invensys
Eurotherm

DeviceNet

Communications handbook

DeviceNet

HA027506ENG/5
July 2010

1. Contents

Issue Status of this manual

Issue 4 includes Enhanced DeviceNet designed for the semiconductor industry.

Issue 5 corrects parameters in the EDS List in sections 4, 4.2 and 4.5 and updates the mini8 LED status list in section 8.3.2.

2. General

2.1 This Document

The purpose of this document is to provide practical assistance to help set up a Eurotherm controller on a DeviceNet network. It is not a treatise on DeviceNet.

In order to make it practical specific hardware has to be used and in these examples the Rockwell Allen Bradley SLC500/03 processor has been used with a 1747-SDN Scanner module and a 1770-KFD RS232 Interface together with Rockwell RSLinx, RSNetWorx and RSLogic500. A familiarity with these software tools is assumed.

For other hardware the interfaces will be different but the basic process required will be the same.

2.2 Introduction

DeviceNet was designed as a low-level network for communications between Programmable Logic Controllers and relatively simple devices such as limit switches and I/O clusters.

Although the Eurotherm Advanced DeviceNet products allow large I/O messages (2700 has 120 words of input and output data), practical systems are constrained by the total I/O space available in the scanner being used – for example 300 words of combined I/O data in the Allen Bradley 1747-SDN/B Scanner Module - and by the amount of traffic permissible on the network. To put this in perspective, a single Eurotherm device can generate and consume as much information as 15 DeviceNet 64 bit digital I/O modules! Not only is this a great deal of data, but it also takes 15 times as long to transmit as a simple I/O device.

Eurotherm controllers offer DeviceNet communications on three different levels. The first two only require configuration of the network, the third requires plc programming as well.

1. The simplest uses standard pre-configured parameters which allow a network to be set up with little configuration work, the most common parameters then being available in the plc.

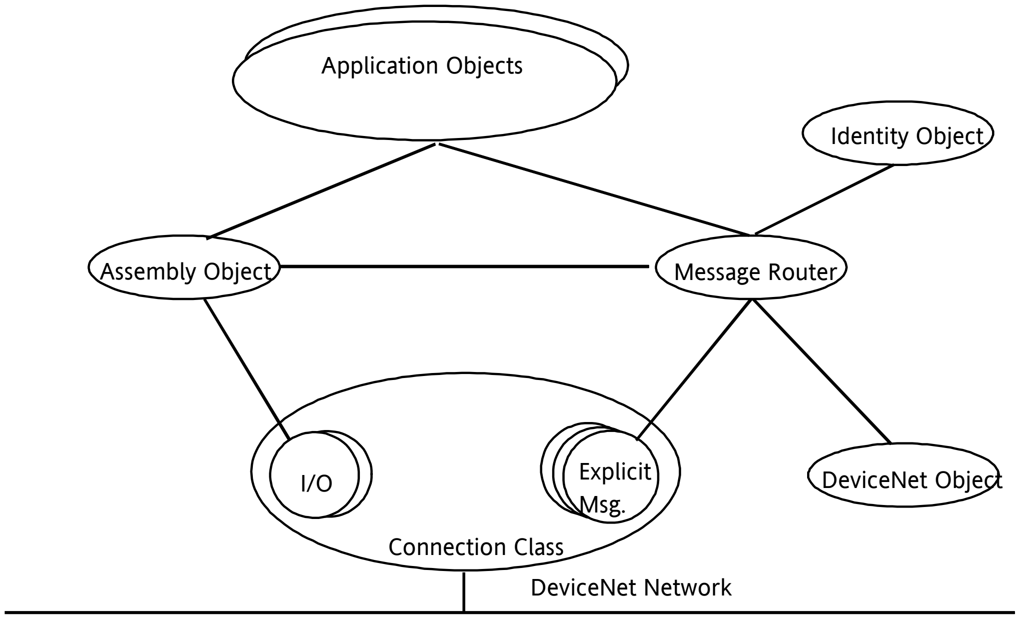
2. The next level uses 'indirection' techniques which gives access to any parameter in the controller via its Tag address. Again in this application the parameters are available in the plc.

3. The third level of communications uses 'explicit message program control' on DeviceNet. This allows the plc to control the network messages directly by issuing a Request and waiting for a Response. This can reduce network traffic.

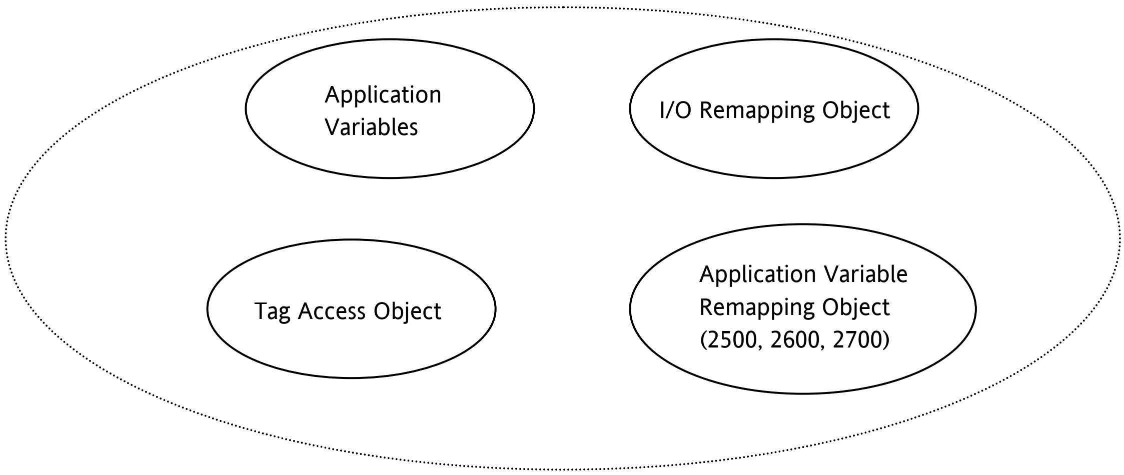
On the 2400, 2500, 2600 & 2700 explicit messaging can be used to read or write blocks of 16 parameters, such as may be used to up / download a recipe program.

2.3 The DeviceNet Object Model

The mix of objects within a DeviceNet device is usually depicted graphically. The diagram below shows the overall distribution of DeviceNet objects within the interface.



This is very much a standard object mapping, containing the usual mandatory DeviceNet objects, as described in the ODVA Specification.



The I/O Remapping Objects are the parameters being read/written on the DeviceNet network

The Application Variable Object is a list of predefined parameters available to be selected as IO Remapped objects.

The Application Variable Remapping Object uses Tag Addresses to add further User defined parameters to the Application Variables Object (and from there to the I/O Remapping Object)

The Tag Access Object requires the use of explicit messaging to read and write blocks of data.

2.4 The DeviceNet Implementation

This implementation provides a common DeviceNet interface firmware for 2400/2500/2600/2700/3500 & Mini8 controller. This takes the form of an internally fitted DeviceNet gateway. The physical implementation is identical for 2400/2600/2700/3500, but is a separate board for 2500 & Mini8 controller. The 2200 and the PC3000 are implemented in a different way but are included in the examples.

The implementation provides a Group 2 only Server, supporting all optional DeviceNet features, i.e.:

Polled I/O, COS/Cyclic, Bit Strobe, Heartbeat Messaging, Device Shutdown Messaging

For further information on the definitions of these functions, refer to the ODVA DeviceNet specification.

DeviceNet masters exchange data with DeviceNet slave devices by using I/O messages; there are four different types of I/O messages: strobe, poll, change-of-state (COS), and cyclic.

The strobe I/O message, which is 8 bytes (64 bits) in length, is broadcast by the master to all devices on the network. Each of the bits corresponds to one of the node addresses (0 to 63). Each device on the network that supports strobe I/O messages, responds by placing its input data, which can be a maximum of 8 bytes per device, on the network. This is supported by some Eurotherm controllers but is only likely to be useful if one or two parameters are required from a large number of devices.

The poll I/O message, which can be a maximum of 255 bytes in length, is sent by the master to a specific slave device on the network. This is effectively point-to-point communication. The Input data from the slave device is read continuously and the output data to the device is written continuously

The change-of-state (COS) I/O message is sent by a slave device to the master whenever the state of the input data changes or, in some cases, at a user-configurable rate (heartbeat). A COS I/O message does not solicit a response from the scanner. This is a point-to-point communication.

The cyclic I/O message is sent by a slave device to the master at a user-configurable rate. A cyclic I/O message does not solicit a response from the master. This is a point-to-point communication.

I/O Message	Strobe	Poll	COS	Cyclic
2600 / 2700	√	√	√	√
2500	√	√	√	√
2400	√	√	√	√
2200		√		
Mini8 controller	√	√	√	√
3500	√	√	√	√
PC3000		√		

The granularity of data transmitted on a DeviceNet network is one byte. This means that even if just a single bit of data needs to be transmitted a whole byte has to be used.

2.5 Hardware

The 2400, 2600, 2700 and 3500 use a plug in DeviceNet module. The 2200, 2500 and Min8 have to be ordered as DeviceNet ready products, although the Mini8 can be modified in the field. The PC3000 requires a DeviceNet Communications Module.

2.6 Tag Addresses

The default communications in all Eurotherm controllers is Modbus. Whilst Modbus is not available in controllers set up for DeviceNet the Tag Address map used to identify parameters within the controllers is based on the same tables.

To read and write the very common parameters it is not really necessary to refer to these Tag Address maps. However when other parameters are required to be used it may be necessary to find the particular parameter addresses.

The best way to find a parameter address is on iTools, otherwise it will be necessary to refer to the instrument documentation. Some tag details are included in the tables at the end of each instrument section. On the 2700 it is possible to determine a particular parameters address via the operator interface.

The 3500 & Mini8 controller provide look up tables in the iTools Help Pages.

3. Procedure for Setting up a Network

There are 5 stages to setting up a network.

- Physical wiring	Section 2.1
- Setting up the controller	Section 2.2
- Setting up the Scanner using EDS files	Section 2.3
- Establishing Communications	Section 2.4
- Transferring data on the network	Section 3 2700
	Section 4 2500
	Section 5 2400
	Section 6 2200
	Section 7 Mini8 controller
	Section 8 3500
	Section 9 PC3000
	Section 10 Explicit Messages

3.1 Physical Wiring

The DeviceNet linear bus trunk line – drop line topology may be constructed from either DeviceNet Thick Cable or DeviceNet Thin Cable or a combination of both. DeviceNet Thick Cable enables long trunk line distances and sturdier trunk or drop lines while the use of DeviceNet Thin Cable provides easier routing and termination of either trunk lines or drop lines. Table 1 lists recommended DeviceNet Thick Cable and DeviceNet Thin Cable from Belden Wire & Company.

Belden DeviceNet Thick Cable & Thin Cable

Belden #	Conductors	Type
3082A	2 – 15 AWG/ 2 – 18 AWG	Trunk (Thick)
3083A	2 – 15 AWG/ 2 – 18 AWG	Trunk (Thick)
3084A	2 – 22 AWG/ 2 – 24 AWG	Drop (Thin)
3085A	2 – 22 AWG/ 2 – 24 AWG	Drop (Thin)

The total amount of trunk line allowable on the network depends upon the data rate and the type of cable used – thick or thin. The cable distance between any 2 points in the cable system must not exceed the Maximum Cable Distance allowed for the baud rate. For trunk lines constructed of only 1 type of cable refer to Table 2 to determine the Maximum Cable Distance based on the data rate and the type of cable used. Cable distance between two points includes both trunk line cable length and drop line cable length that exists between the two points.

Terminating resistors are required on each end of the trunk line. Specification for the resistors: 121ohm, 1% metal film, ¼ watt. Drop lines up to 6m (20 feet) each are permitted, allowing 1 or more nodes to be attached. DeviceNet allows branching structures only on a drop line. Termination resistors should never be installed at the end of a drop line, only at the ends of the trunk line. Up to 64 nodes are supported.

Network Length	Varies w/speed, up to 4000m possible w/repeaters		
Baud Rate	125	250	500
Thick trunk	500m (1,640ft)	250m ((820ft)	100m (328ft)
Thin trunk	100m (328ft)	100m (328ft)	100m (328ft)
Max drop	6m (20ft)	6m (20ft)	6m (20ft)
Cumulative drop	156m (512ft)	78m (256ft)	39m (128ft)

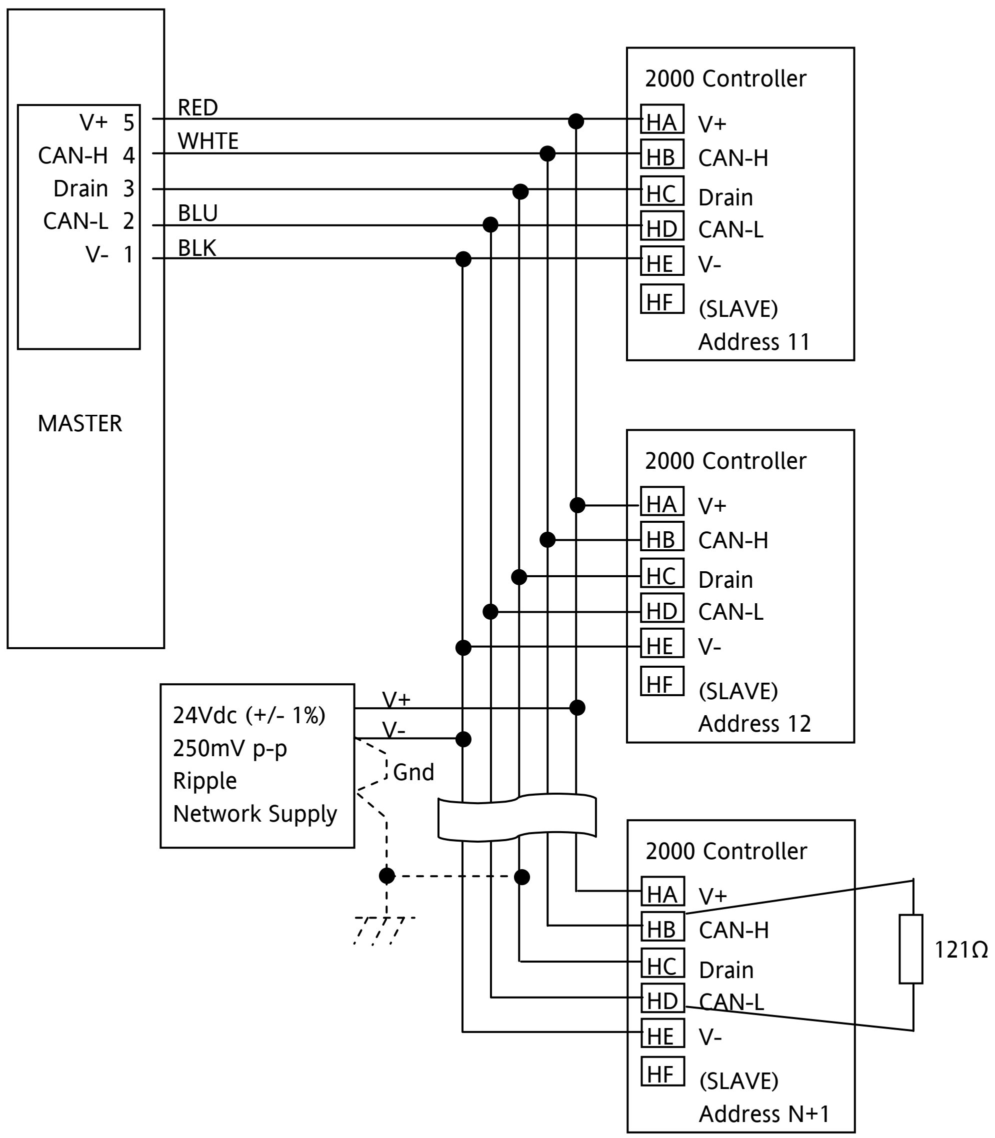
3.2 Terminal Description

2200; 2400; 2600; 2700; 3500 Terminal	Std Label 2500 Mini8 Controller	Colour	Description
HA	V+	Red	DeviceNet network power positive terminal. Connect the red wire of the DeviceNet cable here. If the DeviceNet network does not supply the power, connect the positive terminal of an external 11-25 Vdc power supply.
HB	CAN_H	White	DeviceNet CAN_H data bus terminal. Connect the white wire of the DeviceNet cable here.
HC	DRAIN	None	Shield/Drain wire connection. Connect the DeviceNet cable shield here. To prevent ground loops, the DeviceNet network should be grounded in only one location.
HD	CAN_L	Blue	DeviceNet CAN_L data bus terminal. Connect the blue wire of the DeviceNet cable here.
HE	V-	Black	DeviceNet network power negative terminal. Connect the black wire of the DeviceNet cable here. If the DeviceNet network does not supply the power, connect the negative terminal of an external 11-25 Vdc power supply.

For PC3000 see supplied installation documents.

Note that the DeviceNet network is powered by an external independent 24v supply which is separate from the internal powering of the individual controllers themselves.

3.3 Typical Wiring Diagram



3.4 Setting up the Controller

The configuration of controller for DeviceNet is slightly different for each type of controller but, having selected DeviceNet, there are only 2 parameters to set up – Baud rate and Address.

Valid Baud rates are 125k, 250k and 500k, and addresses may be from 0 to 63. Generally use 500k unless the network is longer than 100m. There is no priority in the addressing – all addresses are treated equally.

The 3500, 26/2700 and 2400 use a DeviceNet communications module in slot H. This may be added by the User. The 2200, 2500 and Mini8 controller have to be purchased from the factory as DeviceNet ready instruments. A DeviceNet Comms module has to be purchased for PC3000.

In the 3500, 26/2700, 2400 and 2200 the configuration is set on the HA comms. The instrument must be in configuration mode to select DeviceNet communications and to set the baud rate. The address may be set in operating mode at access level 3.

The 2500 and Mini8 controller use a DIL switch. An enhanced DeviceNet interface, designed for use in the semiconductor industry, is available for Mini8 controller which uses a rotary switch for setting baud rate and a pair of rotary switches for setting address.

PC3000 is set using the DeviceNet slave function block as described in Section 9.

3.5 Setting up the Scanner

Use RSLinx and the Tools/Node Commissioning on RSNetWorx to set up the Scanner address and Baud Rate at which the network is to run. Baud rate cannot be changed 'on-line' it is only changed by closing down and re-starting the network.

Scanner is set up as the master.

Register all the required Eurotherm Electronic Data Sheets using the EDS Wizard in the Tools menu of RSNetWorx.

EDS Files are available from Eurotherm.

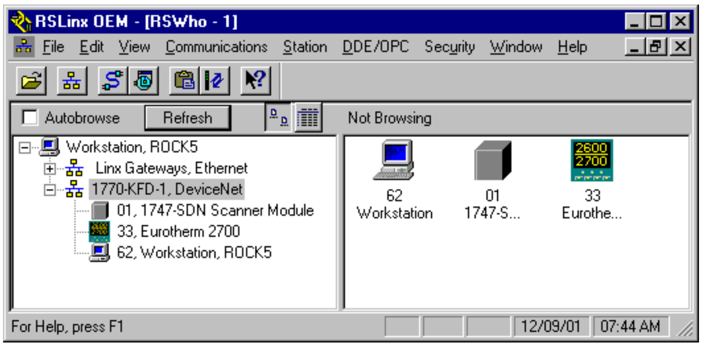
Files: 2200.eds 2400.eds 2500.eds 2600.eds 2700.eds 3500.eds Mini8.eds PC3kDNS.eds
www.eurotherm.co.uk or www.eurotherm.com

*Hint for Profibus Users: Note the EDS file is unique and applies to the specific device. The device itself, **not** the .eds file, is configured for each DeviceNet application.*

3.6 Establishing Communications

With the DeviceNet network correctly wired up and powered, and the scanner and controllers configured with valid unique addresses and the same baud rate, communications will commence. If there is no communications check the common baud rate, unique addresses, 24v supply, the wiring, the termination resistors and finally the devices themselves.

In these examples the Scanner in slot 6 has been set to address 1, the RS232 interface to 62 and the 2700 to address 33. All baud rates are 500k.



RSLinx will show the active items on the network.

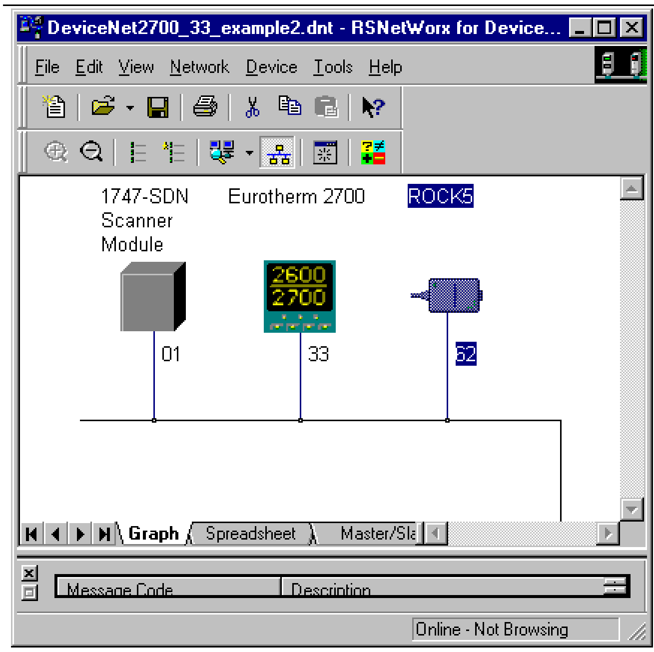
RS Linx showing the computer via the RS232 interface the scanner and the 2700 at address 33.

At this stage communications is active. Looking at Comms/H Module/Activity (Level 3 access) on the 2700 will show that it is active. At this stage though it is only 'Hardware' communications and there is no transfer of data.

Data transfer has to be set up as a separate operation which involves both setting up the 2700 so that it knows what parameters it has to handle and setting up the scanner to make use of these parameters.

Parameters are either INPUT parameters read by the Scanner or OUTPUT parameters written by the scanner.

One way to configure the 2700 INPUT parameters and OUTPUT parameters is via the DeviceNet network. To do this the following examples use RSNetWorx.



The network as seen on the graph view of RSNetWorx.

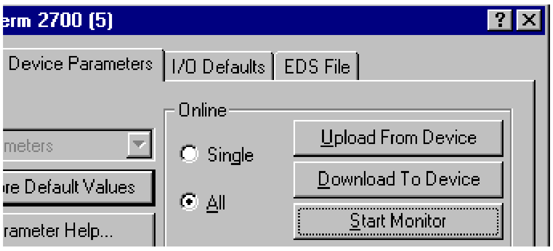
Looking on the master/slave view the 2700 will be under the list 'Slaves w/out master.'

The 1747-SDN scanner module and the host computer (via the 1770 RS232 unit) will be in the list as 'Devices which are not slaves'.

Note that going ON-LINE with RSNetWorx (Menu Network – On Line) or F10 will first give a warning message:

To Upload or download first right click on the device and select upload. In the case of Eurotherm Instruments do not download unless you are absolutely certain that the RSNetWorx file (*.DNT) is what you want. It is possible, for example, to overwrite the address of a slave.

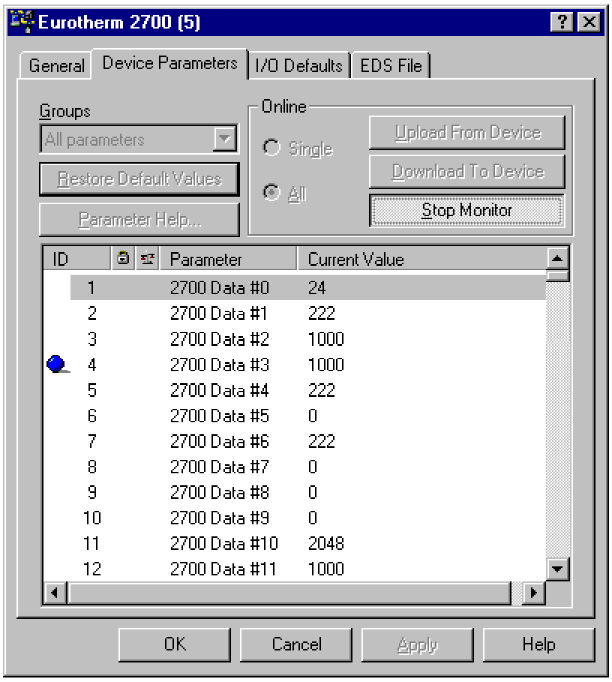
Having uploaded from the instrument and going to the Properties – Device Parameters tab you can see the on-line controls.



The radio buttons give the choice of single parameter upload/download or all parameters.

It is suggested that with Eurotherm devices Upload using ‘All’ but download each parameter one by one using ‘Single’

The ‘Start Monitor’ button will continuously scan ‘All’ or a ‘Single’ parameter(s) giving the current values. This is a good way to double check parameters that you have modified as part of the network configuration.



The ‘Monitor’ mode showing live values of the ‘predefined’ parameters in the 2700.

Output parameters can clicked on and be written to.

The DeviceNet files from RSNetWorx that are included are only designed to allow them to be opened and browsed. There is NO purpose in downloading them to your network as the DeviceNet configuration also requires the actual physical instruments identities to match the original in the saved files.

For example, replacing one 2700 at address 33 with another at address 33 will cause the network to assume there is NO instrument at address 33. First delete the original from the scanlist and then add the new one.

4. Transferring Data – 2600 / 2700

This has been set up with a 2700 controller but the 2600 communications is identical.

The 2700 is a "Generic device type, Group 2 only server." As a DeviceNet slave or server the 2700 offers up to 60 analogue INPUT parameters TO the master or client and may receive up to 60 analogue OUTPUT parameters FROM the master or client.

The design of DeviceNet in the 2700 has been to make it easy to read the most common parameters but retain the possibility of a user selecting any other parameter within the controller. This information is all in the 2700 electronic data sheet registered in RSNetWorx, 2700.eds and is the way the parameters are viewed through the 2700 device properties in RSNetWorx.

The 2700 DeviceNet parameters are divided into 8 sections.
A list of instrument parameters pre-defined and immediately available for selection on the INPUT or OUTPUT tables

a list of additional user defined parameters to add to the OUTPUT table
a list of additional user defined parameters to add to the INPUT table
the actual INPUT table of parameters to be READ by the DeviceNet client
the actual OUTPUT table of parameters to be WRITTEN by the client
the Tag address of additional parameters to be READ by the DeviceNet client
the Tag address of additional parameters to be WRITTEN by the client
a group that can be used for explicit messaging

EDS List	Quantity	Description
1 to 161	161	Predefined parameters 2700 Data #0 to #160
162 to 177	16	User defined OUTPUT parameters 2700 Data #168 to #183
178 to 193	16	User defined INPUT parameters 2700 Data #184 to #199
194 to 253	**60**	**Enter #<number> of required INPUT parameters**
254 to 313	**60**	**Enter #<number> of required OUTPUT parameters**
314 to 329	16	Enter Tag Address of user defined OUTPUT parameters
330 to 345	16	Enter Tag Address of user defined INPUT parameters
346 to 351	Specialist Parameters – explicit messaging	

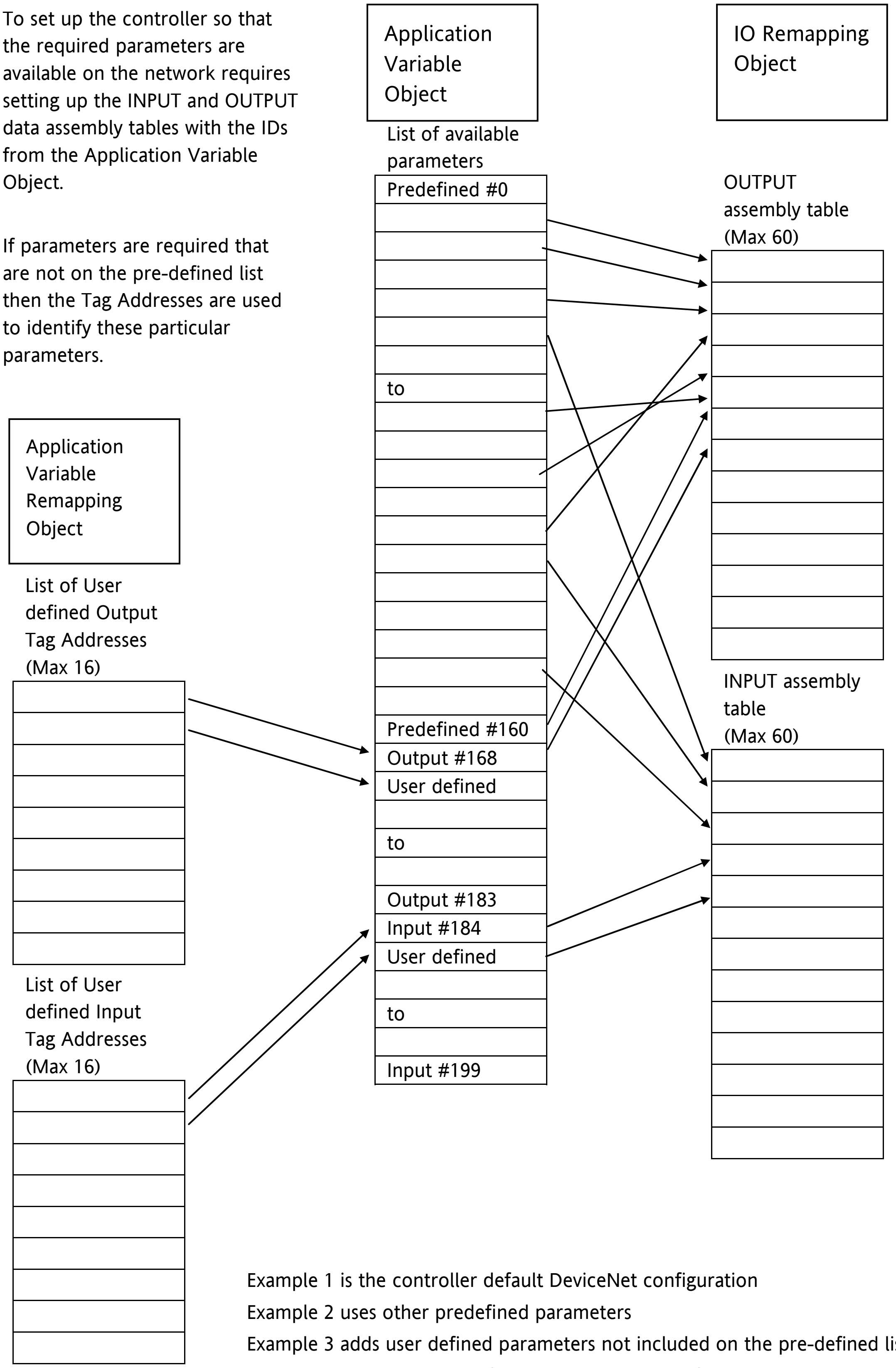
This information can be seen by inspecting the 2700.EDS file in a text editor.

To set up the controller so that the desired parameters can be read and written involves setting up the INPUT and OUTPUT data assembly tables (highlighted in the table above).

This is illustrated by the following diagram and examples.

To set up the controller so that the required parameters are available on the network requires setting up the INPUT and OUTPUT data assembly tables with the IDs from the Application Variable Object.

If parameters are required that are not on the pre-defined list then the Tag Addresses are used to identify these particular parameters.



Example 1 is the controller default DeviceNet configuration

Example 2 uses other predefined parameters

Example 3 adds user defined parameters not included on the pre-defined list.

Example 4 sets the 2700 up first and uploads its configuration to the network.

4.1 Default Example 1

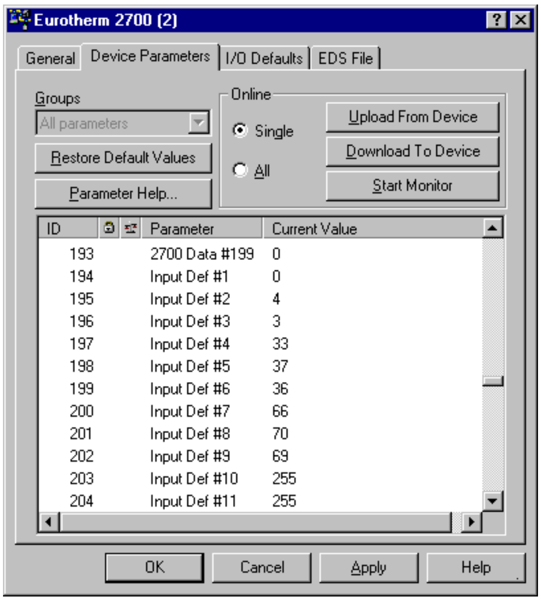
This is called the default example because this is the way the controller is delivered, as new, from Eurotherm. It is also the way the controller would be set up if a new DeviceNet module was added to an existing controller. There is an exception to this statement which is highlighted in Example 4.

The requirement is to be able to read and write the following parameters. Firstly the input parameters. The #numbers in the table below come from the Attribute ID Table in Section 3.5.

Input Parameter	#<number>
Process Variable (Loop 1)	0
Working Setpoint (Loop 1)	4
Working Output Power (Loop 1)	3
Process Variable (Loop 2)	33
Working Setpoint (Loop 2)	37
Working Output (Loop 2)	36
Process Variable (Loop 3)	66
Working Setpoint (Loop 3)	70
Working Output (Loop 3)	69
TOTAL LENGTH	18 bytes

Example 1 – Required INPUT Data assembly table

Right click on the 2700 icon in RSNetWorx and select Properties –to Device Parameters tab. The #numbers in the table above have to be entered into the first nine INPUT table parameters 'Input Def #1' to 'Input Def #9' as per the figure below.



This is the Device Parameters tab of the properties of the 2700 DeviceNet slave.

Add the required Attributes (#numbers) for the input table.

Download single parameters as they are entered.

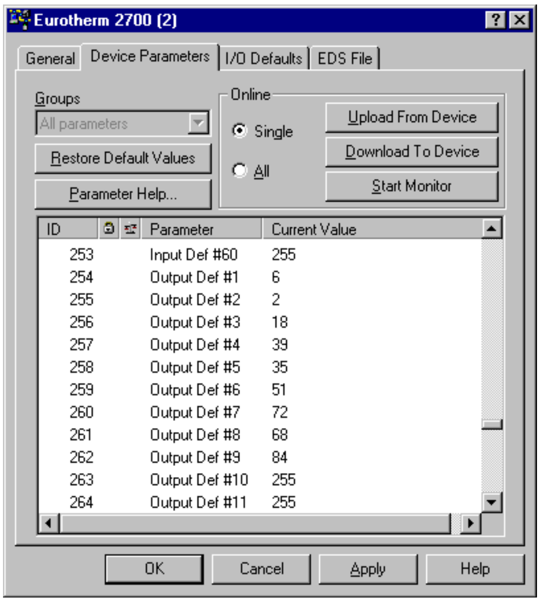
All the remaining parameters of the input table MUST be set to 255 to indicate that they are not being used – in this case Input Def#10 to #60.

Notice that there are 9 parameters giving a data table size of 18 bytes. This information will be required later to set up the scanner.

The same now has to be done for the OUTPUT parameters. The # numbers in this table have to be entered into the first nine OUTPUT table parameters 'Output Def#1' to 'Output Def#9' as per the figure below taken from the Device Parameters tab of the properties of the DeviceNet slave.

Output Parameter	**#<number>**
Target Setpoint (Loop 1)	6
Target Output Power (Loop 1)	2
Auto/Manual Select (Loop 1)	18
Target Setpoint (Loop 2)	39
Target Output Power (Loop 2)	35
Auto/Manual Select (Loop 2)	51
Target Setpoint (Loop 3)	72
Target Output Power (Loop 3)	68
Auto/Manual Select (Loop 3)	84
TOTAL LENGTH	18 bytes

Example 1 – Required Output Data Assembly Table



Adding the IDs for the output table.

