

Application note

e180 and e190 PROFINET configuration

AN00251-009

Integrated support for PROFINET allows you to configure the exchange of process data objects (PDOs) in minutes with the simple to use MotiFlex e180 and MicroFlex e190 servo drives



Introduction

Firmware build 5860.2.0 introduced support for PROFINET on the MotiFlex e180 and MicroFlex e190 AC servo drives. Using this firmware (or later versions, 5863 onwards is recommended) it is possible to configure Process Data Object data transfer between a PLC, or other PROFINET client device, and the servo drive's NETDATA array. This data exchange may be used to pass application parameters/diagnostics between devices for example, or could be used to control axis motion using a drive profile such as the Generic Drive Interface (GDI). It is important therefore that these drives are fitted with the Mint enabled memory module (plus code +N8020) as a Mint program is required to manipulate NETDATA as necessary for the application.

This application note shows how to connect and configure a MotiFlex e180 for PROFINET communications and then also illustrates how an ABB AC500 PLC could be used to exchange data with the drive. The procedure is identical for a MicroFlex e190 drive. The process for 3rd party PLCs, e.g. Siemens and VIPA, is very similar so this application note can be used as a general guide – some tips for Siemens/Vipa are included at the end of this document. A sample AC500 PLC project controlling a MotiFlex e180 running the Generic Drive Interface via PROFINET is also included for reference (see application note AN00204 for further details about the operation of the GDI).

Pre-requisites

You will need to have the following to work through this application note:

- Mint Workbench build 5852 or later (see www.abb.com/motion for latest downloads and support information)
- A MotiFlex e180 drive (or MicroFlex e190 drive) with build 5863 or later firmware (only the drive is required, a motor is not needed just to test data exchange with a PLC)
- A PC or laptop running Automation Builder 1.2 or later
- An AC500 PLC processor with terminal base and CM579-PNIO coupler
- 4 port (or more) Ethernet switch
- Ethernet cables to connect the PROFINET coupler, PLC processor, MotiFlex e180 and PC to the Ethernet switch

It is assumed the reader has a basic working knowledge of Automation Builder, CoDeSys, the AC500 PLC, MotiFlex e180/MicroFlex e190 and Mint Workbench. Throughout the remainder of this document references to MotiFlex e180 may be replaced by MicroFlex e190 if you intend to use this drive instead.

Configuring the device (station) name

The PROFINET station name is identical to the device name assigned by the user. The name can be set via the following methods:

- Using the Identification page of the configuration wizard in Workbench (this is the simplest and therefore the recommended method). The page contains detailed encoding information and the entered data is verified against the station name rules. The configuration wizard does NOT support Punycode encoding:

Identification

This page allows you to choose a convenient name for the MotiFlex e180, so it can be easily identified.

Note

The name must fulfil the PROFINET station name requirements:

Allowed characters **a..z, 0..9, ., -**

Single word or split via **.** into labels (Example: **machine0.mechanic1.axis2**)

Maximal total length 240 characters.

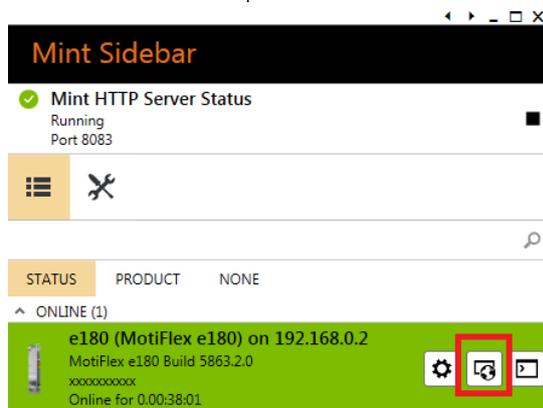
Maximal label length 63 characters.

No **-** at start or end of a label

Name

Serial 15160016

- Using the drive's PROFINET web page (accessible via the Mint Sidebar tray application). The web page allows the user to enter a name that includes a Unicode character (e.g. ü) and this will be encoded using Punycode, however it is recommended to avoid Unicode characters as it is only this web page that will display the name correctly – all other screens will show the “plain” name...



Set requested

Success

Identification

Name	<input type="text" value="mühle0"/>
Name (plain)	xn-mhle0-kva
MAC address	00:18:CF:10:04:CA
Address	<input type="text" value="192.168.1.1"/>
Mask	<input type="text" value="255.255.255.0"/>
Gateway	<input type="text" value="192.168.1.241"/>
	<input type="button" value="Set"/>

- Using Device Configuration Protocol (DCP) functionality if supported by the master (this can be set from the network scan tab for the PROFINET coupler within Automation Builder if online with the PLC for example). The station name is stored in the drive's object dictionary (i.e. non-volatile storage). The drive performs an internal reboot after setting the new value

