Advanced User Guide

SM DeviceNet

Unidrive SP

Part Number: 0471-0009
Issue Number: 1

www.controltechniques.com

Safety Information

The solutions module and its associated drive are intended as components for professional incorporation into complete equipment or systems. If installed incorrectly the drive may present a safety hazard. The drive uses high voltages and currents, carries a high level of stored electrical energy and is used to control mechanical equipment that can cause injury.

Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and User Guide carefully.

Careful consideration must be given to the functions of the drive and solutions module, which might result in a hazard, either through their intended functions e.g. auto-start or through incorrect operation due to a fault or trip e.g. stop/start, forward/reverse, maximum speed, loss of communications link.

In any application where a malfunction of the drive or solutions module could lead to damage, loss or injury, a risk analysis must be carried out and where necessary further measures taken to reduce the risk. To ensure mechanical safety additional safety devices such as electro-mechanical interlocks may be required. The drive must not be used in a safety critical application without high-integrity protection against hazards arising from a malfunction.

General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the variable speed drive (Drive) with the motor.

The contents of this guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of this guide, without notice.

Drive software version

This product is supplied with the latest version of user-interface and machine control software. If this product is to be used in a new or existing system with other Drives, there may be some differences between their software and the software in this product. These differences may cause this product to function differently. This may also apply to Drives returned from a Control Techniques Service Centre.

If there is any doubt, contact a Control Techniques Drive Centre.

Issue Code: 1
Hardware: UT77 Issue 01.00
Firmware: V0.01.00

Contents

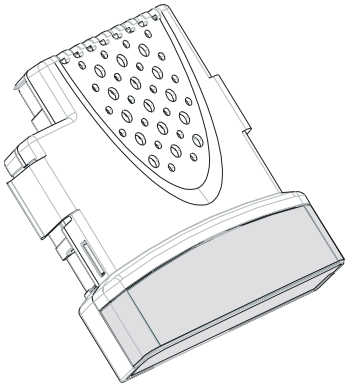
1 Introduction

NOTE Unidrive SP parameters are denoted in this manual by "#MM.PP", where MM refers to the menu number, and PP refers to the parameter number within that menu. Please refer to the Unidrive SP manual for full parameter definitions.

1.1 SM DeviceNet Module for Unidrive SP

The SM DeviceNet module for Unidrive SP is an option module that can be fitted to any one of the three expansion slots in the Unidrive SP. The SM DeviceNet module uses a 16-bit processor and is capable of communicating at 500 Kbits/sec, currently the fastest data rate available for DeviceNet.

Figure 1-1 Unidrive SP Option Module



The SM DeviceNet module is powered from the Unidrive SP internal power supply. The DeviceNet network power supply must be connected, and this will keep the transceiver circuits powered up when the Unidrive SP is powered down.

The Unidrive SP can be connected to a back-up power supply. This keeps the control electonics and option modules powered up, allowing the SM DeviceNet module to continue communicating with the DeviceNet master controller when the main supply to the Unidrive SP is switched off.

1.2 Product Conformance Certificate

The SM DeviceNet module has been submitted to the Open DeviceNet Vendors Association (ODVA) to be tested for full DeviceNet Conformance Certification.

1.3 Overview Specification

- Supported data rates (bits/sec): 500K, 250K, 125K
- 1 to 28 input/output polled data words supported
- Explicit communications provides access to all Unidrive SP parameters
- 8 pre-defined DeviceNet profiles supported
- CT Single Word or PPO 4 Word mode non-cyclic data channel (optional)

2 Mechanical Installation

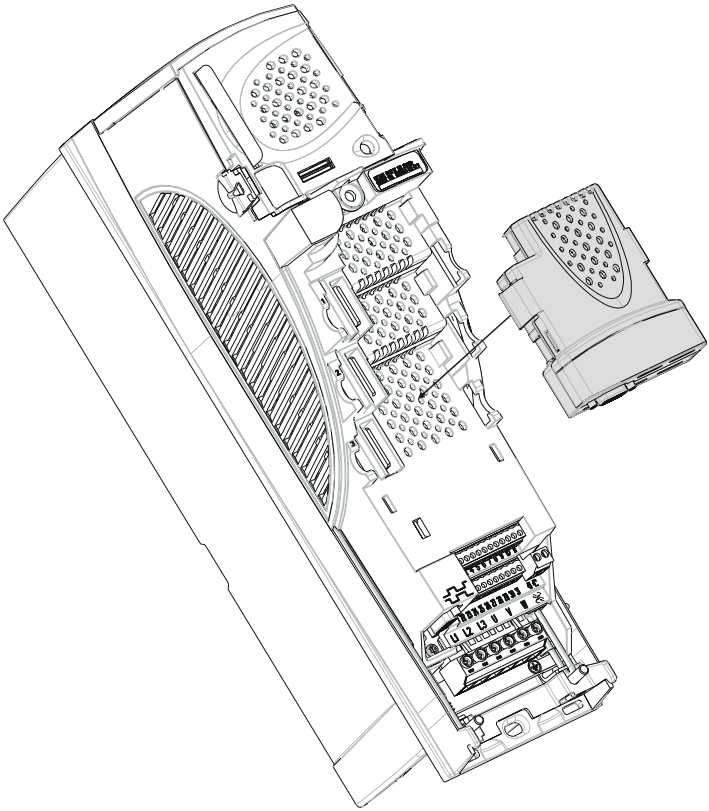
CAUTION

The Unidrive SP must be disconnected from the mains supply before installing or removing the Advanced User Guide module.

2.1 Installing The SM DeviceNet Module

- Locate the SM DeviceNet module into the required slot, and press down until the module clicks into place

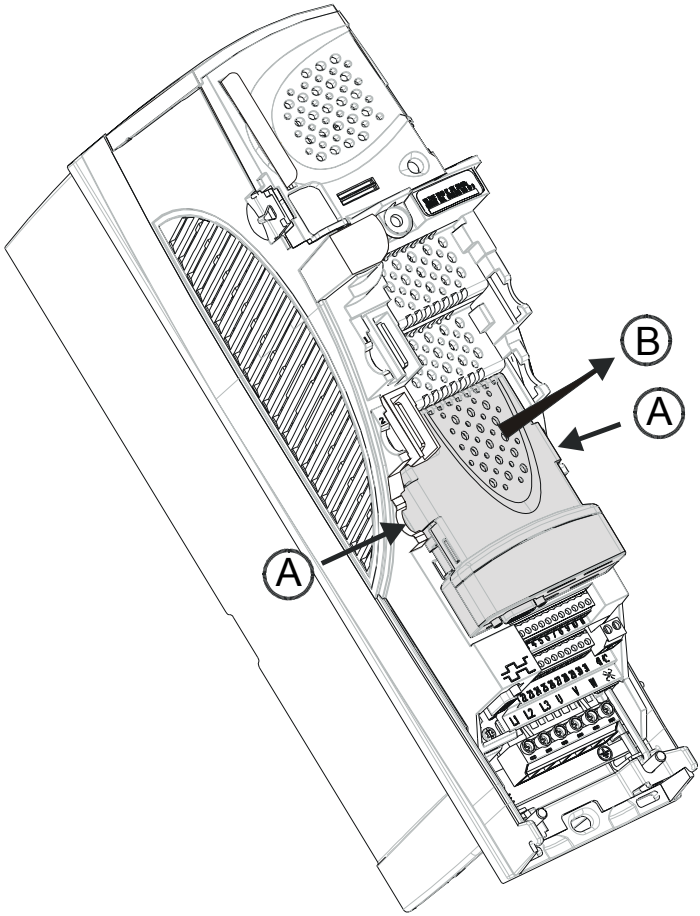
Figure 2-1 .Installing The SM DeviceNet Module



2.2 Removing The SM DeviceNet Module

- To remove the SM DeviceNet module from the slot, press both clips inwards (A) and lift the module away (B) from the Unidrive SP.

Figure 2-2 Removing The SM DeviceNet Module

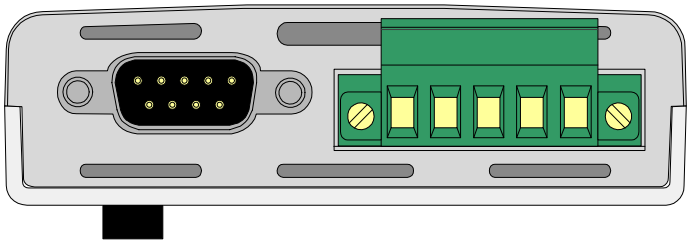


3 Electrical Installation

3.1 SM DeviceNet Module

The SM DeviceNet module has a standard DeviceNet 5-way screw terminal block connector for the DeviceNet network. The 9-way male D-type also allows access to the SM DeviceNet module. (See note below.)

Figure 3-1 SM DeviceNet Module - Front View



The standard 5-way DeviceNet terminal block connector is numbered from Terminal 1 on the left hand side to Terminal 5 on the right hand side. The terminal functions are given in the table below.

Table 3.1 SM DeviceNet Module Connectors

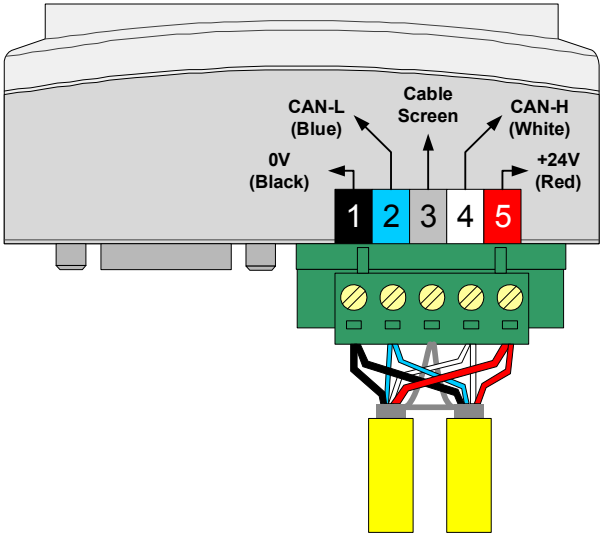
5-Way Terminal	D-type Terminal	Function	Description
1	6	0V	0V DeviceNet external supply
2	2	CAN-L	Negative data line
3	3,5 Shell	Screen	Cable braided screen connection
4	7	CAN-H	Positive data line
5	9	+24V	+24V DeviceNet external supply

NOTE Control Techniques does not recommend using the D-type connector for connecting to DeviceNet networks, as D-type connectors are not a recognised standard DeviceNet connector.

3.2 DeviceNet Connections

To connect the SM DeviceNet module to the DeviceNet network, make the connections as shown in the diagram below. The length of the "pigtail" screen connection should be kept as short as possible.

Figure 3-2 DeviceNet Network Connections



3.3 DeviceNet Cable

DeviceNet cable has 2 twisted pairs plus overall screening. DeviceNet has a specified colour code, and it is strongly recommended that this code is maintained. The data wires are white and blue, and the network power supply wires are red and black.

Table 3.2 DeviceNet Cable Colour Codes

Cable	Data Signal	Terminal	Description
Black	0V	1	0V external power supply
Blue	CAN-L	2	Negative data line
Braided Shield	Screen	3	Cable screen
White	CAN-H	4	Positive data line
Red	+24V	5	+24V external power supply

DeviceNet networks run at high data rates, and require cable specifically designed to carry high frequency signals. Low quality cable will attenuate the signals, and may render the signal unreadable for the other nodes on the network. Cable specifications and a list of approved manufacturers of cable for use on DeviceNet networks is available on the Open DeviceNet Vendors Association web site at www.odva.org.

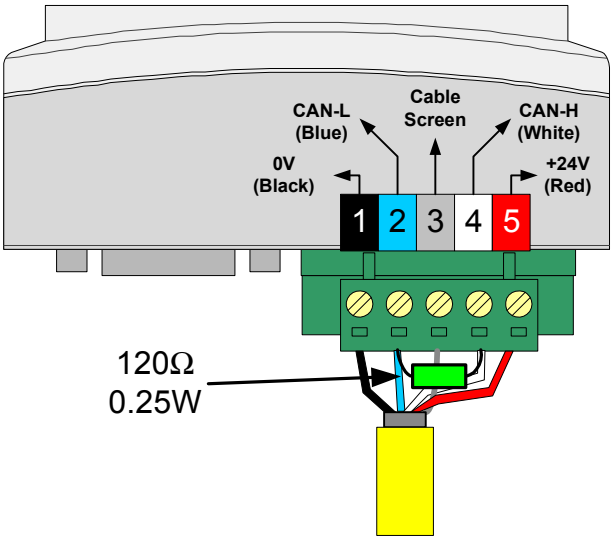
NOTE Control Techniques can only guarantee correct and reliable operation of the SM DeviceNet module if all other equipment installed on the DeviceNet network (including the network cable) has been approved by the ODVA.

3.4 DeviceNet Network Termination

It is very important in high-speed communications networks that the network communications cable is fitted with the specified termination resistor network at each end of the cable. This prevents signals from being reflected back down the cable and causing interference.

120R 0.25W termination resistors should be fitted across the CAN-H and CAN-L lines at the BOTH ends of the trunk cable run, as shown in the diagram below.

Figure 3-3 DeviceNet Network Termination



For further details, refer to DN-6.7.2, “DeviceNet Cable System: Planning and Installation Manual”, available from the Allen Bradley web site at www.ab.com.

Failure to terminate a network correctly can seriously affect the operation of the network. If the correct termination resistors are not fitted, the noise immunity of the network is greatly reduced.

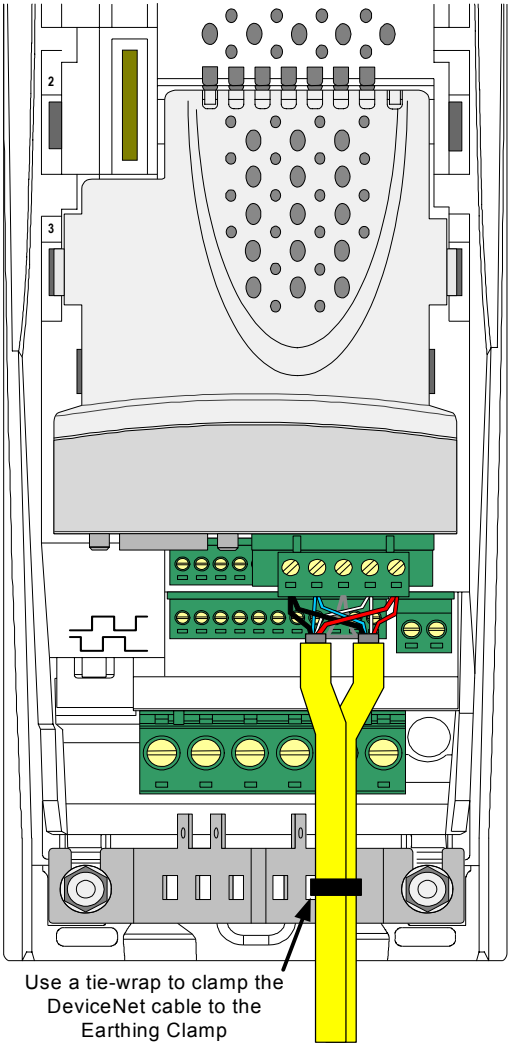
If too many termination resistors are fitted on a DeviceNet network, the network will be over-loaded, resulting in reduced signal levels. This may cause nodes to miss some bits of information, resulting in transmission errors being reported. If network overload is excessive, the signal levels may be so low that nodes cannot detect any network activity at all.

3.5 DeviceNet Cable Screen Connections

The SM DeviceNet module should be wired with the cable shields isolated from earth at each Unidrive SP. The cable shields should be linked together at the point where they emerge from the cable, and formed into a short pigtail to be connected to pin 3 on the DeviceNet connector.

The DeviceNet cable can be tie-wrapped to the Earthing Frame to provide strain relief, but the DeviceNet cable screen must kept isolated from earth at each node. The only exception to this is the DeviceNet earth point. Refer to .

Figure 3-4 DeviceNet Cable Screen Arrangement



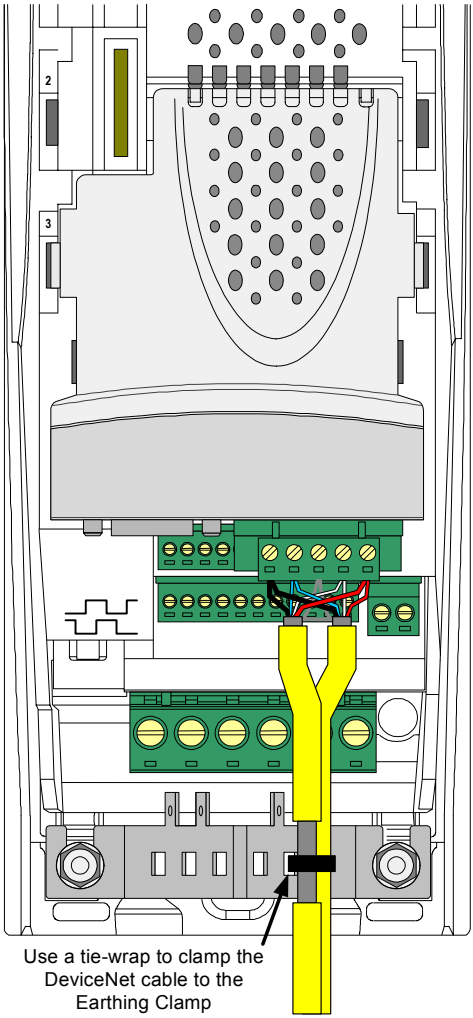
For further details, refer to DN-6.7.2, “DeviceNet Cable System: Planning and Installation Manual”, available from the Allen Bradley web site at www.ab.com

3.6 DeviceNet Earth Point

The DeviceNet cable sscreen must be earth AT ONE POINT only, usually near the centre point of the cable run. This is to prevent the cable screen from becoming live in the event of catastrophic failure of another device on the DeviceNet network.

If a Unidrive SP node is the desired earth point, the screen of one of the DeviceNet cables can be exposed and clamped to the Earthing Clamp, as shown in Figure 3-5 below.

Figure 3-5 DeviceNet Earth Point



3.7 DeviceNet Power Supply Requirements

A comprehensive guide to wiring and sizing a power supply for a DeviceNet network is available from the Allen Bradley web site at www.ab.com. DN-6.7.2 “DeviceNet Cable System: Planning and Installation Manual” provides all necessary details and guidelines to specifying and installing a suitable power supply for a DeviceNet network.

The SM DeviceNet module is powered by the Unidrive SP, and only the transceiver ciruitry is powered by the DeviceNet network power supply. Consequently, the DeviceNet will draw most current when the Unidrive SP is completely powered down.

The table below shows the typical current drawn from the DeviceNet network power supply when the Unidrive SP is completely powered down. A factor of 2 should be allowed for in-rush current if the DeviceNet module is connected to the DeviceNet network while the Unidrive SP is powered down.

