Technical Note

ProSoft TECHNOLOGY

PLX3x EtherNet/IP gateways and PowerFlex drives

Applicable products include:

- **All PLX3x-EIP-xxx gateways**
  EtherNet/IP to xxx gateways
- **All legacy DFNT products**
  EtherNet/IP legacy driver

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Asia Pacific

Malaysia Office
Phone: +60 3.7941.2888
asiapc@prosoft-technology.com
Languages spoken: Chinese, English, Japanese

China Office
Phone: +86.21.5187.7337
asiapc@prosoft-technology.com
Languages spoken: Chinese, English

Europe

France Office
Phone: +33 (0)5.34.36.87.20
support.emea@prosoft-technology.com
Languages spoken: French, English

Middle East and Africa
Phone: +971.(0)4.214.6911
mea@prosoft-technology.com
Languages spoken: English, Hindi

North America

California
Phone: +1 661.716.5100
support@prosoft-technology.com
Languages spoken: English, Spanish

Latin America

Brasil Office
Phone: +55.11.5084.5178
Support.la@prosoft-technology.com
Languages spoken: Portuguese, English

Regional Office
Phone:+52.222.264.1814
Support.la@prosoft-technology.com
Languages spoken: Spanish, English

PLX3x EIP driver and PowerFlex Drives

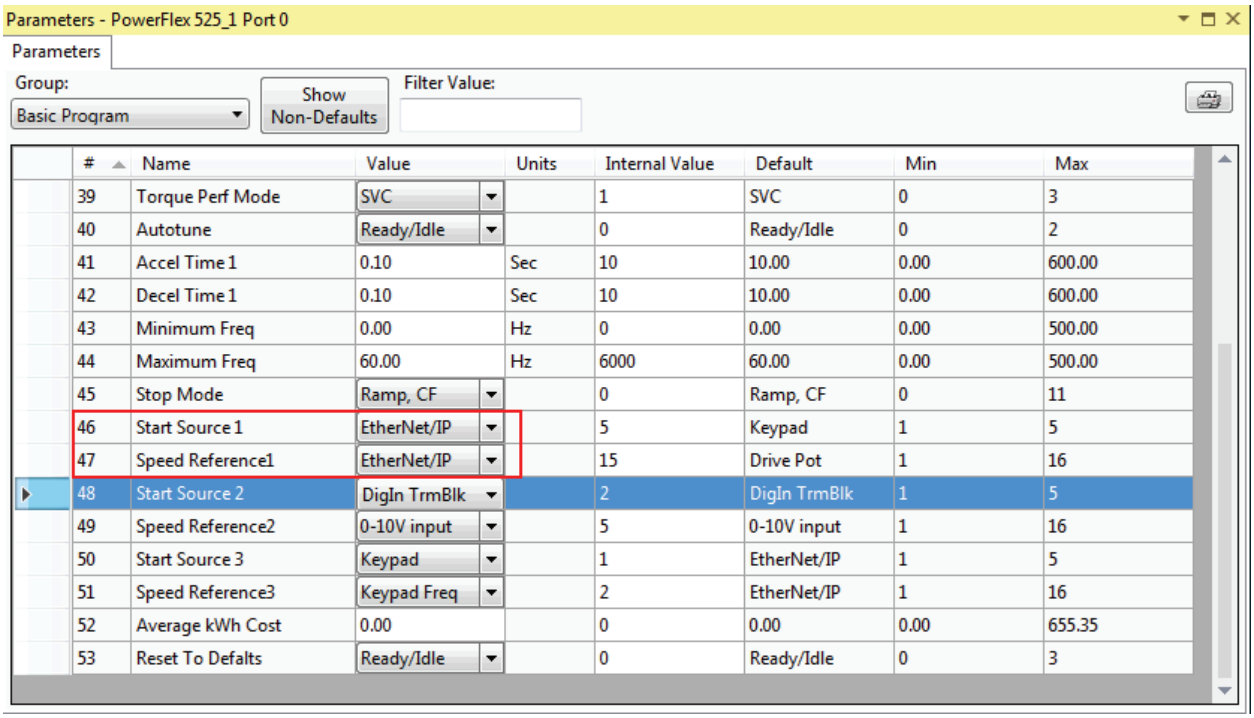
This document describes how to control a PowerFlex 525 drive by using the EtherNet/IP (EIP) driver of PLX3x gateways. This technote is also applicable to other PowerFlex drives. The steps explained are identical to what's required when using the EtherNet/IP (DFNT) driver used in legacy products.

The PowerFlex 525 supports both Class 1 and Class 3 server connections. Since the PLX3x does not operate as a Class 1 client (I/O scanner), the messaging described in this document will use Class 3 messaging.

See the Appendix A for a list of reference documents.

1. Configure the PowerFlex 525 to enable EtherNet/IP comms for writing the Logical Command and Reference words.

Using Connected Componence Workbench, with the "Drives - Unified Device Configuration" installed, set parameters 46 and 47 to EtherNet/IP. This will enable EtherNet/IP as the primary controlling source for these parameters.



