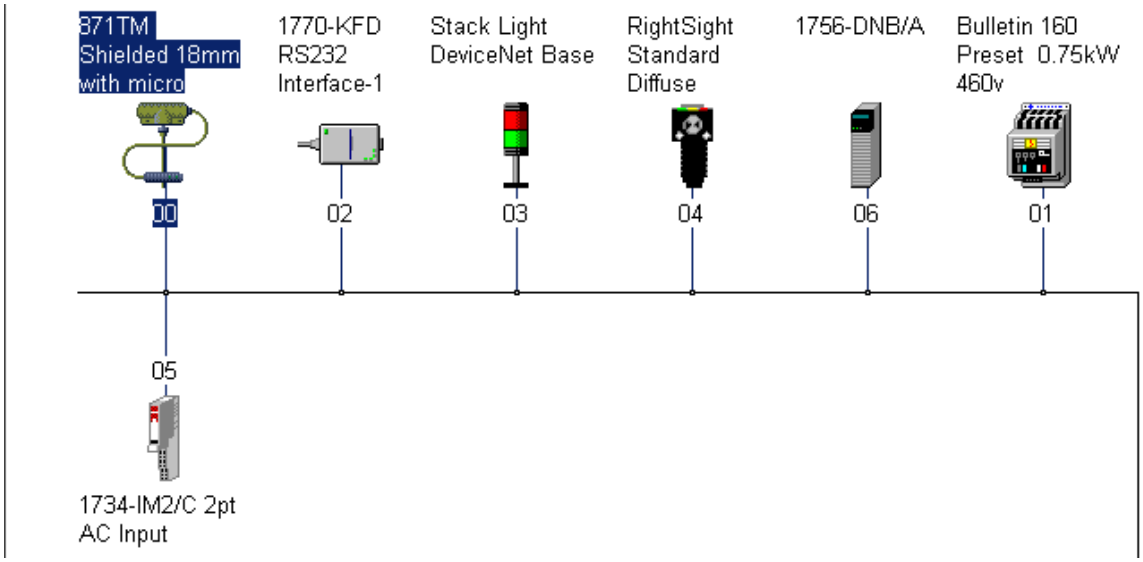


PLC220 Lab Exercise 17

PowerFlex 4 DeviceNet Set-Up

Power Flex 4 Set-Up

Lesson Objective

By the end of this session, students should be able to:

1. Configure the 22-COMM-D DeviceNet Adapter for a PowerFlex 4- AC Drive
2. Configure the AC Drive as a node on a DeviceNet network.
3. Download Ladder Logic program a ControlLogix PLC to monitor / control the AC Drive.

ControlLogix File Required
PLC_220_Module_6_PF_4.L5K

Introduction:

This lesson will use 22-COMM-D DeviceNet Adapter to allow a PowerFlex 4 AC Drive to be a Node on a DeviceNet Network.

Once the drive is configured using RSNetWorx for DeviceNet on a DevceNet network, a ladder logic program will monitor and control the PowerFlex 4 used using RSLogix / Studio 5000 software and a ControlLogix PLC. ..

This lesson will cover installation / configuration of a:

22-COMM-D DeviceNet Adapter for a PowerFlex 4 AC Drive.
Configure the PowerFlex4 as a DeviceNet node
Communicate with a ControlLogix PLC and the PowerFlex4

Install 22-COMM-D DeviceNet Adapter:

Installation of the adapter requires two components:

1. The 22-COMM-D DeviceNet
2. 22-XCOMM-DC -Base – DSI External Communication Kit

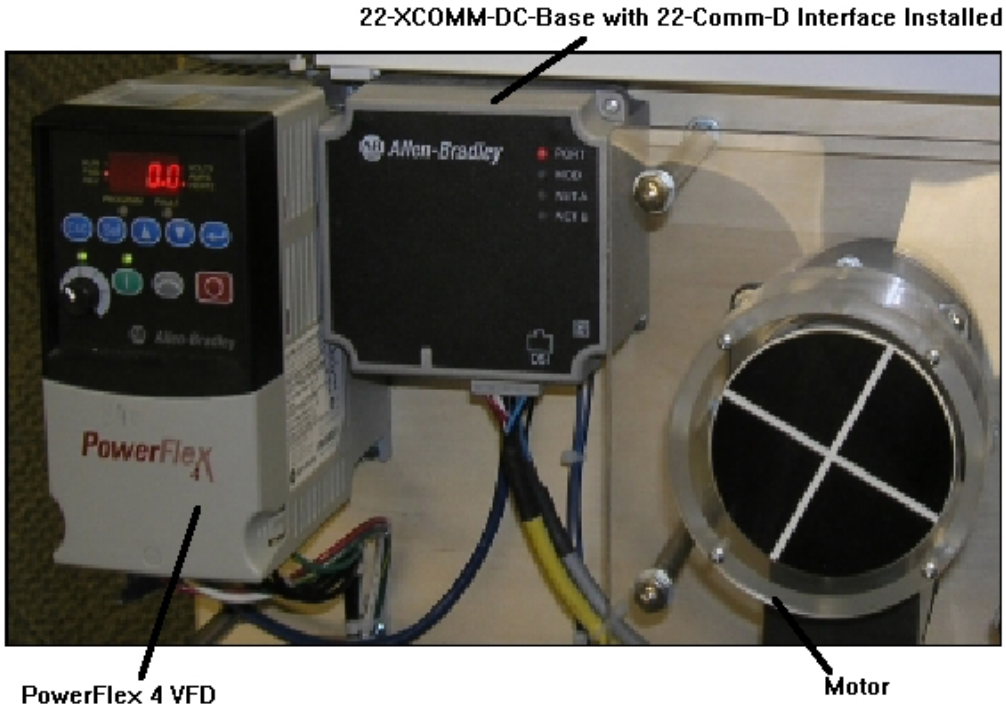


Figure 1-A
22-COMM-D Adapter Components

The 22-COMM-D DeviceNet Adapter installs in 22-XCOMM-DC –Base Cover

Figure 2-A
22-COMM-D DeviceNet Adapter in 22-XCOMM-DC –Base

Note: DeviceNet Open style connector
8 Switch DIP for Node Commissioning

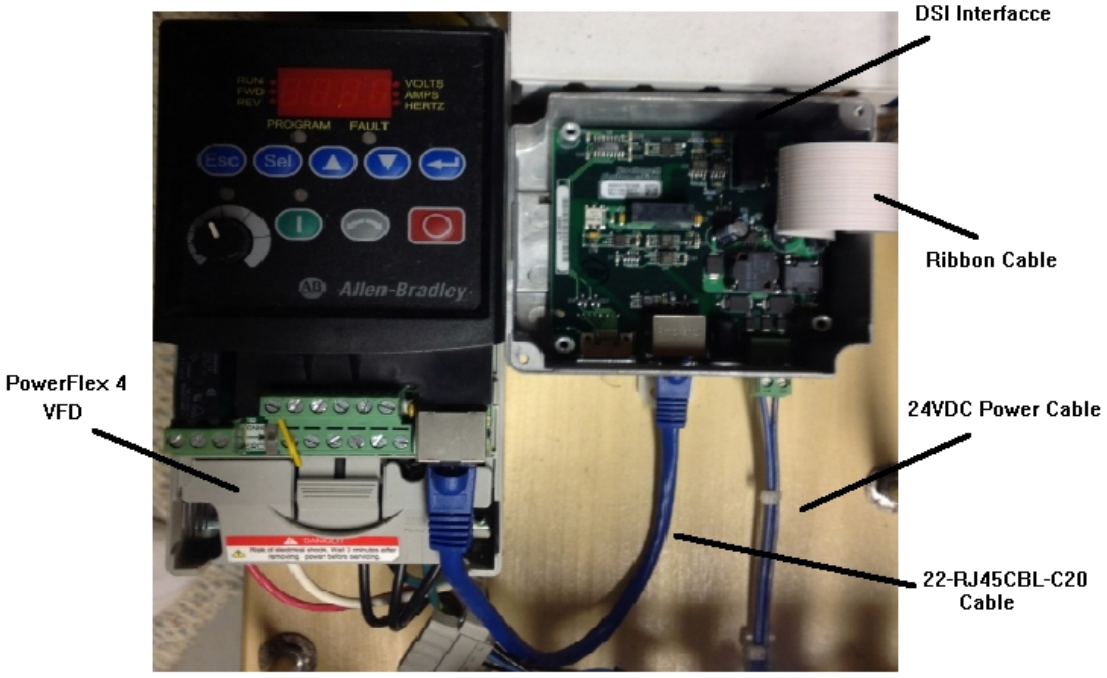


Figure 3-A
DSI Interface Installed In 22-XCOMM-DC –Base

22 RJ45CBL-C20 connects RJ-45 port on PowerFlex 4 VFD to RJ-45 port on DSI interface.

Note: RJ-45 port use RS-485 Serial Communication Standard -
Do Not Plug in Ethernet Devices
Ribbon cable: Connects DSI Interface PC board to 22-COMM-D Interface Board
Remove the original cover from the drive.