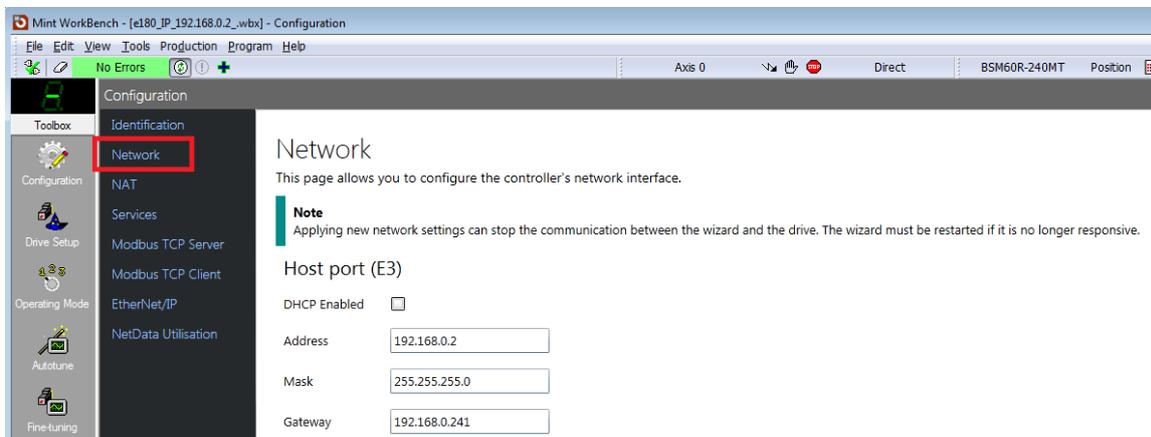
Configuring the drive's IP address

The assignment of the drive's IP address during boot-up (via Dynamic Host Configuration Protocol – DHCP) may be possible if this is supported by the master but a change in IP address might cause conflicts with a configuration made via Workbench so the use of DHCP is not recommended.

Most PROFINET masters allow the user to keep the IP configuration as already present on the device. This is the preferred method for configuration, especially because the front port of the drive can be used for many networks simultaneously (e.g. PROFINET, Modbus TCP, ICM/Workbench connection).

To set the drive's IP address either...

- Use the Configuration wizard in Workbench, select the Network tab and enter the required IP address for the host port (E3), network mask (usually 255.255.255.0) and gateway address (only used if there is a router between the PLC and the drive.....usually this is not the case so the gateway address should be set to an unused IP address on the same subnet)...

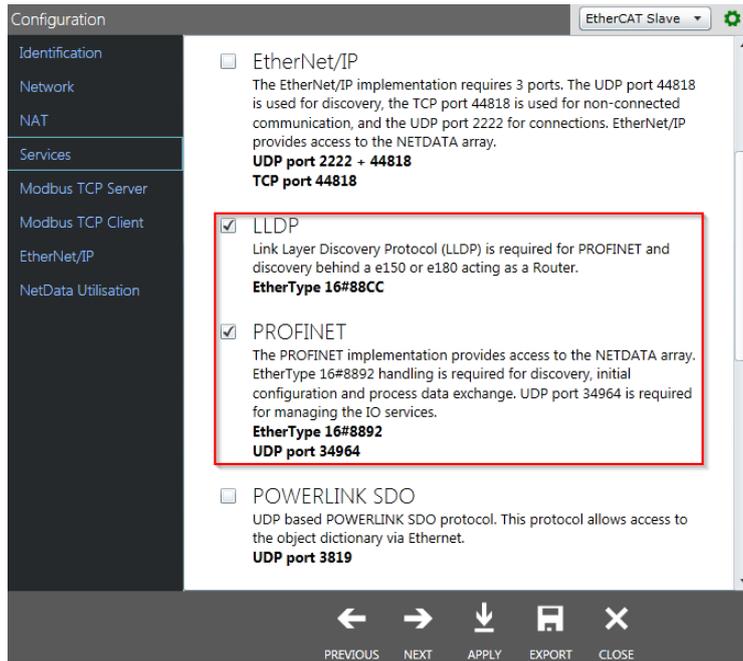


Note: When using an AC500 PLC as the PROFINET master it is very important that the Gateway IP address set on the drive matches the setting in the AC500 PLC project

- Use the drive's PROFINET web page (accessible via the link on the Mint Sidebar application dialog as before)

Enabling the PROFINET service

PROFINET can be disabled for cyber security reasons. It is important to check the setting before trying to get online via PROFINET to the drive. All network services can be configured via the Services page within the configuration wizard in Workbench...



LLDP and PROFINET both need to be selected for correct PROFINET operation. The PROFINET implementation does not provide a SYNC tick that required for closed loop axis control via PROFINET. Instead the implementation exposes the drive's internal NETDATA channels (0-999) allowing the PLC to read/write 32 bit integer or floating point values. This allows control of the axis via the Mint based Generic Drive Interface for example (see application note AN00204 and the attached AC500 project) or the user can create their own Mint applications and use PROFINET to exchange command/status/parameter data.

It is possible to use the drive on an EtherCAT or Ethernet Powerlink (EPL) network (using the two real time Ethernet ports on the top of the drive) and simultaneously have a connection to a PROFINET master.

This concludes the steps necessary for configuration of the drive, from this point onwards all topics relate to configuration of the PROFINET master (e.g. PLC).

