



Using Yaskawa CM049 BACnet Option with Delta Controls DSM-RTR

1. INTRODUCTION:

The following information describes utilizing the Yaskawa E7U and P7U Variable Frequency Drives with Yaskawa's CM049 BACnet Option to achieve BACnet control, monitoring and parameter access. This document contains the general setup, connections, drive parameters and gateway objects available to the E7U and P7U drives.

Before either the drives or any of the supporting devices are connected, review the associated user and/or technical manuals. Read and follow all safety precautions.

2. INTENDED AUDIENCE:

This document assumes that the reader is familiar with Yaskawa E7U and P7U Drives, BACnet, BACnet MS/TP and RS485.

3. REFERENCES:

All Yaskawa documents listed below are available from the Yaskawa web site: www.Yaskawa.com. Check www.Deltacontrols.com for Delta specific literature. For BACnet refer to www.ashrae.org or www.bacnet.org.

E7 User Manual -- **TM.E7.01**

E7 Programming Manual -- **TM.E7.02**

P7 User Manual -- **TM.P7.01**

P7 Programming Manual -- **TM.P7.02**

BACnet Option Installation Guide – **IG.AFD.23**

Delta's DSM-RTR_Installation_Guide.pdf

4. TERMS:

BACnet	Building Automation Control network
Modbus RTU	A subset of the Modbus Protocol. In this case, functions 0x03, 0x06, 0x08 and 0x10 are supported.
MS/TP	Master/Slave Token Passing

5. SETUP:

5.1. Equipment:

The figure below shows a general BACnet system and its connections. This system was used for this application note. The items used include:

- Laptop running Delta's ORCAview software
- CAT-5 Ethernet cross-over cable
- Shielded twisted pair communications cable
- Yaskawa E7U or P7U drive
- A 24 VDC power supply

Note: The hardware and software listed in the figure below should not be considered as a Yaskawa endorsement of said hardware and software. The hardware and software are listed as examples only.

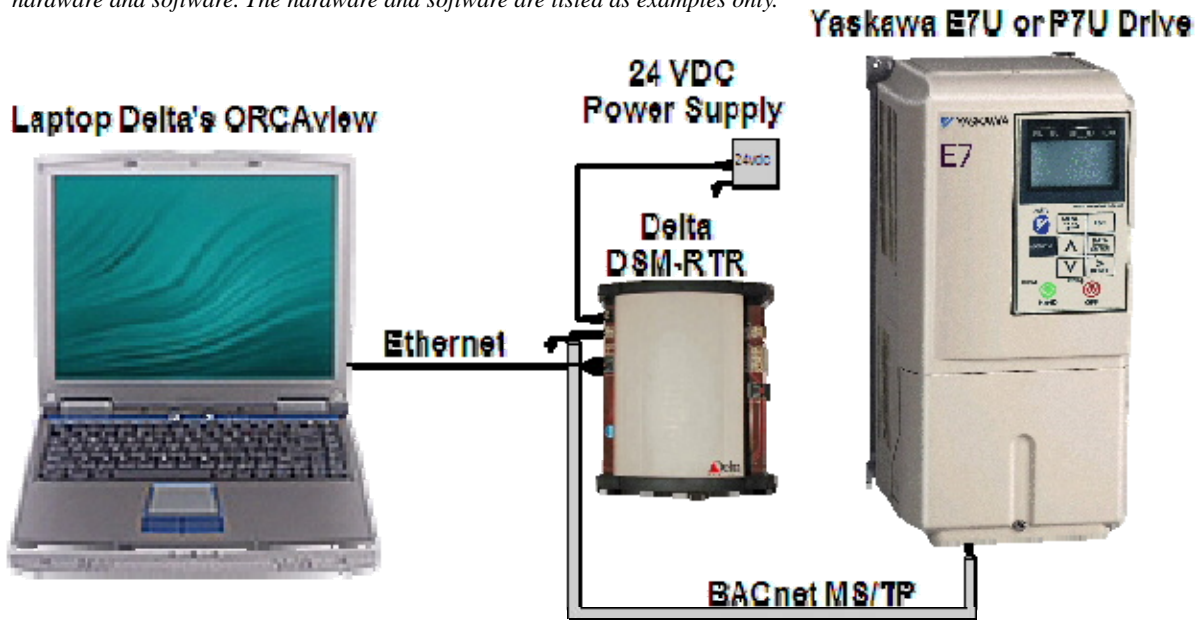


Figure 1: System Layout

5.2. CM049 Setup:

Make sure that power is disconnected from the drive. Remove the drive covers and mount the CM049 BACnet Option on the drive control board. Refer to the *BACnet Option Installation Guide, IGA.FD.23*, for details on installing the CM049 BACnet Option on an E7U or P7U drive.