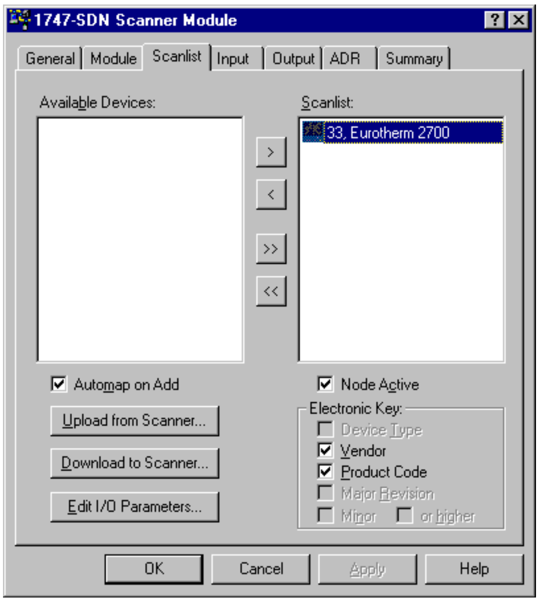
Download single parameters as they are entered.

All the remaining parameters of the output table MUST be set to 255 to indicate that they are not being used – in this case Output Def#10 to #60.

Note that the output data table length is 9 parameters or 18 bytes. This will be needed later to set up the scanner.

With all these parameters set in the controller the DeviceNet set up of the controller is completed. It now remains to set the scanner up to poll these parameters.

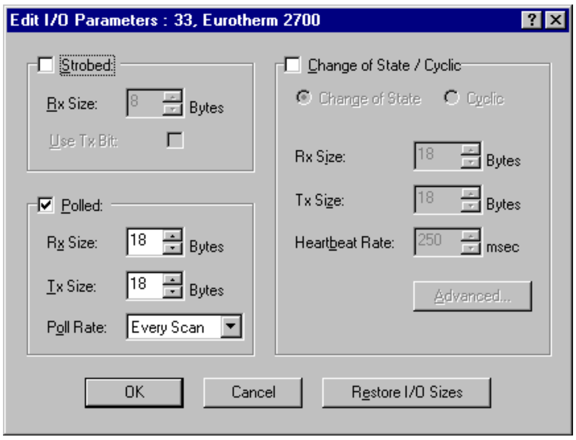
Setting up the scanner to read/write these parameters, right click on the Scanner Icon and go to the Scanner properties. Ensure under the 'Module' Tab that the Scanner is allocated to the correct slot.



Select the Scanlist tab.

Firstly, if the 2700 is not already in the scanlist highlight it and click the right arrow to add it.

Select the 2700 on the scanlist and then click on 'Edit I/O Parameters'.



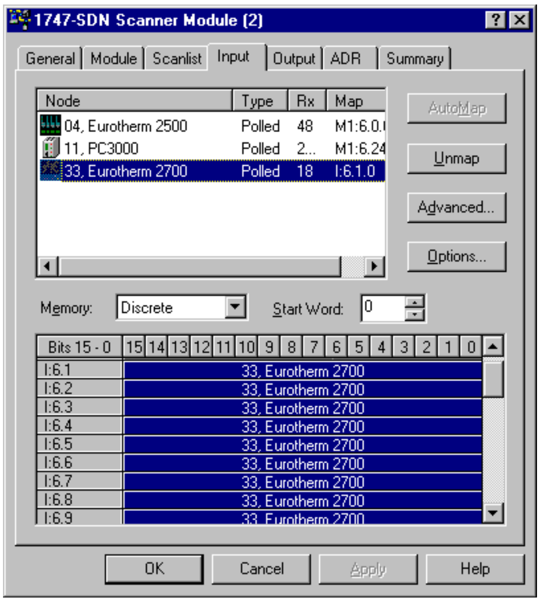
Select 'Polled' mode
Set the Rx (or INPUT) byte size to 18
Set the Tx (or OUTPUT) byte size to 18.

THIS MUST MATCH THE LENGTH OF THE PARAMETERS SET UP IN THE 2700.

In this example:
9 parameters = 9 words = 18 bytes.

This is now sufficient to establish communications between the scanner and the controller.

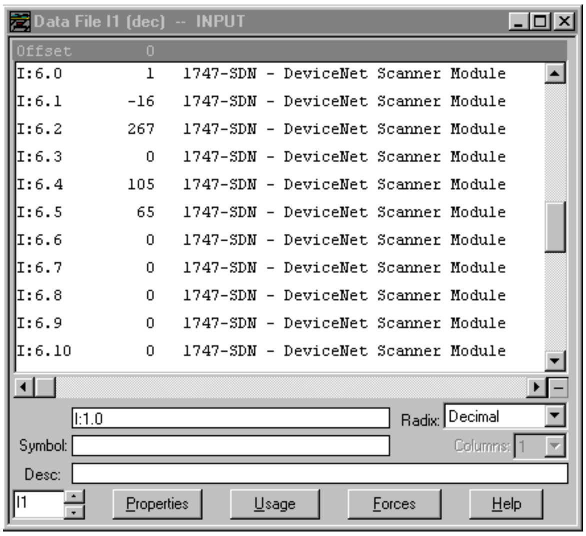
To make use of the parameters they have been mapped into discrete I/O. The scanner is in slot 6 and the INPUT values are in I:6.1 to I:6.9 and the OUTPUT values in O:6.1 to O:6.9



Click OK and now Download this into the scanner module.

The SLC500 has to be in PROGRAM mode. Once the data is downloaded power cycle the plc or reboot the Scanner.

In the plc using RSLogix500 the actual controller parameter values are



The parameters will be in the same order as they were defined in the controller INPUT table, i.e.

I:6.1 is Loop 1 PV = -16

I:6.4 = Loop 2 PV = 105

I:6.7 = Loop 3 PV = 0.

Note: these are integers.

If PV1 is displayed with 1 decimal point then the –16 above represents –1.6.

Similarly a setpoint of 10.0 would be sent as 100.

The parameters can now be used just like any other I/O in the plc.

Note that the setpoints are outputs from the plc. If an operator were to change a setpoint on the instrument itself, it would immediately be overwritten from the plc by the next scan of the DeviceNet network.

Note further that if the value written by the plc is ‘out of range’ as far as the controller is concerned it is silently ignored. This feature is required if, for example, the PID terms are in the output list. In this situation they would be being permanently written to putting the PID block into perpetual debump.

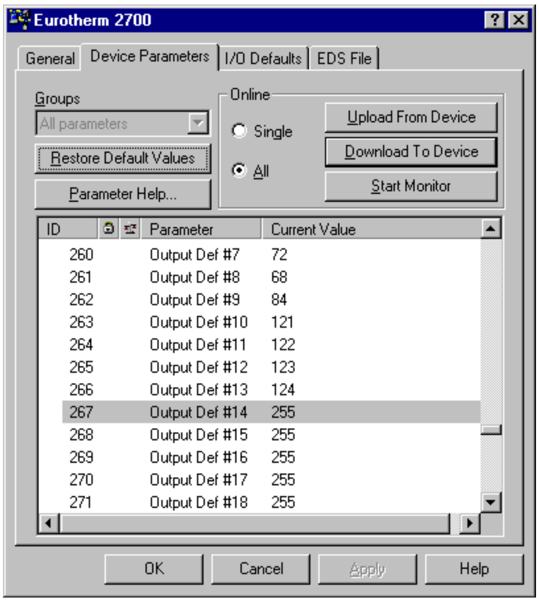
4.2 Example 2.

In this example the 2700 User Variables 1 to 4 will be added to the default OUTPUT table and the RealCV 1 to 8 (the results of analogue calculation blocks 1 to 8) will be added to the default INPUT table.

The IDs of the User Values 1 to 4 (ID 121 to 124) are taken off the Attribute ID Table of pre-defined parameters for the 2700 in section 3.5.

Output Parameter	#<number>
Target Setpoint (Loop 1)	6
Target Output Power (Loop 1)	2
Auto/Manual Select (Loop 1)	18
Target Setpoint (Loop 2)	39
Target Output Power (Loop 2)	35
Auto/Manual Select (Loop 2)	51
Target Setpoint (Loop 3)	72
Target Output Power (Loop 3)	68
Auto/Manual Select (Loop 3)	84
User Value 1	121
User Value 2	122
User Value 3	123
User Value 4	124
TOTAL LENGTH	26 bytes

Example 2 – Required Output Data Assembly Table



Add the extra IDs for the output table Output Def #10 to #13.

Download single parameters as they are entered.

Unused Output def parameters must be set to 255.

Note that the OUTPUT table has 13 parameters and is therefore 26 bytes in length.

Input Parameter	#<number>
Process Variable (Loop 1)	0
Working Setpoint (Loop 1)	4
Working Output Power (Loop 1)	3
Process Variable (Loop 2)	33
Working Setpoint (Loop 2)	37
Working Output (Loop 2)	36
Process Variable (Loop 3)	66
Working Setpoint (Loop 3)	70
Working Output (Loop 3)	69
Analogue Block 1 O/P	
Analogue Block 2 O/P	
Analogue Block 3 O/P	
Analogue Block 4 O/P	
Analogue Block 5 O/P	
Analogue Block 6 O/P	
Analogue Block 7 O/P	
Analogue Block 8 O/P	
TOTAL LENGTH	34 bytes

Example 2 – Required Input Data Assembly Table

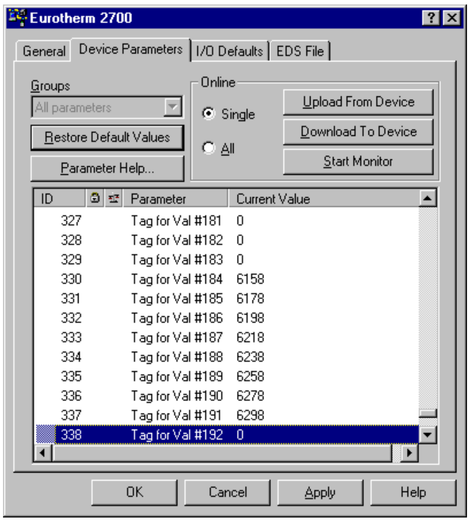
Studying the reference table in of pre-defined parameters (Section 3.5) it is not possible to find these new Analogue block parameters.

In this situation the user has first to define these parameters using their Tag address in the table using the device parameters 330 to 337 as highlighted below.

EDS list	Quantity	Description
1 to 161	161	Predefined parameters #0 to #160
162 to 177	16	User defined OUTPUT parameters #168 to #183
178 to 193	16	User defined INPUT parameters #184 to #199
194 to 253	60	Enter #<number> of required INPUT parameters
254 to 313	60	Enter #<number> of required OUTPUT parameters
314 to 329	16	Enter Tag Address of user defined OUTPUT parameters
330 to 345	**16**	**Enter Tag Address of user defined INPUT parameters**
346 to 351	Specialist Parameters – block read or write	

The Tag Addresses for these parameters are in the table below.

Parameter	Tag address
Analogue Block 1.RealCV	6158
Analogue Block 1.RealCV	6178
Analogue Block 1.RealCV	6198
Analogue Block 1.RealCV	6218
Analogue Block 1.RealCV	6238
Analogue Block 1.RealCV	6258
Analogue Block 1.RealCV	6278
Analogue Block 1.RealCV	6298



Add the Tag address for each new user defined parameter required in the input table 'Tag for Val #184 to #191.

Download single parameters as they are entered.

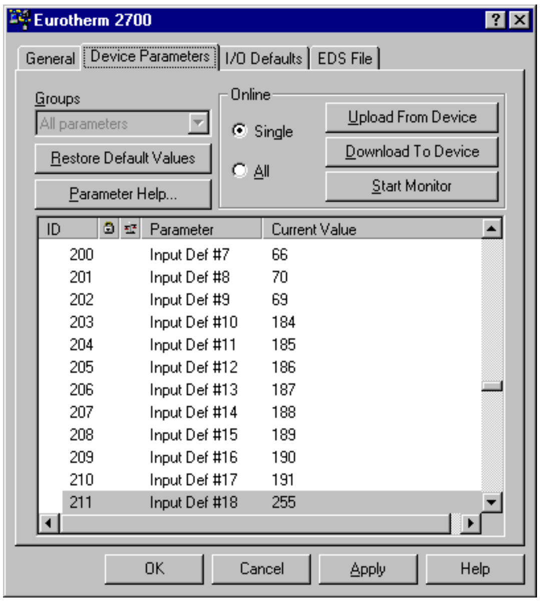
These 8 parameters are Tag for #184 to #191 so returning to the INPUT table, add these IDs, values 184 to 191 for the new parameters.

Input Parameter	Attribute ID #<number>
Process Variable (Loop 1)	0
Working Setpoint (Loop 1)	4
Working Output Power (Loop 1)	3
Process Variable (Loop 2)	33
Working Setpoint (Loop 2)	37
Working Output (Loop 2)	36
Process Variable (Loop 3)	66
Working Setpoint (Loop 3)	70
Working Output (Loop 3)	69
Analogue Block 1 O/P	184
Analogue Block 2 O/P	**185**
Analogue Block 3 O/P	**186**
Analogue Block 4 O/P	**187**
Analogue Block 5 O/P	**188**
Analogue Block 6 O/P	**189**
Analogue Block 7 O/P	**190**
Analogue Block 8 O/P	**191**
TOTAL LENGTH	34 bytes

Example 2 – Required INPUT data assembly with the 8 user defined parameters.

Note that the input data table is 19 parameters or 34 bytes long.

Giving the final set up of the controller



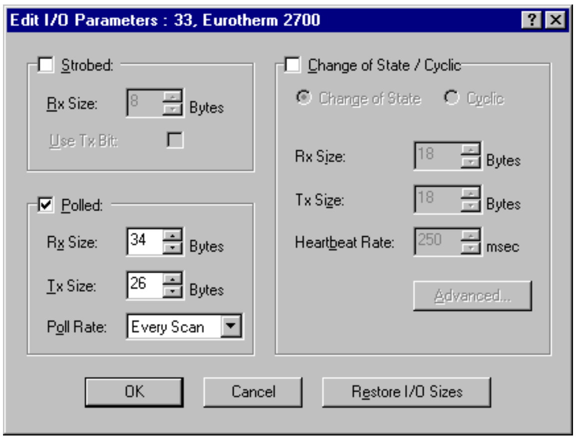
Add the IDs for the new user defined parameters into the input table.

Download single parameters as they are entered.

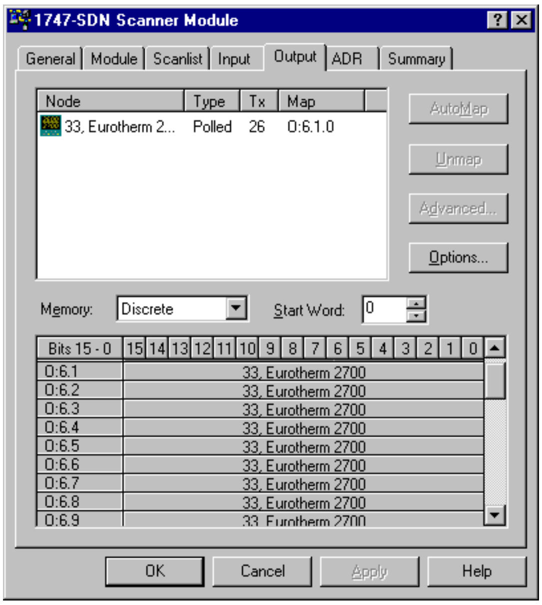
Using this technique of indirection any parameter within the controller may be accessed using its Tag address. There is a maximum of 16 INPUT and 16 OUTPUT parameters that can be defined in this way.

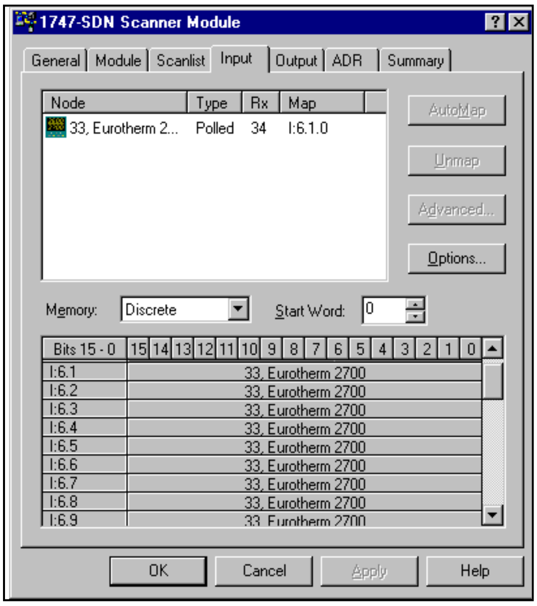
The 2700 is set up as required to match the defined data assembly tables of this example.

The scanner module now has to be updated to include these extra parameters which make the INPUT data assembly 34 bytes and the OUTPUT data assembly 26 bytes.



These may now be mapped into the plc I/O tables or memory.





Again the instrument parameters are available to the plc as any other I/O.

4.3 Example 3

Example 2 used User defined parameters in the OUTPUT table.

To add User defined parameters to the OUTPUT table the Tag addresses would be entered starting in item 314 as ‘Tag for Val #168’. This #168 is entered in the OUTPUT table in the first available slot starting at item 267 ‘Output Def #14’ .

For example an analogue out put Module in slot 4 has a PV with the Tag address 4628. So ‘Tag for Val#168’ takes the value the Tag address 4628

311	Output Def #58	255
312	Output Def #59	255
313	Output Def #60	255
314	Tag for Val #168	4628
315	Tag for Val #169	0
316	Tag for Val #170	0
317	Tag for Val #171	0
318	Tag for Val #172	0

262	Output Def #9	84
263	Output Def #10	121
264	Output Def #11	122
265	Output Def #12	123
266	Output Def #13	124
267	Output Def #14	168
268	Output Def #15	255
269	Output Def #16	255

This is ‘Tag for Val #168’ so the output assembly table Output Def #14 takes the value 168.

The Scanner has now also to be configured to have two more bytes in the output table making it 28.

4.4 Example 4

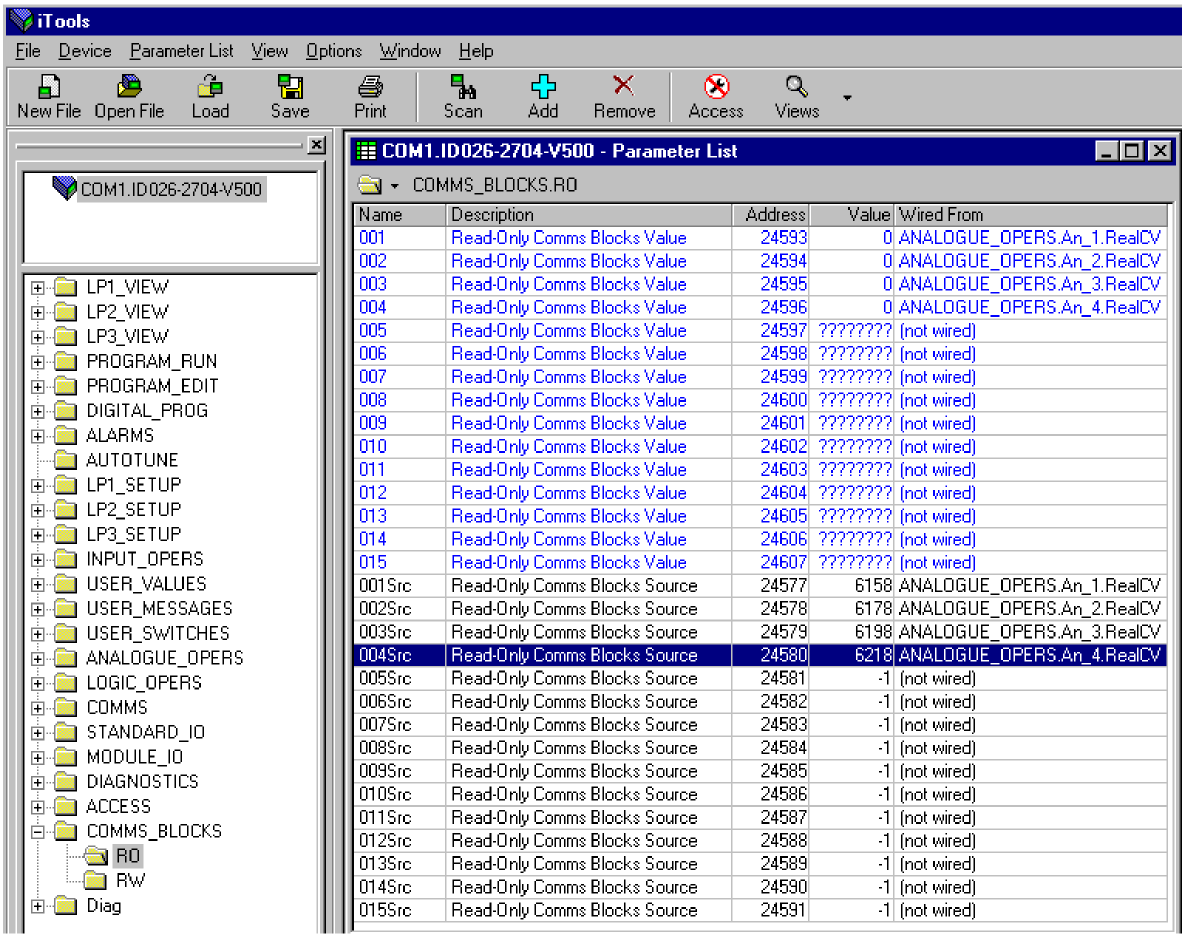
DeviceNet Configuration via the 2700 controller.

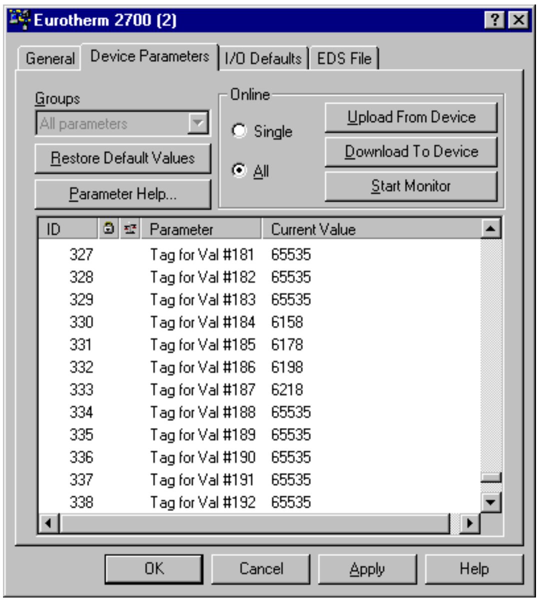
The indirection table for the 2600/2700 user defined parameters is available in the controller itself. The normal way to access this is via iTools which does not work on DeviceNet. To use iTools either use the J port or the H communications module in the instrument would have to be changed to a standard RS232 or 485 module and the instrument configuration changed to Modbus.

If the table has been set up in an instrument and then it is converted to DeviceNet the indirection table in the instrument will be copied automatically to the DeviceNet Module.

However if there is no indirection table configured, the DeviceNet module will automatically take the default configuration shown in Example 1.

In the example below a Modbus instrument was set up on iTools using the READ ONLY comms blocks. As can be seen the outputs from the first 4 analogue calculation blocks have been added.





Looking at this back on DeviceNet the properties of the Read only parameters show the same parameters, addresses 6158, 6178 etc.

It is still necessary to add these (#184 to #188) to the Input assembly table via the network.

Similarly output parameters can be added to the indirection table.

4.5 2600 & 2700 Class, Instance, Attribute ID Tables

EDS List	Quantity	Description
1 to 161	161	Predefined parameters 2700 Data #0 to #160 **Class 100 Instance 1 Attributes 0 to 160**
162 to 177	16	User defined OUTPUT parameters 2700 Data #168 to #183 **Class 100 Instance 1 Attributes 168 to 183**
178 to 193	16	User defined INPUT parameters 2700 Data #184 to #199 **Class 100 Instance 1 Attributes 184 to 199**
194 to 253	60	Enter #<number> of required INPUT parameters **Class 102 Instance 1 Attributes 1 to 60**
254 to 313	60	Enter #<number> of required OUTPUT parameters **Class 102 Instance 2 Attributes 1 to 60**
314 to 329	16	Enter Tag Address of user defined OUTPUT parameters **Class 103 Instance 2 Attributes 1 to 16**
330 to 345	16	Enter Tag Address of user defined INPUT parameters **Class 103 Instance 1 Attributes 1 to 16**
346 to 351	Specialist Parameters – explicit messaging Class 101 Instance 1 Attributes 1 to 6	

Attribute ID #<number>	2600/2700 Variable	Tag Address
0	Loop1 PV	1
1	Loop1TargetSP	2
2	Loop1 Manual Output	3
3	Loop1 Working OP	4
4	Loop1 Working SP	5
5	Loop1 SP select	15
6	Loop1 SP1	24
7	Loop1 SP2	25
8	Loop1 Valve Position	53
9	Loop1 Active Set	72
10	Loop1 Loop Status	76
11	Loop1 Feedforward Trim Limit	99
12	Loop1 Cascade Disable	131
13	Loop1 Ratio Enable	151
14	Loop1 Lead PV	155
15	Loop1 Ratio SP	156
16	Loop1 Ratio Trim	157
17	Loop1 Override Disable	160
18	Loop1 Manual Mode	273
19	Loop1 Alarm Status Word	336
20	Loop1 PropBand1	351
21	Loop1 IntegralTime1	352
22	Loop1 DerivativeTime1	353
23	Loop1 RelCoolGain1	354
24	Loop1 ManReset1	355
25	Loop1 CutbackHigh1	356
26	Loop1 CutbackLow1	357
27	Loop1 Remote SP	485
28	Loop1 Remote SP enable	633
29	Loop1 Aux PV	769
30	Loop1 Aux WSP (override sp)	773
31	Loop1 Aux LSP (cascade slave lsp)	792
32	Loop1 Override SP	831
33	Loop2 PV	1025
34	Loop2 Target SP	1026
35	Loop2 Man Output	1027
36	Loop2 Working OP	1028
37	Loop2 Working SP	1029
38	Loop2 SP select	1039
39	Loop2 SP1	1048
40	Loop2 SP2	1049
41	Loop2 Valve Position	1077
42	Loop2 Active Set	1096
43	Loop2 Loop Status	1100
44	Loop2 Feedforward Trim Limit	1123
45	Loop2 Cascade Disable	1155
46	Loop2 Ratio Enable	1175
47	Loop2 Lead PV	1179
48	Loop2 Ratio SP	1180
49	Loop2 Ratio Trim	1181
50	Loop2 Override Disable	1184
51	Loop2 Manual Mode	1297
52	Loop2 Alarm Status Word	1360
53	Loop2 PropBand1	1375
54	Loop2 IntegralTime1	1376
55	Loop2 DerivativeTime1	1377
56	Loop2 RelCoolGain1	1378
57	Loop2 ManReset1	1379
58	Loop2 CutbackHigh1	1380
59	Loop2 CutbackLow1	1381
60	Loop2 Remote SP	1509
61	Loop2 Remote SP enable	1657
62	Loop2 Aux PV	1793
63	Loop2 Aux WSP (override sp)	1797
64	Loop2 Aux LSP (cascade slave lsp)	1816
65	Loop2 Override SP	1855
66	Loop3 PV	2049
67	Loop3 Target SP	2050
68	Loop3 Manual Output	2051
69	Loop3 Working OP	2052
70	Loop3 Working SP	2053
71	Loop3 SP select	2063
72	Loop3 SP1	2072
73	Loop3 SP2	2073
74	Loop3 Valve Position	2101
75	Loop3 Active Set	2120
76	Loop3 L Status	2124
77	Loop3 Feedforward Trim Limit	2147
78	Loop3 Cascade Disable	2179
79	Loop3 Ratio Enable	2199
80	Loop3 Lead PV	2203
81	Loop3 Ratio SP	2204
82	Loop3 Ratio Trim	2205
83	Loop3 Override Disable	2208
84	Loop3 Manual Mode	2321
85	Loop3 Alarm Status Word	2384
86	Loop3 PropBand1	2399
87	Loop3 IntegralTime1	2400
88	Loop3 DerivativeTime1	2401
89	Loop3 RelCoolGain1	2402
90	Loop3 ManReset1	2403
91	Loop3 CutbackHigh1	2404
92	Loop3 CutbackLow1	2405
93	Loop3 Remote SP	2533
94	Loop3 Remote SP enable	2681
95	Loop3 Aux PV	2817
96	Loop3 Aux WSP (override sp)	2821
97	Loop3 Aux LSP (cascade slave lsp)	2840
98	Loop3 Override SP	2879

Attribute ID #<number>	2600/2700 Variable	Tag Address
99	Tune Loop	3072
100	Tune PID	3073
101	TUNE Tune State	3074
102	Autotune	3075

Attribute ID #<number>	2600/2700 Variable	Tag Address
103	Programmer WSP1	5800
104	Programmer WSP2	5801
105	Programmer WSP3	5802
106	Prog. Segm. Time Remaining	5813
107	Prog. Run Program Logic	5817
108	Programmer Run Program No	5820
109	Programmer Run Segment No	5822
110	Programmer PSP1 Run Target	5829
111	Programmer PSP2 Run Target	5830
112	Programmer PSP3 Run Target	5831
113	Programmer PSP1 Run Rate	5832
114	Programmer PSP2 Run Rate	5833
115	Programmer PSP3 Run Rate	5834
116	Programmer Dwell Time1	5841
117	Programmer Dwell Time2	5842
118	Programmer Dwell Time3	5843
119	Programmer Prog Run	5893
120	Programmer Prog Hold	5894

Attribute ID #<number>	2600/2700 Variable	Tag Address
121	User VAL 1	9220
122	User VAL2	9225
123	User VAL3	9230
124	User VAL4	9235
125	User VAL5	9240
126	User VAL6	9245
127	User VAL7	9250
128	User VAL8	9255
129	User VAL9	9260
130	User VAL10	9265
131	User VAL11	9270
132	User VAL12	9275

Attribute ID #<number>	2600/2700 Variable	Tag Address
133	Loop1 Alarm 1 Setpoint	11586
134	Loop1 Alarm 1 Ack	11594
135	Loop1 Alarm 2 Setpoint	11596
136	Loop1 Alarm 2 Ack	11604
137	Loop2 Alarm 1 Setpoint	11634
138	Loop2 Alarm 1 Ack	11642
139	Loop2 Alarm 2 Setpoint	11644
140	Loop2 Alarm 2 Ack	11652
141	Loop3 Alarm 1 Setpoint	11682

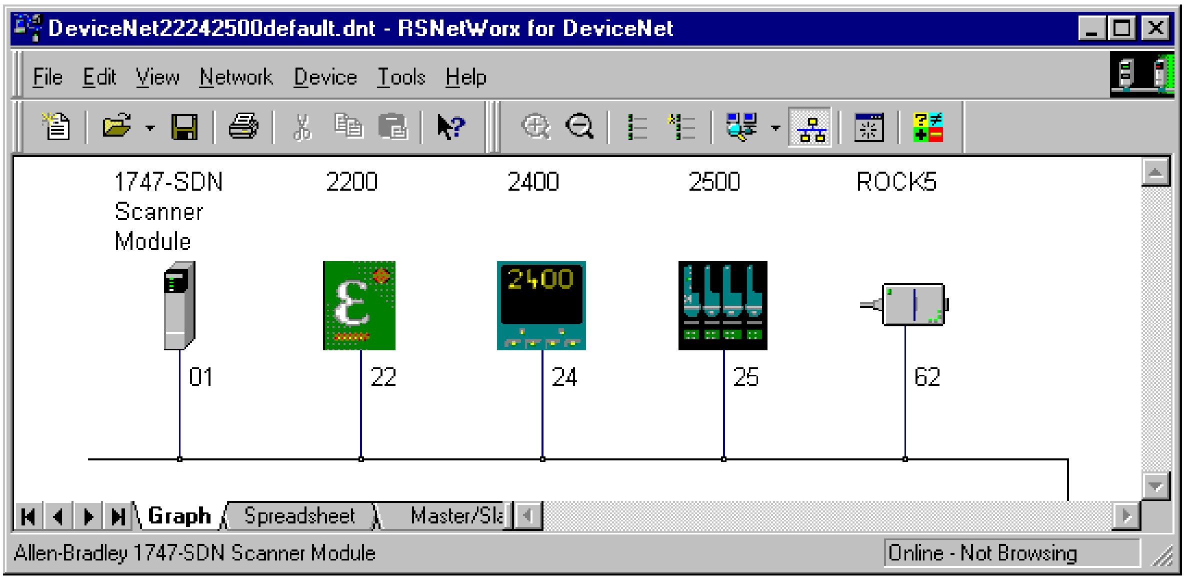
Attribute ID #<number>	2600/2700 Variable	Tag Address
142	Loop3 Alarm 1 Ack	11690
143	Loop3 Alarm 2 Setpoint	11692
144	Loop3 Alarm 2 Ack	11700

Attribute ID #<number>	2600/2700 Variable	Tag Address
145	User Analog Alarm 1 SP	11730
146	User Analog Alarm 1 Ack	11738
147	User Analog Alarm 2 SP	11746
148	User Analog Alarm 2 Ack	11754
149	User Analog Alarm 3 SP	11762
150	User Analog Alarm 3 Ack	11770
151	User Analog Alarm 4 SP	11778
152	User Analog Alarm 4 Ack	11786
153	User Analog Alarm 5 SP	11794
154	User Analog Alarm 5 Ack	11802
155	User Analog Alarm 6 SP	11810
156	User Analog Alarm 6 Ack	11818
157	User Analog Alarm 7 SP	11826
158	User Analog Alarm 7 Ack	11834
159	User Analog Alarm 8 SP	11842
160	User Analog Alarm 8 Ack	11850
161-167	Reserved (not used)	

Attribute ID #<number>	2600/2700 Variable	Tag Address
168-183	Indirect OUTPUT parameters (configurable)	User
184-199	Indirect INPUT parameters (configurable)	defined

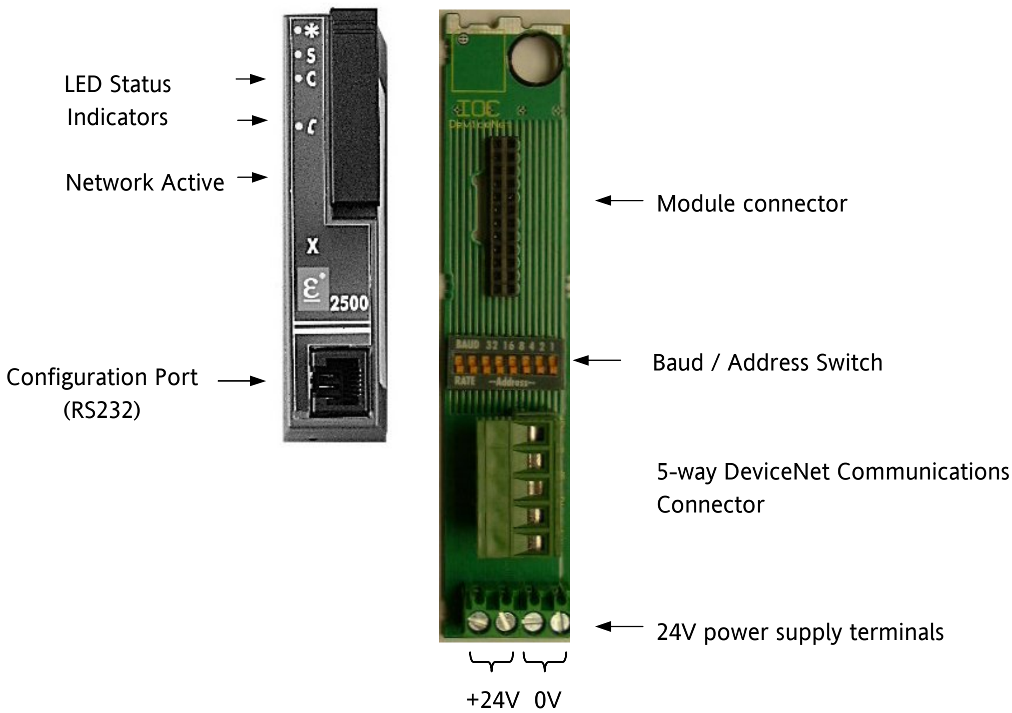
5. Transferring Data – 2500

A network has been set up with a 2500 base at address 25, a 2400 at address 24 and a 2200 at address 22. The baud rate has been set at 500k.



