

Operating a PowerXL DC1/DE1 Drive with a Rockwell PLC on Ethernet/IP

Introduction

The purpose of this application note is to demonstrate how to operate a PowerXL DC1/DE1 drive via Ethernet/IP and a Rockwell ControlLogix PLC with a 1756-EN2T Ethernet/IP scanner. There is an Ethernet/IP module for the DC1/DE1 drives to interface them to Ethernet/IP. This module is catalog number DX-NET-ETHERNET2-2. The drive needs to be configured with an IP address for Ethernet communications. The default IP address is: 192.168.1.254.

The IP address for the drive is set via Web Pages. Enter the IP address of the drive onto the command line in your web browser to open the web pages.

While this application example uses a CompactLogix controller with an integral Ethernet/IP scanner port to control and monitor the PowerXL DC1/DE1 drive over Ethernet/IP, any Ethernet/IP scanner may be used for this purpose. Using RSLogix 5000, the controller will be configured to poll the PowerXL DC1/DE1 drive to operate the drive and monitor motor data.

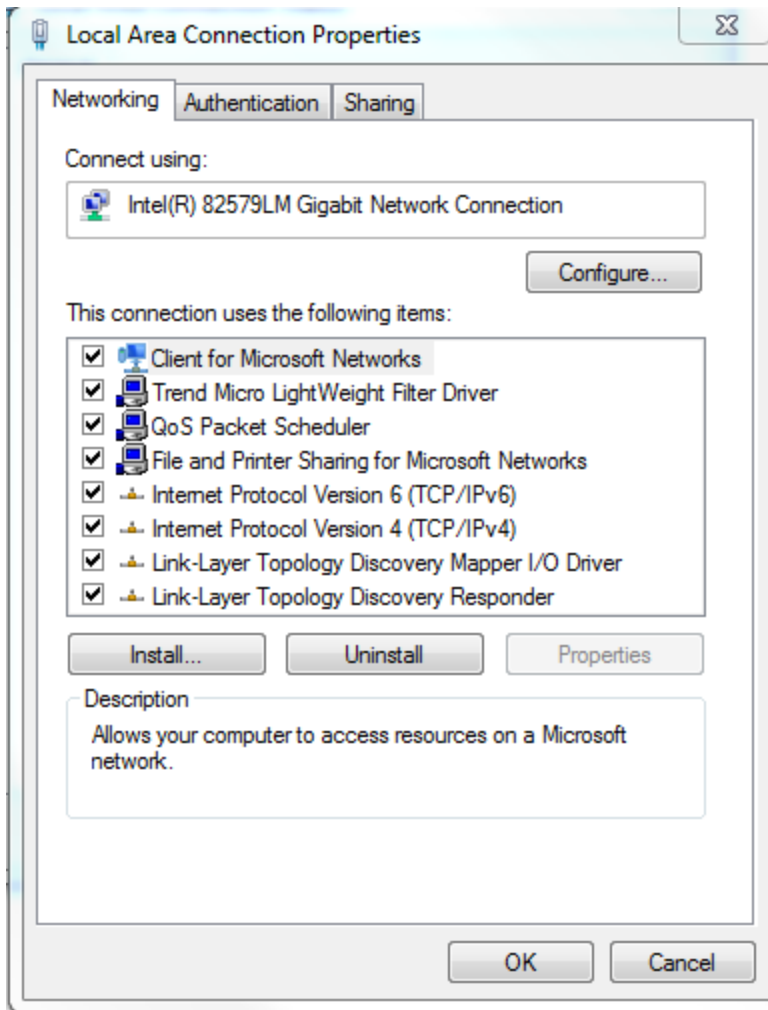
Beginning with version 20 of RSLogix 5000, Ethernet/IP EDS files can be imported into the software tool allowing Eaton motor control products to be easily added to a project by name. It also allows the I/O assemblies to be selected from a list for each device, making this process straight-forward as well.

Eaton also has Add-On Instructions for Ethernet/IP motor control products including one for the DC1/DE1 drive that can be imported into any RSLogix 5000 project. This AOI also creates all the descriptive tags for the DC1/DE1 drive and relates them to the generic I/O tags created for the DC1/DE1 by RSLogix 5000. The AOI also takes care of any scaling of analog values such as speed and current and splits the fault code from the high byte of the status word so it can be more easily read. The AOI can be found on the Eaton website for the PowerXL DC1 drive (www.eaton.com/drives).