Table 3.3 SM DeviceNet Module External Current Consumption

DeviceNet Supply Voltage	Typical Current
19.2V (24V -20%)	12mA
21.6V (24V -10%)	12mA
24V nominal	13mA
26.4V (24V +10%)	14mA
28.8V (24V+20%)	15mA

3.8 Maximum Network Length

The maximum number of nodes that can be connected to a single DeviceNet network segment is 64 nodes. The maximum length of network cable for a DeviceNet network is specified by the Open DeviceNet Vendors Association, and depends on the data rate to be used. Full details of network cable lengths and wiring limitations are available in the Allen Bradley Document Reference DN-6.7.2.

Table 3.4 DeviceNet Maximum Network Lengths

Data Rate (bits/sec)	Maximum Trunk Length (m)	Maximum Drop Length (m)	Max. Cumulative Drop (m)
125K	500	6	156
250K	250	6	78
500K	100	6	39

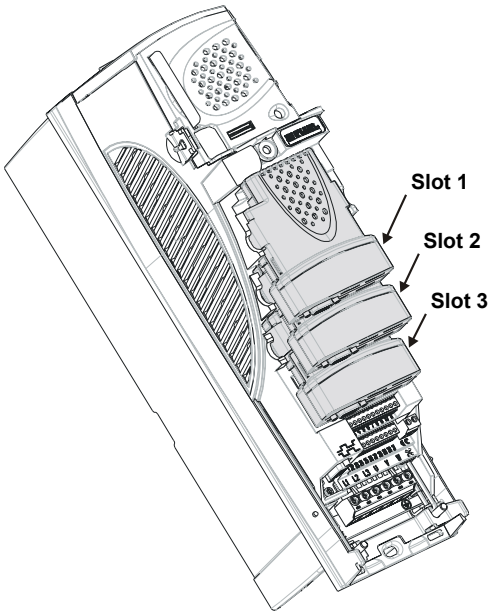
4 Getting Started

Full explanations of the polled data functions and supported data formats are given in Chapter 5. Non-cyclic data and node configuration using non-cyclic data are described in Chapter 7.

NOTE The Unidrive SP must be fitted with firmware V0.10.00 or later for use with the SM DeviceNet module.

Unidrive SP has 3 slots available for option modules, and each slot has a dedicated menu of configuration parameters.

Figure 4-1 Unidrive SP Slot Arrangement



The SM DeviceNet module can be fitted to any slot, and each slot has a corresponding menu of parameters. When referring to a specific parameter for any slot, e.g. DeviceNet MAC-ID, the parameter will be referred to as #MM.03.

Table 4.1 Slot Configuration Menu

Slot	Menu
1	#15.PP
2	#16.PP
3	#17.PP

4.1 Libra Wizard

Libra does not currently have any wizards specified, although it is intended to include wizards at a later date.

4.2 Basic Communications Quick Start

The SM DeviceNet module can be configured using the keypad to establish basic DeviceNet communications. The instructions below assume that the SM DeviceNet module is located in slot 3.

- Power up the Unidrive SP, and ensure that #0.50 is set to "L2".
- Set the node address (#17.03) as required.
- Set the data rate (#17.04) as required.
- Set #MM.00 to 1000 and press RESET to store the configuration in the Unidrive SP.
- The SM DeviceNet module will reset and use the updated configuration parameters from the Unidrive SP, and configure itself accordingly.

Table 4.2 Basic Configuartion Settings

Function	Parameter	Recommended Setting
Node Address	#17.03	1 to 62
Data Rate	#17.04	0 to 2
Data Format	#17.05	5

4.3 DeviceNet MAC-ID (Node Address)

Name	DeviceNet MAC-ID		
Slot 1	#15.03	**Default**	63
Slot 2	#16.03	**Range**	0 to 63
Slot 3	#17.03	**Access**	RW

Every node on a DeviceNet network must be given a unique network node address or MAC-ID. If two or more nodes are assigned the same address, only one node will join the network and start communicating with the master controller. All other nodes with the same address will be prevented from joining the network. The valid range of addresses is from 0 to 63, with a default address of 63. The SM DeviceNet module must be reset to make a change of node address take effect. (See section .)

If an invalid node address is set, the SM DeviceNet module will reject the configured address, default to 63, and set the DeviceNet MAC-ID (#MM.03) to 63.

NOTE MAC-ID 63 should not be used for slave nodes on a DeviceNet network. Some simple DeviceNet devices (such as valves, actuators and proximity sensors) can only be assigned a MAC-ID via the DeviceNet network itself, so they will appear as MAC-ID 63 when they are first connected to the network. Consequently, MAC-ID 63 should always be left un-used to allow such devices to join the network when in their default state. MAC-ID 0 is typically assigned to the DeviceNet master controller, as this guarantees that messages from the master controller have a higher priority on the CAN network.

4.4 DeviceNet Data Rate

Name	DeviceNet Data Rate		
Slot 1	#15.04	**Default**	0
Slot 2	#16.04	**Range**	0 to 2
Slot 3	#17.04	**Access**	RW

Every node on a DeviceNet network must be configured to run at the network data rate. If a node is configured with the wrong data rate, it may cause errors on the CAN network, and eventually trip on “SLx.Er” with Error Code of 66. The SM DeviceNet module must be reset to make a change of data rate take effect. (See section .)

If an invalid data rate is set, the SM DeviceNet module will reject the configured data rate and revert to the nearest valid setting. The default data rate is 125Kbits/sec.

Table 4.3 DeviceNet Data Rates

#MM.04	bits/sec
0	125K
1	250K
2	500K

4.5 DeviceNet Data Format

Name	DeviceNet Data Format		
Slot 1	#15.05	**Default**	5
Slot 2	#16.05	**Range**	0 to 224
Slot 3	#17.05	**Access**	RO

The default data format is 5 Polled Words. Each polled data channel is mapped to a Unidrive SP parameter, with default mappings as shown in the table below.

Table 4.4 Default Data Mapping

Polled Word	Data Width	Data Word	Default Mapping Status
IN Channel 0	16 bit	Word 0	#10.40, status word
IN Channel 1	32 bit	Word 1, 2	#2.01, post-ramp speed reference
IN Channel 2	16 bit	Word 3	#4.20, motor Load as % of rated load
IN Channel 3	16 bit	Word 4	Not mapped
OUT Channel 0	16 bit	Word 0	#6.42, control word
OUT Channel 1	32 bit	Word 1, 2	#1.21, digital speed reference 1
OUT Channel 2	32 bit	Word 3, 4	#4.08, torque reference

Other data formats with are also supported. For further details. see section 5.3.

NOTE If a polled data channel is mapped to a Unidrive SP 32-bit parameter, it will use two 16-bit data words to transfer the data. Refer to section 5.2 for a list of Unidrive SP 32-bit parameters.

4.6 DeviceNet Network Status

Name	DeviceNet Network Status		
Slot 1	#15.06	Default	N/A
Slot 2	#16.06	Range	-10 to 9999
Slot 3	#17.06	Access	RO

The DeviceNet network activity can be monitored in the DeviceNet Network Status parameter, #MM.06. When the SM DeviceNet module is communicating successfully with the DeviceNet master controller, the DeviceNet Network Status will give an indication of the number of data messages per second that are being processed. If a configuration error or network error is detected, the Unidrive SP may trip.

Refer to section for details about the Unidrive SP trip display.

Table 4.5 DeviceNet Network Status Codes

#MM.06	Parameter	Description
>0	Network Healthy	Indicates the number of successful network cycles per second.
0	Network Healthy, No Data Transfer	Indicates that the DeviceNet master has established communications with the SM DeviceNet module, but there is currently no data transfer in progress.
-1	Initialised	Indicates that the SM DeviceNet module has initialised correctly, and is waiting for the DeviceNet master to initialise communications.
-2	Internal Hardware Failure	Indicates that part of the SM DeviceNet module initialisation sequence was not successful. If this fault persists after a power cycle, replace the SM DeviceNet module.
-3	Configuration Error	Indicates that there is an invalid setting in the SM DeviceNet module configuration parameters.
-10	External Power Supply Error	Indicates that the external DeviceNet +24V power supply is missing. The SM DeviceNet module will not communicate unless the the DeviceNet power supply is present and correct.

4.7 Resetting the SM DeviceNet Module

Name	SM DeviceNet Reset		
Slot 1	#15.32	Default	0 (OFF)
Slot 2	#16.32	Range	0 (OFF) to 1 (ON)
Slot 3	#17.32	Access	RW

Changes to the DeviceNet configuration in menu 15, 16 and 17 parameters will not take effect until the SM DeviceNet module has been reset.

To reset an SM DeviceNet module in slot 3:

1. Set #17.32 to ON.
2. When the reset sequence has been completed, #17.32 will be reset to OFF.
3. The SM DeviceNet module will re-initialise using the updated DeviceNet configuration.

NOTE This sequence does NOT store the DeviceNet parameters in the Unidrive SP or the SM DeviceNet FLASH memory.

Reset All option Modules

It is possible to reset all of the option modules fitted on a Unidrive SP at the same time. To reset all Unidrive SP option modules:

- Set #MM.00 to 1070.
- Press the red RESET button on the Unidrive SP.

NOTE This sequence does NOT store the DeviceNet parameters in the Unidrive SP or the SM DeviceNet FLASH memory. See section for details about storing DeviceNet configuration parameters.

5 Polled Data

"OUT data" and "IN data" describe the direction of data transfer as seen by the DeviceNet master controller.

5.1 What is Polled Data?

Polled data is a method of data transfer that must be set-up during network configuration, but is transmitted automatically once configuration is complete. The high-speed data transfer is achieved by transmitting only data bytes over the DeviceNet network, and relying on local mapping information within the SM DeviceNet module and DeviceNet master controller to ensure that the correct data is sent to the correct locations. This method relies on the master controller program writing and reading data values to and from the registers allocated to the node during network configuration, and the source and destination of IN and OUT data being set-up correctly in the Unidrive SP itself.

The flexibility of the SM DeviceNet module means that each polled data OUT channel can be directed to any read-write Unidrive SP parameter. Similarly, each polled data IN channel can use any Unidrive SP parameter as a source of data.

NOTE The polled data mapping cannot be changed dynamically, as changes to the mapping parameters will only take effect during initialisation of the SM DeviceNet module, i.e. after a reset, or at power up.

5.2 32-bit Parameters

If a 32-bit parameter is mapped as a source or destination parameter, two polled or cyclic 16-bit data words will be allocated, affecting the mapping between the DeviceNet master controller registers and Unidrive SP parameters.

Some Unidrive SP and UT70 parameters are 32 bit parameters. The table below lists all 32 bit parameters that can be set as target parameters for cyclic or polled data.

Table 5.1 Unidrive SP 32-bit Parameters

Menu	32-bit Parameters									
Menu 1	#1.01	#1.02#	#1.03	#1.04	#1.06	#1.07	#1.17	#1.18	#1.21	#1.22
	#1.23	#1.24	#1.25	#1.26	#1.27	#1.28	#1.36	#1.37	#1.39	
Menu 2	#2.01	#2.07	#2.11	#2.12	#2.13	#2.14	#2.15	#2.16	#2.17	#2.18
	#2.19	#2.21	#2.22	#2.23	#2.24	#2.25	#2.26	#2.27	#2.28	#2.29
Menu 3	#3.01	#3.02	#3.03	#3.10	#3.18	#3.22	#3.27			
Menu 4	#4.01	#4.02	#4.08	#4.17						
Menu 5	#5.01	#5.03	#5.04	#5.07	#5.08	#5.24	#5.25			
Menu 7	#7.51									
Menu 11	#11.32									
Menu 15	#15.03	#15.19	#15.35							
Menu 16	#16.03	#16.19	#16.35							
Menu 17	#17.03	#17.19	#17.35							
Menu 20	#20.21 to #20.40									
Menu 21	#21.01	#21.02	#21.04	#21.05	#21.07	#21.08	#21.14	#21.24		
Menu 70 to 75	#70.00 to #70.99			#71.00 to #71.99			#72.00 to #72.99			
	#73.00 to #73.99			#74.00 to #74.99			#75.00 to #75.99			
Menu 100 to Menu 105	#100.00 to #100.99			#101.00 to #101.99			#102.00 to #102.99			
	#103.00 to #103.99			#104.00 to #104.99			#105.00 to #105.99			

Table 5.1 Unidrive SP 32-bit Parameters

Menu	32-bit Parameters		
Menu 130 to Menu 135	#130.00 to #130.99	#131.00 to #131.99	#132.00 to #132.99
	#133.00 to #133.99	#134.00 to #134.99	#135.00 to #135.99
Menu 160 to Menu 165	#160.00 to #160.99	#161.00 to #161.99	#162.00 to #162.99
	#163.00 to #163.99	#164.00 to #164.99	#165.00 to #165.99

Parameters in menus 15, 16 and 17 are only 32-bit if one of the intelligent encoder modules is fitted in the appropriate Unidrive SP slot.

5.3 DeviceNet Data Formats

Name	DeviceNet Data Format		
Slot 1	#15.05	Default	5
Slot 2	#16.05	Range	0 to 224
Slot 3	#17.05	Access	RW

The SM DeviceNet module can be configured with up to 28 polled IN and OUT data words. IN and OUT polled data words are mapped using 10 mapping parameters each, with a “block mapping” mode (see section 10.4) available for the additional data words. CT Single Word or PPO 4 Word modes of non-cyclic data using polled data can also be enabled.

The DeviceNet Data Format is specified as “NNPP”, where NN is the non-cyclic data mode, and PP is the number of polled data words.

Table 5.2 Valid DeviceNet Data Formats

#MM.05	NN	PP	Non-cyclic Mode	Polled Words
1 to 28	0	1 to 28	Explicit only	1 to 28
100 to 127	1	0 to 27	Explicit plus CT Single Word	0 to 27
200 to 224	2	0 to 24	Explicit plus PPO 4 Word	0 to 24

Data is mapped to and from Unidrive SP parameters using 10 mapping parameters each for IN and OUT polled data. The number of words used for each parameter depends on the data size of the source (IN) or destination (OUT) parameter. If a channel is mapped to a 32-bit parameter (see section 5.2) in the Unidrive SP, 2 words will be used for the data value. For all other Unidrive SP parameters, 1 word will be used.

For example, #1.21 (digital speed ref 1) is a 32-bit double word parameter, and is mapped (by default settings) to OUT words 1 and 2. By default, the SM DeviceNet module uses the “little endian” data format, so OUT word 1 will contain the low data word, and OUT word 2 will contain the high data word. (Refer to section 10.3 for more details.)

The method used to map data to and from the DeviceNet network is similar to the method used in Unidrive SP for mapping analogue and digital inputs and outputs. The reference for the source or target parameter is entered in the mapping parameter in the form MMPP, where MM = menu number of the target/source parameter and PP = parameter number of the target/source parameter.

Table 5.3 SM DeviceNet Module Mapping Parmaeters

IN Channel	Mapping Parameter			OUT Channel	Mapping Parameter		
	Slot 1	Slot 2	Slot 3		Slot 1	Slot 2	Slot 3
0	#15.10	#16.10	#17.10	0	#15.20	#16.20	#17.20
1	#15.11	#16.11	#17.11	1	#15.21	#16.21	#17.21
2	#15.12	#16.12	#17.12	2	#15.22	#16.22	#17.22
3	#15.13	#16.13	#17.13	3	#15.23	#16.23	#17.23
4	#15.14	#16.14	#17.14	4	#15.24	#16.24	#17.24
5	#15.15	#16.15	#17.15	5	#15.25	#16.25	#17.25
6	#15.16	#16.16	#17.16	6	#15.16	#16.16	#17.16
7	#15.17	#16.17	#17.17	7	#15.17	#16.17	#17.17
8	#15.18	#16.18	#17.18	8	#15.18	#16.18	#17.18
9	#15.19	#16.19	#17.19	9	#15.19	#16.19	#17.19

"Block Mapping" can be used to map several words to consecutive Unidrive SP parameters. Full details about "block mapping" can be found in section 10.4.

If a mapping parameter is set to an invalid value, e.g. destination parameter is read only, or parameter does not exist, the SM DeviceNet module will indicate "Mapping Error" in the Network Status parameter, #MM.06. The reason for the mapping error will be indicated by the Mapping Error Status parameter, #MM.49. Refer to section 5.6 for more details.

When the Data Format is configured using #MM.05, the SM DeviceNet module will communicate using the same number of data words for IN and OUT data. It is, however, possible to configure the SM DeviceNet module to communicate with different numbers of IN and OUT polled data words. Refer to section 10.9 for full details.

NOTE The polled data channels do not use decimal points. For example, in Open Loop mode, the Unidrive SP digital speed reference 1 (#1.21) has units of Hertz, accurate to 1 decimal place. To write a value of 24.6Hz to #1.21, the value must be transmitted as 246.

The following sections show some example data formats that can be selected, and the parameter mapping that will apply (by default) to each format.

5.3.1 5 Polled Words Only (Default)

This data format provides five 16-bit polled data words, with no non-cyclic data channel. The total data length is 10 bytes. To select this data format, set #MM.05 = 5. This data format is selected by default.

Table 5.4 Mapping for 5 Polled Data Words

Data Word	Slot 1	Slot 2	Slot 3	Default Mapping Status
IN Word 0	#15.10	#16.10	#17.10	#10.40, status word (See section)
IN Words 1,2	#15.11	#16.11	#17.11	#2.01, post-ramp speed reference
IN Word 3	#15.12	#16.12	#17.12	#4.20, motor load as % of rated load
IN Word 4	#15.13	#16.13	#17.13	0, not mapped

Table 5.4 Mapping for 5 Polled Data Words

Data Word	Slot 1	Slot 2	Slot 3	Default Mapping Status
OUT Word 0	#15.20	#16.20	#17.20	#6.42, control word (See section)
OUT Word 1,2	#15.21	#16.21	#17.21	#1.21, digital speed reference 1
OUT Word 3,4	#15.22	#16.22	#17.22	#4.08, torque reference

5.3.2 5 Polled Words with Mode 1 Non-Cyclic Data

This data format provides five 16-bit polled data words, plus an additional word for Mode 1 (CT Single Word) non-cyclic data. (See section 7.2) The total data length is 12 bytes. To select this data format, set #MM.05 = 105.

Table 5.5 Mapping for 5 Polled Data Words with Mode 1 Non-Cyclic Data

Data Word	Slot 1	Slot 1	Slot 1	Default Mapping Status
IN Word 0	#15.10	#16.10	#17.10	#90.50, CT Mode 1 non-cyclic data
IN Word 1	#15.11	#16.11	#17.11	#10.40, status word (See section)
IN Word 2,3	#15.12	#16.12	#17.12	#2.01, post-ramp speed reference
IN Word 4	#15.13	#16.13	#17.13	#4.20, motor load as % of rated load
IN Word 5	#15.14	#16.14	#17.14	0, not mapped
OUT Word 0	#15.20	#16.20	#17.20	#90.50, CT Mode 1 non-cyclic data
OUT Word 1	#15.21	#16.21	#17.21	#6.42, control word (See section)
OUT Word 2,3	#15.22	#16.22	#17.22	#1.21, digital speed reference 1
OUT Word 4,5	#15.23	#16.23	#17.23	#4.08, torque reference

5.3.3 10 Polled Words Only

This data format provides ten 16-bit polled data words, with no non-cyclic data channel. The total data length is 20 bytes. To select this data format, set #MM.05 = 10.