#	Name	Value	Units	Internal Value	Default	Min	Max
39	Torque Perf Mode	SVC		1	SVC	0	3
40	Autotune	Ready/Idle		0	Ready/Idle	0	2
41	Accel Time 1	0.10	Sec	10	10.00	0.00	600.00
42	Decel Time 1	0.10	Sec	10	10.00	0.00	600.00
43	Minimum Freq	0.00	Hz	0	0.00	0.00	500.00
44	Maximum Freq	60.00	Hz	6000	60.00	0.00	500.00
45	Stop Mode	Ramp, CF		0	Ramp, CF	0	11
46	Start Source 1	EtherNet/IP		5	Keypad	1	5
47	Speed Reference1	EtherNet/IP		15	Drive Pot	1	16
48	Start Source 2	DigIn TrmBlk		2	DigIn TrmBlk	1	5
49	Speed Reference2	0-10V input		5	0-10V input	1	16
50	Start Source 3	Keypad		1	EtherNet/IP	1	5
51	Speed Reference3	Keypad Freq		2	EtherNet/IP	1	16
52	Average kWh Cost	0.00		0	0.00	0.00	655.35
53	Reset To Defalts	Ready/Idle		0	Ready/Idle	0	3

Also, ensure the PowerFlex drive's Ethernet settings are configured for your network. Consult the documents in Appendix A for more information.

2. Configure the PLX3x EtherNet/IP (EIP) driver to read the Logic Status and Feedback, and write to the Logic Command word and Reference.

*This document will describe the settings for communicating to a PF525 in Single-drive mode. Consult the documents listed in Appendix A for Multi-drive mode configuration.

The table below lists the read/write areas of the PowerFlex 525 in Single-drive mode. Consult the documents in Appendix A for additional functionality.

N-File	Description	
	Write	*Read*
N41:0	Logic Command Word	Logic Status Word
N41:2	Reference	Feedback
N42:3	Communication Timeout	

*__IMPORTANT__ – The current PowerFlex 525 Embedded EtherNet/IP User Manual shows the Reference and Feedback as N42:2, which is incorrect.

The **N42:3** register is Time-out (read/write): Time (in seconds) allowed between messages to the N41 or N44 file. If the adapter does not receive a message in the specified time, it performs the fault action configured in parameter C143 [EN Comm Flt Actn]

a. Using ProSoft Configuration Builder (PCB), configure the PLX3x EIP driver.

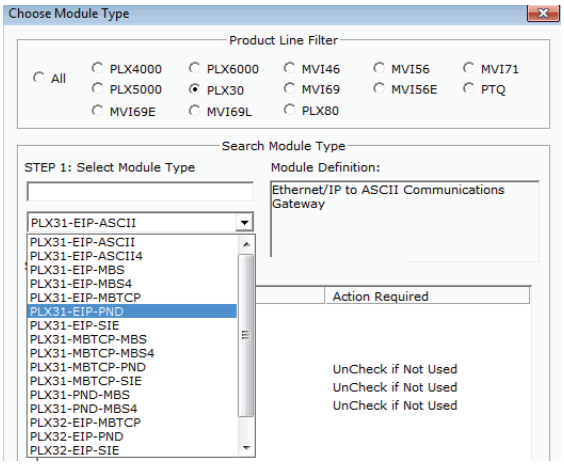
When mapping data between PLX3x protocols, take note that some protocol drivers have specific locations for Input/Output data, these are:

***EIP** Class 1 – The EtherNet/IP Class 1 connections have a definable location for Input/Output data. (not used in this document)*

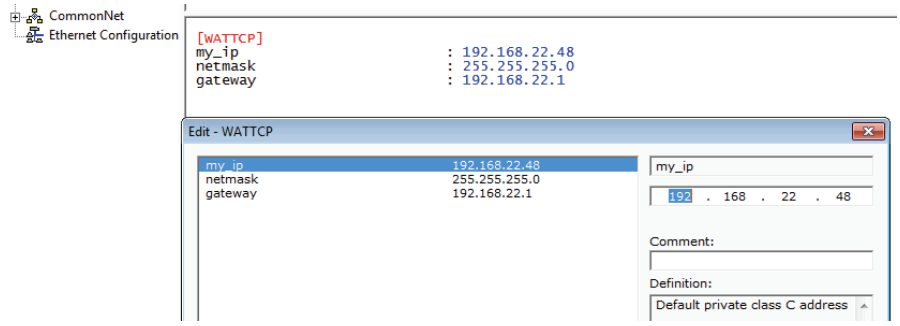
***PND** – The PROFINET Device driver has a definable location for input/output data.*

In this example, the PLX31-EIP-PND EtherNet/IP to PROFINET Device will be used.