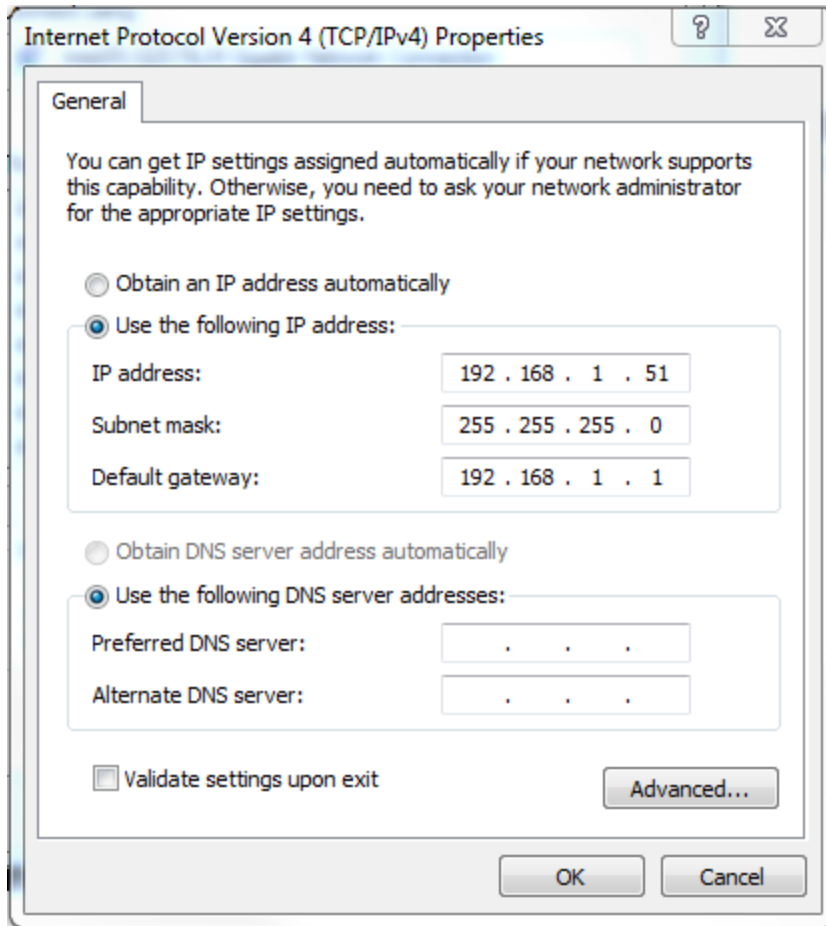
Change the IP Address of your computer

To change the IP address for a computer running Windows 7, follow the procedure below:

1. From the Start menu, choose Control Panel. From the Control Panel, choose Network and Sharing Center.
2. With the computer connected to an Ethernet network, select the Local Area Connection. Unless the computer is connected to a network, this Local Area Connection will not be present.
3. The Local Area Connection Status window will be displayed. Select Properties.
4. From the window shown below, select Internet Protocol Version 4 (TCP/IPv4) to highlight it, then select Properties.



5. Per the following window, select Use the following IP Address, then enter an IP address, Subnet mask and a Default gateway if it applies.



- When finished, select OK and close all the windows used along the way. Your computer's Ethernet port will now be actively using the IP address and Subnet mask you just entered.

Configuring the PowerXL DC1/DE1 Drive – IP Address

The IP addresses for the devices used in this example will be as follows:

PowerXL DC1/DE1 Drive:	192.168.1.254 (default)
CompactLogix:	192.168.1.2
Computer:	192.168.1.51

Subnet mask: 255.255.255.0

Connect your computer, PLC and the PowerXL DC1/DE1 drive to an Ethernet switch.

To configure the IP address of the DC1/DE1 drive, open your web browser and enter the IP address of the drive onto the command line. The Web Pages for the DC1/DE1 drive will open as follows:

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SYSTEM CONFIGURATION

Attribute	Value
Product Name	DX-NET-ETHERNET2-2
Revision	001.002
Production Serial Number	58581304003
ODVA EtherNet/IP Vendor ID	00068
Product Code	0x3028
Protocol Serial Number	0xA1E80003
MAC Address	00:13:45:3B:83:A2
Build Data	T:11C-A:11C0471030F710811A108-L:93030001

STATUS

Data Valid

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Select Network Settings to change the IP Address of the DC1/DE1 drive as follows:

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NETWORK SETTINGS (ETHERNET/IP CLASS0xF5 TCP/IP)

Attribute	Default	Configured	Working Value	Unit
Configuration Method	0	0	0	0:fixed 1:DHCP
DNSEnable	0	0	0	0:disabled 1:enabled
IP Address	192.168.001.254	192.168.001.254	192.168.001.254	IPv4 dotted-decimal
Network Mask	255.255.255.000	255.255.255.000	255.255.255.000	IPv4 dotted-decimal
Gateway Address	192.168.001.200	192.168.001.200	192.168.001.200	IPv4 dotted-decimal
Name Server	000.000.000.000	000.000.000.000	000.000.000.000	IPv4 dotted-decimal
Name Server 2	000.000.000.000	000.000.000.000	000.000.000.000	IPv4 dotted-decimal
Domain Name	"	"		
Host Name	'DX-2716336131'	'DX-2716336136'	DX-2716336136	
Encapsulation Inactivity Timeout	120	120	120	seconds 0:disabled