Table 5.6 Mapping for 10 Polled Data Words

Data Word	Slot 1	Slot 2	Slot 3	Default Mapping Status
IN Word 0	#15.10	#16.10	#17.10	#10.40, status word (See section)
IN Word 1,2	#15.11	#16.11	#17.11	#2.01, post-ramp speed reference
IN Word 3	#15.12	#16.12	#17.12	#4.20, motor load as % of rated motor load
IN Word 4-9	#15.13 to #15.19	#16.13 to #16.19	#17.13 to #17.19	Not mapped
OUT Word 0	#15.20	#16.20	#17.20	#6.42, control word (See section)
OUT Word 1,2	#15.21	#16.21	#17.21	#1.21, digital speed reference 1
OUT Word 3,4	#15.22	#16.22	#17.22	#4.08, torque reference
OUT Word 5-9	#15.23 to #15.29	#16.23 to #16.29	#17.23 to #17.29	0, not mapped

5.3.4 16 Polled Words with Mode 2 Non-Cyclic Data

This data format provides sixteen * 16-bit polled data words, plus an additional 4 words for Mode 2 (PPO 4 Word) non-cyclic data. (See section 7.3) The total data length is 40 bytes. To select this data format, set #MM.05 = 216.

Table 5.7 Mapping for 16 Polled Data Words with Mode 2 Non-Cyclic Data

Data Word	Slot 1	Slot 1	Slot 1	Default Mapping Status
IN Word 0-3	#15.10	#16.10	#17.10	#90.51, Mode 2 non-cyclic data
IN Word 4	#15.11	#16.11	#17.11	#10.40, status word (See section)
IN Word 5,6	#15.12	#16.12	#17.12	#2.01, post-ramp speed reference
IN Word 7	#15.13	#16.13	#17.13	#4.20, motor load as % of rated motor load

Table 5.7 Mapping for 16 Polled Data Words with Mode 2 Non-Cyclic Data

Data Word	Slot 1	Slot 1	Slot 1	Default Mapping Status
IN Word 8-19	#15.14 to #15.19	#16.14 to #16.19	#17.14 to #17.19	0, not mapped
OUT Word 0-3	#15.20	#16.20	#17.20	#90.51, Mode 2 non-cyclic data
OUT Word 4	#15.21	#16.21	#17.21	#6.42,control word (See section)
OUT Word 5,6	#15.22	#16.22	#17.22	#1.21, digital speed reference 1
OUT Word 7,8	#15.23	#16.23	#17.23	#4.08, torque reference
OUT Word 9-19	#15.24 to #15.29	#16.24 to #16.29	#17.24 to #17.29	0, not mapped

Block mapping can be used to map the remaining un-used data words to Unidrive SP or UT70 parameters. See section 10.4.

5.3.5 Pre-defined DeviceNet Assembly Object

Several pre-defined DeviceNet Assembly objects are supported for polled data. Refer to section 10.10 for full details about these pre-defined Assembly objects.

5.4 Unidrive SP Mapping Conflicts

Care must be taken to ensure that there are no clashes with the mapping of the analogue and digital inputs within the Unidrive SP. The SM DeviceNet module will not indicate if there is a conflict with Unidrive SP mapping parameters. This only applies to analogue and digital inputs, and OUT data on the DeviceNet network. The table below shows the parameters that need to be checked for possible mapping conflicts.

Table 5.8 Unidrive SP Destination Parameters

Function	Mapping Parameter		Function	Mapping Parameter
Analogue Input 1	#7.10		Cyclic OUT Slot 1 Channel 7	#15.27
Analogue Input 2	#7.14		Cyclic OUT Slot 1 Channel 8	#15.28
Analogue Input 3	#7.18		Cyclic OUT Slot 1 Channel 9	#15.29
Digital Input 1	#8.21		Cyclic OUT Slot 2 Channel 0	#16.20
Digital Input 2	#8.22		Cyclic OUT Slot 2 Channel 1	#16.21
Digital Input 3	#8.23		Cyclic OUT Slot 2 Channel 2	#16.22
Digital Input 4	#8.24		Cyclic OUT Slot 2 Channel 3	#16.23
Digital Input 5	#8.25		Cyclic OUT Slot 2 Channel 4	#16.24
Digital Input 6	#8.26		Cyclic OUT Slot 2 Channel 5	#16.25
Logic Output 1	#9.10		Cyclic OUT Slot 2 Channel 6	#16.26
Logic Output 2	#9.20		Cyclic OUT Slot 2 Channel 7	#16.27
Motorised Pot Output	#9.25		Cyclic OUT Slot 2 Channel 8	#16.28
Comparator 1 Output	#12.07		Cyclic OUT Slot 2 Channel 9	#16.27
Comparator 2 Output	#12.27		Cyclic OUT Slot 3 Channel 0	#17.20
Variable Select 1 Output	#12.11		Cyclic OUT Slot 3 Channel 1	#17.21
Variable Select 2 Output	#12.31		Cyclic OUT Slot 3 Channel 2	#17.22
PID Output	#14.16		Cyclic OUT Slot 3 Channel 3	#17.23
Cyclic OUT Slot 1 Channel 0	#15.20		Cyclic OUT Slot 3 Channel 4	#17.24
Cyclic OUT Slot 1 Channel 1	#15.21		Cyclic OUT Slot 3 Channel 5	#17.25
Cyclic OUT Slot 1 Channel 2	#15.22		Cyclic OUT Slot 3 Channel 6	#17.26
Cyclic OUT Slot 1 Channel 3	#15.23		Cyclic OUT Slot 3 Channel 7	#17.27

Table 5.8 Unidrive SP Destination Parameters

Function	Mapping Parameter	Function	Mapping Parameter
Cyclic OUT Slot 1 Channel 4	#15.24	Cyclic OUT Slot 3 Channel 8	#17.28
Cyclic OUT Slot 1 Channel 5	#15.25	Cyclic OUT Slot 3 Channel 9	#17.27
Cyclic OUT Slot 1 Channel 6	#15.26		

If a numerical parameter is written to from two different sources, the value of this parameter will depend entirely upon the scan times for the analogue or digital input and the DeviceNet network. Further confusion may be caused due to the update rate of the display. A parameter may appear to be steady at a particular value, but an occasional glitch in the displayed value may be seen. Internally, this value may be changing continuously between 2 values, leading to unusual behaviour from the Unidrive SP.

5.5 DeviceNet Mapping Errors

The SM DeviceNet module will scan and check the DeviceNet mapping parameter configuration for errors. If an error is detected, the DeviceNet Network Status parameter will indicate -3. The mapping error detected will be indicated in #MM.49. See section 9.6 for full details.

5.6 Disabling Data Channels

If any data words are not being used in an application, the un-used mapping parameters should be set to 0. Although the data word will still be transmitted over the DeviceNet network, any incoming data value will be discarded. Unmapped data words being passed back to the DeviceNet master controller will be set to 0.

5.7 Storing DeviceNet Configuration Parameters

Name	Store to SM DeviceNet FLASH Memory		
Slot 1	#15.31	**Default**	OFF
Slot 2	#16.31	**Range**	OFF (0) to ON (1)
Slot 3	#17.31	**Access**	RW

Menu 15, 16 and 17 parameters are stored in the Unidrive SP. The SM DeviceNet module will always use these values during initialisation to configure itself, so if a new SM DeviceNet module is fitted, it will communicate using the same settings as the previous SM DeviceNet module.

NOTE If the stored values in the Unidrive SP are for a different type of option module, the SM DeviceNet module will trip the Unidrive SP on “SLx.dF”. The slot configuration parameters will be set to the default values for DeviceNet, but the default values will NOT be stored in the Unidrive SP.

The DeviceNet configuration parameters can also be stored in the FLASH memory on the SM DeviceNet module. If the Unidrive SP is replaced, the DeviceNet configuration parameters can be restored to the Unidrive SP.

5.7.1 Saving Unidrive SP Parameters

To store Unidrive SP parameters:

1. Set #MM.00 to 1000.
2. Press the red RESET button.

The Unidrive SP will store all parameters (except Menu 20) but the operation of the SM DeviceNet module will not be affected. Changes made to the DeviceNet configuration parameters will not take effect until the SM DeviceNet module is reset.

5.7.2 Storing Parameters to DeviceNet FLASH Memory

To store the DeviceNet configuration parameters in the FLASH memory in the SM DeviceNet module in slot 3:

1. Set #17.31 to ON.
2. Set #MM.00 to 1000.
3. Press the red RESET button.

The Unidrive SP will store its parameters, and DeviceNet communication will be halted immediately. The DeviceNet configuration parameters will be saved within the SM DeviceNet module FLASH memory. The SM DeviceNet module will then reset and re-initialise using the updated configuration parameter values.

5.8

6 Control and Status Words

6.1 Unidrive SP Control Word

The Control Word allows the digital control of the Unidrive SP to be implemented using a single data word. Each bit in the control word has a particular function, and provides a method of controlling the output functions of the Unidrive SP (RUN FWD, JOG, TRIP, etc.) with a single data word

NOTE The Unidrive SP Control Word (#6.42) must be enabled by setting Control Word Enable (#6.43) to 1. When the Control Word is enabled, the source of the control signals (ENABLE, RUN FWD, JOG, etc.) is selected using the AUTO bit.

b15	b14	b13	b12b	b11	b10	b9	b8
	KEYPAD WDOG	RESET					REMOTE

b7	b6	b5	b4	b3	b2	b1	b0
AUTO	NOT STOP	RUN	FWD REV	RUN REV	JOG	RUN FWD	ENABLE

NOTE For safety reasons, the external HARDWARE ENABLE signal (terminal 31) must be present (connected to +24V, terminal 22) before the fieldbus control word can be used to start the Unidrive SP. Typically, this terminal is controlled by the external Emergency Stop circuit to ensure that the Unidrive SP is disabled in an emergency situation.

To select external fieldbus control, set the AUTO bit to 1. This selects the Control Word (#6.42) as the source for the control functions of the Unidrive SP. When AUTO is reset to 0, the Unidrive SP will revert to terminal control.

To select the DeviceNet speed reference, set the REMOTE bit to 1. As the REMOTE bit directly controls #1.42, this will select the digital speed reference as the main speed reference for the Unidrive SP. When REMOTE is reset to 0, the Unidrive SP will revert to using the external analogue speed reference

NOTE By default, the Digital Speed Reference will be #1.21, which is also the default mapping for the fieldbus speed reference. The actual Digital Speed Reference selected when REMOTE is set to 1 will depend on the setting of the Digital Speed Reference Selector, #1.15

Table 6.1 Unidrive SP Control Word Bit Functions

Bit	Function	Description
0	ENABLE	Set to 1 to enable the Unidrive SP. Resetting to 0 will immediately disable the Unidrive SP, and the motor will coast to stop. The external HARDWARE ENABLE signal must also be present before the Unidrive SP can run.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward direction. When reset to 0, the Unidrive SP will decelerate the motor to a controlled stop before the PWM output stack is disabled
2	JOG	Set to 1 to jog the motor. JOG must be set BEFORE setting RUN FWD or RUN REV to enable the Unidrive SP. The direction is specified by RUN FWD and RUN REV. (The motor can also be jogged by using the RUN and FWD REV bits instead of RUN FWD and RUN REV.)

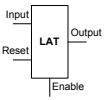
Table 6.1 Unidrive SP Control Word Bit Functions

Bit	Function	Description
3	RUN REV	Set to 1 (with ENABLE set to 1) to run the motor in the reverse direction. When reset to 0, the Unidrive SP will decelerate the motor to a controlled stop before the PWM output stack is disabled
4	FWD REV	Set to 1 to select the reverse direction when operating with a RUN and DIRECTION signal. Set to 0 to run in the forward direction. The RUN signal is used to start and stop the motor.
5	RUN	Set to 1 to run the motor when operating with a RUN and DIRECTION signal. FWD REV is used to select the direction of motor rotation. When reset to 0, the Unidrive SP will decelerate the motor to a controlled stop before the PWM output stack is disabled.
6	NOT STOP	Set to 1 to allow the sequencing bit to be latched. If NOT STOP is zero, all latches are cleared and held at 0.
7	AUTO	Set to 1 to enable the Unidrive SP Control Word. The Control Word Enable (#6.43) must also be set to 1. When reset to 0, the Unidrive SP will operate under under terminal control.
8	REMOTE	Set to 1 to select digital speed reference 1 (#1.21), and reset to 0 to select Analogue Reference 1 (#1.36). REMOTE directly controls #1.42, so Reference Selector (#1.14) and Preset Selector (#1.15) must both be set to 0 (default) for the REMOTE bit to work properly.
9-12	Reserved	
13	RESET	A 0-1 transition of the RESET bit will reset the Unidrive SP from a trip condition. If the reason for the trip is still present, for another fault condition has been detected, the Unidrive SP will immediately trip again. When resetting the Unidrive SP, it is recommended to check the status word to ensure that the reset was successful, before attempting to re-start the Unidrive SP.
14	KEYPAD WDOG	Reserved for use with external keypad modules.
15	Reserved	

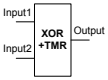
NOTE When a trip occurs, the Unidrive SP control word MUST be set to a safe, disabled state. This ensures that the Unidrive SP does not re-start unexpectedly when it is reset This can be achieved by continuously monitoring the Unidrive SP status word, and interlocking it with the Control Word.

Figure 6-1 (below) shows the key for the Unidrive SP control word sequencing logic diagram (Figure 6-2) on page 24.

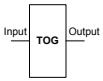
Figure 6-1 Control Word Logic Diagram Key



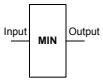
Latch
1. If Enable is 0, Output follows Input
2. If Enable is 1, Output is always 0 if Reset is active
3. If Enable is 1 and Reset is 0, Output latches and stays at 1 if Input is 1



Exclusive OR gate with timer
1. Output is the exclusive OR of Input1 and Input 2
2. If both Input1 and Input2 become active, Output becomes 0 after delay of 60ms

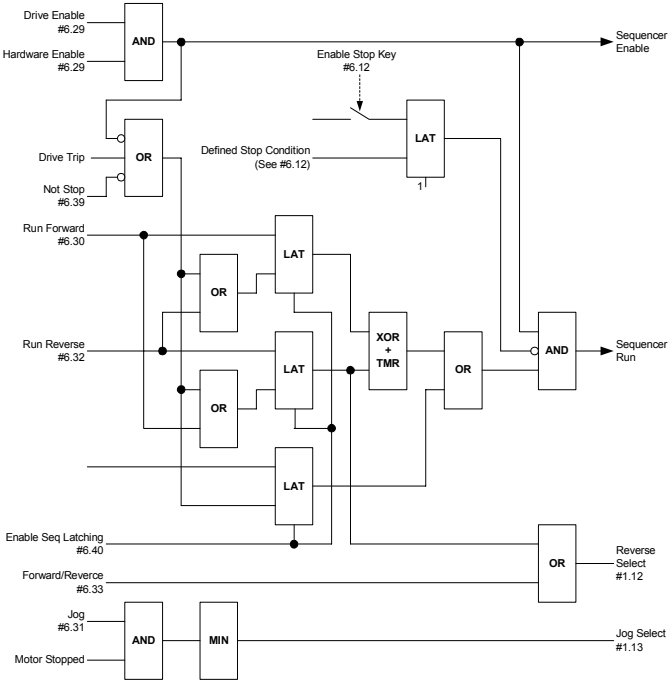


Toggle
1. Output changes state on each non-active to active transition on Input



Minimum Jog Time
1. When Input becomes active, Output remains active while Input is active, and then remains active for a further 100ms
2. Jog must be active before the Sequence Run is active for the Jog function to become active.

Figure 6-2 Control Word Logic Diagram



Some example Unidrive SP control word values are given in the table below.

Table 6.2 Example DeviceNet Control Words

Control Word (Hex)	Control Word (Dec.)	Action
0x0000	0	Control word disabled, Unidrive SP will operate under terminal control
0x0080	128	Disabled
0x0081	129	Enabled, stopped
0x0183	387	Enabled, run fwd, digital speed ref
0x0189	393	Enabled, run rev, digital speed ref
0x0083	131	Enabled, run fwd, analogue speed ref
0x0089	137	Enabled, run rev, analogue speed ref
0x01A1	417	Enabled, run fwd, digital speed ref
0x01B1	433	Enabled, run rev, digital speed ref
0x00A1	161	Enabled, run fwd, analogue speed ref
0x00B1	177	Enabled, run rev, analogue speed ref
0x0085 > 0x0087	133 > 135	Enabled, jog > Enabled, jog fwd
0x0085 > 0x008D	135 > 141	Enabled, jog > Enabled, jog rev
Not yet implemented		Trip Unidrive SP
0x2080	8320	Reset Unidrive SP into fieldbus control, disabled
0x2000	8192	Reset Unidrive SP into terminal control

6.2 Unidrive SP Status Word

The status word returns the status of multiple functions within the Unidrive SP, e.g. At Speed, Zero Speed, Drive Healthy, etc., and provides a quick method of checking the current status of the Unidrive SP. The status word is mapped to polled data as #10.40.

b15	b14	b13	b12b	b11	b10	b9	b8
Not Used	#10.15	#10.14	#10.13	#10.12	#10.11	#10.10	#10.09

b7	b6	b5	b4	b3	b2	b1	b0
#10.08	#10.07	#10.06	#10.05	#10.04	#10.03	#10.02	#10.01

The table below shows the function indicated by each bit in the status word when set to 1. A bit set to 0 indicates that the condition is false.

Table 6.3 Unidrive SP Status Word Bit Functions

Bit	Parameter	Description
0	#10.01	Drive Healthy Indicates the Unidrive SP is not in the trip state. If the Auto-reset feature is being used, this bit is not reset until all auto-resets have been attempted and the next trip occurs.
1	#10.02	Drive Active Indicates that the output stage of the Unidrive SP is active.