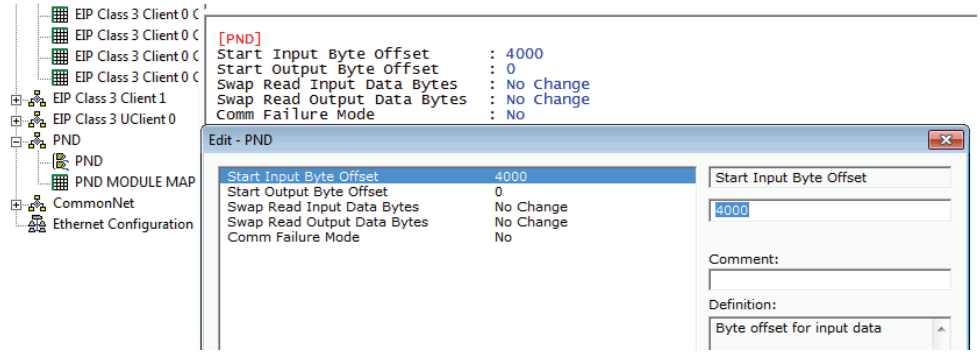
Add the PLX31-EIP-PND to a new or existing project.



b. Configure the PLX3x Ethernet settings as necessary for your network.

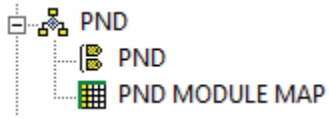


c. Configure the PND PROFINET Device driver by expanding PND and double-click on PND.



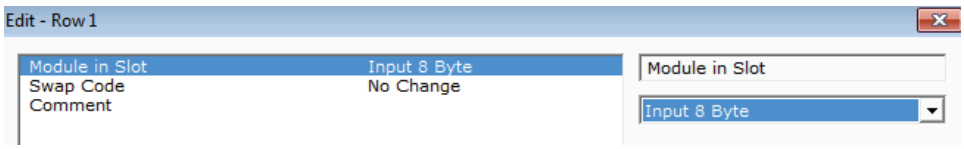
The default addresses will be used in this document. The PROFINET Input data will start on byte 4000 (Integer register 2000), and PROFINET Output data will start on byte/register 0.

d. Double-click on PND MODULE MAP.

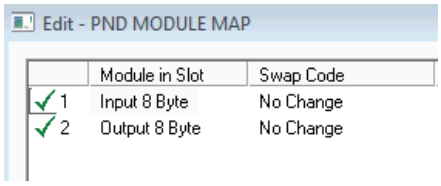


When the Edit window opens, click on Add Row, then Edit Row.

Edit the command to match the settings below. These parameters are explained later.

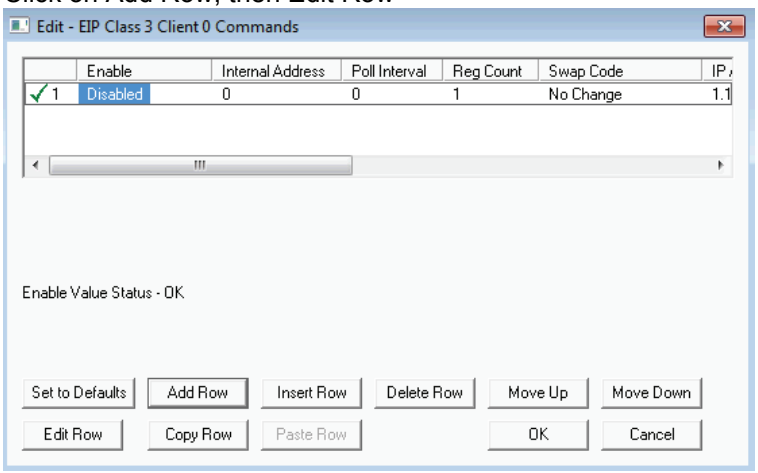


Add another row for 8 Output Bytes. The PND MODULE MAP should match the image below:



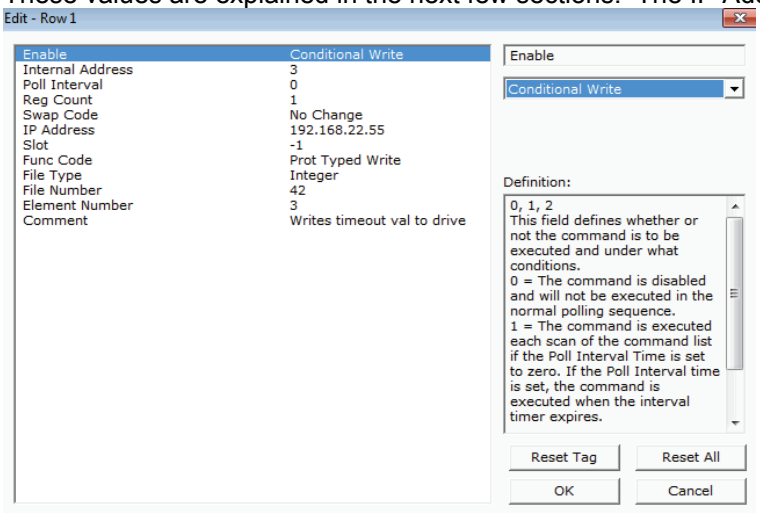
e. Within PCB, expand EIP Class 3 Client 0, and double-click on: EIP Class 3 Client 0 Commands SLC500 2 Address Fields