The 2500 has to be set up using the DIL switches on the IOC terminal base

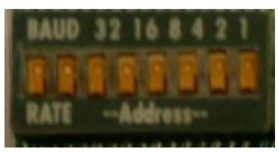
The DeviceNet IOC is identified by the front label and the order code printed on the side label. This IOC must be used with the DeviceNet Terminal Unit.



Address

Baud 32 16 8 4 2 1

Baud
125k ↓ ↓
250k ↓ ↑
500k ↑ ↓



↑ = On

The 2500 uses the standard DeviceNet 5 way connector marked on the terminal unit.

2500 CAN Label	Colour
V+	Red
CAN_H	White
SHIELD	None
CAN_L	Blue
V-	Black

Once correctly connected to the network the yellow 'Network Active' LED will flash. This shows that the module is being scanned but does not have a master. The red Node Fault LED will be on.

The DeviceNet parameter mapping in the 2500 is done solely by means of user defined parameters. There is no fixed list of pre-defined parameters.

The 2500 device parameters are divided into 7 sections

the values of the user defined parameters in the OUTPUT table
the values of the user defined parameters in the INPUT table
the actual INPUT table of parameters to be READ by the DeviceNet client
the actual OUTPUT table of parameters to be WRITTEN by the client
the Tag addresses of the user defined OUTPUT parameters
the Tag addresses of the user defined INPUT parameters
a group that can be used to control block parameter read / write

EDS list	Quantity	Description
1 to 100	100	User defined OUTPUT parameter values 2500 Data #0 to #99
101 to 200	100	User defined INPUT parameter values 2500 Data #100 to #199
201 to 260	60	Enter #number of required INPUT parameters
261 to 320	60	Enter #number of required OUTPUT parameters
321 to 420	100	Enter Tag Address of user defined OUTPUT parameters
421 to 520	100	Enter Tag Address of user defined INPUT parameters
521 to 526	Specialist Parameters – block read or write by explicit messaging	

Output Parameters

The procedure to be followed is

enter Tag address of required parameters in list from ‘Tag for Val#0’.

Unused slots should be set to 65535.

enter the #number of these parameters (values 1 to 100) starting at ‘Output Def #1’.

Unused slots must be set to 255.

Note the number of input bytes that have been used.

The values of these parameters will be found on-line in 2500 Data#0 to 99.

Input Parameters

The procedure to be followed is

enter Tag address of required parameters in list from ‘Tag for Val#100’.

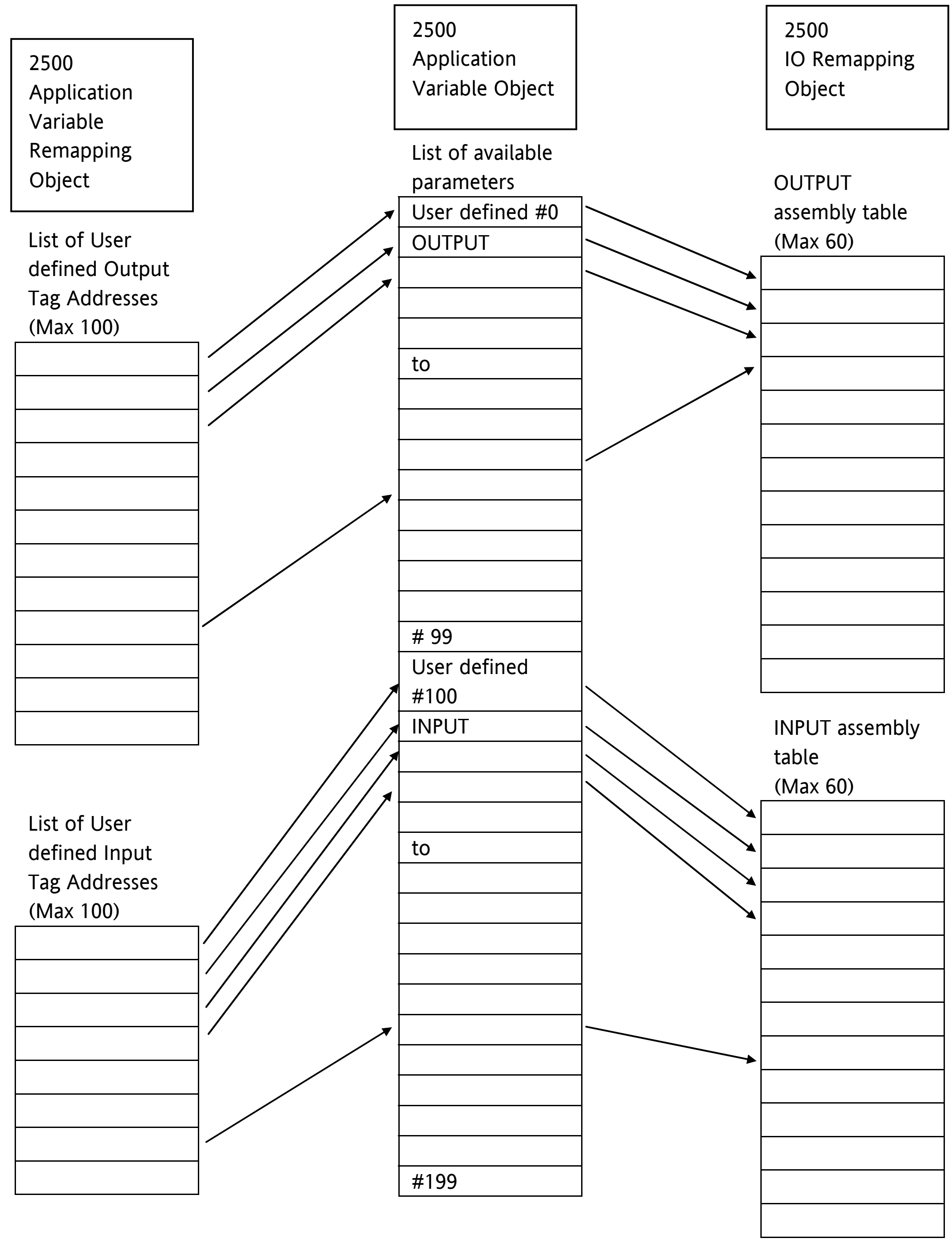
Unused slots should be set to 65535.

enter the #number of these parameters (values 100 to 199) starting at ‘Input Def #1’.

Unused slots must be set to 255.

Note the number of input bytes that have been used.

The values of these parameters will be found on-line in 2500 Data#100 to 199.



This is further illustrated by 3 examples.

Example 1 is as the controller is delivered new.

Example 2 uses other user defined parameters.

Example 3 shows how the 2500 can be configured beforehand using iTools and how this configuration can be uploaded to be used by the Scanner. However the Scanner still has to be set up to match.

5.1 Default Example 1

A new 2500 DeviceNet controller comes with a default parameter set as laid out below. This provides the most commonly required parameters for the 8 loops amounting to 24 input parameters and 24 output parameters.

	Input Parameter	Tag Address
1	Process Variable (Loop 1)	1
2	Working Setpoint (Loop 1)	5
3	Alarm Status (Loop 1)	16085
4	Process Variable (Loop 2)	513
5	Working Setpoint (Loop 2)	517
6	Alarm Status (Loop 2)	16086
7	Process Variable (Loop 3)	1025
8	Working Setpoint (Loop 3)	1029
9	Alarm Status (Loop 3)	16087
10	Process Variable (Loop 4)	1537
11	Working Setpoint (Loop 4)	1541
12	Alarm Status (Loop 4)	16088
13	Process Variable (Loop 5)	2049
14	Working Setpoint (Loop 5)	2053
15	Alarm Status (Loop 5)	16089
16	Process Variable (Loop 6)	2561
17	Working Setpoint (Loop 6)	2565
18	Alarm Status (Loop 6)	16090
19	Process Variable (Loop 7)	3073
20	Working Setpoint (Loop 7)	3077
21	Alarm Status (Loop 7)	16091
22	Process Variable (Loop 8)	3585
23	Working Setpoint (Loop 8)	3589
24	Alarm Status (Loop 8)	16092
TOTAL LENGTH = 24 words = 48 bytes		

	Output Parameter	Tag Address
1	Target Setpoint (Loop 1)	2
2	Auto/Manual Select (Loop 1)	152
3	Alarm Group Ack (Loop 1)	13344
4	Target Setpoint (Loop 2)	514
5	Auto/Manual Select (Loop 2)	664
6	Alarm Group Ack (Loop 2)	13384
7	Target Setpoint (Loop 3)	1026
8	Auto/Manual Select (Loop 3)	1176
9	Alarm Group Ack (Loop 3)	13424
10	Target Setpoint (Loop 4)	1538
11	Auto/Manual Select (Loop 4)	1688
12	Alarm Group Ack (Loop 4)	13464
13	Target Setpoint (Loop 5)	2050
14	Auto/Manual Select (Loop 5)	2200
15	Alarm Group Ack (Loop 5)	16160
16	Target Setpoint (Loop 6)	2562
17	Auto/Manual Select (Loop 6)	2712
18	Alarm Group Ack (Loop 6)	16200
19	Target Setpoint (Loop 7)	3074
20	Auto/Manual Select (Loop 7)	3224
21	Alarm Group Ack (Loop 7)	16240
22	Target Setpoint (Loop 8)	3586
23	Alarm Group Ack (Loop 8)	3736
24	Alarm Status (Loop 8)	16280
TOTAL LENGTH = 24 words = 48 bytes		

Using RSNetWorx , Right-Clicking on the 2500 and select ‘Properties’ and the Device I/O Parameter List tab. The information reflects the tables above.

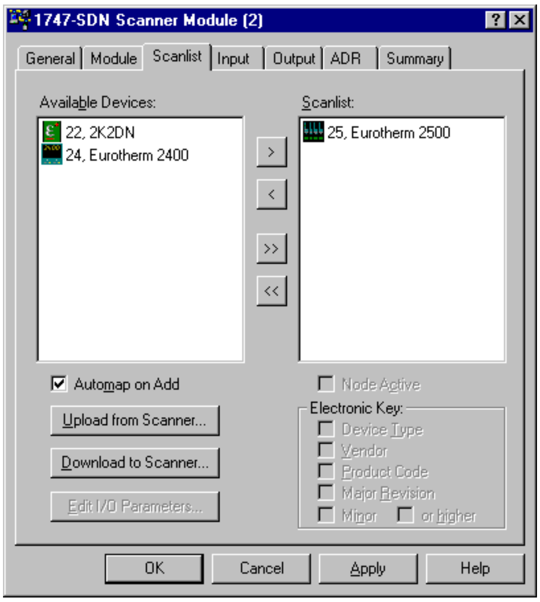
Tag for Val #0 to #23 will be the output Tag addresses (remainder 65535)

Output Def 1 to 24 will have the value 1 to 23 (remainder 255)

Tag for Val #100 to #123 will be the input Tag addresses (remainder 65535)

Input Def 1 to 24 will have the value 100 to 123 (remainder 255)

The default table is 24 INPUT parameters and 24 OUTPUT parameters which is 48 bytes each. For the default example nothing has to be changed.



Now we need to set up the Scanner to read and write these parameters.

'General' Tab – information only

'Module' Tab – set the Scanner module slot correctly (6 in this example)

'Scanlist' Tab – add the Eurotherm 2500 to the scan list (shown)

Edit I/O parameters – leave set to Polled 48 Input and 48 output

'Input' Tab – Map the 24 input parameters to the M file M1:6.0 to M1:6.23

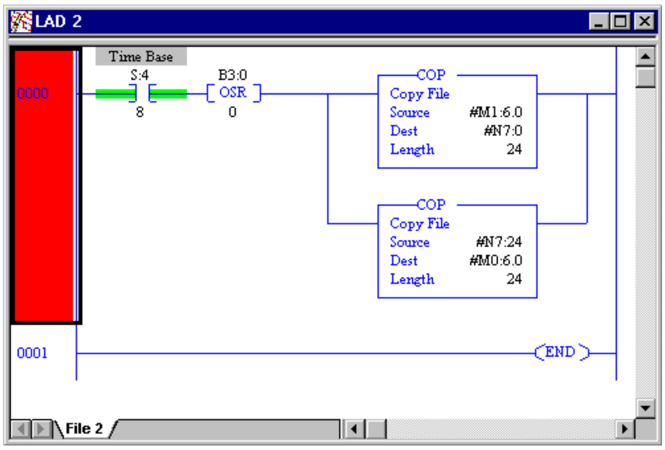
'Output' Tab – Map the 24 output parameters to the M file M0:6.0 to M1:6.23

Click apply and download this to the Scanner (PLC must be in program mode).

Once the network is restarted the 2500 yellow 'Network Active' LED will change from flashing to steady and the red 'Node Fault' LED will go off.

Similarly the Scanner error indicator will show no error on node 25.

The 24 INPUT and 24 OUTPUT parameters are now being transferred back and forth on the network and using COP the data can be transferred periodically between the plc and the M files.



This simple ladder uses COP to transfer the data to and from the M files.

Note that in the interests of minimising resources it would be advantageous to co-ordinate the 2500 refresh rate – typically 220 or 330 mS, the DeviceNet background poll rate and this file transfer interval.

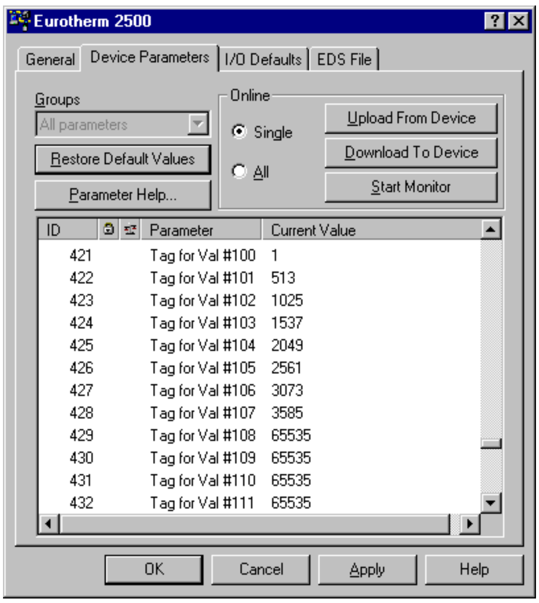
5.2 Example 2

The default table as supplied by Eurotherm in a new module will not suit every application. In this example we will reduce the PLC INPUT parameters to just the 8 loop process variables and the PLC OUTPUT parameters to the 8 loop target setpoints and the 4 setpoints for the User Analogue Alarms blocks.

Number	Input Parameter	Tag Address
1	Process Variable (Loop 1)	1
2	Process Variable (Loop 2)	513
3	Process Variable (Loop 3)	1025
4	Process Variable (Loop 4)	1537
5	Process Variable (Loop 5)	2049
6	Process Variable (Loop 6)	2561
7	Process Variable (Loop 7)	3073
8	Process Variable (Loop 8)	3585
TOTAL LENGTH = 8 words = 16 bytes		

To set this up we go to the 2500 properties and enter the above Tag Address values. Any unused parameters may be set to 65535.

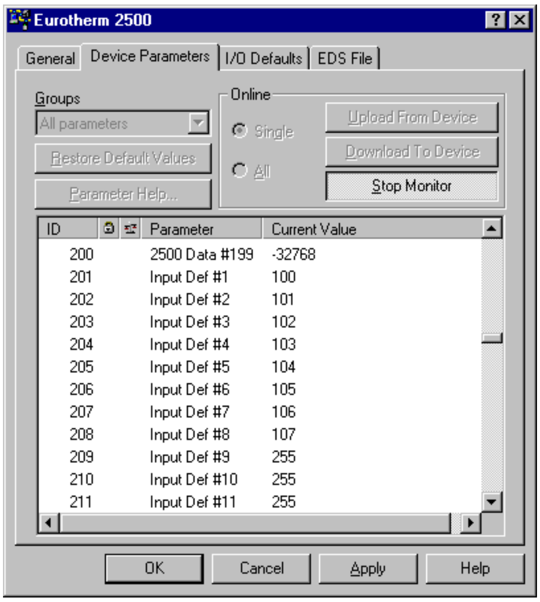
EDS list	Quantity	Description
1 to 100	100	User defined OUTPUT parameter values #0 to #99
101 to 200	100	User defined INPUT parameter values #100 to #199
201 to 260	60	Enter #<number> of required INPUT parameters
261 to 320	60	Enter #<number> of required OUTPUT parameters
321 to 420	100	Enter Tag Address of user defined OUTPUT parameters
421 to 520	**100**	**Enter Tag Address of user defined INPUT parameters**
521 to 526	Specialist Parameters – block read or write	



The Tag addresses of the required parameters have been entered against the Tags for Val #100 to 107.

Unused parameters may be set to the value 65535.

EDS list	Quantity	Description
1 to 100	100	User defined OUTPUT parameter values #0 to #99
101 to 200	100	User defined INPUT parameter values #100 to #199
201 to 260	60	Enter #<number> of required INPUT parameters
261 to 320	60	Enter #<number> of required OUTPUT parameters
321 to 420	100	Enter Tag Address of user defined OUTPUT parameters
421 to 520	100	Enter Tag Address of user defined INPUT parameters
521 to 526	Specialist Parameters – block read or write	



The value 100 to 107 are now entered into Input Def #1 to #8

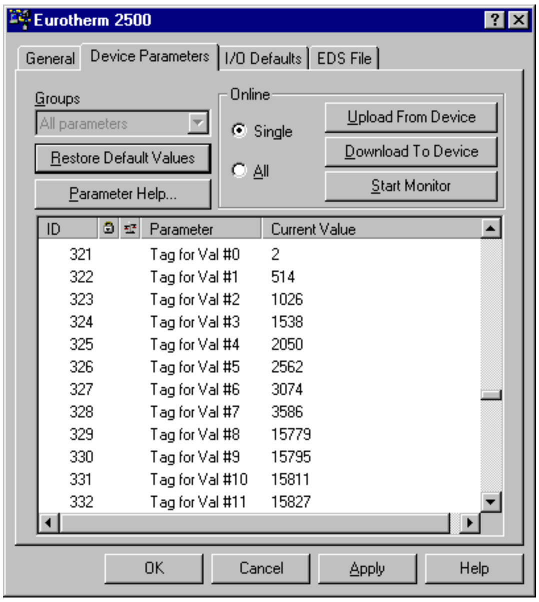
Unused parameters must be set to the value 255.

Now for the OUTPUT parameters.

Number	Output Parameter	Tag address
1	Target Setpoint (Loop 1)	2
2	Target Setpoint (Loop 2)	514
3	Target Setpoint (Loop 3)	1026
4	Target Setpoint (Loop 4)	1538
5	Target Setpoint (Loop 5)	2050
6	Target Setpoint (Loop 6)	2562
7	Target Setpoint (Loop 7)	3074
8	Target Setpoint (Loop 8)	3586
9	User Analogue Alarm SP1	15779
10	User Analogue Alarm SP2	15795
11	User Analogue Alarm SP3	15811
12	User Analogue Alarm SP4	15827
TOTAL LENGTH = 12 words = 24 bytes		

To set this up we go to the 2500 properties and enter the above Tag values. Any unused parameters may be set to 65535.

EDS List	Quantity	Description
1 to 100	100	User defined OUTPUT parameter values #0 to #99
101 to 200	100	User defined INPUT parameter values #100 to #199
201 to 260	60	Enter #<number> of required INPUT parameters
261 to 320	60	Enter #<number> of required OUTPUT parameters
321 to 420	**100**	**Enter Tag Address of user defined OUTPUT parameters**
421 to 520	100	Enter Tag Address of user defined INPUT parameters
521 to 526	Specialist Parameters – block read or write	

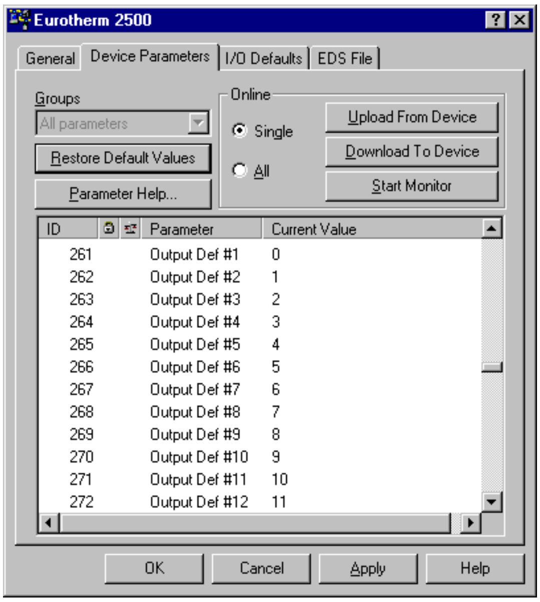


The Tag addresses of the required parameters have been entered against the Tags for Val #0 to #11.

Unused parameters may be set to the value 65535.

EDS List	Quantity	Description
1 to 100	100	User defined OUTPUT parameter values #0 to #99
101 to 200	100	User defined INPUT parameter values #100 to #199
201 to 260	60	Enter #<number> of required INPUT parameters
261 to 320	**60**	**Enter #<number> of required OUTPUT parameters**
321 to 420	100	Enter Tag Address of user defined OUTPUT parameters
421 to 520	100	Enter Tag Address of user defined INPUT parameters
521 to 526	Specialist Parameters – block read or write	

So these values #0 to #11 must be entered into the OUTPUT data list from Def #1 to #12.



Now download all these new settings to the 2500.

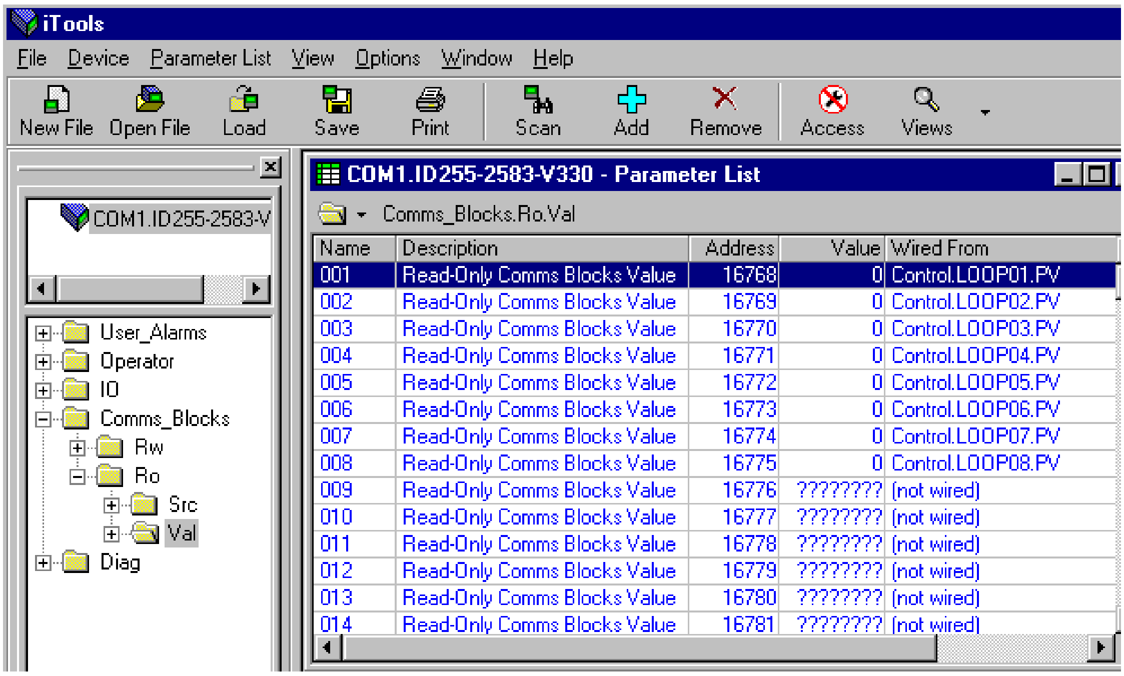
Each value can be downloaded after entry using ‘Single’ or download ‘All’.

Finally return to the properties of the Scanner Module. On the scanlist select the 2500 and use ‘Edit I/O’ to modify the input byte count to 16 and the output byte count to 24. Map these parameters as required. As there are less parameters than were used in the default example it is possible to map them directly onto discrete I/O, in these example the input data is on M1:6.9 to 6.16 and the output data on M0:6.7 to 6.18

Download this new setting to the scanner and restart the network.

5.3 Example 3 – iTools

In Example 2 the required 2500 parameters were selected by configuring the 2500 DeviceNet tables using RSNetWorx. It is also possible to first configure the 2500 directly using iTools and then UPLOAD the configuration from the 2500 into RSNetWorx.



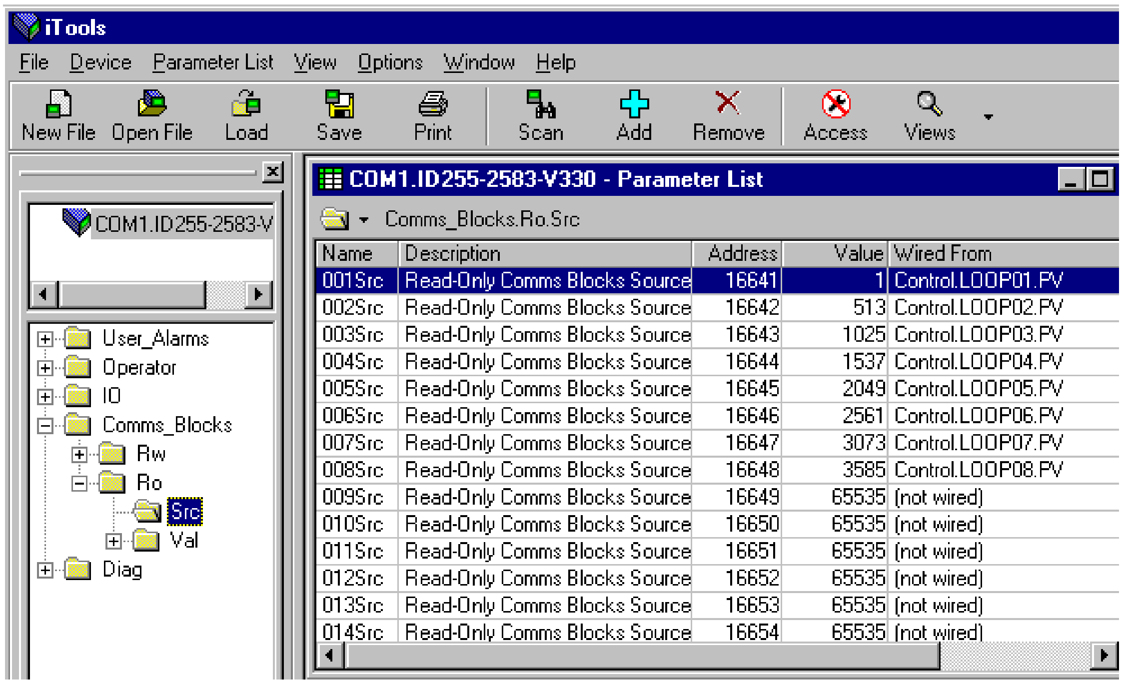
The data in the above screen shows the configuration from Example 2.

The INPUT parameters are in Comms_Blocks.Ro. The Val directory shown above gives the current value of the selected parameters and where the data comes from. The Tag addresses are in the Src directory.

The OUTPUT parameters are in Comms_Blocks.Rw. The Val directory gives the current value of the selected parameters and where the data goes to. The Tag addresses are in the Src directory.

To configure the 2500 it must be connected to iTools using the configuration cable into the RJ11 configuration port on the IOC itself. Plugging in this cable will disconnect the 2500 slave from the DeviceNet network.

Now enter the required Tag Addresses into the Comms_Blocks.Ro.Src and Comms_Blocks.Rw.Src directories.



In the Src directory the tag Value is the Tag address of the required user defined parameter.

Now remove the configuration cable. Using RSNetWorx UPLOAD the 2500 Device Parameters and, if necessary (i.e. the input or output byte count has changed, the mapping needs to be changed etc) modify the Scanner 2500 scanlist I/O parameters to suit.

Restart the DeviceNet network.

5.4 2500 Class, Instance, Attribute ID Table

EDS list	Quantity	Description
1 to 100	100	User defined OUTPUT parameter values 2500 Data #0 to #99 **Class 100 Instance 1 Attributes 0 to 99**
101 to 200	100	User defined INPUT parameter values 2500 Data #100 to #199 **Class 100 Instance 1 Attributes 100 to 199**
201 to 260	60	Enter #number of required INPUT parameters **Class 102 Instance 1 Attributes 1 to 60**
261 to 320	60	Enter #number of required OUTPUT parameters **Class 102 Instance 2 Attributes 1 to 60**
321 to 420	100	Enter Tag Address of user defined OUTPUT parameters **Class 103 Instance 1 Attributes 1 to 100**
421 to 520	100	Enter Tag Address of user defined INPUT parameters **Class 103 Instance 2 Attributes 1 to 100**
521 to 526	Specialist Parameters – block read or write **Class 101 Instance 1 Attributes 1 to 6**	

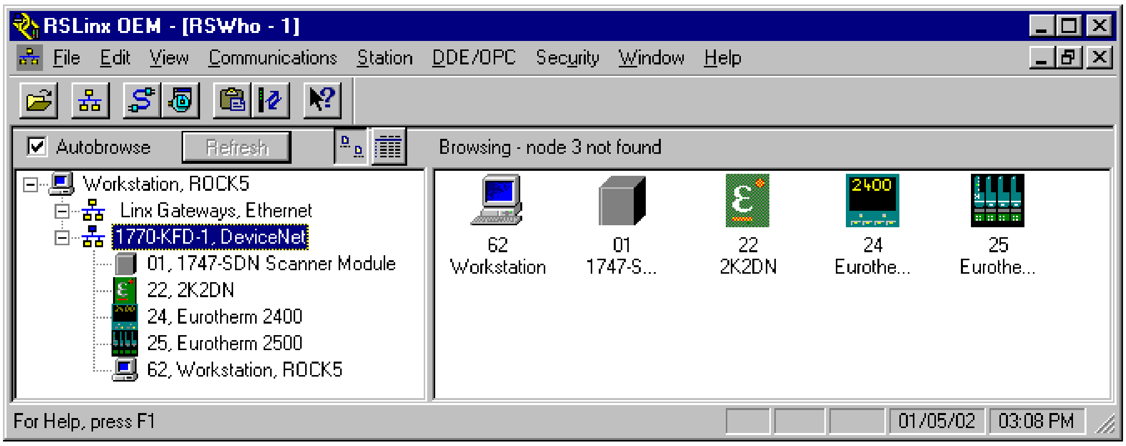
Note – all variables of type INT unless configured using indirection table to be 32 bit (described elsewhere in this document). Data formats are therefore as Tag, i.e. Scaled Integers.

Attribute ID #<number>	Variable	Tag Address
0-99	Indirect R/W parameters (configurable)	16512
100-199	Indirect RO parameters (configurable)	16768

Note that all these parameters are User defined as described in the examples above. To define the parameters their Tag Addresses are required. With the 2500 the best source of Tag Addresses is iTools.

6. Transferring Data – 2400

A network has been set up with a 2500 base at address 25, a 2400 at address 24 and a 2200 at address 22. The baud rate has been set at 500k.



The 2400 has to be set up via the user interface. The controller must have a DeviceNet communications module fitted.

In Configuration mode HA must be set as shown below

id = CmS
Func = dnEt
bAud = 500
res = FuLL

In Operating Mode, with Full Access, in the cmS LiSt the address must be set as shown below

Addr = 24

Hardware wiring is as follows:

Series 2400 Terminal	CAN Label	Colour
HA	V+	Red
HB	CAN_H	White
HC	SHIELD	None
HD	CAN_L	Blue
HE	V-	Black

Once correctly wired to the network and with the correct DeviceNet baud rate and a unique address, communications at the hardware level will be established. This is indicated at the controller by the flashing REM beacon.

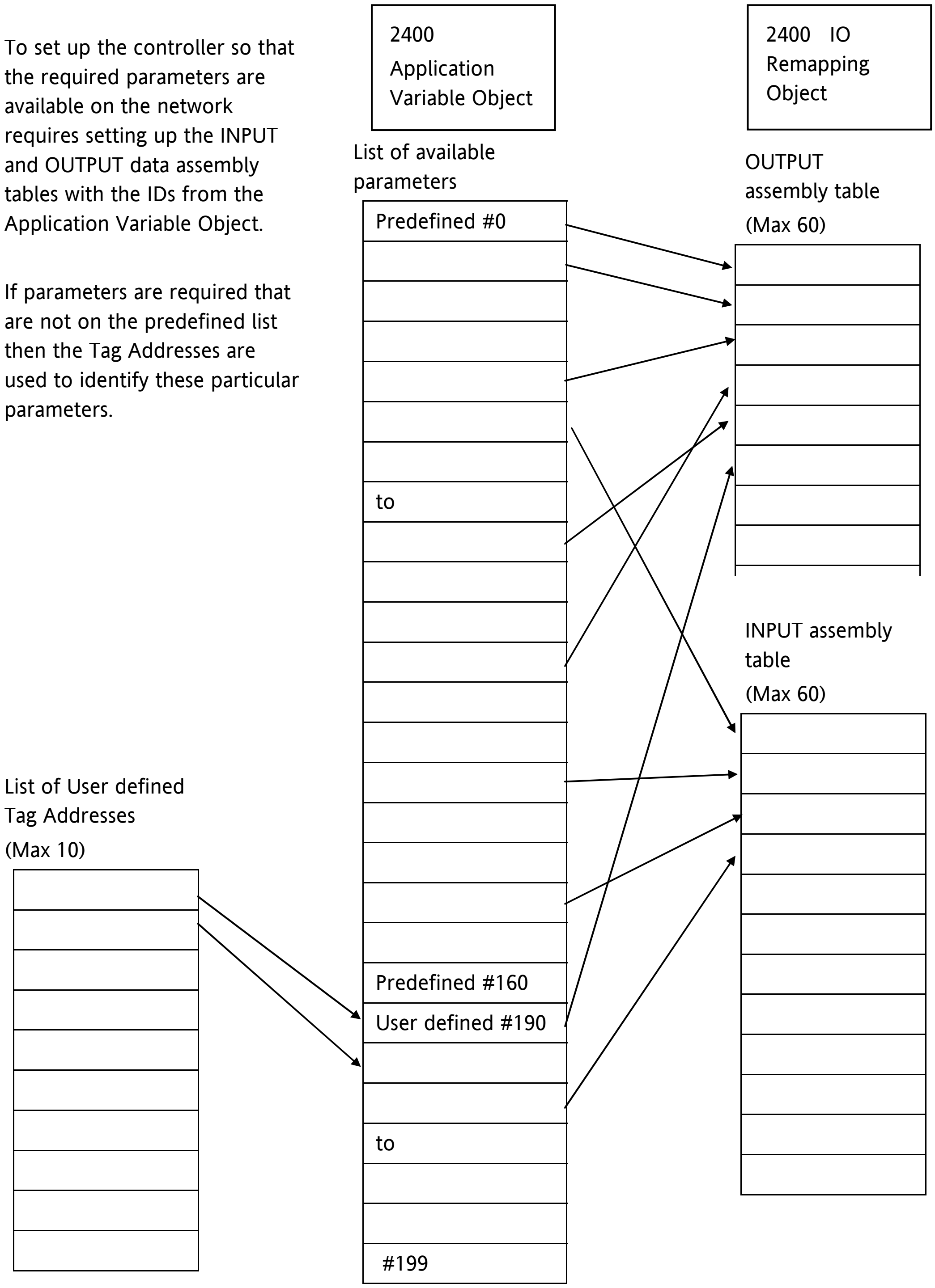
Now the 2400 and the Scanner have to be configured to transfer parameter data.