Table 6.3 Unidrive SP Status Word Bit Functions

Bit	Parameter	Description
2	#10.03	Zero Speed In Open Loop mode, Zero Speed indicates that the absolute value of the post-ramp speed reference (#2.01|) is at or below the zero speed threshold defined by #3.05. In Closed Loop and Servo modes, Zero Speed indicates that the absolute value of speed feedback (#3.02) is at or below the zero speed threshold defined by #3.05.
3	#10.04	Running At Or Below Minimum Speed In bipolar mode (#1.10 = 1) #10.04 is the same as Zero Speed, #10.03. (See above.) In unipolar mode, #10.04 is set if the absolute value of the post-ramp speed reference (#2.01) or speed feedback (#3.02) is at or below minimum speed + 0.5Hz, or minimum speed + 5rpm. (Minimum speed is defined by #1.07.) This parameter is only set if the Unidrive SP is running.
4	#10.05	Below Set Speed Only set if the Unidrive SP is running. Refer to #3.06, #3.07 and #3.09 in the Unidrive SP Advanced User Guide.
5	#10.06	At Speed Only set if the Unidrive SP is running. Refer to #3.06, #3.07 and #3.09 in the Unidrive SP Advanced User Guide.
6	#10.07	Above Set Speed Only set if the Unidrive SP is running. Refer to #3.06, #3.07 and #3.09 in the Unidrive SP Advanced User Guide.
7	#10.08	Load Reached Indicates that the modulus of the active current is greater or equal to the rated active current, as defined in menu 4. Refer to the Unidrive SP Advanced User Guide for more details.
8	#10.09	In Current Limit Indicates that the current limits are active.
9	#10.10	Regenerating In Open Loop, Closed Loop Vector and Servo modes, Regenerating indicates that power is being transferred from the motor to the Unidrive SP. In Regen mode, Regenerating indicates that power is being transferred from the supply to the Unidrive SP.
10	#10.11	Dynamic Brake Active Indicates that the braking IGBT is active. If the IGBT becomes active, this parameter will remain on for at least one second.
11	#10.12	Dynamic Brake Alarm Dynamic Brake Alarm is set when the braking IGBT is active, and the braking energy accumulator is greater than 75%.
12	#10.13	Direction Commanded Direction Commanded is set to 1 if the Pre-ramp Speed Reference (#1.03) is negative, and reset to 0 if the Pre-ramp Speed Reference is zero or positive.
13	#10.14	Direction Running In Open Loop mode, Direction Running is set to 1 if the Post-ramp Speed Reference (#2.01) is negative, and reset to 0 if the Post-ramp Speed Reference is zero or positive. In Closed Loop Vector and Servo modes, Direction Running is set to 1 if the Speed Feedback (#3.02) is negative, and reset to 0 if the Speed Feedback is zero or positive.

Table 6.3 Unidrive SP Status Word Bit Functions

Bit	Parameter	Description
14	#10.15	Mains Loss In Open Loop, Closed Loop Vector and Servo modes, Mains Loss indicates that the drive has detected mains loss from the level of the DC link voltage. This parameter can only become active if mains loss ride through or mains loss stop modes are selected. Refer to #6.03 in the Unidrive SP Advanced User Guide the for more details. In Regen mode, Mains Loss is the inverse of #3.07. Refer to the Unidrive SP Advanced User Guide the for more details.
15	Not Used	Reserved

7 Non-Cyclic Data

"Explicit data" is the non-cyclic data channel on DeviceNet that provides access to any parameter and DeviceNet object within the SM DeviceNet module, and is always enabled and active on the DeviceNet module. Object access using Explicit Data is controlled entirely by the master controller program, and is not usually configured in any way when the DeviceNet network map is defined.

CT Mode Single Word non-cyclic data isalso available on the SM DeviceNet module. This method uses an additional cyclic data word to implement the Single Word protocol to access any Unidrive SP parameter.

PPO 4 Word non-cyclic data is also available on the SM DeviceNet module. This method uses 4 cyclic data words to access any Unidrive SP parameter

As non-cyclic data control is implemented entirely in the DeviceNet master controller, the method used will depend entirely on the type of master controller used. For this reason, Control Techniques is unable to offer any specific technical support with implementing non-cyclic data transfer for any particular DeviceNet scanner and PLC combination.

The Unidrive SP DeviceNet module provides several data formats that allow CT Mode Single Word or PPO 4 Word modes to be used. Refer to section 5.3 for more details.

Table 7.1 SM DeviceNet Module Non-Cyclic Data Modes

Non-Cyclic Mode	Format	#MM.05	Non-cyclic Access
Disabled	None	0PP	Explicit data only
Mode 1	CT Single Word	1PP	Explicit data plus CT Single Word
Mode 2	PPO 4 Word	2PP	Explicit data plus PPO 4 Word

The non-cyclic data channel does not use decimal points. For example, in Open Loop mode, digital speed reference 1 (#1.21) has units of Hertz, accurate to 1 decimal place. To write a value of 24.6Hz to #1.21, the value must be transmitted as 246.

7.1 Explicit Parameter Access

The Control Techniques Object (Class 100 or 0x64) provides access to all Unidrive SP parameters, using the parameters as shown:

Class Code:	100 (0x64)	
Instance:	Menu	
Attribute:	Parameter	
Read Code:	14 (0x0E)	Get_Attribute_Single
Write Code:	16 (0x10)	Set_Attribute_Single

All supported pre-defined DeviceNet objects can also be accessed using explicit messaging. See Chapter 11 for full details. Refer to the master controller documentation for full details about explicit messaging, and how to implement explicit messaging within the particular master controller.

When accessing Unidrive SP parameters using the Control Techniques Object, all parameters must be treated as signed 32-bit parameters. If the target parameter is a 16-bit parameter, the data value will be cast to 16-bit. If the 16-bit data value is negative, the sign will be preserved.

NOTE Multiple parameter access (using the Get_Atttribute_All service) is not supported by the SM DeviceNet module.

7.2 Mode 1 - CT Single Word Mode

The CT Single Word Format (Mode 1) of non-cyclic data uses one word for non-cyclic data. The non-cyclic sub-protocol for Unidrive SP requires a specific sequence of 6 words or "telegrams" to implement the parameter access. Each non-cyclic word or telegram is split into 2 bytes to implement the sub-protocol, with the high byte containing the control codes for each telegram, and the low byte containing the data for each telegram.

7.2.1 Mapping For CT Single Word Non-Cyclc Data

To configure an SM DeviceNet module in slot 3 for CT Single Word Mode non-cyclic data, the following steps must be performed:

1. Select a data format that supports CT Single Word mode. (Refer to section 5.3 for full details.)
2. Set #17.05 to the the required mode.
3. Set #17.32 to ON to reset and reconfigure the SM DeviceNet module.

When the SM DeviceNet module re-initialises, it will map polled data IN Word 0 and OUT Word 0 to the CT Single Word protocol parameter, #90.50. All existing mapping parameters will be moved down by 1 word, i.e. the previous mapping set in #17.10 and #17.20 will now appear in #17.11 and #17.21. The table below shows what happens to the mappings when the data format is changed from 5 Polled Words to 5 Polleds Words with Mode 1 Non-Cyclic Data.

Table 7.2 CT Single Word Non-Cyclic Data Mapping

Mapping Parameter	Before Format Change (#17.05 = 5)		After Format Change (#17.05 = 105)	
	Value	Mapping	Value	Mapping
#17.10	1040	#10.40, status word	9050	#90.50, CT Single Word parameter
#17.11	201	#2.01, post ramp speed reference	1040	#10.40, status word
#17.12	420	#4.20, motor load as % of rated load	201	#2.01, post ramp speed reference
#17.13	0	Not mapped	420	#4.20, motor load as % of rated load
#17.14 to #17.19	0	Not mapped	0	Not mapped
#17.20	642	#6.42, control word	9050	#90.50, CT Single Word parameter
#17.21	121	#1.21, digital speed reference 1	642	#6.42, control word
#17.22	408	#4.08, torque reference	121	#1.21, digital speed reference 1
#17.23	0	Not mapped	408	#4.08, torque reference
#17.24 to #17.29	0	Not mapped	0	Not mapped

NOTE If all IN or OUT mapping parameters are being used when the data format change is implemented, the last mapping parameter value will be lost.

7.2.2 CT Single Word Protocol

All parameter values for Unidrive SP must be written as signed 32-bit data values. Decimal point information is inserted automatically when the data value is written to the Unidrive SP, and removed when the data value is read. Hence, the number of decimal places of the target parameter must be known. Writing a value of 1234 to a parameter with 2 decimal places will produce a value of 12.34 in the target parameter. Similarly, reading a value of 12.34 will return a 32-bit integer value of 1234.

b15	b14	b13	b12	b11	b10	b9	b8
READ	ERR	Reserved	32-BIT	Stamp Number			

b7	b6	b5	b4	b3	b2	b1	b0
Data Byte							

Table 7.3 CT Single Word Format

Bit	Function	Values	Description
0 to 7	Data	0 to 255	Depending on the stamp number of the telegram, this byte contains the menu or parameter number, or high data or low data byte
8 to 11	Stamp number	0 to 6	Indicates the stamp number of the word. This shows which part of the message is currently in progress. Setting the stamp number to 0 resets the internal non-cyclic state machine
12	32-BIT	0 = 16-bit data 1 = 32-bit data	Specifies whether a 16-bit or 32-bit data value is to be written to or read from the Unidrive SP. All data values for Unidrive SP will be returned as 32-bit values
13	Reserved	0	Reserved for future use. Always set to 0
14	ERR	0 = Data OK 1 = Error	Indicates the success or failure of the message. Failure could occur if the parameter does not exist, or is a read-only or write-only parameter
15	READ	0 = Write 1 = Read	Defines whether the data word is part of a READ or WRITE cycle.

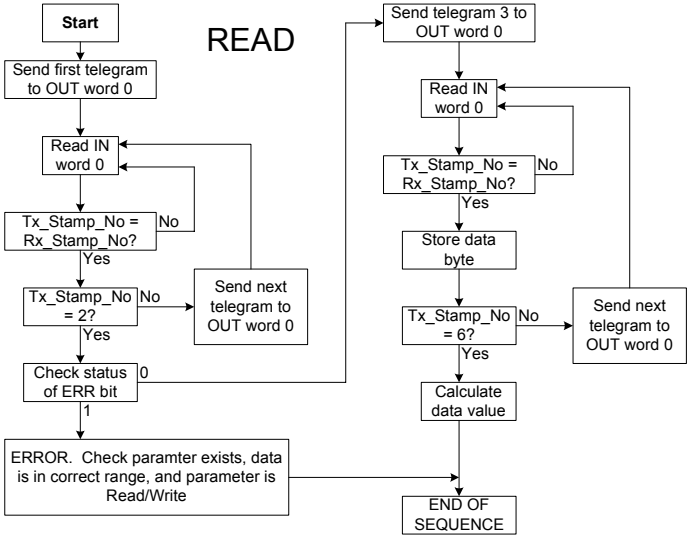
NOTE X = don't care. Generally, these bits should be set to 0. If a message is aborted part way through, the non-cyclic OUT word should be reset to 0. This will reset the non-cyclic state machine, and allow the message sequence to be restarted.

7.2.3 Reading Parameters Using CT Single Word

To read parameters using the non-cyclic channel, the following "telegrams" must be transmitted to construct the final message.

- Telegram 1 Define menu number.
- Telegram 2 Define parameter number.
- Telegram 3 Request high data byte.
- Telegram 4 Request mid-high data byte.
- Telegram 5 Request mid-low data byte.
- Telegram 6 Request low data byte.

Figure 7-1 CT Single Word Read Sequence



The following example telegrams show how to read the post-ramp speed reference (in rpm with 2 decimal places) from #2.01 in the Unidrive SP.

TELEGRAM 1

The first telegram from the DeviceNet master indicates a READ cycle, and the stamp number is 1. The data byte would contain the menu number for the parameter that is to be read.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0001	0000	0010

Data word = 0x9102

Stamp number = 1

Menu = 2

When the first telegram has been received and processed in the slave node, it is mirrored in the non-cyclic IN word back to the PLC. This is the signal to the master controller program that the first telegram of the message has been received and understood, and the second telegram can be transmitted.

TELEGRAM 2

The second telegram from the DeviceNet master also indicates a READ cycle, but the stamp number is now 2. The data byte would contain the parameter number for the parameter that is to read.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0010	0000	0001

Data word = 0x9201

Stamp number = 2

Parameter = 1

When the second telegram has been received and processed in the slave, it is mirrored in the non-cyclic IN word. This is the signal to the master controller program that the second telegram of the message has been received and understood, and the third telegram can be transmitted.

If telegrams 1 and 2 were not received correctly, or an invalid parameter was specified, e.g. parameter is write only, or does not exist, the DeviceNet interface will set the ERROR bit to 1 (b14 = 1). The data bits will have no significance.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1101	0010	XXXX	XXXX

Data word = 0xD2XX

Stamp number = 2

If an error is reported, it is recommended that the non-cyclic data word is set to 0 to ensure that the non-cyclic state machine is completely reset, and ready for the next non-cyclic READ or WRITE sequence.

TELEGRAM 3

The third telegram from the DeviceNet master acts as the indication to the slave to send the high data byte from the requested parameter. The data byte is not used in this telegram, and should be set to 0.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0011	0000	0000

Data word = 0x9300

Stamp number = 3

When the third telegram has been received and processed in the slave node, the node will mirror the stamp number in the non-cyclic IN word, and load the high byte of the parameter value into the data byte.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0011	0000	0000

Data word = 0x9300

Stamp number = 3

Data high byte = 0x00 = 0

TELEGRAM 4

The fourth telegram from the DeviceNet master acts as the indication to the slave to send the mid-high data byte from the requested parameter. The data byte is not used in this telegram, and should be set to 0.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0100	0000	0000

Data word = 0x9400

Stamp number = 4

When the fourth telegram has been received and processed in the slave node, the node will mirror the stamp number in the non-cyclic IN word, and load the high byte of the parameter value into the data byte.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0100	0000	0001

Data word = 0x9401

Stamp number = 4

Data high byte = 0x01 = 1

TELEGRAM 5

The fifth telegram from the DeviceNet master acts as the indication to the slave to send the mid-low data byte from the requested parameter. The data byte is not used in this telegram, and should be set to 0.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0101	0000	0000

Data word = 0x9500

Stamp number = 5

When the fifth telegram has been received and processed in the slave node, the node will mirror the stamp number in the non-cyclic IN word, and load the mid-low byte of the parameter value into the data byte.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0101	0010	0101

Data word = 0x9505

Stamp number = 5

Data high byte = 0x25 = 37

TELEGRAM 6

The sixth telegram from the DeviceNet master acts as the indication to the slave to send the low data byte from the requested parameter. The data byte is not used in this telegram and should be set to 0.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0110	0000	0000

Data word = 0x9600

Stamp number = 6

When the sixth telegram has been received and processed in the slave node, the node will mirror the stamp number in the non-cyclic IN word, and load the low byte of the parameter value into the data byte.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1001	0110	1101	1100

Data word = 0x96DC

Stamp number = 6

Data low byte = 0xDC = 220

Speed = (High byte * 2^{24}) + (Mid-high byte * 2^{16}) + (Mid-low byte * 2^{8}) + Low byte

= (0 * 16777216) + (1 * 65536) + (37 * 256) + 220

= 75228

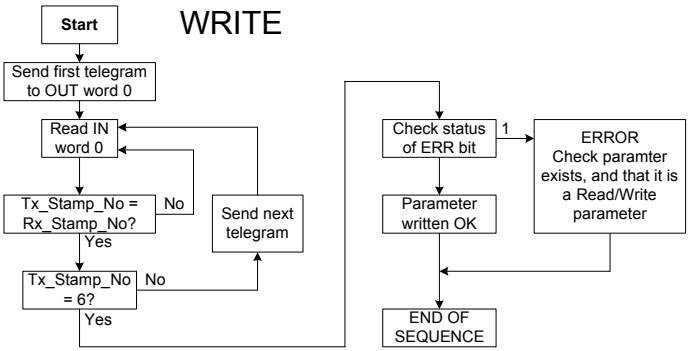
= 7522.8 rpm

7.2.4 Writing Parameters Using CT Single Word

To write to parameters using the non-cyclic channel, the following telegrams must be sent on each network cycle to construct the final message.

- Telegram 1 Define menu number.
- Telegram 2 Define parameter number.
- Telegram 3 Send high data byte.
- Telegram 4 Send mid-high data byte.
- Telegram 5 Send mid-low data byte.
- Telegram 6 Send low data byte.

Figure 7-2 CT Single Word Read Sequence



The following example telegrams show how to set the digital speed reference 1 (#1.21) to 12553.9 rpm (32-bit value is 125539) in the Unidrive SP.

TELEGRAM 1

The first telegram from the DeviceNet master indicates a WRITE cycle by setting the R/W bit to 0. The stamp number is set to 1. The data byte contains the menu number for the parameter that is to be written to.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0001	0001	0000	0001

Data word = 0x1101

Stamp number = 1

Menu = 1

When the first telegram has been received and processed in the slave node, it is mirrored in the non-cyclic IN word. This is the signal to the master controller program that the first telegram of the message has been received and understood, and the second telegram can be transmitted.

TELEGRAM 2

The second telegram from the DeviceNet master also indicates a Write cycle, but the stamp number is now set to 2. The data byte would contain the parameter number for the parameter that is to be written to.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0001	0010	0001	0101

Data word = 0x1215

Stamp number = 2

Parameter = 21

When the second telegram has been received and processed in the slave node, it is mirrored in the non-cyclic IN word. This is the signal to the master controller program that the second telegram of the message has been received and understood, and the third telegram can be transmitted.

TELEGRAM 3

The third telegram from the DeviceNet master has the stamp number set to 3. The data bits contain the high data byte for the parameter being written to.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0001	0011	0000	0000

Data word = 0x1300

Stamp number = 3

Data high byte = 0x00

When the third telegram has been received and processed in the slave node, it is mirrored in the non-cyclic IN word. This is the signal to the master controller program that the third telegram of the message has been received and understood, and the fourth telegram can be transmitted.

TELEGRAM 4

The fourth telegram from the DeviceNet master has the stamp number set to 4. The data bits contain the mid-high data byte for the parameter being written to.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0001	0100	0000	0001

Data word = 0x1401

Stamp number = 4

Data mid-high byte = 0x01 = 1

When the fourth telegram has been received and processed in the slave node, it is mirrored in the non-cyclic IN word. This is the signal to the master controller program that the third telegram of the message has been received and understood, and the fifth telegram can be transmitted.

TELEGRAM 5

The fifth telegram from the DeviceNet master has the stamp number set to 5. The data bits contain the mid-low data byte for the parameter being written to.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0001	0101	1110	1010

Data word = 0x15EA

Stamp number = 5

Data mid-low byte = 0xEA = 234

When the fifth telegram has been received and processed in the slave node, it is mirrored in the non-cyclic IN word. This is the signal to the master controller program that the third telegram of the message has been received and understood, and the sixth telegram can be transmitted.

TELEGRAM 6

The sixth telegram from the DeviceNet master has the stamp number set to 6. The data bits contain the low data byte for the parameter that is being written to.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0001	0110	0110	0011

Data word = 0x1663

Stamp number = 6

Data low byte = 0x63 = 99

When the sixth telegram has been received and processed in the slave node, it will write the data (#1.21 = 12553.9) as transmitted. (The decimal point is automatically inserted when the data is transferred to the Unidrive SP.) If the operation is successful, the ERR bit is reset to 0 and the telegram is reflected in the non-cyclic IN word.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0001	0110	0110	0011

Data word = 0x1663

Stamp number = 6

Data low byte = 0x63 = 99

If there was a problem with writing the data to the defined parameter, e.g. parameter is read only, does not exist, or data is out of range, the ERR bit is set to 1.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0101	0110	XXXX	XXXX

Data word = 0x56XX

Stamp number = 6

7.2.5 Abort CT Single Word Non-cyclic Message

The internal state machine that controls the non-cyclic data transfer will only accept a new telegram if it contains the next expected telegram, i.e. after accepting telegram 2, the state machine will only respond to telegram 3. If telegram 4 is received, it will be ignored.

If an error occurs in the master controller that causes the telegrams to get out of step, the master controller program should time-out, abort the message and reset the non-cyclic state machine.