Obtaining the GSDML file

The PROFINET master will require a GSDML file to be imported into its “device library”. The GSDML file can be retrieved via two different methods:

- Download the file from the firmware page on the motion support internet page (go to Support by Product and select MotiFlex e180 or MicroFlex e190)....

Support - MotiFlex e180



High performance three phase servo drive with real-time Ethernet and functional safety

Product Information

The resources are applicable for both ABB and Baldor branded products. Baldor is a member of the ABB group.

PC/Windows Tools

Tool Name	Version	Link
Servo Drives package	v1.2.4.0	Link
Mint WorkBench	5822	Link

Firmware

Build: 5860 Released: 23 August 2016

- [Revision History](#)
- [Readme.txt](#)
- [Previous Releases](#)

Title	Link	Catalog No.
EtherCAT Slave Information (ESI) file (XML)	Download	MFE180-04xx...
Ethernet POWERLINK Device Description (XDD) file (XML)	Download	MFE180-04xx...
MotiFlex e180 firmware system file (MSX)	Download	MFE180-04xx...
PROFINET Device Description (GSDML) file (XML)	Download	MFE180-04xx...

- Download the file from the index page of the drive's home (web) page. The page hosts all fieldbus description files that are generated from the drive firmware during boot-up:

Fieldbus description files

Fieldbus	Format	File
EtherCAT	ESI	ABB MotiFlex e180 Build 5863.2 (CoE).xml
POWERLINK	XDD	000000B7_MotiFlex_e180_5863_2.xdd
PROFINET	GSDML	GSDML-V2.32-ABB-MotiFlex e180 5863.2-20161216.xml

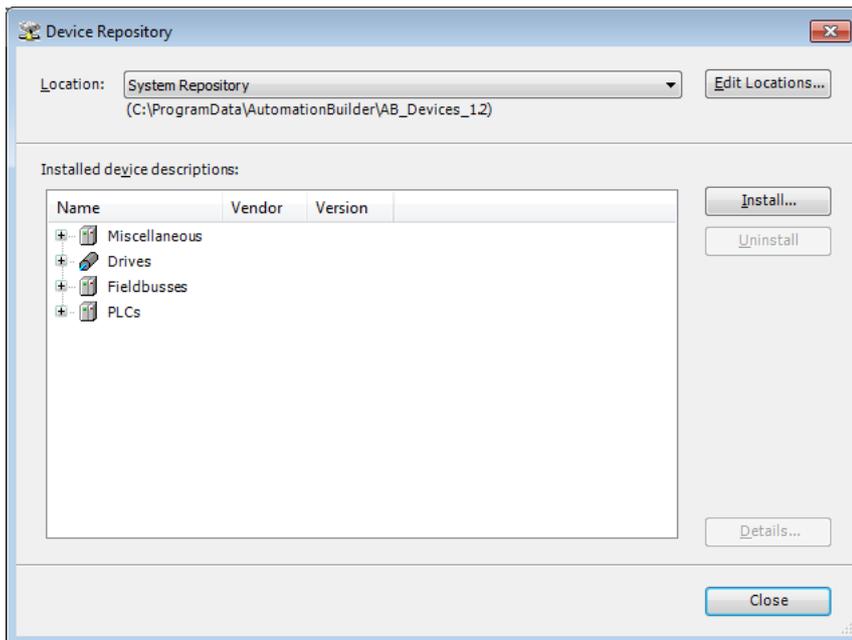
The file name is a compromise between GSDML specification and firmware release process. All files released with a specific firmware version must contain the release number in the file name.

How this file is then used/imported depends on the specific vendor of the PROFINET master (PLC).

