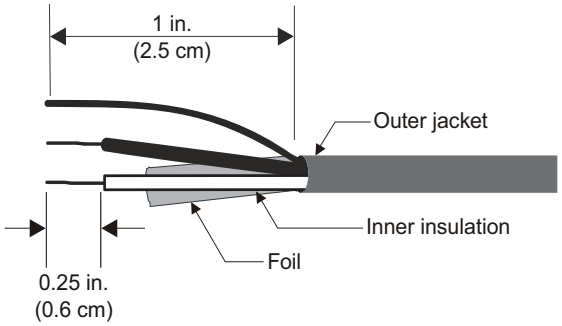

Fig. 4 — Preparing Communication Cable Wires

⚠ CAUTION

POSSIBLE COMMUNICAITONS FAILURE

- Do not allow more than 0.125 inch (0.3 cm) bare communication wire to protrude. See Fig. 5.
- If bare communication wire contacts the cable's foil shield, shield wire, or a metal surface other than the terminal block, communications may fail.
- Best practice is to tape wires up to the BAS plug to prevent contact with any metal. See Fig. 6.

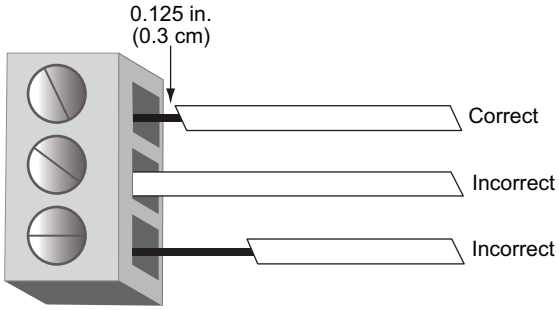

Fig. 5 — Correct vs. Incorrect Connections

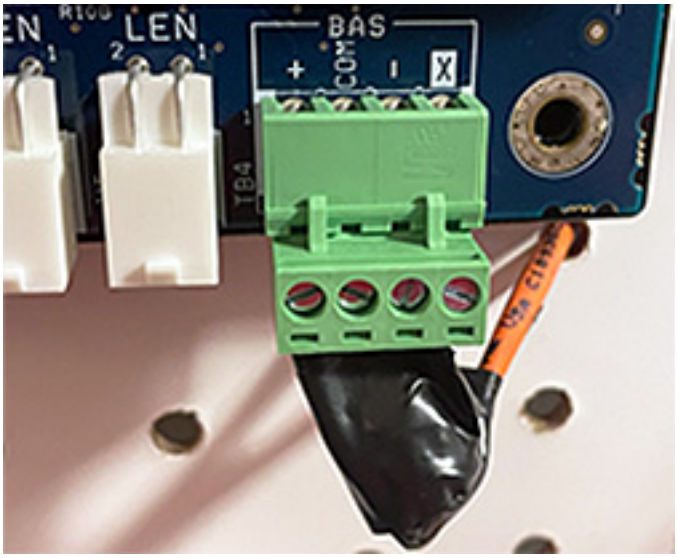

Fig. 6 — Correct Connections — Best Practice

NOTE: Do not ground the shield to earth ground or to the controller's power ground. The PROT485 and the individual controllers allow the shield to float a limited amount so that there are no ground loops. If the voltage on the shield becomes too great, relative to the earth ground, then the excess voltage is bled off with protective devices on the PROT485 or on the controllers.