5.3. Router Setup:

Set the **DNA** jumper to enable **DNA**. Set the **Area/System/Subnet** jumper so that **System** is enabled. Set the **ADDRESS** dip switches to the desired node address of the router.

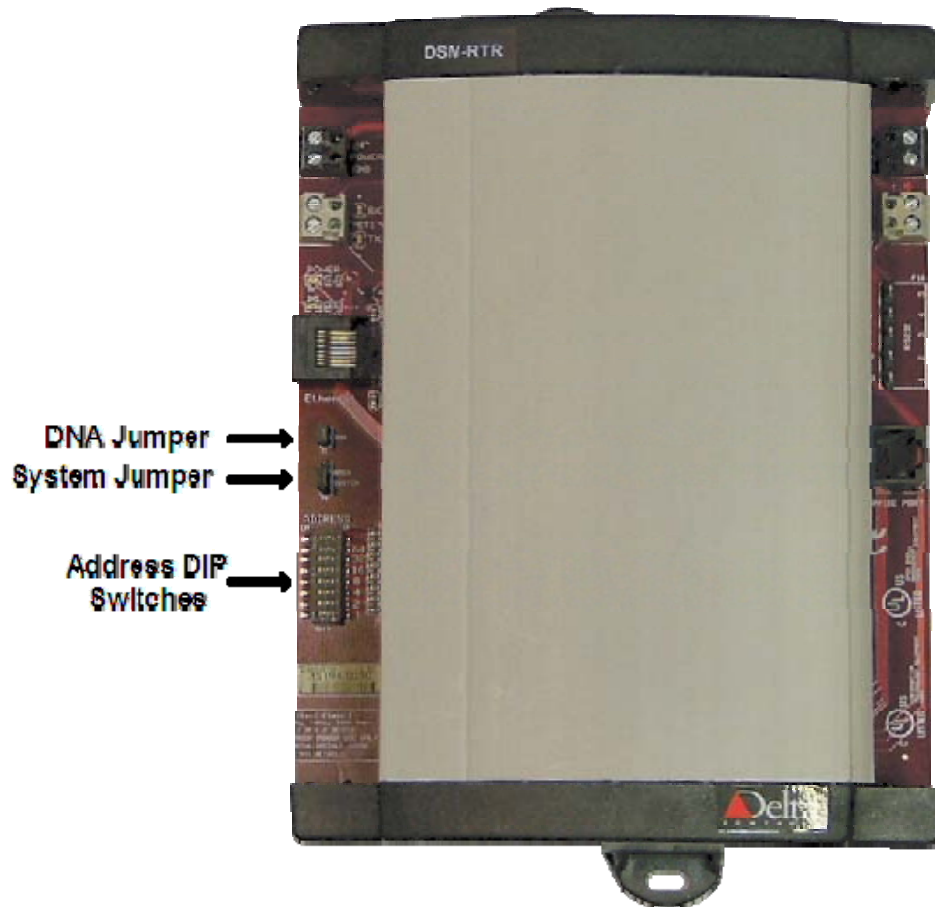


Figure 2: Delta DSM-RTR DIP Switches and Jumpers

** Note that there are different versions and revisions of the router shown above. In some of those revisions the **ADDRESS DIP** switches and the **DNA** and **System** jumpers are located inside the router. The cover must be opened to access these items. Refer to the appropriate Delta manual.*

Connections

5.4. Router Connections:

Turn off the 24VDC power supply and connect it to the **PWR** terminal block above the **NET1** connector of the router. Once connected, turn the 24VDC power supply on and verify that the power supply and router **POWER** LEDs are lit.

Connect one end of the Ethernet cross-over cable to the Ethernet port on the PC and the other end to the Ethernet port on the Delta DSM-RTR router.

