

## PowerFlex 4 – class application note

### Controlling a drive using an AnyBus DeviceNet gateway

October 28, 2002

#### Purpose

The purpose of this document is to provide set-up and capability details of the PowerFlex4 class of ac drive on DeviceNet using the HMS systems AnyBus DeviceNet gateway..

This application note assumes that the user is familiar with the programming procedures of the PF4.

The AnyBus DeviceNet gateway ABC-DEV, is a DIN rail mountable module that provides a RS485 sub-network that can be used to multi-drop several PF4 drives on a Modbus network. The Fieldbus connector is used to connect to DeviceNet, which will be one node on the DeviceNet network. The module also has a pc connector to allow configuration of the module with the ABC configuration software tool. Power at 24V is also required typically at 100mA.

The number of PowerFlex4 drives supported by an ABC module depends on the number of messages configured for each drive. A message (a transaction query & response) consumes 2 instances. An ABC module will support up to 50 instances. Therefore each ABC module can access 25 parameters total. This is a very simplistic view of control, as broadcasting data will reduce the number of transactions, and increase the number of parameters that can be sent.

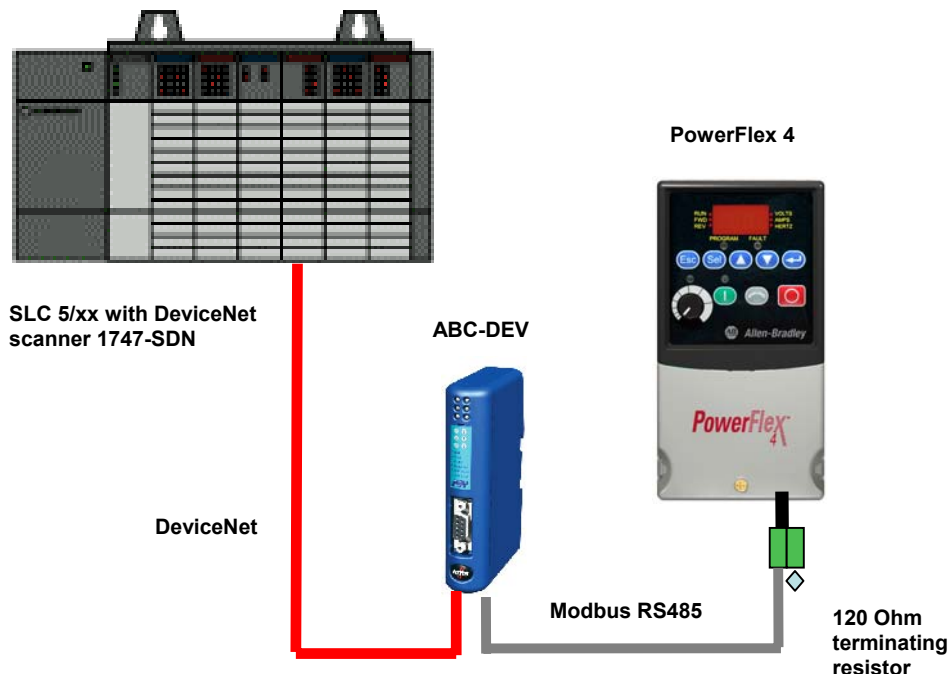
So the ABC DeviceNet module could support 1 drive with 25 parameters total to/from the drive, or 6 drives in a multi-drop with control word, status, reference & feedback (4 parameters/drive).



Address	sw. 3	sw. 4	sw. 5	sw. 6	sw. 7	sw. 8
0	OFF	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	OFF	ON	ON
...	...	...	...	...	...	...
62	ON	ON	ON	ON	ON	OFF
63	ON	ON	ON	ON	ON	ON

Baud rate, bits/sec.	sw. 1	sw. 2
125k	OFF	OFF
250k	OFF	ON
500k	ON	OFF
Reserved	ON	ON

## System Diagram



## RS-485 Wiring Diagrams

The PowerFlex 4 uses an RJ45 socket for the RS-485 connection, primarily to allow for quick and easy connection of our software tools (uses 22-SCM-232 serial converter) and HIMs (22-HIM-\*). For RS-485 multi-drop network applications, the following two wiring options can be employed:

- 1.) RJ45 Splitter Adapter cable - Since RS-485 is daisy-chained, for multiple drives there will be two cables connected at each drive (incoming from previous drive and outgoing to the next drive). A splitter converts a single RJ45 socket connection into two RJ45 socket connections, allowing RJ45 plug cables to be used.
- 2.) RJ45 to Terminal Block cable and to ABC subnet - To avoid using an RJ45 Crimping tool, a simple RJ45 to terminal block cable can be used instead of an RJ45 Splitter Adapter. The benefit is all wire terminations use screw terminals so no special tools are required.