The 2400 device parameters (Full table in Section 6.4) are divided into 6 'groups'

- A list of instrument parameters pre-defined and immediately available for selection on the INPUT or OUTPUT tables
- a list of additional user defined parameters to add to the INPUT or OUTPUT table
- the actual INPUT table of parameters to be READ by the DeviceNet client
- the actual OUTPUT table of parameters to be WRITTEN by the client
- the Tag address of parameters to be READ by or WRITTEN to the DeviceNet client
- a group that can be used to control block parameter read / write

To set up the controller so that the required parameters are available on the network requires setting up the INPUT and OUTPUT data assembly tables with the IDs from the Application Variable Object.

If parameters are required that are not on the predefined list then the Tag Addresses are used to identify these particular parameters.



EDS list	Quantity	Description
1 to 161	161	Predefined parameters #0 to #160
162 to 171	10	User defined INPUT or OUTPUT parameters #190 to #199
172 to 231	**60**	**Enter #<number> of required INPUT parameters**
232 to 291	**60**	**Enter #<number> of required OUTPUT parameters**
292 to 301	10	Enter Tag Address of user defined INPUT or OUTPUT parameters
302 to 307	Specialist Parameters – block read or write	

To set up the controller so that the desired parameters can be read and written involves setting up the INPUT and OUTPUT tables (highlighted in the table above).

This information can be seen by inspecting the 2400.EDS file in a text editor and is the way in which the data is displayed in RSNetWorx Device Parameters.

This is best illustrated by three examples.

Example 1 is the default 2400 DeviceNet configuration.

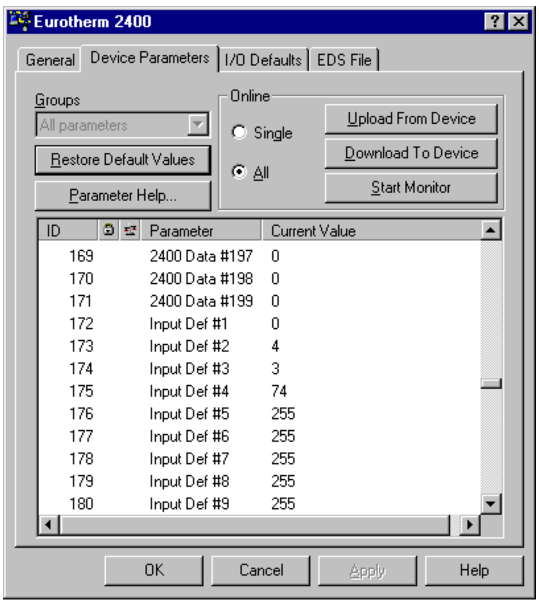
Example 2 uses other pre-defined parameters and includes a simple plc application.

Example 3 adds user defined parameters not included on the pre-defined list.

6.1 Default Example 1

As supplied new the 2400 comes with the following DeviceNet parameter setup. The Attribute for the parameters on the table below come from the full listing in Section 5.4.

Item	Input Parameter	Attribute
1	Process Value	0
2	Working Setpoint	4
3	Working Output Power	3
4	Summary Status	74
Total length = 4 words = 8 bytes		

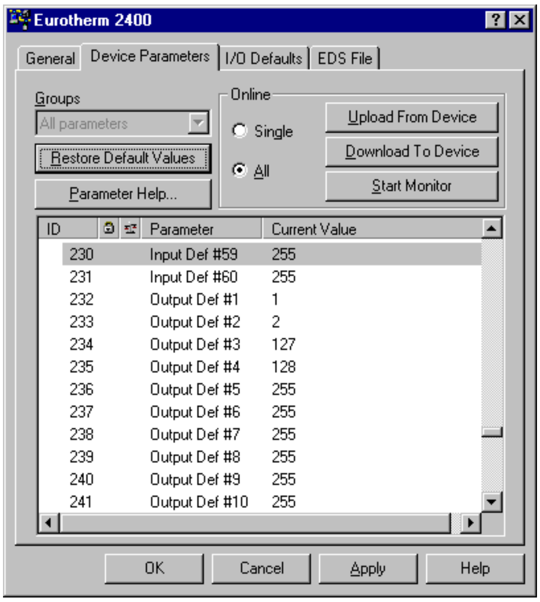


Looking at the Device Parameters via the network we will see these 4 input parameters defined with the above IDs.

Remaining input parameters must be set to 255.

Item	Output Parameter	Attribute
1	Target Setpoint	1
2	Target Output Power	2
3	Auto / Manual	127
4	Alarm Acknowledge	128
Total length = 4 words = 8 bytes		

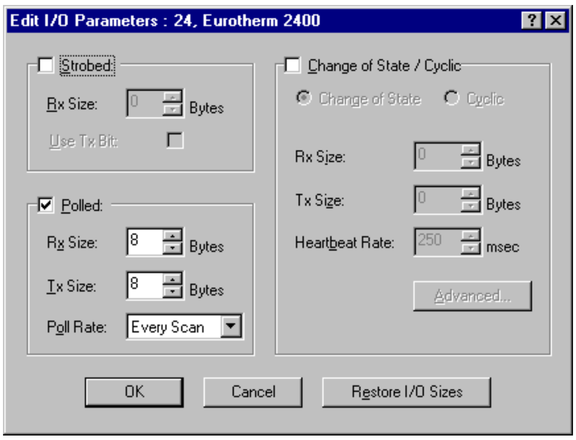
Looking at the Device Parameters via the network we will see these 4 output parameters defined with the above IDs. Remaining input parameters must be set to 255.



Looking at the Device Parameters via the network we will see these 4 output parameters defined with the above IDs.

Remaining input parameters must be set to 255.

All that has to be configured now is the Scanner to transfer these variables.



On the Scanner properties:

'General' Tab – information only

'Module' Tab – set the Scanner module slot correctly (6 in this example)

'Scanlist' tab – add the Eurotherm 2400 to the scan list

Edit I/O parameters – leave the default settings - Polled 8 input and 8 output (shown)

'Input' Tab – Map the 4 input parameters to the M file M1:6.0 to M1:6.3

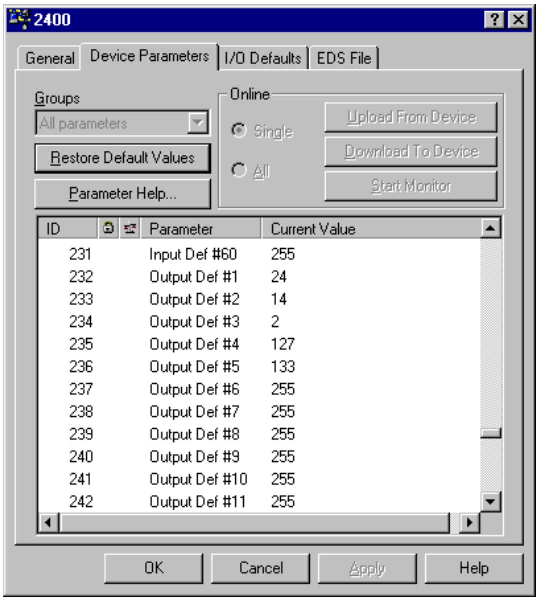
'Output' Tab – Map the 4 output parameters to the M file M0:6.0 to M1:6.3

Click apply to download this to the Scanner (PLC must be in program mode). Once the network is restarted the 2400 REM will change from flashing to steady. Similarly the Scanner error indicator will show no error on node 24. The 4 INPUT and 4 OUTPUT parameters are now being transferred back and forth on the network and will be available in the plc in the I/O files.

6.2 Example 2

In this example the INPUT table stays the same as Example 1 but the output table modified and extended to include the 2 setpoints and the setpoint selector and the disable keys function.

Item	Output Parameter	Attribute
1	Setpoint 2	24
2	Setpoint Select	14
3	Target Output Power	2
4	Auto / Manual	127
5	Disable Keys	133
Total length = 5 words = 10 bytes		



On the 2400 Device Parameters change the Output parameters to the new IDs as listed in the table above.

Download them 'Singly' as entered. Download all may work but check by uploading all afterwards.

All that has to be configured now is the Scanner to transfer these variables.

On the Scanner properties

'Scanlist' tab –

'Edit I/O parameters' – leave set to Polled 8 Input and change the output length to 12.

'Input' Tab – Map the 4 input parameters to the I file I:6.1 to I:6.4

'Output' Tab – Map the 5 output parameters to the O file O:6.1 to O:6.5

Click apply and download this to the Scanner (PLC must be in program mode). Restart the network.

The 4 INPUT and 5 OUTPUT parameters are now being transferred back and forth on the network, and will be available in the plc in the I/O files.

6.2.1 Simple plc application

This uses the 2400 Example 2 configuration:

Item	Output Parameter	PLC Map
1	Setpoint 2	O:6.1
2	Setpoint Select	O:6.2
3	Target Output Power	O:6.3
4	Auto / Manual	O:6.4
5	Disable Keys	O:6.5

Item	Input Parameter	PLC Map
1	Process Value	I:6.1
2	Working Setpoint	I:6.2
3	Working Output Power	I:6.3
4	Summary Status	I:6.4

The 2400 controls a furnace which is used during the day by the operators who use and change the main setpoint, SP 1. The plant is turned down to a standby setpoint SP2 overnight. Setpoint 2 During the day the operators can change the controller settings but overnight the keys are locked.

File 2400Example2.rss ladder Do not leave the keys locked when closing application!

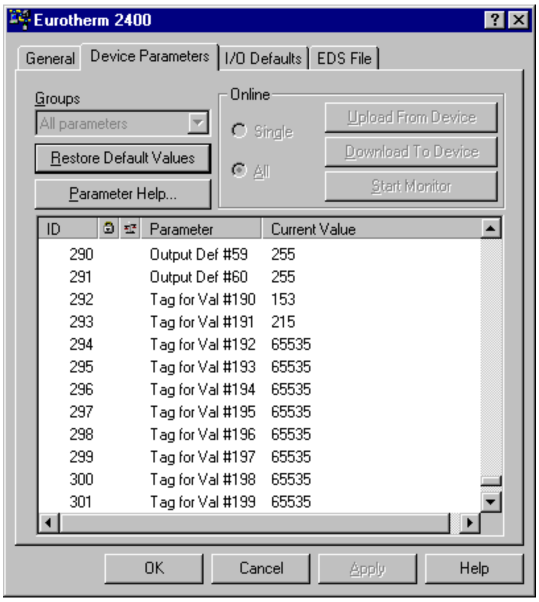
6.3 Example 3

The list of pre-defined parameters in the 2400 is extensive but there is a means of addressing parameters which have not been included. This is done by using the Tag address of the required parameter in the 2400.

For example we shall enable the plc to write to the gain scheduler setpoint at Tag address 153 and to read the CJC temperature of the 2400 t/c input (a useful way to monitor the temperature of a remote cabinet) at Tag Address 215. See Section 6.4.

These two tags will be added onto the end of an existing configuration.

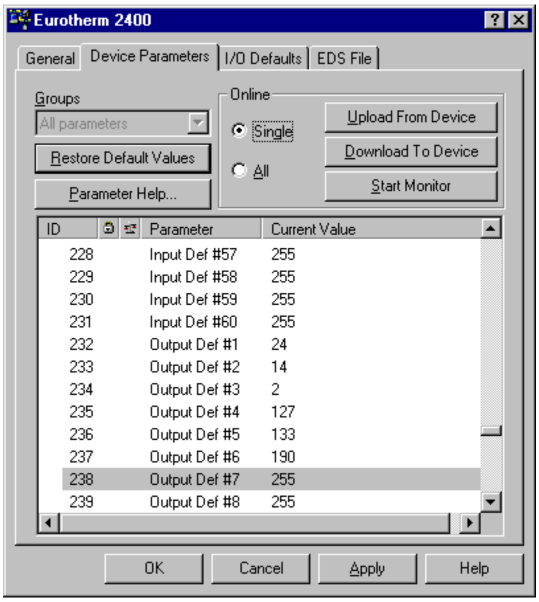
EDS list	Quantity	Description
1 to 161	161	Predefined parameters #0 to #160
162 to 171	10	User defined INPUT or OUTPUT parameters #190 to #199
172 to 231	60	Enter #<number> of required INPUT parameters
232 to 291	60	Enter #<number> of required OUTPUT parameters
292 to 301	**10**	**Enter Tag Address of user defined INPUT or OUTPUT parameters**
302 to 307	Specialist Parameters – block read or write	

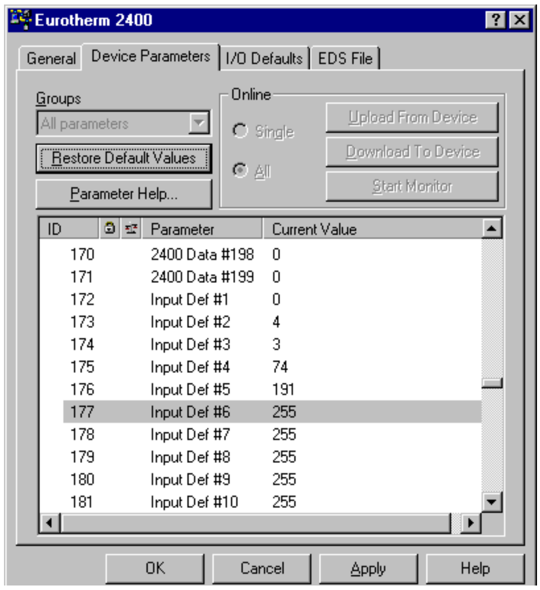


On the properties list for the 2400 we have to go to the list no 292 to enter these Tag addresses in 'Tag for Val #190' and #191.

Gain Schedule SP has Tag address 153, is an OUTPUT and now has ID #190

Input CJC has Tag address 215, is an INPUT and now has ID#191.





So on the output definition list we modify the next available parameter Output Def #7 from 255 to 190

and on the input definition list we modify the next available parameter Input Def #5 from 255 to 191

Finally we have to update the scanlist on the Scanner as the 2400 now has 10 input bytes and 14 Output bytes. These extra parameters will have to be mapped and will then be available to the plc.

6.4 2400 Class, Instance and Attribute ID Table

EDS list	Quantity	Description
1 to 161	161	Predefined parameters #0 to #160 **Class 100 Instance 1 Attributes 0 to 160**
162 to 171	10	User defined INPUT or OUTPUT parameters #190 to #199 **Class 100 Instance 1 Attributes 190 to 199**
172 to 231	60	**Enter #<number> of required INPUT parameters** **Class 102 Instance 1 Attributes 0 to 60**
232 to 291	60	Enter #<number> of required OUTPUT parameters **Class 102 Instance 2 Attributes 0 to 60**
292 to 301	10	Enter Tag Address of user defined INPUT or OUTPUT parameters
302 to 307	Specialist Parameters – block read or write **Class 101 Instance 1 Attributes 1 to 6**	

Note – all variables of type INT - 32 bit format is not supported in this instrument type. Data formats are therefore as Tag, i.e. Scaled Integers. The scaling is based on the number of decimal point places used on the instrument display.

Tag addresses are used to identify parameters in the controller and are identical to the Modbus addresses which are also listed in the Series 2000 Communications Manual, Eurotherm Part No. HA 026230.

After the description is the Tag Address, followed where it is available, by the Attribute ID used in DeviceNet.

There are 161 parameters pre-defined for use on DeviceNet and a further 10 that can be pointed to using parameters with Attributes 190 to 199.

Attribute ID	Description
190-199	Indirect R/W parameters (configurable) – these are not managed via an indirection table, but rather within the interface itself

The tables that follow include all the main instrument parameters in the 'pages' as they appear on the instrument display.

Controller Display	Home Tab Parameter Description	Tag	ID
	Process Variable	1	0
SP	Target setpoint	2	1
OP	% Output power For ON/OFF controllers the following power levels must be written: Cool -100% OFF 0% Heat 100%	3	2
w.SP	Working set point. Read only: use Target set point or currently selected set point (1 to 16) to change the value	5	4
m-A	Auto-man select 0: Auto 1: Manual	273	127
	Pot Position	317	
-	Valve Posn (computed by VP algorithm)	53	52
-	VP Manual Output (alterable in Man only)	60	59
AmPS	Heater current (With PDSIO mode 2)	80	79
C.id	Customer defined identification number	629	
	Setpoint Span	552	
	Error (PV-SP)	39	38
	Remote Input Value	26	25

Status Tab		Tag	ID
Summary Output Status Word		75	74
BIT	**DESCRIPTION**		
0	Alarm 1 State (0 = Safe 1 = Alarm)		
1	Alarm 2 State (0 = Safe 1 = Alarm)		
2	Alarm 3 State (0 = Safe 1 = Alarm)		
3	Alarm 4 State (0 = Safe 1 = Alarm)		
4	Manual Mode (0 = Auto 1 = Manual)		
5	Sensor Break (0 = Good PV 1 = Sensor Broken)		
6	Loop Break (0 = Good closed loop 1 = Open Loop)		
7	Heater Fail (0 = No Fault 1 = Load fault detected)		

8	Tune Active (0 = Auto Tune disabled 1 = Auto Tune active)
9	Ramp/Program Complete (0 = Running/Reset 1 = Complete)
10	PV out of range (0 = PV within table range 1 = PV out of table range)
11	DC control module fault (0= Good. 1= BAD)
12	Programmer Segment Synchronise (0 = Waiting, 1 = Running)
13	Remote input sensor break (0 = Good, 1 = Bad)
14	IP1 Fault
15	Reserved

Status Tab		**Tag**	**ID**
Fast Status Byte		74	73
BIT	**DESCRIPTION**		
Bit 0	Alarm 1 State (0 = Safe 1 = Alarm)		
Bit 1	Alarm 2 State (0 = Safe 1 = Alarm)		
Bit 2	Alarm 3 State (0 = Safe 1 = Alarm)		
Bit 3	Alarm 4 State (0 = Safe 1 = Alarm)		
Bit 4	Manual Mode (0 = Auto 1 = Manual)		
Bit 5	Sensor Break (0 = Good PV 1 = Sensor Broken)		
Bit 6	Loop Break (0 = Good closed loop 1 = Open Loop)		
Bit 7	Heater Fail (0 = No Fault 1 = Load fault detected)		
Control Status Word		76	**75**
BIT	**DESCRIPTION**		
0	Control algorithm Freeze		
1	PV input sensor broken		
2	PV out of sensor range		
3	Self Tune failed		
4	PID servo signal		
5	PID debump signal		
6	Fault detected in closed loop behaviour (loop break)		
7	Freezes the integral accumulator		
8	Indicates that a tune has completed successfully		
9	Direct/reverse acting control		
10	Algorithm Initialisation flag		
11	PID demand has been limited.		
12	Autotune enabled		
13	Adaptive tune enabled		
14	Automatic Droop compensation enabled		
15	Manual / Auto mode switch		
Instrument Status Word		77	76
BIT	**DESCRIPTION**		
0	Config/Oper mode switch		
1	Disables limit checking		
2	SRL ramp running (Read Only)		
3	Remote setpoint active		
4	Alarm acknowledge switch.		
5	Reserved		
6	Reserved		
7	Reserved		
8	Reserved		
9	Reserved		
10	Reserved		
11	Reserved		
12	Reserved		
13	Reserved		
14	Reserved		
15	Reserved		
Program Logic Status		162	
BIT	**DESCRIPTION**		
0	Program Output 1 (0 = OFF 1 = ON)		
1	Program Output 2 (0 = OFF 1 = ON)		
2	Program Output 3 (0 = OFF 1 = ON)		
3	Program Output 4 (0 = OFF 1 = ON)		
4	Program Output 5 (0 = OFF 1 = ON)		
5	Program Output 6 (0 = OFF 1 = ON)		
6	Program Output 7 (0 = OFF 1 = ON)		
7	Program Output 8 (0 = OFF 1 = ON)		
8	Reserved		
9	Reserved		
10	Reserved		
11	Reserved		
12	Reserved		
13	Reserved		
14	Reserved		
15	Reserved		
Digital Output Status Word		551	
BIT	**DESCRIPTION**		
0	H Interface module telemetry (0 = Off, 1 = On)		
1	J Interface module telemetry (0 = Off, 1 = On)		
2	1A module telemetry (0 = Off, 1 = On)		
3	LB logic telemetry (0 = Off, 1 = On)		
4	LA logic telemetry (0 = Off, 1 = On)		
5	1B module telemetry (0 = Off, 1 = On)		
6	1C module telemetry (0 = Off, 1 = On)		
7	2A module telemetry (0 = Off, 1 = On)		
8	2B module telemetry (0 = Off, 1 = On)		
9	2C module telemetry (0 = Off, 1 = On)		
10	3A module telemetry (0 = Off, 1 = On)		
11	3B module telemetry (0 = Off, 1 = On)		
12	3C module telemetry (0 = Off, 1 = On)		
13	AA relay telemetry (0 = Off, 1 = On)		
14	Reserved		
15	Reserved		
Digital Input Status Word		87	86
BIT	**DESCRIPTION**		
0	H Interface module (0 = Off, 1 = On)		
1	J Interface module (0 = Off, 1 = On)		
2	1A module (0 = Off, 1 = On)		
3	LB logic input (0 = Off, 1 = On)		
4	LA logic input (0 = Off, 1 = On)		

5	1B module telemetry	(0 = Off, 1 = On)
6	1C module	(0 = Off, 1 = On)
7	2A module	(0 = Off, 1 = On)
8	2B module	(0 = Off, 1 = On)
9	2C module	(0 = Off, 1 = On)
10	3A module	(0 = Off, 1 = On)
11	3B module	(0 = Off, 1 = On)
12	3C module	(0 = Off, 1 = On)
13	Reserved	
14	Reserved	
15	Reserved	

Parameter Description	Tag	ID
SP Rate Limit Holdback Status 0: Inactive 1: Active	41	40
Pot Break	350	
Freeze Control Flag 0: Controlling 1: Hold	257	
SP Rate Limit Active Status 0: No setpoint rate limit 1: Setpoint rate limit active	275	129
Sensor Break Status Flag 0: Good 1: Sensor break	258	
Power Failed flag 0: Good 1: Power fail detected	259	
New Alarm Flag	260	
Loop Break Status Flag 0: Good 1: Loop break	263	
Integral Hold Status Flag 0: Good 1: Integral hold	264	
SRL Complete Status 0: Setpoint rate limit incomplete 1: Setpoint rate limit complete	277	131
Remote Input Status Flag 0: Good 1: Fault	280	
Sync Continue Flag 0: Continue 1: Awaiting synch	281	

Controller Display	Run Tab Parameter Description	Tag	ID
PrG	Current program running (active prog no.)	22	21
StAt	Program Status 1: Reset 2: Run 4: Hold 8: Holdback 16: Complete	23	22
PSP	Programmer setpoint	163	
CYC	Program cycles remaining	59	58
SEG	Current segment number	56	55
StYP	Current segment type 0: End 1: Ramp (Rate) 2: Ramp (Time to target) 3: Dwell 4: Step 5: Call	29	28
SEGt	Segment time remaining (secs)	36	35
	Segment time remaining (mins)	63	62
tGt	Target setpoint (current segment)	160	
rAtE	Ramp rate	161	
PrGt	Program time remaining	58	57
FASt	Fast run 0: No 1: Yes	57	56
out.1	Logic 1 output (current program) 0: Off (applies to all 8 logic outputs) 1: On (applies to all 8 logic o/ps)	464	
out.2	Logic 2 output (current program)	465	
out.3	Logic 3 output (current program)	466	
out.4	Logic 4 output (current program)	467	
out.5	Logic 5 output (current program)	468	
out.6	Logic 6 output (current program)	469	
out.7	Logic 7 output (current program)	470	
out.8	Logic 8 output (current program)	471	
SYnc	Segment synchronisation 0: No 1: Yes	488	
SEG.d	Flash active segment in lower display	284	
	Advance Segment Flag	149	
	Skip Segment Flag	154	
	Program Logic Status	162	

Controller Display	Alarm Tab Parameter Description	Tag	ID
1---	Alarm 1setpoint value	13	12
2---	Alarm 2setpoint value	14	13
3---	Alarm 3setpoint value	81	80
4---	Alarm 4setpoint value	82	81
HY 1	Alarm 1 hysteresis	47	46
HY2	Alarm 2 hysteresis	68	67
HY3	Alarm 3 hysteresis	69	68
HY4	Alarm 4 hysteresis	71	70
Lbt	Loop break time 0: Off	83	82
diAG	Enable diagnostic messages 0: No Diagnostics 1: Diagnostics	282	
	Acknowledge All Alarms	274	128

Controller Display	Autotune Tab Parameter Description	Tag	ID
tunE	Autotune enable 0: No Tune 1: Tune	270	124
drA	Adaptive tune enable 0: No Adaotive Tune 1: Tune	271	125
drA.t	Adaptive tune trigger level	100	99
Adc	Automatic droop compensation (manual reset) 0: Manual reset 1: Calculated	272	126

Controller Display	PID Tab Parameter Description	Tag	ID
G.SP	Gain scheduler setpoint	153	
SEt	Current PID set (read only if gain scheduling is selected) 0: Set 1 1: Set 2	72	71
Pb	Proportional band PID1	6	5
ti	Integral time PID1 0: Off	8	7
td	Derivative time PID1 0: Off	9	8
rES	Manual reset PID1	28	27
Hcb	Cutback high PID1 0: Auto	18	17
Lcb	Cutback low PID1 0: Auto	17	16
rEL.c	Relative cool gain PID1	19	18
Pb2	Proportional band PID2	48	47
ti 2	Integral time PID2 0: Off	49	48
td2	Derivative time PID2 0: Off	51	50
rES.2	Manual reset PID2	50	49
Hcb2	Cutback high PID2 0: Auto	118	
Lcb2	Cutback low PID2 0: Auto	117	
rEL2	Relative cool gain PID2	52	51
FF.Pb	Feedforward proportional band	97	96
FF.tr	Feedforward trim	98	97
FF.du	Feedforward trim limit	99	98

Controller Display	Motor Tab Parameter Description	Tag	ID
tm	Valve travel time	21	20
I nt	Valve inertia time	123	100
bAc.t	Valve backlash time	124	101
mP.t	Minimum pulse time	54	
u.br	Bounded sensor break strategy	128	105
Sb.oP	VP Bounded sensor break	62	61

Controller Display	I/O Tab Parameter Description	Tag	ID
	DC Output 1A Telemetry	126 94	
	DC Output 2A Telemetry	127 58	
	DC Output 3A Telemetry	128 22	
	BCD Input Value	96	95

Controller Display	Setpoint Tab Parameter Description	Tag	ID
SSEL	Select setpoint 0: SP1 1: SP2	15	14
	2: SP 3 3: SP 4 4: SP 5 5: SP 6 6: SP 7 7: SP 8 8: SP 9 9: SP 10 10: SP 11 11: SP 12 12: SP13 13: SP14 14: SP15 15: SP16		
L-r	Local or remote setpoint select 0: Local 1: Remote	276	130
SP 1	Setpoint 1	24	23
SP 2	Setpoint 2	25	24
SP 3	Setpoint 3	164	
SP 4	Setpoint 4	165	
SP 5	Setpoint 5	166	
SP 6	Setpoint 6	167	
SP 7	Setpoint 7	168	
SP 8	Setpoint 8	169	
SP 9	Setpoint 9	170	
SP 10	Setpoint 10	171	
SP 11	Setpoint 11	172	
SP 12	Setpoint 12	173	
SP 13	Setpoint 13	174	
SP 14	Setpoint 14	175	
SP 15	Setpoint 15	176	
SP 16	Setpoint 16	177	
rm.SP	Remote setpoint	485	
rmt.t	Remote setpoint trim	486	
rAt	Ratio setpoint	61	60
Loc.t	Local setpoint trim	27	26
SP L	Setpoint 1 low limit	112	
SP H	Setpoint 1 high limit	111	
SP2.L	Setpoint 2 low limit	114	
SP2.H	Setpoint 2 high limit	113	
Loc.L	Local setpoint trim low limit	67	66
Loc.H	Local setpoint trim high limit	66	65

SPrr	Setpoint rate limit 0: Off	35	34
Hb.tY	Holdback type for sp rate limit 0: Off 1: Low 2: High 3: Band	70	69
Hb	Holdback value for srtpoint rate limit	65	64
	Programmer State Write	57	
	Programmer state Read	23	22

Controller Display	Input Tab Parameter Description	Tag	ID
FiLt	Input 1 filter time constant 0: Off	101	
FLt.2	Input 2 filter time constant 0: Off	103	
PV.iP	Select input 1 or input 2	288	136
F.1	Derived input function factor 1	292	140
F.2	Derived input function factor 2	293	141
Hi.IP	Switchover transition region high	286	134
Lo.IP	Switchover transition region low	287	135
	Potentiometer Calibration Enable	310	
	Potentiometer Input Calibration Node	311	
	Potentiometer Calibration Go	312	
Emi.S	Emmisivity	38	37
Emi.S2	Emmisivity input 2	104	
CAL	User calibration enable 0: Factory 1: User	110	
CAL.S	Selected calibration point 0: None 1: Input 1 low 2: Input 1 high 3: Input 2 low 4: Input 2 high	102	
AdJ	User calibration adjust input 1	146	
AdJ	User calibration adjust input 2	148	
OFS.1	Input 1 calibration offset	141	118
OFS.2	Input 2 calibration offset	142	119

mV.1	Input 1 measured value	202	
mV.2	Input 2 measured value	208	
CJC.1	Input 1 cold junction temp. reading	215	
CJC.2	Input 2 cold junction temp. reading	216	
Li.1	Input 1 linearised value	289	137
Li.2	Input 2 linearised value	290	138
PV.SL	Currently selected setpoint	291	139

Controller Display	Output Tab Parameter Description	Tag	ID
OP.Lo	Low power limit	31	30
OP.Hi	High power limit	30	29
rOP.L	Remote low power limit	33	32
rOP.H	Remote high power limit	32	31
OPrr	Output rate limit 0: Off	37	36
FOP	Forced output level	84	83
CYC.H	Heat cycle time	10	9
hYS.H	Heat Hysteresis (on/off output)	86	85
ont.H	Heat output minimum on time 0: Auto	45	44
CYC.C	Cool cycle time	20	19
hYS.C	Cool Hysteresis (on/off output)	88	87
ont.C	Cool output minimum on time 0: Auto	89	88
HC.db	Heat/cool dead band (on/off op)	16	15
End.P	Power in end segment	64	63
Sb.OP	Sensor break output power	34	33
Sb.OP	On/Off Sensor Brk OP Power 0: -100% 1: 0% 2: 100%	40	39

Controller Display	Information Tab Parameter Description	Tag	ID
diSP	Lower readout display 0: Standard 1: Load current 2: Output power 3: Status 4: Program time 5: None 6: Valve position 7: Process value 2 8: Ratio setpoint 9: Selected prog. number 10: Remote setpoint	106	
LoG.L	PV minimum	134	111
LoG.H	PV maximum	133	110
LoG.A	PV mean value	135	112
LoG.t	Time PV above threshold level	139	116
LoG.v	PV threshold for timer log	138	115
rES.L	Logging reset 0: Not reset 1: Reset	140	117
mCt	Maximum Control Task Time	201	
w.OP	Working output	4	3
SSr	PDSIO SSR status 0: Good 1: Load fail 2: Open 3: Heater fail 4: SSR fail 5: Sn fail	79	78
FF.OP	Feedforward component of output	209	
P OP	Proportional component of output	214	
I OP	Integral component of output	55	54
d OP	Derivative component of output	116	
VP S	VP motor calibration state 0: Start 1: Waiting 2: Open valve 3: BLUp/InDn 4: Ttup 5: Overshoot 6: InUp/BLDn 7: TT down 8: Open 9: Low lim 10: Stopping 11: Raise 12: Inert up 13: Lower 14: Low lim 15: Stopping 16: Lower 17: InDn/BL 99: Abort	210	

Controller Display	Miscellaneous Tab	Tag	ID
	Parameter Description		
	Instrument Mode	199	**120**
	Instrument Version Number	107	
	Instrument Ident	122	
	Slave Instrument Target Setpoint	92	**91**
	Slave Instrument Ramp Rate	93	**92**
	Slave Instrument Sync	94	**93**
	Remote SRL Hold	95	**94**
	CNOMO Manufacturers ID	121	
	Remote Parameter	151	
	Error Logged Flag	73	**72**
	Ramp Rate Disable	78	**77**
	Maximum Input Value	548	
	Minimum Input Value	549	
	Holdback Disable	278	**132**
	All User Interface Keys Disable	279	**133**

6.4.1 Ramp/Dwell Programmer Data

Program Data Organisation

There are no pre-defined DeviceNet Tags in this area. To read and write programs will require Explicit Messaging. See Section 8 for examples.

A 2400 series controller can contain multiple “programs”, each consisting of up to 16 segments. The data for each program starts at the base tag address given by the following table:

Program	Base Address (Decimal)	Base Address (Hex)
Program 0 (Currently Running Program - changes permitted only in hold, and are not permanently stored)	8192	2000
Program 1	8328	2088
Program 2	8464	2110
Program 3	8600	2198
Program 4	8736	2220

The parameters used to describe a program are organised into 17 blocks, each of 8 words in length, starting at the base address for the program. There is one block for general program data, such as the units to be used for ramp and dwell times, and 16 further blocks for the segment data itself. To obtain the tag address of the data block for a given program, add the block offset given in the next table to the program

Contents	Offset (Decimal)	Offset (Hex)
Program General Data	0	0
Segment 1	8	8
Segment 2	16	10
Segment 3	24	18
Segment 4	32	20
Segment 5	40	28
Segment 6	48	30
Segment 7	56	38
Segment 8	64	40
Segment 9	72	48
Segment 10	80	50
Segment 11	88	58
Segment 12	96	60
Segment 13	104	68
Segment 14	112	70
Segment 15	120	78
Segment 16	128	80

Program General Data

The offsets of each parameter within the program general data block is given by the next table:

Address Offset	Parameter
0	HoldbackType 0: None 1: Low 2: High 3: Band
1	HoldbackValue
2	Ramp Units 0: Secs 1: Mins 2: Hours
3	Dwell Units 0: Secs 1: Mins 2: Hours
4	Program Cycles
5	Reserved
6	Reserved
7	Reserved

Program Segment Data

Program segment data is specified using 8 tag addresses, with the contents varying depending on the type of the segment. The format per segment is detailed in the following table, which gives the offset from the start of a segment data block for each item.

Address Offset	Segment Types					
	STEP	DWELL	RAMP RATE	RAMP TIME TO TARGET	CALL	END
0	Segment Type	Segment Type	Segment Type	Segment Type	Segment Type	Segment Type
1	Target Setpoint		Target Setpoint	Target Setpoint		
2		Duration	Rate	Duration		
3					Program Number	End Type
4	Logic O/P's	Logic O/P's	Logic O/P's	Logic O/P's	Call Cycles	Logic O/P's
5						
6						
7						

Example Address calculations

Program 1, Segment 4, Segment Type = 8328 + 32 + 0 = 8360 (20A8 Hex)

Program 2, Holdback Value = 8464 + 0 + 1 = 8465 (2111 Hex)

Program 4 Segment 16, End Type = 8872 + 128 + 3 = 9003 (232B Hex)

Power Level in End Segment

This has the tag address 64 in 2400 controllers.

