WAKE TECH
Biotechnology, Engineering, & Skilled Technologies

BACnet/MS-TP Lab

BAT-221: BAS Networking

BACnet/MS-TP Lab

SYNOPSIS

We are going to set up three BACnet devices on a BACnet/MSTP network.

We will then read and write points on the BACnet devices.

OBJECTIVES

Upon completion of this activity the student will be able to:

- Configure a BACnet/MSTP controller
- Set up a BACnet/MSTP network with multiple devices
- Read and Write to a BACnet/MSTP device

PARTS AND EQUIPMENT

- Contemporary Controls BAScontrol22S controller
  [https://www.ccontrols.com/basautomation/bascontrol22s.php]
- Contemporary Controls BASstat Series BAST-221CH-B2
  [https://www.ccontrols.com/basautomation/basstat.php]
- ACI BN Series BACnet BN2110-R2
  [https://www.workaci.com/sites/default/files/product_cutsheet/BACnet_Modbus%20Room_0.pdf]
- BACnet RS-485 shielded twisted-pair wire
- 120 Ω resistor
- Laptop with wired RJ-45 ethernet port

REFERENCES

- Introduction to BACnet [https://www.ccontrols.com/pdf/BACnetIntroduction.pdf]
- SparkFun According to Pete #54 - How RS-485 Works
  [https://www.youtube.com/watch?v=9NJVs3_g_PY]
- Contemporary Controls BASstat Multi-Stage Thermostat User Manual
  [https://www.ccontrols.com/pdf/um/BASstat-B2-usermanual.pdf]
- ACI BN Series BACnet BN2110-R2 Product Instruction
  [https://www.workaci.com/sites/default/files/product_instruction/I0000926_0.pdf]

SOFTWARE

- Angry IP Scanner [https://angryip.org/]
- BACnet Discover Tool (BDT) [https://www.ccontrols.com/sd/bdt.htm]

BACKGROUND

PROCEDURES

Part 1: BASControl22S Configuration

1.1 - IPv4 address

All the controllers and laptops may be on the same network and therefore every ip network device must have a unique IPv4 address with a common subnet mask. Configure the controller and laptop IPv4 addresses before connecting them to the switch (later step).

Laptop IPv4 address: _____

Laptop Subnet mask: _____

Controller IPv4 address: _____

Controller Subnet mask: _____

==Make sure that no one else will be using the either of your IPv4 addresses.==

1.2 - Configure laptop

Configure your laptop with the static ip configuration.

1.3 - BACnet Device Name and Device Id

Every device in a BACnet network must have a unique Device Name. Set your Device Name to your last name. If multiple students have the same last name, add first name initials.

Controller BACnet Name:

_____

Figure 1: BAScontrol22S - System Configuration

Every device in a BACnet network must have a unique Device ID (Device Object Identifier). The Device ID must be an integer in the range of 0 to 4,194,302. For each device, configure the unique Device ID before connecting it to the BACnet network.

Controller BACnet Device Id: _____

- BACNet tab

o Device Name
o Device Id

Make sure that no one else will be using the same BACnet Device Name or Device Id.

1.4 - MSTP settings

MAC Address

Every MSTP device must have a unique MAC Address on the MSTP network. The MAC Address is a value between 0 and 127 for master devices. The MAC address of the MSTP device is not the same as the MAC address of the NIC.

The default MAC Address of the BAScontrol22S controller is 0.

Max Masters

The Max Masters is the maximum number of MSTP devices on the network. All the MSTP devices on the network, must have the Max Masters set to the same value. Some MSTP devices do not allow the configuration of the Max Masters and therefore it would be best to leave Max Masters to 127.

Max Info

The Max Info is the maximum number of messages an MSTP device may send while in possession of the token.

Baudrate

The Baudrate is the speed of the serial communication on the MSTP network. Some MSTP devices allow for auto-configuration where the devices negotiate the baudrate. The BAScontrol22 and BASstat devices due not allow auto-configuration. It is best to configure all the MSTP devices for a specific baudrate.

1.5 - Configure controller

Change BASControl22 to work with MS/TP.