AC500 PLC configuration

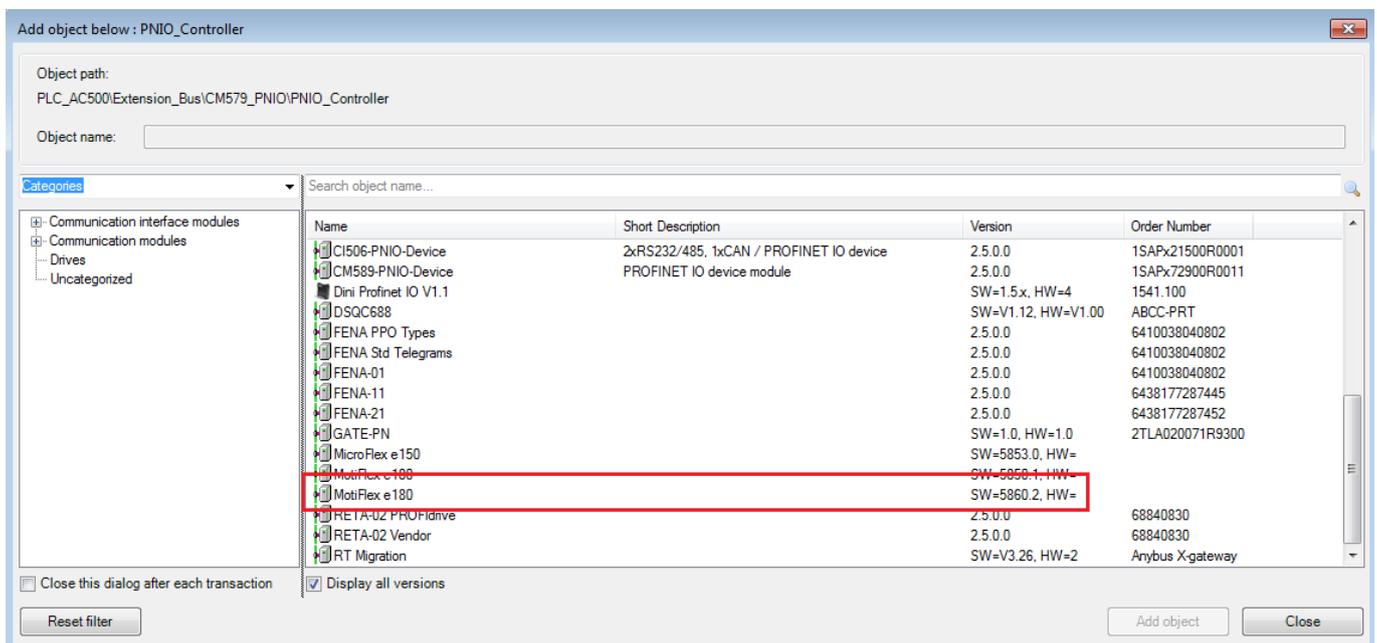
First we must ensure the GSDML file to suit the firmware loaded on our MotiFlex e180 drive is added to the Automation Builder device repository (if we aren't sure it's not already included).

From the Automation Builder menu select Tools>Device Repository...

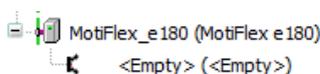


Click on the 'Install...' button and navigate to the GSDML file for the drive (that you either downloaded from the support website or retrieved directly from the drive earlier) and click 'Open'. The file will be imported and the dialog should show that a "MotiFlex e180" device has been installed.

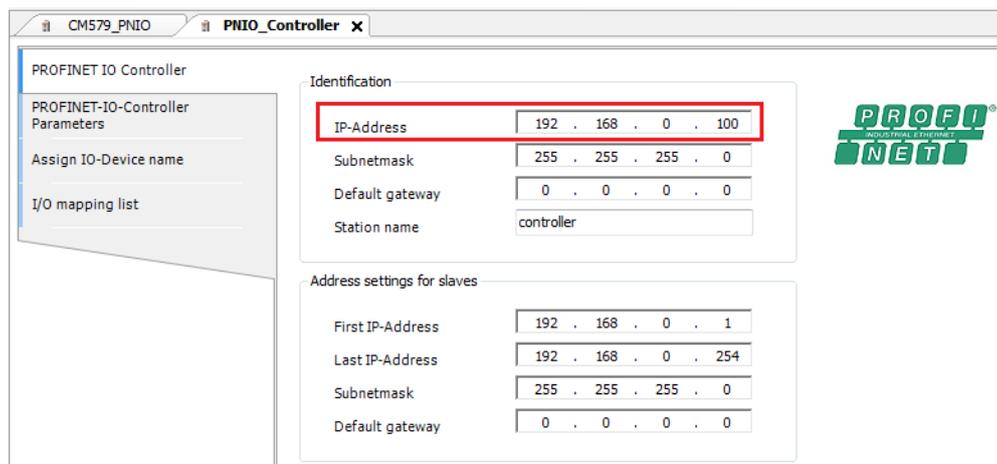
For this application note a CM579-PNIO coupler has been assumed to have been added to the PLC's extension bus and added to the Automation Builder device tree. Right-click the PROFINET controller icon in the device tree and select 'Add object'. A dialog will appear listing all of the available PROFINET slave devices in the repository...



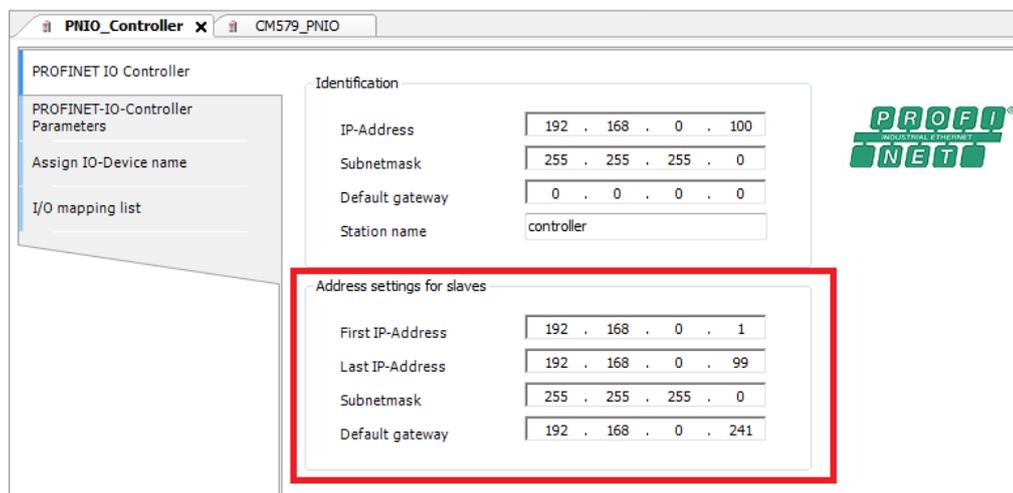
Be sure to select the correct MotiFlex e180 entry if there is more than one (the Version column will show the firmware version associated with the entry). Once selected click the 'Add object' button to add it to the device tree...