A Mode 1 non-cyclic message can be be abandoned by resetting the state machine. This is done be setting the non-cyclic word to 0.

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0000	0000	0000	0000

Data word = 0x0000

Stamp number = 0

7.3 Mode 2 - PPO 4 Word Mode

The PPO 4 Word Format (Mode 2) of non-cyclic data uses 4 cyclic or polled data words for non-cyclic data. This allows any Unidrive SP parameter to accessed using a single combination of data words.

7.3.1 Mapping For PPO 4 Word Non-Cyclc Data

To configure an SM DeviceNet module in slot 3 for PPO 4 Word Mode non-cyclic data, the following steps must be performed:

1. Select a data format that supports PPO 4 Word mode. (Refer to section 5.3.)
2. Set #17.05 to the the required mode.
3. Set #17.32 to ON to reset and reconfigure the SM DeviceNet module.

When the SM DeviceNet module re-initialises, it will map IN Words 0 to 3 and OUT Words 0 to 3 to the PPO 4 Word protocol parameter, #90.51. All existing mapping parameters will be moved down by 1 channel, i.e. the previous mappings set in #17.10 and #17.20 will now appear in #17.11 and #17.21 respectively. The table below shows what happens to the mappings when the data format is changed from 10 Polled Words (#MM.05 = 10) to 10 Polleds Words with Mode 2 Non-Cyclic Data. (#MM.05 = 210)

Table 7.4 PPO 4 Word Mode Mapping

Mapping Parameter	Before Format Change (#17.05 = 10)		After Format Change (#17.05 = 210)	
	Value	Mapping	Value	Mapping
#17.10	1040	#10.40, status word	9051	#90.51, PPO 4 Word parameter
#17.11	201	#2.01, post ramp speed reference	1040	#10.40, status word
#17.12	420	#4.20, motor load as % of rated load	201	#2.01, post ramp speed reference
#17.13	0	Not mapped	420	#4.20, motor load as % of rated load
#17.14 to #17.19	0	Not mapped	0	Not mapped
#17.20	642	#6.42, control word	9051	#90.51, PPO 4 Word parameter
#17.21	121	#1.21, digital speed reference 1	642	#6.42, control word
#17.22	408	#4.08, torque reference	121	#1.21, digital speed reference 1
#17.23	0	Not mapped	408	#4.08, torque reference
#17.24 to #17.29	0	Not mapped	0	Not mapped

If all IN or OUT mapping parameters are being used when the data format change is implemented, the last mapping parameter value will be lost.

7.3.2 PPO 4 Word Protocol

Decimal point information is inserted automatically when the data value is written to the Unidrive SP, and removed when the data value is read. Hence, the number of decimal places of the target parameter must be known. Writing a value of 1234 to a parameter with 2 decimal places will produce a value of 12.34 in the target parameter. Similarly, reading a value of 12.34 will return a 32-bit integer value of 1234.

Table 7.5 shows the data structure required on the OUT data to implement PPO 4 Word request.

Table 7.5 PPO 4 Word OUT Data Structure

OUT Data Word	Function		
	b15-b12	b11 - b8	b7-b0
OUT Word 0	TASK ID	0000	MENU
OUT Word 1	PARAMETER		Reserved
OUT Word 2	DATA HIGH WORD		
OUT Word 3	DATA LOW WORD		

The PPO 4 Word protocol is controlled by the TASK ID and REQUEST ID. The TASK ID specifies the transaction required, and the remainder of the data words carry the data for the transaction. Table 7.6 lists the possible RESPONSE ID codes.

Table 7.6 TASK ID Codes

TASK ID	Function	Description
0	No Task	No non-cyclic transaction required
1	Fieldbus Specific	
2	Fieldbus Specific	
3	Fieldbus Specific	
4	Not Implemented	Reserved
5	Not Implemented	Reserved
6	Request Parameter Value	Read parameter value from Unidrive SP. Specify MENU and PARAMETER, set DATA HIGH WORD and DATA LOW WORD to 0.
7	Change Parameter Value (16 bit)	Write 16-bit parameter value to Unidrive SP. Specify MENU, PARAMETER and DATA LOW WORD. (Any value in DATA HIGH WORD will be discarded.) This function can be used to write to 32-bit Unidrive SP parameters, but the range of values is limited to 16-bits.
8	Change Parameter Value (32 bit)	Write 32-bit parameter value to Unidrive SP. Specify MENU, PARAMETER, DATA HIGH WORD and DATA LOW WORD. This function can be used to write to 16-bit Unidrive SP parameters, but if DATA HIGH WORD is not set to 0, a value over-range error will be reported.
9	Request Last Parameter Reference	Returns the last parameter for the specified menu. Specify MENU. (Values in PARAMETER, DATA HIGH WORD and DATA LOW WORD will be discarded.)

Table 7.7 shows the data structure of a PPO 4 Word response that will be returned by a SM DeviceNet module on the IN data.

Table 7.7 PPO 4 Word IN Data Structure

IN Data Word	Function		
	b15-b12	b11-b8	b7-b0
IN Word 0	RESPONSE ID	0000	MENU
IN Word 1	PARAMETER		
IN Word 2	DATA HIGH WORD		
IN Word 3	DATA LOW WORD		

The RESPONSE ID indicates the success or otherwise of the requested transaction. Table 7.8 lists the possible RESPONSE ID codes.

Table 7.8 RESPONSE ID Codes

RESPONSE ID	Function	Description
0	No Task	No non-cyclic transaction active
1	Fieldbus Specific	Refer to
2	Fieldbus Specific	Refer to
3	Not Implemented	
4	Transfer Parameter Value (16-bit)	Returns a 16 bit data value from the Request Parameter Value specified by TASK ID 6, or the successful Change Parameter Value (16-bit) specified by TASK ID 7.
5	Transfer Parameter Value (32-bit)	Returns a 32 bit data value from the Request Parameter Value specified by TASK ID 6, or the successful Change Parameter Value (32-bit) specified by TASK ID 8.
6	Transfer Last Parameter Reference	Returns the highest parameter for the menu specified by Request Last Parameter Reference, TASK ID 8.
7	Error - TASK ID Could Not Be Executed	The previously specified TASK ID could not be completed. Word 3 will return an error code to indicate the reason for the TASK ID failure. See Table 7.9 *PPO 4 Word Error Codes* .
8	Error - Read Only Parameter	Target parameter specified by TASK ID 7 or TASK ID 8 is read only, and cannot be modified.

If RESPONSE ID 7 has been received, the error code can be read from Word 3. This will indicate the reason why the TASK ID request failed.

Table 7.9 PPO 4 Word Error Codes

ERROR CODE	Error	Description
0	Invalid Menu	The specified menu does not exist.
1	Parameter Is Read Only	The specified parameter is read only, and cannot be written to.
2	Value Out Of Range	The specified data value is out of range for the parameter.
3	Invalid Parameter	The specified parameter does not exist.

7.3.3 Reading Parameters Using PPO 4 Word

The diagram below shows the sequence of events required to read a Unidrive SP parameter using the PPO 4 Word non-cyclic channel.

Figure 7-3 PPO 4 Word Read Sequence

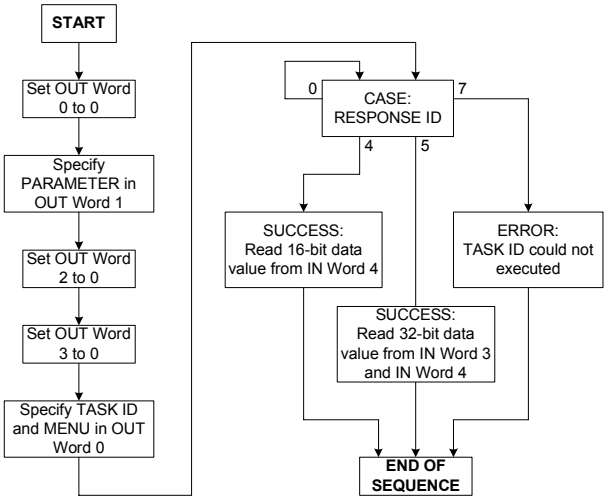


Table 7.10 shows the possible TASK ID and RESPONSE ID combinations that may be seen when attempting to read a parameter value from a Unidrive SP.

Table 7.10 PPO 4 Word Read TASK ID and RESPONSE ID Combinations

Function	TASK ID	RESPONSE ID	Message Status
No Task	0	0	No message active
Request Parameter Value (16 bit)	6	4	Parameter read successfully, 16 bit value returned in Word 3
Request Parameter Value (32 bit)	6	5	Parameter read successfully, 32 bit value returned in Words 2 and 3
Request Parameter Value (16 bit)	6	7	TASK ID 6 could not be executed. Check the error code in IN Word 3 for the reason why.
Request Last Parameter Reference)	9	6	The highest parameter reference in specified menu is available in IN Word 3.
Request Last Parameter Reference	9	7	TASK ID 9 could not be executed. Check the error code in IN Word 3 for the reason why.

Table 7.11 shows an example set of data words for PPO 4 Word mode. This example will read the value in the post ramp speed reference (#2.01) in the Unidrive SP.

Table 7.11 PPO 4 Word Read Request Example

OUT Data Word	Hex Value	Function		
		b15-b12	b11	b10-b0
OUT Word 0	0x6002	TASK ID = 6	0	MENU = 2
OUT Word 1	0x0001	PARAMETER = 1		
OUT Word 2	0x0000	DATA HIGH WORD = 0		
OUT Word 3	0x0000	DATA LOW WORD = 0		

Table 7.12 shows an example successful read response to the read instruction illustrated above. The value returned is 15284, which equates to 1528.4 rpm.

Table 7.12 PPO 4 Word Read Response Example

IN Data Word	Hex Value	Function		
		b15-b12	b11	b10-b0
IN Word 0	0x5002	RESPONSE ID = 5	0	MENU = 2
IN Word 1	0x0001	PARAMETER = 1		
IN Word 2	0x0000	DATA HIGH WORD = 0		
IN Word 3	0x3BB4	DATA LOW WORD = 15284		

7.3.4 Writing Parameters Using PPO 4 Word

The diagram below shows the sequence of events required to write to a Unidrive SP parameter using the PPO 4 Word non-cyclic channel.

Figure 7-4 PPO 4 Word Write Sequence

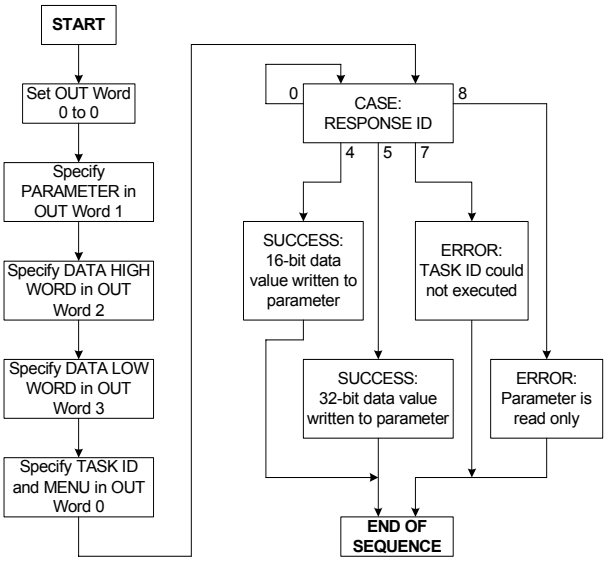


Table 7.13 shows the possible TASK ID and RESPONSE ID combinations that may be seen when attempting to write to the should be expected.

Table 7.13 PPO 4 Word Write TASK ID and RESPONSE ID Combinations

Function	TASK ID	RESPONSE ID	Message Status
No Task	0	0	No message active
Request Parameter Value (16 bit)	7	4	Parameter (16 bit) written successfully
Request Parameter Value (32 bit)	8	5	Parameter (32 bit) written successfully

Table 7.13 PPO 4 Word Write TASK ID and RESPONSE ID Combinations

Function	TASK ID	RESPONSE ID	Message Status
Request Parameter Value (16 bit)	7	7	TASK ID 7 could not be executed. Check the error code in IN Word 3 for the reason why.
Request Parameter Value (32 bit)	8	7	TASK ID 8 could not be executed. Check the error code in IN Word 3 for the reason why.
Request Parameter Value (32 bit)	8	8	Parameter is read only, and cannot be written to.

Table 7.14 shows an example set of data words for PPO 4 Word mode. This example will write a value of 1553.9 rpm (32-bit value is 15539) to the digital speed reference 1 (#1.21) to in the Unidrive SP.

Table 7.14 PPO 4 Word Write Request Example

OUT Data Word	Hex Value	Function		
		b15-b12	b11	b10-b0
OUT Word 0	0x8001	TASK ID = 8	0	MENU = 1
OUT Word 1	0x0015	PARAMETER = 21		
OUT Word 2	0x0001	DATA HIGH WORD = 1		
OUT Word 3	0x3CB3	DATA LOW WORD = 15539		

Table 7.15 shows an example successful write response to the write instruction illustrated above.

Table 7.15 PPO 4 Word Write Response Example

IN Data Word	Hex Value	Function		
		b15-b12	b11	b10-b0
IN Word 0	0x5001	RESPONSE ID = 5	0	MENU = 1
IN Word 1	0x0015	PARAMETER = 21		
IN Word 2	0x0000	DATA HIGH WORD = 0		
IN Word 3	0x3CB3	DATA LOW WORD = 15539		

7.4 Fieldbus Specific TASK IDs

The PPO 4 Word non-cyclic data is derived from the Variable Speed Drive Profile for Profibus-DP. TASK IDs 2, 3 and 4 are specific to Profibus-DP, and are not used in the SM DeviceNet module.

7.5 DeviceNet Set-up using Non-Cyclic Data

The SM DeviceNet module can also be configured using Explicit Data, CT Single Word or PPO 4 Word non-cyclic data. The configuration parameters for the slot in which the SM DeviceNet module is located can be accessed as #82.PP.

Changes made to the SM DeviceNet module configuration will not take effect until the module has been reset. The SM DeviceNet module can be reset by writing a value of 1 to #82.32. A brief interruption in DeviceNet communications may be seen while the reset sequence is in progess.

8 EDS Files

8.1 What are EDS Files?

EDS (Electronic Data Sheets) files are text files that are used by DeviceNet network configuration software tools. They contain information about the device, such as manufacturer, product type, product code, etc., and they also provide information on the default settings and functions supported by the device. Mapping information is also included that allows access to device parameters over the DeviceNet network.

EDS files are not downloaded to the PLC or scanner, and are only used during network configuration. It is actually possible to configure a network without the EDS files, but they do help to provide a good picture of the network within the network configuration software.

8.2 Generic EDS Files

A generic EDS file is available for use with any Unidrive SP fitted with Version 0.10.xx software. Generic EDS files for Mentor II, Unidrive and Commander SE are also supplied. These files are available from your local Control Techniques Drive Centre.

These files contain a basic common selection of the Unidrive SP parameters, allowing configuration of speed or torque references, acceleration and deceleration ramps, motor data set-up, digital and analogue I/O configuration parameters, and DeviceNet configuration parameters.

Table 8.1 Generic EDS Files

Drive	Drive Firmware	Generic EDS File
Unidrive Open Loop	V2.XX.XX	G2_OPEN.EDS
Unidrive Open Loop	V3.XX.XX	G3_OPEN.EDS
Unidrive Closed Loop	V2.XX.XX	G2_CLSD.EDS
Unidrive Closed Loop	V3.XX.XX	G3_CLSD.EDS
Unidrive Servo	V2.XX.XX	G2_SERVO.EDS
Unidrive Servo	V2.XX.XX	G2_SERVO.EDS
Unidrive Regen	V3.XX.XX	G3_REGEN.EDS
Mentor II	V4.10.XX	G410_M4Q.EDS
Mentor II	V5.01.XX	G501_M4Q.EDS
Mentor II	V5.02.XX	G502_M4Q.EDS
Mentor II	V5.04.XX	G504_M4Q.EDS
Mentor II	V5.05.XX	G505_M4Q.EDS
Commander SE	V1.XX.XX	G1_CSE.EDS
Commander SE	V2.XX.XX	G2_CSE.EDS
Unidrive SP Open Loop	V0.XX.XX	G0SP_OPEN.EDS
Unidrive SP Closed Loop	V0.XX.XX	G0SP_CLSD.EDS
Unidrive SP Servo	V0XX.XX	G0SP_SERVO.EDS
Unidrive SP Regen	V0.XX.XX	G0SP_REGEN.EDS

Drive icon files are also supplied for use with the DeviceNet configuration software being used. EDS files must usually be installed into the software package being used to configure a DeviceNet network. Refer to the software documentation for instructions on how to install EDS files. Control Techniques cannot provide specific technical support for any of these software packages.

8.3 EDS File Revisions

The EDS files from Control Techniques have undergone several revisions as specifications have been changed or tightened up. The table below shows the compatibility with the most common DeviceNet configuration tools.

Table 8.2 EDS File Compatibility

EDS Revision	DeviceNet Manager	RSNetworx
1.X	OK	Not compatible
2.X	OK	V2.XX.XX and earlier
3.X	OK	V3.XX.XX

8.4 Advanced EDS Files

Advanced EDS files are not currently available for the SP DeviceNet module. They will be available at a later date.

9 Diagnostics

The information from the parameters described below should always be noted before contacting Control Techniques for technical support.

9.1 Module ID Code

Name	Module ID Code		
Slot 1	#15.01	**Default**	N/A
Slot 2	#16.01	**Range**	0 to 499
Slot 3	#17.01	**Access**	RO

The Module Code indicates the type of module that is fitted in the corresponding slot. The table below shows the modules available for Unidrive SP.

Table 9.1 Option Module ID Codes

Module Code	Module Type	Category
0	None fitted	None
101	Resolver	Position Feedback
102	Intelligent Encoder	Position Feedback
103	DriveLink	Position Feedback
201	I/O Expansion	I/O Expansion
301	SM Applications Plus	Applications Module
302	SM Application	Applications Module
403	SM Profibus-DP	Fieldbus
407	SM DeviceNet	Fieldbus

9.2 SM DeviceNet Firmware Version

Name	SM DeviceNet Firmware - Major Version		
Slot 1	#15.02	**Default**	N/A
Slot 2	#16.02	**Range**	00.00 to 99.99
Slot 3	#17.02	**Access**	RO

Name	SM DeviceNet Firmware - Minor Version		
Slot 1	#15.51	**Default**	N/A
Slot 2	#16.51	**Range**	0 to 99
Slot 3	#17.51	**Access**	RO

The full version of the SM DeviceNet module firmware version can be read for the corresponding slot. This manual was written for SM DeviceNet modules fitted with V0.01.00 firmware. The table below shows how to construct the full firmware version from these values.

Table 9.2 SM DeviceNet Firmware Version

Major Version	Minor Version	Firmware Version
1.01	5	V1.01.05

9.3 DeviceNet MAC-ID

Name	DeviceNet MAC-ID		
Slot 1	#15.03	**Default**	63
Slot 2	#16.03	**Range**	0 to 63
Slot 3	#17.03	**Access**	RW

Every node on a DeviceNet network must be assigned a unique MAC-ID, i.e. node address. If two or more nodes have the same MAC-ID, only one node will join the network. DeviceNet nodes default to a MAC-ID of 63, so ideally, the MAC-ID should be configured on each node BEFORE it is connected to the DeviceNet network.