- Admin tab
  o Enable BACnet MS/TP
- Wired/IP tab
  o Address
  o Netmask
- BACnet
  o Device Name
  o Device Id
- MSTP tab
  o MAC = 0
  o Max Masters = 127
  o Max Info = 100

Figure 2: BAScontrol22S - MS/TP Configuration

          o   Baudrate = 38400
          o   Tolerance = LENIENT

<mark>Note: Submit to save changes. The controller must be restarted after any changes are saved.</mark>

Controller Device Name: _____

Controller Device Id: _____

Controller MAC Address: _____

1.6 - Connect laptop and controller to LAN

Connect the laptop and the controller to the LAN. Confirm that you can connect to the controller from your laptop after adding them to the LAN.

Part 2: BASstat Series BAST-221

2.1 - Overview

We are now going to wire the BASstat device to the BAScontrol22S controller.

2.2 - Product Information

Read the Product Guide and Installation Manual for the BAST-221C.

2.3 - Purpose

What functionality does the BASstat provide?

2.4 - MSTP Settings

Every device in a BACnet network must have a unique Device ID (Device Object Identifier). The Device ID must be an integer in the range of 0 to 4,194,302. For each device, configure the unique Device ID before connecting it to the BACnet network.

Every device on the MSTP network must have a unique Device Id and a unique MAC address.

BASstat Device Id: _____

BASstat MAC Address: _____

2.5 - Configuration

Using the BASstat Installation Manual, fill out table settings based upon the Device Id and MAC Address.

Due not use the default Device instance for the BASstat.

Item	Mnemonic	Description	Value
E21	Baud	BACnet MS/TP Baud rate	38.4
E22	Addr	BACnet MS/TP MAC address	
E23	devH	Device instance no. – Hi bytes	
E24	devL	Device instance no. – Low bytes	

E25	AdrH	Max_Master – The highest allowed MAC address for BACnet MS/TP master nodes	127

2.6 - Wire device for power

Make sure you do not wire BASstat while power is live.

Wire 24 VAC to the BASstat.

Do not turn on power to the BASstat until the instructor has verified your wiring.

2.7 - Instructor verification of power wiring

Have the instructor check the wiring before you power the BASstat device.

2.8 - Configure MSTP settings

Using the Installation Manual, configure the MSTP settings for the BASstat.

2.9 - Wire MSTP device

Do not wire the BASstat while power is supplied to either controller or device.

Wire the BASstat device to the controller using RS-485.

Both ends of the EIA-485 serial cable must terminate at end-of-line with a 120 Ω terminator. Some devices have built-in end-of-line termination that may be used.

The BAScontrol22S has built-in termination. Read the product specifications to figure how to utilize the end-of-line terminator.

The BASstat does not have built-in termination and if this device is at the end of line, a 120 Ω resistor must be used.

2.10 - Instructor verification of MSTP wiring

Have the instructor check the wiring before you power the controller and BASstat device.

2.11 - Configure BACnet Server

On your controller's webpage, go into the System Config and click BACnet on the top. Click the Configure BACnet Servers button.

To add the BASstat device as a BACnet MSTP server:

1. Click "Add Server"
2. Do not click the Routed checkbox as the device is on the same network as us.
3. Click "MS/TP" as we are using BACnet/MSTP.
4. Add the Server Name.
5. Add the Device Instance.
6. Add the MAC Address.
7. Click "Submit"