Click on Add Row, then Edit Row

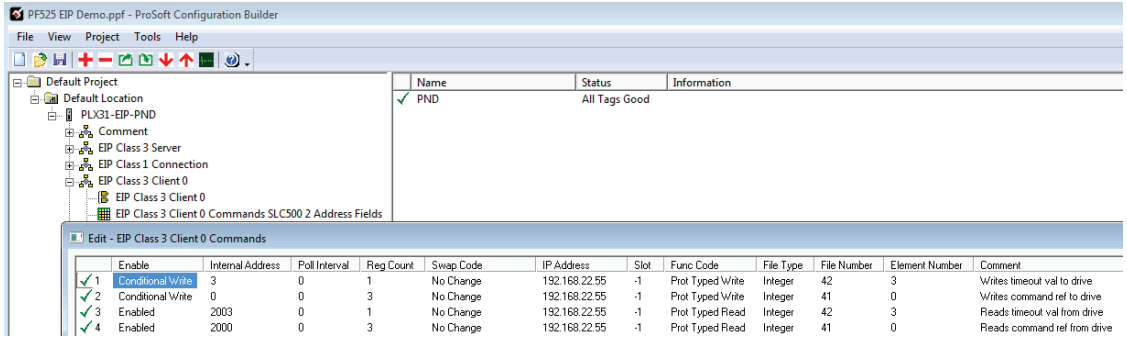


f. In the Edit command window, modify your command to match the settings below. The only parameter that may differ is the IP Address. While in this window, explore the different parameters and notice the definition pane on the right change.

These values are explained in the next few sections. The IP Address is the IP Address of the PowerFlex drive.



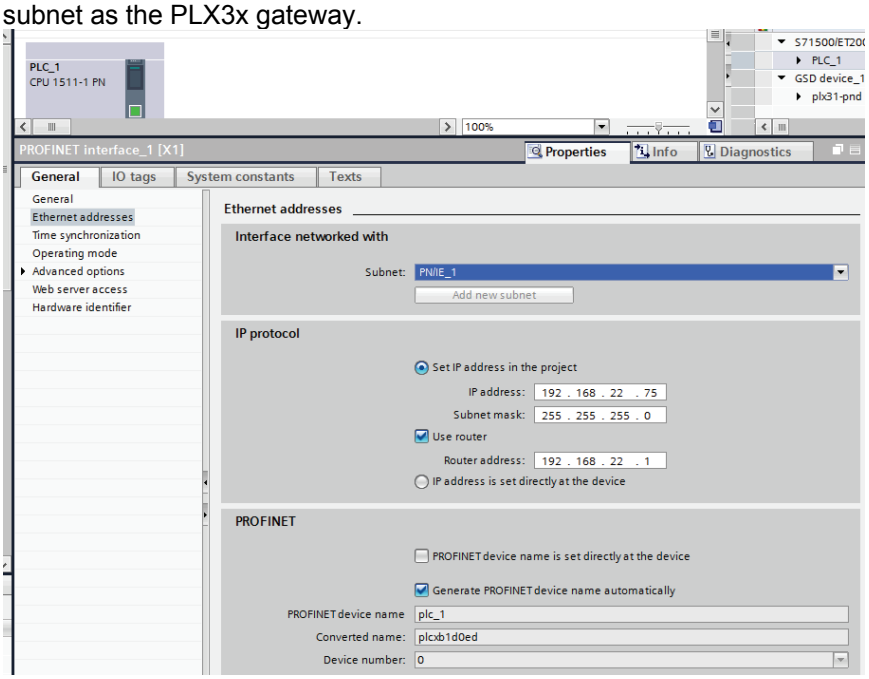
g. Add three more commands that match the settings below, and endure ensure the correct IP Address is used.



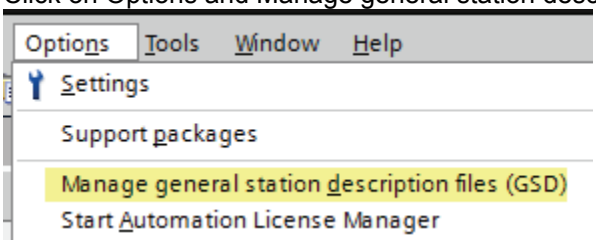
h. Download the configuration to the PLX31-EIP-PND by right clicking on the gateway and choose Download from PC to Device.