24 VDC Power Cable supplies power to the DSI Interface

See Devicenet_22comm-D_User_Manual.pdf for DIP Switch setting for 22-COMM-D interface.

See Devicenet_22comm-D_User_Manual.pdf for Diagnostic Indicator Descriptions for 22-COMM-D interface.

Equipment Required:

Computer with RSLogix 5000 / Studio 5000 software
RSLinx software
RSNetWorx for DeviceNet software
Ethernet Port

ControlLogix Demo board with 1756-DNB module, 1756-processor
1756-Ethernet Communication Module
Discrete Input / Output Modules

DeviceNet Demo Board with 871TM Prox switch
RightSight Standard Diffuse Photoelectric Sensor
855T – Stack Light
1791D 8B8P Compact Block I/O
PowerFlex 4 VFD

Note: Other components are also installed on DeviceNet Demo Board

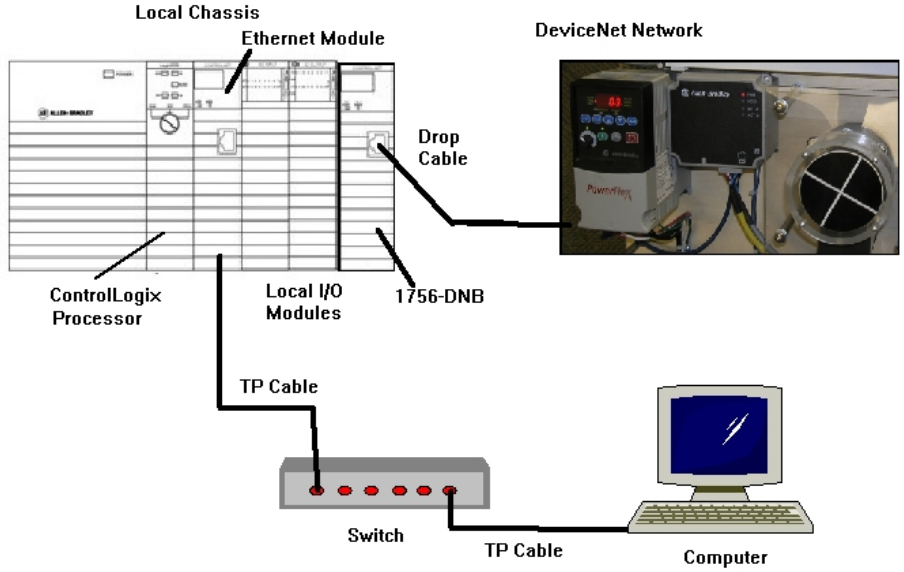


Figure 4-A

Ensure all the DeviceNet component's cables are connected to the IDC taps on the bottom of the DeviceNet Demo Board

Twisted pair Ethernet cables from Computer Ethernet Port the 1756-EtherNet Module
Note: the cable may be directly connected - no Switch required

DeviceNet drop cable to connect the DeviceNet Demo Board to the front port on the 1756-DNB Module located on the ControlLogix Demo Board.

Power-up ControlLogix and DeviceNet Demo Boards

Note: If the display on the 1756-DNB Module shows - No Network Power – the 1756-DNB Module is not receiving power from the DeviceNet network (drop cable) cable.

In the Lab exercise a connection will be made from the computer's Ethernet Port thru RSNetWorx for DeviceNet using a RSLinx, EtherNet/IP Driver to connect to the DeviceNet network

Ensure the Computer can connect to the ControlLogix Demo board using the 1756 – Ethernet Communication Module with an EtherNet/IP driver.

Note: DeviceNet Scanner Module - 1756-DNB – located in slot 6.

Configure PowerFlex 4 Inputs and Outputs on DeviceNet:

Connect the VFD to a DeviceNet network that has a 1756-DNB module attached. Use RSNetworx to browse the network to verify the DeviceNet VFD

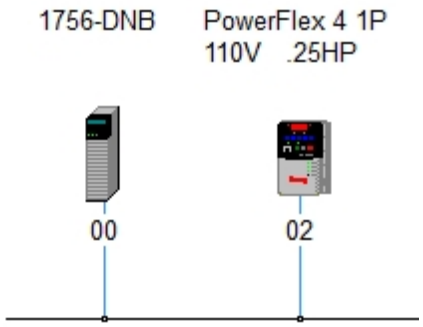


Figure 5-A
PowerFlex 4 VFD as Node 2 on DeviceNet Network.

Node: PowerFlex 4 VFD on DeviceNet Demo Board may be different node address

Remove all components from the1756-DNB Scanlist. Add PowerFlex 4 VFD in the 1756-DNB Scanner Scanlist.