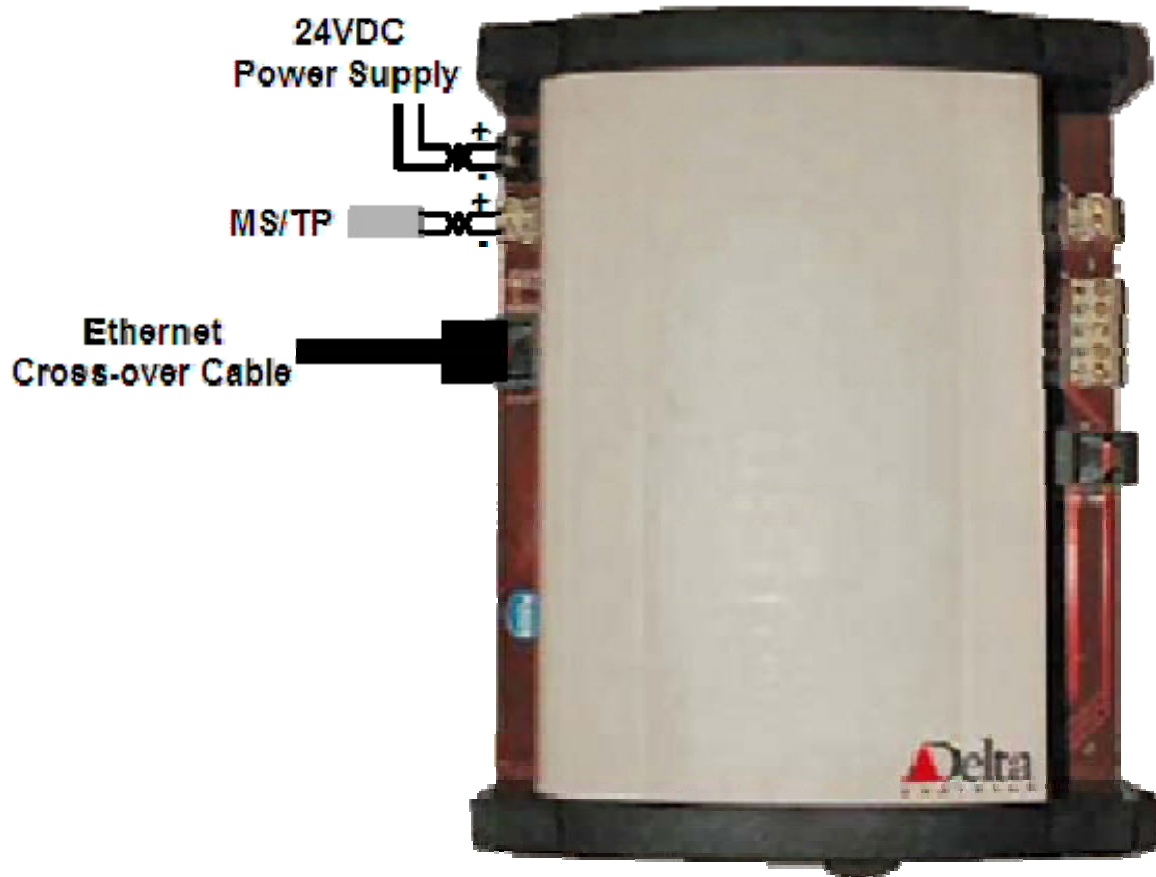


Figure 3: Delta DSM-RTR Connections

5.5. CM049 BACnet Option to Drive Connections:

With the drive power off, install the CM049 BACnet Option on the drive to be connected to the BACnet MS/TP network. Set the Address, Baud Rate and Termination dip switches on the CM049 BACnet Option as required by the application. Refer to the *CM049 BACnet Option Installation Guide, IGA.FD.23*, for details on installing and setting up the BACnet Option on a drive. Connect the BACnet Option to the E7U and P7U drive terminals as shown in the figure below.

5.6. CM049 BACnet Option to BACnet MS/TP Network Connections:

Connect the BACnet MS/TP network cable from the **NET1** connector on the gateway to the appropriate connector on the BACnet Option as shown below. The BACnet MS/TP network cable should be connected to all of the devices on the network segment serially from the router with the shield grounded at the router end only.