3. Configure a S7-1500 as a PROFINET Controller using TIA Portal

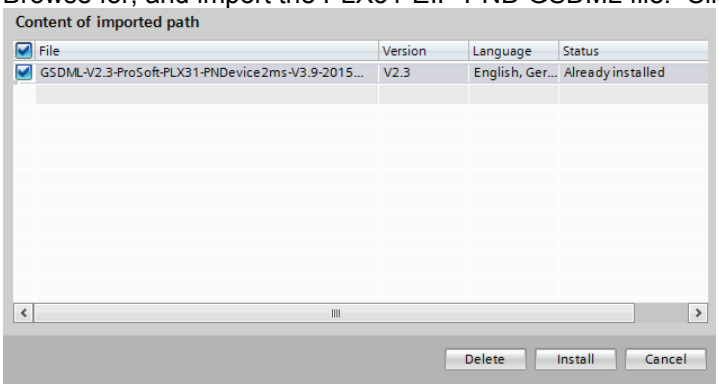
a. Ensure the S7-1500 is networked. If not, click on Add new subnet. Also ensure the IP Address is on the same subnet as the PLX3x gateway.



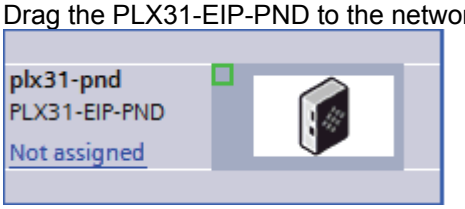
b. Click on Options and Manage general station description files (GSD)



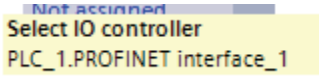
c. Browse for, and import the PLX31-EIP-PND GSDML file. Click Install.



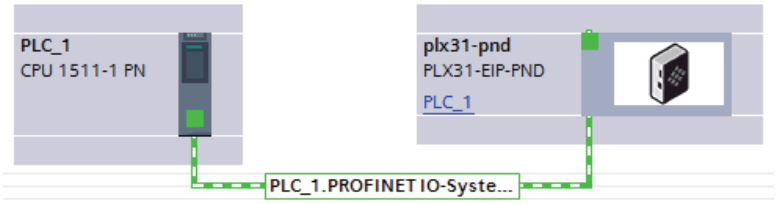
d. Using the device Catalog, under Other field devices>Gateway>ProSoft Technology, Inc.>PLX30
Drag the PLX31-EIP-PND to the network.



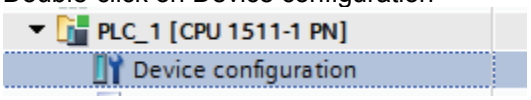
e. Click the blue Not assigned link within the PLX31, and select the IO controller



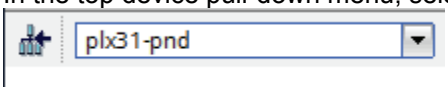
Once done, the PLX31 is assigned to the S7-1500



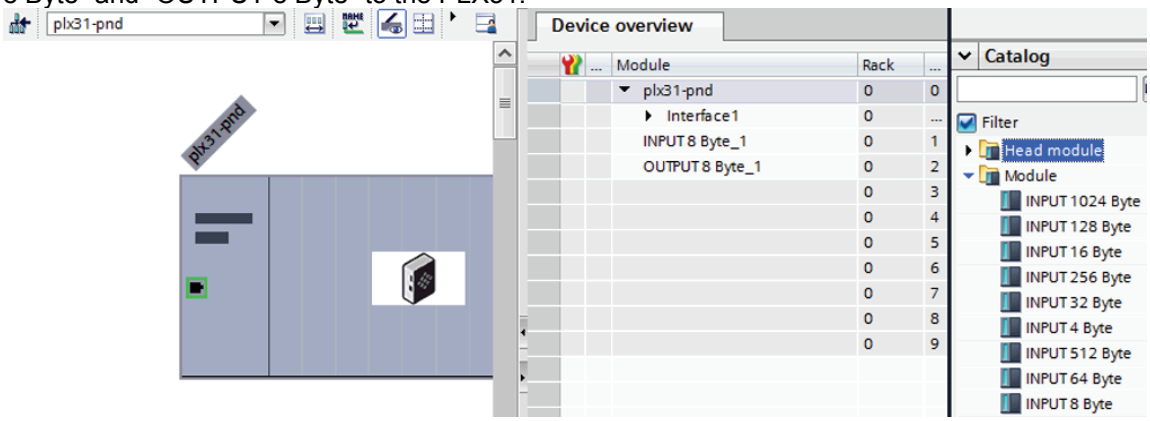
f. Double-click on Device configuration



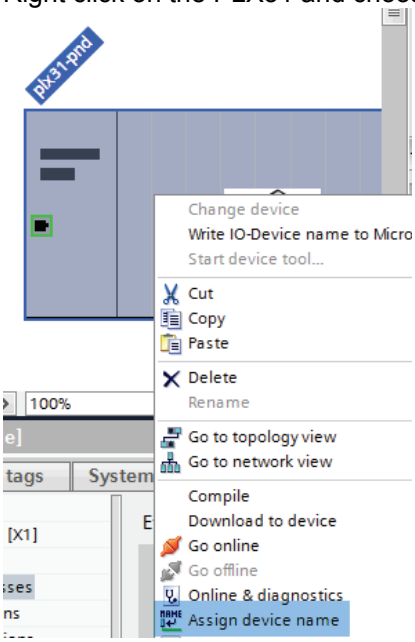
g. In the top device pull-down menu, select plx31-pnd



h. Right-click on the PLX31 and choose Properties.
i. Under PROFINET interface [X1], click on EtherNet addresses, and specify an IP address to use.
j. It's a good time to save, so save the project.
k. Still in the Devices configuration window, select the PLX31 and expand Module, under the Catalog. Drag "INPUT 8 Byte" and "OUTPUT 8 Byte" to the PLX31.