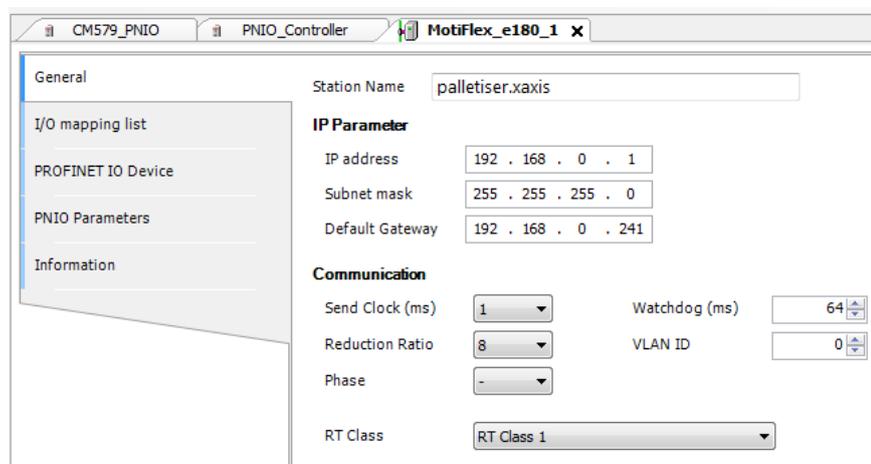
The coupler must be assigned an IP address in the same subnet as the drive (or vice-versa). Double-click the PROFINET controller icon in the device tree. The PROFINET IO Controller tab lets us set the IP address. The default IP address for a MotiFlex e180 drive (or MicroFlex e190 drive) is 192.168.0.1 so we might set the PLC coupler to 192.168.0.100 for example...



We must also setup the address range for the slave devices and make sure the default Gateway for these matches the setting we made on the drive earlier...

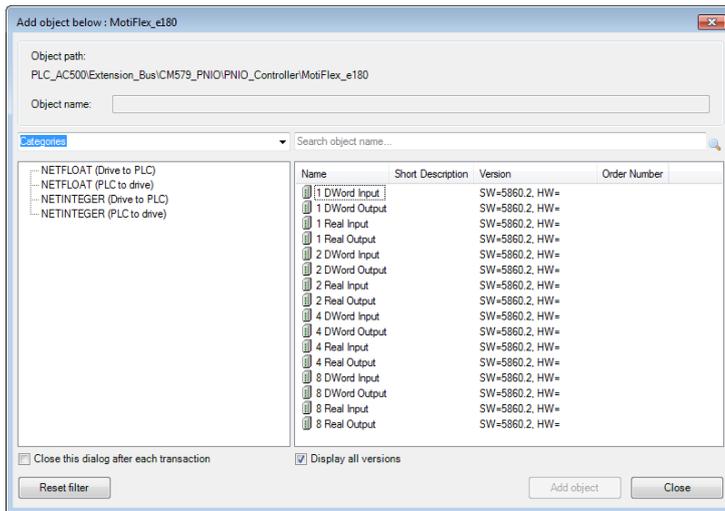


Now double-click the MotiFlex e180 icon in the device tree. The General tab in the right hand pane now allows us to set the expected station name (that we set on the drive itself earlier) as well as the expected IP address for the drive as well as some general PROFINET settings...