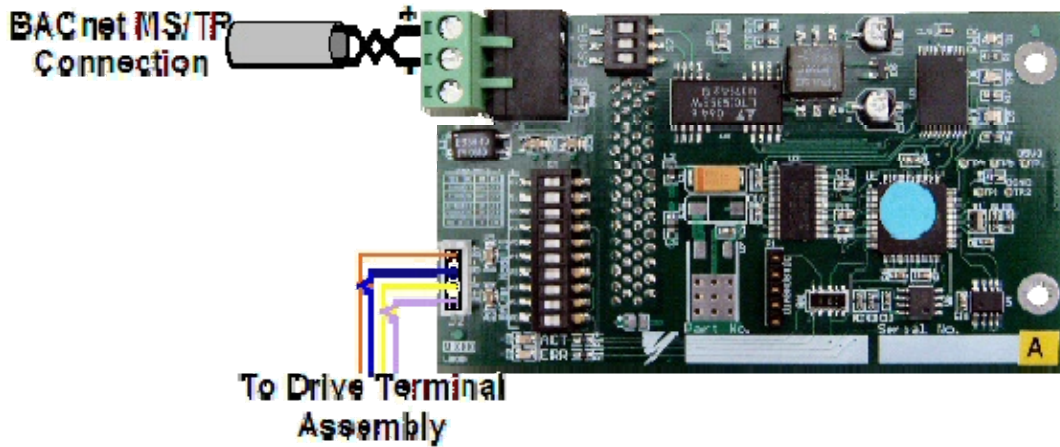


Figure 4: BACnet Option MS/TP Network Connection

5.7. Software:

Delta's ORCAview version 3.33 was used in this setup. Verify that the version of application software in the router is compatible with the version of ORCAview used. Always refer to the ORCAview documentation for specific information.

Install the ORCAview USB key and start ORCAview.

6. Configuration:

6.1. Discover the BACnet Network:

From ORCAview Navigator select **Find New Devices** from the drop down menu of **BACnet Protocol**.

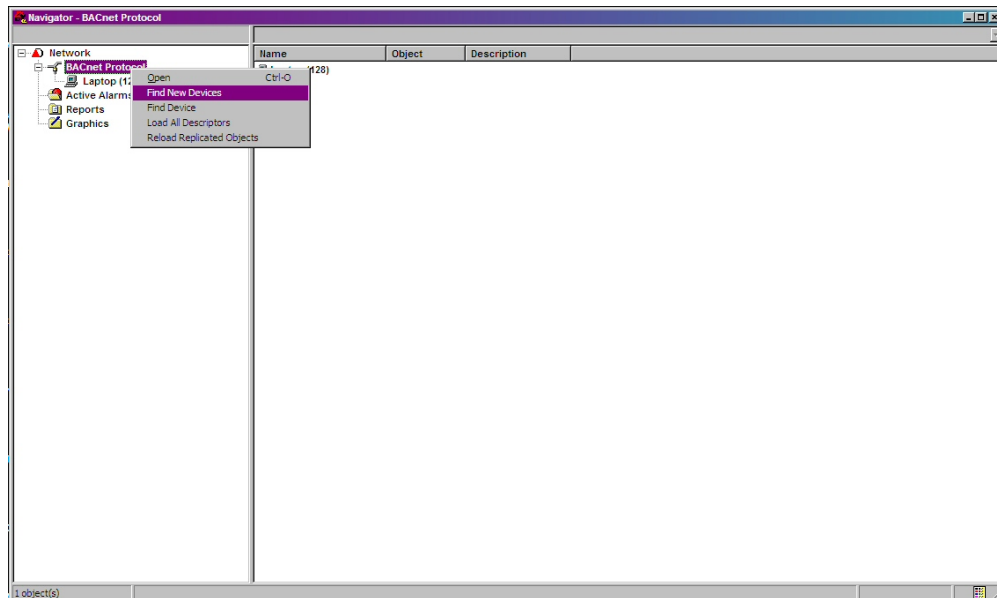


Figure 5: Discover BACnet Network

6.2. Configure Router:

Once the router has been discovered on the BACnet network, highlight the router so that the router objects are displayed. Note that the router address is the address set by the DIP switches plus one-hundred.