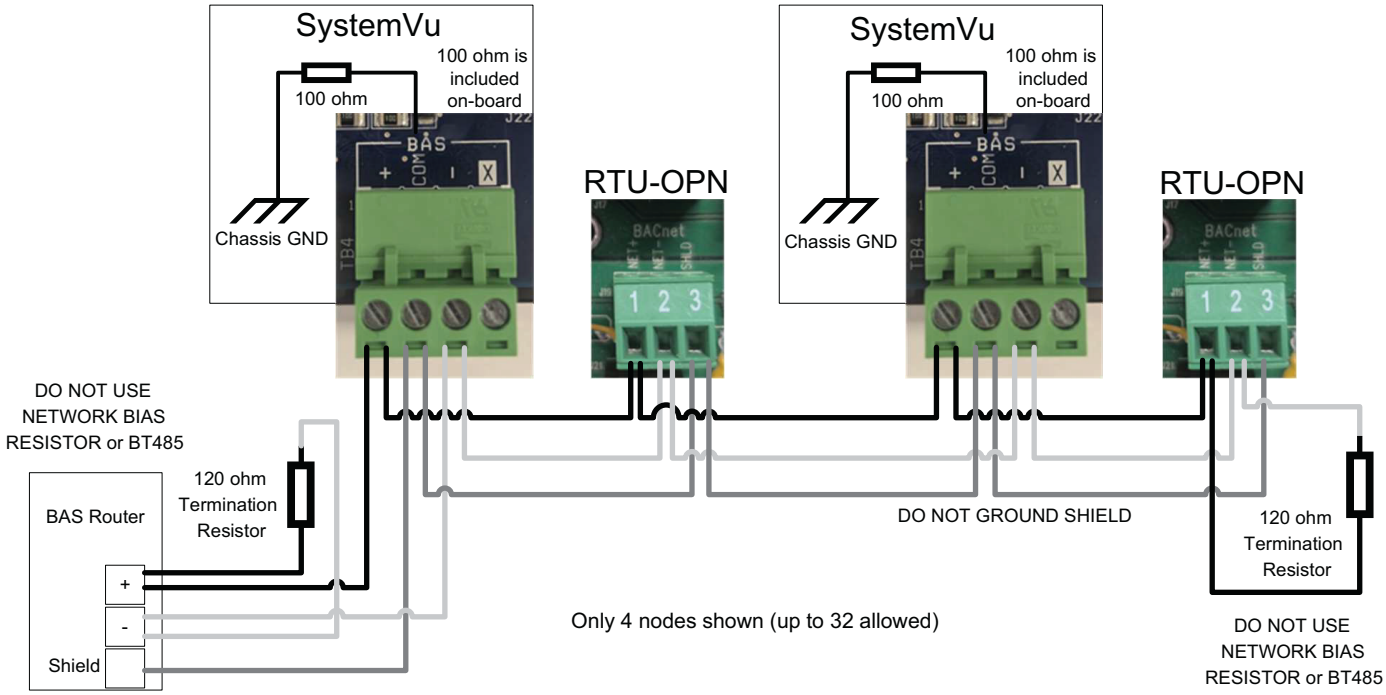

Fig. 7 — BACnet Wiring on Mixed Device Network

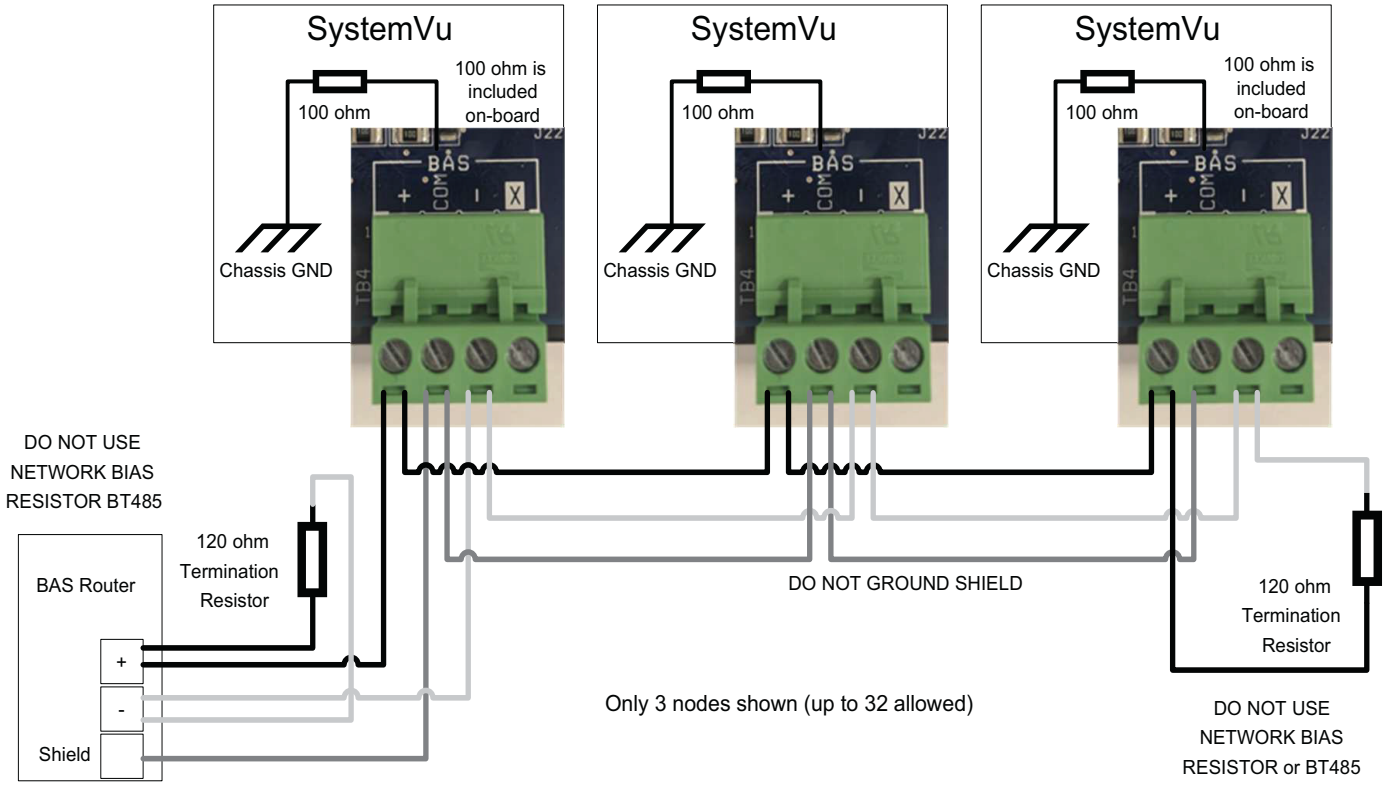

Fig. 8 — BACnet Wiring on SystemVu Only Network

Network Design

With a locally biased controllers, per RS-485 standards, the maximum recommended number of nodes per segment/trunk depends on the baud rate of the network.

38,400 baud = maximum of 15 nodes and a router

76,800 baud = maximum of 31 nodes and a router

Please note that the SystemVu controller is a LOCALLY biased device as opposed to the OPEN product line which are NETWORK biased devices.

Therefore, the BT485 device is NOT used in a SystemVu only network and it is NOT used in a network composed of SystemVu and OPEN products together.

In addition, the end of line / end of net switches on OPEN products and routers are NOT used with SystemVu controllers on the bus. Since these switches may also add network biasing, they are not needed with a locally biased product. There are no end of line switches on SystemVu products.

NOTE: Note: A 120 Ohm Resistor MUST be used to terminate the bus at both ends in accordance with standard RS-485 requirements. The TERM485 device is recommended.

With careful wiring practices, one network segment can use up to 4,000 feet of network wire. However, best results are achieved when total wire length on a trunk is limited to 2000 feet.

In addition, the use of a repeater (the REP485 is the only currently allowed repeater) for network segments over 2000 feet of wire is encouraged, but not mandatory. Please refer to the Open Controller Network Wiring Guide for detailed REP485 installation instructions. Note that the REP485 counts as a node on both network segments it connects.

The use of the PROT485 device is highly recommended for all network segments with SystemVu controllers. Please refer to the Open Controller Network Wiring Guide for detailed PROT485 installation instructions.

Finally, please note that rigorous adherence to the wiring hygiene recommendations here and in the Open Controller Network Wiring Guide will produce the best network results.

SystemVu controllers should have the BAS wiring connected to plus, minus, and the shield wire to COM as shown in Fig. 7 and 8.

Network Topology

All BACnet MS/TP networks should be wired in a true “daisy-chain” configuration.

BACnet MS/TP network best practices dictate that the MAC addressing of the nodes on the network should be sequential with the physical location of the units. For example, if the router is the first node on the network, it should have the lowest MAC address. The next unit on the daisy-chain should have a MAC address one number higher, etc.

Grounding and Polarity

A quality earth ground is essential to ensure proper unit operation AND proper BAS communication function.

There is not one standard ground resistance threshold that is recognized by all agencies.

However, the NFPA (National Fire Protection Association) and IEEE have recommended a ground resistance value of 5.0 ohms or less. The NEC has stated: “Make sure that system impedance to ground is less than 25 ohms specified in NEC 250.56.” In facilities with sensitive equipment, it should be 5.0 ohms or less. The telecommunications industry has often used 5.0 ohms or less as their value for grounding and bonding.

If you suspect you may have grounding issues at a facility, specialized earth grounding testers are used by qualified electrical contractors to test for correct grounding.

In addition, control power polarity should be maintained throughout the BAS network AND communication wiring polarity should be maintained as well. Per the recommendations in the Open Controller Network Wiring Guide regarding the PROT485, shield wires should NOT be grounded to any earth ground or to the controller’s power ground. The PROT485 and the individual controllers allow the shield to float a limited amount so that there are no ground loops. If the voltage on the shield becomes too great relative to the earth ground, then the excess voltage is bled off with protective devices on the PROT485 or on the controllers.

Packet Segmentation

The BACnet stack used with the SystemVu product does NOT currently support packet segmentation.

Segmentation should be turned OFF on the third-party devices.

Please be aware that the segmentation feature is NOT required for current BTL (BACnet Testing Laboratories) certification.

i-Vu Integration Tips – Source Files and Version Variations

The current SystemVu products are compatible with i-Vu versions 7.0 and later. Older versions of i-Vu software may not work correctly with current SystemVu products.

All current i-Vu patches must be installed when connecting to SystemVu products. These may be obtained from the “Controls Download” section of HVACPartners or from the Carrier Controls website software section.

It is often necessary to manually add the SystemVu source files to the i-Vu server and place into the appropriate folder.

Please note that the source files are located on HVACPartners (Currently located under the SUPPORT TAB > POST SALE SUPPORT > SERVICE SOFTWARE).

COV (Change of Value) and Third-Party Routers

The COV feature in BACnet MS/TP is used extensively by some third-party vendors.

However, SystemVu only supports a limited number of COV points. Router requests for COV points that are not supported by the SystemVu controller can lead to network errors and poor network performance.

Turning the COV function OFF in the third-party devices can be a helpful tool when troubleshooting network traffic issues.

Certain job sites or customers may require that the COV feature be used.

If this is the case, Table 2 shows the exact COV points supported by the SystemVu controller.