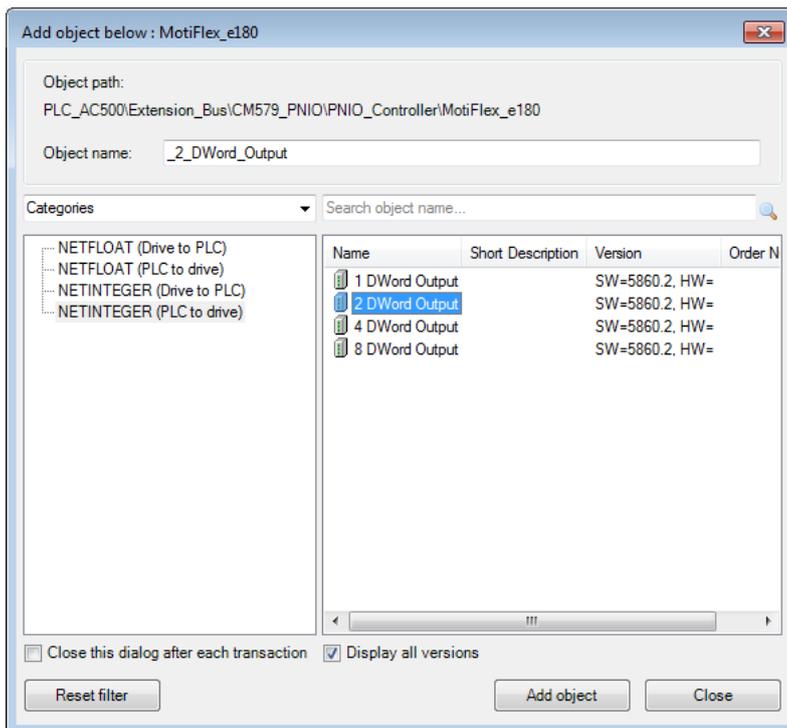


The station name must match the drive's name exactly. Similarly the IP parameters must also match the settings made on the drive earlier. Please refer to the Automation Builder Help system for further information about the general communication parameters. Try to use the longest send rate (combination of Send Clock and Reduction Ratio) you can to minimize the network loading (e.g. there is no point reading data at 4ms intervals if the application doesn't need to react to changes in data any faster than every 500ms).

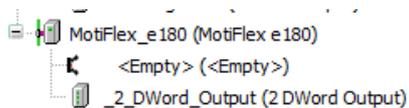
We can now add some PDO mappings between the PLC and drive (in both directions). Right click the MotiFlex e180 icon in the device tree and select 'Add object'. Automation Builder now displays the virtual modules that can be added to PROFINET 'Slot 2' (.63) on the drive...



Options are provided to select whether NETFLOAT or NETINTEGER data is to be sent from the Drive to PLC (PLC inputs), or from the PLC to the Drive (PLC outputs). Modules are then provided for blocks of 1, 2, 4 or 8 NETDATA locations on the drive. There are modules that can be used if 32 bit integer data is to be exchanged (DWord) and modules that can be used if 32 bit IEEE float data is to be exchanged (Real)...as you select a data exchange type in the left hand pane the right hand pane automatically filters to show only the relevant selections...



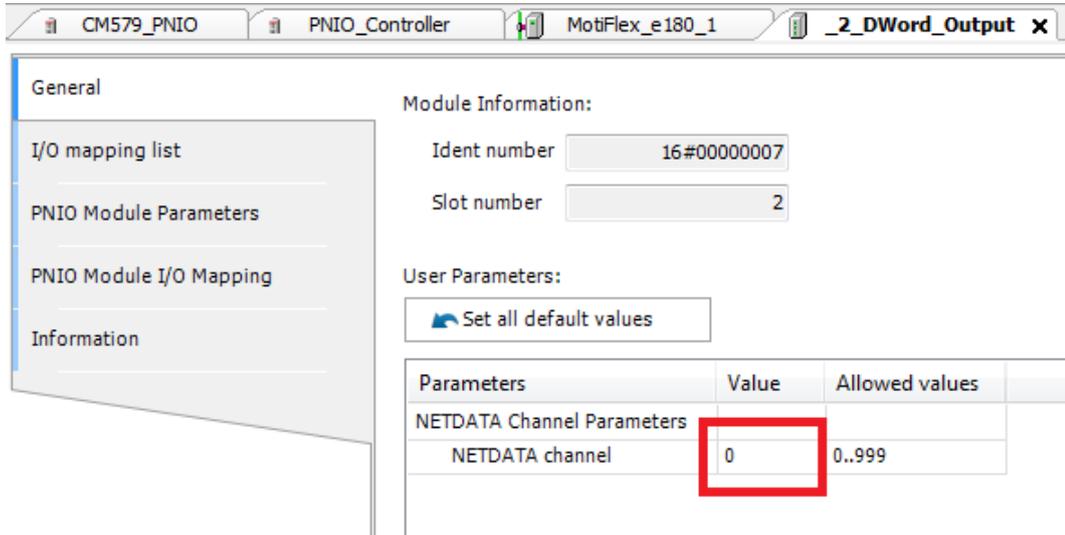
After adding one of these module objects the device tree updates to show the PDO mapping...



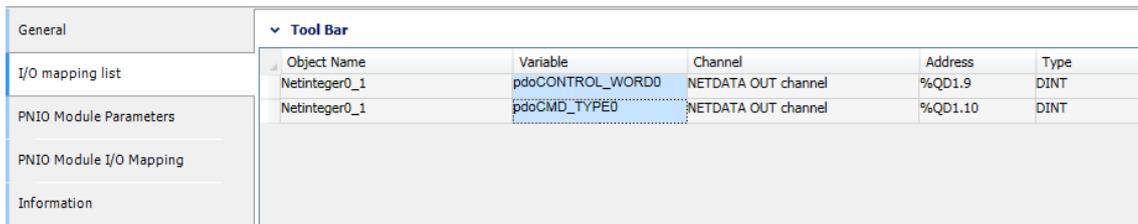
Double-click the PDO entry to access its configuration in the right hand pane. The General tab lets you specify the starting address for the NETDATA locations that have been added. By default this is set to NETDATA channel 0...