Both wiring options are covered in more detail below.

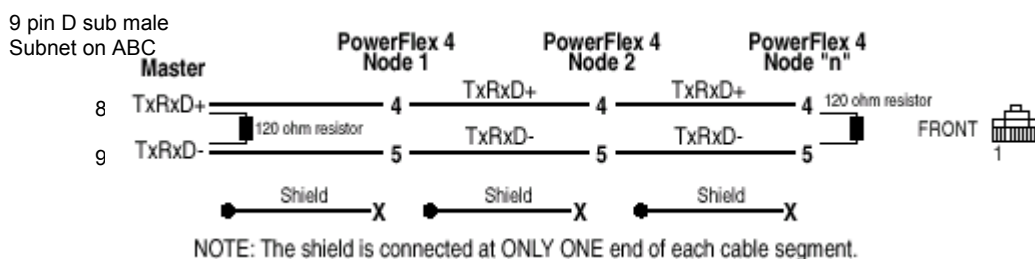
### RJ45 Splitter Adapter cable

Splitters are off-the-shelf items available via 3rd Party suppliers. To allow for clearance issues, the splitter needs to include a length of cable between the RJ45 plug and 2-port RJ45 socket as opposed to a T-adapter version.



**Example 3rd Party RJ45 Adapter Splitter cable**

The network cable would be wired as follows:



Note that only two wires are used, connecting to pins 4 and 5. DO NOT USE 8-CONDUCTOR CABLES AND CONNECT ALL OF THE WIRES. Some of the RJ45 pins on the PowerFlex 4 contain power and ground connections for peripheral devices and must not be connected drive to drive.

The 120-ohm resistor can easily be added to the SUBCON connector since it uses screw terminals. Connecting the other 120-ohm resistor involves crimping a resistor directly on an RJ45 plug or using an RJ45 plug terminator from a 3rd party (note the resistor must be on pins 4 and 5).

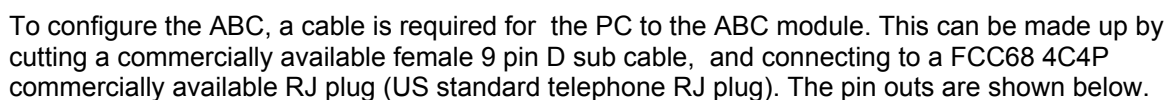
### RJ45 to Terminal Block

As previously stated, the RJ45 to terminal block cable eliminates the need for using an RJ45 crimping tool and allows for screw terminal connections for all of the wires. It's also easier to connect the 120-ohm terminating resistor on the last drive. In this example, approximately 10" from the ends of a 22-RJ45CBL-C20 were cut, creating two pigtail cables. A Phoenix Contact Inverted Combicon plug (#18 25 527) was wired to the cable and a Phoenix Contact 2-row Combicon plug (#18 53 120) was connected to it.



**RJ45 to Terminal Block cable**

The wiring diagram is as follows:

Table 1: 9-pin DSUB pin description

### Modular 4/4 connector



## Drive & AnyBus module Set-up

- Set switches on the ABC module to a Node Address of "03" with baud rate 125kB
- This setup assumes that the PF4 is at its default settings.
- Connect the subnet cable plug to the ABC, and the RJ45 to the drive.
- Power up the drive.
- Setup the following drive parameters

<b>P.036</b>	Start Source	5	RS485 DSI port
<b>P.038</b>	Speed Reference	5	RS485 DSI port
<b>A.103</b>	Comms Data Rate	3	9600 baud
<b>A.104</b>	Comm Node Address	100	Modbus node address
<b>A.107</b>	Comm Format	0	RTU 8-N-1

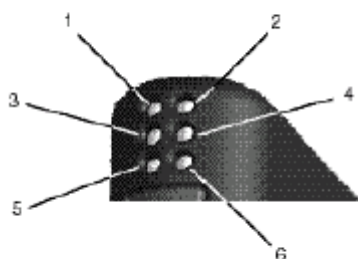


Figure 6: LED numbers



Figure 7: LED label

Cycle the power to the drive and power up the ABC 24v supply.