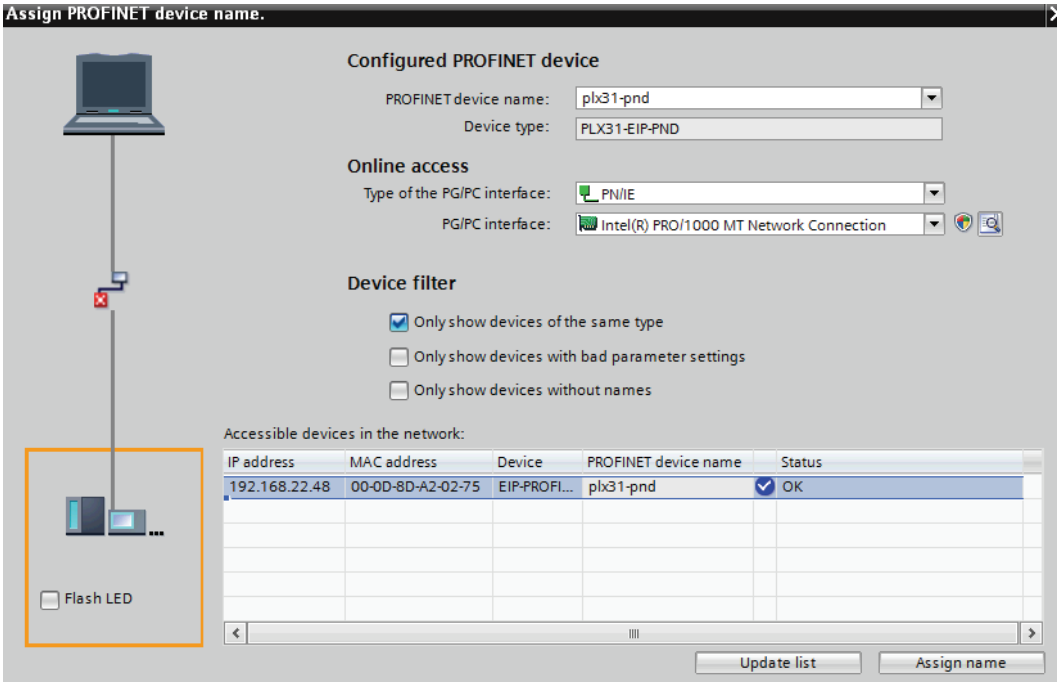


l. Right click on the PLX31 and choose Assign device name



m. Ensure the "Online access" interface types are set, and click Update list if the PLX31 isn't shown. Once the PLX31 is shown, select it, click on Assign name.

Once the name is assigned, you should see a blue checkmark next to the PLX31 status. You can close this window.



n. Compile and download the project to the S7-1500.

4. In-depth review of data mapping and configuration

The image below is a snapshot of the previously entered parameters for the PLX31-EIP-PND.

Edit - EIP Class 3 Client 0 Commands

	Enable	Internal Address	Poll Interval	Reg Count	Swap Code	IP Address	Slot	Func Code	File Type	File Number	Element Number	Comment
✓1	Conditional Write	3	0	1	No Change	192.168.22.55	-1	Prot Typed Write	Integer	42	3	Writes timeout val to drive
✓2	Conditional Write	0	0	3	No Change	192.168.22.55	-1	Prot Typed Write	Integer	41	0	Writes command ref to drive
✓3	Enabled	2003	0	1	No Change	192.168.22.55	-1	Prot Typed Read	Integer	42	3	Reads timeout val from drive
✓4	Enabled	2000	0	3	No Change	192.168.22.55	-1	Prot Typed Read	Integer	41	0	Reads command ref from drive

Edit - PND

Start Input Byte Offset	4000
Start Output Byte Offset	0
Swap Read Input Data Bytes	No Change
Swap Read Output Data Bytes	No Change
Comm Failure Mode	No

Edit - PND MODULE MAP

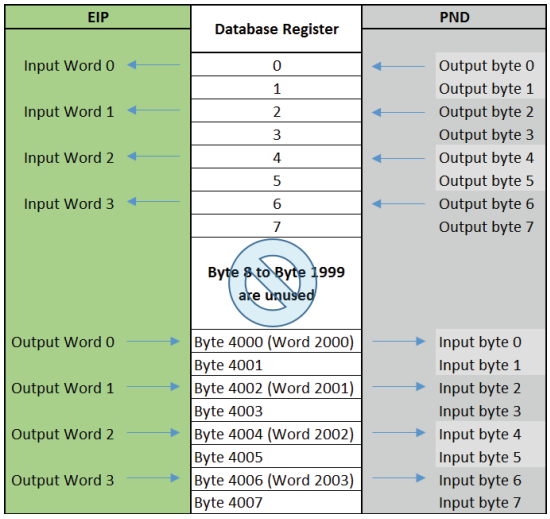
	Module in Slot	Swap Code
✓1	Input 8 Byte	No Change
✓2	Output 8 Byte	No Change

The table below shows what parameters and their address will be used to communicate with the PF525.