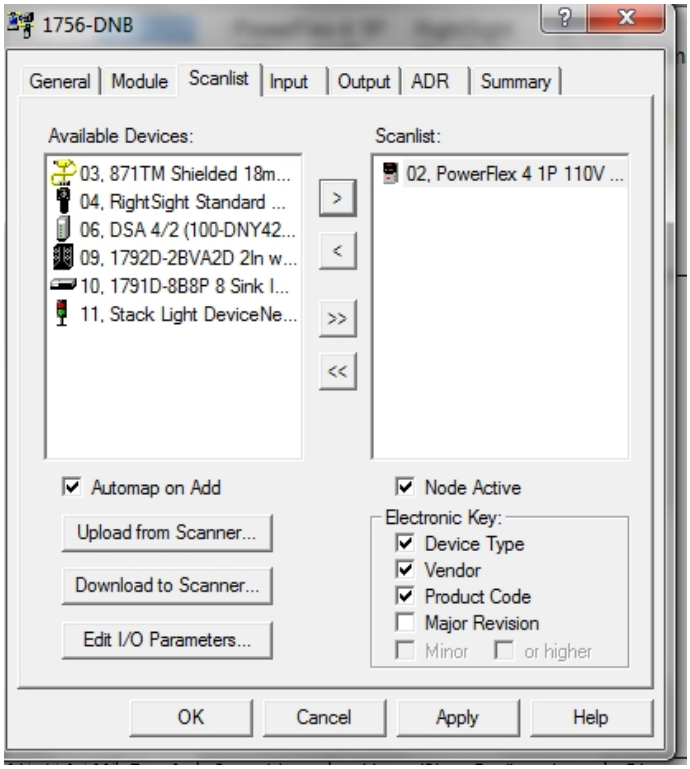


Figure 6-A

PowerFlex 4 VFD as Node 2 in 1756-DNB Scanner Scanlist

Navigate to the I/O Data tab for the PowerFlex 4 VFD

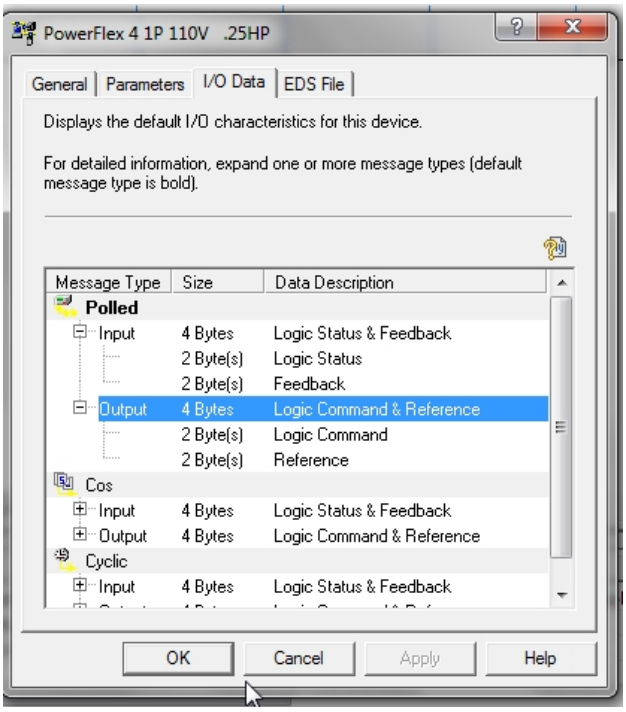


Figure 7-A
I/O Data Tab PowerFlex 4 AC Drive

Note: PowerFlex 4 has 4 Bytes of Input Data and 4 Bytes of Output Data

For Input Data, Bytes 0 and 1 are Logic Status Word – Feedback from the VFD

Logic Status Word

Logic Bits																
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Status	Description
															x	Ready	0 = Not Ready 1 = Ready
														x		Active	0 = Not Active 1 = Active
													x			Command Direction	0 = Reverse 1 = Forward
												x				Actual Direction	0 = Reverse 1 = Forward
											x					Accel	0 = Not Accelerating 1 = Accelerating
										x						Decel	0 = Not Decelerating 1 = Decelerating
									x							Alarm	0 = No Alarm 1 = Alarm
								x								Fault	0 = No Fault 1 = Fault
							x									At Speed	0 = Not At Reference 1 = At Reference
				x	x	x										Local Control [1]	000 = Port 0 (TB) 001 = Port 1 010 = Port 2 011 = Port 3 100 = Port 4 101 = Port 5 110 = Port 6 111 = No Local
x	x	x	x													Reference	0000 = Ref A Auto 0001 = Ref B Auto 0010 = Preset 2 Auto 0011 = Preset 3 Auto 0100 = Preset 4 Auto 0101 = Preset 5 Auto 0110 = Preset 6 Auto 0111 = Preset 7 Auto 1000 = Term Blk Manual 1001 = DPI 1 Manual 1010 = DPI 2 Manual 1011 = DPI 3 Manual 1100 = DPI 4 Manual 1101 = DPI 5 Manual 1110 = DPI 6 Manual 1111 = Jog Ref

[1] See "Owners" in drive User Manual for further information.

Figure 8-A
Logic Status Word for DeviceNet PowerFlex VFDs

Logic Status Word (Word = 16 bits) monitors the VFD

For Input Data, Bytes 2 and 3 will monitors the frequency the VFD is outputting to the motor.

Output Data controls a DeviceNet VFD

For Output Data, Bytes 0 and 1 are Logic Command Signals – Controls the VFD, Stopping, Starting, Jog, etc. See Figure 9-A

Logic Command Word

Logic Bits															Command	Description
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Stop (1)	0 = Not Stop 1 = Stop
														X		Start (1)(2)	0 = Not Start 1 = Start
													X			Jog	0 = Not Jog 1 = Jog
												X				Clear Faults	0 = Not Clear Faults 1 = Clear Faults
										X	X					Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Direction Control
									X							Local Control	0 = No Local Control 1 = Local Control
								X								MOP Increment	0 = Not Increment 1 = Increment
						X	X									Accel Rate	00 = No Command 01 = Accel Rate 1 Command 10 = Accel Rate 2 Command 11 = Hold Accel Rate
				X	X											Decel Rate	00 = No Command 01 = Decel Rate 1 Command 10 = Decel Rate 2 Command 11 = Hold Decel Rate
	X	X	X													Reference Select (3)	000 = No Command 001 = Ref. 1 (Ref A Select) 010 = Ref. 2 (Ref B Select) 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
X																MOP Decrement	0 = Not Decrement 1 = Decrement

(1) A "0 = Not Stop" condition (logic 0) must first be present before a "1 = Start" condition will start the drive. The Start command acts as a momentary Start command. A "1" will start the drive, but returning to "0" will not stop the drive.

Figure 9-A
PowerFlex 4 Logic Command Word

For Output Data, Bytes 2 and 3 will control the frequency the VFD is outputting to the motor – controlling motor speed.

The ControlLogix processor will start/stop the drive and control the drive speed.
It will also monitor the VFD frequency output and if the ready to Run and if the VFD is running.

Mapping VFD Inputs and Outputs in the 1756-DNB Scanner

Drive mapping to the 1756-DNB will be modified from its Automap on Add setting.

With Auto mapping applied (default) the drive inputs are mapped as a DINT and the drive outputs are mapped as a DINT.

Navigate to the 1756-DNB Scanner's Properties -> Input tab.

See Figure 10-A

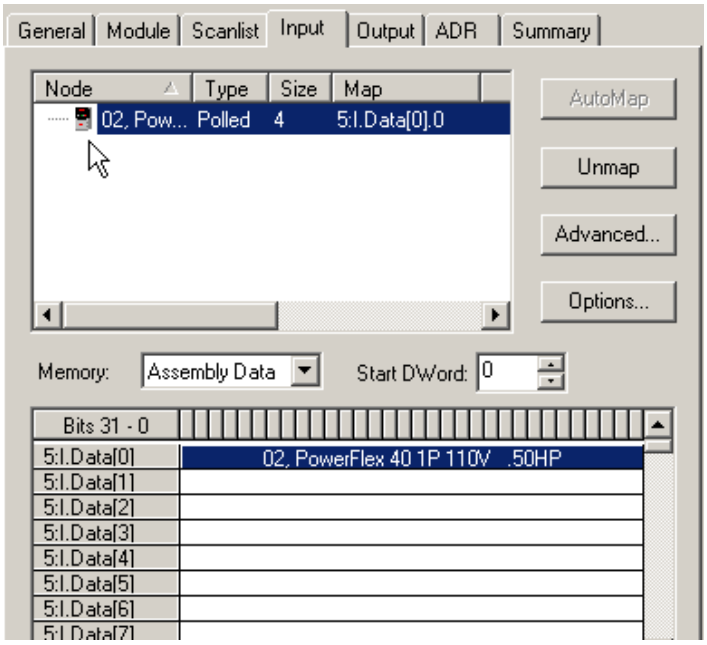


Figure 10-A
Default Input Mapping of Drive

Click the 1756-DNB Output tab

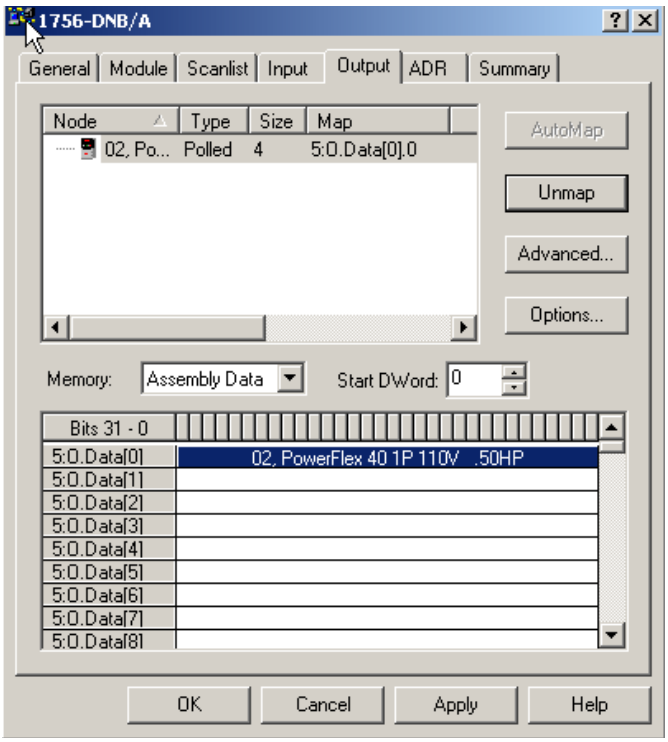


Figure 11-A
Default Output Mapping of Drive

Remapping of the VFDs Inputs and Outputs will make it easier to control / monitor Frequency values through the ControlLogix Ladder File.

Return to the 1756-DNB Input tab.