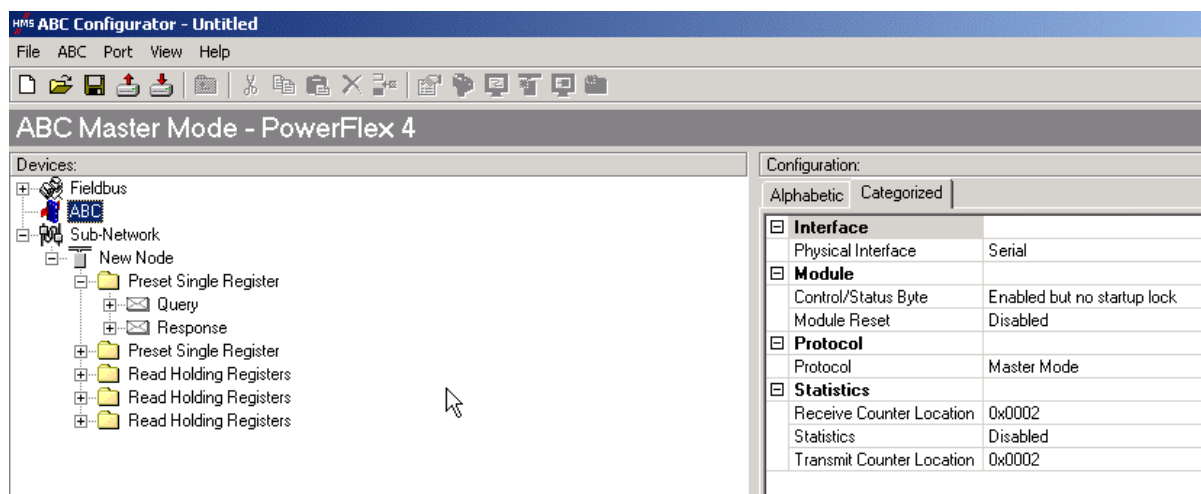
LED 5 should now be solid green

LED 6 should be flashing green

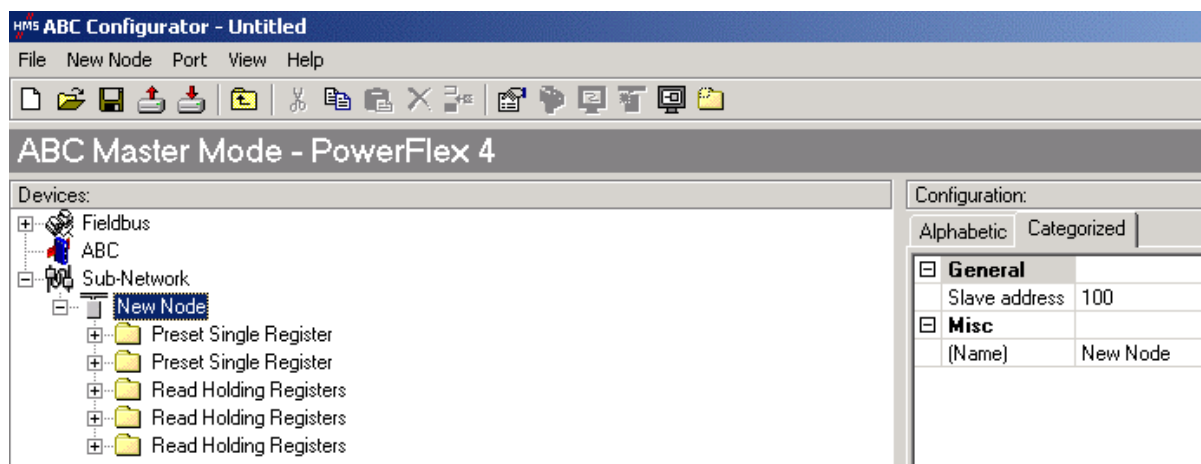
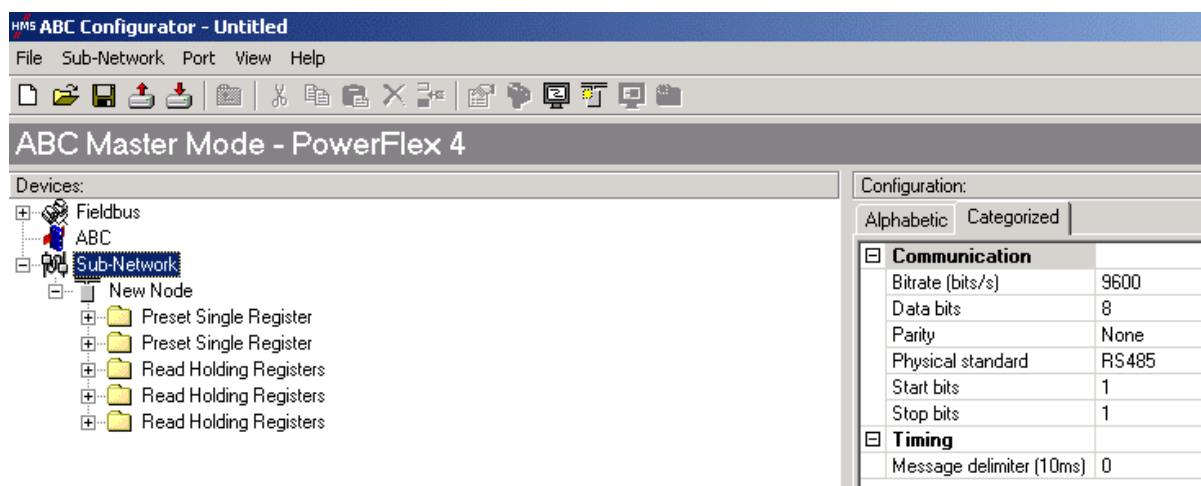
Now attach the configuration cable to the port on the ABC and start up the HMS configuration software.

