



## *User Guide*

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# ***SM-DeviceNet***

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Solutions Module for:

- Unidrive SP
- Commander SK
- Digitax ST
- Mentor MP
- Affinity

Part Number: 0471-0009-07

Issue Number: 7



[www.controltechniques.com](http://www.controltechniques.com)

## General Information

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

The contents of this guide are believed to be correct at the time of printing. In the interests of 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 content of the guide without notice.

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## Environmental Statement

Control Techniques is committed to minimising the environmental impacts of its manufacturing operations and of its products throughout their life cycle. To this end, we operate an Environmental Management System (EMS) which is certified to the International Standard ISO 14001. Further information on the EMS, our Environment Policy and other relevant information is available on request, or can be found at [www.greendrives.com](http://www.greendrives.com).

The electronic variable speed drives manufactured by Control Techniques have the potential to save energy and (through increased machine/process efficiency) reduce raw material consumption and scrap throughout their long working lifetime. In typical applications, these positive environmental effects far outweigh the negative impacts of product manufacture and end-of-life disposal.

Nevertheless, when the products eventually reach the end of their useful life, they must not be discarded but should instead be recycled by a specialist recycler of electronic equipment. Recyclers will find the products easy to dismantle into their major component parts for efficient recycling. Many parts snap together and can be separated without the use of tools, while other parts are secured with conventional fasteners. Virtually all parts of the product are suitable for recycling.

Product packaging is of good quality and can be re-used. Large products are packed in wooden crates, while smaller products come in strong cardboard cartons which themselves have a high-recycled fibre content. If not re-used, these containers can be recycled. Polythene, used on the protective film and bags from wrapping product, can be recycled in the same way. Control Techniques' packaging strategy prefers easily recyclable materials of low environmental impact, and regular reviews identify opportunities for improvement.

When preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

## Software Statement

This Solutions Module (SM) is supplied with the latest software version. When retro-fitting to an existing system, all software versions should be verified to confirm the same functionality as Solutions Modules of the same type already present. This also applies to products returned from a Control Techniques Service Centre or Repair Centre. If there is any doubt please contact the supplier of the product.

The software version of the Solutions Module can be identified by looking at Pr **MM.02** and Pr **MM.51**, where **MM** is the relevant menu number for the Solutions Module slot being used.

See Pr **MM.02** and Pr **MM.51** description later in this manual for more information.

The software version takes the form of xx.yy.zz, where Pr **MM.02** displays xx.yy and Pr **MM.51** displays zz (e.g. for software version 01.01.00 Pr **MM.02** will display 1.01 and Pr **MM.51** will display 0).

## REACH legislation

EC Regulation 1907/2006 on the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) requires the supplier of an article to inform the recipient if it contains more than a specified proportion of any substance which is considered by the European Chemicals Agency (ECHA) to be a Substance of Very High Concern (SVHC) and is therefore listed by them as a candidate for compulsory authorisation.

For current information on how this requirement applies in relation to specific Control Techniques products, please approach your usual contact in the first instance. Control Techniques position statement can be viewed at:

<http://www.controltechniques.com/REACH>

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# 1 Safety information

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## 1.1 Warnings, Cautions and Notes



A **Warning** contains information, which is essential for avoiding a safety hazard.



A **Caution** contains information, which is necessary for avoiding a risk of damage to the product or other equipment.

**NOTE**

A **Note** contains information which helps to ensure correct operation of the product.

## 1.2 Electrical safety - general warning

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive.

Specific warnings are given at the relevant places in this User Guide.

## 1.3 System design and safety of personnel

The drive is intended as a component for professional incorporation into complete equipment or a system. 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 equipment which 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, start up and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this User Guide carefully.

The STOP and SECURE DISABLE / SAFE TORQUE OFF functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit. The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

**With the sole exception of the SECURE DISABLE / SAFE TORQUE OFF function on Unidrive SP and Digitax ST, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.**

**NOTE**

The SECURE DISABLE / SAFE TORQUE OFF function is only available as standard on the Unidrive SP and Digitax ST. The Commander SK does not have a secure disable feature. .

Careful consideration must be given to the functions of the drive which might result in a hazard, either through their intended behavior or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

The SAFE TORQUE OFF function has been approved by BGIA as meeting the requirements of the following standards, for the prevention of unexpected starting of the drive:

EN 61800-5-2:2007 SIL 3

EN ISO 13849-1:2006 PL e

EN 954-1:1997 Category 3

The SAFE TORQUE OFF function may be used in a safety-related application. The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.

## 1.4 Environmental limits

Instructions in the *Unidrive SP User Guide*, *Commander SK Getting Started Guide*, *Commander SK Technical Data Guide*, *Digitax ST User Guide* and *Mentor MP User Guide* regarding transport, storage, installation and use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

## 1.5 Access

Drive access must be restricted to authorized personnel only. Safety regulations which apply at the place of use must be complied with.

## 1.6 Fire protection

The drive enclosure is not classified as a fire enclosure. A separate fire enclosure must be provided.

## 1.7 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective earth (ground) connections.

The *Unidrive SP User Guide*, *Digitax ST User Guide* and *Mentor MP User Guide* contain instructions for achieving compliance with specific EMC standards.

Within the European Union, all machinery in which this product is used must comply with the following directives:

- 2006/42/EC: Safety of machinery.
- 2004/108/EC: Electromagnetic Compatibility.

## 1.8 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations and that the motor shaft is not exposed.

Standard squirrel cage induction motors are designed for single speed operation. If it is intended to use the capability of the drive to run a motor at speeds above its designed maximum, it is strongly recommended that the manufacturer is consulted first.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective. The motor should be installed with a protection thermistor. If necessary, an electric forced vent fan should be used.

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon.

It is essential that the correct value is entered in the motor rated current parameter, Pr **5.07** (or Pr **0.46** in Unidrive SP, Affinity and Digitax ST, or Pr **0.28 {SE07}** in Mentor MP, or Pr **0.06** in Commander SK). This affects the thermal protection of the motor.

## 1.9 Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system.

Measures must be taken to prevent unwanted changes due to error or tampering.

## 1.10 Electrical installation

### 1.10.1 Electric shock risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC supply cables and connections
- Output cables and connections
- Many internal parts of the drive, and external option units

Unless otherwise indicated, control terminals are single insulated and must not be touched.