Summary of Programmer Enumerators

Controller Display	Parameter Description
tYPE	Current Segment Type 0: End 1: Ramp (Rate) 2: Ramp (Time to target) 3: Dwell 4: Step 5: Call
End.t	End Segment Type 0: Reset 1: Indefinite Dwell 2: Set Output

Controller Display	Parameter Description
Hb	Holdback Type 0: None 1: Low 2: High 3: Band
dwL.U	Dwell Units 0: Seconds 1: Minutes 2: Hours
rmP.U	Ramp Units 0: Seconds 1: Minutes 2: Hours

7. Transferring Data - 2200

A network has been set up with a 2500 base at address 25, a 2400 at address 24 and a 2200 at address 22. The baud rate has been set at 500k.

The table below lists the factory default assignment for the Polled I/O message described in the [IO_Info] section of the EDS file.

Default 2200 INPUT Parameters

Input Words	Parameter
1	Measured Value (PV)
2	Target Setpoint (TS)
3	Output Power (OP)
4	Summary Output Status

where the Summary Output Status bits are set according to the table below.

Summary Output Status	
Bit	**Description**
0	Alarm 1 State
1	Alarm 2 State
2	Alarm 3 State
3	Alarm 4 State
4	Manual Mode
5	Sensor Break
6	Loop Break
7	Heater Fail
8	Load Fail
9	Ramp/Program
10	PV out of range
11	SSR Fail
12	New Alarm
13	Remote input sensor break
14	Reserved
15	Reserved

Default 2200 OUTPUT Parameters

A single user configurable output parameter is available.

Output Words	Parameter
1	Parameter Value
2	‘Address’

To write a parameter using the Polled I/O message, first enter the new Parameter Value, then the Address. To calculate the value required for the ‘Address’, add 256 to the Attribute ID value shown in the Parameter Address Maps shown at the end of this document.

For example, to write to the Target Setpoint – Attribute value 5 – the Address value would be 261.

7.1 Default Example 1

The 2200 parameter tables are not directly configurable so the only task is to transfer the data required. There are 4 input parameters (8 bytes) and 2 output parameters (4 bytes). The example 2200Examples.rss has been set up as follows and the data may be used as required.

2200 parameter	I/O file
Measured Value (PV)	I6.6
Target Setpoint (TS)	I6.7
Output Power (OP)	I6.8
Summary Output Status	I6.9

To read any other parameters within the instrument the only possibility is to use explicit messaging which is described in the section below.

There is only one write parameter, but by selecting the appropriate ID from the tables in Section 6.3 any parameter in the instrument can be written to. Alternatively see the next section on explicit messaging.

2200 parameter	I/O file
Set value	O6.7
Parameter ID + 256	O6.8

The normal requirement is to set the address to 256 + 5 to write to the setpoint (ID = 5). The set value is then written to the controller. There is a Custom Data Monitor showing these values in the example.

To write to a different parameter set the new value as required and its address in the same copy sequence.

e.g. set value 25 and address 272 will set the proportional band to 25.

7.2 Explicit Messaging

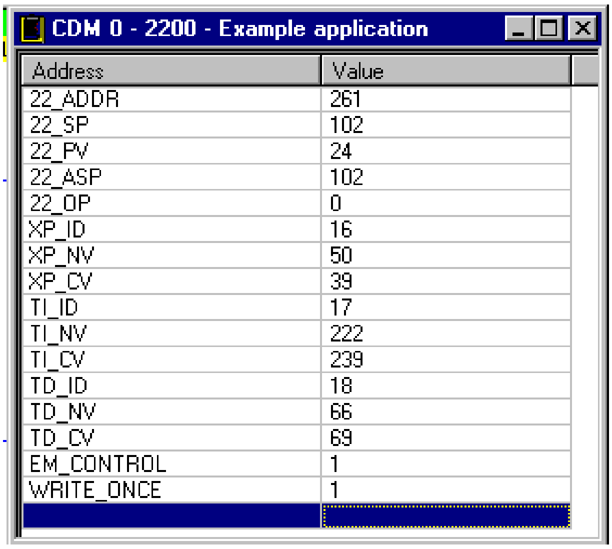
An example is included in the 2200Examples.rss application. This will either read 3 parameters continually or, with new values entered into the table a 'write-once' sequence may be executed. The 3 parameters selected are the PID terms.

The ladder logic sequence has been done as a straight sequence, avoiding indirect addressing, error detection etc., for simplicity and only as an example to show communication. Section 7.2.4 gives key data on Explicit Messaging in the 1747SDN Scanner Module.

7.2.1 User Parameters

N7:60 to 69 are the parameters used to send and read values from the 2200.

N7 address	Value	Description
60	16	Prop band ID
61		New value
62		Current Value
63	17	Integral ID
64		New value
65		Current Value
66	18	Derivative ID
67		New value
68		Current Value
69	0 1 2	Do nothing Read continuous Write once



CDM 0 - 2200 - Example application

Address	Value
22_ADDR	261
22_SP	102
22_PV	24
22_ASP	102
22_OP	0
XP_ID	16
XP_NV	50
XP_CV	39
TI_ID	17
TI_NV	222
TI_CV	239
TD_ID	18
TD_NV	66
TD_CV	69
EM_CONTROL	1
WRITE_ONCE	1

The first 5 parameters are read and written using the normal DeviceNet polling.

XP_*, TI_* and TD_* are the parameters taken from the previous table.

Explicit Messaging will be used to read the current value (CV) or to write the new value (NV). The parameters are selected by choosing the correct Attribute ID from the tables in 6.3. The PID parameters have IDs 16, 17, and 18.

Use EM_CONTROL to read (=1) write once (= 2) or do nothing (=0).

Reset the WRITE_ONCE bit to write continuously.

7.2.2 Explicit Read Message

Transaction Read File – request sent to scanner M0:224. The required format is shown below. The transaction is initiated by sending this to the M0 file and the waiting for the response in the M1 file.

N7 address	Description	Upper byte	Lower Byte	Description	Word value
70	Transaction ID	00000001	00000001	Command: Execute	257
71	Port	00000000	00000110	Byte Size	6
72	Service (14)	00001110	00010110	MacID (22)	3606
73	Class	00000000	01100100	Class=100	100
74	Instance	00000000	00000001	Instance =1	1
75	Attribute	Set to required parameter (from N60, 63 or 66)			

Note: byte size is class, instance, and attribute.

When transaction has been executed then Scanner Input file I:6/15 is set

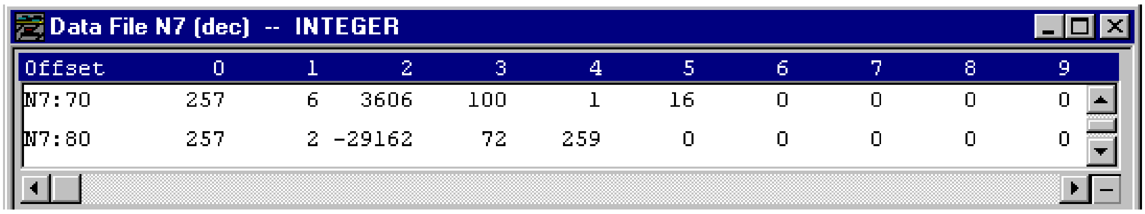
Transaction Read File – response received from scanner M1:224

N7 address	Description	Upper byte	Lower Byte	Description	Word value
80	Transaction ID	00000001	00000001	Status: OK	257
81	Port	00000000	00000110	Byte Size	2
82	Service	10001111	00010110	MacID (22)	
83	Value	Transfer this to N62, N65, N68			

Clear Transaction – sent to scanner M0:224

N7 address	Description	Upper byte	Lower Byte	Description	Word value
84	Transaction ID	00000001	00000003	Command: Execute	259

When transaction has been cleared then Scanner Input file I:6/15 is reset.



Data File N7 (dec) -- INTEGER

Offset	0	1	2	3	4	5	6	7	8	9
N7:70	257	6	3606	100	1	16	0	0	0	0
N7:80	257	2	-29162	72	259	0	0	0	0	0

7.2.3 Explicit Write

Transaction Write File – request sent to scanner M0:224

N7 address	Description	Upper byte	Lower Byte	Description	Word value
90	Transaction ID	00000001	00000001	Command: Execute	257
91	Port	00000000	00001000	Byte Size	8
92	Service (16)	00010000	00010110	MacID (22)	4118
93	Class	00000000	01100100	Class=100	100
94	Instance	00000000	00000001	Instance =1	1
95	Attribute	Set to required parameter (from N60, 63 or 66)			
96	New value	Get from N61, N64, N67			

Note: byte size is class, instance, attribute, and value

When transaction has been executed then Scanner Input file I:6/15 is set

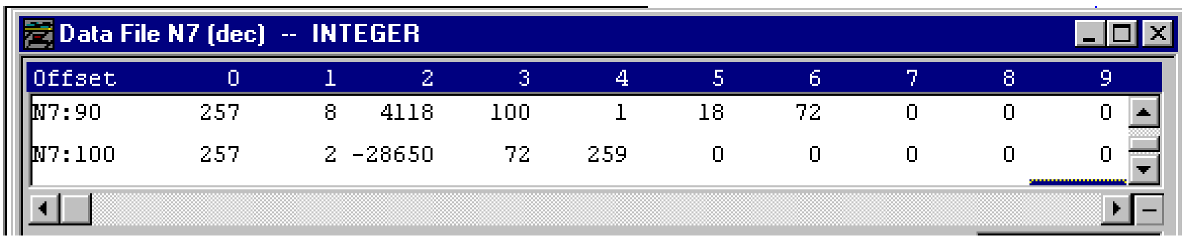
Transaction Write File – response received from scanner M1:224

N7 address	Description	Upper byte	Lower Byte	Description	Word value
100	Transaction ID	00000001	00000001	Status: OK	257
101	Port	00000000	00000010	Byte Size	2
102	Service	10010000	00010110	MacID (22)	
103	Value	Transfer this to N62, N65, N68			

Clear Transaction – sent to scanner **M0:224**

N7 address	Description	Upper byte	Lower Byte	Description	Word value
104	Transaction ID	00000001	00000003	Reset	259

When transaction has been cleared then Scanner Input file I:6/15 is reset.


Data File N7 (dec) -- INTEGER

Offset	0	1	2	3	4	5	6	7	8	9
N7:90	257	8	4118	100	1	18	72	0	0	0
N7:100	257	2	-28650	72	259	0	0	0	0	0

7.2.4 Explicit Message Descriptions

Transaction ID – a user given number to identify the transaction. Up to 10 may be used but the 2200 example only ever uses one.

MacID is the slave address.

Commands – used in transaction request. This example uses 1 and 3.

Command Code	Description
0	Ignore
1	Execute
2	Get status of TXID
3	Reset all TXID
4	Delete transaction TXID
5-255	Reserved

Status – in transaction response. The scanner errors are not used in this example.

Status Code	Description
0	Ignore
1	OK
2	In progress
3 - 15	Errors (See scanner documentation)
16-255	Reserved

Services. This example only uses the 'Single' services.

Name	Code	Description
Get Attribute Single	14	Upload single value
Set Attribute Single	16	Download single value
Get Attribute All	1	Upload all value
Set Attribute All	2	Download all value

7.3 2200 Class Instance &Attribute ID Table

Parameters are Read/Write (RW) which may be used as OUTPUT or INPUT parameters or Read Only (RO) which may only be used as INPUT parameters.

Class = 100 Instance = 1 Attribute in Table.

Home List

Mn	Parameter Name	Attribute		
	Process Variable	0	0h	RO
UPoS	Valve Position	6	6h	
OP	% Output Level	1	1h	RO RW
w.SP	Working Setpoint	2	2h	RO
SP	Target Setpoint (SP)	5	5h	RW
m-A	Manual Mode	8	8h	RW
AmPS	Load Current Requires PDSIO Mode 2	7	7h	RO
di SP	Lower Display	139	8Bh	R/W
Ci d	Customer Defined Identification Number	140	8Ch	R/W

Alarm List

Mn	Parameter Name	Attribute		
1---	Alarm 1 Setpoint	9	09h	RW
2---	Alarm 2 Setpoint	10	0Ah	RW
3---	Alarm 3 Setpoint	11	0Bh	RW
4---	Alarm 4 Setpoint	12	0Ch	RW
HY	Alarm 1-4 Hysteresis	141	8Dh	R/W
Lbt	Loop Break Time	13	0Dh	RW

Autotune List

Mn	Parameter Name	Attribute		
tunE	Autotune Enable	14	0Eh	RW
Adc	Automatic Droop Compensation (PD only control)	15	0Fh	RW

PID List

Mn	Parameter Name	Attribute		
Pb	Proportional Band	16	10h	RW
ti	Integral Time	17	11h	RW
td	Derivative Time	18	12h	RW
rES	Manual Reset %	19	13h	RW
Lcb	Cutback Low	20	14h	RW
Hcb	Cutback High	21	15h	RW
rEL.c	Relative Cool Gain	22	16h	RW

Setpoint List

Mn	Parameter Name	Attribute		
SSEL	Setpoint Select	23	17h	RW
L-r	Local or Remote Setpoint Select	24	18h	RW
SP 1	Setpoint 1	25	19h	RW
SP 2	Setpoint 2	26	1Ah	RW
rm.SP	Remote Setpoint	27	1Bh	RW
Loc.t	Local Setpoint Trim	28	1Ch	RW
SP1.L	Setpoint 1 Low Limit	29	1Dh	RW
SP1.H	Setpoint 1 High Limit	30	1Eh	RW
SP2.L	Setpoint 2 Low Limit	31	1Fh	RW
SP2.H	Setpoint 2 High Limit	32	20h	RW
Loc.L	Local Setpoint Trim Low Limit	33	21h	RW
Loc.H	Local Setpoint Trim High Limit	34	22h	RW
SPrr	Setpoint Rate Limit	35	23h	RW
dwEL	Dwell Time	36	24h	RW
End.t	Go To State At End of Program	37	25h	RW
ProG	Program Control	38	26h	RW
StAt	Program Status	39	27h	RO

Input List

Mn	Parameter Name	Attribute		
Fi Lt	Input filter time	40	28h	RW
OFSt	Process Value Offset	41	29h	RW
CAL	Calibration Type	42	2Ah	RW
CAL.S	Calibration Select	43	2Bh	RW
AdJ	User Calibration Adjust	44	2Ch	RO
CJC	Cold Junction Compensation Temperature	45	2Dh	RO
mU	Input Millivolt Value	46	2Eh	RO

Output List

Mn	Parameter Name	Attribute		
OP.Lo	Low Power Limit	47	2Fh	RW
OP.Hi	High Power Limit	48	30h	RW
Sb.OP	Sensor Break Output	49	31h	RW
CYC.H	Heat Cycle Time	50	32h	RW
CYC.C	Cool Cycle Time	51	33h	RW
ont.H	Heat Output Minimum ON Time	52	34h	RW
ont.C	Cool Output Minimum ON Time	53	35h	RW
mtr	Motor Travel Time	54	36h	RW

On/Off List

Mn	Parameter Name	Attribute		
hYS.H	Heat Hysteresis	55	37h	RW
hYS.C	Cool Hysteresis	56	38h	RW
HC.db	Heat/Cool Dead Band	57	39h	RW

Comms List

	Parameter Name	Attribute		
Addr	Comms Address	58	3Ah	RW

Misc. Status & Comms-Only Parameters

Mn	Parameter Name	Attribute		
	Process Error	143	8Fh	RO
	Controller Version Number	61	3Dh	RO
	CNOMO Manufactures Identifier	62	3Eh	RO
	Controller Identifier	59	3Bh	RO
	Instrument Mode	60	3Ch	RW
	PV Millivolts From Comms	63	3Fh	RW
	Input Test Point Enable	64	40h	
	Sensor Break Sourced From Test	99	63h	
	Filter Initialization Flag	66	42h	
	Sensor Break Status Flag	67	43h	RO
	Acknowledge All Alarms	68	44h	RW
	Disable Keys	142	8Eh	RW

Control Status

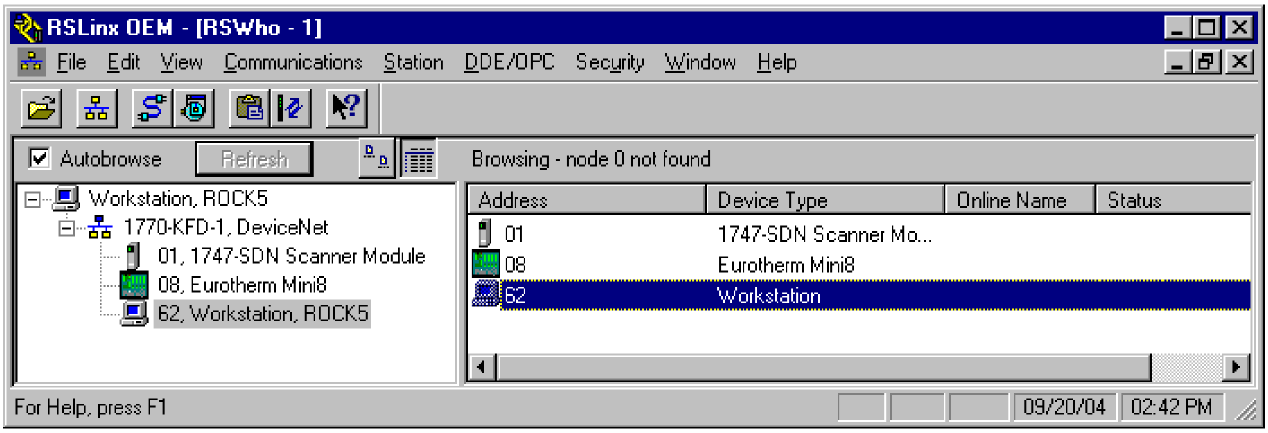
Bit	Description	Attribute		
0	Control algorithm freeze	4	04h	RW
1	PV input sensor broken			
2	PV out of sensor range			
3	Self-tune fail			
4	PID servo signal			
5	PID debump signal			
6	Fault detected in closed loop behaviour (loop break)			
7	Freezes the integral accumulator			
8	Indicates that a tune has completed successfully			
9	Direct/reverse acting control			
10	Algorithm initialization flag			
11	PID demand has been lifted			
12	Reserved			
13	Auto/Adaptive tune enabled			
14	Automatic droop compensation enabled			
15				

8. Transferring Data – Mini8 Controller

In the Mini8 Controller DeviceNet is implemented in one of two ways. There is a standard DeviceNet interface module and an Enhanced DeviceNet module. Differences occur when setting addresses, baud rates, hardware interconnections and indication of the status of the module and network. Both implementations are described in this section.

Transfer of data is the same for both options.

A network has been set up with a Mini8 controller at address 8. The baud rate has been set at 500k.

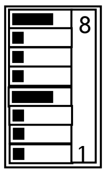


8.1 DeviceNet Interface

8.1.1 Setting Baud Rate and Address in the Standard Module

The baud rate & address are set on the Mini8 controller using the DIL switch or by iTools.

Sw	OFF	ON
8	Baud rate	Baud rate
7	Baud rate	Baud rate
6	-	Address 32
5	-	Address 16
4	-	Address 8
3	-	Address 4
2	-	Address 2
1	-	Address 1



OFF ↔ ON

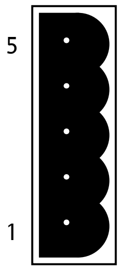
Example shows 500k baud rate and address 8

Sw	Baud rate		
	125k	250k	500k
8	OFF	OFF	ON
7	OFF	ON	OFF

Use 500k unless the total length of the DeviceNet network is longer than 100m.

Address 0 is a valid DeviceNet address but Mini8 Controller addresses can be set via iTools, when all switches are set to 0.

8.1.2 Hardware Wiring



Pin	Mini8 controller Legend	CAN Label	Colour
5	V+	V+	Red
4	CH	CAN_H	White
3	DR	DRAIN	None
2	CL	CAN_L	Blue
1	V-	V-	Black

8.2 Enhanced DeviceNet Interface

This is designed for use in the semiconductor industry. It uses a rotary switch for setting baud rate and a pair of rotary switches for setting address.

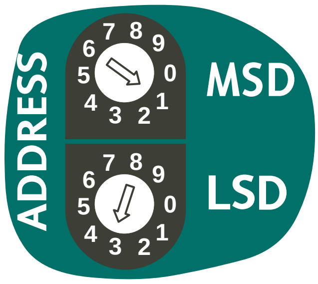
8.2.1 Address Switch

The Node ID (address) is set via two BCD rotary switches, one for each digit.

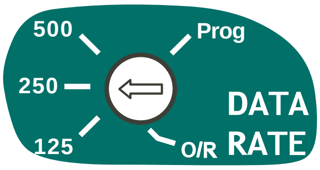
For example, an address of 13 is configured by setting the MSD to 1 and LSD to 3.

Valid DeviceNet address range is 0 - 63. If the switches are set in the range 64 - 99 the switches will be ignored and the node address will be configured by the Mini8 Controller via iTools.

When the address is changed the DeviceNet interface will automatically restart.



8.2.2 Baud Rate Switch



The baud rate is selected by a single BCD rotary switch, and can be set to 125K, 250K or 500K.

The 'Prog' position is selected when it is required to upgrade the Mini8 Controller firmware.

The O/R position is selected when it is required to set Baud Rate using iTools configuration software.

When the baud rate is changed or the 'Prog' position is selected the instrument must be power cycled for the change to be activated.

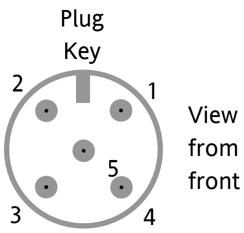
Make sure that the switch is set to valid positions as marked on the panel.

8.2.3 Switch Position in iTools

The value of the Baud Rate and Address is returned so that it can be read by iTools. Please note, however, that if the DeviceNet network is unpowered for any reason, any changes to the Baud Rate and Address will NOT be seen in iTools even though the Mini8 Controller is powered and communicating normally via the CC port or config clip.

8.2.4 Connector

The 5-way connector shown in section 8.1.2 is replaced by a 'Micro-Connect' circular 5-pin M12 male connector.



Pin	Legend	Function
5	CAN_L	CAN_L
4	CAN_H	CAN_H
3	V-	V-
2	V+	V+
1	DR	DRAIN

8.3 DeviceNet Status Indication

For DeviceNet the status of the module and the network is shown by 6 LED indicators on the front panel.

Power and State of Relays

LEDs P, A and B show power and, relay states.

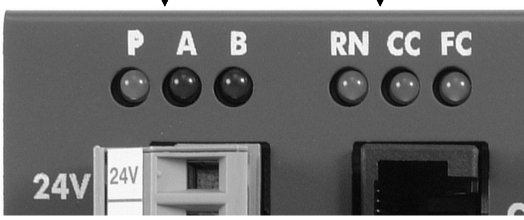
Legend	P Green	A Red	B Red
Function	24V connected	Relay A state	Relay B state
OFF	No power	De-energised	De-energised
ON	Powered	Energised	Energised

Running and Configuration

LEDs RN and CC show Run state and Configuration.

Legend	RN Green	CC Green
Function	Run mode	Configuration
OFF	Not running	--
Blinking	Standby	Config traffic
ON	Running	--

☺ The Mini8 controller is controlling normally ONLY if the green RN LED is permanently ON.



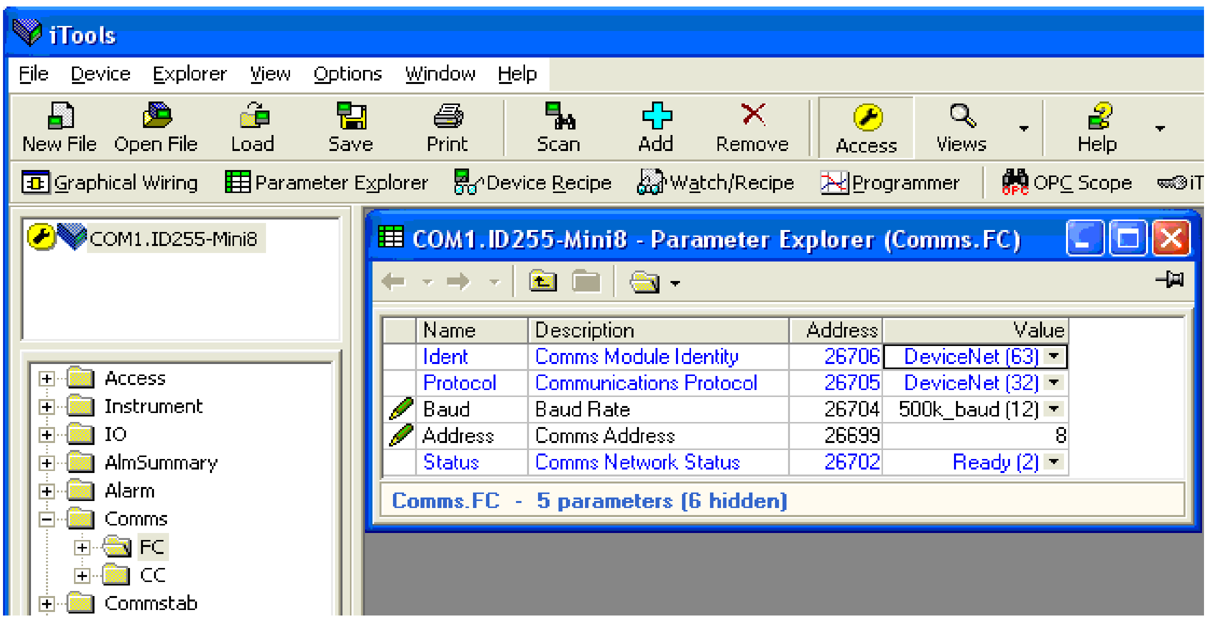
Network Status

The status of the network is shown by the LED indicator 'FC'.

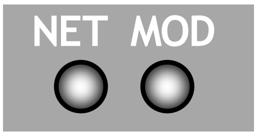
Comms Network Status is also shown in iTools by the 'Status' parameter

FC LED Green	'Status' Parameter Enumeration	Meaning
On	RUNNING (0)	Network connected and running
Off	INIT (1)	Network initialising
Blinking	READY (2)	DeviceNet traffic detected but not for this address
Off	OFFLINE (3)	No DeviceNet traffic detected

The 'Status' parameter is found in the Comms list:-



8.3.1 Status Indication for Enhanced DeviceNet



If an Enhanced DeviceNet module is fitted, two bi-colour LEDs are used to indicate Module and Network status.

These two LEDs replace the single LED shown as FC on other modules. See previous section.

8.3.2 Module Status Indication

The module status LED (MOD) has the functionality shown below:

LED State	Device State	Description
OFF	Off	No power applied to DeviceNet network.
Green/Red flashing	Self test	LED power-up test. Regular flash: Interface module initialising. If the LED remains in this flashing state indefinitely, check the Baud rate switch setting.
Green ON	Operational	DeviceNet interface is operational.
Red ON	Unrecoverable fault	Mini8 Controller not powered. Nvol checksum failure.
Red/off flashing	Recoverable fault	Communications error between the network and the DeviceNet module.

8.3.3 Network Status Indication

The network status LED (NET) indicates the status of the Enhanced DeviceNet communications link as shown in the table below.

Note: The final column shows the enumerated values for the ‘Comms Network Status’ parameter available in iTools.

LED State	Network State	Description	‘Status’ Parameter Enumerations
OFF	Off	Device is not on line	OFFLINE (10)
Green flashing	On-line, not connected	Device is on line but has no connections established	READY (11)
Green ON	On-line and connected	Device is on line and has connections established	ONLINE (12)
Red flashing	Connection timed out	One or more connections have timed out	IO TIMEOUT (13)
Red ON	Critical link failure	Communication error that has rendered the device incapable of communicating on the network	LINK FAIL (14)
Green/Red	Communications fault	Communications fault but the device has received an Identify Communication Faulted Request	COMM FAULT (15)

Now the Mini8 Controller and the Scanner have to be configured to transfer parameter data.

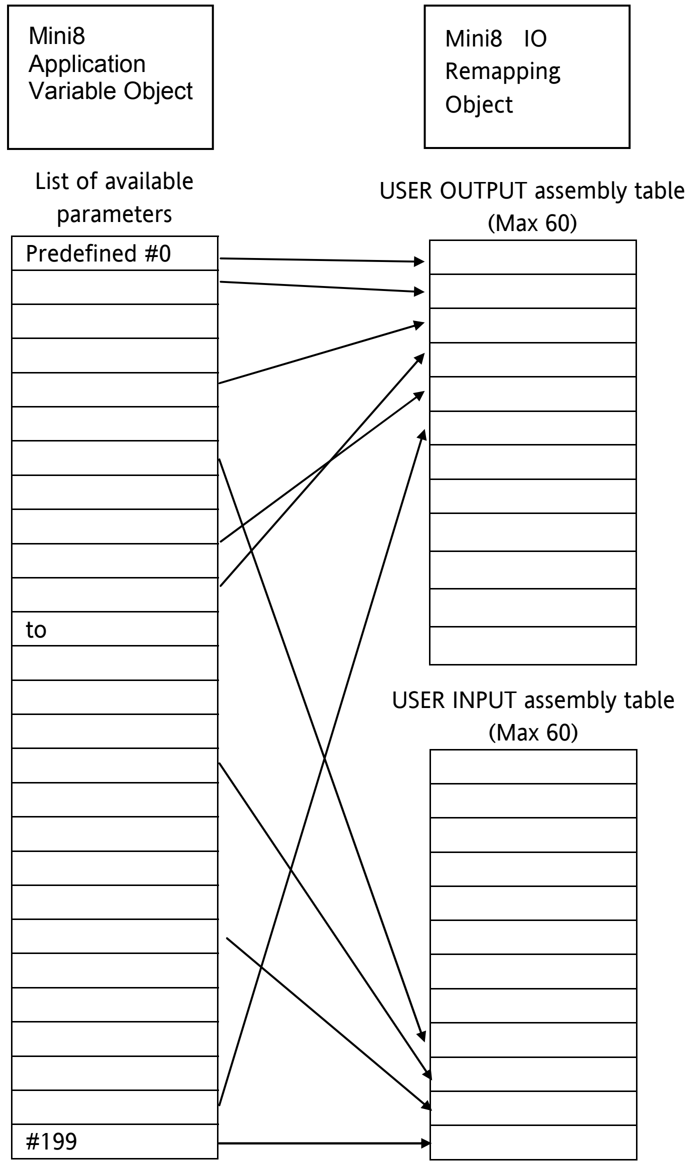
The Mini8 Controller device parameters are divided into 3 ‘groups’:-

A list of instrument parameters pre-defined for selection on the INPUT or OUTPUT tables.
The actual INPUT table of parameters to be READ by the DeviceNet client.
The actual OUTPUT table of parameters to be WRITTEN by the client.

8.3.4 Table Modification

Make a list of parameters required in the input and output tables to suit the application. If the parameter is listed in the predefined list then use the attribute number of that parameter.

To set up the controller so that the required parameters are available on the network requires setting up the INPUT and OUTPUT data assembly tables with the IDs from the Application Variable Object.



EDS list	Quantity	Description
1 to 200	200	Predefined parameters #0 to #199
201 to 260	**60**	**Enter #<number> of required INPUT parameters**
261 to 320	**60**	**Enter #<number> of required OUTPUT parameters**

To set up the controller so that the desired parameters can be read and written involves setting up the INPUT and OUTPUT tables (highlighted in the table above).

This information can be seen by inspecting the Mini8.EDS file in a text editor and is the way in which the data is displayed in RSNetWorx Device Parameters.

This is best illustrated by four examples.

Example 1 is the default Mini8 controller DeviceNet configuration.

Example 2 uses a limited number of parameters.

Example 3 uses other parameters from the pre-defined list.

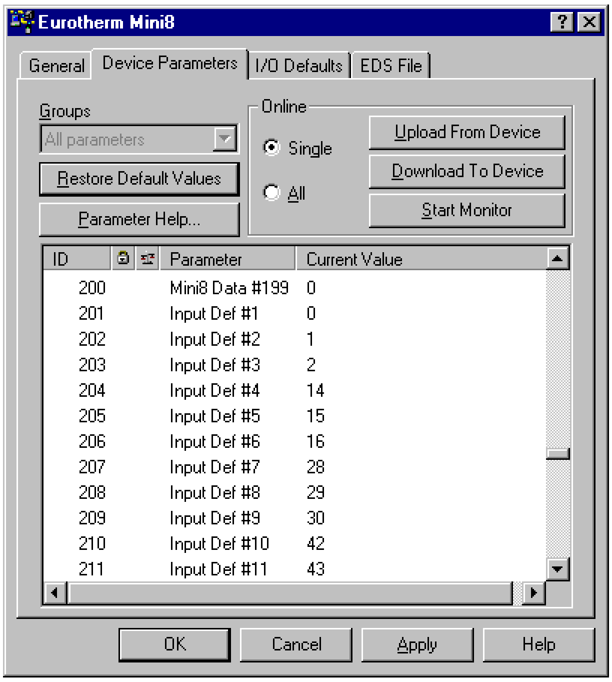
Example 4 adds parameters NOT included on the pre-defined list.

8.4 Default Example 1

As supplied new, the Mini8 controller comes with the following DeviceNet parameter setup. The value of the attributes for the parameters on the table below are from the full listing in Section 8.8.

Item	Input Parameter	Value (Attr ID)
1	Loop.1.Main.PV	0
2	Loop.1.Main.WorkingSP	1
3	Loop.1.Main.ActiveOut	2
4	Loop.2.Main.PV	14 (0EH)
5	Loop.2.Main.WorkingSP	15 (0FH)
6	Loop.2.Main.ActiveOut	16 (10H)
7	Loop.3.Main.PV	28 (1CH)
8	Loop.3.Main.WorkingSP	29 (1DH)
9	Loop.3.Main.ActiveOut	30 (1EH)
10	Loop.4.Main.PV	42 (2AH)
11	Loop.4.Main.WorkingSP	43 (2BH)
12	Loop.4.Main.ActiveOut	44 (2CH)
13	Loop.5.Main.PV	56 (38H)
14	Loop.5.Main.WorkingSP	57 (39H)
15	Loop.5.Main.ActiveOut	58 (3AH)
16	Loop.6.Main.PV	70 (46H)
17	Loop.6.Main.WorkingSP	71 (47H)
18	Loop.6.Main.ActiveOut	72 (48H)
19	Loop.7.Main.PV	84 (54H)
20	Loop.7.Main.WorkingSP	85 (55H)
21	Loop.7.Main.ActiveOut	86 (56H)
22	Loop.8.Main.PV	98 (62H)
23	Loop.8.Main.WorkingSP	99 (63H)
24	Loop.8.Main.ActiveOut	100 (64H)
25	AlmSummary.General.AnAlarmStatus1	144 (90H)
26	AlmSummary.General.AnAlarmStatus2	145 (91H)
27	AlmSummary.General.AnAlarmStatus3	146 (92H)
28	AlmSummary.General.AnAlarmStatus4	147 (93H)
29	AlmSummary.General.SBrkAlarmStatus1	148 (94H)
30	AlmSummary.General.SBrkAlarmStatus2	149 (95H)
31	AlmSummary.General.SBrkAlarmStatus3	150 (96H)
32	AlmSummary.General.SBrkAlarmStatus4	151 (97H)
33	AlmSummary.General.CTAlarmStatus1	152 (98H)
34	AlmSummary.General.CTAlarmStatus2	153 (99H)
35	AlmSummary.General.CTAlarmStatus3	154 (9AH)
36	AlmSummary.General.CTAlarmStatus4	155 (9BH)
37	AlmSummary.General.NewAlarm	156 (9CH)
38	AlmSummary.General.AnyAlarm	157 (9DH)
39	AlmSummary.General.NewCTAlarm	158 (9EH)
40	Programmer.1.Run.ProgStatus	184 (B8H)
Total Length = 40 words x 2 = 80 bytes		

In RSNetworx right click on the Mini8 controller and select properties. By looking at the properties of the Mini8 controller the default input table can be inspected.