Close the BACnet Servers window. On the System Configuration window, click Submit and then Close. You must restart the controller.
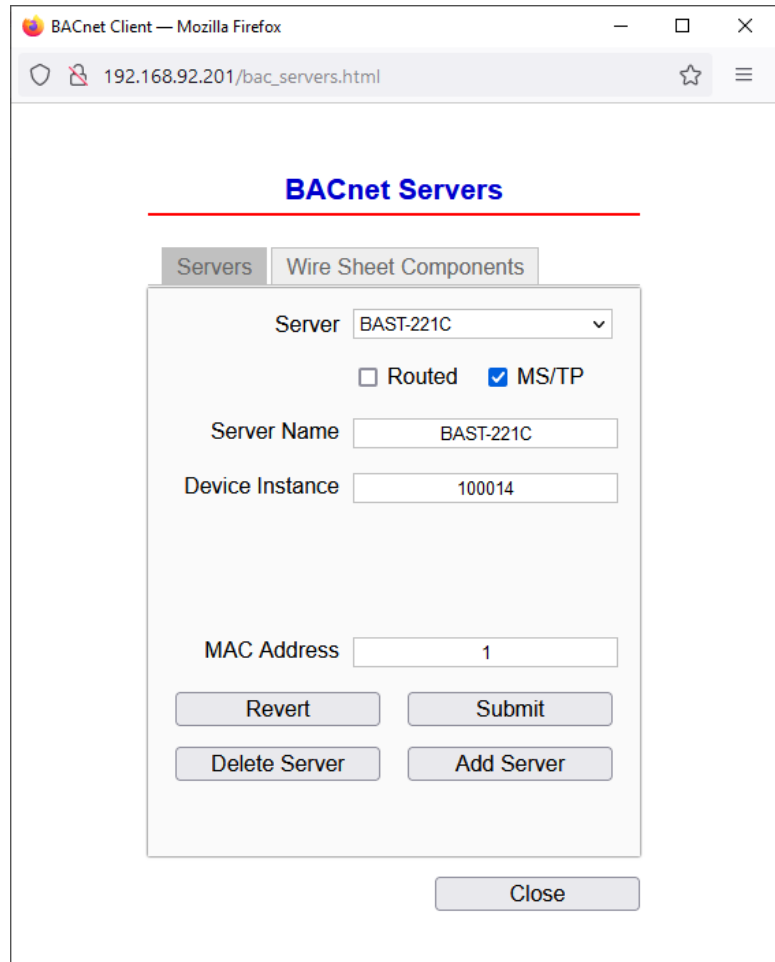
2.12 - BASstat Objects - read

Using the BASstat User Manual, find out the Object Type & Id for the Object Names in the table below.

Figure 3: BAScontrol22S - BACnet Servers

Use the BACnet Utility, to find the Present Values for the objects in the table.

	Object Type	Object Id	Present Value
Current Temperature			
Current Humidity			
Cooling Temperature Setpoint			

Verify the Current Temperature and Current Humidity match the display of the sensor.

2.13 - BASstat Object – write

Change the Cooling Temperature Setpoint. Verify the change in the Cooling Temperature Setpoint by reading the value again.

Part 3: ACI BACnet BN2110-R2

3.1 - Overview

We are going to add the ACI BN2110-R2 (BN Series) to the MSTP network. The BAScontrol22S and BN2110-R2 devices will be at the end-of-line and the BASstat will be in the middle of the RS-485 connection.

BAScontrol22 === BASstat === BN2110-R2

3.2 - Product Information

Read the Product Guide and Installation Manual for the BN2110-R2.

3.3 - Purpose

What functionality does the ACI BN2110-R2 provide?

3.4 - MSTP Settings

The MAC address on the BN Series device is configured by pins 1-7 of the 10-pin DIP switch.

BN Series MAC Address: _____

The Device Id is initially set as 1035000 + MAC Address.

BN Series Device Id: _____

3.5 - Configuration

BACnet MSTP
The BN Series can be configured to work either on a BACnet MSTP or Modbus network. The device is configured for BACnet by setting the 4-pin DIP switch. Set the appropriate pins to enable Bacnet MSTP

MAC Address
Set the MAC address of the DN Series device by pins 1-7 of the 10-pin DIP switch.

Baudrate
For our MSTP network, we are going to use a baudrate of 38400. Set the 8-10 pins of the 10-pin DIP switches to configure the baudrate.

3.6 - Wire device for power and MSTP

Do not wire the device while power is supplied to either the controller or either of the MSTP devices.

Wire 24 VAC to the BN Series device.

We are going to wire the BN Series device to the BASstat using RS-485. Since the BASstat will no longer reside at the end of the line, we will not need an end-of-line (EOL) termination. Remove the 120 Ω resistor.

The BN Services devices has a built-in end-of-line (EOL) termination that can be used. Make sure the appropriate jumper is set to enable the EOL termination. Since the BN device, has a built-in EOL termination, you will not need to utilize the 120 Ω resistor.

3.7 - Instructor verification of power and MSTP wiring

Have the instructor check the wiring before you power the controller and MSTP devices.

3.8 - Configure BACnet Server

Add the new BACnet MSTP device to the configuration of the BAScontrol22S.

You must restart the controller.

3.9 - BN Series Objects - read

Using the BASstat User Manual, find out the Object Type & Id for the Object Names in the table below.

Use the BACnet Utility, to find the Present Values for the objects in the table.

	Object Type	Object Id	Present Value
Temperature Sensor			
Humidity Sensor			