As you are connected to the module, go-online when asked, and upload the configuration from the device.

The screens below show a device already fully configured.



The ABC module is setup to have the same communication as the drive, and will be used in the master mode.



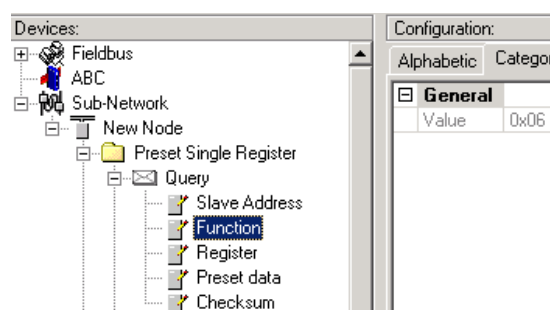
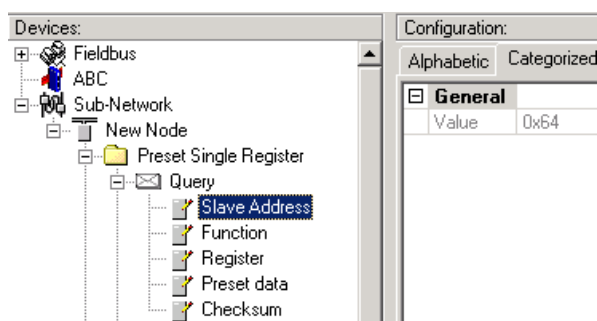
The master mode uses a scan list based on transactions of query and response. The ABC sends out a query on the subnet, and the addressed node is expected to send a response to this query. Therefore each transaction results in 2 instances of messages (query & response).

An ABC module will support up to 50 instances, and each transaction will be used to access 1 parameter. Therefore each ABC module can access 25 parameters total. This is a very simplistic view of control, as broadcasting data will reduce the number of transactions, and increase the number of parameters that can be sent.

To write a parameter to the drive, use Preset Single Register

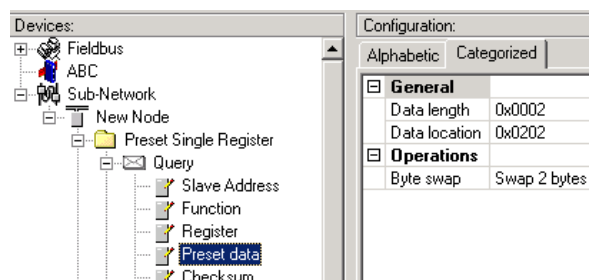
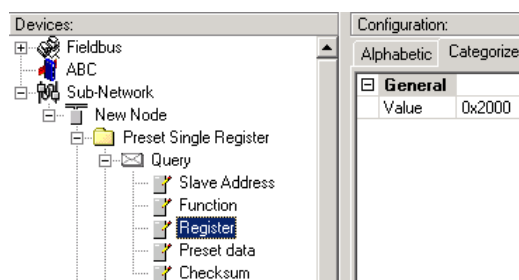
To read a parameter from the drive, use Read Holding Register

The screens below detail the settings to setup the control word to the Drive



Node address = 100 (64h)