### 1.10.2 Stored charge

The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.



# 2 Introduction

## 2.1 What Is DeviceNet?

DeviceNet is a networking system that falls into the generic category of Fieldbus. Fieldbuses are generally defined as industrial networking systems that are intended to replace traditional wiring systems. Figure 2-1 shows the traditional cabling requirements to transfer signals between a controller and two nodes.

**Figure 2-1 SM-DeviceNetTraditional cable layout**

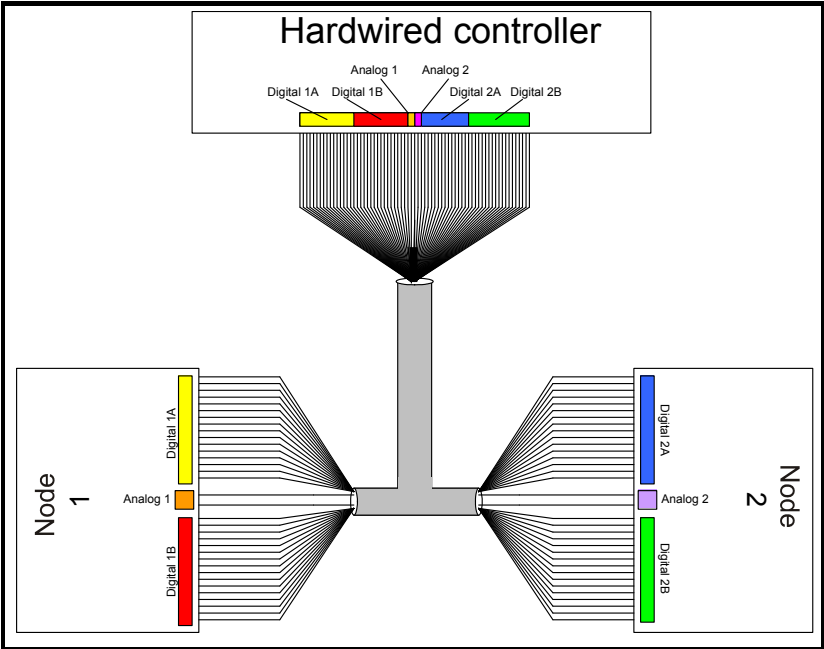


Table 2.1 details how the wiring is used to communicate data between the controller and the nodes. Each signal that is communicated requires one signal wire giving a total of 66 signal wires plus a 0V return.

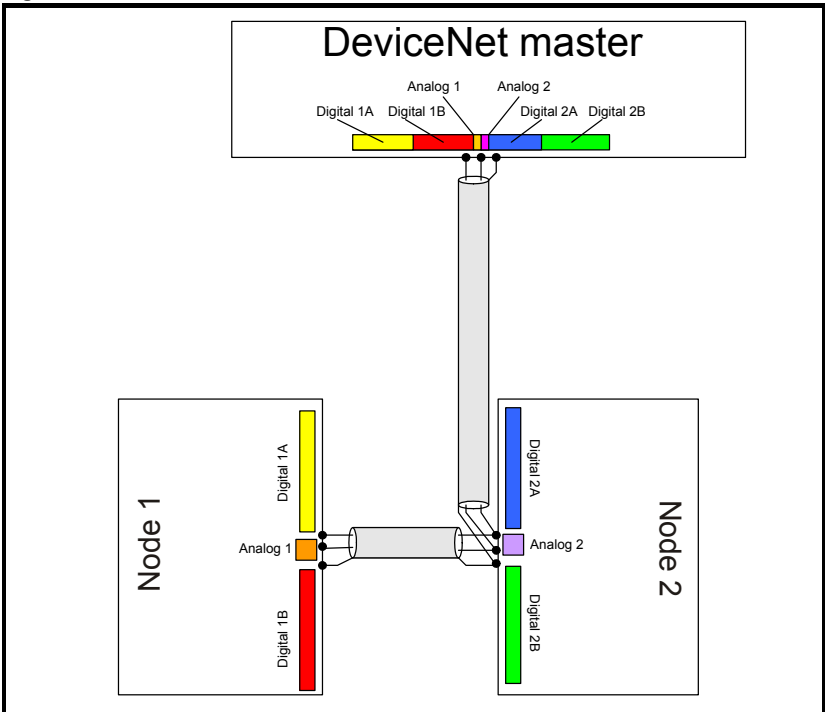
**Table 2.1 Traditional wiring details**

Number of signals	Type	Source / Destination	Description
16	digital Inputs	node 1 to master	status signals
16	digital outputs	controller to slave 1	control signals
1	analog output	controller to slave 1	control signal
16	digital inputs	node 2 to master	status signals
16	digital outputs	controller to slave 2	control signals
1	analog output	controller to slave 2	control signal

A fieldbus topology such as DeviceNet allows the same configuration to be realised using only 2 signal wires plus a shield and power. This method of communication saves significantly on the amount of cabling required and can improve overall system reliability, as the number of inter-connections is greatly reduced.

Figure 2-2 shows a typical DeviceNet system transferring the same signals as given in the traditionally wired example. The signals are now transmitted by converting them into a serial data stream which is received by the master as if they were connected using traditional wiring. The data stream on DeviceNet allows up to 56 (*28 input and 28 output*) independent values to be sent or received by the master, there are also methods available (non-cyclic data) to allow random access to drive parameters.

**Figure 2-2 DeviceNet overview**



**Table 2.2 Data mappings for SM-DeviceNet**

Number of network words	Type	Source / Destination	Description
1	digital inputs	slave 1 to master	status signals
1	digital outputs	master to slave 1	control signals
1	analog output	master to slave 1	control signal
1	digital inputs	slave 2 to master	status signals
1	digital outputs	master to slave 2	control signals
1	analog output	master to slave 2	control signal

Table 2.2 details the number of data words used to communicate the signals using the DeviceNet network. It can be seen that the resulting reduction in cabling is significant. DeviceNet can transfer data using two distinct modes. The first of these modes is cyclic where signals are sent in predefined blocks at regular intervals. This is the equivalent of the hard-wired example above in Figure 2-1.