1. Click the Unmap Button to delete Automap information.
   Input Screen will appear as:

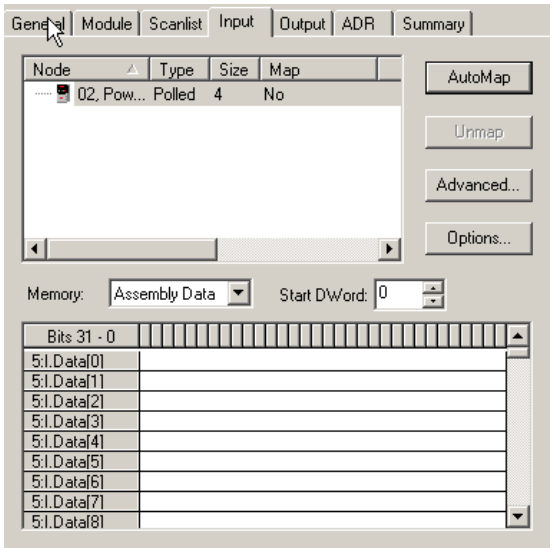


Figure 12-A
Inputs Unmapped

2. Click the Output tab - Unmap Outputs (Unmap Button). Output Screen will appear as:

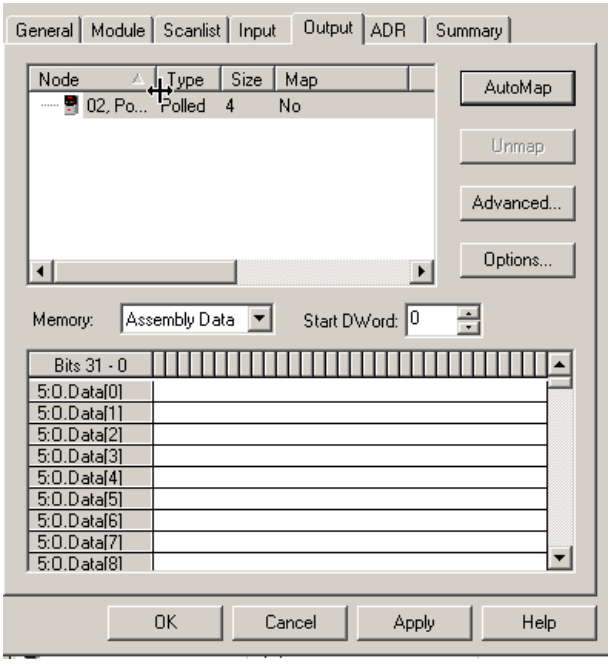


Figure 13-A
Outputs Unmapped

Return to Input tab to manually map Input Data for the VFD.
Instead of have one (1) DINT Element for Input Data, two (2) 16 bit INTs will be used.

This will allow the VFD status bits and the speed reference feedback to appear in separate data elements, making it easier to find the data when monitoring / troublingshooting the processor ladder logic.

On the Input mapping screen click the Advanced… button.

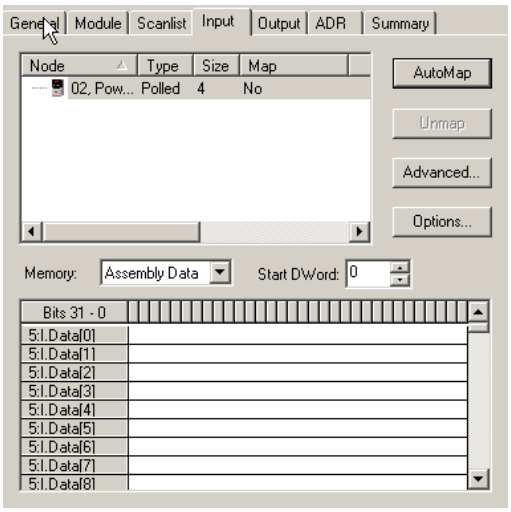


Figure 14-A
Advanced… Button

The Advanced Mapping screen appears.

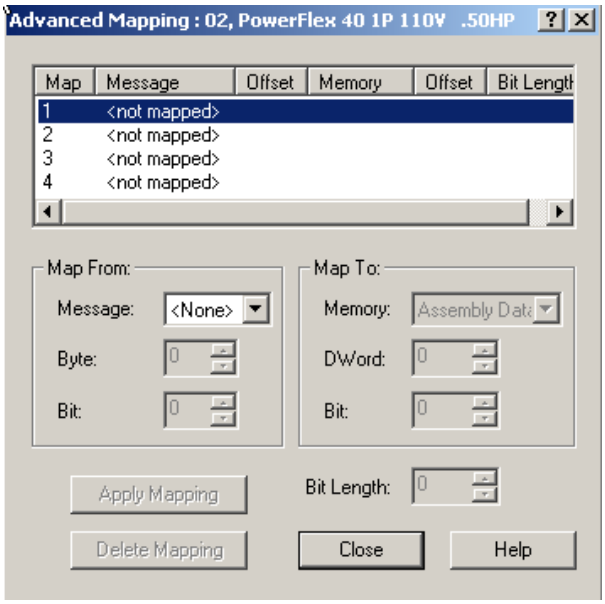


Figure 15-A
Advanced Mapping Screen

Make sure Map 1 is selected in upper region of the Advanced Mapping Window.

On the left side of the screen in the Map From region – Message box, select Polled.

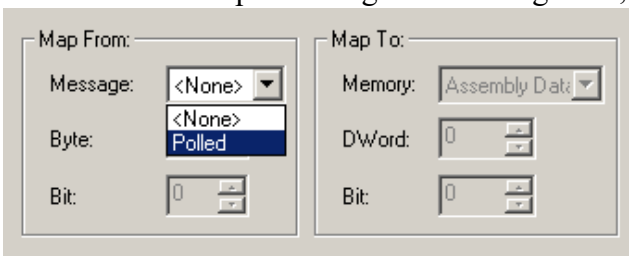


Figure 16-A
Select Polled Message

The data for DeviceNet components uses a byte (8 bits) as the default data size.

Map From: at Byte 0, Bit 0,
Map To DWord 0, Bit 0,
Bit Length 16.
The Advanced Mapping screen will appear as:

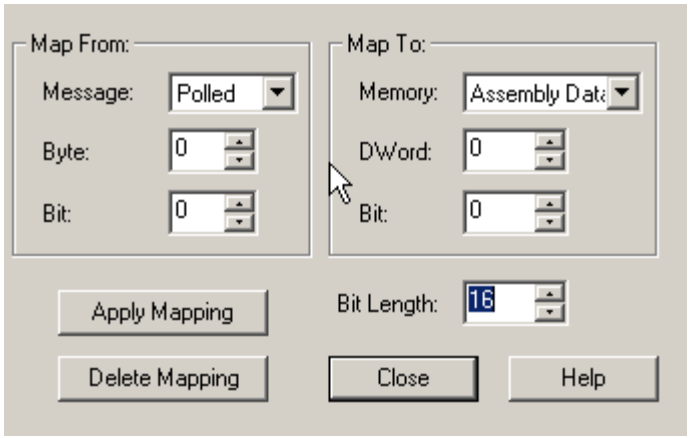


Figure 17-A
Advanced Mapping

Click the Apply Mapping button to save the modified map settings.

The upper region of the Advanced Mapping Screen will appear as:

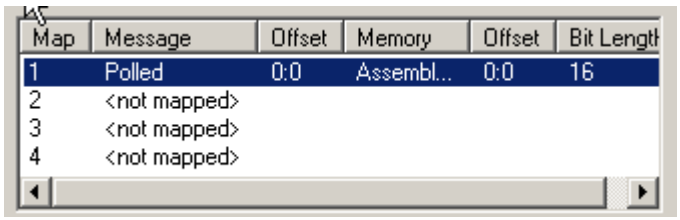


Figure 18-A

Apply Mapping

Select Map 2.

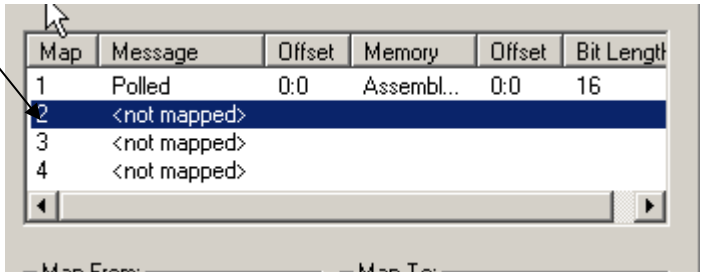


Figure 19-A
Map 2 Selected

In Map From region, select Message – Polled, Byte 2, Bit 0

In Map To, select DWord 1, Bit 0

Bit Length 16.

The Advance Mapping screen should appear as:

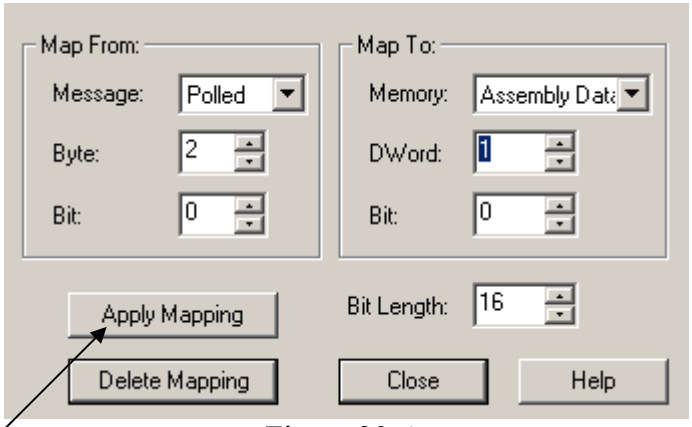


Figure 20-A
Map 2 Data

Click the Apply Mapping button.