STATUS

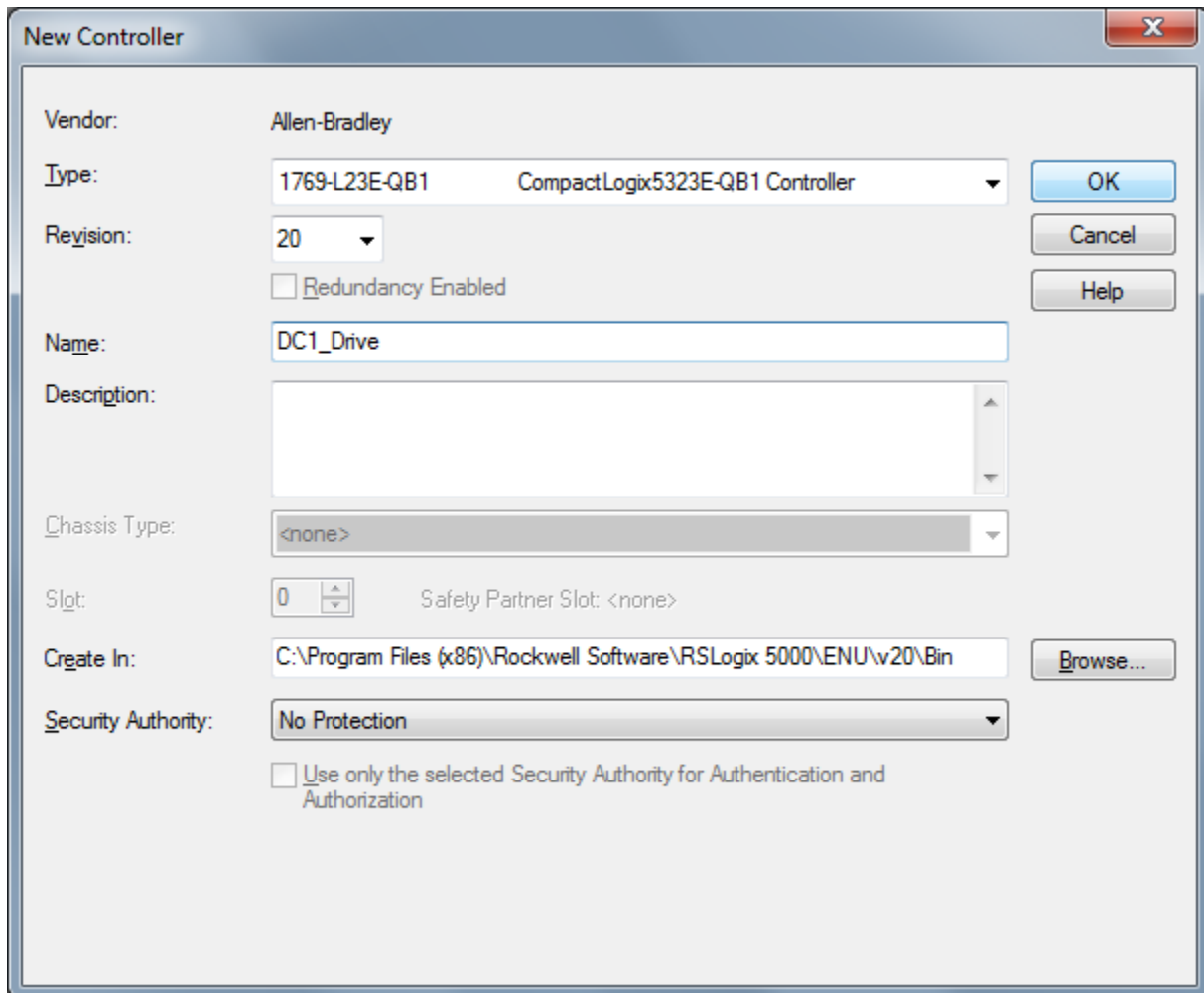
Data Valid

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As noted above, the IP address for the drive in this example is 192.168.1.254.

Creating a Project in RSLogix 5000

Create a project in RSLogix 5000. Give the project a name and select the controller type, per the following:



The screenshot shows the 'New Controller' dialog box with the following configuration:

- Vendor: Allen-Bradley
- Type: 1769-L23E-QB1 (CompactLogix5323E-QB1 Controller)
- Revision: 20
- Redundancy Enabled
- Name: DC1_Drive
- Description: (empty)
- Chassis Type: <none>
- Slot: 0 (Safety Partner Slot: <none>)
- Create In: C:\Program Files (x86)\Rockwell Software\RSLogix 5000\ENU\w20\Bin
- Security Authority: No Protection
- Use only the selected Security Authority for Authentication and Authorization

Select OK to create the project.