The second method of transfer is called non-cyclic data and is used for sending values that only need to be changed occasionally or where the source or destination of the signal changes; this is the equivalent of a temporary patch lead that is removed after use.

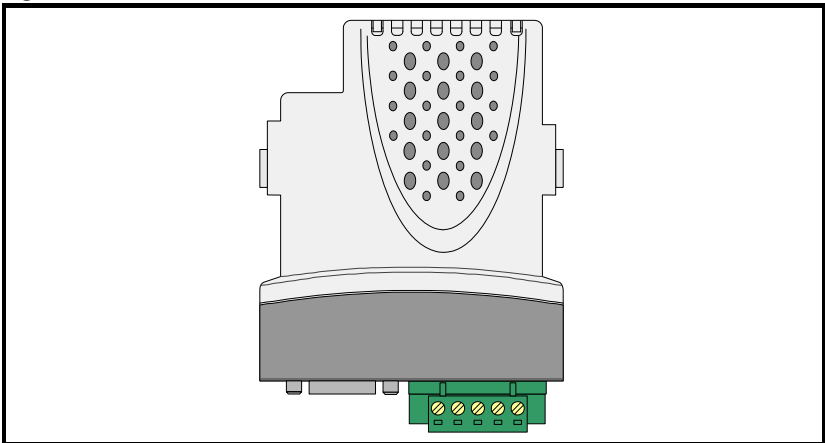
## 2.2 What is SM-DeviceNet?

SM-DeviceNet is a fieldbus Solutions Module that can be installed to the expansion slot(s) in any of the following drives to provide DeviceNet slave connectivity:

- Unidrive SP
- Commander SK
- Digitax ST
- Mentor MP

In the case of Unidrive SP, Digitax ST or Mentor MP, it is possible to use more than one SM-DeviceNet or a combination of SM-DeviceNet and other Solutions Modules to provide additional functionality such as extended I/O, gateway functionality, or additional PLC features.

**Figure 2-3 SM-DeviceNet Solutions Module**



## 2.3 General specification

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

## 2.4 Unidrive SP, Digitax ST and Mentor MP

The required drive can be connected to a back-up power supply. This keeps the control electronics and Solutions Module powered up, allowing the SM-DeviceNet to continue communicating with the DeviceNet master controller when the line power to the drive is switched off.

### NOTE

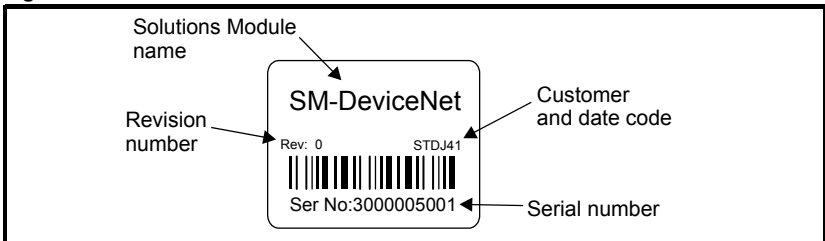
The back-up supply is provided through the drive and not the connections on SM-DeviceNet, which have an alternative use.

## 2.5 Solutions Module identification

SM-DeviceNet can be identified by:

1. The label located on the underside of the Solutions Module.
2. The color coding across the front of the SM-DeviceNet (dark grey).

**Figure 2-4 SM-DeviceNet label**



### 2.5.1 Date code format

The date code is split into two sections: a letter followed by a number. The letter indicates the year, and the number indicates the week number (within the year) in which the Solutions Module was built. The letters go in alphabetical order, starting with A in 1990 (B in 1991, C in 1992 etc.).

#### Example:

A date code of P35 would correspond to week 35 of year 2006.

## 2.6 Product Conformance Certificate

SM-DeviceNet has been awarded full DeviceNet Conformance Certification by the Open DeviceNet Vendors Association (ODVA). A copy of the certificate is available on request from your supplier or local Control Techniques Drive Centre.

## 2.7 Conventions used in this guide

The configuration of the host drive and Solutions Module is done using menus and parameters. A menu is a logical collection of parameters that have similar functionality. In the case of a Solutions Module, the parameters will appear in menu 15 for the

Commander SK and in menu 15, 16 or 17 for the Unidrive SP, depending on the slot the module is installed into. The menu is determined by the number before the decimal point.

The method used to determine the menu or parameter is as follows:

- Pr **xx.00** - signifies any menu and parameter number 00.
- Pr **MM.xx** - where MM signifies the menu allocated to the Solution Module (this could be 15 or 16 on Digitax ST, 15, 16 or 17 on Unidrive SP and Mentor MP but will always be 15 on Commander SK).

**NOTE**

All references in this manual to SM-Applications should also extend to SM-Applications Lite, SM-Applications Plus and SM-Applications Lite V2. The exceptions to this are references to the SM-Applications input/output, CTSync or the EIA (RS) -485 port, as these are not supported on SM-Applications Lite or SM-Applications lite V2 but are on SM-Applications Plus. For full details of the differences see the *SM-Applications Modules and Motion Processors User Guide*.

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# 3 Mechanical installation

## 3.1 General installation

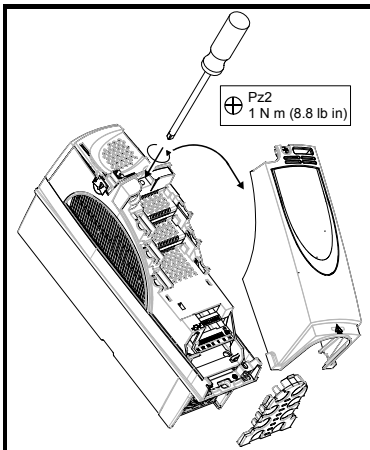


Before installing a Solutions Module in any drive, ensure the AC supply has been disconnected for at least 10 minutes and refer to Chapter 1 *Safety information* on page 6. If using a DC bus supply ensure this is fully discharged before working on any drive or Solutions Module.