Map 1- 16 bits will be the Logic Status Word – See Figure 8

Map 2 – 16 bits will be the frequency Feedback of the VFD.

The Advance Mapping screen for PowerFlex 4 inputs appears as:

See Figure 21-A

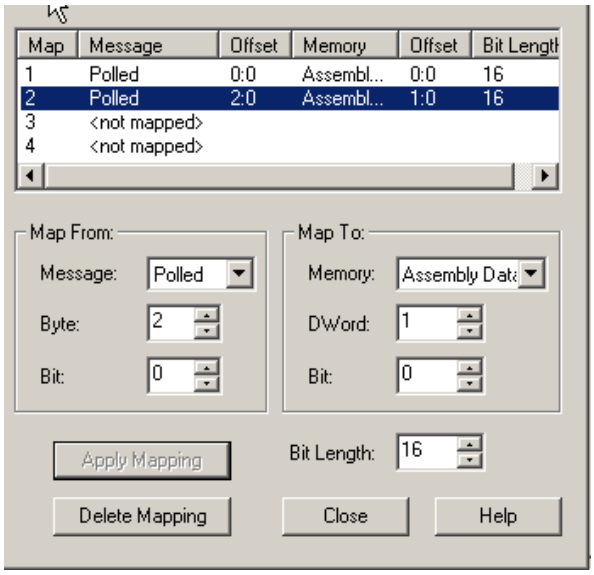


Figure 21-A
Input Advanced Mapping Completed

Click the Close button.

The Close button will return to the Input screen for the PowerFlex 4 VFD.

The Input Logic Status Data for the drive will use the first 16 bits (0-15) of I.Data[0]
The Input Feedback will use the first 16 bits (0-15) of I.Data[1].

.

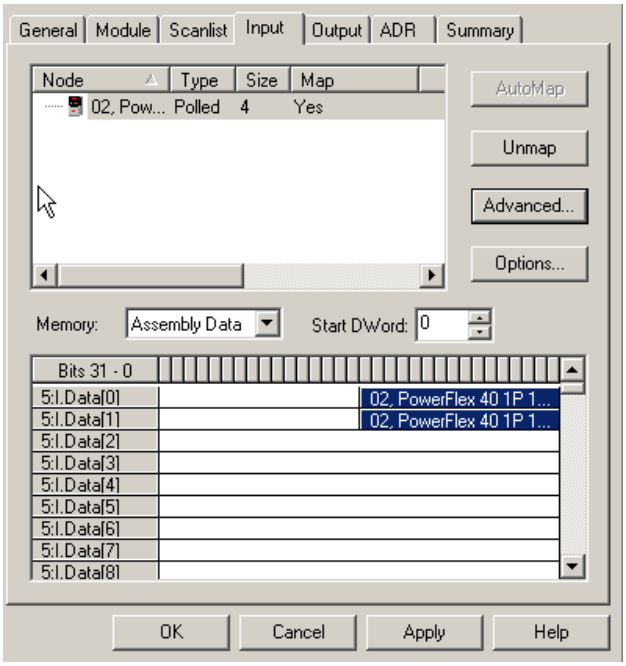


Figure 22-A

Inputs after Advance Mapping

Click the Apply button to accept the mapping

The Logic Status Word of the VFD is now mapped to first input data element, Bits (0-15) of the 1756-DNB module.

The 1756-DNB Scanner Module is located in Slot 6 of the ControLogix Demo Board

If bit Local:6:I.Data[0].0 is ON in the PLC –the drive is Ready to run – Not Faulted

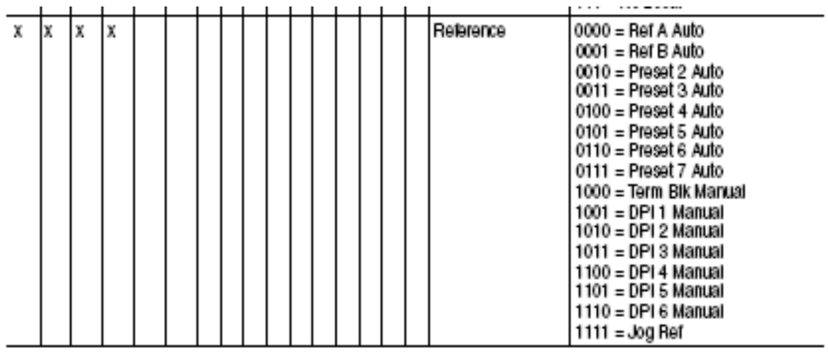
If bit Local:6:I.Data[0].1 is ON in the PLC –the drive is running (Active)

If bit Local:6:I.Data[0].4 is ON in the PLC –the drive is accelerating.

Drive Frequency Feedback information is in 6:I.Data[1] – bits 0-15.

Logic Status Word

Logic Bits															Status	Description
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Ready	0 = Not Ready 1 = Ready
														X		Active	0 = Not Active 1 = Active
													X			Command Direction	0 = Reverse 1 = Forward
												X				Actual Direction	0 = Reverse 1 = Forward
											X					Accel	0 = Not Accelerating 1 = Accelerating
										X						Decel	0 = Not Decelerating 1 = Decelerating
									X							Alarm	0 = No Alarm 1 = Alarm
								X								Fault	0 = No Fault 1 = Fault
							X									At Speed	0 = Not At Reference 1 = At Reference
				X	X	X										Local Control [1]	000 = Port 0 (TB) 001 = Port 1 010 = Port 2 011 = Port 3 100 = Port 4 101 = Port 5 110 = Port 6 111 = No Local



x	x	x	x													Reference	0000 = Ref A Auto 0001 = Ref B Auto 0010 = Preset 2 Auto 0011 = Preset 3 Auto 0100 = Preset 4 Auto 0101 = Preset 5 Auto 0110 = Preset 6 Auto 0111 = Preset 7 Auto 1000 = Term Blk Manual 1001 = DPI 1 Manual 1010 = DPI 2 Manual 1011 = DPI 3 Manual 1100 = DPI 4 Manual 1101 = DPI 5 Manual 1110 = DPI 6 Manual 1111 = Jog Ref

(1) See "Owners" in drive User Manual for further information.

Figure 23- A
Logic Status Word

The PowerFlex 4 Outputs will be mapped using the 1756-DNB Scanner Properties - Output tab.

The procedure is similar to the Advanced Mapping of Inputs.

Automapping of Outputs removed on page 11. See Figure 13-A.

Click the Advanced button on the Output tab window, the Advanced Mapping screen for drive Outputs appears.

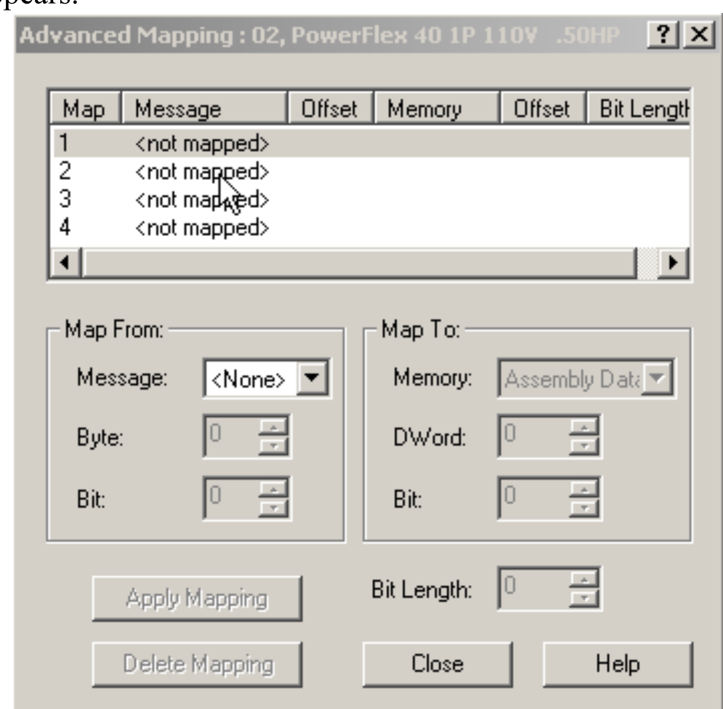


Figure 23-A

Advanced Mapping Screen for Drive Outputs

Follow the steps on pages 12-15 to configure the Advanced Mapping for the VFD Outputs. Steps are the same as mapping Inputs

Note; Map 1 - Bytes 0 and 1 are the Logic Command Word – 16 bits
Controls stopping, starting, etc.