Install EDS Files for Eaton Products into RSLogix 5000

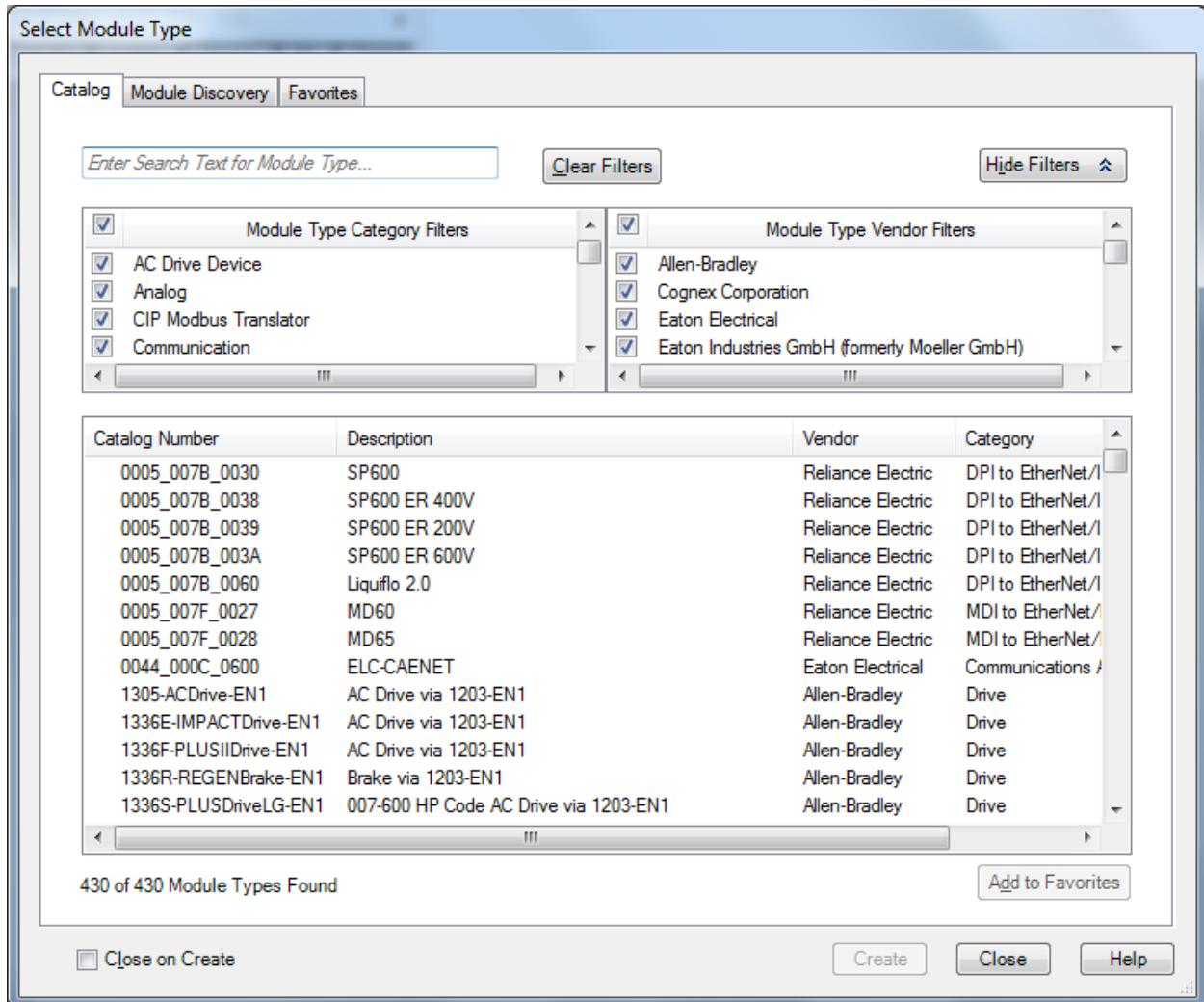
There is an Ethernet/IP EDS file for all Eaton Ethernet/IP products, compatible with RSLogix 5000, version 20 or later. These files can be installed into the RSLogix 5000 software via the following:

1. Download the EDS files for Eaton Ethernet/IP products from the following link: www.eaton.com/drives. The eds files are under OEM Drives, then either under the PowerXL DE1 or PowerXL DC1. Download and save the eds files on your harddrive.
2. Select the Tools drop down menu in RSLogix 5000
3. Select EDS Hardware Installation Tool
4. Follow the installation wizard, browsing for the EDS file previously saved to your hard drive.