N-File	Description	
	Write	*Read*
N41:0	Logic Command Word	Logic Status Word
N41:2	Reference	Feedback
N42:3	Communication Timeout	

On several PowerFlex drives, N41:1 is not used.

The below image shows the flow of data between the EtherNet/IP and PROFINET protocols, as configured.



Command 1 is writing 1 register (Reg Count) to N42:3 (Integer, File Number, Element Number)
Command 1 is getting the value to write from Internal Address 3, which is a Word (2-bytes)
Commands 1&2 are conditional commands that execute on any change of the counted registers.
Example: The PROFINET Controller changes the value of Output byte 6 to 300. The PLX3x recognizes this change, and executes Command 1, writing a value of 300 to N42:3 on the PF525.

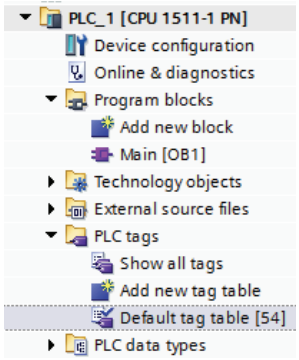
Command 2 is writing 3 registers (Reg Count) to N41:0 (Integer, File Number, Element Number)
Command 2 is getting the values to write starting at Internal Address 0, which is a Word (2-bytes)
Example: The PROFINET Controller changes Output byte 4 to a value of 1000. The PLX3x recognizes this change, and executes Command 2, writing a value of 1000 to N41:2 on the PF525.

Commands 3 and 4 are reading the same registers as Status and Feedback.
Command 3 and 4 are continuous commands that execute based off the EIP Class 3 Client 0 Minimum Command Delay parameter, and the command's Poll Interval. The Status and Feedback is read and passed to the PROFINET Controller.

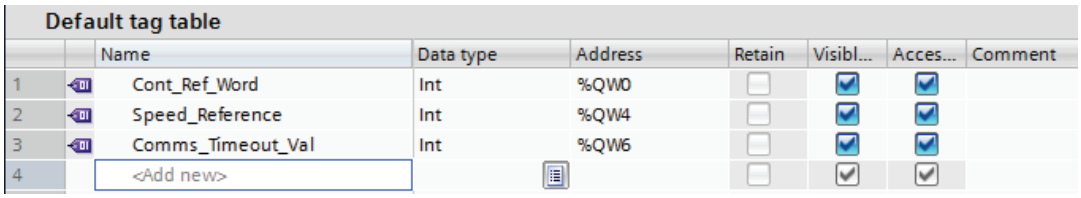
Any other PLX3x EIP (EtherNet/IP) and legacy DFNT (EtherNet/IP) can use the table above. For example, instead of a PROFINET Controller writing to DB register 0, a PLX31-EIP-MBTCP's Modbus TCP/IP driver can read/write to the same DB registers the PROFINET Controller is referencing.

5. Application verification

a. Within TIA Portal, double-click on Default tag table

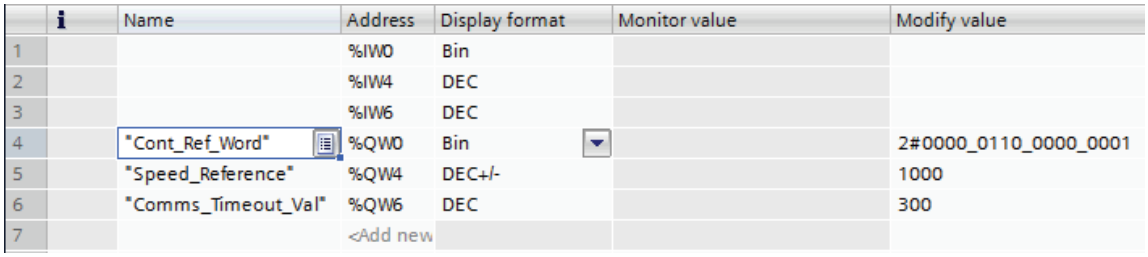


b. Create the following tags

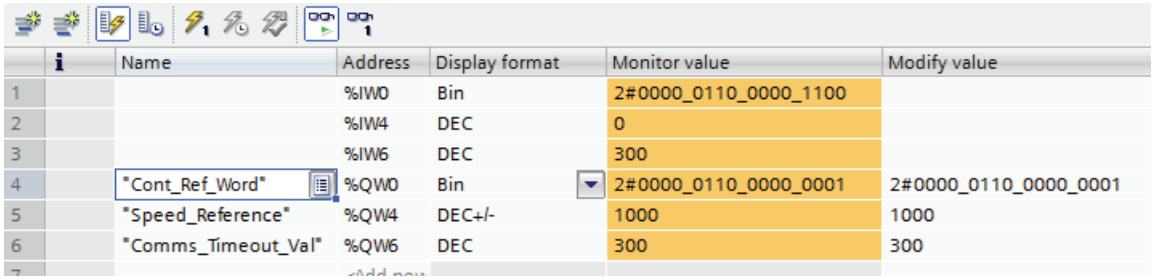


c. Double-click on Add new watch table
By default, Watch table_1 will be created.