NOTE The DeviceNet protocol protects against multiple nodes having the same MAC-ID. If two nodes are accidentally assigned the same MAC-ID, the node that powers up first will join the network successfully, but will subsequently prevent the second node from joining the DeviceNet network.

Protection mechanism called Duplicate MAC-ID check. Prevents 2 nodes with same MAC-ID from communciating on network. If another node blocks the module from joining, it will trip SLx.Er, with error code 66 and network status -3.

9.4 DeviceNet Data Rate

Name	DeviceNet Data Rate		
Slot 1	#15.04	**Default**	0
Slot 2	#16.04	**Range**	0 to 2
Slot 3	#17.04	**Access**	RW

Every node on a DeviceNet network must be configured to run at the same data rate. If a node is configured to run at a different data rate, this may cause errors on the CAN network. Ideally, every node should be configured to operate at the same data rate BEFORE it is connected to the DeviceNet network.

Table 9.3 DeviceNet Data Rates

Data Rate	bits/sec
0	125K
1	250K
2	500K

9.5 DeviceNet Network Status

Name	DeviceNet Network Status		
Slot 1	#15.06	Default	N/A
Slot 2	#16.06	Range	-10 to 9999
Slot 3	#17.06	Access	RO

The status of the DeviceNet network is displayed in the DeviceNet Diagnostic parameter. The DeviceNet network activity can be monitored for the corresponding slot. When the SM DeviceNet module is communicating successfully with the DeviceNet master controller, the number of messages per second is displayed. A complete polled data transfer (1 input and 1 output assembly object) is counted as 1 message, and every completed explicit message is also counted as 1 message.

Table 9.4 DeviceNet Network Status Codes

#MM.06	Parameter	Description
>0	Network Healthy	Indicates the number of network cycles per second, and that the DeviceNet slave is exchanging data with the DeviceNet master controller.
0	Network Healthy, No Data Transfer	Indicates that the DeviceNet master controller has established communications with the DeviceNet node, but there is currently no data transfer in progress.
-1	Initialised	Indicates that the SM DeviceNet module has initialised correctly, and is waiting for the DeviceNet master controller to initialise communications.
-2	Internal Hardware Failure	Indicates that part of SM DeviceNet module initialisation test was not successful. If this fault persists after a power cycle, replace the DeviceNet module.
-3	Configuration Error	Indicates that there is an invalid setting in the DeviceNet configuration parameters.
-10	External Power Supply Loss	The external +24V DeviceNet power supply has been lost. The SM DeviceNet module will not communicate without this supply.

9.6 DeviceNet Mapping Conflicts

Name	DeviceNet Mapping Status		
Slot 1	#15.49	Default	0
Slot 2	#16.49	Range	0 to 255
Slot 3	#17.49	Access	RO

If the DeviceNet Network Status parameter (#MM.06) indicates -3, a mapping configuration error has been detected. The reason for the error is indicated by the DeviceNet Mapping Status parameter, #MM.49. When an mapping error has been corrected, reset the SM DeviceNet module by setting #MM.32 to ON (1).

Table 9.5 Generic Mapping Error Codes

Error	Mapping Status	Description
No Error Detected	0	No error detected with IN or OUT data mapping configuration.
Direct Data Mapping Error	2	Non-cyclic data cannot be used when direct data mapping is enabled.
Invalid Non-Cyclic Mode	3	An invalid non-cyclic data mode has been selected
Multiple Non-Cyclic Modes	4	Only 1 non-cyclic mode can be used. More than one has been mapped in the IN and OUT mapping parameters.

Table 9.5 Generic Mapping Error Codes

Error	Mapping Status	Description
Multiple Non-Cyclic Mapping Error	104	A non-cyclic data mode has been mapped more than once in the IN data mapping configuration parameters. (#MM.10 to #MM.19)
Configuration Read Error	110	An error has occurred reading the IN data mapping configuration parameters (#MM.10 to #MM.19) from the Unidrive SP.
Invalid Source Parameter	111	One or more parameters specified in the IN data mapping configuration (#MM.10 to #MM.19) is outside of the allowed range for DeviceNet. The allowable parameter range is from #0.00 to #199.99.
Read Mismatch	112	One or more parameters specified in the IN data mapping configuration (#MM.10 to #MM.19) cannot be used as a source parameter for IN data. The parameter may not exist, or is a write-only parameter.
Hole In IN Data Mapping Configuration	113	IN data mapping parameters (#MM.10 to #MM.19) are not contiguous. It is not possible have an un-used parameter in the middle of the polled/cyclic data.
Too Many IN Data Objects Mapped	120	After expanding ranges of block mappings, more than 32 IN mappings are defined.
Mapping Over Length	121	Total size of all IN data mappings has exceeded the total size of the polled/cyclic data.
Register Mode Objects Exceeded	122	More than 10 cyclic/polled IN data words have been selected with Register Mode.
Multiple Non-Cyclic Mapping Error	204	A non-cyclic data mode has been mapped more than once in the OUT data mapping configuration parameters. (#MM.20 to #MM.29)
Configuration Read Error	210	An error has occurred reading the OUT data mapping configuration parameters (#MM.20 to #MM.29) from the Unidrive SP.
Invalid Destination Parameter	211	One or more parameters specified in the OUT data mapping configuration (#MM.20 to #MM.29) is outside of the allowed range for DeviceNet. The allowable parameter range is from #0.00 to #199.99.
Write Mismatch	212	One or more parameters specified in the OUT data mapping configuration (#MM.20 to #MM.29) cannot be used as a destination parameter for OUT data. The parameter may not exist, or is a read-only parameter. This error will also occur if an attempt is made to map OUT data to the configuration parameters of a fieldbus option in another slot, unless that fieldbus module is configured in Register Mode, i.e. #MM.09 = ON (1).
Hole In OUT Data Mapping Configuration	213	OUT data mapping parameters (#MM.20 to #MM.29) are not contiguous. It is not possible have an un-used parameter in the middle of the polled/cyclic data.
Duplicate Mapping Error	214	Two or more OUT data mapping comfiguration parameters (#MM.20 to #MM.29) have been configured wit the same destination parameter reference.
Too Many OUT Data Objects Mapped	220	After expanding ranges of block mappings, more than 32 OUT mappings are defined.
Mapping Over Length	221	Total size of all OUT data mappings has exceeded the total size of the polled/cyclic data.
Register Mode Objects Exceeded	222	More than 10 cyclic/polled OUT data words have been selected with Register Mode.

There are some additional error codes that are specific to the SM DeviceNet module. These are listed in section 9.6.

Table 9.6 SM DeviceNet Module Specific Mapping Error Codes

Error	Mapping Status	Description
Assembly Object Error	30	The pre-defined DeviceNet assembly objects (20 to 23, 70 to 73) cannot be used when direct data mapping is enabled.
Invalid Input Assembly Object	31	An invalid input assembly object has been specified. Refer to section 10.9 for more details,
Invalid Output Assembly Object	32	An invalid output assembly object has been specified. Refer to section 10.9 for more details,
Assembly Objects Incompatible	33	The Input and Output assembly objects must both be flexible (106 to 161) or pre-defined. (20 to 23, 70 to 73.) They cannot be mixed.

9.7 Unidrive SP Trip Display Codes

If the SM DeviceNet module detects an error during operation, it will force a trip on the Unidrive SP. However, the trip code displayed on the Unidrive SP will only indicate which slot initiated the trip, and not the exact reason for the trip.

The table below shows the possible trip codes that will be displayed on the Unidrive SP when a problem is detected with the SM DeviceNet module, or when the SM DeviceNet module inititiates a trip.

Table 9.7 Unidrive SP Trip Display Codes

Slot Where Trip Was Initiated			Fault	Description
Slot 1	Slot 2	Slot 3		
SL1.HF	SL2.HF	SL3.HF	Hardware Fault	Unidrive SP has detected that an option module is present, but is unable to communicate with it.
SL1.tO	SL2.tO	SL3.tO	Watchdog Timeout	Not used by SM DeviceNet module.
SL1.Er	SL2.Er	SL3.Er	Error	User trip generated by the SM DeviceNet module
SL1.nF	SL2.nF	SL3.nF	Not Fitted	SM DeviceNet module was disconnected while operational, or SM DeviceNet module has crashed. This trip will also occur if a Unidrive SP slot is configured for a SM DeviceNet module, but the module is not fitted in the slot.
SL1.dF	SL2.dF	SL3.dF	Different Fitted	The slot configuration parameters stored in the Unidrive SP are not valid DeviceNet configuration parameters. This trip will also occur when a SM DeviceNet module is fitted to a previously un-used slot.

9.8 SM DeviceNet Error Code

Name	SM DeviceNet Error Code		
Slot 1	#15.50	Default	N/A
Slot 2	#16.50	Range	0 to 255
Slot 3	#17.50	Access	RO

If the SM DeviceNet module detects an error during operation, it will force a trip the Unidrive SP, and update the SM DeviceNet Error Code parameter. The table below shows the SM DeviceNet Trip Codes.

Table 9.8 SM DeviceNet Trip Codes

Error Code	Fault	Description
60	Hardware Initialisation Error	The SM DeviceNet module could not complete the initialisation procedure.
61	Configuration Error	An invalid configuration has been detected. Refer to #MM.49 for Configuration Error Code
62	Configuration Changed	
63	Invalid Data Rate	The specified data rate is not valid.
64	Invalid MAC-ID	The specified MAC-ID (node address) is not valid
65	Network Loss	No new messages have been received for the specified Network Loss Trip Time.
66	Bus Off Error	The CAN controller has seen an excessive number of transmission errors, and has taken itself off the DeviceNet network.
70	FLASH Transfer Error	The SM DeviceNet module was unable to upload the configuration parameters from its FLASH memory to the Unidrive SP
71	External Power Supply Loss	The external +24V DeviceNet network power supply.has been lost. DeviceNet nodes are not allowed to communicate on a DeviceNet netowrk unless this power supply is present.
72	Transmission Failure	The SM DeviceNet module was unable to transmit a message. This trip may be seen if the Network Loss Trip is disabled, and there are no other devices on the DeviceNet network to acknowledge the transmitted messages.
74	SM DeviceNet Module Overtemperature	When the temperature inside the SM DeviceNet module exceeds 90 degrees, the SM DeviceNet module will switch the Unidrive SP to full speed. If the temperature exceeds 100 degress, the SM DeviceNet module will trip the Unidrive SP.
90 - 99	Internal Software Fault	If this fault is seen, cycle the power to the Unidrive SP. If fault persists, replace the SM DeviceNet module.

10 Advanced Features

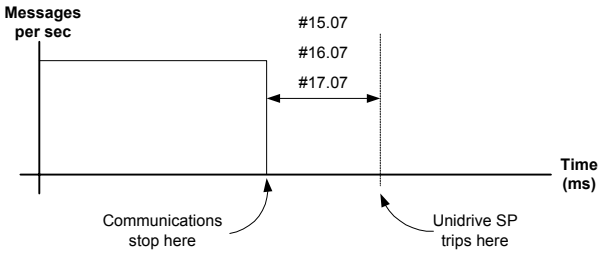
10.1 DeviceNet Network Loss Trip

Name	DeviceNet Network Loss Trip Timeout		
Slot 1	#15.07	Default	200
Slot 2	#16.07	Range	0 to 3000
Slot 3	#17.07	Access	RW

The SM DeviceNet module resets an internal timer when a valid message is received from the DeviceNet network. The trip is triggered when no new messages are received before the timer times out.

The trip is not enabled internally until polled or cyclic data has been detected. This prevents spurious network loss trip while the DeviceNet master controller is initialising the DeviceNet network.

Figure 10-1 DeviceNet Network Loss Trip



As the trip delay time is reduced, the network loss trip will occur more quickly in the event of a network loss event. However, if the network loss trip time is reduced too far, spurious network loss trips may occur due to time-out occurring before the next message has chance to arrive.

The minimum network loss trip time that can be set depends entirely on the number of messages per second being received under normal operation. As a rough guide, the network loss trip time should be set such that a minimum of 4 messages will be received in the specified time period under normal operating conditions.

The Network Loss trip can be disabled by setting #15.07, #16.07 or #17.07 to 0, but the Unidrive SP will continue to operate using the last received values in the case of a network loss. It is the User's responsibility to ensure that adequate safety precautions are taken to prevent damage or injury in the event of a communications network loss.

10.2 UT70 Parameters

SM DeviceNet modules fitted with V0.01.00 firwmare do not currently allow direct access to UT70 parameters. This feature will be implemented in future versions of firmware.

If the DeviceNet mapping is configured to read and write data from and to menu 18,19 and 20 user parameters in the Unidrive SP, this will allow the UT70 to access the data being transmitted over the DeviceNet network.

10.3 Data Endian Format

Name	DeviceNet Data Endian Format		
Slot 1	#15.08	Default	ON
Slot 2	#16.08	Range	N/A
Slot 3	#17.08	Access	RO

All UT70 parameters (and some Unidrive SP parameters) are 32-bit double word parameters, while most Unidrive SP parameters are 16-bit word parameters. However, when data is sent over the DeviceNet network, it is transmitted as 8-bit bytes. Therefore, when a 32-bit double word or 16-bit word data value is split into four or two 8-bit bytes, it is important that the receiving node reconstructs the received 8-bit bytes correctly to arrive at the 32-bit or 16-bit data value that was originally transmitted. The order in which 8-bit bytes are transmitted is known as the “Data Endian Format”. For DeviceNet, the endian format is specified as “little endian”.

Data Endian Format	#MM.08	16-bit Value	32-bit Value	
		Byte Order	Word Order	Byte Order
Little	1	Low byte first High byte second	Low word first High word second	Low byte first Mid low byte second Mid high byte third High byte fourth

For example, #1.21 (digital speed ref 1) is a 32-bit double word parameter, and is mapped (by default settings) to OUT words 1 and 2. As the SM DeviceNet module uses the “little endian” data format, OUT word 1 will contain the low data word, and OUT word 2 will contain the high data word.

10.4 Block Mapping

The Unidrive SP provides 10 mapping parameters each for IN data and OUT data. However, the SM DeviceNet module is capable of more than 10 words of IN and OUT data, so “block mapping” is provided to allow these additional words to be mapped.

Block mapping can only be used when mapping data to Unidrive SP user parameters in #18.PP, #19.PP and #20.PP, and UT70 parameters. If successive mapping parameters are mapped to different higher parameters within the same Unidrive SP user menu or UT70 PLC parameter menu, the mappings will be interpreted as indicating a range of parameters.

10.4.1 IN Data

“IN” refers to data as seen by the DeviceNet master controller. Hence, IN data is data that is being transmitted from the Unidrive SP to the DeviceNet master controller. Consider a Unidrive SP with the following configuration:

- Slot 1 - UT70 module.
- Slot 2 - UT70 module.
- Slot 3 - SM DeviceNet module, configured for Data Format = 28.

Table 10.1 IN Data Block Mapping Example

Mapping Parameter	Target Parameter	Data Width	Description
#15.10	#10.40	16-bit	Status word
#15.11	#2.01	32-bit	Post-ramp speed reference (32-bit parameter in Unidrive SP)
#15.12	#4.20	16-bit	Motor load as % or rated speed

Table 10.1 IN Data Block Mapping Example

Mapping Parameter	Target Parameter	Data Width	Description
#15.13	#18.11	8*16-bit	Block mapping of 8 * 16-bit words to Unidrive SP parameters #18.11 to #18.18
#15.14	#18.18		
#15.15	#20.21	5*32-bit	Block mapping of 5 * 32-bit words to Unidrive SP parameters #20.21 to #20.25
#15.16	#20.25		
#15.17	0	----	Not mapped
#15.18	0	----	Not mapped
#15.19	0	----	Not mapped

Table 10.2 IN Data Block Mapping Data Structure Example

Data Word	Target Parameter	Data Word	Target Parameter
Word 0	#10.40	Word 12,13	#20.21
Word 1,2	#2.01	Word 14,15	#20.22
Word 3	#4.20	Word 16,17	#20.23
Word 4	#18.11	Word 18,19	#20.24
Word 5	#18.12	Word 20,21	#20.25
Word 6	#18.13	Word 22	Not mapped
Word 7	#18.14	Word 23	Not mapped
Word 8	#18.15	Word 24	Not mapped
Word 9	#18.16	Word 25	Not mapped
Word 10	#18.17	Word 26	Not mapped
Word 11	#18.18	Word 27	Not mapped

10.4.2 OUT Data

"OUT" refers to cyclic data as seen by the DeviceNet master controller. Hence, OUT data is data that is being transmitted from the DeviceNet master controller to the Unidrive SP. Consider a Unidrive SP with the following configuration:

- Slot 1 - UT70 module.
- Slot 2 - UT70 module.
- Slot 3 - SM DeviceNet module, configured for Data Format = 28.

Table 10.3 OUT Data Block Mapping Example

Mapping Parameter	Target Parameter	Data Width	Description
#15.20	#6.42	16-bit	Control word
#15.21	#1.21	32-bit	Digital speed reference 1
#15.22	#4.08	32-bit	Torque reference
#15.23	#19.15	9*16-bit	Block mapping of 9 * 16-bit words to Unidrive SP parameters #19.15 to #19.23
#15.24	#19.23		
#15.25	#20.31	6*32-bit	Block mapping of 6 * 32-bit words to Unidrive SP parameters #20.31 to #20.36
#15.26	#20.36		
#15.27	0	----	Not mapped
#15.28	0	----	Not mapped
#15.29	0	----	Not mapped

Table 10.4 OUT Data Block Mapping Data Structure Example

Data Word	Target Parameter	Data Word	Target Parameter
Word 0	#6.42	Word 12	#19.22
Word 1,2	#1.21	Word 13	#19.23
Word 3,4	#4.08	Word 14,15	#20.31
Word 5	#19.15	Word 16,17	#20.32
Word 6	#19.16	Word 18,19	#20.33
Word 7	#19.17	Word 20,21	#20.34
Word 8	#19.18	Word 22,23	#20.35
Word 9	#19.19	Word 24,25	#20.36
Word 10	#19.20	Word 26	Not mapped
Word 11	#19.21	Word 27	Not mapped

10.5 Direct Data Mapping

Name	Direct Mapping Enable		
Slot 1	#15.09	Default	OFF (0)
Slot 2	#16.09	Range	OFF (0) or ON (1)
Slot 3	#17.09	Access	RW

By default, #MM.10 to #MM.29 are used as pointers to specify the destination parameter for OUT data received from the master controller, and the source parameter of IN data to be transmitted to the master controller.

When Direct Data Mapping is enabled, #MM.10 to #MM.29 are used as the actual destination and source parameters for OUT data and IN data respectively. Hence, OUT data values arriving from the PLC will be written directly into #MM.10 to #MM.19.

NOTE Non-cyclic data also cannot be used when Direct Data Mapping mode is enabled.