Table 2 — SystemVu Objects Supporting COV-Guide

DESCRIPTION	BACNET OBJECT NAME	BACNET TYPE	BACNET INSTANCE NUMBER	BACNET DESCRIPTION
Linkage equipment mode reported to the zones.	lnk_mode	AV:	261	Linkage Equipment Mode
A discrete hardware input that when configured for use can be used as part of the logic that determines the occupied or unoccupied state of the control.	remocc	BV:	29	Remote Occupancy Switch
Indoor Air Quality that has been resolved from all of the possible indoor air quality sources available in the system.	iaq	AV:	1009	Indoor Air Quality Level
Indoor air quality that is received over the network.	iaq_net	AV:	7001	Network IAQ Value
Outdoor Air Quality (OAQ) Level (sensor).	oaq	AV:	1012	OA Quality Level
Network Outdoor Air Quality (OAQ) Level Sensor.	oaq_net	AV:	7002	Network OAQ Value
Outside Air Relative Humidity that has been resolved from all of the possible outdoor air humidity sources available in the system.	oarh	AV:	1022	OA Relative Humidity
Outdoor air relative humidity network sensor.	oarh_net	AV:	7003	Network OARH Value
Outside Air Temperature that has been resolved from all of the possible outdoor air temperature sources available in the system.	oa_temp	AV:	1003	Outdoor Air Temperature
Outdoor air temperature from the BMS network.	oat_net	AV:	7007	Network OAT Value
Outdoor Air CFM that is received over the network.	ocfm_net	AV:	371	Network OACFM Value
Outdoor fan High temperature override.	odfhtovr	AV:	9066	ODF Override Temperature
Return Air Relative Humidity that is the result of the engineering conversion performed on the sensor in the return air duct work.	rarh	AV:	30	RA Relative Humidity
Relative Air Relative Humidity (RARH) Sensor read in from network sensor.	rarh_net	AV:	7004	Network RARH Value
Return Air Temperature that has been resolved from all of the possible return air temperature sources available in the system.	ra_temp	AV:	1010	Return Air Temperature
Return air temperature from the network.	rat_net	AV:	7005	Network Return Air Temp
Supply Air Temperature that has been resolved from all of the possible supply air temperature sources available in the system. This represents the temperature of the air being output from packaged unit.	sa_temp	AV:	1008	Supply Air Temperature
Space Relative Humidity (SPRH) Sensor read in from network sensor.	sprh_net	AV:	376	Network SPRH Value
Space Temperature is a legacy point that has typically been used for writing space temperature values over a CCN network.	space_temp	AV:	2007	Pilot Space Temp Value
Space Temperature is the reading from the network.	spt_net	AV:	7006	Network Space Temp Value
System Touch Space Temperature reading from the network.	stst_net	AV:	8023	System Touch Temp Value

BACnet Point Integration with Third Party Routers

With certain third-party vendors the automated BACnet point identification feature is either very slow or will not work with SystemVu units due to the high number of available BACnet points on a standard SystemVu unit.

If this occurs, it is advisable to provide a specific point list by point name / BACnet identifier to the third-party vendor. This will allow the vendor to discover the points needed for the job much more quickly.

Of course, this will be job specific depending on unit type, controls contractor, engineer's sequence of operation, etc.

See Table 3 for an example of an abbreviated point list.

Table 3 — Abbreviated Example of Point List

POINT DESCRIPTION	POINT ACESS	UNITS	BACnet OBJECT NAME	BACnet ID	VALUE RANGE	CNN POINT EQUIVALENT
BACnet device for IAQ	R/W		devlag	AV:8001	0 TO 4194303	DEAVIAQ
BACnet device for OAQ	R/W		devoaq	AV:8002	0 TO 4194303	DEVOAQ
BACnet device for OARH	R/W		devoarh	AV:8004	0 TO 4194303	DEVOARH
BACnet device for OAT	R/W		devoat	AV:8003	0 TO 4194303	DEVOAT
BACnet device for RARH	R/W		devrarh	AV:8005	0 TO 4194303	DEVRARH
BACnet device for RAT	R/W		devrat	AV:8006	0 TO 4194303	DEVRAT
BACnet device for SPRH	R/W		devsprh	AV:8028	0 TO 4194303	DEVSPRH
BACnet device for SPT	R/W		devspt	AV:8007	0 TO 4194303	DEVSPT

APDU Timing, Polling Rates, etc. with Third-Party Routers

It is not uncommon to need to adjust a number of router settings that vary significantly from job to job.

Unfortunately, there are not “set in stone” values that work on every job.

Please be aware that some of these values include APDU timeout rates, polling rates, and NPDU timeout rates.

In general, longer polling rates for BACnet objects are to be preferred (polling too frequently increases bus traffic). Polling/refresh rates should not be set below every 30 seconds. It is best to keep the polling/refresh rates between 1 and 5 minutes. In general, the recommendations in OAPN022 application tip regarding read and write rates should be observed.

It is a best practice to set timeout rates such as APDU timeout rates at the highest timeout rate of any device on the network. Many devices default at 3000 milliseconds. SystemVu is defaulted to 6000ms and cannot be changed. When applying SystemVu controls on a BACnet bus with other devices, all devices should be set to match SystemVu at 6000ms.

The SystemVu APDU segment length is fixed at 480 bytes. Since the BACnet stack used for SystemVu controllers does NOT support packet segmentation, some third-party routers may need have the APDU segment size or RPM “chunking” or “bin packing” algorithms manually adjusted to properly work with features such as Read Property Multiples.

Frame Rates and Third-Party Routers

Many third-party vendors default their router “MS/TP Max Info Frames” value to “100”. This is too high for SystemVu nodes – a value of “20” will provide a more stable network.

All legacy production SystemVu software versions have the “Max Info Frames” value default to “10”. Older versions defaulted to “1” which can cause network issues. If a network with older SystemVu units is experiencing issues, upgrading to current production software is recommended.

The current A2L production units have adjustable frame rates and max master values.

SYSTEMVU INTEGRATION WITH SYSTEM TOUCH OVER MS/TP PORT

What is System Touch

The System Touch is a touchscreen device with a color LCD display that provides as a user interface to controllers on a single BACnet network. The System Touch has built-in temperature and humidity sensors. These values can be read by controllers to control equipment. You can also wire an external thermistor to the System Touch and use its value instead of the built-in temperature sensor's value.

For more details about the System Touch, refer the below documents available on HVACPartners or the Carrier Controls Website

- System Touch Installation and Setup Guide
- System Touch User Guide
- System Touch Product data sheet

Steps to Connect SystemVu and System Touch over MS/TP Port

NOTE: You must configure the SystemVu Communication Protocol to ‘BACnet’ for proper System Touch interface with the SystemVu controller and System Touch device.

1. Update the SystemVu to latest firmware.
2. Enable BACnet in the BAS Protocol (Menu > Settings > Network Settings).
3. Connect System Touch to SystemVu over MS/TP as shown in Fig. 9.
4. Once connection is established, click on ‘Setup’ of System Touch from home screen.
5. Enter the password (the default password is ‘admin’)
6. Click on the “Discovery”. Verify System Touch tries to communicate with SystemVu and displays the SystemVu controller.
7. For more details about the System Touch, refer the documents mentioned above.