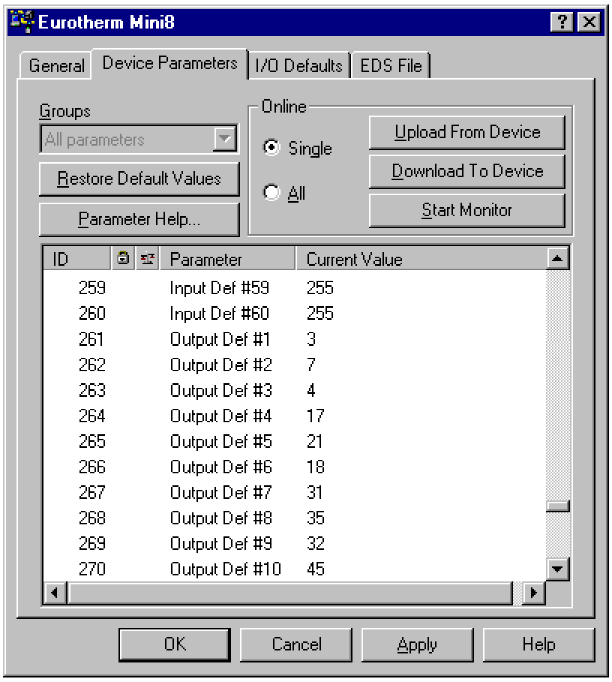
The current value is the attribute ID of the parameter required.

At the end of the input def part of the table the remaining items are given the value 255 which means not used.

A maximum of 60 parameters are possible.

Item	Output Parameter	Attribute
1	Target SP – Loop 1	3
2	Auto/Manual – Loop 1	7
3	Manual Output – Loop 1	4
4	Target SP – Loop 2	17 (11H)
5	Auto/Manual – Loop 2	21 (15H)
6	Manual Output – Loop 2	18 (12H)
7	Target SP – Loop 3	31 (1FH)
8	Auto/Manual – Loop 3	35 (23H)
9	Manual Output – Loop 3	32 (20H)
10	Target SP – Loop 4	45 (2DH)
11	Auto/Manual – Loop 4	49 (31H)
12	Manual Output – Loop 4	46 (2EH)
13	Target SP – Loop 5	59 (3BH)
14	Auto/Manual – Loop 5	63 (3FH)
15	Manual Output – Loop 5	60 (3CH)
16	Target SP – Loop 6	73 (49H)
17	Auto/Manual – Loop 6	77 (4DH)
18	Manual Output – Loop 6	74 (4AH)
19	Target SP – Loop 7	87 (57H)
20	Auto/Manual – Loop 7	91 (5BH)
21	Manual Output – Loop 7	88 (58H)
22	Target SP – Loop 8	101 (65H)
23	Auto/Manual – Loop 8	105 (69H)
24	Manual Output – Loop 8	102 (66H)
TOTAL LENGTH 24 words x 2 = 48 bytes.		

By looking at the properties of the Mini8 controller the default output table can be inspected.

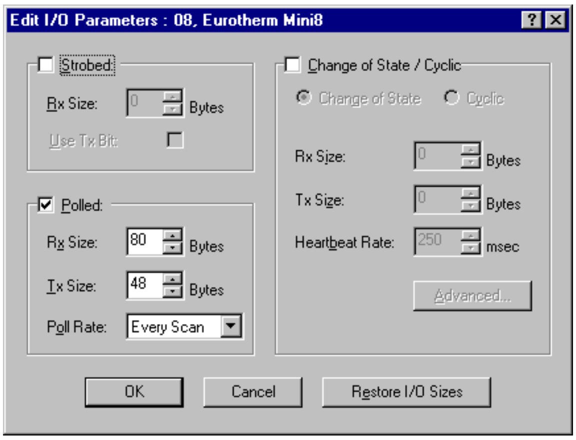


The current value is the attribute ID of the parameter required.

At the end of the output def part of the table the remaining items are given the value 255 which means not used.

A maximum of 60 parameters are possible.

Now the scanner has to be set up to transfer this data. On RSNetWorx right click on the Scanner and select properties.



On the Scanner properties:

'General' Tab – information only

'Module' Tab – set the Scanner module slot correctly (6 in this example)

'Scanlist' tab – add the Eurotherm Mini8 from 'available' to the scan list

'Edit I/O parameters' – tick Polled 80 Rx input and 48 Tx output (shown)

'Input' Tab – Map the 40 input parameters to the M file M1:6.0 to M1:6.39

'Output' Tab – Map the 24 output parameters to the M file M0:6.0 to M1:6.23

Click apply to download this to the Scanner (PLC must be in program mode). Once the network is restarted the Min8 FC LED will change from flashing to steady. Similarly the Scanner error indicator will show no error on node 8.

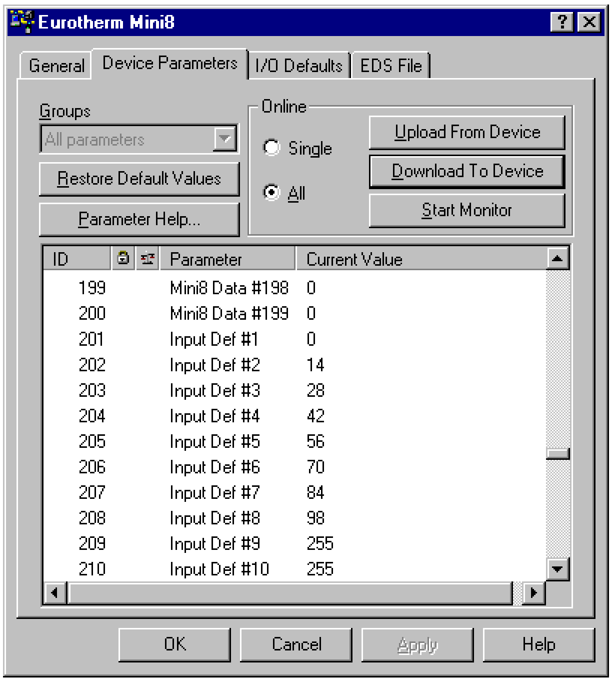
The 40 INPUT and 24 OUTPUT parameters are now being transferred back and forth on the network and will be available to the plc from the memory files M1:6 and M0:6 using 'COPY' functions. There are too many parameters to transfer directly into the module I/O files.

8.5 Example 2

In this example the input table is reduced to just the 8 loop PVs and the output table to the 8 Loop target setpoints.

Item	Input Parameter	Value (Attr ID)
1	Loop.1.Main.PV	0
2	Loop.2.Main.PV	14
3	Loop.3.Main.PV	28
4	Loop.4.Main.PV	42
5	Loop.5.Main.PV	56
6	Loop.6.Main.PV	70
7	Loop.7.Main.PV	84
8	Loop.8.Main.PV	98
Total Length = 8 words x 2 = 16 bytes		

In RSNetworx right click on the Mini8 controller and select properties. By looking at the properties of the Mini8 controller the default input table can be modified.



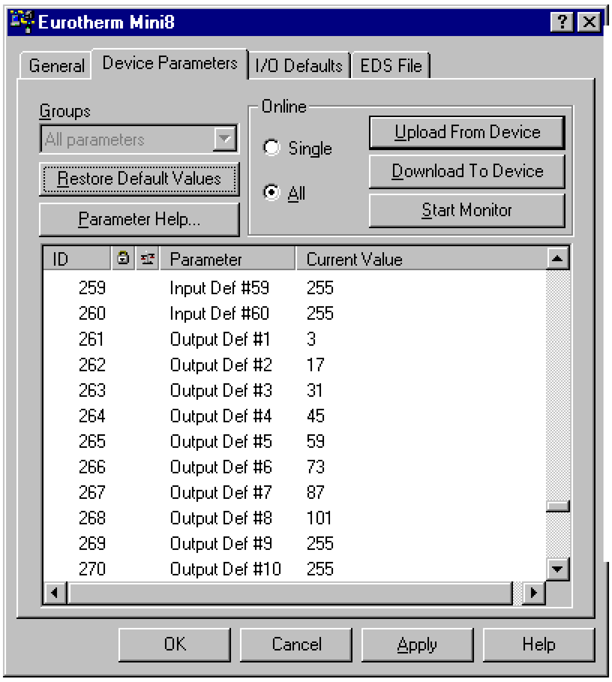
The current value of the first 8 input defs are set to the tribute IDs of the 8 Loop PVs.

After that the remaining items must be given the value 255 which means not used.

Once the values have been changed 'Download to the Device' to update the Mini8.

Now the output table must be modified.

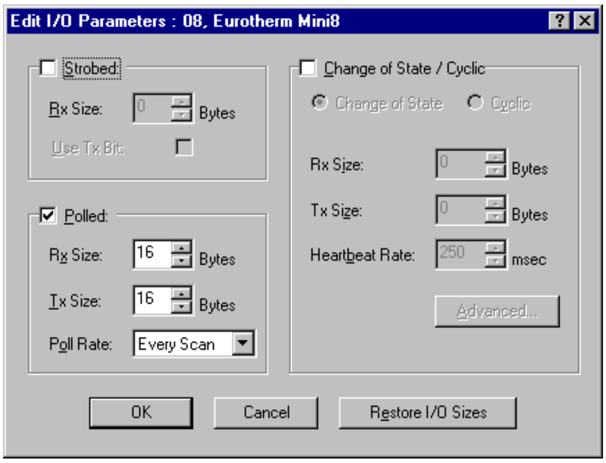
Item	Output Parameter	Attribute
1	Target SP – Loop 1	3
2	Target SP – Loop 2	17
3	Target SP – Loop 3	31
4	Target SP – Loop 4	45
5	Target SP – Loop 5	59
6	Target SP – Loop 6	73
7	Target SP – Loop 7	87
8	Target SP – Loop 8	101
TOTAL LENGTH 8 words x 2 = 16 bytes.		



The current value of the first 8 output defs are set to the tribute IDs of the 8 Loop target setpoints..

After that the remaining items must be given the value 255 which means not used.

Once the values have been changed 'Download to the Device' to update the Mini8.



On the Scanner properties:

'General' Tab – information only

'Module' Tab – set the Scanner module slot correctly (6 in this example)

'Scanlist' tab – add the Eurotherm Mini8 from 'available' to the scan list

'Edit I/O parameters' – tick Polled, input Rx=16 and output Tx =16 (shown)

'Input' Tab – Map the 8 input parameters to the module I/O file I:6.1 to I:6.8

'Output' Tab – Map the 8 output parameters to the module I/O file O:6.1 to O1:6.8.

Click apply to download this to the Scanner (PLC must be in program mode). Once the network is restarted the Min8 FC LED will change from flashing to steady. Similarly the Scanner error indicator will show no error on node 8.

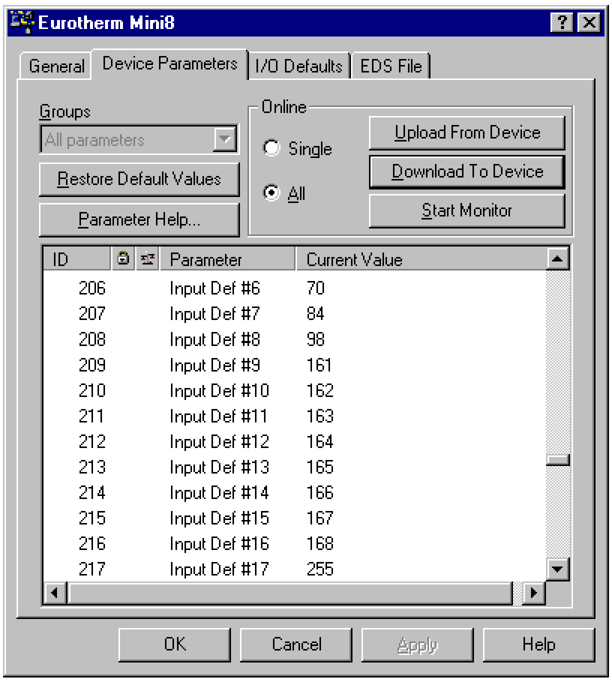
The 8 INPUT PV and 8 OUTPUT SP parameters are now being transferred back and forth on the network and will be available in the plc in the module I/O files I:6 and O:6. Note O:6.0 must be set to 1.

8.6 Example 3

In this example the input table is from Example 2 has parameters from the predefined list added. The 8 actual current inputs from the predefined list are added to the input table. Looking at the complete list of pre-defined variables in the Mini8 controller in the table in 7.6 the CT load currents 1 to 8 have values 0f 161 to 168.

Item	Input Parameter	Value (Attr ID)
1	Loop.1.Main.PV	0
2	Loop.2.Main.PV	14
3	Loop.3.Main.PV	28
4	Loop.4.Main.PV	42
5	Loop.5.Main.PV	56
6	Loop.6.Main.PV	70
7	Loop.7.Main.PV	84
8	Loop.8.Main.PV	98
9	CT Load Current 1	161
10	CT Load Current 2	162
11	CT Load Current 3	163
12	CT Load Current 4	164
13	CT Load Current 5	165
14	CT Load Current 6	166
15	CT Load Current 7	167
16	CT Load Current 8	168
Total Length = 16 words x 2 = 32 bytes		

In RSNetWorx right click on the Mini8 controller and select properties. By looking at the properties of the Mini8 controller the default input table can be modified.



The values of the input definitions are modified to add the CT current values after the eight PVs.

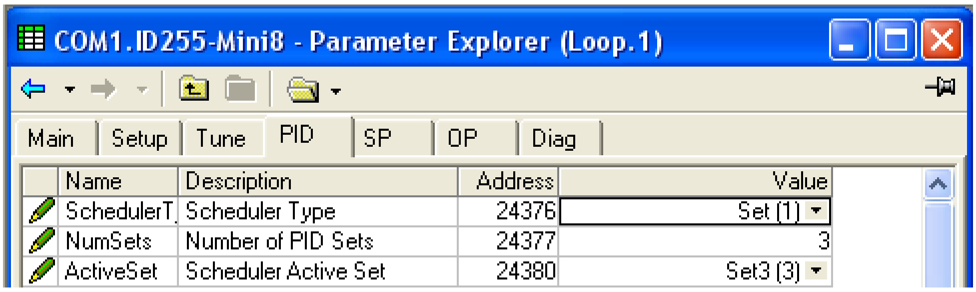
Then download to the Mini8.

8.7 Example 4

In this example, on the Output table, parameters will be added which are not on the predefined list. This requires modification of the Mini8 controller itself using iTools.

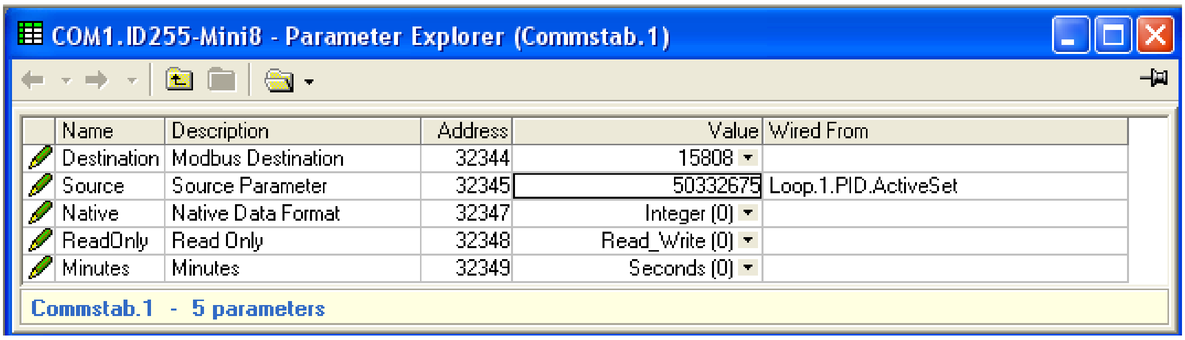
The 'Scheduler Active Set' parameter will be added for each of the 8 loops. This will allow the plc to select the PID set to be used for a particular task.

First the Loop.1.PID.SchedulerType has to be set to 'Set' and Loop.1.PID.NumSets set to 3 and similarly for Loops 2 to 8.

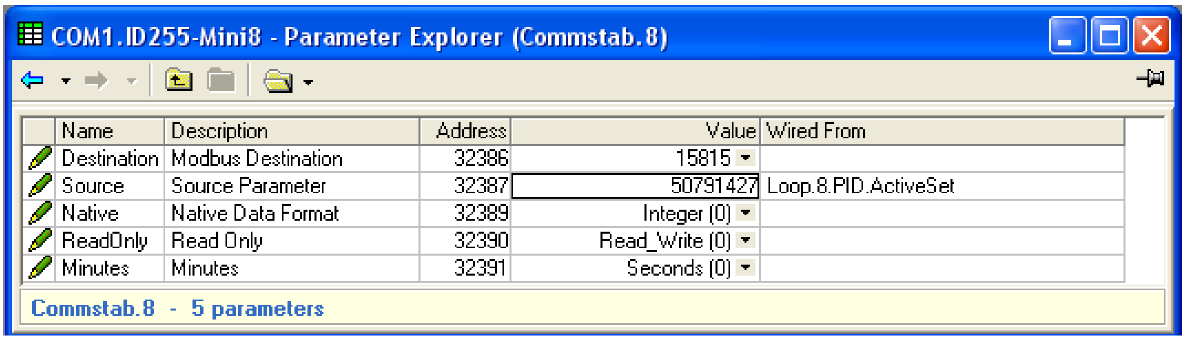


These parameters now have to be entered into the CommsTab tables. We will use AttributeID 192 to 199 for the eight 'Scheduler Active Set'. From the table in 7.5 these have Modbus addresses 15808 to 15815.

So in Configuration mode, in Commstab.1, set the Destination parameter to 15808 and drag and drop the Scheduler Active Set to the Source parameter 'wired from'.



Similarly with Commstab.2 to .8

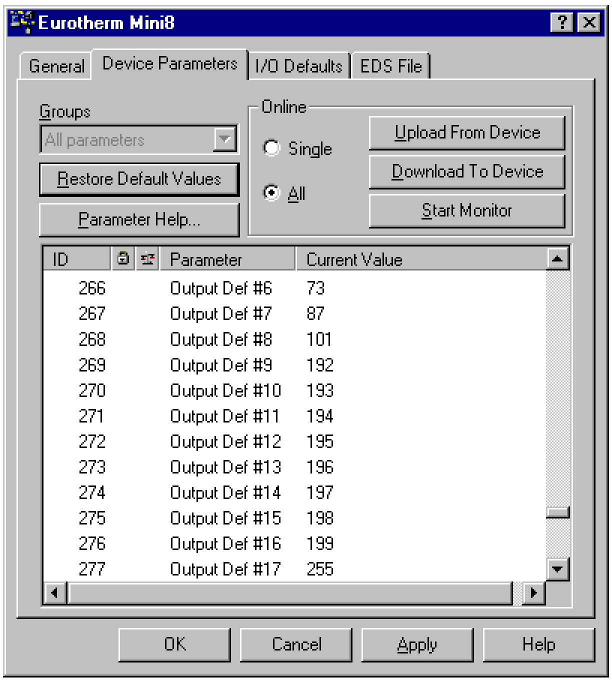


Return the Mini8 controller to operating mode.

Now set the output table in DeviceNet.

Item	Output Parameter	Attribute
1	Target SP – Loop 1	3
2	Target SP – Loop 2	17
3	Target SP – Loop 3	31
4	Target SP – Loop 4	45
5	Target SP – Loop 5	59
6	Target SP – Loop 6	73
7	Target SP – Loop 7	87
8	Target SP – Loop 8	101
9	Scheduler Active set Loop 1	192
10	Scheduler Active set Loop 2	193
11	Scheduler Active set Loop 3	194
12	Scheduler Active set Loop 4	195
13	Scheduler Active set Loop 5	196
14	Scheduler Active set Loop 6	197
15	Scheduler Active set Loop 7	198
16	Scheduler Active set Loop 8	199
TOTAL LENGTH 16 words x 2 = 32 bytes.		

Output Def #9 to #16 values are modified from 255 according to the table above.



Download this new output definition to the Mini8.

Then update the scanner I/O to 32 bytes in and 32 bytes out.

Map the inputs to M1:6:0 to 15 or I:6.1 to 16. (From Example 3)

Map the Outputs to M0:6:0 to 15 or O:6.1 to 16

These values will now be available in the plc at the locations as mapped.

(Note if using IO rather set O:6.0 and I:6.0 to 1.)

8.8 Mini8 controller Class, Instance and Attribute ID Table

EDS list	Quantity	Description
1 to 200	200	Predefined parameters #0 to #199 **Class 100 Instance 1 Attributes 0 to 199**
201 to 260	60	Enter #<number> of required INPUT parameters **Class 102 Instance 1 Attributes 0 to 60**
261 to 320	60	Enter #<number> of required OUTPUT parameters **Class 102 Instance 2 Attributes 0 to 60**

Note – all variables of type INT - 32 bit format is not supported in this instrument type. Data formats are therefore as Tag, i.e. Scaled Integers. The scaling is based on the number of decimal point places used on the instrument display.

This is the list of 200 parameters available to be included in the input and output tables.

Parameter	Attribute ID	Modbus Address (used by CommsTab)
Process Variable – Loop 1	0	15616
Working Setpoint – Loop 1	1	15617
Working Output – Loop 1	2	15618
Target Setpoint – Loop 1	3	15619
Manual Output – Loop 1	4	15620
Setpoint 1 – Loop 1	5	15621
Setpoint 2 – Loop 1	6	15622
Auto/Manual Mode – Loop 1	7	15623
Proportional Band – Loop 1 working Set	8	15624
Integral Time – Loop 1 working Set	9	15625
Derivative Time – Loop 1 working Set	10	15626
Cutback Low – Loop 1 working Set	11	15627
Cutback High – Loop 1 working Set	12	15628
Relative Cooling Gain – Loop 1 working Set	13	15629
Process Variable – Loop 2	14	15630
Working Setpoint – Loop 2	15	15631
Working Output – Loop 2	16	15632
Target Setpoint – Loop 2	17	15633
Manual Output – Loop 2	18	15634
Setpoint 1 – Loop 2	19	15635
Setpoint 2 – Loop 2	20	15636
Auto/Manual Mode – Loop 2	21	15637
Proportional Band – Loop 2 working Set	22	15638
Integral Time – Loop 2 working Set	23	15639
Derivative Time – Loop 2 working Set	24	15640
Cutback Low – Loop 2 working Set	25	15641
Cutback High – Loop 2 working Set	26	15642
Relative Cooling Gain – Loop 2 working Set	27	15643
Process Variable – Loop 3	28	15644
Working Setpoint – Loop 3	29	15645
Working Output – Loop 3	30	15646
Target Setpoint – Loop 3	31	15647
Manual Output – Loop 3	32	15648
Setpoint 1 – Loop 3	33	15649
Setpoint 2 – Loop 3	34	15650
Auto/Manual Mode – Loop 3	35	15651
Proportional Band – Loop 3 working Set	36	15652
Integral Time – Loop 3 working Set	37	15653
Derivative Time – Loop 3 working Set	38	15654

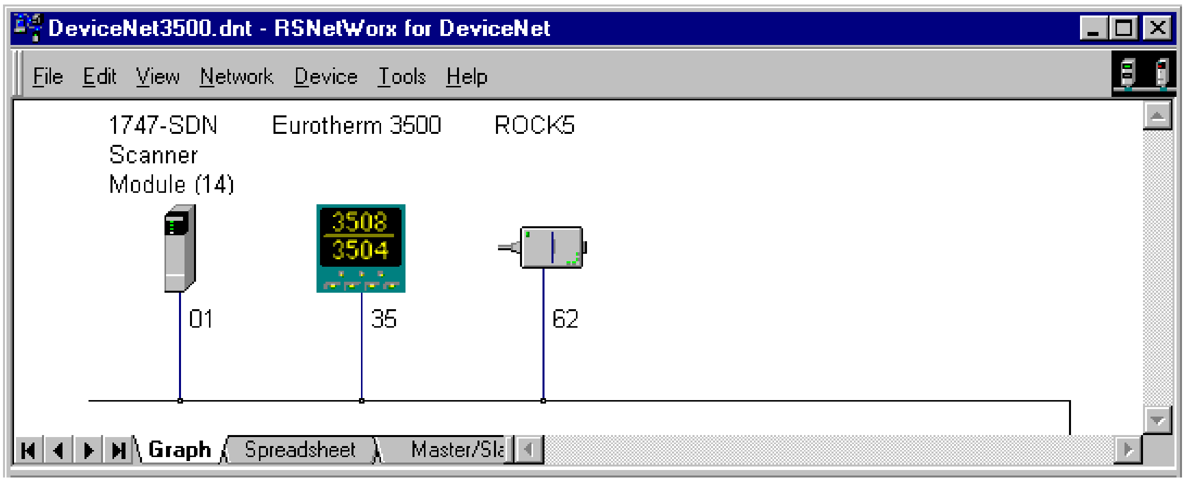
Parameter	Attribute ID	Modbus Address (used by CommsTab)
Cutback Low – Loop 3 working Set	39	15655
Cutback High – Loop 3 working Set	40	15656
Relative Cooling Gain – Loop 3 working Set	41	15657
Process Variable – Loop 4	42	15658
Working Setpoint – Loop 4	43	15659
Working Output – Loop 4	44	15660
Target Setpoint – Loop 4	45	15661
Manual Output – Loop 4	46	15662
Setpoint 1 – Loop 4	47	15663
Setpoint 2 – Loop 4	48	15664
Auto/Manual Mode – Loop 4	49	15665
Proportional Band – Loop 4 working Set	50	15666
Integral Time – Loop 4 working Set	51	15667
Derivative Time – Loop 4 working Set	52	15668
Cutback Low – Loop 4 working Set	53	15669
Cutback High – Loop 4 working Set	54	15670
Relative Cooling Gain – Loop 4 working Set	55	15671
Process Variable – Loop 5	56	15672
Working Setpoint – Loop 5	57	15673
Working Output – Loop 5	58	15674
Target Setpoint – Loop 5	59	15675
Manual Output – Loop 5	60	15676
Setpoint 1 – Loop 5	61	15677
Setpoint 2 – Loop 5	62	15678
Auto/Manual Mode – Loop 5	63	15679
Proportional Band – Loop 5 working Set	64	15680
Integral Time – Loop 5 working Set	65	15681
Derivative Time – Loop 5 working Set	66	15682
Cutback Low – Loop 5 working Set	67	15683
Cutback High – Loop 5 working Set	68	15684
Relative Cooling Gain – Loop 5 working Set	69	15685
Process Variable – Loop 6	70	15686
Working Setpoint – Loop 6	71	15687
Working Output – Loop 6	72	15688
Target Setpoint – Loop 6	73	15689
Manual Output – Loop 6	74	15690
Setpoint 1 – Loop 6	75	15691
Setpoint 2 – Loop 6	76	15692
Auto/Manual Mode – Loop 6	77	15693
Proportional Band – Loop 6 working Set	78	15694
Integral Time – Loop 6 working Set	79	15695
Derivative Time – Loop 6 working Set	80	15696
Cutback Low – Loop 6 working Set	81	15697
Cutback High – Loop 6 working Set	82	15698
Relative Cooling Gain – Loop 6 working Set	83	15699
Process Variable – Loop 7	84	15700
Working Setpoint – Loop 7	85	15701
Working Output – Loop 7	86	15702
Target Setpoint – Loop 7	87	15703
Manual Output – Loop 7	88	15704
Setpoint 1 – Loop 7	89	15705
Setpoint 2 – Loop 7	90	15706
Auto/Manual Mode – Loop 7	91	15707
Proportional Band – Loop 7 working Set	92	15708

Parameter	Attribute ID	Modbus Address (used by CommsTab)
Integral Time – Loop 7 working Set	93	15709
Derivative Time – Loop 7 working Set	94	15710
Cutback Low – Loop 7 working Set	95	15711
Cutback High – Loop 7 working Set	96	15712
Relative Cooling Gain – Loop 7 working Set	97	15713
Process Variable – Loop 8	98	15714
Working Setpoint – Loop 8	99	15715
Working Output – Loop 8	100	15716
Target Setpoint – Loop 8	101	15717
Manual Output – Loop 8	102	15718
Setpoint 1 – Loop 8	103	15719
Setpoint 2 – Loop 8	104	15720
Auto/Manual Mode – Loop 8	105	15721
Proportional Band – Loop 8 working Set	106	15722
Integral Time – Loop 8 working Set	107	15723
Derivative Time – Loop 8 working Set	108	15724
Cutback Low – Loop 8 working Set	109	15725
Cutback High – Loop 8 working Set	110	15726
Relative Cooling Gain – Loop 8 working Set	111	15727
Module PV – Channel 1	112	15728
Module PV – Channel 2	113	15729
Module PV – Channel 3	114	15730
Module PV – Channel 4	115	15731
Module PV – Channel 5	116	15732
Module PV – Channel 6	117	15733
Module PV – Channel 7	118	15734
Module PV – Channel 8	119	15735
Module PV – Channel 9	120	15736
Module PV – Channel 10	121	15737
Module PV – Channel 11	122	15738
Module PV – Channel 12	123	15739
Module PV – Channel 13	124	15740
Module PV – Channel 14	125	15741
Module PV – Channel 15	126	15742
Module PV – Channel 16	127	15743
Module PV – Channel 17	128	15744
Module PV – Channel 18	129	15745
Module PV – Channel 19	130	15746
Module PV – Channel 20	131	15747
Module PV – Channel 21	132	15748
Module PV – Channel 22	133	15749
Module PV – Channel 23	134	15750
Module PV – Channel 24	135	15751
Module PV – Channel 25	136	15752
Module PV – Channel 26	137	15753
Module PV – Channel 27	138	15754
Module PV – Channel 28	139	15755
Module PV – Channel 29	140	15756
Module PV – Channel 30	141	15757
Module PV – Channel 31	142	15758
Module PV – Channel 32	143	15759
Analogue Alarm Status 1	144	15760
Analogue Alarm Status 2	145	15761
Analogue Alarm Status 3	146	15762

Parameter	**Attribute ID**	**Modbus Address (used by CommsTab)**
Analogue Alarm Status 4	147	15763
Sensor Break Alarm Status 1	148	15764
Sensor Break Alarm Status 2	149	15765
Sensor Break Alarm Status 3	150	15766
Sensor Break Alarm Status 4	151	15767
CT Alarm Status 1	152	15768
CT Alarm Status 2	153	15769
CT Alarm Status 3	154	15770
CT Alarm Status 4	155	15771
New Alarm Output	156	15772
Any Alarm Output	157	15773
New CT Alarm Output	158	15774
Reset New Alarm	159	15775
Reset New CT Alarm	160	15776
CT Load Current 1	161	15777
CT Load Current 2	162	15778
CT Load Current 3	163	15779
CT Load Current 4	164	15780
CT Load Current 5	165	15781
CT Load Current 6	166	15782
CT Load Current 7	167	15783
CT Load Current 8	168	15784
CT Load Status 1	169	15785
CT Load Status 2	170	15786
CT Load Status 3	171	15787
CT Load Status 4	172	15788
CT Load Status 5	173	15789
CT Load Status 6	174	15790
CT Load Status 7	175	15791
CT Load Status 8	176	15792
PSU Relay 1 Output	177	15793
PSU Relay 2 Output	178	15794
PSU Digital Input 1	179	15795
PSU Digital Input 2	180	15796
Program Run	181	15797
Program Hold	182	15798
Program Reset	183	15799
Program Status	184	15800
Current Program	185	15801
Program Time Left	186	15802
Segment Time Left	187	15803
User Value 1	188	15804
User Value 2	189	15805
User Value 3	190	15806
User Value 4	191	15807
User Value 5	192	15808
User Value 6	193	15809
User Value 7	194	15810
User Value 8	195	15811
User Value 9	196	15812
User Value 10	197	15813
User Value 11	198	15814
User Value 12	199	15815

9. Transferring Data – 3500

A network has been set up with a 3500 at address 35. The baud rate has been set at 500k.



The 3500 DeviceNet parameters (baud rate & address) are set up in the COMMS page. The DeviceNet comms module must be plugged in slot H. This may be ordered separately and added in the field.

Set the DeviceNet communications as required. For more information refer to the 3500 manual HA027988.

Page	COMMS	Writable	Visible
Slot	H	n/a	Level 3 only
Ident	Comms	Config only	Level 3 only
Protocol	DeviceNet	Config only	Level 3 only
Baud Rate	125k, 250k, 500k	Config only	Level 3 only
Address	35	Config & Level 3	Level 3 only
Status	Init,Offline,Ready,Running	n/a	Level 3 only

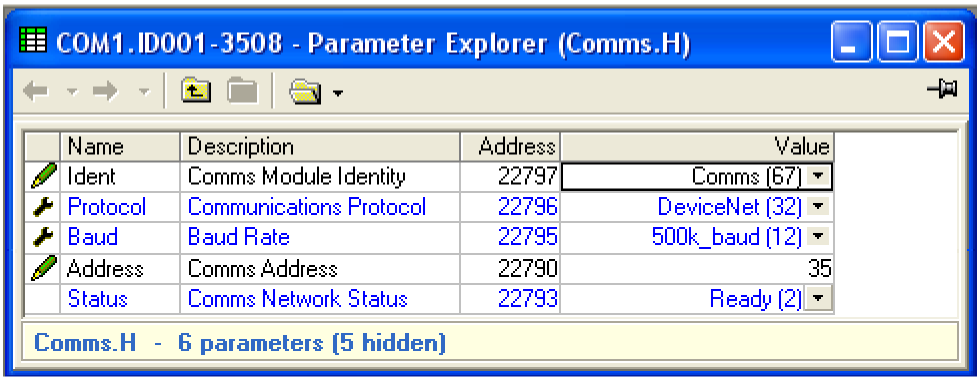
Note that Slot J can have Modbus installed so that the instrument can be on the DeviceNet network and be configured by iTools.

Note that the Config clip will take over the Slot H comms so cannot be used at the same time as DeviceNet.

Hardware wiring is as follows:

3500 Legend	CAN Reference	Colour
HA	V+	Red
HB	CAN_H	White
HC	SHIELD	None
HD	CAN_L	Blue
HE	V-	Black

In iTools the parameters are in the directory Comms.H



Once correctly wired to the network and with the correct DeviceNet baud rate and a unique address, communications at the hardware level will be established. This is indicated at the controller by the flashing H indicator and the Comms.H.Status parameter will be 'Ready'.

Comms.H.Status	H indicator	Status
Offline	Off	No DeviceNet traffic detected
Ready	Flashing	DeviceNet traffic detected but not for this address
Running	On	DeviceNet traffic detected addressing this instrument

Now the 3500 and the Scanner have to be configured to transfer parameter data.