d. Within Watch table_1, add the tags you just created, and the Input addresses listed below



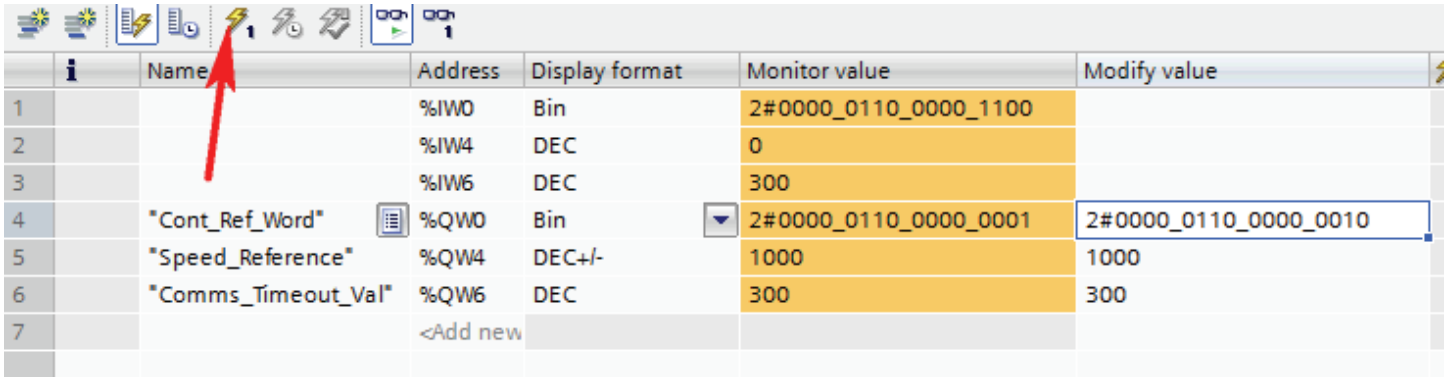
e. Click the Monitor all button (Play button)



Any change to the three output words will cause the associated EtherNet/IP command to be issued to the PF drive.

To test this:

1. Enter a value (in seconds) for the Timeout parameter.
2. Enter a value for the speed reference
3. Enter this binary value for the control word: 0000_0110_0000_0010
   ONLY TEST THIS ON A TEST SYSTEM, AND NOT ON A WORKING APPLICATION.
4. Once you press the Modify button, the Modify values will be issued, and the drive will start, using the speed reference from step 2 above. You should also see the %IW Input registers (Logic Status and Feedback) update.



	Name	Address	Display format	Monitor value	Modify value
1		%IW0	Bin	2#0000_0110_0000_1100	
2		%IW4	DEC	0	
3		%IW6	DEC	300	
4	"Cont_Ref_Word"	%QW0	Bin	2#0000_0110_0000_0001	2#0000_0110_0000_0010
5	"Speed_Reference"	%QW4	DEC+/-	1000	1000
6	"Comms_Timeout_Val"	%QW6	DEC	300	300
7		<Add new			

Appendix A

ProSoft Configuration Builder
http://www.prosoft-technology.com/Products/ProSoft-Software/ProSoft-Configuration-Builder

PLX3x User Manual
http://www.prosoft-technology.com/content/download/9671/182665/version/13/file/PLX3x_user_manual.pdf

PLX31-EIP-PND product page
http://www.prosoft-technology.com/Products/Gateways/PLX3x/PLX31/EtherNet-IP-to-PROFINET-R-IO-Device-Gateway

PowerFlex 25-COMM-E2P Dual-Port EtherNet/IP Adapter
http://literature.rockwellautomation.com/idc/groups/literature/documents/um/520com-um003_-en-e.pdf

EtherNet/IP Capacity Tool
http://www.rockwellautomation.com/resources/downloads/rockwellautomation/zip/solutions/integrated-architecture/ethernetipsetup.zip

PowerFlex 525 Embedded EtherNet User Manual (IMPORTANT-This is the latest UM, and incorrectly has N42:2 being used as Reference/Feedback, when N41:2 is the correct address)
http://literature.rockwellautomation.com/idc/groups/literature/documents/um/520com-um001_-en-e.pdf

20-COMM-E User Manual
http://literature.rockwellautomation.com/idc/groups/literature/documents/um/20comm-um010_-en-p.pdf