Map 2 – Bytes 2 and 3 are the Speed Reference Word -16 bits
Word value will control the frequency output of the VFD

The completed Advanced Output screen will appear as:

See Figure 25-A

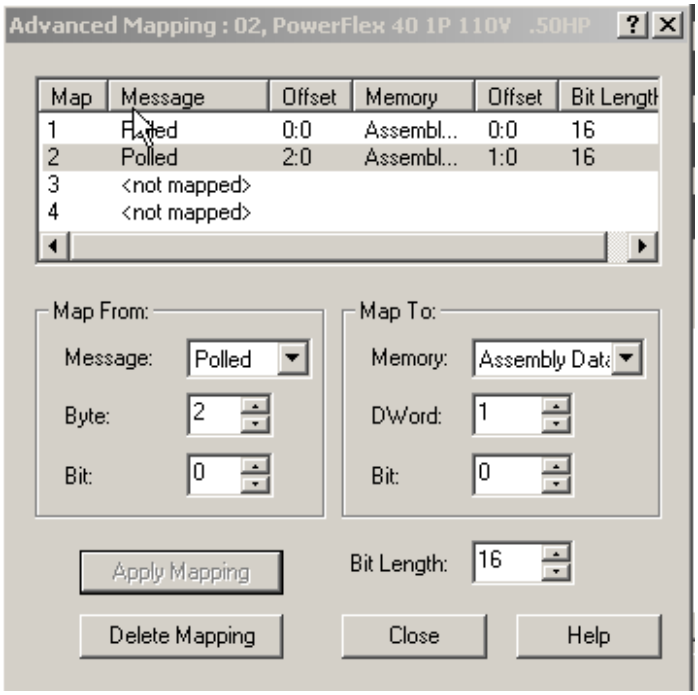


Figure 25-A
Advance Mapping for Drive Outputs

Click the close button on the Advance Mapping screen to return to the Output tab screen. The screen will appear as:

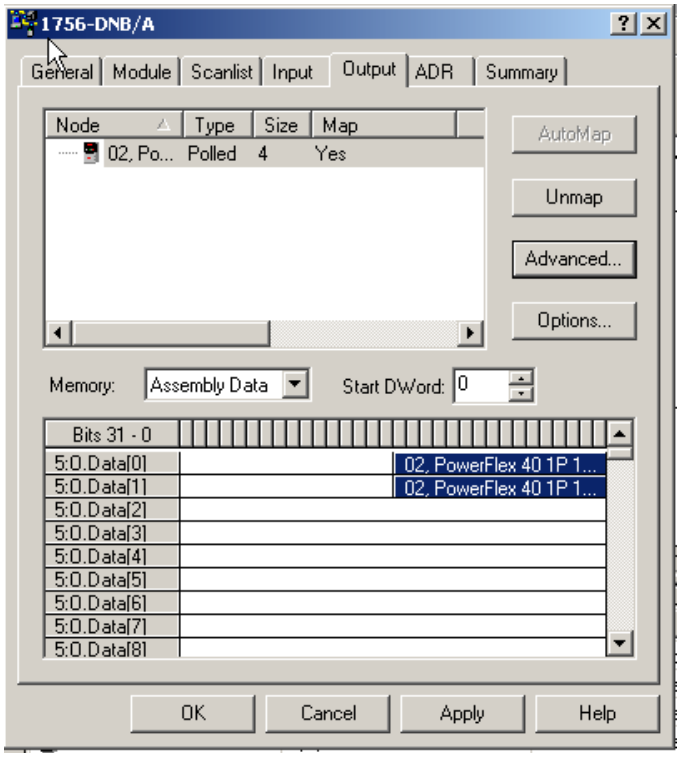


Figure 26-A
Drive Outputs After Advanced Mapping

Click the Apply button to accept the output mapping.

The Logic Command of the VFD is now mapped to first output data Element, Bits (0-15) of the 1756-DNB module.

For example if bit Local:6:O.Data[0].0 is ON in the PLC –the drive will stop.

If bit Local:5:O.Data[0].1 is toggled from OFF to ON in the PLC –the drive will start
.

Note: For VFD starting and stopping only a momentary signal is required – 3 Wire Control

Note: The Start Bit requires a toggle from OFF to ON to start the drive. The bit being True / ON does not necessarily mean the drive is running.

Note: Stop signal take precedence over start signal

Drive Speed Reference information is in 6:O.Data[1] – bits 0-15.

Logic Command Word

Logic Bits															Command	Description
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
															X	Stop (1)	0 = Not Stop 1 = Stop
														X		Start (1)(2)	0 = Not Start 1 = Start
													X			Jog	0 = Not Jog 1 = Jog
												X				Clear Faults	0 = Not Clear Faults 1 = Clear Faults
										X	X					Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Direction Control
									X							Local Control	0 = No Local Control 1 = Local Control
								X								MOP Increment	0 = Not Increment 1 = Increment
						X	X									Accel Rate	00 = No Command 01 = Accel Rate 1 Command 10 = Accel Rate 2 Command 11 = Hold Accel Rate
				X	X											Decel Rate	00 = No Command 01 = Decel Rate 1 Command 10 = Decel Rate 2 Command 11 = Hold Decel Rate
	X	X	X													Reference Select (3)	000 = No Command 001 = Ref. 1 (Ref A Select) 010 = Ref. 2 (Ref B Select) 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
X																MOP Decrement	0 = Not Decrement 1 = Decrement

(1) A "0 = Not Stop" condition (logic 0) must first be present before a "1 = Start" condition will start the drive. The Start command acts as a momentary Start command. A "1" will start the drive, but returning to "0" will not stop the drive.

Figure 27-A
PowerFlex 4 Logic Command Word

See Chapter 4 and Appendix D of Devicenet_22comm-D_User_Manual.pdf for additional information on configuring the 22-Comm-D VFD DeviceNet Interface.

Configure Drive For Network Use:

Ensure RSNetWorx is Online

Using RSNetworx Upload the parameters from the PowerFlex 4 drive.

Right click the PowerFlex 4 icon on the Network Layout window – Select Properties