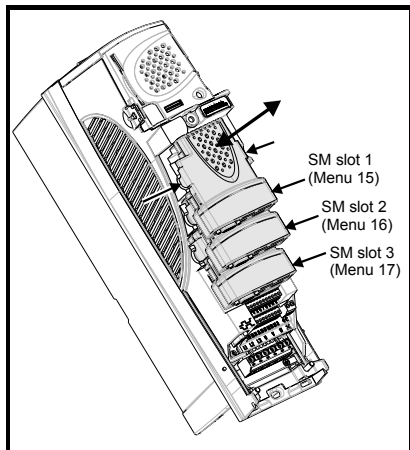
### 3.1.1 Installation on Unidrive SP

Three Solutions Module slots are available on Unidrive SP. The Solutions Module can be plugged into any of these slots, but it is recommended that slot 3 be used for the first Solutions Module, then slot 2 and then slot 1. This ensures the maximum mechanical support for the Solutions Module once installed (see Figure 3-2).

**Figure 3-1 Removing the Unidrive SP terminal cover**



**Figure 3-2 Fitting and removing a Solutions Module with Unidrive SP**



1. Before installing a Solutions Module, ensure the AC supply (or DC bus supply) has been disconnected for at least 10 minutes.
2. Ensure that any +24V and low voltage DC power supplies (if used) have been disconnected from the drive.
3. Check that the exterior of the Solutions Module is not damaged and the multiway connector on the underside of the module is free from dirt and debris.
4. Do not install a damaged or dirty Solutions Module in the drive.
5. Remove the terminal cover from the drive as shown in Figure 3-1.
6. Position the drive connector of the Solutions Module over the appropriate connector of the drive and push downwards until it locks into place. Make any wiring connections as appropriate (see Chapter 4 *Electrical installation* on page 18 for additional information).
7. Re-fit the terminal cover to the drive by reversing the procedure shown in Figure 3-1.
8. Connect the AC or DC bus supply to the drive.

9. When a Solutions Module is installed for the first time, as the drive is powered-up, the drive will trip on *SL1.dF* or *SL2.dF* or *SL3.dF* depending on which slot the Solutions Module is installed to. A parameter save must now be performed. Set Pr **xx.00** = 1000 (or 1001 in the case of solely using the 24V back-up power supply) and press the *Stop/Reset* button.
10. To access the advanced parameters refer to the *Unidrive SP User Guide*.
11. Check that Menu 15 (*slot 1*), 16 (*slot 2*), or 17 (*slot 3*) parameters are now available (*depending on which slot is used*).
12. Check that Pr **15.01**, Pr **16.01** or Pr **17.01** shows the correct code for the SM-DeviceNet (407).
13. Power the drive down and back up again. The Solutions Module is now ready for programming.

**NOTE** If the Solutions Module is changed for a different type, the drive will trip as in step 9. Follow the above procedure again to install the module.

If the checks in steps 11 and 12 fail, either the Solutions Module is not fully inserted, or it is faulty. If a trip code is now present refer to Chapter 10 *Diagnostics* on page 56.

**NOTE** When using the 24V back-up power supply only, the *SLx.dF* trip will be hidden (as the drive is already displaying a *UV* trip).

**NOTE** When fitting two or more Solutions Modules simultaneously, the *SLx.dF* trip is only applicable to the module installed in the lowest numerical slot.

**NOTE** If an *SLx.dF* trip is not seen after the initial power-up, the Solutions Module is not installed properly to the drive. Power down the drive, remove and re-fit the Solutions Module. Then power can be re-applied to the drive.

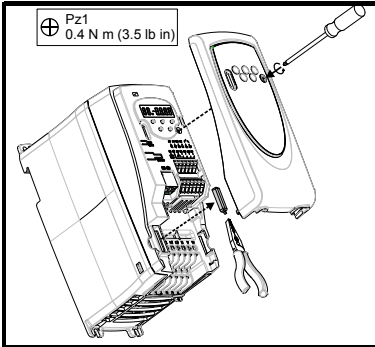
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### 3.1.2 Installation on Commander SK

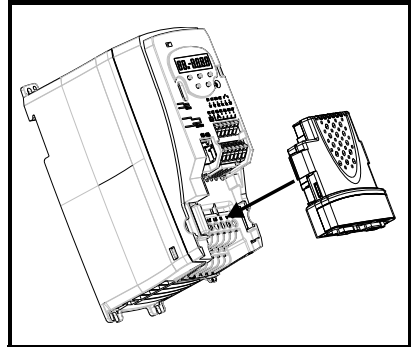


To allow a Solutions Module to be installed to Commander SK, a protective cover must be removed to allow access to the PCB edge connector (see Figure 3-3). This cover provides protection from direct contact of the PCB edge connector by the user. When this cover is removed and Solutions Module installed, the Solutions Module provides the protection from direct contact. If the Solutions Module is then removed, this PCB edge connector becomes exposed. The user is required to provide protection in this case.

**Figure 3-3 Removing the Commander SK terminal cover**



**Figure 3-4 Fitting and removing a Solutions Module for the Commander SK**



1. Before installing a Solutions Module, ensure the AC or DC bus supply has been disconnected for at least 10 minutes.
2. Ensure that any +24V and low voltage DC power supplies (if used) have been disconnected from the drive.
3. Check that the exterior of the Solutions Module is not damaged and the multiway connector on the underside of the module is free from dirt and debris.
4. Do not install a damaged or dirty Solutions Module in the drive.
5. Remove the terminal cover from the drive as shown in Figure 3-3.
6. Position the drive connector of the Solutions Module over the appropriate connector of the drive and push downwards until it locks into place. Make any wiring connections as appropriate (see Chapter 4 *Electrical installation* on page 18 for additional information). Ensure that the plastic tab, which covers the drive's Solutions Module connector, is removed before fitting any Solutions Module (see Figure 3-4).
7. Re-fit the terminal cover to the drive by reversing the procedure shown in Figure 3-3.
8. Connect the AC or DC bus supply to the drive.
9. When a Solutions Module is installed to a Commander SK for the first time, as the drive is powered-up, the drive will trip on SL.dF. Press the STOP/RESET button to clear the trip. The Commander SK automatically saves the Solutions Module identity details to memory which will avoid any future SL.dF trips.
10. To access the advanced parameters refer to the *Commander SK Getting Started Guide*.

**NOTE**

If a SL.dF trip is not seen after the first power-up, the Solutions Module is not installed properly to the drive. Power down the drive, remove and re-fit the Solutions Module. Then power can be re-applied to the drive.