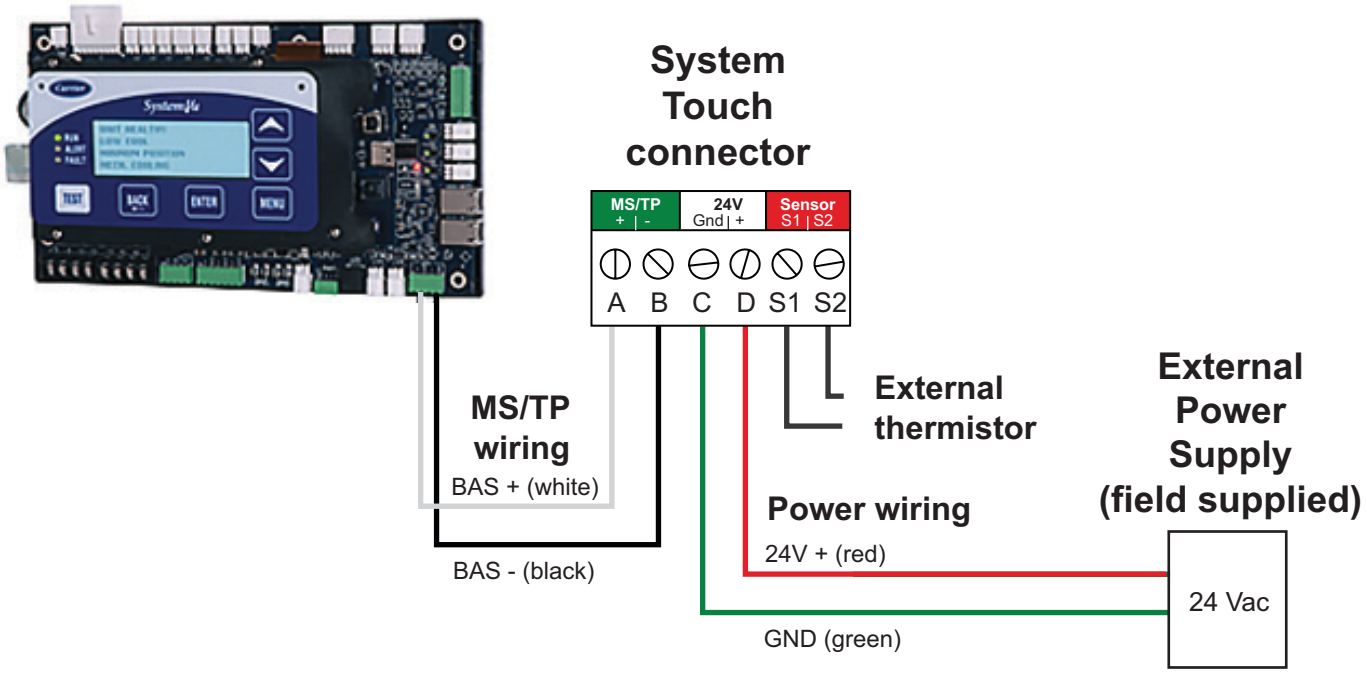

Fig. 9 — SystemVu to System Touch MS/TP Pin Connections

Using System Touch's Temperature and Humidity Sensors

The System Touch's Temperature sensor and Humidity Sensor can be requested by the SystemVu controller. For requesting these values from System Touch, we need to configure as below.

1. Connect System Touch and SystemVu Board as described above.
2. On System Touch, navigate to Setup > Touchscreen Setup > Sensor Setup.
3. Select "Internal" and "Deg F" as shown in Fig. 10.

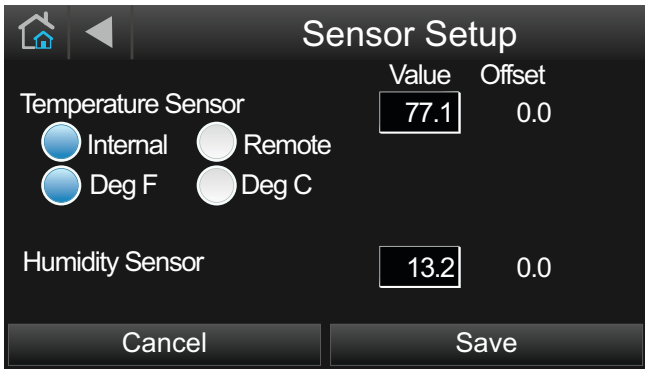

Fig. 10 — Sensor Setup Menu Screen

4. Using UI on SystemVu board, Navigate to SETTINGS > NETWORK SETTINGS > BACNET > SYSTEM TOUCH.
5. Set DEVICE INSTANCE to System Touch Device Instance.
6. Set POLLING Rate (System Touch Poll Rate) to at least 10.
   NOTE: The default is 0 to prevent scanning.
7. Set SPACE TEMP AI = 1.
8. Set SPACE RH AI = 4.
9. With these settings, SystemVu Board will poll the Space Temperature and Humidity Sensor values from System Touch.
10. For more information about the default value and the configuration values, refer to "APPENDIX A" in the Controls and user manual document for the SystemVu unit you are using.

SYSTEMVU INTEGRATION WITH EQUIPMENT TOUCH OVER RNET

What is Equipment Touch

The Equipment Touch is a touchscreen device with a color LCD display that you connect to SystemVu controller to view or change its property values, schedule equipment, view trends and alarms, and more, without having to access the i-Vu server.

For more details about the Equipment Touch, refer to the below documents available on HVACPartners or the Carrier Controls Website.

- Equipment Touch User Guide
- Equipment Touch Installation and Setup guide
- i-Vu Equipment Touch Product Data Sheet

Steps to Connect SystemVu and Equipment Touch over Rnet Port

NOTE: You must configure the SystemVu Communication Protocol to 'BACnet' for proper Equipment Touch interface with the SystemVu controller and Equipment Touch device.

1. Update the SystemVu to latest firmware.
2. Enable BACnet in the BAS Protocol (Menu > Settings > Network Settings).
3. Connect Equipment Touch to SystemVu over Rnet as shown in Fig. 11.
4. Once connection is established, Equipment Touch will start uploading touch file from the SystemVu device, as shown in Fig. 12.