When Direct Data Mapping mode is enabled, all mapping parameters (#MM.10 to #MM.29) will be reset to 0.

Table 10.5 Direct Data Mapping Configurations

#MM.05	#MM.39	#MM.40	Description
1 to 10	----	----	The first 10 OUT words will be written directly to #MM.10 to #MM.19, and the first 10 IN words will be read directly from #MM.20 to #MM.29
0	106 to 124 (even numbers only)	107 to 1125 (odd numbers only)	
11 to 28	----	----	Cyclic data is limited to 10 IN and 10 OUT cyclic data words. Network Status will indicate -3, and Mapping Status will indicate 122 or 222. Refer to.section 9.6
0	126 to 160 (even numbers only)	127 to 161 (odd numbers only)	
100 to 127 200 to 224	----	----	Non-cyclic data cannot be used in Direct Data Mapping mode. Network Status will indicate -3, and Mapping Error Code will indicate 2. Refer to section 9.6.
0	70 to 73	20 to 23	Direct Data Mapping mode cannot be with pre-defined DeviceNet assembly objects. Network Status will indicate -3, and Mapping Status Code will indicate 4. Refer to section 9.6.

10.6 Menu 82 - Local Option Module Parameter Access

The menu used to configure the SM DeviceNet module depends on the slot in the Unidrive SP where the SM DeviceNet module is fitted. Menu 82 can be used to ensure that the DeviceNet configuration parameters can be accessed without necessarily knowing in which Unidrive SP slot the SM DeviceNet module is fitted.

When a Menu 82 parameter is accessed from DeviceNet, the SM DeviceNet module will re-direct it to the menu in the Unidrive SP that is associated with the slot where the SM DeviceNet module is fitted.

Table 10.6 Local Slot Configuration Parameter Access

Parameter	SM DeviceNet module in Slot 1	SM DeviceNet module in Slot 2	SM DeviceNet module in Slot 3
#82.01 - #82.51	#15.01 - #15.51	#16.01 - #16.51	#17.01 - #17.51

Menu 82 parameters are only accessible from the DeviceNet network using explicit or non-cyclic data.

10.7 Restore SM DeviceNet Defaults

Name	Restore SM DeviceNet Defaults		
Slot 1	#15.30	**Default**	OFF (0)
Slot 2	#16.30	**Range**	OFF (0) or ON (1)
Slot 3	#17.30	**Access**	RW

If the SM DeviceNet module detects that the Unidrive SP has been restored to default values, it will over-write the slot configuration parameters with the DeviceNet default values.

NOTE If the stored values in the Unidrive SP are for a different type of fieldbus interface, the SM DeviceNet module will trip “SLx.DF” with Error Code 70. It will over-write the parameter values with the DeviceNet default values, but will NOT store these values in the Unidrive SP.

#MM.30 specifies whether the default values should be written to the SM DeviceNet FLASH memory. If #MM.30 is set to ON, the default values will be written into the SM DeviceNet module FLASH memory.

The full sequence of events to restore default settings for a SM DeviceNet module fitted in slot 3 is as follows:

1. Set #17.00 to 1233 to restore European defaults to the Unidrive SP.
2. DeviceNet communications will be stopped.
3. The Unidrive SP will load and store its default parameter values.
4. The SM DeviceNet module will overwrite all #17.PP parameters with DeviceNet default values.
5. If #17.30 is set to ON (1), the DeviceNet default parameter values will be stored in the SM DeviceNet module FLASH memory.
6. The SM DeviceNet module will reset and re-initialise using the default values.

10.8 Restore Previous SM DeviceNet Configuration

Name	Upload from SM DeviceNet FLASH Memory		
Slot 1	#15.33	**Default**	OFF (0)
Slot 2	#16.33	**Range**	OFF (0) or ON (1)
Slot 3	#17.33	**Access**	RW

If DeviceNet configuration parameters have been stored in the SM DeviceNet module FLASH memory, these values can be restored to the Unidrive SP. When the parameter values have been uploaded to the Unidrive SP, the SM DeviceNet module will reset and re-configure using the updated parameter values.

This feature allows a pre-configured SM DeviceNet module to be fitted to a Unidrive SP without losing the DeviceNet configuration.

NOTE If the SM DeviceNet module is unable to upload the configuration parameters to the Unidrive SP, or configuration parameters have never been stored in the SM DeviceNet FLASH memory, the Unidrive SP will trip "SLx.ER" with a Trip Code of 70.

When #MM.33 is set to ON, the DeviceNet module will transfer the configuration parameters from its FLASH memory to the Unidrive SP, over-writing the existing values in the Unidrive SP.

The full sequence of events for restoring values from a SM DeviceNet module fitted in slot 3 is as follows:

1. Set #17.33 to ON.
2. DeviceNet communications will be stopped.
3. The SM DeviceNet module will overwrite all #17.PP parameters with the DeviceNet values stored in its internal FLASH memory.
4. #17.33 will be reset to OFF.
5. The SM DeviceNet module will reset and re-initialise using the default values.

NOTE This procedure will NOT store the updated Unidrive SP parameters.

10.9 Selecting Input And Output Assembly Objects

Name	DeviceNet Input Assembly Object		
Slot 1	#15.39	**Default**	114
Slot 2	#16.39	**Range**	70 to 73 106 to 160 (even numbers only)
Slot 3	#17.39	**Access**	RW

Name	DeviceNet Output Assembly Object		
Slot 1	#15.40	**Default**	115
Slot 2	#16.40	**Range**	20 to 23 107 to 161 (odd numbers only)
Slot 3	#17.40	**Access**	RW

If the number of polled words is specified using the DeviceNet Data Format parameter, #MM.05, the number of IN and OUT polled words will be the same. (See section 5.3)

When the DeviceNet Data Format (#MM.05) is set to 0, the Input and Output assembly objects can be specified separately in #MM.39 and #MM.40 respectively. This allows

different numbers of IN and OUT polled data words to be specified.

Table 10.7 DeviceNet Input and Output Assembly Objects

Polled Words	Input Assembly Object	Input Assembly Object	Polled Words	Input Assembly Object	Input Assembly Object
1	106 (0x6A)	107 (0x6B)	15	134 (0x86)	135 (0x87)
2	108 (0x6C)	109 (0x6D)	16	136 (0x88)	137 (0x89)
3	110 (0x6E)	111 (0x6F)	17	138 (0x8A)	139 (0x8B)
4	112 (0x70)	113 (0x71)	18	140 (0x8C)	141 (0x8C)
5	114 (0x72)	115 (0x73)	19	142 (0x8E)	143 (0x8F)
6	116 (0x74)	117 (0x75)	20	144 (0x90)	145 (0x91)
7	118 (0x76)	119 (0x77)	21	146 (0x92)	147 (0x93)
8	120 (0x78)	121 (0x79)	22	148 (0x94)	149 (0x95)
9	122 (0x7A)	123 (0x7B)	23	150 (0x96)	151 (0x97)
10	124 (0x7C)	125 (0x7D)	24	152 (0x98)	153 (0x99)
11	126 (0x7E)	127 (0x7F)	25	154 (0x9A)	155 (0x9B)
12	128 (0x80)	129 (0x81)	26	156 (0x9C)	157 (0x9D)
13	130 (0x82)	131 (0x83)	27	158 (0x9E)	159 (0x9F)
14	132 (0x84)	133 (0x85)	28	160 (0xA0)	161 (0xA1)

10.10 Supported Drive Profiles

The DeviceNet specification includes a series of pre-defined profiles for different devices, including Drives, and the SM DeviceNet module supports several of these pre-defined assembly objects. The format of the DeviceNet pre-defined assembly objects is fixed.

Table 10.8 Pre-defined DeviceNet Assembly Objects

Object	Type	Object Name
20 (0x14)	Output	Basic Speed Control Output
21 (0x15)	Output	Extended Speed Control Output
22 (0x16)	Output	Speed and Torque Control Output
23 (0x17)	Output	Extended Speed and Torque Control Output
70 (0x46)	Input	Basic Speed Feedback
71 (0x46)	Input	Extended Speed Fedback
72 (0x46)	Input	Basic Speed and Torque Feedback
73 (0x48)	Input	Extended Speed and Torque Feedback

To select a pre-defined Input or Output assembly object:

1. Set the Data Format (#MM.05) to 0.
2. Specify the Input Assembly Object required in #MM.39.
3. Specify the Output Assembly Object required in #MM.40.
4. Set #MM.32 to ON to reset the SM DeviceNet module, and make the changes take effect.

NOTE The parameter mapping of the pre-defined DeviceNet objects CANNOT be changed.

10.10.1 Basic Speed Control

Output Assembly Object 20

The scanner must be configured for 4 Tx bytes (or 2 Tx words) if this output assembly object is selected.

Table 10.9 Basic Speed Control

Data Word	Function
Word 0	Basic Control Word (See below)
Word 1	SpeedRef (See section 11.5.5)

The Basic Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 11.4 for mapping details of each function.

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					FaultRst		RunFwd

10.10.2 Extended Speed Control

Output Assembly Object 21

The scanner must be configured for 4 Tx bytes (or 2 Tx words) if this output assembly object is selected.

Table 10.10 Extended Speed Control

Data Word	Function
Word 0	Extended Control Word (See below)
Word 1	SpeedRef (See section 11.5.5)

The Extended Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 11.4 for mapping details of each function

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
	NetRef	NetCtrl			FaultRst	RunRev	RunFwd

10.10.3 Basic Speed and Torque Control

Output Assembly Object 22

The scanner must be configured for 6 Tx bytes (or 3 Tx words) if this output assembly object is selected.

Table 10.11 Basic Speed and Torque Control

Data Word	Function
Word 0	Basic Control Word (See below)
Word 1	SpeedRef (See section 11.5.5)
Word 2	TorqueRef (See section 11.5.7)

The Basic Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 11.4 for mapping details of each function.

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					FaultRst		RunFwd

10.10.4 Extended Speed and Torque Control

Output Assembly Object 23

The scanner must be configured for 6 Tx bytes (or 3 Tx words) if this output assembly object is selected.

Table 10.12 Extended Speed and Torque Control

Data Word	Function
Word 0	Extended Control Word (See below)
Word 1	SpeedRef (See section 11.5.5)
Word 2	TorqueRef (See section 11.5.7)

The Extended Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 11.4 for mapping details of each function.

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
	NetRef	NetCtrl			FaultRst	RunRev	RunFwd

10.10.5 Basic Speed Feedback

Input Assembly Object 70

The scanner must be configured for 4 Rx bytes (or 2 Rx words) if this input assembly object is selected.

Table 10.13 Basic Speed Feedback

Data Word	Function
Word 0	Basic Status Word (See below)
Word 1	SpeedActual (See section 11.5.4)

The Basic Status Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 11.4 for mapping details of each function.

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					FaultRst		RunFwd

10.10.6 Extended Speed Feedback

Input Assembly Object 71

The scanner must be configured for 4 Rx bytes (or 2 Rx words) if this input assembly object is selected.

Table 10.14 Extended Speed Feedback

Data Word	Function
Word 0	Basic Status Word (See below)
Word 1	SpeedActual (See section 11.5.4)

The Basic Status Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 11.4 for mapping details of each function.

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					FaultRst		RunFwd

10.10.7 Basic Speed and Torque Feedback

Input Assembly Object 72

The scanner must be configured for 6 Rx bytes (or 3 Rx words) if this input assembly object is selected'

Table 10.15 Basic Speed and Torque Feedback

Data Word	Function
Word 0	Basic Status Word (See below)
Word 1	SpeedActual (See section 11.5.4)
Word 2	TorqueActual (See section 11.5.6)

The Extended Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 11.4 for mapping details of each function.

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					FaultRst		RunFwd

10.10.8 Extended Speed and Torque Feedback

Input Assembly Object 73

The scanner must be configured for 6 Rx bytes (or 3 Rx words) if this input assembly object is selected.

Table 10.16 Extended Speed and Torque Feedback

Data Word	Function
Word 0	Basic Status Word (See below)
Word 1	SpeedActual (See section 11.5.4)
Word 2	TorqueActual (See section 11.5.6)

The Extended Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 11.4 for mapping details of each function.

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					FaultRst		RunFwd

11 DeviceNet Object Model

The Object Model has the following object classes present.

Table 11.1 Supported Objects

Object Class	Class Code
Identity	0x01 (1)
Message Router	0x02 (2)
DeviceNet	0x03 (3)
Connection	0x05 (5)
Assembly	0x04 (4)
Control Supervisor	0x29 (41)
AC/DC Drive	0x2A (42)
Motor Data	0x28 (40)
Control Techniques Group	0x64 (100)

11.1 Identity Object

Class: 0x01 (1)

This object provides identification of and general information about the device.

11.1.1 VendorID

Name:	VendorID		
Class	0x01	**Default**	257
Instance	0x01	**Data Type**	UINT
Attribute	0x01	**Access**	Get

Returns the Vendor ID code, which is 0x101 (257) for Control Techniques.

11.1.2 DeviceType

Name:	DeviceType		
Class	0x01	**Default**	2
Instance	0x01	**Data Type**	UINT
Attribute	0x02	**Access**	Get

Returns the Device Type code. The Unidrive SP belongs to Group 2, AC Drives.

11.1.3 ProductCode

Name:	ProductCode		
Class	0x01	**Default**	See below
Instance	0x01	**Data Type**	UINT
Attribute	0x03	**Access**	Get

Identifies the current Unidrive SP configuration. Currently, only generic EDS files are supported, and the Product Code is calculated as shown below.

Table 11.2

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Product			(#11.29/100) * 3				#11.31			0					

For Unidrive SP, Product = 1.

#11.29 returns the major software revision number.

#11.31 returns the Unidrive SP operating mode, e.g. open loop, closed loop, servo, etc.

11.1.4 Revision

Name:	Revision		
Class	0x01	Default	N/A
Instance	0x01	Data Type	UINT
Attribute	0x04	Access	Get

Returns the major and minor revisions of the Unidrive SP. The major revision is returned in the high byte, while the minor revision is contained in the low byte.

Table 11.3 Revision

#15.08	Major Revision	Minor Revision
0	(#11.29 Mod 100) + 1	127

The major revision value is used in matching the appropriate EDS file to the current device configuration.

11.1.5 SerialNumber

Name:	SerialNumber		
Class	0x01	Default	N/A
Instance	0x01	Data Type	UDINT
Attribute	0x06	Access	Get

Returns a serial number of the SM DeviceNet module. This value is entered during production, and cannot be edited.

11.1.6 ProductName

Name:	ProductName		
Class	0x01	Default	SP DeviceNet
Instance	0x01	Data Type	SHORT_STRING
Attribute	0x07	Access	Get

Returns a short string to indicate the Product Name. The SM DeviceNet module returns the string “SM DeviceNet”.

11.2 DeviceNet Object

Class: 0x03 (3)

The DeviceNet Object provides the configuration and status of the DeviceNet port. The MAC-ID and Data Rate can also be set in #0.45 and #0.46 on the Unidrive SP keypad.

11.2.1 MAC-ID

Name:	MAC-ID		
Class	0x03	Default	63
Instance	0x01	Data Type	USINT
Attribute	0x01	Access	Get/Set

The MAC-ID is read from #MM.03 at power up and reset. When this attribute is written to, the SM DeviceNet module will update the MAC-ID in #MM.03 and reset, causing the new value to take effect immediately.

11.2.2 DataRate

Name:	DataRate		
Class	0x03	Default	0
Instance	0x01	Data Type	USINT
Attribute	0x02	Access	Get/Set

The Data Rate is read from #MM.04 at power up and reset. When this attribute is written to, the SM DeviceNet module will update the Data Rate in #MM.04. The new value is not stored automatically, and the SM DeviceNet module is not reset.

The table below shows the attribute values for each data rate.

Table 11.4 DeviceNet Data Rate

Setting	bits/sec
0	125K
1	250K
2	500K

11.2.3 AllocationByte

Name:	AllocationByte		
Class	0x03	Default	0
Instance	0x01	Data Type	USINT
Attribute	0x05	Access	Get

Returns 2 bytes of information. The low byte contains the Allocation Byte, with each bit assigned as shown in the table below.

The high byte indicates the MAC-ID of the master device which allocated the Master/Slave Pre-defined Connection set. 255 means the Predefined Master/Slave Connection set has not yet been allocated.

Table 11.5 Allocation Byte

Bit	Action
0	Explicit Message
1	Polled
2	Strobed (Not supported)
3	Reserved
4	Change of State (Not supported)
5	Cyclic (Not supported)
6	Acknowledge Suppression
7	Reserved

11.3 Motor Data Object

Class: 0x28 (40)

11.3.1 MotorType

Name:	MotorType1		
Class	0x28	**Default**	7
Instance	0x01	**Data Type**	USINT
Attribute	0x03	**Access**	Get/Set

Name:	MotorType2		
Class	0x28	**Default**	7
Instance	0x02	**Data Type**	USINT
Attribute	0x03	**Access**	Get/Set

There are 2 instances of the Motor Data object. Instance 1 will represent the Menu 5 motor information (Motor Map 1) and Instance 2 will represent the menu 21 motor map. (Motor Map 2) The instance being used by the other dependant DeviceNet objects will be determined by #21.15. #21.15 is polled in the background task, so the user should be aware that during motor map changeover, the RPM speed reference might not be accurate.

MotorType 1 is linked directly to #MM.35, and MotorType2 is linked directly to #MM.36.

Table 11.6 Supported Motor Types

#15.36, #15.37	**Motor Type**
6	Wound Rotor Induction Motor
7	Squirrel Cage Induction Motor (Default)
9	Sinusoidal PM BL Motor
10	Trapezoidal PM BL Motor

11.3.2 RatedCurrent

Name:	RatedCurrent1		
Class	0x28	**Default**	#5.07
Instance	0x01	**Data Type**	USINT
Attribute	0x06	**Access**	Get/Set

Name:	RatedCurrent2		
Class	0x28	**Default**	#21.07
Instance	0x02	**Data Type**	USINT
Attribute	0x06	**Access**	Get/Set

Specifies the rated current of the motor in Amps. Instance 1 is mapped to #5.07 in the Unidrive SP, while Instance 2 is mapped to #21.07.

Set #5.07 = RatedCurrent1 * 10

Get RatedCurrent1 = #5.07 / 10

Set #21.07 = RatedCurrent2 * 10

Get RatedCurrent2 = #21.07 / 10

11.3.3 RatedVoltage

Name:	RatedVoltage1		
Class	0x28	Default	#5.09
Instance	0x01	Data Type	USINT
Attribute	0x07	Access	Get/Set

Name:	RatedVoltage2		
Class	0x28	Default	#21.09
Instance	0x02	Data Type	USINT
Attribute	0x07	Access	Get/Set

Specifies the rated motor voltage in Volts. Instance 1 is mapped directly to #5.09 in the Unidrive SP, and Instance 2 is mapped directly to #21.09.

11.3.4 RatedFreq

Name:	RatedFreq1		
Class	0x28	Default	
Instance	0x01	Data Type	USINT
Attribute	0x09	Access	Get/Set

Name:	RatedFreq2		
Class	0x28	Default	
Instance	0x02	Data Type	USINT
Attribute	0x09	Access	Get/Set

Specifies the rated motor frequency in Hertz. in Volts. Instance 1 is linked to #5.06 in the Unidrive SP, and Instance 2 is linked to #21.06.