11. Check that Menu 15 parameters are now available.
12. Check that Pr **15.01** shows the correct code for SM-DeviceNet (407).
13. Power the drive down and back up again. The Solutions Module is now ready for programming.

**NOTE**

If the Solutions Module is changed for a different type, the drive will trip as in step 9. Follow the above procedure again to install the module. If the checks in steps 11 and 12 fail, either the Solutions Module is not fully inserted, or it is faulty. If a trip code is now present refer to Chapter 10 *Diagnostics* on page 56.

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## 4 Electrical installation

### 4.1 SM-DeviceNet terminal descriptions

SM-DeviceNet has a standard 5-way screw terminal block connector (shown on the right) for the DeviceNet network. The 9-way male D-type may also be used to connect to SM-DeviceNet. These connectors are detailed in the SM-DeviceNet specification.

Figure 4-1 SM-DeviceNet - front view

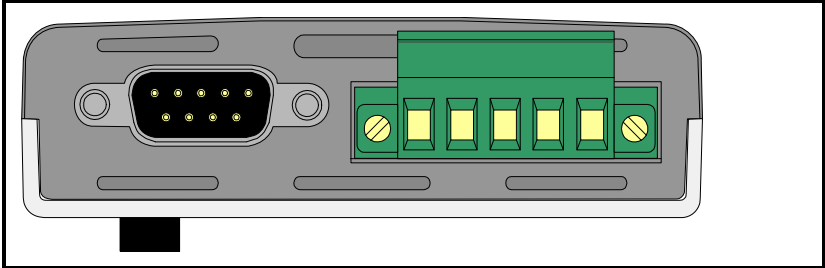


Table 4.1 SM-DeviceNet terminal descriptions

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	Shield	Cable braided shield connection
4	7	CAN-H	Positive data line
5	9	+24V	+24V DeviceNet external supply

**NOTE**

The external supply terminals provide power for the DeviceNet transceiver circuitry, but do NOT provide power to keep the SM-DeviceNet operating in the event of the mains power supply loss to the drive. An external supply will keep the DeviceNet transceivers powered up and the network load characteristics constant in the event of loss of power to the drive.



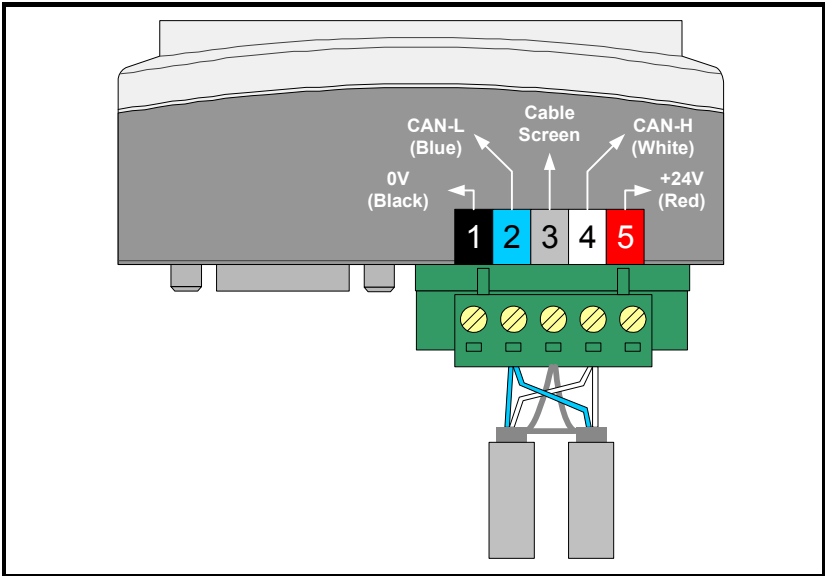
**CAUTION**

Any external supply must be suitably installed to prevent noise on the network. Connecting pins 1 and 5 to an external supply allows the line driver circuitry to remain powered when the drive and the SM-DeviceNet module are turned off. This 24V input does not allow SM-DeviceNet to continue communicating.

## 4.2 SM-DeviceNet connections

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

Figure 4-2 SM-DeviceNet connections



## 4.3 DeviceNet cable

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

Table 4.2 DeviceNet cable color codes

Cable	Data signal	Terminal	Description
Black	0V	1	0V external power supply.
Blue	CAN-L	2	Negative data line.
Braided Shield	Shield	3	Cable shield.
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](http://www.odva.org).

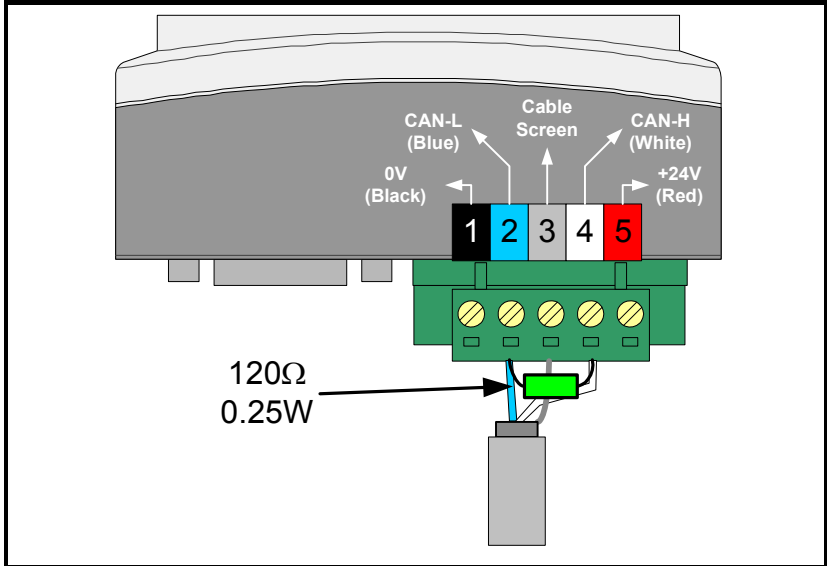
**NOTE** Control Techniques can only guarantee correct and reliable operation of SM-DeviceNet if all other equipment installed on the DeviceNet network (including the network cable) has been approved by the ODVA.

## 4.4 DeviceNet network termination

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

For DeviceNet 120 ohm 0.25W termination resistors should be installed across the CAN-H and CAN-L lines at both ends of the network segment, as shown in Figure 4-3 below.