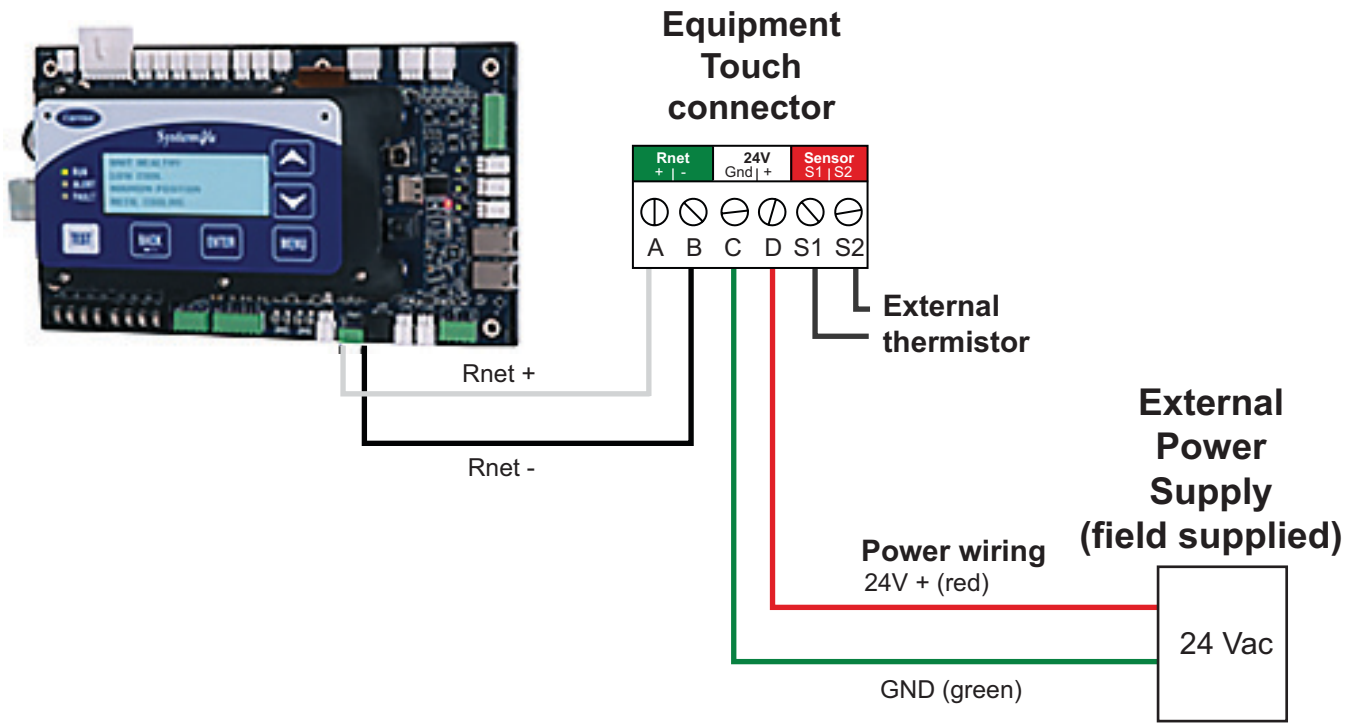

Fig. 11 — SystemVu to Equipment Touch Pin Connections (over RNET)

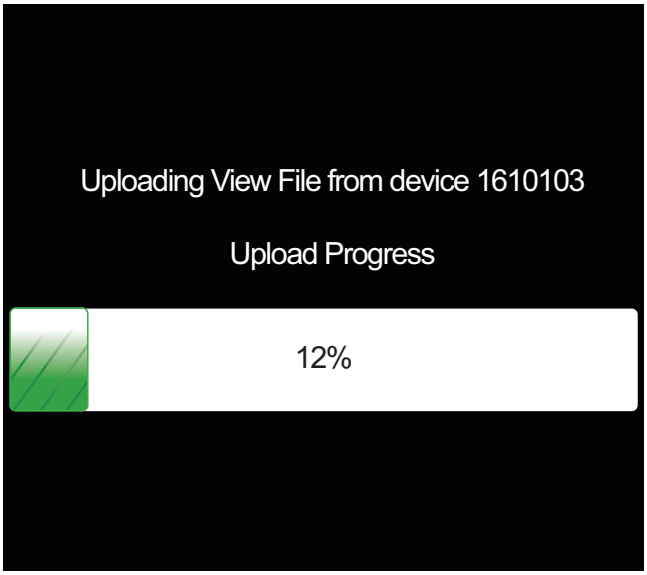

Fig. 12 — Firmware Uploading

5. After successful upload, Equipment Touch displays the following screen (Fig. 13).

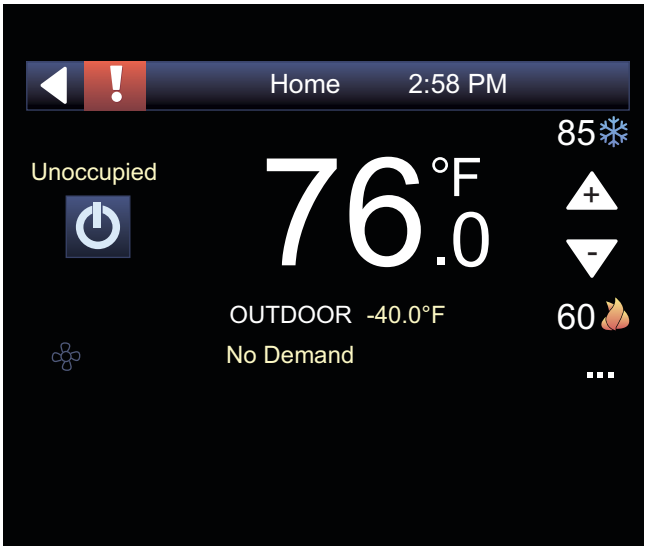

Fig. 13 — Firmware Successfully Upload

6. For more details about the Equipment Touch, see the Equipment Touch Installation and Setup Guide.

Using Equipment Touch Temperature and Humidity Sensors

The Equipment Touch Temperature and Humidity sensors can be used by the SystemVu controller. For requesting these values from Equipment Touch, we need to configure as below.

1. Connect Equipment Touch and SystemVu Board as described above.
2. On Equipment Touch, navigate to Setup > Touchscreen Setup > Sensor Setup.
3. Select the check box 'Enable Transmit' for both 'Temperature Sensor' and 'Humidity Sensor' (see Fig. 14).

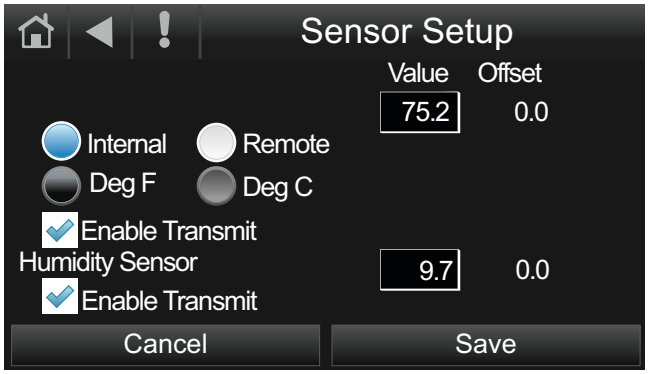

Fig. 14 — Sensor Setup — Enable Transmit Selection

4. With these settings, Equipment Touch will Transmit the Temperature Sensor and Humidity Sensor Values to SystemVu.

FIRMWARE UPGRADE PROCESS FOR EQUIPMENT TOUCH/SYSTEM TOUCH

Firmware Update Steps

1. Create a folder on the flash drive called "touch", then put the ETxxxxx.hex or STxxxxx.hex file in the folder.
2. Plug the flash drive into the Equipment/System Touch's USB port.
3. From the System Screen, touch Setup > Touchscreen Setup > Reload Firmware.
4. A warning message appears. Touch Yes to continue.
5. The following series of messages appear:

- Verifying Firmware Image.
- Reading Firmware image from USB.
- Installing Application.
- Verifying Firmware Image.

6. After successful firmware update, remove the flash drive.

SYSTEMVU INTEGRATION WITH ZS SENSOR OVER RNET

ZS Sensors

ZS Sensors are thermistor-based temperature sensors that can optionally sense humidity, motion, and either CO_2 or VOC. ZS Sensors communicate with the HVAC system through the Rnet.

ZS Sensor functionality is determined by:

- The sensor models
- The sensor's sensing capabilities (temperature, humidity, motion, CO_2, VOC)
- The control program that runs the associated equipment

ZS Sensors are wired to the Rnet port on SystemVu controllers. For more information about Zone Sensor, refer to the below manuals documents available on HVACPartners or the Carrier Controls Website.