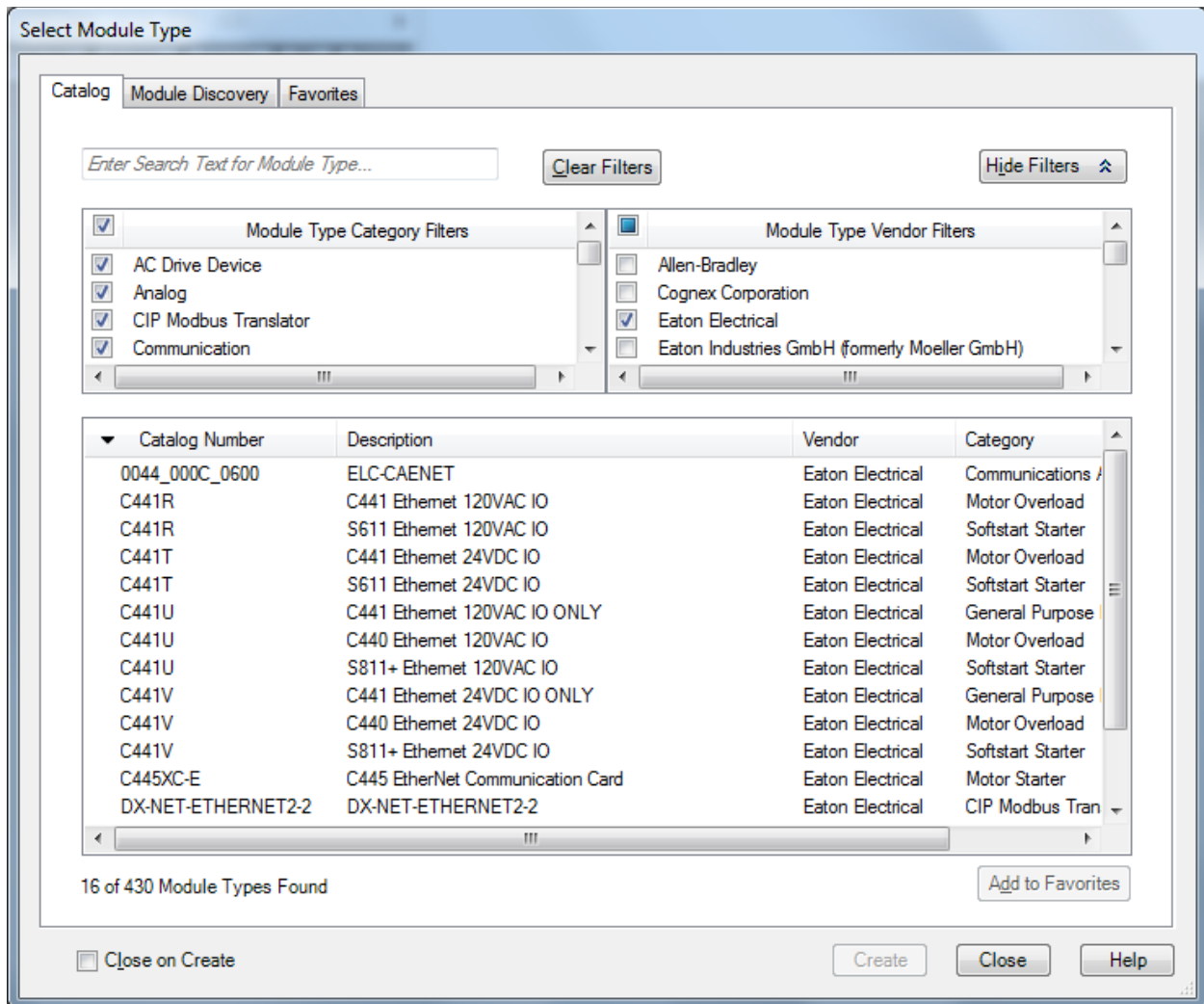
Once the EDS file has been installed into RSLogix 5000, the DC1/DE1 drive can be added to an Ethernet/IP network, per the following.

Creating an Ethernet/IP Network in RSLogix 5000

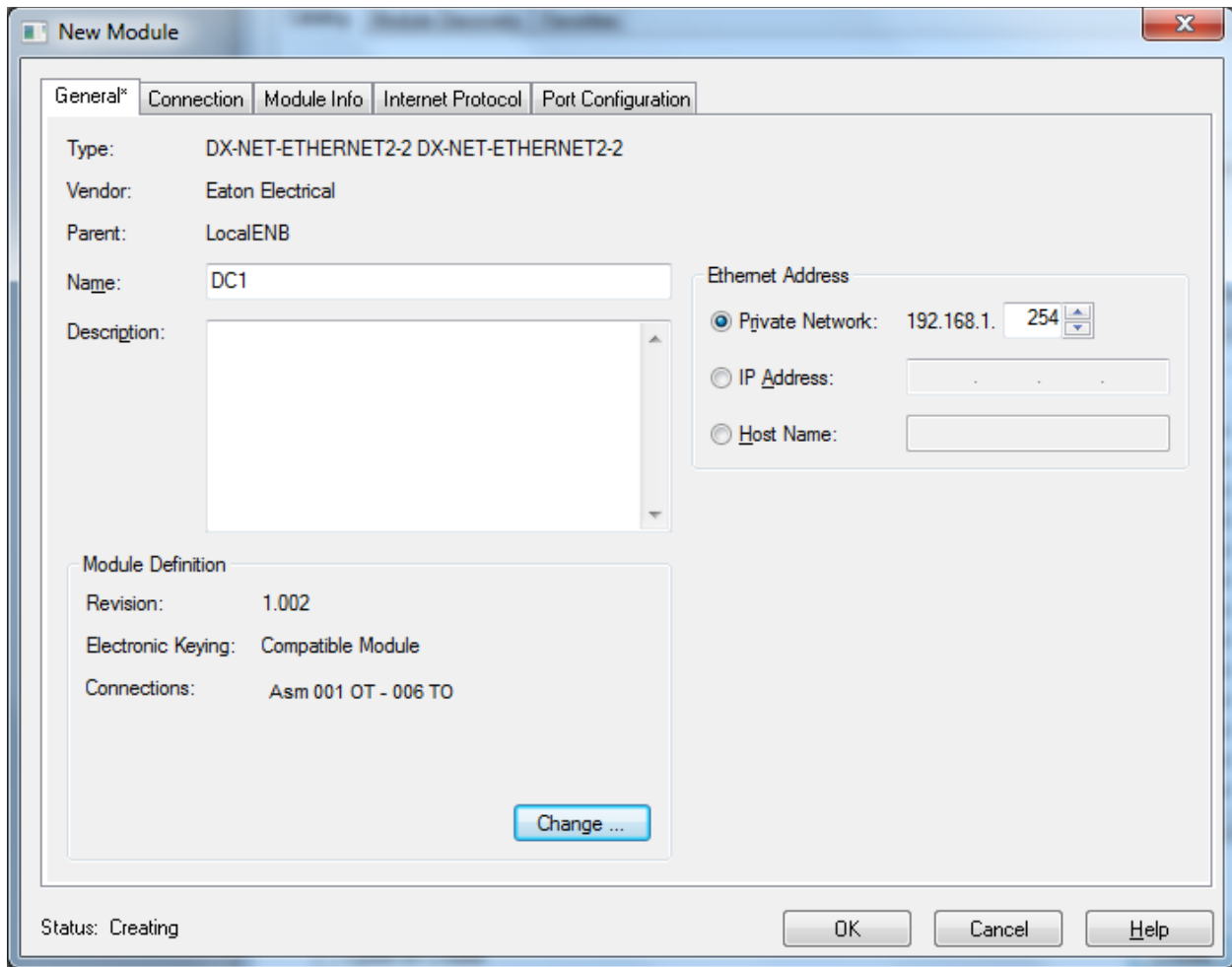
On the Controller Organizer on the left portion of the project screen in RSLogix 5000, near the bottom, right click on Ethernet and select New Module. The following screen will open:



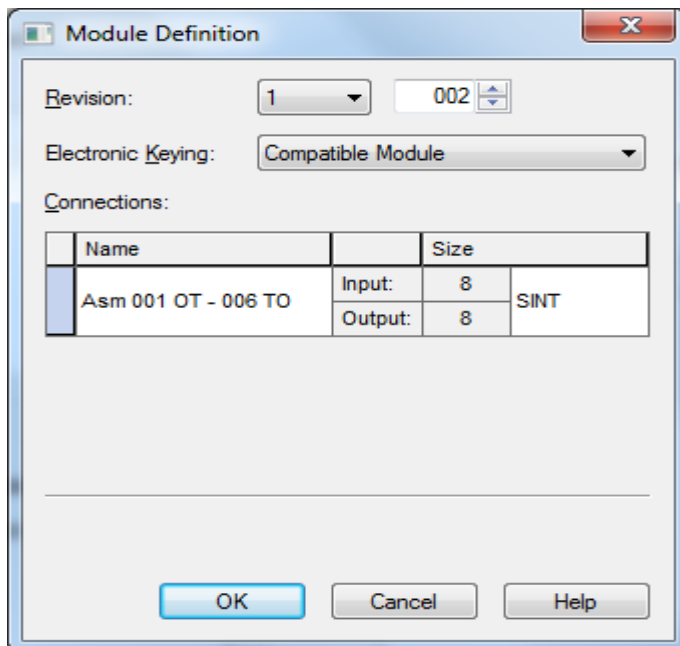
Select the checkmark to the left of Module Type Vendor Filters to clear all check marks on the right portion of the window. Then select "Eaton Electrical" to check the box to its left and only Eaton products will be displayed below, as follows:



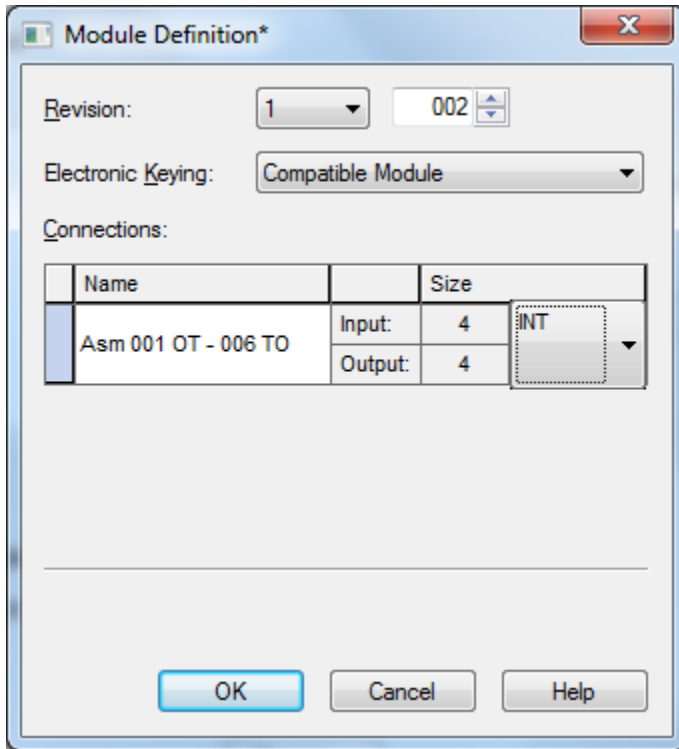
Select the DX-NET-ETHERNET2-2 from the list, then select Create. This same eds file is used for the DC1 and DE1. Fill in the necessary information: Device Name, IP address and I/O assemblies as shown below. Note that there is only one I/O assembly pair for these devices. The I/O assembly pair for the DC1 drive is the same for the DE1 drive.