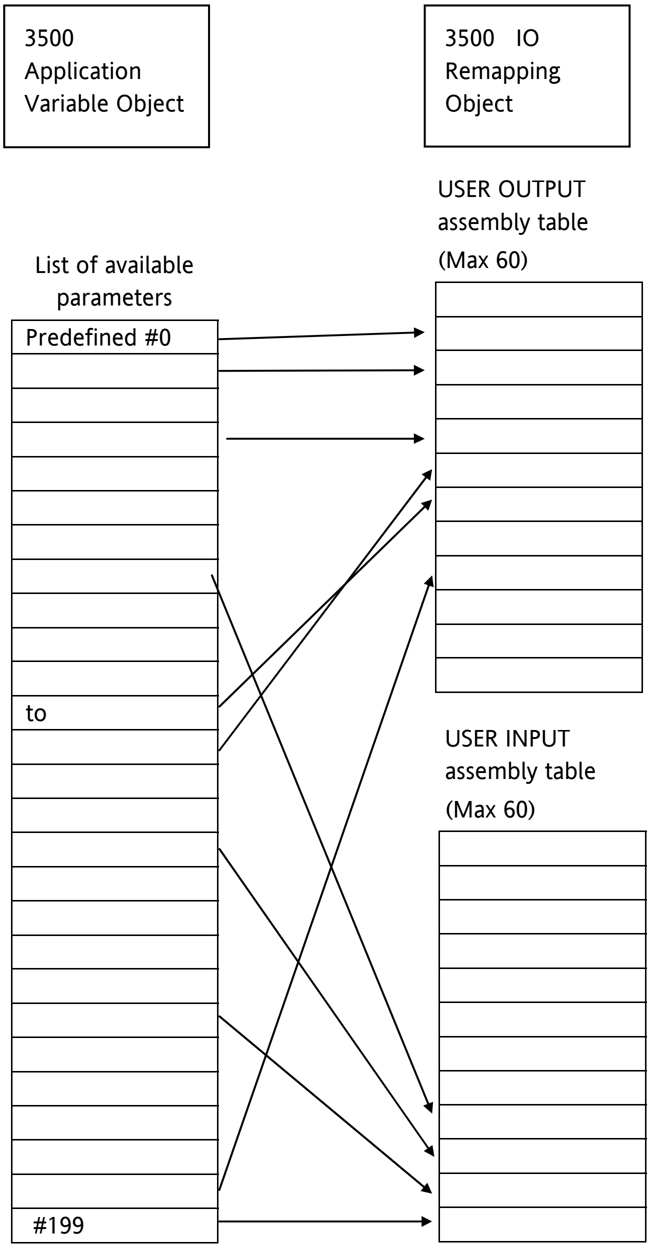
The 3500 device parameters (full table in Section 8.8) are divided into 3 'groups'

- A list of instrument parameters pre-defined for selection on the INPUT or OUTPUT tables.
- The actual INPUT table of parameters to be READ by the DeviceNet client.
- The actual OUTPUT table of parameters to be WRITTEN by the client.

9.1 Table Modification

Make a list of parameters required in the input and output tables to suit the application. If the parameter is listed in the predefined list then use the attribute number of that parameter.

To set up the controller so that the required parameters are available on the network requires setting up the INPUT and OUTPUT data assembly tables with the IDs from the Application Variable Object.



EDS list	Quantity	Description
1 to 200	200	Predefined parameters #0 to #199
201 to 260	**60**	**Enter #<number> of required INPUT parameters**
261 to 320	**60**	**Enter #<number> of required OUTPUT parameters**

To set up the controller so that the desired parameters can be read and written involves setting up the INPUT and OUTPUT tables (highlighted in the table above).

This information can be seen by inspecting the 3500.EDS file in a text editor and is the way in which the data is displayed in RSNetWorx Device Parameters.

This is best illustrated by three examples.

Example 1 is the default 3500 DeviceNet configuration.

Example 2 uses a limited number of parameters and adds a pre-defined parameter

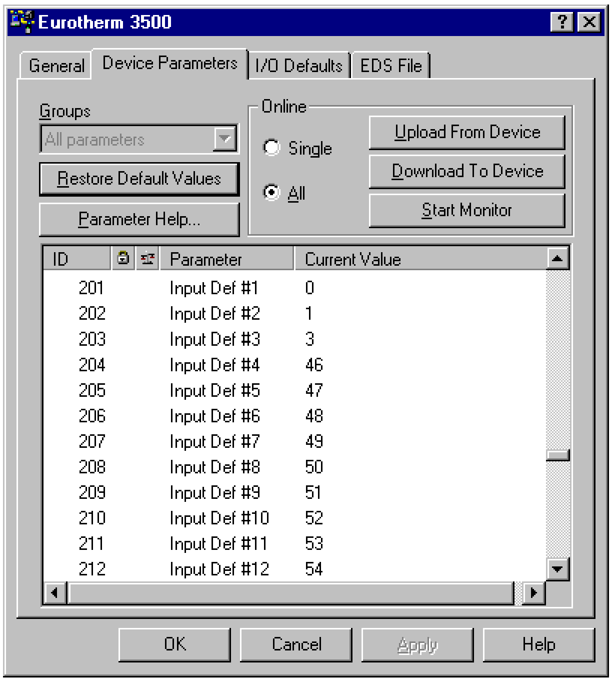
Example 3 shows how to add parameters NOT included on the pre-defined list.

9.2 Default Example 1

As supplied new the 3500 comes with the following DeviceNet parameter setup. The value of the attributes for the parameters on the table below are from the full listing in Section 8.5.

Item	Input Parameters	Value
1	Loop.1.Main.PV	0
2	Loop.1.Main.WorkingSP	1
3	Loop.1.Main.ActiveOut	3
4	IO.Mod.1.A.Status	46 (2Eh)
5	IO.Mod.1.A.PV	47(2Fh)
6	IO.Mod.1.B.PV	48 (30h)
7	IO.Mod.1.C.PV	49 (31h)
8	IO.Mod.2.A.Status	50 (32h)
9	IO.Mod.2.A.PV	51 (33h)
10	IO.Mod.2.B.PV	52 (34h)
11	IO.Mod.2.C.PV	53 (35h)
12	IO.Mod.3.A.Status	54 (36h)
13	IO.Mod.3.A.PV	55 (37h)
14	IO.Mod.3.B.PV	56 (38h)
15	IO.Mod.3.C.PV	57 (39h)
16	IO.Mod.4.A.Status	58 (3Ah)
17	IO.Mod.4.A.PV	59 (3Bh)
18	IO.Mod.4.B.PV	60 (3Ch)
19	IO.Mod.4.C.PV	61 (3Dh)
20	IO.Mod.5.A.Status	62 (3Eh)
21	IO.Mod.5.A.PV	63 (3Fh)
22	IO.Mod.5.B.PV	64 (40h)
23	IO.Mod.5.C.PV	65 (41h)
24	IO.Mod.6.A.Status	66 (42h)
25	IO.Mod.6.A.PV	67 (43h)
26	IO.Mod.6.B.PV	68 (44h)
27	IO.Mod.6.C.PV	69 (45h)
28	Alarm.1.Out	72 (48h)
29	Alarm.2.Out	73 (49h)
30	Alarm.3.Out	74 (4Ah)
31	Alarm.4.Out	75 (4Bh)
32	Alarm.5.Out	76 (4Ch)
33	Alarm.6.Out	77 (4Dh)
34	Alarm.7.Out	78 (4Eh)
35	Alarm.8.Out	79 (4Fh)
36	AlmSummary.NewAlarm	70 (46h)
37	AlmSummary.AnyAlarm	71 (47h)
38	Programmer.Run.ProgStatus	158 (9Eh)
39	Programmer.Run.ProgTimeLeft	152 (98h)
40	Programmer.Run.SegTimeLeft	153 (99h)
Total Length = 40 words x 2 = 80 bytes		

In RSNetworx right click on the 3500 and select properties. By looking at the properties of the 3500 the default input table can be inspected.



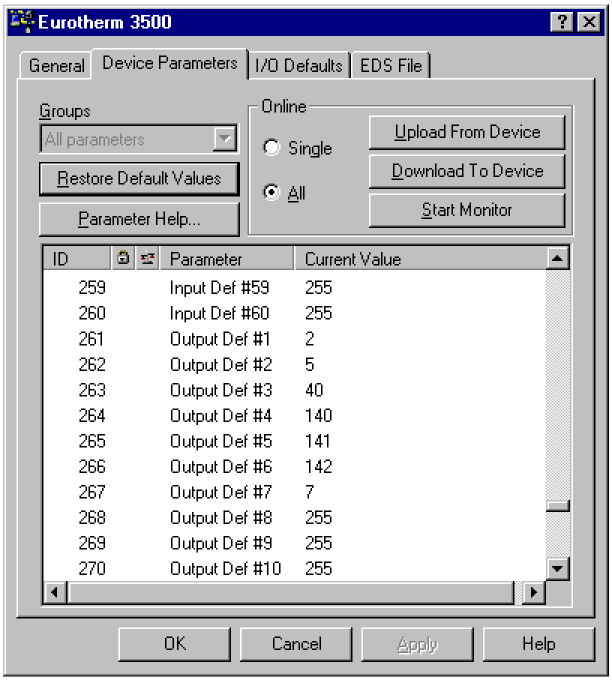
The current value is the attribute ID of the parameter required.

At the end of the input def part of the table the remaining items are given the value 255 which means not used.

A maximum of 60 input parameters are possible.

Item	Output Parameter	Value
1	Loop.1.Main.TargetSP	2
2	Loop.1.Main.AutoMan	5
3	Loop.1.OP.ManualOutVal	40 (28h)
4	Programmer.Setup.ProgRun	140 (8Ch)
5	Programmer.Setup.ProgReset	141 (8Dh)
6	Programmer.Setup.ProgHold	142 (8Eh)
7	Loop.1.Tune.AutoTuneEnable	7
Total Length 7 words X 2 = 14 bytes		

By looking at the properties of the 3500 the default output table can be inspected.

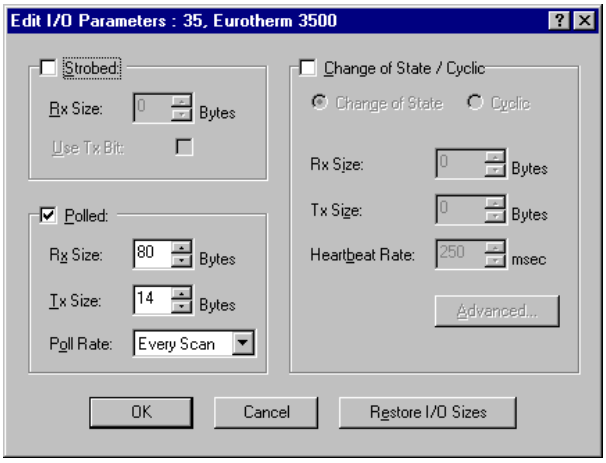


The current value is the attribute ID of the parameter required.

At the end of the output def part of the table the remaining items are given the value 255 which means not used.

A maximum of 60 output parameters are possible.

Now the scanner has to be set up to transfer this data. On RSNetWorx right click on the Scanner and select properties.



On the Scanner properties:

'General' Tab – information only

'Module' Tab – set the Scanner module slot correctly (6 in this example)

'Scanlist' tab – add the Eurotherm 3500 from 'available' to the scan list

'Edit I/O parameters' – tick Polled 80 Rx input and 14 Tx output (shown)

'Input' Tab – Map the 40 input parameters to the M file M1:6.0 to M1:6.39

'Output' Tab – Map the 24 output parameters to the M file M0:6.0 to M1:6.23

Click apply to download this to the Scanner (PLC must be in program mode). Once the network is restarted the 3500 H indicator will change from flashing to steady. Similarly the Scanner error indicator will show no error on node 35.

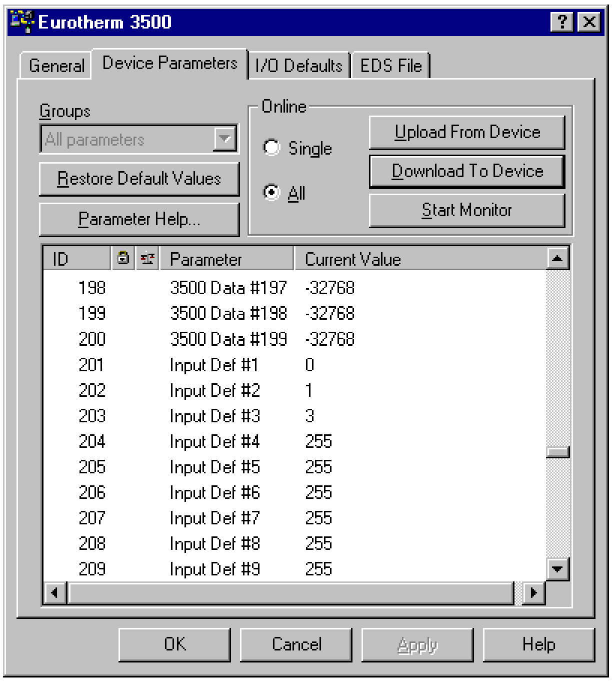
The 40 INPUT and 7 OUTPUT parameters are now being transferred back and forth on the network and will be available in the plc from the files M1:6 and M0:6. There are too many parameters in the input table to transfer directly to the module input table (I:6).

9.3 Example 2

In this example the input & output tables are reduced to just the key loop parameters. One new predefined parameter (Loop Inhibit) is added to the output list.

Item	Input Parameter	Value (Attr ID)
1	Loop.1.Main.PV	0
2	Loop.1.Main.WorkingSP	1
3	Loop.1.Main.ActiveOut	3
Total Length = 3 words x 2 = 6 bytes		

In RSNetWorx right click on the 3500 and select properties. By looking at the properties of the 3500 the default input table can be modified.



The current value of the first 3 input defs are set to the tribute IDs of the parameters in the table above.

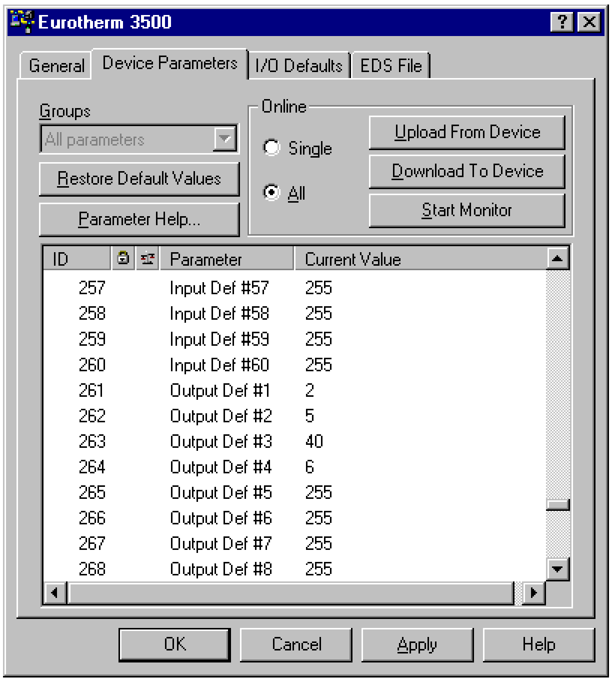
After that the remaining items must be given the value 255 which means not used.

Once the values have been changed 'Download to the Device' to update the 3500.

Now the output table must be modified.

Item	Output Parameter	Attribute
1	Loop.1.Main.TargetSP	2
2	Loop.1.Main.AutoMan	5
3	Loop.1.OP.ManualOutVal	40
4	Loop.1.Main.Inhibit	6
TOTAL LENGTH 4 words x 2 = 8 bytes.		

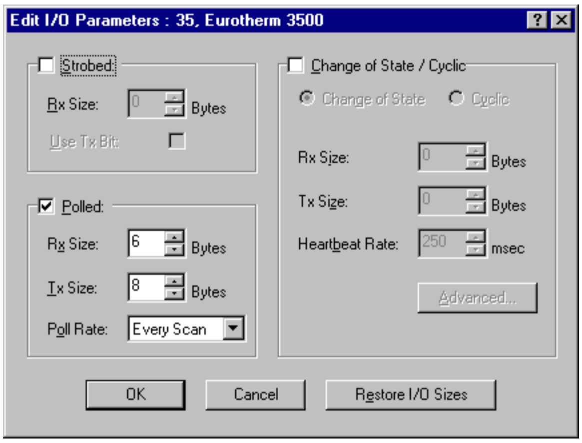
The Loop.1.Main.Inhibit attribute value of 6 is obtained from the complete table of pre-defined parameters in section 9.5.



The current value of the first 4 output defs are set to the attribute IDs of the parameters listed above.

After that the remaining items must be given the value 255 which means not used.

Once the values have been changed 'Download to the Device' to update the 3500.



On the Scanner properties:

'General' Tab – information only

'Module' Tab – set the Scanner module slot correctly (6 in this example)

'Scanlist' tab – add the Eurotherm Mini8 from 'available' to the scan list

'Edit I/O parameters' – tick Polled, input Rx=6 and output Tx =8 (shown)

'Input' Tab – Map the 3 input parameters to the IO file I:6.1 to I:6.4

'Output' Tab – Map the 4 output parameters to the IO file O:6.1 to O1:6.4

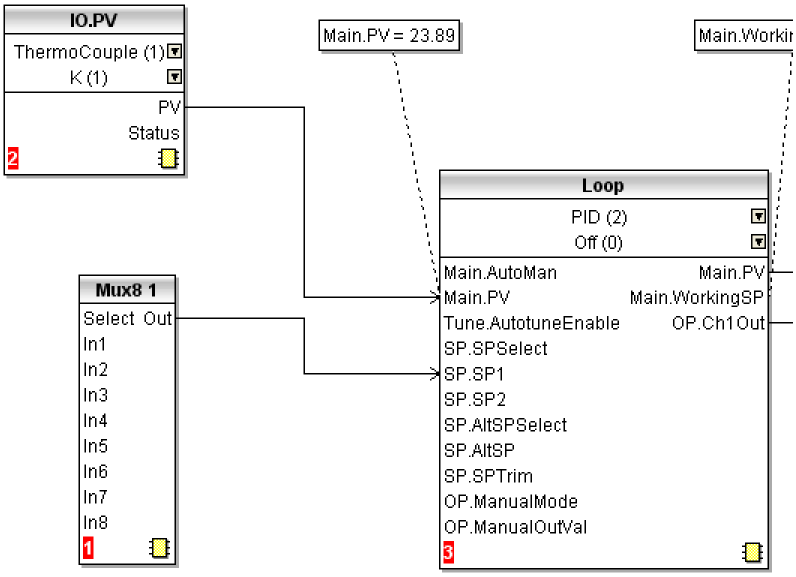
Click apply to download this to the Scanner (PLC must be in program mode). Once the network is restarted the 3500 H indicator will change from flashing to steady. Similarly the Scanner error indicator will show no error on node 35.

The 3 loop input parameters and 4 loop output parameters are now being transferred back and forth on the network and will be available in the plc in the I/O files for the scanner module in slot 6.

9.4 Example 3

This shows how to add parameters not on the pre-defined list. This requires the 'Commstab' redirection tables as shown in the Mini8 controller Example 4. These tables are only available in phase 2 versions of the 3500.

The example shows the setpoint coming from a Mux8 block and the example shows how the 8 Mux8 inputs and the selected are added to the output list. The plc can then set and select the required setpoint for a task.



The Mux8 parameters are not on the predefined list in Section 8.5 so the nine parameters will be redirected to the last nine positions on the predefined list #191 to #199 – from the table these have Modbus addresses 15807 to 15815.

The nine Mux8 parameters have redirected to these addresses in the 3500 itself, in the CommsTab pages.

The Output table required in the scanner is shown below

Item	Output Parameter	Attribute
1	Loop.1.Main.AutoMan	5
2	Loop.1.OP.ManualOutVal	40
3	Loop.1.Main.Inhibit	6
4	Mux8.Select	191
5	Mux8.In1	192
6	Mux8.In2	193
7	Mux8.In3	194
8	Mux8.In4	195
9	Mux8.In5	196
10	Mux8.In6	197
11	Mux8.In7	198
12	Mux8.In8	199
TOTAL LENGTH 12ords x 2 = 24ytes.		

This is now entered into the 3500 I/O list in the scanner as before.

9.5 3500 Class, Instance and Attribute ID Table

EDS list	Quantity	Description
1 to 200	200	Predefined parameters #0 to #199 Class 100 Instance 1 Attributes 0 to 199
201 to 260	60	Enter #<number> of required INPUT parameters **Class 102 Instance 1 Attributes 0 to 60**
261 to 320	60	Enter #<number> of required OUTPUT parameters **Class 102 Instance 2 Attributes 0 to 60**

Note – all variables of type INT - 32 bit format is not supported in this instrument type. Data formats are therefore as Tag, i.e. Scaled Integers. The scaling is based on the number of decimal point places used on the instrument display.

This is the list of 200 parameters available to be included in the input and output tables.

Parameter	Attribute ID	Modbus Address (used by Comms Tab)
Loop.1.Main.PV	0	15616
Loop.1.Main.WorkingSP	1	15617
Loop.1.Main.TargetSP	2	15618
Loop.1.Main.ActiveOut	3	15619
Loop.1.Diag.TargetOutVal	4	15620
Loop.1.Main.AutoMan	5	15621
Loop.1.Main.Inhibit	6	15622
Loop.1.Tune.AutoTuneEnable	7	15623
Loop.1.PID.ProportionalBand	8	15624
Loop.1.PID.IntegralTime	9	15625
Loop.1.PID.DerivativeTime	10	15626
Loop.1.PID.RelCh2Gain	11	15627
Loop.1.PID.CutbackHigh	12	15628
Loop.1.PID.CutbackLow	13	15629
Loop.1.PID.ProportionalBand2	14	15630
Loop.1.PID.IntegralTime2	15	15631
Loop.1.PID.DerivativeTime2	16	15632
Loop.1.PID.RelCh2Gain2	17	15633
Loop.1.PID.CutbackHigh2	18	15634
Loop.1.PID.CutbackLow2	19	15635
Loop.1.PID.ProportionalBand3	20	15636
Loop.1.PID.IntegralTime3	21	15637
Loop.1.PID.DerivativeTime3	22	15638
Loop.1.PID.RelCh2Gain3	23	15639
Loop.1.PID.CutbackHigh3	24	15640
Loop.1.PID.CutbackLow3	25	15641
Loop.1.PID.ActiveSet	26	15642
Loop.1.SP.SP1	27	15643
Loop.1.SP.SP2	28	15644
Loop.1.SP.AltSPSelect	29	15645
Loop.1.SP.AltSP	30	15646
Loop.1.SP.Rate	31	15647
Loop.1.SP.RateDone	32	15648
Loop.1.OP.OutputLowLimit	33	15649
Loop.1.OP.OutputHighLimit	34	15650
Loop.1.OP.Ch1Out	35	15651
Loop.1.OP.Ch2Out	36	15652
Loop.1.OPRate	37	15653
Loop.1.OP.SensorBreakMode	38	15654

Parameter	Attribute ID	Modbus Address (used by Comms Tab)
Loop.1.OP.SafeOutVal	39	15655
Loop.1.OP.ManualOutVal	40	15656
Loop.1.Diag.LoopBreakAlarm	41	15657
IO.PV.PV	42	15658
IO.PV.Status	43	15659
IO.LgcIO.LA.MeasuredVal	44	15660
IO.LgcIO.LB.MeasuredVal	45	15661
IO.Mod.1.A.Status	46	15662
IO.Mod.1.A.PV	47	15663
IO.Mod.1.B.PV	48	15664
IO.Mod.1.C.PV	49	15665
IO.Mod.2.A.Status	50	15666
IO.Mod.2.A.PV	51	15667
IO.Mod.2.B.PV	52	15668
IO.Mod.2.C.PV	53	15669
IO.Mod.3.A.Status	54	15670
IO.Mod.3.A.PV	55	15671
IO.Mod.3.B.PV	56	15672
IO.Mod.3.C.PV	57	15673
IO.Mod.4.A.Status	58	15674
IO.Mod.4.A.PV	59	15675
IO.Mod.4.B.PV	60	15676
IO.Mod.4.C.PV	61	15677
IO.Mod.5.A.Status	62	15678
IO.Mod.5.A.PV	63	15679
IO.Mod.5.B.PV	64	15680
IO.Mod.5.C.PV	65	15681
IO.Mod.6.A.Status	66	15682
IO.Mod.6.A.PV	67	15683
IO.Mod.6.B.PV	68	15684
IO.Mod.6.C.PV	69	15685
AlmSummary.NewAlarm	70	15686
AlmSummary.AnyAlarm	71	15687
Alarm.1.Out	72	15688
Alarm.2.Out	73	15689
Alarm.3.Out	74	15690
Alarm.4.Out	75	15691
Alarm.5.Out	76	15692
Alarm.6.Out	77	15693
Alarm.7.Out	78	15694
Alarm.8.Out	79	15695
Math2.1.Out	80	15696
Math2.2.Out	81	15697
Math2.3.Out	82	15698
Math2.4.Out	83	15699
Math2.5.Out	84	15700
Math2.6.Out	85	15701
Math2.7.Out	86	15702
Math2.8.Out	87	15703
Math2.9.Out	88	15704
Math2.10.Out	89	15705
Math2.11.Out	90	15706
Math2.12.Out	91	15707
Math2.13.Out	92	15708
Math2.14.Out	93	15709

Parameter	Attribute ID	Modbus Address (used by Comms Tab)
Math2.15.Out	94	15710
Math2.16.Out	95	15711
Math2.17.Out	96	15712
Math2.18.Out	97	15713
Math2.19.Out	98	15714
Math2.20.Out	99	15715
Math2.21.Out	100	15716
Math2.22.Out	101	15717
Math2.23.Out	102	15718
Math2.24.Out	103	15719
Lgc2.1.Out	104	15720
Lgc2.2.Out	105	15721
Lgc2.3.Out	106	15722
Lgc2.4.Out	107	15723
Lgc2.5.Out	108	15724
Lgc2.6.Out	109	15725
Lgc2.7.Out	110	15726
Lgc2.8.Out	111	15727
Lgc2.9.Out	112	15728
Lgc2.10.Out	113	15729
Lgc2.11.Out	114	15730
Lgc2.12.Out	115	15731
Lgc2.13.Out	116	15732
Lgc2.14.Out	117	15733
Lgc2.15.Out	118	15734
Lgc2.16.Out	119	15735
Lgc2.17.Out	120	15736
Lgc2.18.Out	121	15737
Lgc2.19.Out	122	15738
Lgc2.20.Out	123	15739
Lgc2.21.Out	124	15740
Lgc2.22.Out	125	15741
Lgc2.23.Out	126	15742
Lgc2.24.Out	127	15743
Lgc8.1.Out	128	15744
Lgc8.2.Out	129	15745
Timer.1.Out	130	15746
Timer.2.Out	131	15747
Timer.3.Out	132	15748
Timer.4.Out	133	15749
Total.1.TotalOut	134	15750
Total.2.TotalOut	135	15751
Counter.1.Count	136	15752
Counter.2.Count	137	15753
Txdr.1.OutVal	138	15754
Txdr.2.OutVal	139	15755
Programmer.Setup.ProgRun	140	15756
Programmer.Setup.ProgReset	141	15757
Programmer.Setup.ProgHold	142	15758
Programmer.Setup.EventOuts	143	15759
Spare	144	15760
Spare	145	15761
Spare	146	15762
Spare	147	15763
Spare	148	15764

Parameter	Attribute ID	Modbus Address (used by Comms Tab)
Spare	149	15765
Spare	150	15766
Programmer.Run.PSP	151	15767
Programmer.Run.ProgTimeLeft	152	15768
Programmer.Run.SegTimeLeft	153	15769
Programmer.Run.EndOutput	154	15770
Programmer.Setup.AdvSeg	155	15771
Programmer.Setup.SkipSeg	156	15772
Programmer.Run.CurProg	157	15773
Programmer.Run.ProgStatus	158	15774
UsrVal.1.Val	159	15775
UsrVal.2.Val	160	15776
UsrVal.3.Val	161	15777
UsrVal.4.Val	162	15778
UsrVal.5.Val	163	15779
UsrVal.6.Val	164	15780
UsrVal.7.Val	165	15781
UsrVal.8.Val	166	15782
UsrVal.9.Val	167	15783
UsrVal.10.Val	168	15784
UsrVal.11.Val	169	15785
UsrVal.12.Val	170	15786
UsrVal.13.Val	171	15787
UsrVal.14.Val	172	15788
UsrVal.15.Val	173	15789
UsrVal.16.Val	174	15790
Loop.2.Main.PV	175	15791
Loop.2.Main.WorkingSP	176	15792
Loop.2.Main.ActiveOut	177	15793
Loop.2.Main.TargetSP	178	15794
Loop.2.OP.ManualOutVal	179	15795
Loop.2.SP.SP1	180	15796
Loop.2..SP.SP2	181	15797
Loop.2.SP.AltSPSelect	182	15798
Loop.2.SP.AltSP	183	15799
Loop.2.Main.AutoMan	184	15800
Loop.2.PID.ActiveSet	185	15801
Loop.2.Diag.SchedPB	186	15802
Loop.2.Diag.SchedTi	187	15803
Loop.2.Diag.SchedTd	188	15804
Loop.2.Diag.SchedCBL	189	15805
Loop.2.Diag.SchedCBH	190	15806
Loop.2.Diag.SchedR2G	191	15807
Programmer.2.Setup.ProgRun	192	15808
Programmer.2.Setup.ProgReset	193	15809
Programmer.2.Setup.ProgHold	194	15810
Programmer.2.Setup.ActiveOuts	195	15811
Programmer.2.Run.PSP	196	15812
Programmer.2.Run.ProgTimeLeft	197	15813
Programmer.2.Run.SegTimeLeft	198	15814
Programmer.2.Run.CurProg	199	15815

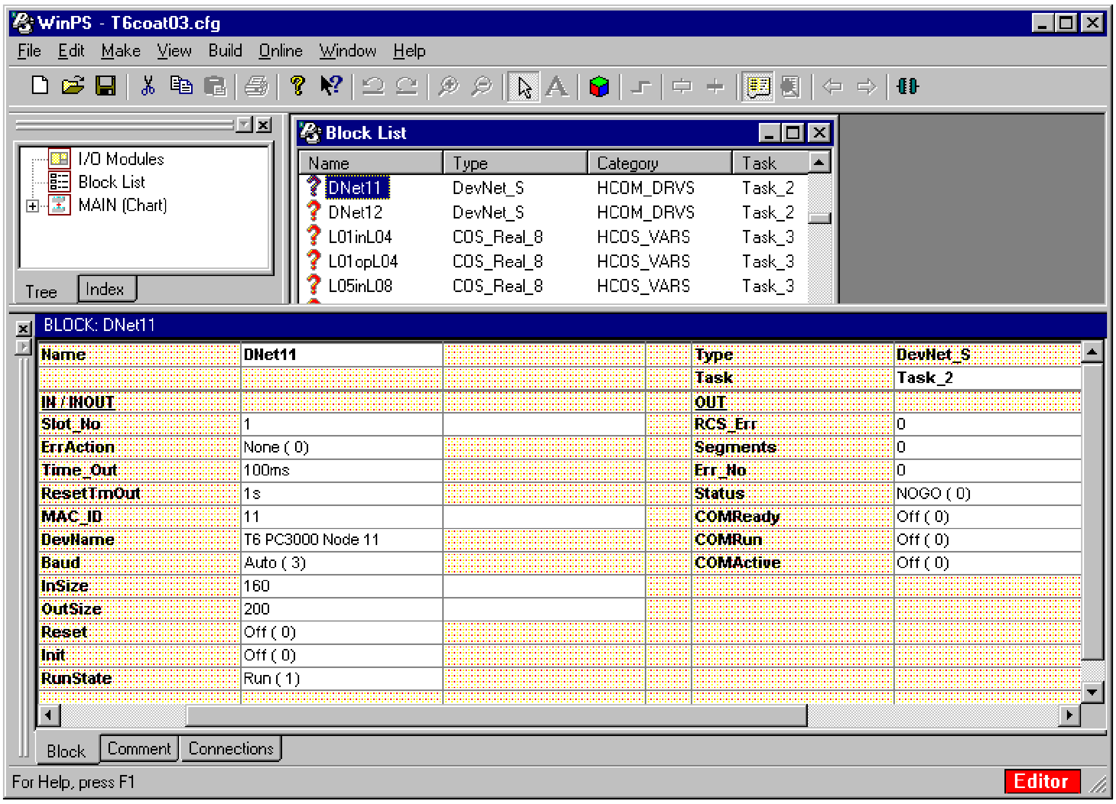
10. PC3000

To place a PC3000 as a slave on a DeviceNet network requires a DeviceNet Communications card placed in the first available slot in the main rack – slot 1 in this example. The card uses a Hilscher sub-board which may be configured using Hilscher's own configuration tools. However it can also be configured by the PC3000 application program itself.

The PC3000 LCM+ requires the extra RAM3 board to take the Fieldbus downloadable function block library and the PS or WinPS tools require the library templates.

This is a brief summary of the requirements of the PC3000 application program. Firstly an instance of the HCOS_DRVS.Com_Table has to be created to allocate the necessary memory etc.

Then an instance of a DeviceNet slave HCOS_DRVS.DevNet_S has to be created.

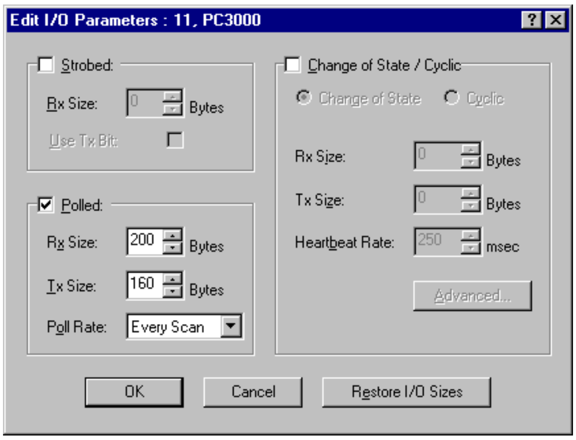


In this example the slave address (Mac_ID) has been set to 11 and the Baud rate on Auto – it will set itself.

It is also necessary to calculate the exact INPUT (160 bytes) and OUTPUT (200 bytes) sizes and enter them. These sizes MUST be multiples of 8 bytes. For this reason the maximum number of INPUT bytes is 248 and OUTPUT bytes is 248.

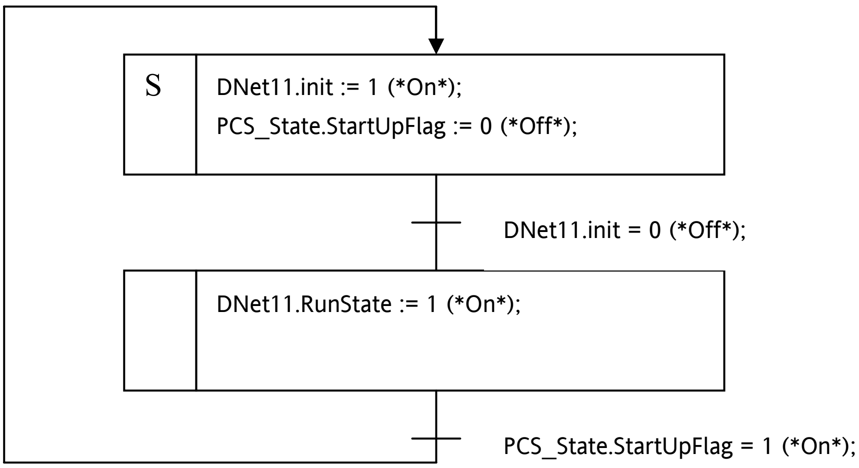
There must also be the corresponding instances of HCOS_VARS variables to match these byte sizes. COS_Real_8 have been used and there are 20 set with 'Mode' to INPUT with addresses from 1:0:2~, 1:16:2~, 1:32:2~ up to 1:144:2~ giving 160 bytes or 80 variables.

For the OUTPUTS there are 25 with 'Mode' set to Output with addresses from 1:0:2~ to 1:192:2~ with this last block limited to 4 variables (NoOfVars = 4). This gives 200 bytes or 100 variables.