- ZS Sensors User Guide
- ZS Sensors Installation Guide

Steps to Connect SystemVu and ZS Sensor Over Rnet Port

Each ZS Sensor connected via the Rnet port must have a unique address, but addresses do not have to be sequential.

Open the hinged cover on the sensor enclosure, and then use the DIP switches to set an address from 0 to 14. (1 is factory default.) Each DIP switch has the value shown in the Fig. 15 below. Turn on as many DIP switches as you need so that their total value equals the address.

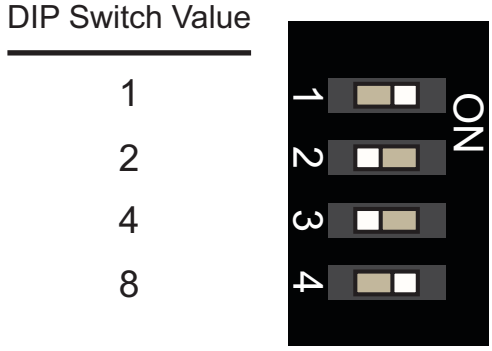

Fig. 15 — Dip Switch on ZS Sensor

EXAMPLE: DIP switches 1 and 4 below are on. Their values (1 + 8) total 9, so the sensor's address is 9.

1. Connect SystemVu Controller and Zone Sensor over Rnet Port as shown in Fig. 16-17.
2. On SystemVu User Interface Navigate to SETTINGS / NETWORK SETTINGS / ZS SENSOR CFG and set the ZS Sensor address (see Fig. 18).
3. SystemVu supports up to 5 Zone Sensors which can be connected over Rnet Port (see Fig. 19).
4. Please note that there is a 500mA VA limit for the Rnet plug. Check the total VA consumption of the sensors prior to connecting them to the SystemVu board.

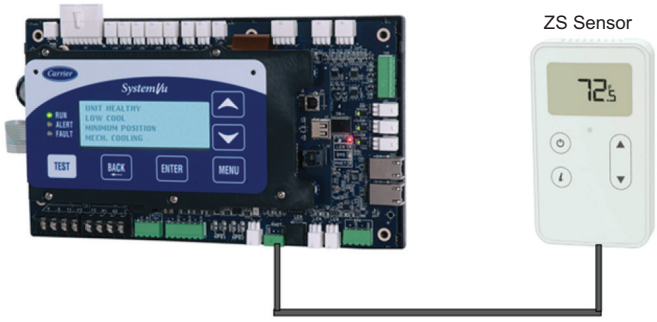

Fig. 16 — ZS Sensor Connection to SystemVu over RNET

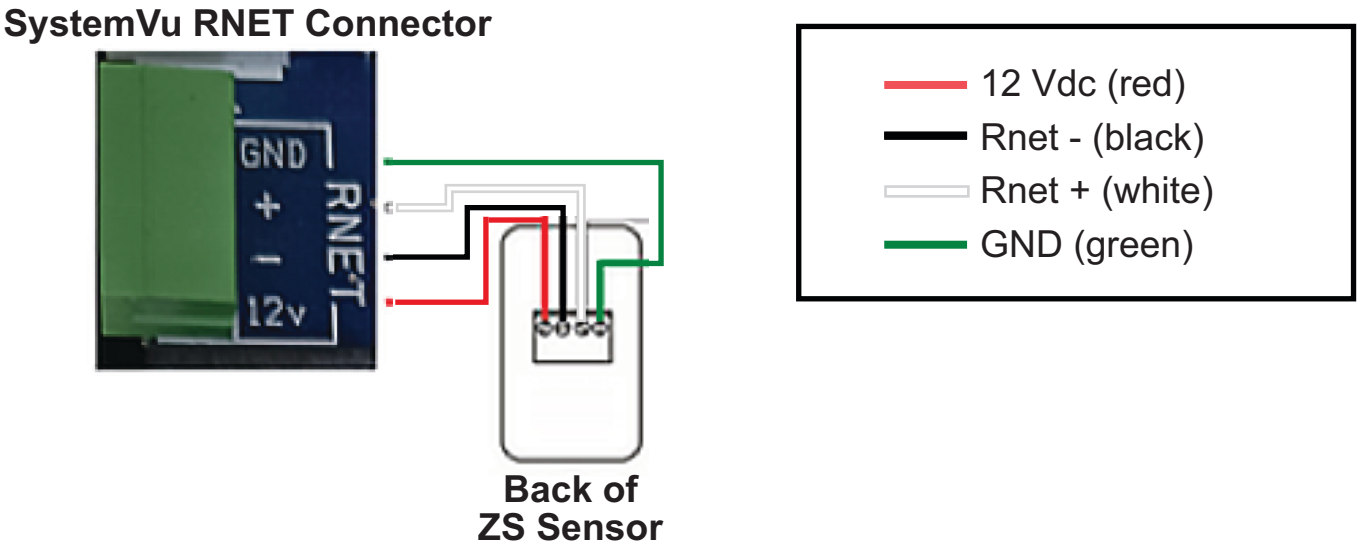

Fig. 17 — SystemVu to ZS Sensor Pin Connections

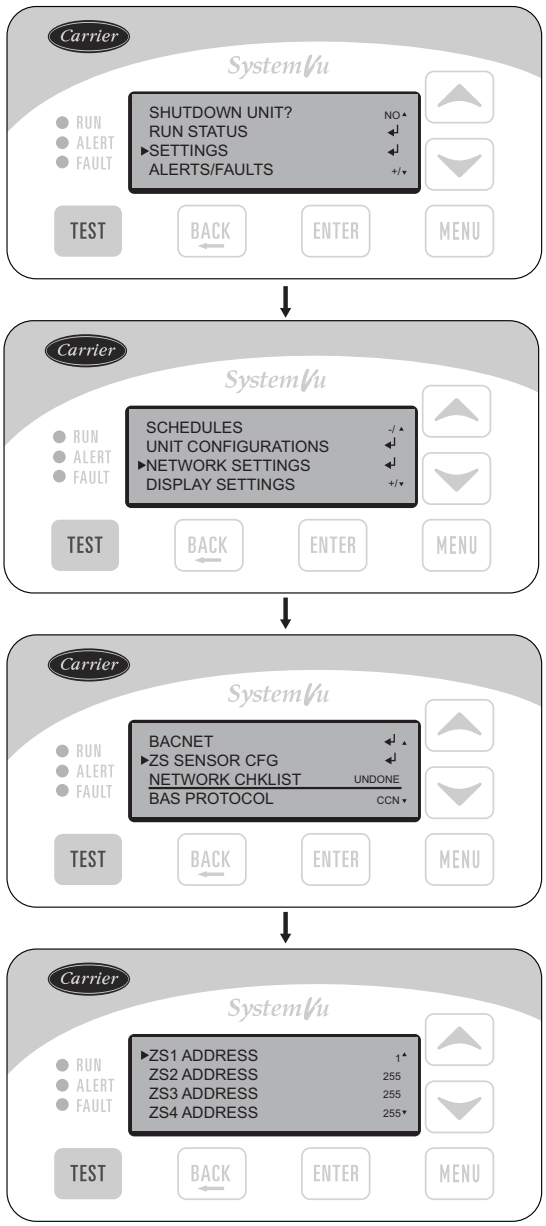

Fig. 18 — Path for Configuring ZS Sensor Address

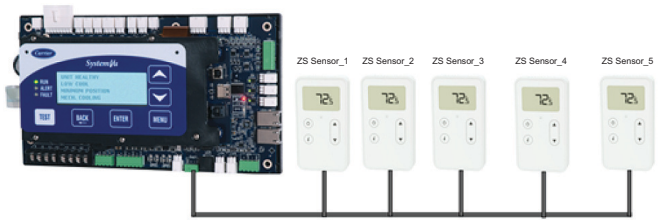

Fig. 19 — SystemVu to ZS Sensor Connection Diagram

BOARD ACTIVITY INDICATORS

Red Status LED

Proper Operation of the SystemVu Board can be visually checked by looking at the red status LED (see Fig. 20).