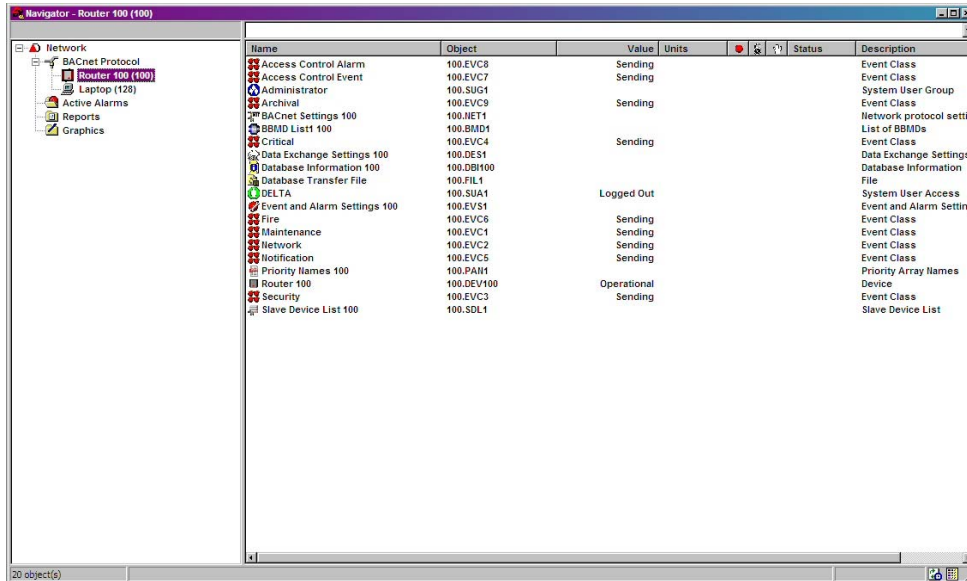


Figure 6: ORCAview Navigator Network

6.2.1. Router BACnet Network Settings:

Select BACnet Settings [node address] object from the list of objects displayed. The object is selected by double-clicking on the object.

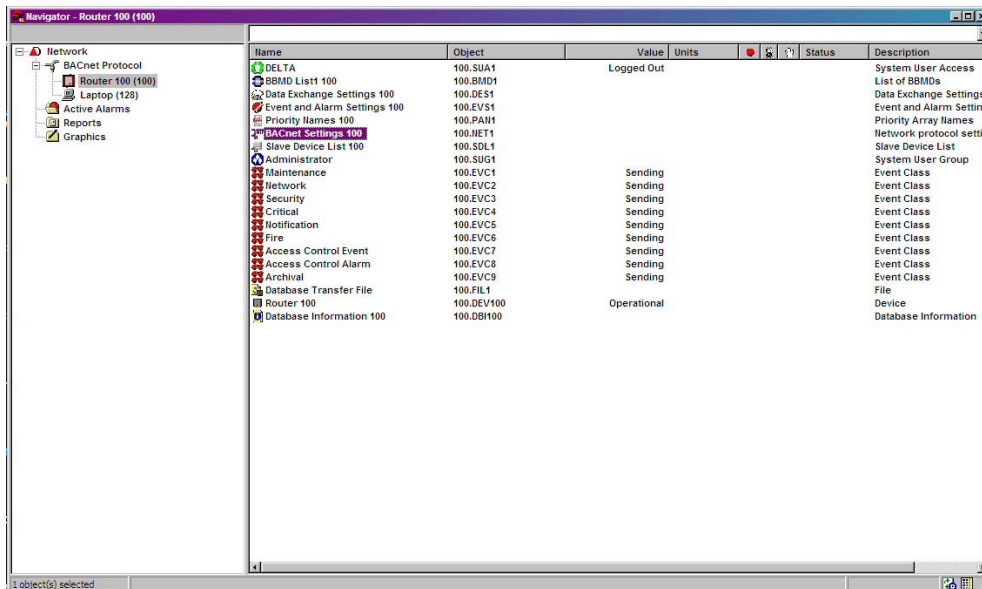


Figure 7: ORCAview Navigator Network

6.2.2. Set BACnet MS/TP Network Baud Rate:

Select **Router** from the list of displayed devices and **BACnet Settings** from the list of device objects displayed. From the **Setup** tab, select **Port one (1)** MS/TP from the table. Select the **Baud Rate** for the BACnet MS/TP **NET1** network from the drop down list below. Values of 9600bps, 19200bps, 38400bps and 78600bps are allowed. A baud rate of 38400bps was used in this setup.