To view the Module Definition window, select the Change button and the following window will open:



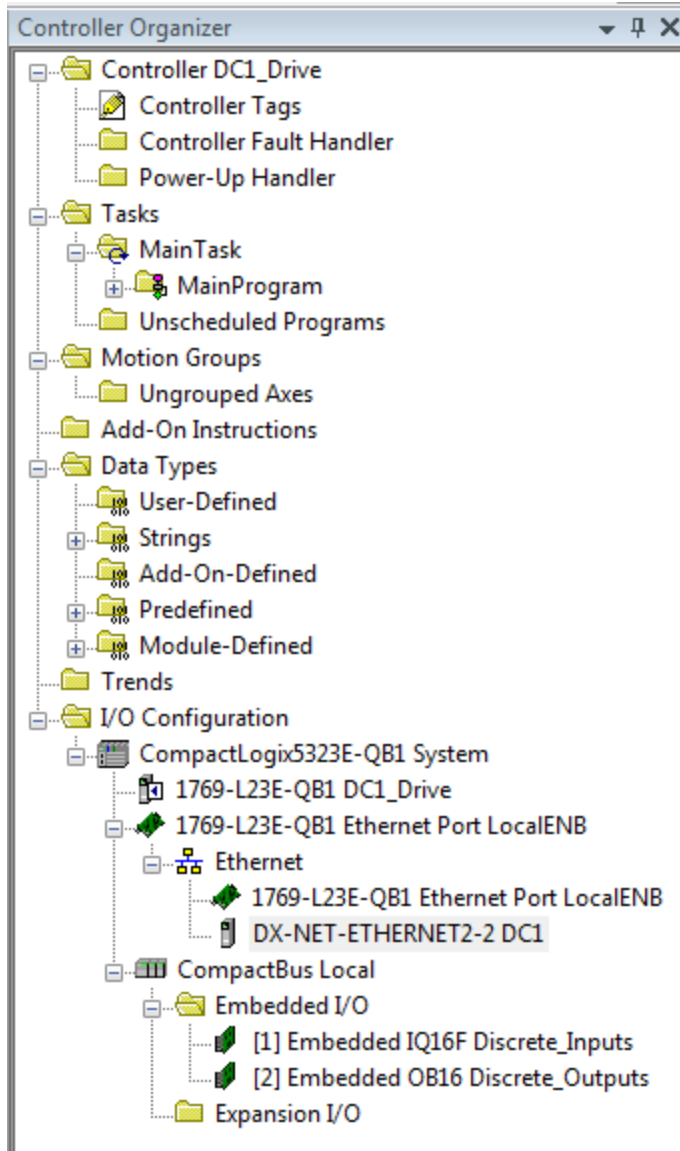
It is highly recommended that the data type be changed from SINT to INT as follows:



Much of the I/O data to and from the drive are 16-bit word values, such as motor speed and motor current. This makes viewing and setting these values much more straight forward. Another option is to download the Add-On Instruction developed for the DC1/DE1 drive. The AOI creates all I/O tags in the proper data type, such as BOOL, Bytes and Words. It also handles all the scaling and provides data in engineering units. The AOI can be used as many times in your program as the number of drives in the system. The AOI for the DC1/DE1 drives as well as for all Eaton Ethernet/IP motor control products can be found on the Eaton website at www.eaton.com.

Select OK to close and save this screen. Then select OK to the New Module window just created, then Close the Select Module Type screen.

The DX-NET-ETHERNET2-2 should now be displayed in the Controller Organizer under Ethernet as shown below:



If you choose to use the Add-On Instruction for the DC1/DE1 drives, this would be a good time to import it into your project. Complete instructions for using AOIs is provided with the AOI.

If you do not use the Add-On Instruction for the DC1/DE1 drives, generic I/O tags will need to be used. They have been created in the Controller Tags area as follows:

Name	Value	Force Mask	Style	Data Type
DC1:I	{...}	{...}		_0044:DX_NET_ETHERNET2_2_A07...
DC1:I.ConnectionFaulted	0		Decimal	BOOL
DC1:I.Data	{...}	{...}	Decimal	INT[4]
DC1:I.Data[0]	0		Decimal	INT
DC1:I.Data[1]	0		Decimal	INT
DC1:I.Data[2]	0		Decimal	INT
DC1:I.Data[3]	0		Decimal	INT
DC1:O	{...}	{...}		_0044:DX_NET_ETHERNET2_2_A52...
DC1:O.Data	{...}	{...}	Decimal	INT[4]
DC1:O.Data[0]	0		Decimal	INT
DC1:O.Data[1]	0		Decimal	INT
DC1:O.Data[2]	0		Decimal	INT
DC1:O.Data[3]	0		Decimal	INT
Local:1:C	{...}	{...}		AB:Embedded_IQ16F:C:0
Local:1:I	{...}	{...}		AB:Embedded_IQ16F:I:0
Local:2:C	{...}	{...}		AB:Embedded_OB16:C:0
Local:2:I	{...}	{...}		AB:Embedded_OB16:I:0
Local:2:O	{...}	{...}		AB:Embedded_OB16:O:0

Note there are 4 generic integer Input tags and 4 generic integer output tags for the DC1/DE1. These tags do contain the name provided for this device.