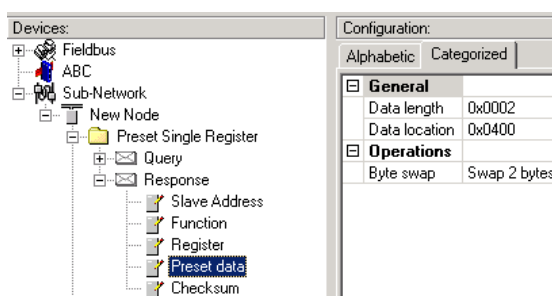
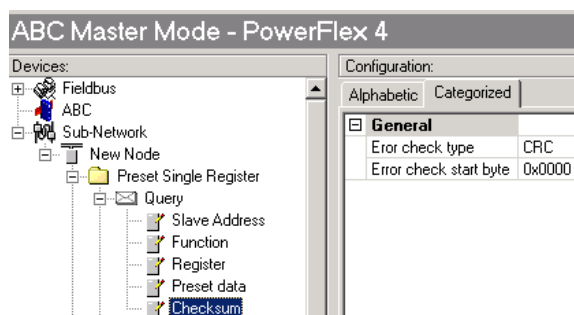
A write command is 06h



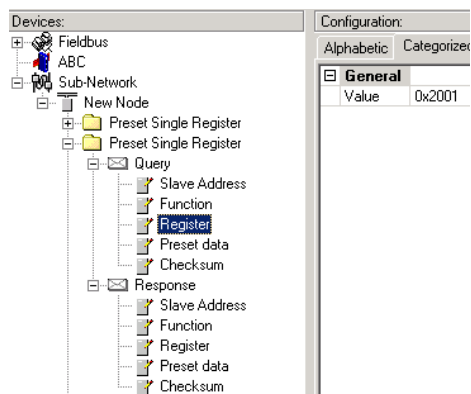
The control word is at address 2000h (8192 dec)

It is stored in address 0202h of the ABC and it is 2 bytes long. The byte order is reversed in the ABC when compared to a AB SLC, so swap the bytes.

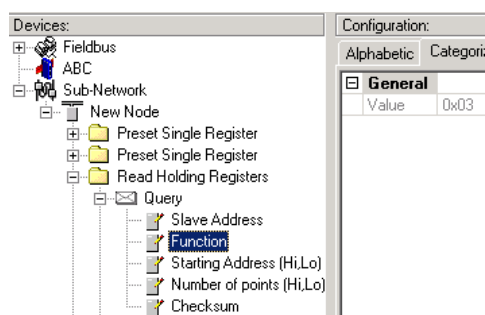




Setup the response to our query, which has exactly the same data but for the location of the register on the ABC. Thus the query and response are 1 transaction and 2 instances.

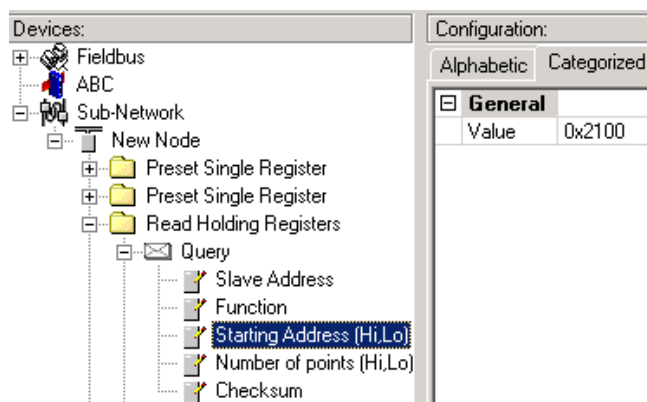


Setup the second query and response for the reference word at address 2001h.

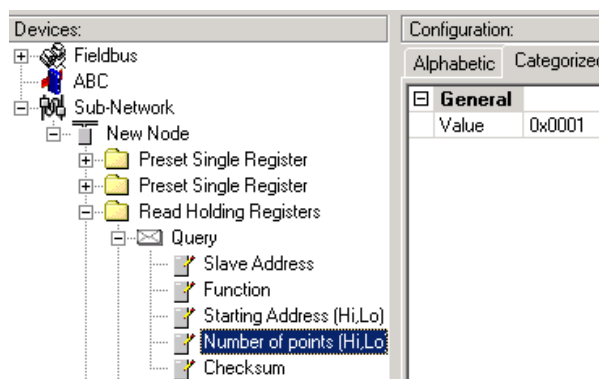


The 3<sup>rd</sup> query and response sets up a read to the status word of the drive. A read instruction is 03h.