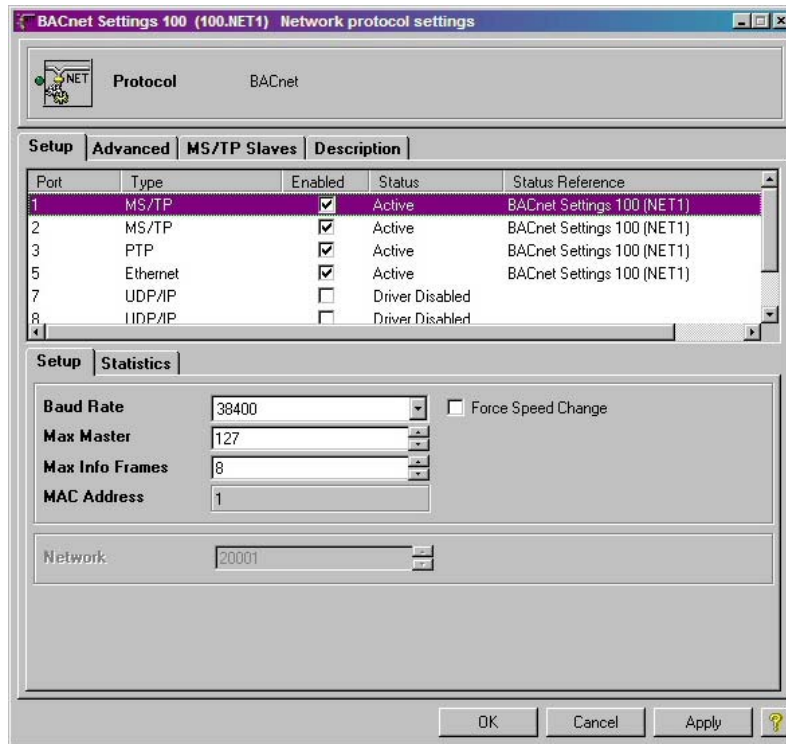


Figure 8: Router Baud Rate Setup

Note: It is possible to have two separate BACnet MS/TP networks connected to the router. Port one (1) of the table controls the settings of the BACnet MS/TP network connected to the router NET1 connector. Port two (2) controls the settings of the BACnet MS/TP network connected to the router NET2 connector. These two networks do not have to operate at the same baud rate.

7. Verify Communications:

7.1. Apply Power to the Drive:

After all connections have been made, verify the wiring and connections before applying power to the drive. Refer to the appropriate User Manual for information on connecting the drive to a power grid. After all connections have been checked, apply power to the drive.

7.2. Set Drive Parameters:

The E7U and P7U drives communicate with the CM049 BACnet Option utilizing an embedded Modbus RTU protocol to map the BACnet objects to the appropriate drive registers and parameters. Be aware that a 2-wire, 3-wire or user reset of the drive could cause the values of the parameters listed below to change. Make sure to check these parameters as part of any troubleshooting.

The table below shows the drive parameters that affect communications with the CM049 BACnet Option. Refer to the E7U or P7U User or Programming Manuals for information on other parameters and their settings.

Table 1 – E7U and P7U Router Connected Communication Parameters			
Drive Parameter	Parameter Name	Value	Description
b1-01	Reference Source	2	For BACnet network control of the drive frequency reference set b1-01 to 2. If BACnet is used for monitoring only set b1-01 to either 0 or 1 as specified in the application.
b1-02	Run Source	2	For BACnet network control of the drive run command set b1-02 to 2. If BACnet is used for monitoring only set b1-02 to either 0 or 1 as specified in the application.
H5-01	Serial Comm Adr	1F*	Sets the drive address <i>BACnet</i>
H5-02	Serial Baud Rate	3*	Set the baud rate to 3 (9600 bps) <i>BACnet</i>
H5-03	Serial Com Sel	0*	Set parity to 0 (none) <i>BACnet</i>
H5-04	Serial Fault Sel	3	The Alarm Only selection (3) allows the drive to continue operation in the event of a communications fault. If your application calls out for a stopping method as a result of a communications fault, select 0, 1 or 2 as the application requires
H5-05	Serial Fault Detect	0/1	Set to enabled or disabled as the application requires
H5-06	Transmit WaitTIM	5*	This value should not be changed unless told to do so by a Yaskawa application engineer.
H5-07	RTS Control Sel	1*	RTS must be enabled <i>BACnet</i>
H5-08	Protocol Select	0	Set protocol to Memobus (Modbus) <i>BACnet</i>
H5-09	CE Detect Time	2.0	This value should not be changed unless told to do so by a Yaskawa application engineer.