**Figure 4-3 DeviceNet network termination**



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

If too many termination resistors are installed 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 potential transmission errors.

## 4.5 SM-DeviceNet cable shield connections

The SM-DeviceNet should be wired with the cable shields isolated from ground at each drive. 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.

**NOTE** The DeviceNet cable can be tie-wrapped to the grounding bar or local convenient mounting that is not live to provide strain relief, but the DeviceNet cable shield must be kept isolated from ground at each node. The only exception to this is the DeviceNet ground point. Refer to section 4.6 *DeviceNet ground point* on page 21.

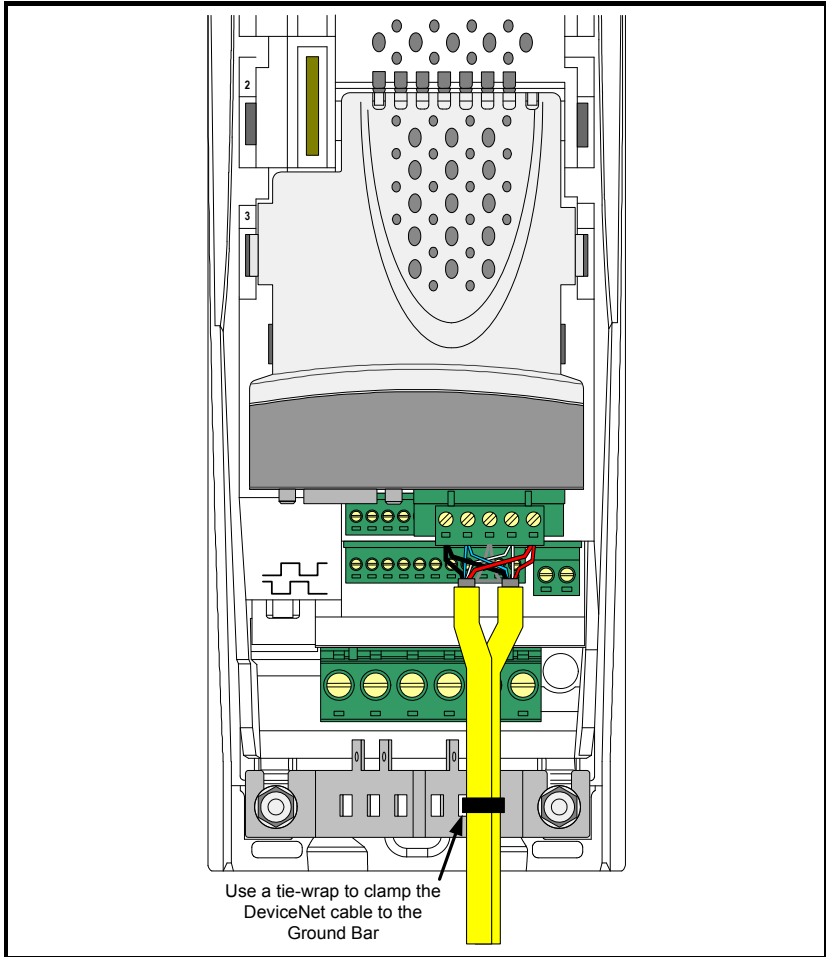
## 4.6 DeviceNet ground point

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

## 4.7 Using Unidrive SP as a ground point

If a Unidrive SP node is the desired ground point, the shield of one of the DeviceNet cables can be exposed and clamped to the Grounding Bar, as shown in Figure 4-4 below.

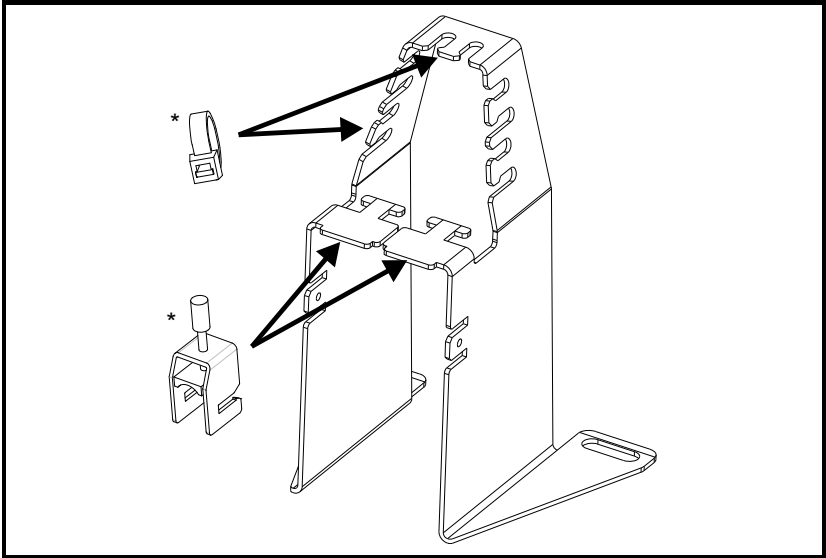
**Figure 4-4 DeviceNet cable shield arrangement**



## 4.8 Using Commander SK as a ground point

When using Commander SK as the network grounding point it is recommended that the grounding bracket part number 6541-0036-00 is used. The network cable can then be connected to ground using appropriate clamps (not supplied), or alternatively, tied to the bracket using cable ties.

**Figure 4-5 SK-Bracket**



**NOTE** Care should be taken when clamping cables to avoid damage to the cable.

## 4.9 Drive backup supply requirements

When using Unidrive SP, Digitax ST or Mentor MP, and where the DeviceNet network is required to continue operating in the event of a loss of the line power to the drive, a backup +24V power supply should be connected to the drive. All Solutions Modules draw their power from the drive's internal power supply, which will guarantee that the SM-DeviceNet will continue to communicate.

The external power supply pins on the SM-DeviceNet connectors will NOT keep the SM-DeviceNet powered up. These pins will only supply power to the DeviceNet transceiver circuitry, and the maximum current drawn is 10mA.

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

**Table 4.3 SM-DeviceNet external power supply 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

## 4.10 Maximum network length

The maximum number of nodes that can be connected to a single DeviceNet network segment is 64. 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.