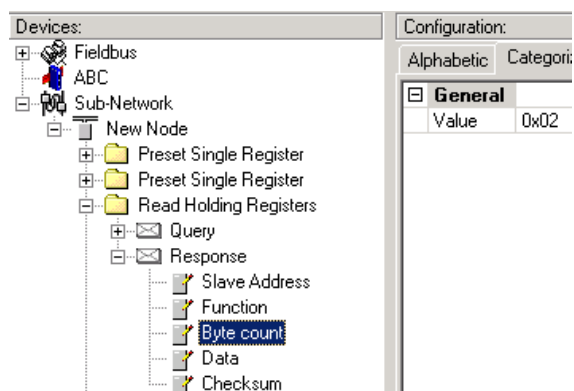




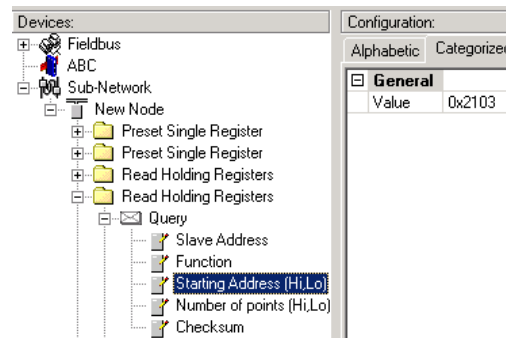
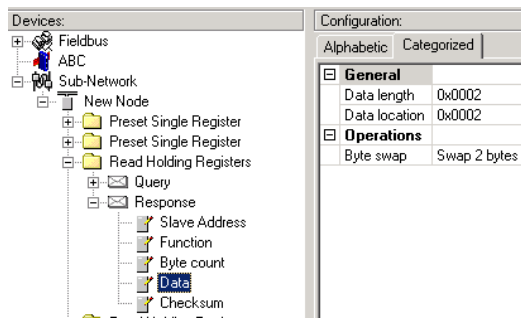
The address of the status word is located at 2100h in the drive.



It is one data location



With 2 bytes of data



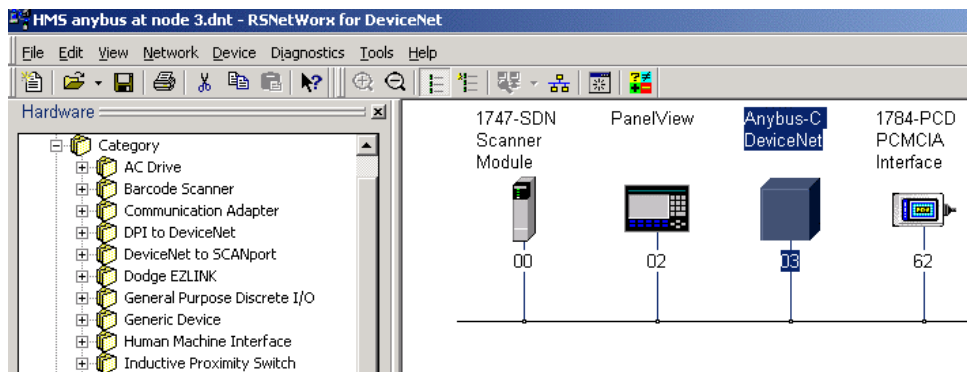
Again the bytes need swapping

Finally the 4th query and response is for the speed feedback located at 2103h in the drive.

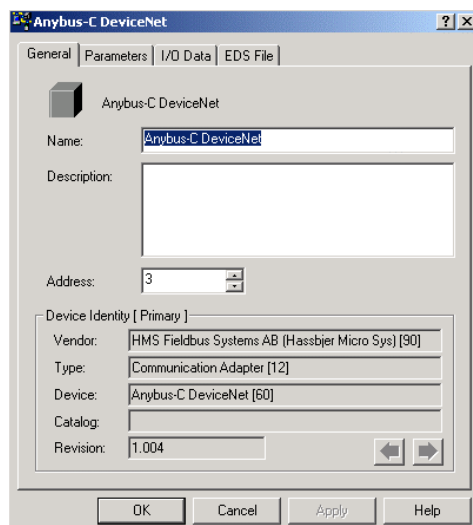
I have also configured a 5<sup>th</sup> query and response for the drive error code at 2101h.

Download the configuration to the ABC, and cycle power to the ABC.