So for example, if we just added a 2 DWord mapping from the PLC to the Drive starting at NETDATA channel 0 then the PLC would be expected to write 32 bit integer data to NETINTEGER(0) and NETINTEGER(1) on the drive.

Single click the PDO mapping name (e.g. _2_DWord_Output) and this can be changed to something more meaningful (often using the NETDATA channels in the name makes most sense (e.g. Netinteger0_1 might be a sensible name for our entry above).



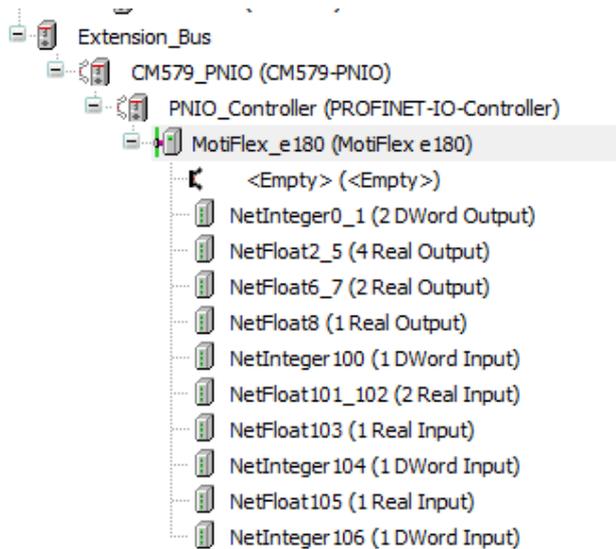
Selecting I/O mapping list or PNIO Module I/O mapping in the right hand pane allows us to give names to each address that will then be used by the 61131 PLC application...



As a more comprehensive example, consider the PDO mappings required for the Generic Drive Interface. The table below shows the most effective way of adding the modules necessary for this interface...

Command word	NetInteger 0	PLC to Drive (2 DWord)
Command type	NetInteger 1	
Value	NetFloat 2	PLC to Drive (4 Real)
Speed	NetFloat 3	
Accel	NetFloat 4	
Decel	NetFloat 5	
Acceljerk	NetFloat 6	PLC to Drive (2 Real)
Deceljerk	NetFloat 7	
Offset	NetFloat 8	PLC to Drive (1 Real)
Status word	NetInteger 100	Drive to PLC (1 DWord)
Measured position	NetFloat 101	Drive to PLC (2 Real)
Measured velocity	NetFloat 102	
Following error	NetFloat 103	Drive to PLC (1 Real)
Axis mode	NetInteger 104	Drive to PLC (1 DWord)
RMS current	NetFloat 105	Drive to PLC (1 Real)
Error code	NetInteger 106	Drive to PLC (1 DWord)

...and this would appear in the device tree as shown below...



The icon labelled '<Empty>' above the Slot 2 mapping is for Slot 1. Slot 1 can be used if attempting to use the MotiFlex e180 to replace an existing drive that is using PROFIDRIVE.

Four module types are provided for Slot 1:

- Standard Telegram 1
- Standard Telegram 2
- PPO Type 3
- PPO Type 4

The example below shows how the mapping works for a PPO Type 4 module...

Input name	NETDATA location
Status word 1 (ZSW1)	NETDATA channel 0
Main actual value (HIW)	NETDATA channel 1
Actual value (PZD3)	NETDATA channel 2
Actual value (PZD4)	NETDATA channel 3
Actual value (PZD5)	NETDATA channel 4

PROFIDRIVE uses 16 bit integer data and each 16 bit value is located in a single NETDATA location (which is 32 bits wide). A Mint program on the drive must be used to interpret and act on the PROFIDRIVE command word and provide the necessary status word data, the drive does NOT internally support the PROFIDRIVE profile.

ABB does not currently provide a standard template for this so it is recommended wherever possible to use the Mint Generic Drive Interface in combination with Slot 2 PDO mappings for both new and retrofit applications.