The data layouts for the 4 input and output words are described below. Each assembly is 8 bytes, or 4 words (INTs). The data layouts are as follows. They're shown in words.

Process data field

Master → Slave	CW	REF	PDI 3	PDI 4
Slave → Master	SW	ACT	PDO 3	PDO 4

The length of each data unit is 1 word.

The following is a description of each value.

Description of data content

Byte:	Meaning	Explanation
CW	Control word	Command
SW	Status word	Status Word
REF	Reference Value	Setpoint value
ACT	Actual Value	Actual value
PDO	Process Data Out	Process data output
PDI	Process Data In	Process data input

The Reference value is Speed Reference and the Actual Value is Speed Actual in 0.0 – 60.0 Hz (scaled: 0-600).

Control Word

PNU	Description	
	value = 0	value = 1
0	stop	Operation
1	Clockwise rotating field (FWD)	Anticlockwise rotating field (REV)
2	No action	Fault Reset
3	No action	free run-down
4	Not used	
5	No action	Quick stop (ramp)
6	No action	Fixed frequency 1 (FF1)
7	No action	Overwrite setpoint value with 0
8	Not used	
9	Not used	
10	Not used	
11	Not used	
12	Not used	
13	Not used	
14	Not used	
15	Not used	

Speed Reference Value

The permissible values fall within the range of P1-02 (minimum frequency) and P1-01 (maximum frequency). This value is scaled by a factor of 0.1.

Process Data Input 3 (PDI3)

This value is not used.

Process Data Input 4 (PDI4)

Acceleration Time:

This parameter is fixed and represents . The permissible values fall within the following ranges, based on which drive is used. This value is scaled with a factor of 0.01.

DC1: 0 to 600 sec

DE1: 0 to 300 sec

Status Word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB
Error Messages								Device status							

Device status

Bit	Description	
	value = 0	value = 1
0	Drive not ready	ready for operation (READY)
1	stop	Operation (RUN)
2	Clockwise rotating field (FWD)	Anticlockwise rotating field (REV)
3	no error	Fault detected (FAULT)
4	Acceleration ramp	Frequency actual value equals setpoint input
5	–	Zero speed
6	Speed control deactivated	Speed control activated
7	Not used	

Fault Codes

Failure code [hex]	Value shown on display	Description
00	5t aP	Stop, ready for operation
01	0l -b	Brake chopper overcurrent
02	0L -br	Braking resistor overload
03	0- l	<ul style="list-style-type: none"> Overcurrent at frequency inverter output Motor overload Overtemperature on frequency inverter heat sink
04	l -t-rP	Motor, thermal overload
05	P5 -trP	Internal fault (power section)
06	0. Ua l E	Overvoltage (DC link)
07	H. Ua l E	Undervoltage (DC link)
08	0-t	Overtemperature (heat sink)
09	U-t	Overtemperature (heat sink)
0A	P-dEF	Default settings (parameters have been loaded)
0C	E-tr iP	external error message
0C	5C -trP	Field bus error
0D		reserved
0E	P-L055	Phase failure (mains side)
0F	5Pl n-F	Motor pick-up control function (for catching spinning motors) failed
10	th -Fl t	Internal thermistor fault (heat sink)
11	dRtR -F	EEPROM checksum fault
12	4-20 F	Analog input: <ul style="list-style-type: none"> Out-of-range value Wire breakage (4-mA monitoring)

Actual Speed

The DC1/DE1 variable speed starters actual speed will fall within the range of P-02 (minimum frequency) and P-01 (maximum frequency). The value is scaled by a factor of 0.1.

Process Data Out 3 (PDO3)

This value is fixed and represents motor current. The motor current is scaled by a factor of 0.1.

Process Data Out 4 (PDO4)

This value is not used.

Additional information concerning this I/O data is described in the DC1/DE1 drive Ethernet/IP user manual.

To operate the DC1/DE1 drive on Ethernet/IP, there needs to be a jumper added to the drives terminals.

DC1: Connect a jumper between terminals 1 and 2. Then, the drive may be operated via Ethernet/IP.

DE1: Connect a jumper between terminals 2 and 3. Then, the drive may be operated via Ethernet/IP.

For both drives, configuration parameter P-12 needs to be set to a value of 3 for Modbus control. That allows these drives to be controlled and monitored via Ethernet/IP.

References

PowerXL DC1 Series VFD User Manual, Publication MN04020003Z_EN

PowerXL DE1 Series VFD User Manual, Publication MN040011EN

PowerXL DC1/DE1 Series VFD Ethernet/IP Manual, Publication MN040024EN

Additional Help

In the US or Canada: please contact the Technical Resource Center at 1-877-ETN-CARE or 1-877-326-2273 option 2, option 6.

All other supporting documentation is located on the Eaton web site at www.eaton.com/drives



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