Note: * Values in **bold** text cannot be changed from the values shown in the table above without affecting communications

7.3. Verify Router to CM049 BACnet Option Communications:

With the router connected to the drive and operational, first check the CM049 BACnet Option LED status. The **PWR** LED at the top right of the BACnet Option should be lit. If it is not, check that the option is firmly seated on the drive's **CN2** connector and that power has been supplied to the drive.

If the BACnet MS/TP network is running and the correct baud rate has been set in both the router and the drive, both the **Tx** and **Rx** LEDs at the top right of the option should be blinking very rapidly. If only the **Tx** LED is blinking (not in auto baud) a minute or so after power up, check the baud rate settings and the BACnet MS/TP cable connections.

7.4. Verify Drive to BACnet CM049 Communications:

Next check that the **ACT** LED on the lower left of the option is blinking at about a 250ms rate. The **ERR** LED should be off. If the **ACT** LED is not blinking or the **ERR** LED lit, check the wiring between the drive terminal assembly and the CM049 BACnet Option. Also check the drive communication parameters.

7.5. Discover the Drive:

Discover new network devices as shown in step 7.1. The Yaskawa drive will be displayed on the BACnet network as a new node. In this case, the drive node/MAC address was set to 37.

Name	Object	Value	Units	Status	Description
Operation Cmd	37.AV4	0			Analog Variable
Operator Disconnect	37.BV32	OFF			Binary Variable
Output Current	37.AV12	0	A		Analog Variable
Output Frequency	37.AV10	0			Analog Variable
Output Power	37.AV13	0	kW		Analog Variable
Output Voltage	37.AV11	0	V		Analog Variable
Overcurrent - Ground Fault	37.BV18	OFF			Binary Variable
Overrun Error	37.BV52	OFF			Binary Variable
Overspeed	37.BV27	OFF			Binary Variable
Overtorque Detect	37.BV44	OFF			Binary Variable
Param Accept	37.BV55	OFF			Binary Variable
Param Data	37.AV30	0			Analog Variable
Param Enter	37.BV56	OFF			Binary Variable
Param I Number	37.AV29	0			Analog Variable
Parity Error	37.BV61	OFF			Binary Variable
PI Feedback Level	37.AV19	0			Analog Variable
PI Feedback Loss	37.BV32	OFF			Binary Variable
PI Input Level	37.AV20	0	%		Analog Variable
PI Output Level	37.AV21	0	%		Analog Variable
PI Setpoint Cmd	37.AV3	0	%		Analog Variable
Rated Current - n9-01	37.A19	320			Analog Input
READY	37.BV15	READY			Binary Variable
Ref Sel-PI Setpoint	37.BQ4	OFF			Binary Output
Ref Sel-Term S5 III	37.BQ5	OFF			Binary Output
Ref Sel-Term S6 III	37.BQ6	OFF			Binary Output
Ref Sel-Term S7 III	37.BQ7	OFF			Binary Output
Reference Select Cmd	37.AV5	0			Analog Variable
Retry Error	37.BV46	OFF			Binary Variable
REV-FWD	37.BV14	FWD			Binary Variable
Run Command Mode	37.BV43	COM			Binary Variable
Run FWD Cmd	37.BV1	OFF			Binary Variable
Run REV Cmd	37.BV2	OFF			Binary Variable
RUN-STOP	37.BV13	OFF			Binary Variable
Scale Format - b5-20	37.A17	1			Analog Input
Set Fault Contact Cmd	37.BV12	OFF			Binary Variable
Timeout Error	37.BV54	OFF			Binary Variable
Torque Reference	37.AV14	0	%		Analog Variable
Yaskawa Node37	37.DEV37	Operational			Device

Figure 9: Drive Discovered

7.6. Verify Drive Objects:

Verify the values of the Yaskawa Node device objects. If the values are empty, there is no BACnet communications between the router and the drive. If the value is **Error**, the data has been deemed as unreliable. This indicates that communication between the BACnet Option and the drive has either stopped or contains too many errors.

8. Run the Drive:

8.1. Set The Drive Frequency Reference:

If drive parameter b1-01 is set to 2 (serial communications), enter the desired frequency in AV2. With drive parameter o1-03 set to zero (0) (display in 0.01Hz) enter a value between 6.00 and 60.00. Once applied, this value becomes the drive's frequency reference.