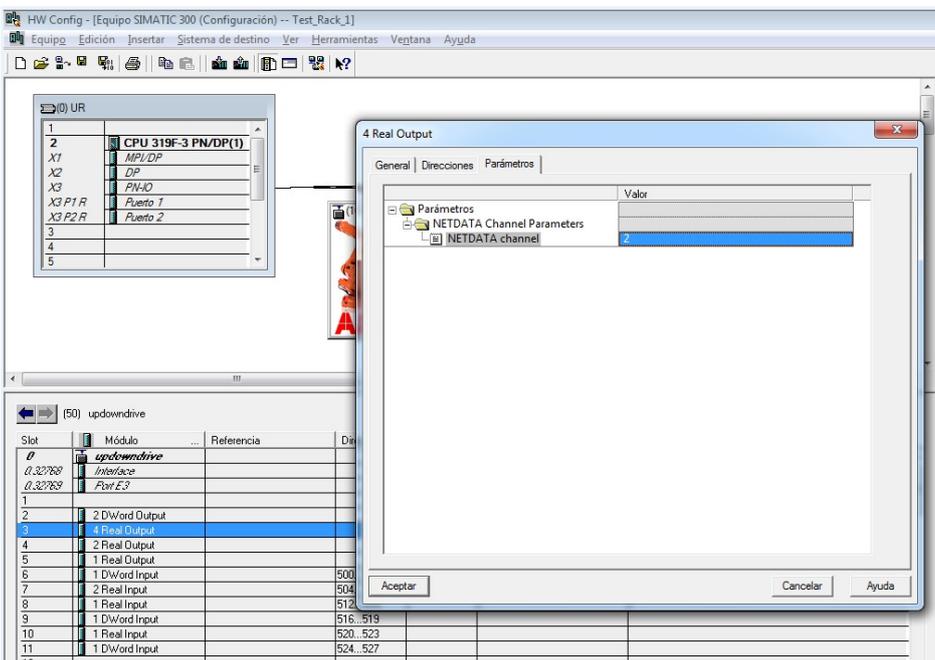
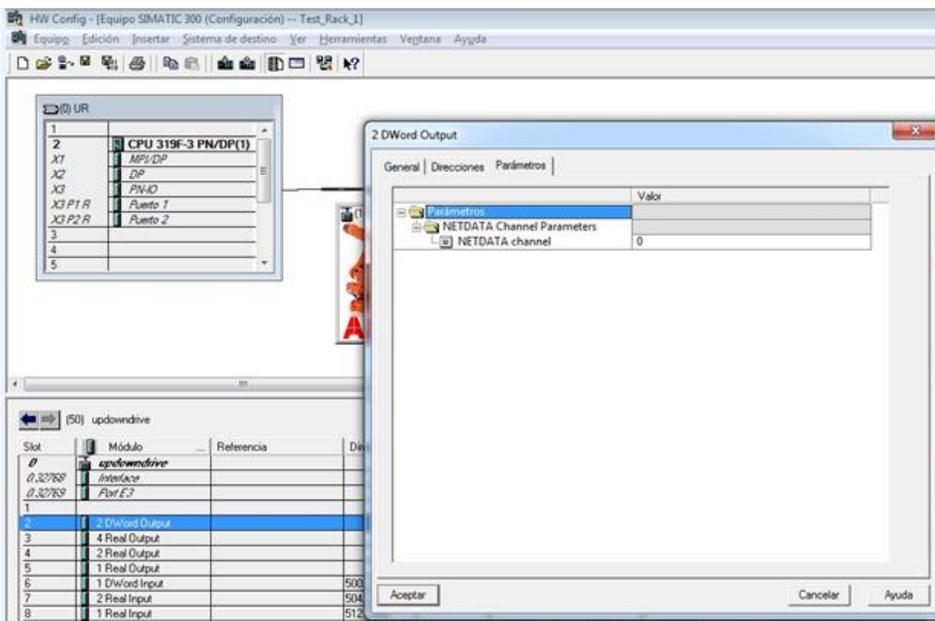
Using a Siemens or VIPA PLC

The process for using these PLCs is very similar (i.e. the GSDML file must be imported, relevant 'PLC to Drive' and 'Drive to PLC' modules must be added to the configuration, the start NETDATA location for each module added must be set, the drive name must be configured etc...). The screen shots below illustrate how the previously detailed configuration steps appear within Step 7 software...

GDI mappings added to slots on the device:

Slot	Módulo	Referencia	Dirección E	Dirección S	Dirección de diagnóstico	Comentario
0	updowndrive				8182*	
0.32768	Interface				8181*	
0.32769	Port E3				8180*	
1						
2	2 DWord Output			500...507		
3	4 Real Output			508...523		
4	2 Real Output			524...531		
5	1 Real Output			532...535		
6	1 DWord Input		500...503			
7	2 Real Input		504...511			
8	1 Real Input		512...515			
9	1 DWord Input		516...519			
10	1 Real Input		520...523			
11	1 DWord Input		524...527			
12						

Configuring the Netdata address for each slot (via right-click):



One area that can cause some confusion though with these PLC types is the addressing of the PLC data and how this corresponds to the NETDATA on the drive. The table below attempts to clarify this (assumes that NetInteger(0) has been mapped as an output to QD0)...

MSB								NETINTEGER (0)								LSB							
QD0																							
QW0												QW2											
QB0						QB1						QB2						QB3					
0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000		

MSB								NETINTEGER (1)								LSB							
QD4																							
QW4												QW6											
QB4						QB5						QB6						QB7					
0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000		

MSB								NETINTEGER (2)								LSB							
QD8																							
QW8												QW10											
QB8						QB9						QB10						QB11					
0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000		

Examples:

Writing 123 to QD0 in the PLC will result in 123 appearing in NetInteger(0) on the drive.

Setting Q3.0 in the PLC will result in setting 1 (the LSB) in NetInteger(0) on the drive.

Setting Q1.0 in the PLC will result in setting 65536 (bit 16) in NetInteger(0) on the drive.

The same principle applies to PLC input addressing.

Contact Us

For more information please contact your local ABB representative or one of the following:

www.abb.com/motion
www.abb.com/drives
www.abb.com/drivespartners
www.abb.com/PLC

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