**Table 4.4 DeviceNet maximum segment lengths**

Data rate (bits/sec)	Maximum network length (m)
1M	30
800K	50
500K	100
250K	250
125K	500
100K	700
50K	1000
20K	2500
10K	5000

## 4.11 Spurs

Control Techniques do not recommend the use of spurs on a DeviceNet network.

## 4.12 Minimum node to node cable length

The DeviceNet specification does not specify a minimum node to node distance, however, Control Techniques advises a minimum distance of 1m between nodes to prevent excessive bend radii and to reduce network reflections.

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## 5 Getting started

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This section is intended to provide a generic guide for setting up SM-DeviceNet and a master controller/PLC. Figure 5.1 *Quick start chart SM-DeviceNet* on page 25 is intended as the starting point for a new installation. The following pages detail the various methods available to configure SM-DeviceNet. It is recommended that all of this section is read, before attempting to configure a system. Table 5.1 shows the different versions of drive firmware required to use SM-DeviceNet.

**Table 5.1 SM-DeviceNet version compatibility**

Drive Type	Drive Firmware	SM-DeviceNet Firmware
Commander SK	Version 01.02.00 or later	Version 03.00.00 or later
Unidrive SP	Version 01.00.00 or later	Version 01.00.03 or later
Mentor MP	Version 01.00.00 or later	Version 03.01.00 or later
Digitax ST	Version 01.00.00 or later	Version 01.00.03 or later

**NOTE** It is recommended that the latest firmware is used where possible to ensure all features are supported.

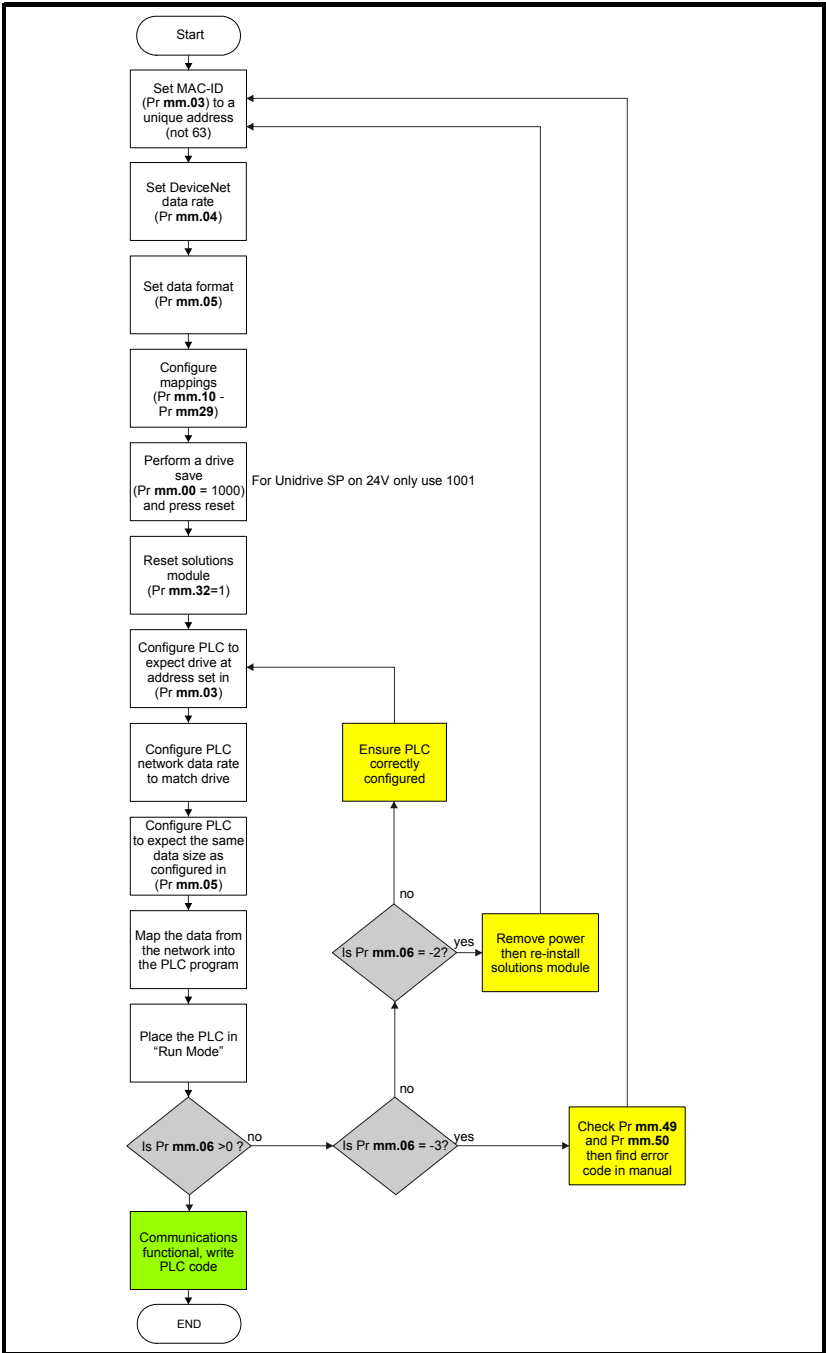
**NOTE** Due to the large number of different PLCs/masters that support DeviceNet, details cannot be provided for any specific master or PLC. Generic support is available through your supplier or local drive centre. Before contacting your supplier or local drive centre for support ensure you have read Chapter 10 *Diagnostics* on page 56 of this manual and check you have configured all parameters correctly.

Ensure the following information is available before calling:

- A list of all parameters in SM-DeviceNet.
- The drive firmware version (*see the drive documentation*).
- The system file version of SM-Applications family or Motion Processors, if installed.



# 5.1 Quick start chart SM-DeviceNet



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## 5.2 SM-DeviceNet MAC-ID (Node address)

SM-DeviceNet MAC-ID		
Pr <b>MM.03</b>	<b>Default</b>	63
	<b>Range</b>	0 to 63
	<b>Access</b>	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 MAC-ID, only one node will join the network and start communicating with the master controller. All other nodes with the same MAC-ID will be prevented from joining the network. The valid range of MAC-IDs is from 0 to 63, with a default address of 63. SM-DeviceNet must be reset to make a change of MAC-ID take effect (see section 5.6 *Resetting the SM-DeviceNet (re-initializing)* on page 28).