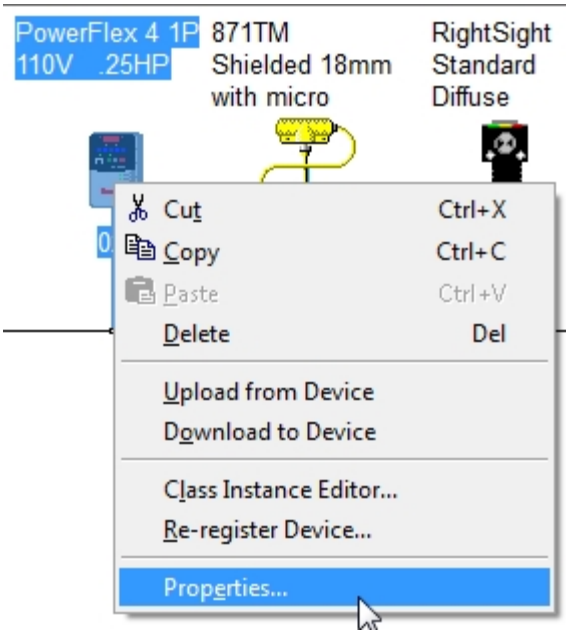


Figure 28-A
PowerFlex 4 Properties

Click the Parameters tab

Click the Upload button if required

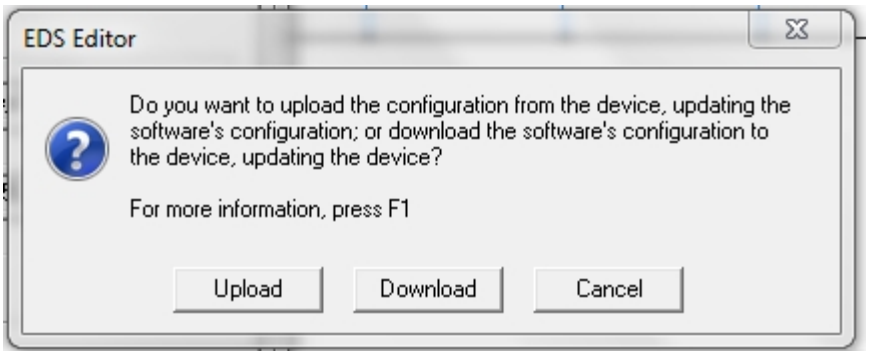


Figure 29-A
Upload VFD Parameters

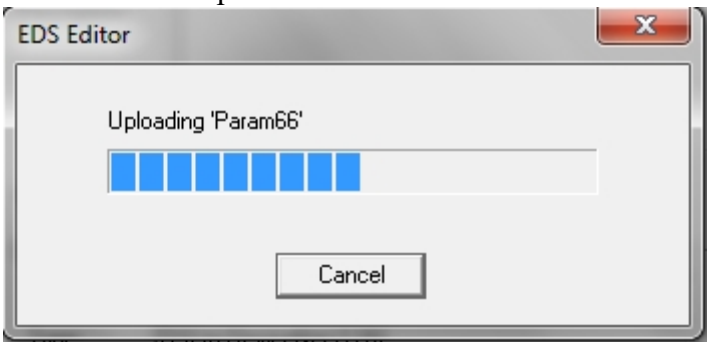


Figure 30-A
Upload Progress Bar - VFD Parameters

Navigate to view Parameters 36 –Start Source and Parameter 38 – Speed Reference

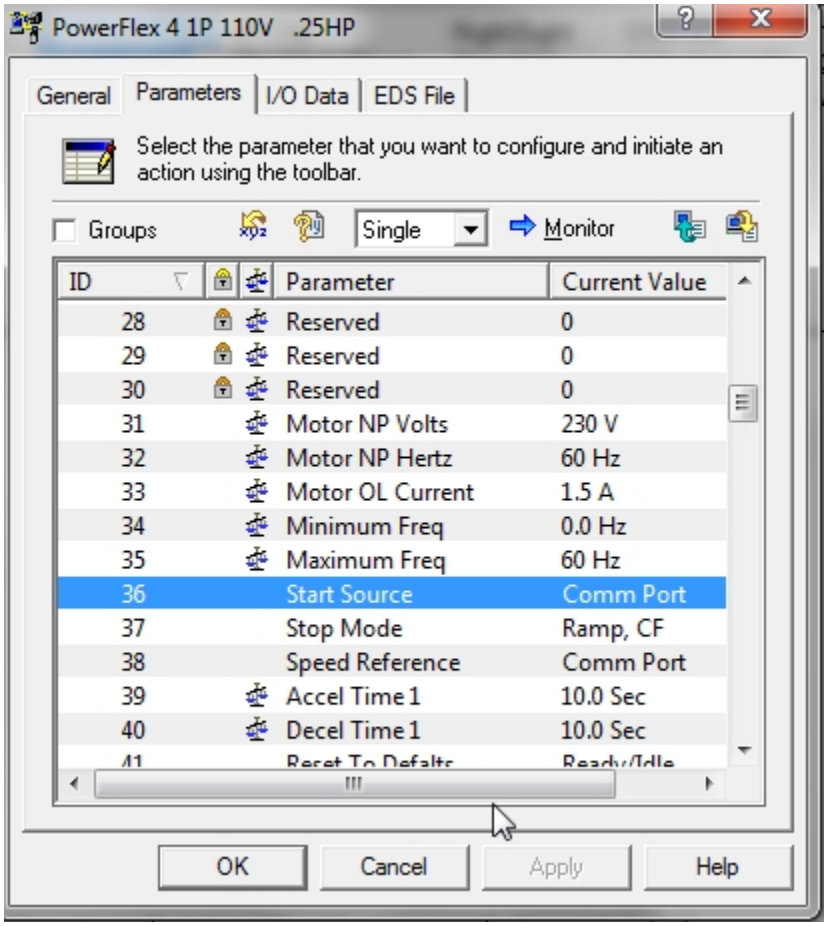


Figure 31-A
PowerFlex 4 VFD Parameters

Current Value of Parameter 36 – Start Source:_____

Current Value of Parameter 38 – Speed Reference:_____

Verify parameters 36, Start Source, and Parameter 38, Speed Reference, are set for Comm Port.

If the Parameters' values are not Comm Port change both Parameter values to Comm Port using the drop-down selection boxes for the Parameters

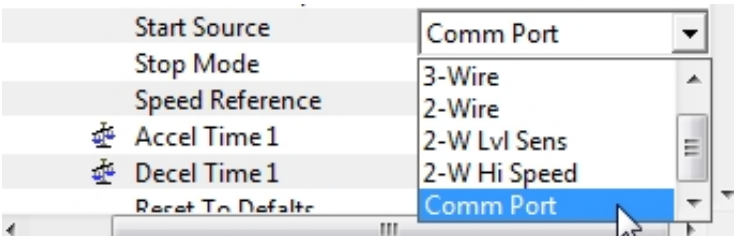


Figure 32-A
Start Source PowerFlex 4 VFD Parameters

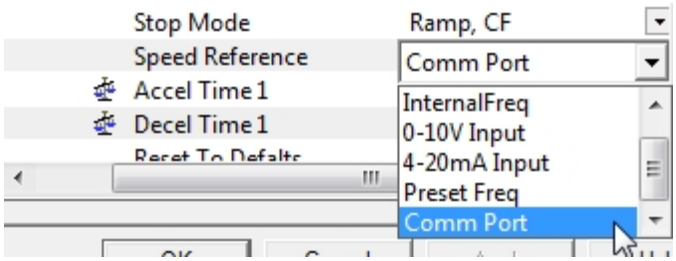


Figure 33-A
Speed Reference PowerFlex 4 VFD Parameters

See pages 3-9 through 3-11 of 22a-Powerflex_4_User_Manual.pdf for additional information on configuring Start, Stop and Speed Reference Parameters of the PowerFlex 4 VFD.

Click the Apply button to download changes to the VFD

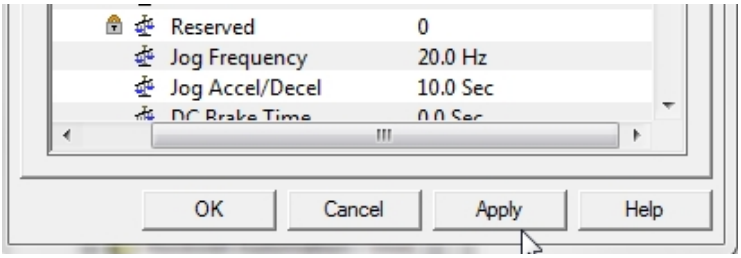


Figure 34-A
PowerFlex 40 Download Parameters

Click Yes to Confirm Download to the PowerFlex 4 VFD

See Figure 35-A

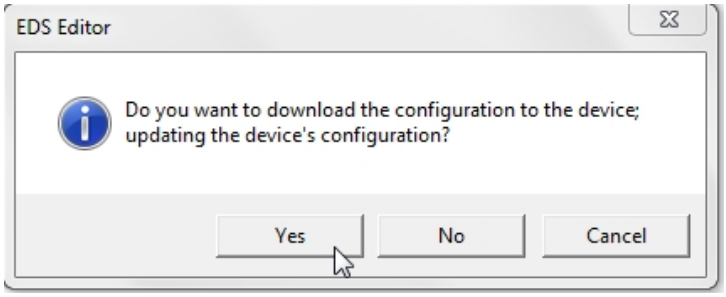


Figure 35-A
Confirm Download to VFD

Save the DeviceNet Configuration file as Module_6_PF4_VFD.dnt

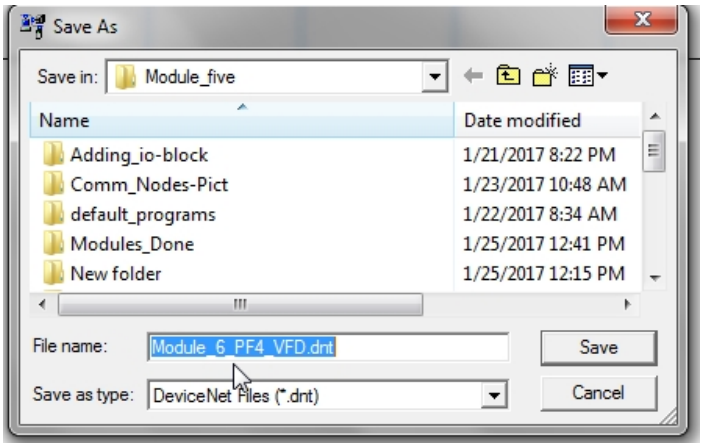


Figure 36-A
Save VFD Network Configuration File

Download the Module_6_PF4_VFD.dnt to the 1756-DNB Scanner

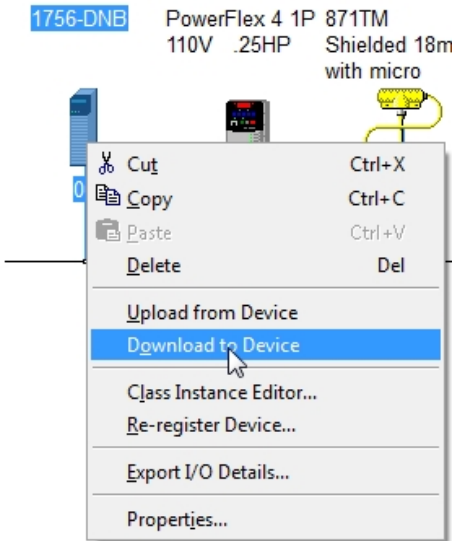
1. 