Set #5.06 =RatedFreq1 * 10

Get RatedFreq1 = #5.06 / 10

Set #21.06 = RatedFreq2 * 10

Get RatedFreq2 = #21.06 / 10

11.3.5 BaseSpeed

Name:	BaseSpeed1		
Class	0x28	Default	#5.08
Instance	0x01	Data Type	USINT
Attribute	0x0F	Access	Get/Set

Name:	BaseSpeed2		
Class	0x28	Default	#21.08
Instance	0x02	Data Type	USINT
Attribute	0x0F	Access	Get/Set

Specifies the base speed of the motor voltage in RPM. Instance 1 is mapped directly to #5.08 in the Unidrive SP, and Instance 2 is mapped directly yo #21.08.

11.3.6 Motor2Select

Name:	Motor2Select		
Class	0x28	Default	
Instance	0x01	Data Type	USINT
Attribute	0x64	Access	Get/Set

Selects between Motor Map 1 and Motor Map 2 in the Unidrive SP.

Set #11.45

Get #21.15

11.4 Control Supervisor

Class: 0x29 (41)

11.4.1 RunFwd

Name:	RunFwd		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x03	Access	Get/Set

Set to 1 to run the Unidrive SP in the forward direction.

Get/Set #6.42 bit 1

11.4.2 RunRev

Name:	RunRev		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x04	Access	Get/Set

Set to 1 to run the Unidrive SP in the reverse direction.

Get/Set #6.42 bit 3

11.4.3 NetCtrl

Name:	NetCtrl		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x05	Access	Get/Set

Switches the Unidrive SP between terminal and fieldbus control.

Get/Set #6.42 bit 7

11.4.4 State

Name:	State		
Class	0x29	Default	N/A
Instance	0x01	Data Type	USINT
Attribute	0x05	Access	Get

This returns a code to indicate the current operating state of the Unidrive SP.

Table 11.7

State	DeviceNet State	Unidrive SP State
1	Startup	This state is skipped on Unidrive SP
2	Not_Ready	Inhibit
3	Ready	Ready

Table 11.7

State	DeviceNet State	Unidrive SP State
4	Enabled	Run or Stop (Stop is only enabled by default in Servo mode.)
5	Stopping	Deceleration or Injection
6	Fault_Stop	AC_UU (this will only occur if Mains Loss is enabled.)
7	Faulted	Tripped
0	Vendor Specific	All other Unidrive SP states, e.g. Scan, Orienting, Regen Active, etc.

11.4.5 RunningFwd

Name:	RunningFwd		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x07	Access	Get

Indicates that the Unidrive SP is running in the forward direction.

Get True (#10.40 & 0x2002) == 0x0002

Get False (#10.40 & 0x2002) != 0x0002

11.4.6 RunningRev

Name:	RunningRev		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x08	Access	Get

Indicates that the Unidrive SP is running in the reverse direction.

Get True (#10.40 & 0x2002) == 0x2002

Get False (#10.40 & 0x2002) != 0x2002

11.4.7 Faulted

Name:	Faulted		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x0A	Access	Get

Indicates that the Unidrive SP is tripped, i.e. not healthy

Get !#10.01

11.4.8 FaultRst

Name:	FaultRst		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x0C	Access	Set

Resets the Unidrive SP from a tripped condition.

Set true #10.33

Set false No action

11.4.9 FaultCode

Name:	FaultRst		
Class	0x29	Default	N/A
Instance	0x01	Data Type	USINT
Attribute	0x0D	Access	Set

If the Unidrive SP is tripped, the fault code is obtained from parameter #10.20 in the Unidrive SP.

Get #10.20

If the fault code in #10.20 is one of the following, the table gives the appropriate ODVA code.

Table 11.8

Unidrive SP Fault Code	ODVA Fault Code
1	0x3220
2	0x3210
3	0x2300
4	0x7112
6	0x9000
20	0x2310
21	0x4300
26	0x5112
32	0x3130

If the code is not on the above list, the error code will be returned as 0x1000 + #10.20.

11.4.10 CtrlFromNet

Name:	CtrlFromNet		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x0F	Access	Get

Indicates that the Unidrive SP is running in the reverse direction.

Get #6.42 bit 7 & #6.43

11.4.11 DriveEnablet

Name:	DriveEnable		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x0F	Access	Get/Set

Enables the Unidrive SP. This puts the Unidrive SP into the “Ready” state, allowing the RunFwd and RunRev attributes to control the Unidrive SP. RunFwd and RunRev will have no effect if DriveEnable is not set to 1.

Get/Set #6.42 bit 0

NOTE The external hardware enable signal (terminals 22 and 31) must also be present before the Unidrive SP will go to the Ready state.

11.5 AC/DC Drive Object

Class: 0x2A (42)

11.5.1 AtReference

Name:	AtReference		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x03	Access	Get

Indicates that the Unidrive SP is running at the requested speed.

Get #10.06

11.5.2 NetRef

Name:	NetRef		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x04	Access	Get/Set

Selects the source of the speed reference. Analogue input 1 is used as the speed reference when running under local control, with Digital Speed Reference 1 being used as the speed reference for network control.

Get/Set #6.42 bit 8

The reference can only be changed between local and remote when the Unidrive SP is configured in speed control mode. If a change is requested when in torque mode then a 'Device state conflict' error code 10h will be returned.

11.5.3 DriveMode

Name:	DriveMode		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x06	Access	Get/Set

The following is a list of the valid DriveMode settings and the impact they have on #4.11.

Table 11.9 Get DriveMode

DriveMode	Unidrive SP Mode	#11.31	#4.11
1	Open Loop Speed	0,1	0
2	Closed Loop Speed	2,3	0
3	Torque Control	Don't care	1
0	User Defined	4	0

Table 11.10 Set DriveMode

DriveMode	Unidrive SP Mode	#11.31	#4.11	Comment
0	Vendor Specific	4	N/A	#11.31 will never be changed by setting the DriveMode attribute. An error (0x10) will be generated if the requested DriveMode value corresponds to the current Unidrive SP operating mode.
1	Open Loop Speed	0,1	0	
2	Closed Loop Speed	2,3	0	
3	Torque Control	0,1,2,3	1	
4	Process Control	N/A		
5	Position Control	N/A		

11.5.4 SpeedActual

Name:	SpeedActual		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x07	Access	Get

Returns the actual speed of the motor in RPM. The source of the motor speed depends on the operating mode of the Unidrive SP.

Get #5.04 (Open Loop)

Get #3.02 (Closed Loop, Servo)

11.5.5 SpeedRef

Name:	SpeedRef		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x08	Access	Get/Set

Sets the speed reference in RPM. As the Unidrive SP uses units of Hz for speed, these values are converted when reading from or writing to this attribute.

Set #1.21 = (RPM * Pole Pairs) / 6 (Open Loop)

Get RPM = (#2.01 * 6) / Pole Pairs (Open Loop)

Get/Set #1.21 * 10 (Closed Loop, Servo)

11.5.6 TorqueActual

Name:	TorqueActual		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x0B	Access	Get

Returns the actual load on the motor as a percentage of the rated motor load. This attribute has 1 decimal place fixed precision, so a value of 1000 represents 100.0% load.

Get #4.20

11.5.7 TorqueRef

Name:	TorqueRef		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x0C	Access	Get/Set

Sets the load (torque) reference as % of rated motor load (torque). This attribute has 1 decimal place fixed precision, so a value of 1000 represents 100.0% load.

Set #4.08 = TorqueRef / 10

Get Torque Ref = #4.08 * 10

11.5.8 RefFromNet

Name:	RefFromNet		
Class	0x29	Default	
Instance	0x01	Data Type	USINT
Attribute	0x0C	Access	Get

Indicates the source of the speed reference.

TRUE if #1.49 = 3 and #1.50 = 1

FALSE otherwise.

11.6 Control Techniques Object

Class code: 0x64 (100)

The Control Techniques object provides access to all Unidrive SP parameters. For example, parameter #4.20 would be accessed as Class 100, Instance 4, Attribute 20.

Table 11.11

Instance	Menu	Name
1	1	Speed Reference
2	2	Ramp Control
3	3	Speed Control
4	4	Current Control
5	5	Motor Control
6	6	Sequencing
7	7	Analogue I/O
8	8	Digital I/O
9	9	Logic
10	10	Drive Status
11	11	Drive Set-up
12	12	Programmable Thresholds
13	13	Position Control
14	14	Process PID Loop
15	15	Slot 1 Configuration
16	10	Slot 2 Configuration
17	11	Slot 3 Configuration
18	12	User Application Menu 1
19	13	User Application Menu 2
20	14	User Application Menu 3
21	15	Second Motor Map
70 to 75	70 to 75	PLC Registers of UT70 fitted in the lowest numbered slot
81	81	UT70 Virtual Set-up Menu (UT70 in lowest numbered slot)
82	82	Fieldbus Virtual Set-up Menu
100 to 105	100 to 105	PLC Registers of UT70 Fitted in Slot 1
130 to 135	130 to 135	PLC Registers of UT70 Fitted in Slot 2
160 to 165	160 to 165	PLC Registers of UT70 Fitted in Slot 3

12 Quick Reference

12.1 Complete Parameter Reference

Table 12.1

Slot 1	Slot 2	Slot 3	Default	Description
#15.01	#16.01	#17.01	----	Module ID Code
#15.02	#16.02	#17.02	----	Major Firwmare Version
#15.03	#16.03	#17.03	63	Node Address
#15.04	#16.04	#17.04	0	Data Rate
#15.05	#16.05	#17.05	5	Data Format
#15.06	#16.06	#17.06	----	Network Status
#15.07	#16.07	#17.07	200	Network Loss Trip Timeout
#15.08	#16.08	#17.08	ON (1)	Endian Format Select
#15.09	#16.09	#17.09	OFF (0)	Direct Data Mapping Enable
#15.10	#16.10	#17.10	1040	IN Mapping 0
#15.11	#16.11	#17.11	201	IN Mapping 1
#15.12	#16.12	#17.12	420	IN Mapping 2
#15.13	#16.13	#17.13	0	IN Mapping 3
#15.14	#16.14	#17.14	0	IN Mapping 4
#15.15	#16.15	#17.15	0	IN Mapping 5
#15.16	#16.16	#17.16	0	IN Mapping 6
#15.17	#16.17	#17.17	0	IN Mapping 7
#15.18	#16.18	#17.18	0	IN Mapping 8
#15.19	#16.19	#17.19	0	IN Mapping 9
#15.20	#16.20	#17.20	642	OUT Mapping 0
#15.21	#16.21	#17.21	121	OUT Mapping 1
#15.22	#16.22	#17.22	408	OUT Mapping 2
#15.23	#16.23	#17.23	0	OUT Mapping 3
#15.24	#16.24	#17.24	0	OUT Mapping 4
#15.25	#16.25	#17.25	0	OUT Mapping 5
#15.26	#16.26	#17.26	0	OUT Mapping 6
#15.27	#16.27	#17.27	0	OUT Mapping 7
#15.28	#16.28	#17.28	0	OUT Mapping 8
#15.29	#16.29	#17.29	0	OUT Mapping 9
#15.30	#16.30	#17.30	0	Restore SM DeviceNet Defaults
#15.31	#16.31	#17.31	0	Store to SM DeviceNet FLASH Memory
#15.32	#16.32	#17.32	0	Reset SM DeviceNet Module
#15.33	#16.33	#17.33	0	Restore Previous Configuration from SM DeviceNet FLASH memory
#15.34	#16.34	#17.34	0	Reserved
#15.35	#16.35	#17.35	----	Serial Number
#15.36	#16.36	#17.36	0	Reserved
#15.37	#16.37	#17.37	0	
#15.38	#16.38	#17.38	0	
#15.39	#16.39	#17.39	5	Input Assembly Object

Table 12.1

Slot 1	Slot 2	Slot 3	Default	Description
#15.40	#16.40	#17.40	5	Output Assembly Object
#15.41	#16.41	#17.41	0	Reserved
#15.42	#16.42	#17.42	0	
#15.43	#16.43	#17.43	0	
#15.44	#16.44	#17.44	0	
#15.45	#16.45	#17.45	0	
#15.46	#16.46	#17.46	0	
#15.47	#16.47	#17.47	0	
#15.48	#16.48	#17.48	0	
#15.49	#16.49	#17.49	----	SM DeviceNet Mapping Conflicts
#15.50	#16.50	#17.50	----	SM DeviceNet Trip Codes
#15.51	#16.51	#17.51	----	Minor Firmware Version

12.2 DeviceNet Network Status

Table 12.2 DeviceNet Network Status Codes

#MM.06	Parameter	Description
>0	Network Healthy	Indicates the number of successful network cycles per second.
0	Network Healthy, No Data Transfer	Indicates that the DeviceNet master has established communications with the SM DeviceNet module, but there is currently no data transfer in progress.
-1	Initialised	Indicates that the SM DeviceNet module has initialised correctly, and is waiting for the DeviceNet master to initialise communications.
-2	Internal Hardware Failure	Indicates that part of the SM DeviceNet module initialisation sequence was not successful. If this fault persists after a power cycle, replace the SM DeviceNet module.
-3	Configuration Error	Indicates that there is an invalid setting in the SM DeviceNet module configuration parameters.
-10	External Power Supply Error	Indicates that the external DeviceNet +24V power supply is missing. The SM DeviceNet module will not communicate unless the the DeviceNet power supply is present and correct.

12.3 SM DeviceNet Error Codes

Table 12.3 SM DeviceNet Trip Codes

Error Code	Fault	Description
60	Hardware Initialisation Error	The SM DeviceNet module could not complete the initialisation procedure.
61	Configuration Error	An invalid configuration has been detected. Refer to #MM.49 for Configuration Error Code
62	Configuration Changed	
63	Invalid Data Rate	The specified data rate is not valid.
64	Invalid MAC-ID	The specified MAC-ID (node address) is not valid
65	Network Loss	No new messages have been received for the specified Network Loss Trip Time.

Table 12.3 SM DeviceNet Trip Codes

Error Code	Fault	Description
66	Bus Off Error	The CAN controller has seen an excessive number of transmission errors, and has taken itself off the DeviceNet network.
70	FLASH Transfer Error	The SM DeviceNet module was unable to upload the configuration parameters from its FLASH memory to the Unidrive SP
71	External Power Supply Loss	The external +24V DeviceNet network power supply.has been lost. DeviceNet nodes are not allowed to communicate on a DeviceNet netowrk unless this power supply is present.
72	Transmission Failure	The SM DeviceNet module was unable to transmit a message. This trip may be seen if the Network Loss Trip is disabled, and there are no other devices on the DeviceNet network to acknowledge the transmitted messages.
74	SM DeviceNet Module Overtemperature	When the temperature inside the SM DeviceNet module exceeds 90 degrees, the SM DeviceNet module will switch the Unidrive SP to full speed. If the temperature exceeds 100 degress, the SM DeviceNet module will trip the Unidrive SP.
90 - 99	Internal Software Fault	If this fault is seen, cycle the power to the Unidrive SP. If fault persists, replace the SM DeviceNet module.

12.4 DeviceNet Mapping Errors

Table 12.4 Generic Mapping Error Codes

Error	Mapping Status	Description
No Error Detected	0	No error detected with IN or OUT data mapping configuration.
Direct Data Mapping Error	2	Non-cyclic data cannot be used when direct data mapping is enabled.
Invalid Non-Cyclic Mode	3	An invalid non-cyclic data mode has been selected
Multiple Non-Cyclic Mapping Error	104	A non-cyclic data mode has been mapped more than once in the IN data mapping configuration parameters. (#MM.10 to #MM.19)
Configuration Read Error	110	An error has occurred reading the IN data mapping configuration parameters (#MM.10 to #MM.19) from the Unidrive SP.
Invalid Source Parameter	111	One or more parameters specified in the IN data mapping configuration (#MM.10 to #MM.19) is outside of the allowed range for DeviceNet. The allowable parameter range is from #0.00 to #199.99.
Read Mismatch	112	One or more parameters specified in the IN data mapping configuration (#MM.10 to #MM.19) cannot be used as a source parameter for IN data. The parameter may not exist, or is a write-only parameter.
Hole In IN Data Mapping Configuration	113	IN data mapping parameters (#MM.10 to #MM.19) are not contiguous. It is not possible have an un-used parameter in the middle of the polled/cyclic data.
Too Many IN Data Objects Mapped	120	After expanding ranges of block mappings, more than 32 IN mappings are defined.
Mapping Over Length	121	Total size of all IN data mappings has exceeded the total size of the polled/cyclic data.

Table 12.4 Generic Mapping Error Codes

Error	Mapping Status	Description
Register Mode Objects Exceeded	122	More than 10 cyclic/polled IN data words have been selected with Register Mode.
Multiple Non-Cyclic Mapping Error	204	A non-cyclic data mode has been mapped more than once in the OUT data mapping configuration parameters. (#MM.20 to #MM.29)
Configuration Read Error	210	An error has occurred reading the OUT data mapping configuration parameters (#MM.20 to #MM.29) from the Unidrive SP.
Invalid Destination Parameter	211	One or more parameters specified in the OUT data mapping configuration (#MM.20 to #MM.29) is outside of the allowed range for DeviceNet. The allowable parameter range is from #0.00 to #199.99.
Write Mismatch	212	One or more parameters specified in the OUT data mapping configuration (#MM.20 to #MM.29) cannot be used as a destination parameter for OUT data. The parameter may not exist, or is a read-only parameter. This error will also occur if an attempt is made to map OUT data to the configuration parameters of a fieldbus option in another slot, unless that fieldbus module is configured in Register Mode, i.e. #MM.09 = ON (1).
Hole In OUT Data Mapping Configuration	213	OUT data mapping parameters (#MM.20 to #MM.29) are not contiguous. It is not possible have an un-used parameter in the middle of the polled/cyclic data.
Duplicate Mapping Error	214	Two or more OUT data mapping configuration parameters (#MM.20 to #MM.29) have been configured with the same destination parameter reference.
Too Many OUT Data Objects Mapped	220	After expanding ranges of block mappings, more than 32 OUT mappings are defined.
Mapping Over Length	221	Total size of all OUT data mappings has exceeded the total size of the polled/cyclic data.
Register Mode Objects Exceeded	222	More than 10 cyclic/polled OUT data words have been selected with Register Mode.

Table 12.5 SM DeviceNet Module Specific Mapping Error Codes

Error	Mapping Status	Description
Assembly Object Error	30	The pre-defined DeviceNet assembly objects (20 to 23, 70 to 73) cannot be used when direct data mapping is enabled.
Invalid Input Assembly Object	31	An invalid input assembly object has been specified. Refer to section 10.9 for more details,
Invalid Output Assembly Object	32	An invalid output assembly object has been specified. Refer to section 10.9 for more details,
Assembly Objects Incompatible	33	The Input and Output assembly objects must both be flexible (106 to 161) or pre-defined. (20 to 23, 70 to 73.) They cannot be mixed.