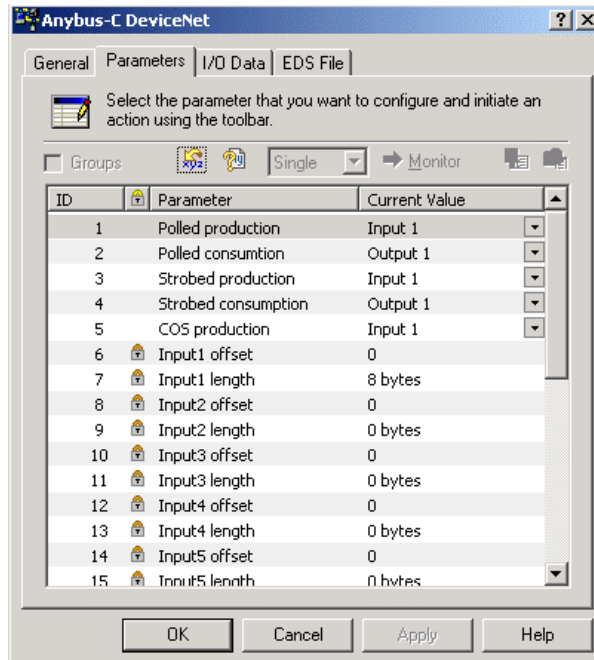
Now we need to create a DeviceNet configuration in the DeviceNet scanner. Use the EDS wizard to register an EDS file for the ABC and go-online to see the following devices. The panelview in my application is used to control the drive.



Double click on the ABC and we can see the general data screen.



Click in the parameter tab to see the configuration.

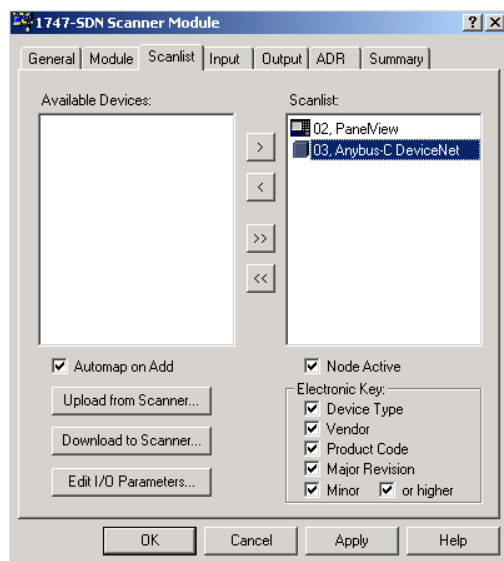


Note the size of input and output. This config:

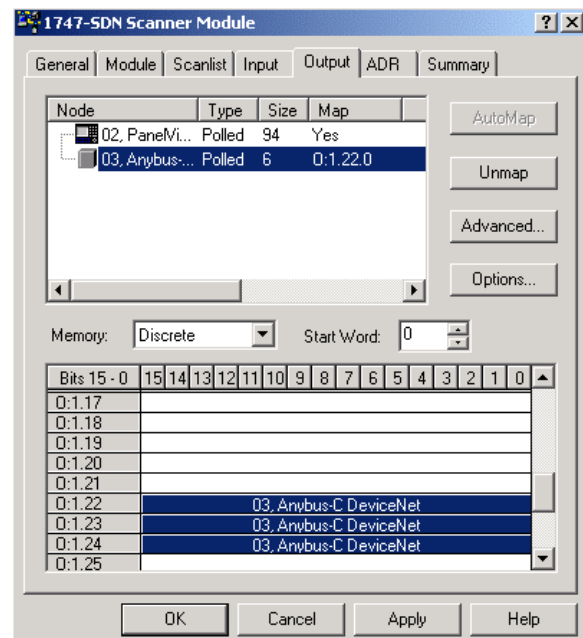
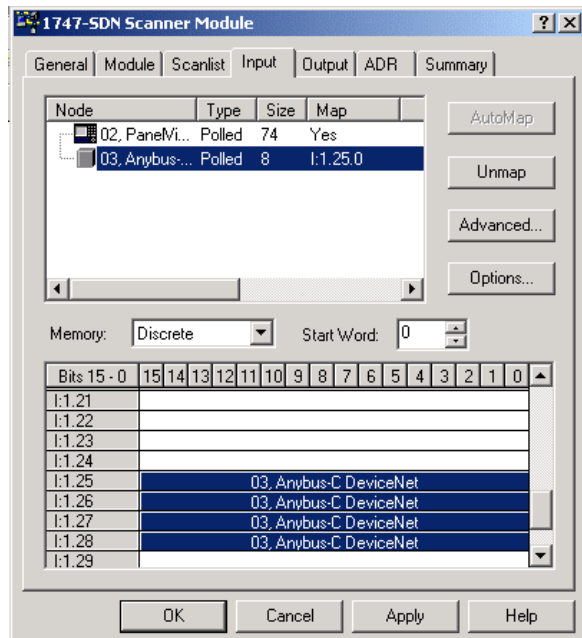
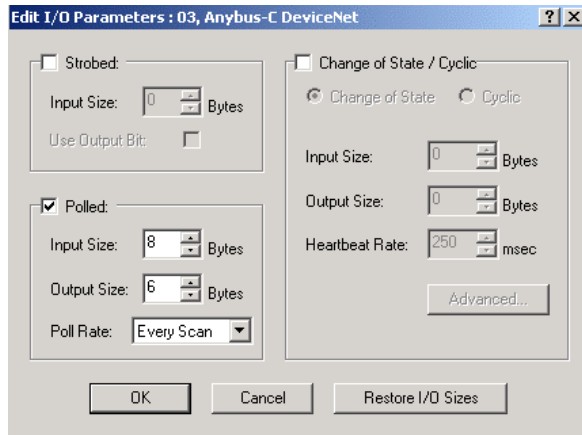
Control Wd & Ref out = 2 wds = 4bytes + ABC config wd = 6bytes