Figure 37-A
Download File to the 1756-DNB Scanner

Open and Import PLC_220_Module_6_PF_4.L5K to Studio 5000

Download the demo program PLC_220_Module_6_PF_4.ACD to the ControlLogix Demo Unit.

Put processor in RUN mode

Put 1756-DNB Scanner into Run Mode

If the PowerFlex 4 VFD is faulted, press the Stop button on the Drive's keypad Unit to Reset Fault.

Press the blue Escape button (Esc) on the PowerFlex 4 until the Numeric Display on the VFD reads 0.0

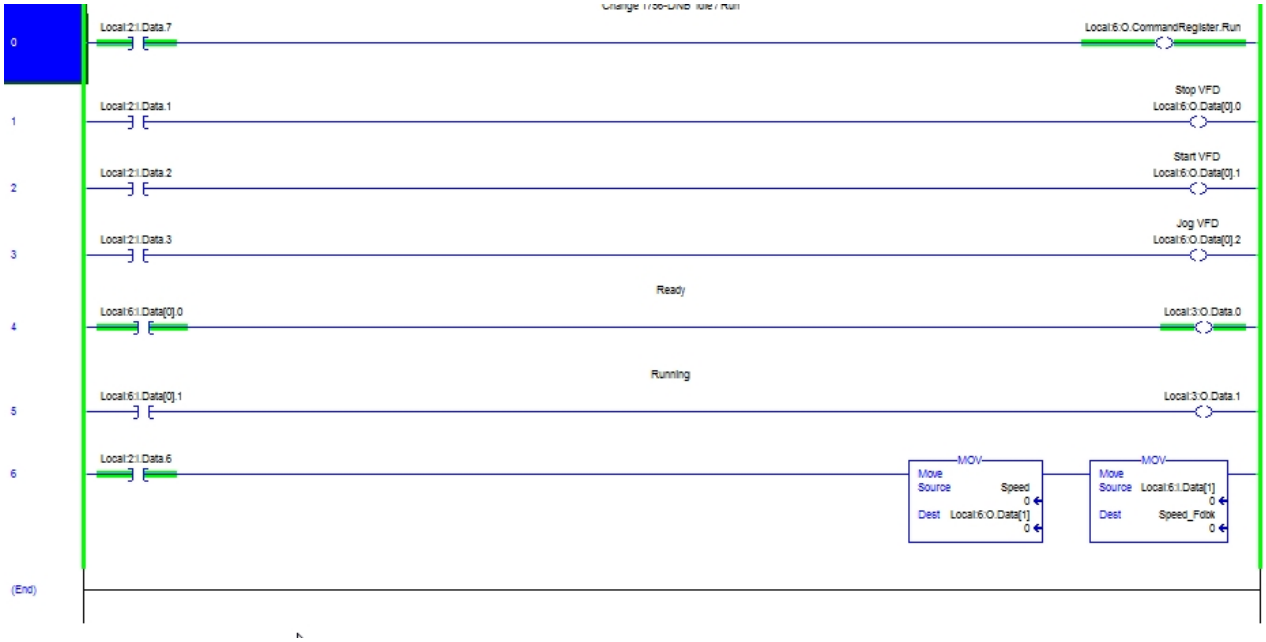


Figure 38-A
Ladder Logic Demo File

Verify Operation:

Rung 0 – Puts the 1756- DNB in RUN Mode
Rung 1- Stop s the VFD
Rung 2 – Starts the V FD
Rung3 – Jogs the VFD
Rung 4 – Monitors if VFD is Ready to Run
Rung 5 – Monitors if VFD is Running
Rung 6 – Speed Tag sends Frequency command to VFD
Speed Fdbk – shows VFD Frequency Output
Ensure PLC and 1756-DNB Scanner are in RUN Mode

Verify that VFD is not Faulted

If the PowerFlex 4 VFD is faulted, press the Stop button on the Drive's keypad Unit

Verify PL0 on Contrologix Demo Board is on – Drive Ready to RUN

Press PB2 on the Contrologix Demo Board

Does PL1 on Contrologix Demo Board come On?_____

Is the VFD Running?_____

Ensure SW6 on Contrologix Demo Board is ON (right position)

At Rung 6 enter the value of 30 in the Speed tag.

Is the VFD running?_____

What frequency is the VFD outing to the motor?_____

At Rung 6 Value of Speed_Fdbk? _____

Explain:_____

Press PB1 on the Contrologix Demo Board

What happens to the VFD?_____

What happens to PL1?_____

Put the 17566-DNB Module into IDLE Mode

State of PL0 on Contrologix Demo Board;_____

Explain:_____

_____

Press Stop button on VFD keypad Unit

State of PL0 on Contrologix Demo Board;_____

Explain:_____

_____

Put the 17566-DNB Module into RUN Mode

Press PB3 on the ControlLogix Demo Board

What happens to the VFD?_____

Release PB3 pushbutton

What happens to the VFD?_____

Press and hold PB3 on the ControlLogix Demo Board

What is the maximum frequency the VFD ouputs?_____

PB3 controls what function for the VFD?_____

Navigate to the RSNetWorx For DeviceNet - View PowerFlex 4 Parameter #78

Use Monitor to view Parameter #78 Online

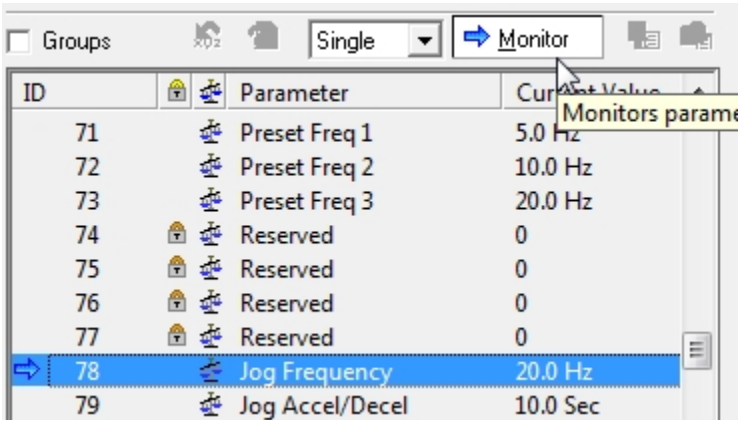


Figure 39-A
Mointor PowerFlex 4 Parameter 78

Value of PowerFlex 4 Parameter 78:_____

Press PB1 and PB2 pushbuttons on the ControlLogix Demo Board

What happens with the VFD?_____

Explain:_____

_____

Add a Rung 7 that will turn ON PL7 when the VFD reaches its commanded frequency (At Speed)

Review Questions

1. T F Input bits in the 1756-DNB modules stop, start, jogs a DeviceNet VFD

2. How much Output data does the PowerFlex 4 VFD use in the 1756-DNB?

   a) 16 Bits

   b) 1 Bytes

   c) 32 Bits

   d) 2 Bytes

3. Which data bit will Jog a PowerFlex 4 VFD

   a) 0

   b) 1

   c) 2

   d) 3

4. T F PowerFlex 4 output data monitors the VFD

5. How many bits make up the PowerFlex 4's Feedback value?

   a) 2

   b) 4

c) 8

d) 16

e) 32

6. T F Output Data bit 0 stops a PowerFlex 4 VFD

Review Question Answers

1) F

2) c

3) c

4) F

5) d

6) T

.

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