Fig. 20 — Red Status LED Indicator

Table 4 provides information on Status LED.

Table 4 — Status LED

Red Status LED Condition	Board Software Status
OFF Continuously	Board unpowered or power supply defective
FLASHING ON 200 ms, OFF 200 ms	Board is in Bootloader mode
FLASHING ON 1000 ms, OFF 1000 ms	Boot loader is not running, application software is running
ON Continuously or FLASHING at any other frequency	Board or software is defective

Green Status LED

The SystemVu controller has one Green LED. This LED (indicates Local Equipment Network) should always be blinking whenever power is ON. If LEN LED is not blinking, check LEN connection for potential communication errors (MBB J15, J16, J17, and J2 on the Display).

Yellow Status LED

Yellow LED is used to indicates Building Automated Systems (BAS) communication activity. The LED will blink when the MBB transmits a message on the BACnet bus.

TROUBLESHOOTING BACNET MS/TP

BACnet MS/TP Configurations

SystemVu can use the BACnet MS/TP protocol for communications. This section in the document contains Carrier's recommendations for configuring and wiring an MS/TP network that will provide the best network performance with Carrier controllers. However, Carrier controllers will work on any BACnet-compliant MS/TP network. Controllers can communicate on an MS/TP network at 9600 bps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 76.8 kbps, or 115.2 kbps.

For configuring SystemVu BACnet Baud Rate, navigate to the below menu in user interface and select the Baud Rate.

UI Menu > SETTINGS / NETWORK SETTINGS / BACNET

Please note that source files are needed for proper detection of SystemVu units by an i-Vu system. Source files are included in cumulative patches OR can be manually imported into i-Vu. Source files and the process for importing them are located on HVACPartners.

i-Vu MODSTAT

For additional debugging on iVu systems use the MODSTAT command in i-Vu which when requested will trigger the System Software Information along with BACnet Firmware version as shown in the below Images.

1. Select the Controller listed under Router (see Fig. 21).

2. Right click and select the MODSTAT (Module Status) command. (see Fig. 22). A new Pop up window will come with the list of Controller Software and BACnet firmware versions as shown in Fig. 23.

Fig. 21 — iVu Router Menu Screenshot

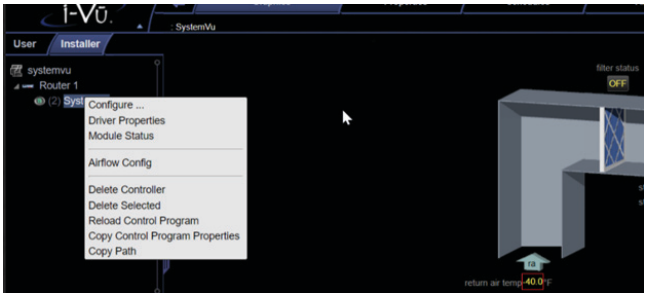

Fig. 22 — iVu MODSTAT Command Screenshot

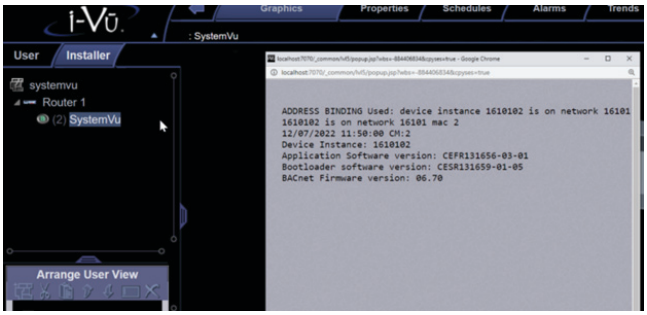

Fig. 23 — iVu Firmware Versions Screenshot

Controller Addressing

Each SystemVu controller on the MS/TP network must have a unique BACnet MS/TP MAC address, which is set by the User Interface Menu. Valid addresses are 1-99.

BACnet MS/TP network best practices dictate that the MAC addressing of the nodes on the network should be sequential with the physical location of the units. I.E. If the router is the first node on the network, it should have the lowest MAC address. The next unit on the daisy-chain should have a MAC address one number higher, etc.

Troubleshooting guidelines

If a SystemVu controller is not detected over MS/TP network, verify all the configuration settings like Baud Rate, MAC address and BAS Protocol settings. On i-Vu networks, make sure the source files have been manually imported.

NOTE: Use the same polarity throughout the network. Also use a 120-ohm resistor at each end of the network.

Network troubleshooting needs to be deliberate and sequential. In the event of rolling communication failures or no communications at all the best approach is to start with the physical layer, then progress to the network layer, and finally the application layer.

PHYSICAL LAYER

The use of an oscilloscope as described in the Open Controller Network Wiring guide is always the first step. If your waveforms are not clean, packet collisions will occur which will cause losses of communication. Waveforms should look similar to the one shown in Fig. 24, NOT like the distorted (noisy) waveform shown in Fig. 25.