Object	Value	Units	Status	Description
37.AV27	30	sec		Analog Variable
37.A18	0	%		Analog Input
37.A12	0	%		Analog Input
37.AO1	0	%		Analog Output
37.AO2	0	%		Analog Output
37.BV41	ON			Binary Variable
37.BV6	LOCAL			Binary Variable
37.BV5	LOCAL			Binary Variable
37.AV24	0			Analog Variable
37.BV31	OFF			Binary Variable
37.AV26	0			Analog Variable
37.AV22	11			Analog Variable
37.BV49	OFF			Binary Variable
37.AV8	0			Analog Variable
37.BV17	OFF	V		Binary Variable
37.AV18	317			Analog Variable
37.AV23	30	sec		Analog Variable
37.BV36	OFF			Binary Variable
37.A16	0			Analog Input
37.BV17	OFF			Binary Variable
37.BV21	OFF			Binary Variable
37.BV20	OFF			Binary Variable
37.BV39	ON			Binary Variable
37.AV6	4			Analog Variable
37.AV16	310			Analog Variable
37.BV3	OFF			Binary Variable
37.BV24	OFF			Binary Variable
37.BV16	OFF			Binary Variable
37.AV7	0			Analog Variable
37.BV4	OFF			Binary Variable
37.AV23	4010			Analog Variable
37.BV53	OFF			Binary Variable
37.BV35	OFF			Binary Variable
37.AV2	30			Analog Variable
37.BV37	ON			Binary Variable
37.BV38	ON			Binary Variable
37.AV9	30			Analog Variable
37.BV48	OFF			Binary Variable

Figure 10: Set Frequency Reference.

8.2. Run the Drive.

To run the drive in the forward direction, either enter a one (1) in AV1 or set BV1 to active. To run in the reverse direction, enter a two (2) in AV1 or set BV2 to active. Be sure that reverse is enabled by checking parameter b1-04.

It is not permissible to enter a value of three (3) into AV1 or to set both BV1 and BV2 to active or any combination of the above that results in forward and reverse commands being set simultaneously.

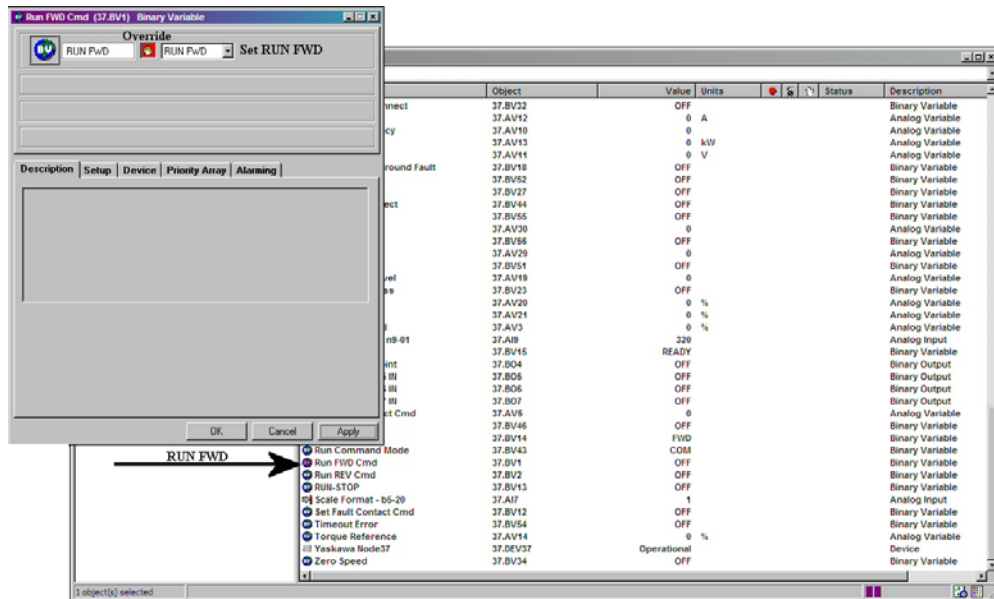


Figure 11: Set RUN FWD

8.3. Stop the Drive.

To stop the drive either set AV1 to 0 or BV1 and BV2 to inactive.