Status Wd & Spd Feedback & Error code = 3 wds = 6 bytes +ABC config wd = 8 bytes

Close the ABC dialogue box and double click the scanner. Upload from the scanner, and goto the scanlist tab. Use the right arrow to put the ABC in the scanlist.



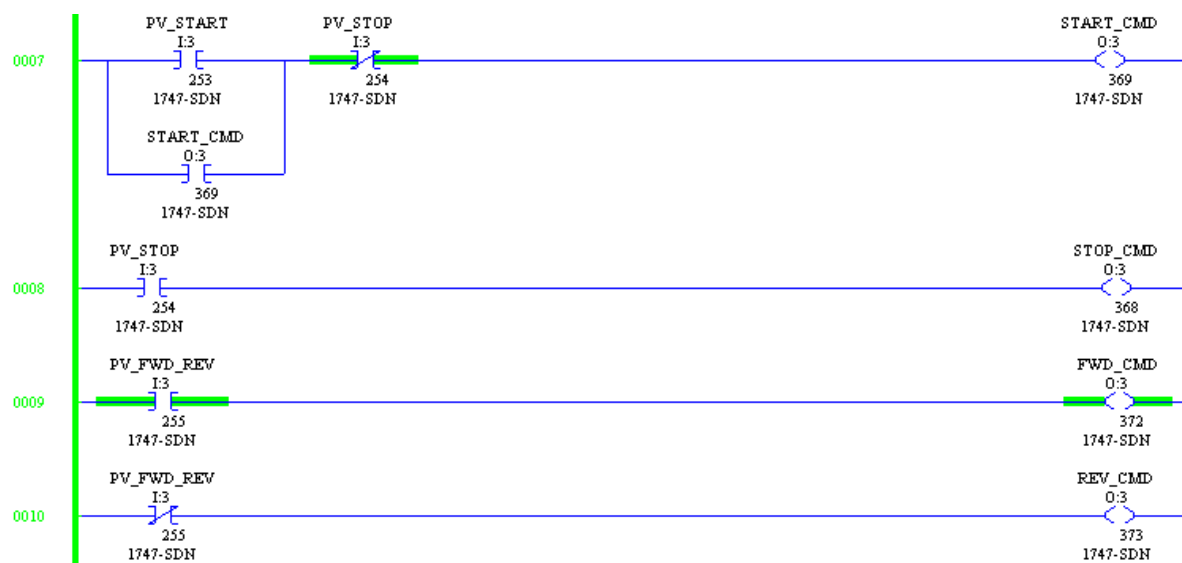
and select the Edit I/O checkbox to modify the sizes of the messages we setup.



Goto the Input and output tabs and map the ABC.

Return to the scanlist tab, and download the configuration to the scanner. Turn the SLC key to program.

The following program details how we control the drive. Please refer to Appendix C of the PowerFlex 4 user manual for the bit allocations of the control, status and error words.



The ramp generator circuit below, provides a reference from 0 to 500 which represents 50.0 Hz.

The Modbus protocol details that parameters can be both read (03h) and written (06h) using the following addresses:

Basic Display Parameters	d1 to d19	0001h – 0013h
Basic Programming parameters	P31 to P41	001Fh – 0029h
Advanced Programming Parameters	A51 to A107	0033h – 006Bh