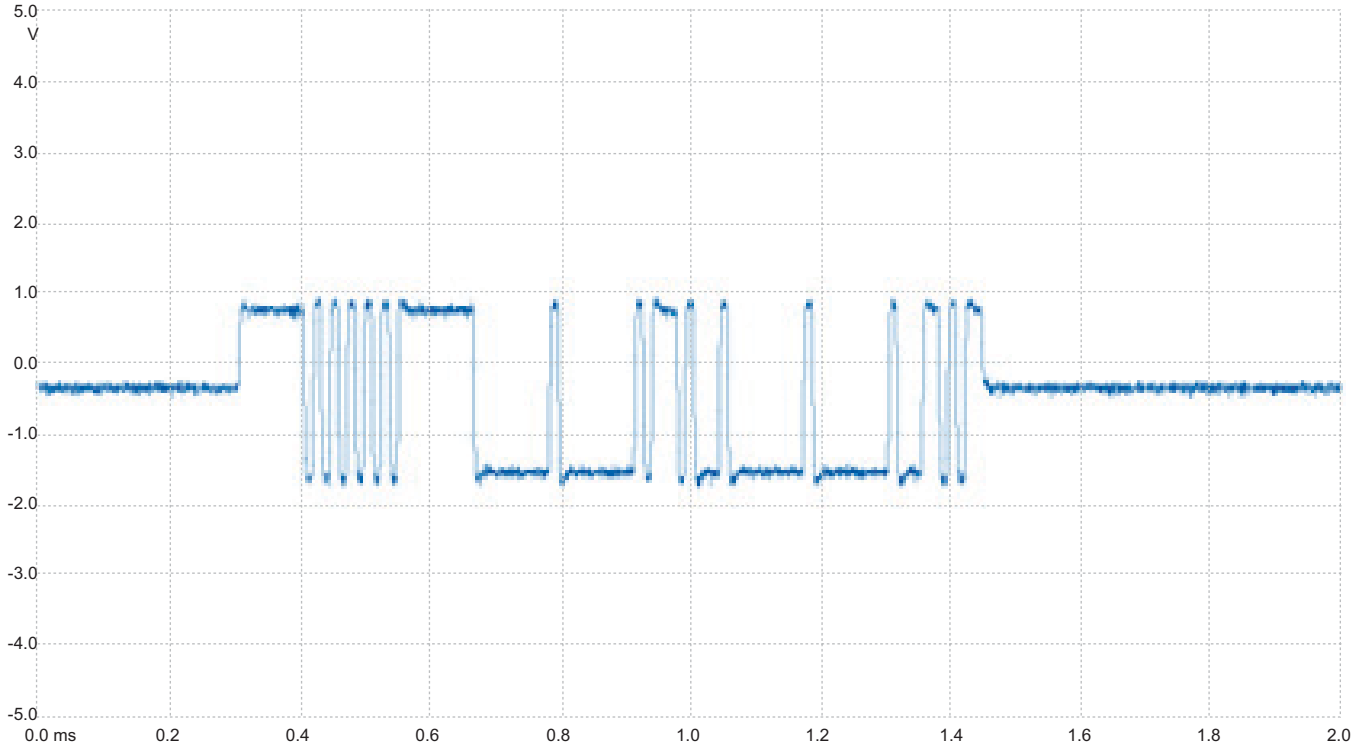

Fig. 24 — Example of Correct Waveform

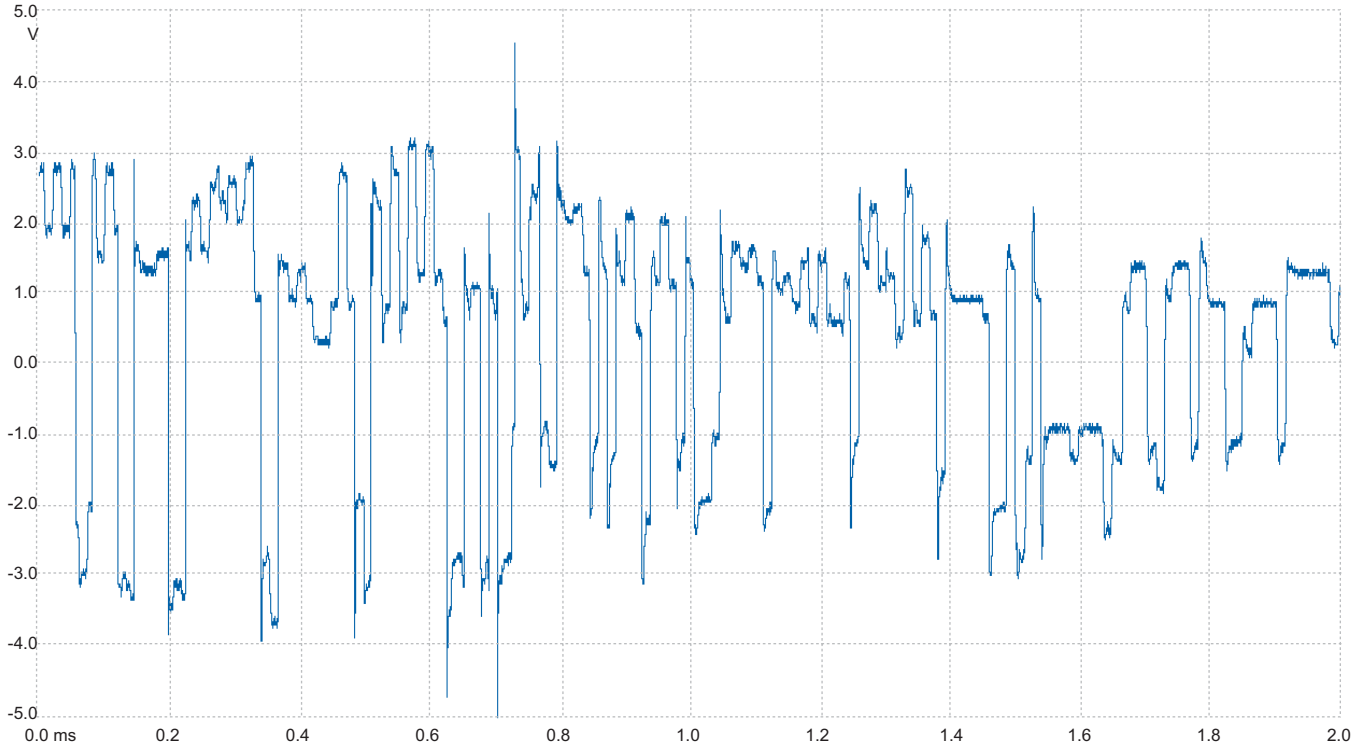

Fig. 25 — Example of Distorted (Noisy) Waveform

A number of factors can cause waveform distortions on the physical layer. Poor wiring hygiene, damaged wire segments, damaged RS-485 transceiver circuits on individual boards, and electrical interference from “noisy” environments are just a few of the issues that can all contribute to physical layer distortions. Isolating portions of the network segment by splitting the communication bus in half repeatedly, while tedious, is the best technique to isolate physical layer defects.

Please note that collisions caused by incorrect network software settings can also lead to distorted waveforms. While not as common as physical layer defects this should be taken into consideration - see section addressing the network layer.

Verify the proper wire is being used and is connected properly at each device and the router. Termination resistors must be at the beginning and end of each bus segment. Ensure network bias resistors are not used since SystemVu is already locally biased. These items are the most common issues found during troubleshooting.

NETWORK LAYER

Once any physical layer issues are resolved, the next step is to analyze the network layer. The use of network bus traffic monitoring tools is very valuable when trying to isolate network problems. There are number of tools available, such as Wireshark®[1] which allows the diagnosis of issues such as COV over polling, APDU timing, duplicate MAC addresses, etc.

The most common network layer issues are with APDU timeout, BACnet point writes, COV increments, and segmentation setting. SystemVu products are hard set to 6000ms APDU timeout, therefore all devices on the same bus should be set to 6000ms for best results. COV should be disabled unless clearly being used. If COV is being used ensure the refresh increments are set so that COV requests do not occur too frequently. The goal should be for COV requests to occur no more often than every 60 seconds. Ensure BACnet writes/refresh or broadcast rates are reasonable and not occurring too frequently. Usually point writes should not be greater than once per minute. Lastly, ensure packet segmentation is disabled on the network bus.

1. Third-party trademarks and logos are the property of their respective owners.

APPLICATION LAYER

Depending on the router being used, once the physical layer and network layer issues have been resolved, a detailed study of the alarms and alerts present on the router can reveal timing, source file, and software issues. It is best practice for all routers and devices on the network to have updated firmware patches and cumulative patches as applicable.

NETWORK POINT LIST FOR BACNET

SystemVu BACnet Points List

The BACnet point list may vary from product to product and software version to software version of SystemVu. For the specific list of supported BACnet Points refer to “APPENDIX E – BACNET POINTS LIST” in the Controls document for the SystemVu product you are using

SystemVu Alarm List

The alarms list may vary from product to product and software version to software version of SystemVu. For the list of Alarms supported refer to the Controls document for the SystemVu product you are using.