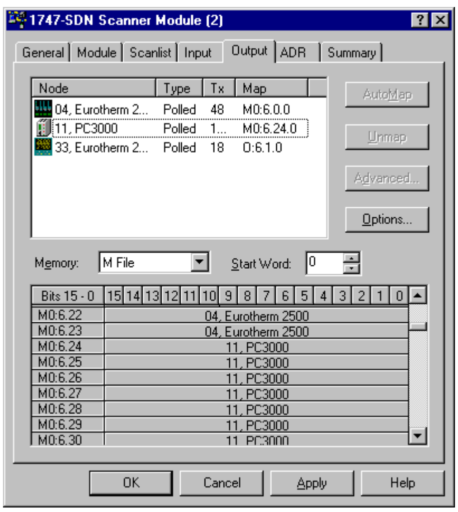
The INPUT bytes to PC3000 are OUTPUT bytes (Tx) from the plc and vice versa as shown in the scanner I/O configuration shown.

The final task is a short sequence to auto configure the DeviceNet card on power up.



The first step tells the slave to configure itself with the data in the driver block. When this is complete it resets the init flag and step 2 puts the slave in run mode. On power up the startup flag ensures the initialisation is repeated. Because the slave board is separate from the PC3000 LCM itself it does not affect the DeviceNet network if the PC3000 is not in Run mode. This means you can build and download without disturbing the network.

Finally with this number of parameters the data would be transferred using the M files.



Note that the PLC output parameters are written all the time – this means that any values in PC3000 INPUT variables will be over written as soon as communications is established.

11. Explicit Message Block Read/Write

First see Section 6.2 on the use of Explicit Messaging to read and write individual parameters on the 2200 controller. Explicit messaging will work on any slave given the CLASS, INSTANCE and ID of the required parameter. It can therefore also be used with the 2400, 2500, 2600 or 2700.

Explicit messaging involves sending a precisely formatted file to the Scanner file M1:224 and the response is picked up from M0:224. See the scanner's supporting documentation for details and Section 7.2 for a basic example with the 2200.

This block mode uses a Tag Access Application Variable to read/write 2400, 2500, 2600 or 2700 controller variables in blocks of up to 32 bytes starting at a 16 bit Tag address. This is usually 16 analogue values, but can be 8 32 bit values including single precision floating point data. Most often used to download recipe values or ramp/soak programs to controllers. It is not available in 2200 or PC3000.

The examples will be a read block and a write block where the start address and block size are integers which can be set to suit.

A further example will read and write a specific program to a 2700.

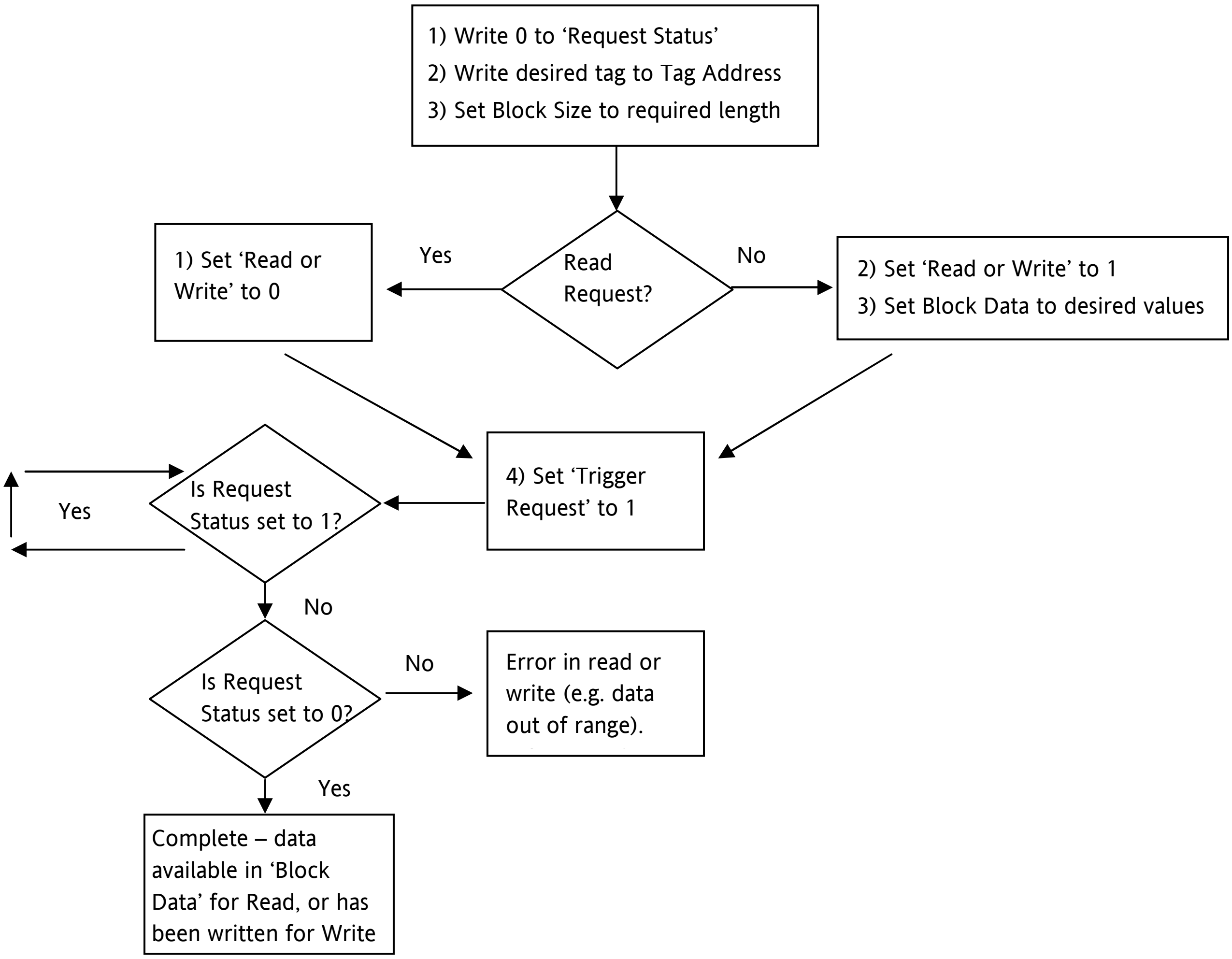
This uses the Tag Access Application Variable Object in the 2400, 2500 and 2600/2700 device parameter list.

Class is 101, Instance is 1

Attribute ID	Variable	Description
1	Tag Address	Base Tag for the Block access
2	Block Size	Size of Block in 16 bit words
3	Block Data	Actual data values
4	Read or Write	Selects read or write operation
5	Trigger Request	Triggers request
6	Request Status	Write value of 0 to clear. Read values: 0: Complete 1: Request Pending 3: Error in read/write request (for example write data is out of range).

The flowchart shows how these variables are used.

11.1 Flow Chart



11.2 Implementation – 2700 Read Block

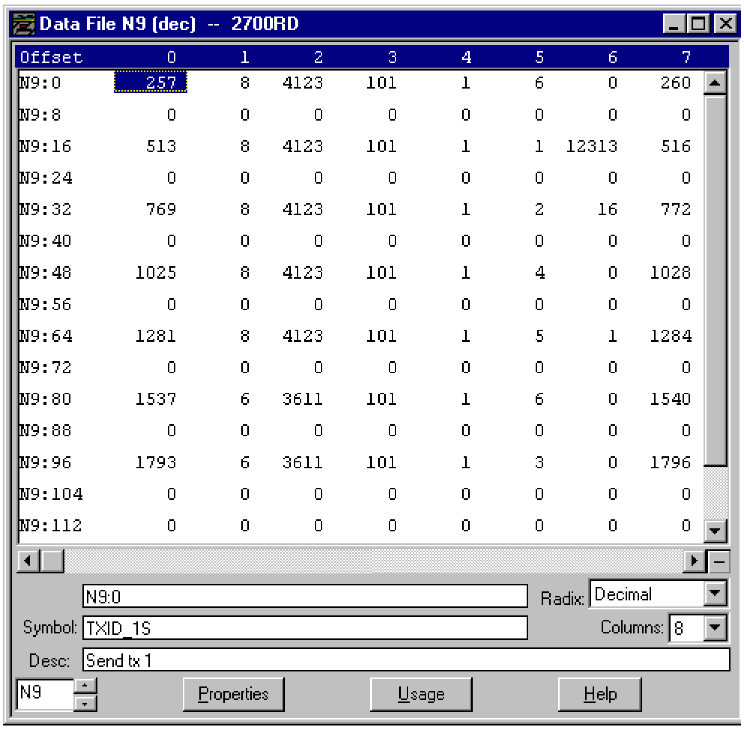
The flowchart is implemented in the follow order in the plc. 2700 address is 27.

Order	Action.	Value	Transaction Table	
0	Clear all transactions in Scanner	Write Reset Command to Scanner	Request	Response
1	Clear sequence in 2700	Write 0 to ID 6	N9:0	N9:8
2	Write Base Tag address	Write <addr> to ID 1	N9:16	N9:24
3	Write Block Size	Write <size> to ID 2	N9:32	N9:40
4	Set mode to Read	Write 0 to ID 4	N9:48	N9:56
5	Execute instruction	Write 1 to ID 5	N9:64	N9:72
6	Check result	Read ID 6	N9:80	N9:88
7	If result is OK transfer data	Read ID 3	N9:96	N9:104
Back to 6	If result is error repeat Execute			
Back to 1	Back to the start after time delay			

This is the N9 data file as set up. With 8 columns each line represents an EM request followed by an EM response.

The N9 table addresses are the start of each transaction block. These expand to the following data table.

The tables below show how the transaction requests are built up and the expected responses.



Offset	0	1	2	3	4	5	6	7
N9:0	257	8	4123	101	1	6	0	260
N9:8	0	0	0	0	0	0	0	0
N9:16	513	8	4123	101	1	1	12313	516
N9:24	0	0	0	0	0	0	0	0
N9:32	769	8	4123	101	1	2	16	772
N9:40	0	0	0	0	0	0	0	0
N9:48	1025	8	4123	101	1	4	0	1028
N9:56	0	0	0	0	0	0	0	0
N9:64	1281	8	4123	101	1	5	1	1284
N9:72	0	0	0	0	0	0	0	0
N9:80	1537	6	3611	101	1	6	0	1540
N9:88	0	0	0	0	0	0	0	0
N9:96	1793	6	3611	101	1	3	0	1796
N9:104	0	0	0	0	0	0	0	0
N9:112	0	0	0	0	0	0	0	0

1a. Request to clear sequence in instrument

N9 address	Description	Upper byte	Lower Byte	Description	Word value
0	Transaction ID=1	00000001	00000001	Command: Execute	257
1	Port	00000000	00001000	Byte Size	8
2	Service (16) = write	00010000	00011011	MacID (27)	4123
3				Class=101	101
4				Instance =1	1
5				ID = 6	6
6				0 = clear	0

Byte size is Class, Instance, Attribute and Value

1b. Response to clear request

N9 address	Description	Upper byte	Lower Byte	Description	Word value
8	Transaction ID=1	00000001	00000001	Status: OK	257

1c. Delete transaction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
7	Transaction ID=1	00000001	00000004	Command: Delete transaction	260

2a. Request to write block base address (=12313 the first half of segment 1 in program)

N9 address	Description	Upper byte	Lower Byte	Description	Word value
16	Transaction ID=2	00000010	00000001	Command: Execute	513
17	Port	00000000	00001000	Byte Size	8
18	Service (16) = write	00010000	00011011	MacID (27)	4123
19				Class=101	101
20				Instance =1	1
21				ID = 2	2
22				Value	0

Byte size is Class, Instance, Attribute and Value

2b. Response to write block request

N9 address	Description	Upper byte	Lower Byte	Description	Word value
24	Transaction ID=2	00000010	00000001	Status: OK	513

2c. Delete transaction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
23	Transaction ID=2	00000010	00000004	Command: Delete transaction	516

3a. Request to write block size (=16)

N9 address	Description	Upper byte	Lower Byte	Description	Word value
32	Transaction ID=3	00000011	00000001	Command: Execute	769
33	Port	00000000	00001000	Byte Size	8
34	Service (16) = write	00010000	00011011	MacID (27)	4123
35				Class=101	101
36				Instance =1	1
37				ID = 2	2
38				Value	16

Byte size is Class, Instance, Attribute and Value

3b. Response to write block size request

N9 address	Description	Upper byte	Lower Byte	Description	Word value
40	Transaction ID=3	00000011	00000001	Status: OK	769

3c. Delete transaction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
39	Transaction ID=3	00000011	00000004	Command: Delete transaction	772

4a. Request to set mode to READ (=0)

N9 address	Description	Upper byte	Lower Byte	Description	Word value
48	Transaction ID=4	00000100	00000001	Command: Execute	1025
49	Port	00000000	00001000	Byte Size	8
50	Service (16) = write	00010000	00011011	MacID (27)	4123
51				Class=101	101
52				Instance =1	1
53				ID = 4	4
54				Value	0

Byte size is Class, Instance, Attribute and Value

4b. Response to mode READ request

N9 address	Description	Upper byte	Lower Byte	Description	Word value
56	Transaction ID=4	00000100	00000001	Status: OK	1025

4c. Delete transaction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
55	Transaction ID=4	00000100	00000004	Command: Delete transaction	1028

5a. Request to write Execute instruction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
64	Transaction ID=5	00000101	00000001	Command: Execute	1281
65	Port	00000000	00001000	Byte Size	8
66	Service (16) = write	00010000	00011011	MacID (27)	4123
67				Class=101	101
68				Instance =1	1
69				ID = 5	5
70				Value	1

Byte size is Class, Instance, Attribute and Value

5b. Response to write Execute instruction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
72	Transaction ID=5	00000101	00000001	Status: OK	1281

5c. Delete transaction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
71	Transaction ID=5	00000101	00000004	Command: Delete transaction	1284

6a. Request to Check Status (0 = Block read OK, 3 = Error)

N9 address	Description	Upper byte	Lower Byte	Description	Word value
80	Transaction ID=6	00000110	00000001	Command: Execute	1537
81	Port	00000000	00000110	Byte Size	6
82	Service (14) = read	00001110	00011011	MacID (27)	3611
83				Class=101	101
84				Instance =1	1
85				ID = 6	6

Byte size is Class, Instance, Attribute and Value

6b. Response to Check status request

N9 address	Description	Upper byte	Lower Byte	Description	Word value
88	Transaction ID=6	00000110	00000001	Status: OK	1537
89				Byte Size	2
90					
91	Value returned			0 = action completed OK	0

6c. Delete transaction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
87	Transaction ID=6	00000110	00000004	Command: Delete transaction	1540

7a. Request to read all block values

N9 address	Description	Upper byte	Lower Byte	Description	Word value
96	Transaction ID=7	00000111	00000001	Command: Execute	1793
97	Port	00000000	00000110	Byte Size	6
98	Service (14) = read	00001110	00011011	MacID (27)	4123
99				Class=101	101
100				Instance =1	1
101				ID = 3	5

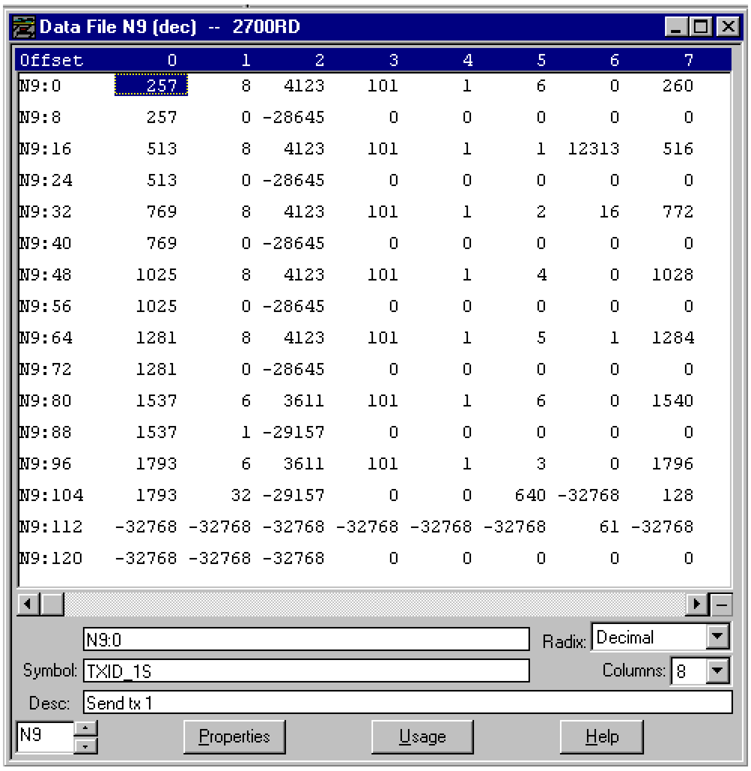
Byte size is Class, Instance, Attribute and Value

7b. Response to write Execute instruction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
104	Transaction ID=7	00000111	00000001	Status: OK	1793
105				Byte Size	32
106					
107				Value_0	
To 122				Value_15	

7c. Delete transaction

N9 address	Description	Upper byte	Lower Byte	Description	Word value
103	Transaction ID=7	00000111	00000004	Command: Delete transaction	1796


Data File N9 (dec) -- 2700RD

Offset	0	1	2	3	4	5	6	7
N9:0	257	8	4123	101	1	6	0	260
N9:8	257	0	-28645	0	0	0	0	0
N9:16	513	8	4123	101	1	1	12313	516
N9:24	513	0	-28645	0	0	0	0	0
N9:32	769	8	4123	101	1	2	16	772
N9:40	769	0	-28645	0	0	0	0	0
N9:48	1025	8	4123	101	1	4	0	1028
N9:56	1025	0	-28645	0	0	0	0	0
N9:64	1281	8	4123	101	1	5	1	1284
N9:72	1281	0	-28645	0	0	0	0	0
N9:80	1537	6	3611	101	1	6	0	1540
N9:88	1537	1	-29157	0	0	0	0	0
N9:96	1793	6	3611	101	1	3	0	1796
N9:104	1793	32	-29157	0	0	640	-32768	128
N9:112	-32768	-32768	-32768	-32768	-32768	-32768	61	-32768
N9:120	-32768	-32768	-32768	0	0	0	0	0

N9:0 Radix: Decimal
Symbol: TXID_1S Columns: 8
Desc: Send tx 1
N9 Properties Usage Help

The N9 data file after the sequence has been run.

Each transaction has been successful as the first value is the same as the sent value (257, 5123, 769 etc.)

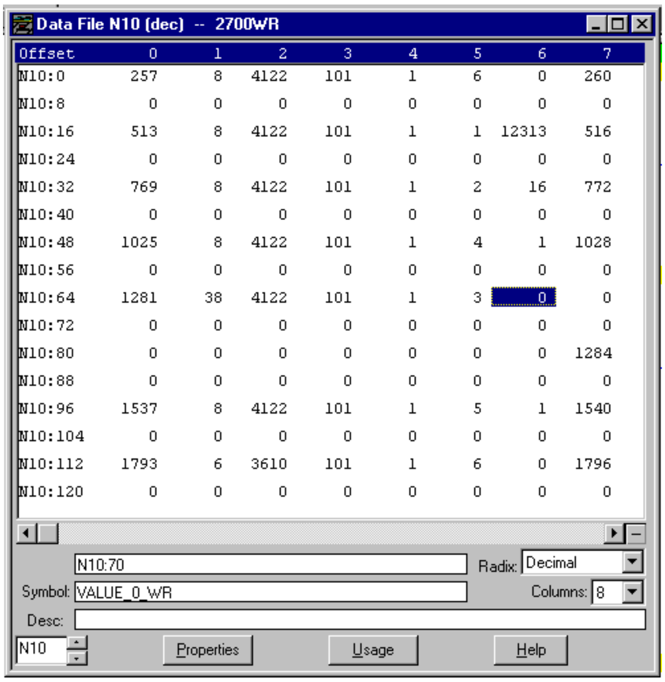
The 16 values are 0, 0, 640, -32768, 128 etc.

The application is in the ladder 2700RD and the bits B3:2/0 to 15 are used to control it. B3:2/15 starts the sequence. It repeats every 2 seconds based on timer T4:0. It was found necessary to add timer T4:1 to provide a short 50mS delay between each transaction otherwise the Scanner was liable to get overloaded and fault.

11.3 Implementation – 2700 Write Block

The flowchart is implemented in the follow order in the plc.

Order	Action.	Value	Transaction Table	
0	Clear all transactions in Scanner	Write Reset Command to Scanner	Request	Response
1	Clear sequence in 2700	Write 0 to ID 6	N10:0	N10:8
2	Write Base Tag address	Write <addr> to ID 1	N10:16	N10:24
3	Write Block Size	Write <size> to ID 2	N10:32	N10:40
4	Set mode to Write	Write 1 to ID 4	N10:48	N10:56
5	Trnsfer Data	Write <values> to ID3	N10:64	N10:88
6	Execute instruction	Write 1 to ID 5	N10:96	N10:104
7	Check result	Read ID 6	N10:112	N10:120
	If result is error set flag		B3:1/14	
Back to 0	Back to the start after time delay			



This N10 data file is made up in exactly the same way as the read table in the previous example.

With 8 columns each line represents an EM request followed by an EM response.

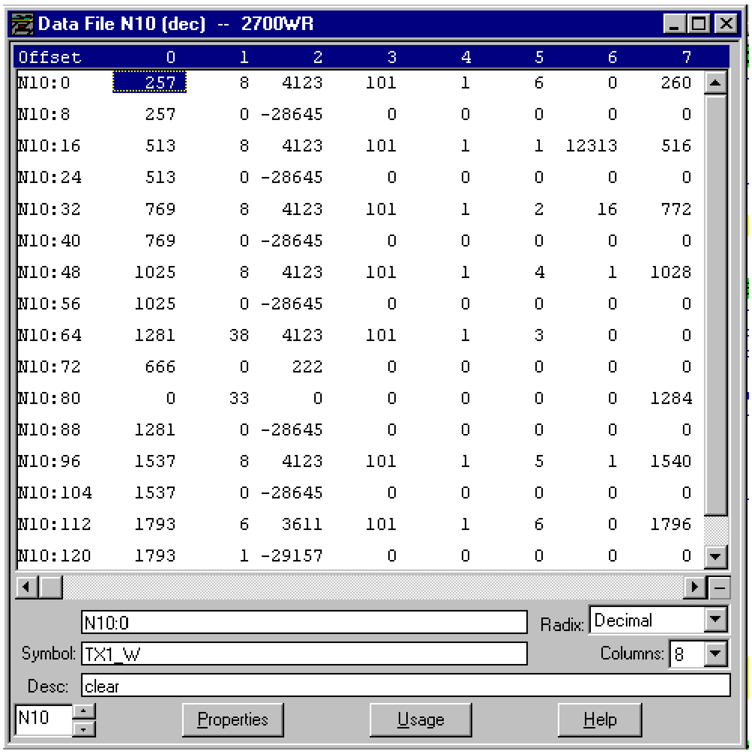
In this case the 16 values to be written are in N10:70 to 85

After the ladder is run the results are as shown.

Each transaction was successful as the response was the same as the request (257, 513, 769 etc).

The values written were the 3 loop setpoints for segment 1 of the program and are Loop 1 = 666 (N10:72) Loop 2 = 222 (N10: 74) Loop 3 = 33 (N10:81)

N10:123 shows that the write was successful.

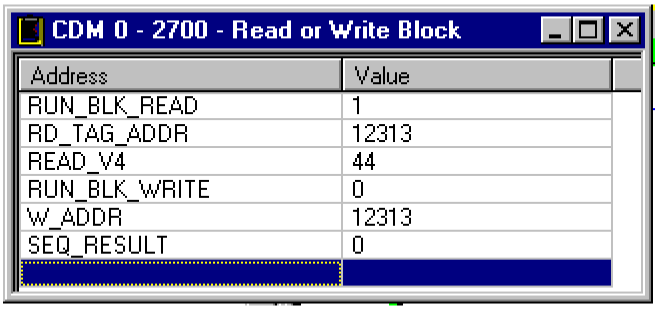

Data File N10 (dec) -- 2700WR

Offset	0	1	2	3	4	5	6	7
N10:0	257	8	4123	101	1	6	0	260
N10:8	257	0	-28645	0	0	0	0	0
N10:16	513	8	4123	101	1	1	12313	516
N10:24	513	0	-28645	0	0	0	0	0
N10:32	769	8	4123	101	1	2	16	772
N10:40	769	0	-28645	0	0	0	0	0
N10:48	1025	8	4123	101	1	4	1	1028
N10:56	1025	0	-28645	0	0	0	0	0
N10:64	1281	38	4123	101	1	3	0	0
N10:72	666	0	222	0	0	0	0	0
N10:80	0	33	0	0	0	0	0	1284
N10:88	1281	0	-28645	0	0	0	0	0
N10:96	1537	8	4123	101	1	5	1	1540
N10:104	1537	0	-28645	0	0	0	0	0
N10:112	1793	6	3611	101	1	6	0	1796
N10:120	1793	1	-29157	0	0	0	0	0

N10:0 Radix: Decimal
Symbol: TX1_W Columns: 8
Desc: clear
N10 Properties Usage Help

The application is in the ladder 2700WR and the bits B3:3/0 to 15 are used to control it. B3:3/15 starts the sequence. It repeats every 2 seconds based on timer T4:2. It was found necessary to add timer T4:3 to provide a short 50mS delay between each transaction otherwise the Scanner was liable to get overloaded and fault.

A custom data monitor shows the key variables for this and the previous READ example. The RD_TAG_ADDR and W_ADDR are set to the start of the first segment of the programmer.


CDM 0 - 2700 - Read or Write Block

Address	Value
RUN_BLK_READ	1
RD_TAG_ADDR	12313
READ_V4	44
RUN_BLK_WRITE	0
W_ADDR	12313
SEQ_RESULT	0

11.4 Implementation – 2600 Programmer Upload/Download

This follows on from the previous example. It requires a 2600 (or 2700) at address 26 to be mapped into the scan list.

Sequence for Upload (Block READ)

Order	Action.	Value
0	Clear all transactions in Scanner	Write Reset Command to Scanner
1	Clear sequence in 2600	Write 0 to ID 6
2	Set mode to Read	Write 1 to ID 4
3	Write Block Size	Write <size> to ID 2
4	Write 1st Base Tag address	Write <addr> to ID 1
5	Execute instruction	Write 1 to ID 5
7	Check result	Read ID 6
8	If result is error set flag	
9	Get Data 1	Read <values> on ID3
10	Transfer data	
Back to 4	Write 2nd Base Tag address	Write <addr> to ID 1
	Execute instruction	Write 1 to ID 5
	Check result	Read ID 6
	If result is error set flag	
	Get Data 2	Read <values> on ID3
	Transfer data	
Back to 4	Write 3nd Base Tag address	Write <addr> to ID 1
	Etc	

Sequence for Download (Block WRITE)

Order	Action.	Value
0	Clear all transactions in Scanner	Write Reset Command to Scanner
1	Clear sequence in 2600	Write 0 to ID 6
2	Set mode to Write	Write 1 to ID 4
3	Write Block Size	Write <size> to ID 2
4	Write 1st Base Tag address	Write <addr> to ID 1
5	Transfer Data 1	Write <values> to ID3
6	Execute instruction	Write 1 to ID 5
7	Check result	Read ID 6
	If result is error set flag	
Back to 4		
	Write 2nd Base Tag address	Write <addr> to ID 1
	Transfer Data 2	Write <values> to ID3
	Execute instruction	Write 1 to ID 5
	Check result	Read ID 6
	If result is error set flag	
	Write 3nd Base Tag address	Write <addr> to ID 1
	Etc	

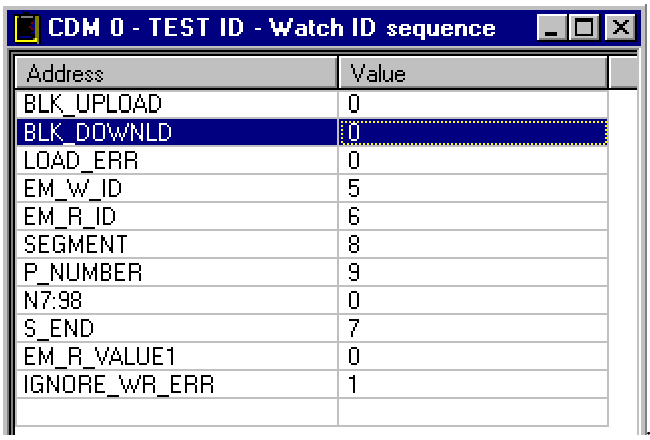
The 2600 programmer Tag address map is laid out as outlined in the table below.

Start Tag Address	Length	Description
12288	24	Program details
12312	32	Segment 1 details
12328	32	Segment 2 details
12344	32	Segment 3 details
... etc up to a max of 100 segments		

The application only downloads blocks of 16 parameters so the program details are written 16 from the base address and then 16 from the base address + 8. The segments are then each written with 2 blocks of 16.

In the application all the data is mapped directly onto file N9. With this set at a max of 256 elements it allows all the data of a 7 segment program to be uploaded. (Program is 24 words + 7 x 32 segments = 248 words).

The data may then be modified and downloaded. The application is controlled through a Custom Data Monitor.



Set P_NUMBER to the program number that is to be up or downloaded.

(Wait until the new number has been downloaded).

Set S_END to the last segment number required (max 7 in this example)

Set BLK_UPLOAD to upload a program.

(It resets when complete)

Set BLK_DOWNLD to download the program but be sure N9 has valid data.

(It resets when complete).

LOAD_ERR is set if there is a response from the 2600 says that the last sequence was in error. This never occurred in uploads but did occasionally in downloads although the data was written correctly. There are two actions.

Firstly set the parameter at Tag address 12753to 1 (instrument must be in configuration mode). This only ever has to be done once.

Setting IGNORE_WR_ERROR allows the sequence to continue regardless of the reported error.

The plc program has 3 ladder files – a main ladder (2600) and two subroutines one for explicit message write and one for explicit message read.

The Program Number can be changed and is immediately written. Then Bit B3:2/0 initiates an upload and B3:2/1 a download. Note that the new data must be ready before invoking the download. Bit words B3:0 and 3:1 are used to control the sequences.

File N7 is used to set up the explicit message requests and receive the responses. Writes start at N7:0 and reads at N7:40.

Timers have been included to introduce a delay between transactions. These may not be necessary but it was found that the scanner occasionally faulted without them.

12. References

http://www.eurotherm.co.uk/

TAG ADDRESSES

Books: Series 2000 Communications Handbook HA 026230, Mini8 controller Engineering Handbook HA028581, 3500 Engineering Handbook HA 027988

ELECTRONIC DATA SHEETS

Files: 2200.eds 2400.eds 2500.eds 2600.eds 2700.eds 3500.eds mini8.eds

www.Eurotherm.com or iTools CD

The PC3000 file PC3kDNS.eds is supplied with the PC3000 DeviceNet Module and Function Block Library.

SLC500 LADDER EXAMPLES.

File 2400Example2.RSS, 2200Examples.RSS, 2700ReadWrite.RSS, 2600PROGRAMMERv2.RSS

NOTE: These files are to show typical applications and as such come with no guarantees. If any part is used in any way in real applications the application will require full functional testing in the situation where it is used.

VERSIONS

CPU SLC500/03 1747-L531 OS302

Scanner : 1747SDN/B	Rev 4.026
Interface: 1770KFD	Rev 1.004
RSLinx	2.30.01
RSNetWorx	2.22.18.0
RSLogix500	4.50.00

The above products are all from Allen-Bradley, a Rockwell Automation Business.

Allen-Bradley Headquarters
1201 South Second Street
Milwaukee
WI 53204 USA

Mini8 controller	v1.04
3500	v1.12
2700	v5.00
2600	v3.00
2500	v3.30
2400	U4.09
2200	U3.03

The products above are manufactured by Eurotherm Ltd, an Invensys Business.

Eurotherm Ltd
Faraday Close
Worthing
BN13 3PL
UK

Eurotherm: International sales and service

AUSTRALIA Sydney
Eurotherm Pty. Ltd.
Telephone (+61 2) 9838 0099
Fax (+61 2) 9838 9288
E-mail info.eurotherm.au@invensys.com

AUSTRIA Vienna
Eurotherm GmbH
Telephone (+43 1) 798 7601
Fax (+43 1) 798 7605
E-mail info.eurotherm.at@invensys.com

BELGIUM & LUXEMBOURG Moha
Eurotherm S.A/N.V.
Telephone (+32) 85 274080
Fax (+32) 85 274081
E-mail info.eurotherm.be@invensys.com

BRAZIL Campinas-SP
Eurotherm Ltda.
Telephone (+5519) 3707 5333
Fax (+5519) 3707 5345
E-mail info.eurotherm.br@invensys.com

CHINA
Eurotherm China
Shanghai Office
Telephone (+86 21) 6145 1188
Fax (+86 21) 6145 2602
E-mail info.eurotherm.cn@invensys.com
Beijing Office
Telephone (+86 10) 5909 5700
Fax (+86 10) 5909 5709 or
Fax (+86 10) 5909 5710
E-mail info.eurotherm.cn@invensys.com

DENMARK Copenhagen
Eurotherm Danmark AS
Telephone (+45 70) 234670
Fax (+45 70) 234660
E-mail info.eurotherm.dk@invensys.com

FINLAND Abo
Eurotherm Finland
Telephone (+358) 2250 6030
Fax (+358) 2250 3201
E-mail info.eurotherm.fi@invensys.com

FRANCE Lyon
Eurotherm Automation SA
Telephone (+33 478) 664500
Fax (+33 478) 352490
E-mail info.eurotherm.fr@invensys.com

GERMANY Limburg
Eurotherm Deutschland GmbH
Telephone (+49 6431) 2980
Fax (+49 6431) 298119
E-mail info.eurotherm.de@invensys.com

INDIA Chennai
Eurotherm India Limited
Telephone (+91 44) 2496 1129
Fax (+91 44) 2496 1831
E-mail info.eurotherm.in@invensys.com

IRELAND Dublin
Eurotherm Ireland Limited
Telephone (+353 1) 469 1800
Fax (+353 1) 469 1300
E-mail info.eurotherm.ie@invensys.com

ITALY Como
Eurotherm S.r.l
Telephone (+39 031) 975111
Fax (+39 031) 977512
E-mail info.eurotherm.it@invensys.com

KOREA Seoul
Eurotherm Korea Limited
Telephone (+82 31) 2738507
Fax (+82 31) 2738508
E-mail info.eurotherm.kr@invensys.com

NETHERLANDS Alphen a/d Rijn
Eurotherm B.V.
Telephone (+31 172) 411752
Fax (+31 172) 417260
E-mail info.eurotherm.nl@invensys.com

NORWAY Oslo
Eurotherm A/S
Telephone (+47 67) 592170
Fax (+47 67) 118301
E-mail info.eurotherm.no@invensys.com

POLAND Katowice
Invensys Eurotherm Sp z o.o
Telephone (+48 32) 218 5100
Fax (+48 32) 218 5108
E-mail info.eurotherm.pl@invensys.com

SPAIN Madrid
Eurotherm España SA
Telephone (+34 91) 661 6001
Fax (+34 91) 661 9093
E-mail info.eurotherm.es@invensys.com

SWEDEN Malmo
Eurotherm AB
Telephone (+46 40) 384500
Fax (+46 40) 384545
E-mail info.eurotherm.se@invensys.com

SWITZERLAND Wollerau
Eurotherm Produkte (Schweiz) AG
Telephone (+41 44) 787 1040
Fax (+41 44) 787 1044
E-mail info.eurotherm.ch@invensys.com

UNITED KINGDOM Worthing
Invensys Eurotherm Limited
Telephone (+44 1903) 268500
Fax (+44 1903) 265982
E-mail info.eurotherm.uk@invensys.com

U.S.A Ashburn VA
Eurotherm Inc.
Telephone (+1 703) 724 7300
Fax (+1 703) 724 7301
E-mail info.eurotherm.us@invensys.com

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Represented by:

invensys
Eurotherm

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