If an invalid node address is set, SM-DeviceNet will over-write the value in Pr **MM.03** with 63. When the SM-DeviceNet is reset, this value will be used as the DeviceNet node address.

### NOTE

MAC-ID (node address) 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 initially 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 network.

## 5.3 SM-DeviceNet data rate

SM-DeviceNet Data Rate		
Pr <b>MM.04</b>	<b>Default</b>	0
	<b>Range</b>	-1 to 2
	<b>Access</b>	RW

Every node on an SM-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 SM-DeviceNet network, and eventually trip on "SLx.Er" with error code of 66. SM-DeviceNet must be reset to make a change of data rate take effect (see section 5.6 *Resetting the SM-DeviceNet (re-initializing)* on page 28).

**Table 5.2 SM-DeviceNet data rates**

Pr <b>MM.04</b>	bits/sec
-1	Auto
0	125K
1	250K
2	500K

SM-DeviceNet can automatically detect the network data rate by setting Pr **MM.04** to -1. The SM-DeviceNet will monitor the network, if the data rate is detected, it will set Pr **MM.04** to the indicate the detected data rate. However, it should be noted that the new value of Pr **MM.04** will NOT be stored.

The recommended sequence of events using auto-detection of the data rate as follows:

1. Power up the drive.
2. Set Pr **MM.04** to -1
3. Reset SM-DeviceNet by setting Pr **MM.32** to On (1).
4. Connect the SM-DeviceNet to the DeviceNet network.
5. Wait for Pr **MM.04** to change from -1.
6. Refer to the relevant User Guides for information about saving drive parameters.

**NOTE**

SM-DeviceNet may have problems detecting the network data rate if there is little traffic on the DeviceNet network. Auto-detection of the data rate is ideal when connecting a new node to an existing network, but may not work reliably if a network is powered up with all nodes attempting to detect the network data rate.

## 5.4 SM-DeviceNet data format

SM-DeviceNet Data Format		
Pr <b>MM.05</b>	Default	4
	Range	0 to 224
	Access	RO

The default data format is 4 Polled Words. Each polled data channel is a 32-bit data value (using two 16-bit polled data words to create a 32-bit data word) and is mapped to a drive parameter, with default mappings as shown in the table below.

**Table 5.3 SM-DeviceNet Default Data Mapping**

Polled channel	Data word	Default mapping status
IN channel 0	Word 0, 1	Pr <b>10.40</b> , status word
IN channel 1	Word 2, 3	Pr <b>2.01</b> , post-ramp speed reference
OUT channel 0	Word 0, 1	Pr <b>6.42</b> , control word
OUT channel 1	Word 2, 3	Pr <b>1.21</b> , digital speed reference 1

Other data formats are also supported. For further details see section 5.4 *SM-DeviceNet data format* on page 27.

## 5.5 SM-DeviceNet operating status

SM-DeviceNet operating status		
Pr <b>MM.06</b>	Default	N/A
	Range	-10 to 9999
	Access	RO

DeviceNet network activity can be monitored in the SM-DeviceNet operating status parameter Pr **MM.06**. When SM-DeviceNet is communicating successfully with the DeviceNet master controller, the SM-DeviceNet operating status will give an approximate indication of the number of data messages per second that are being processed.

**Table 5.4 SM-DeviceNet operating status codes**

MM.06	Parameter	Description
>0	Network OK	Indicates the approximate number of successful network cycles per second.
0	Network OK, no data transfer	Indicates that the DeviceNet master has established communications with SM-DeviceNet, but there is currently no data transfer in progress.
-1	Initialised	Indicates that the SM-DeviceNet has initialised correctly and is waiting for the DeviceNet master to initialize communications. This may also indicate a mismatch between the master and the SM-DeviceNet configuration.
-2	Internal hardware failure	Indicates that part of the SM-DeviceNet initialisation sequence was not successful. If this fault persists after a power cycle, replace the SM-DeviceNet.
-3	Configuration error	Indicates that there is an invalid setting in the SM-DeviceNet configuration parameters.
-4	Unrecoverable software error	An internal software error has occurred. Reset SM-DeviceNet to clear, if the error persists, replace the SM-DeviceNet.
-8	Data rate detection in progress	The SM-DeviceNet is currently attempting to detect the DeviceNet network data rate.
-10	External power supply error	Indicates that the external DeviceNet +24V power supply is missing. The SM-DeviceNet will not communicate unless the DeviceNet power supply is present and correct.

## 5.6 Resetting the SM-DeviceNet (re-initializing)

SM-DeviceNet reset		
Pr MM.32	Default	0 (OFF)
	Range	0 (OFF) to 1 (On)
	Access	RW

Changes to the SM-DeviceNet configuration parameters in menu **MM** will not take effect until the SM-DeviceNet has been reset.

To reset SM-DeviceNet:

1. Set Pr **MM.32** to On (1).
2. When the reset sequence has been completed, Pr **MM.32** will be reset to OFF (0) [the change to 1 (On) may not be visible].
3. The SM-DeviceNet will re-initialize using the updated configuration.

**NOTE** This sequence does NOT store SM-DeviceNet configuration parameters in the drive.

## 5.7 Resetting Solutions Modules

**Unidrive SP - to reset all Solutions Modules installed:**

1. Set Pr **MM.00** to 1070.
2. Press the red RESET button on the drive.

**Mentor MP - to reset all Solutions Modules installed:**

1. Set Pr **MM.00** to Save.
2. Press the red RESET button on the drive.

**NOTE** This sequence does NOT store the SM-DeviceNet configuration parameters in the drive or the SM-DeviceNet FLASH memory.

## 5.8 Storing SM-DeviceNet configuration parameters

Parameters in menu **MM** are stored in the host drive. SM-DeviceNet will always use these values during initialisation to configure itself, so if a new SM-DeviceNet is installed to the same slot, it will communicate using the same settings as the previous SM-DeviceNet.

If the stored values in the host drive are for a different type of Solutions Module, the host drive will trip. The slot configuration parameters will be set to default values for SM-DeviceNet, but the default values will NOT be stored in the host drive.

The SM-DeviceNet configuration parameters can also be stored in the FLASH memory on the SM-DeviceNet. If the drive is replaced, the SM-DeviceNet configuration parameters can subsequently be restored to a different drive.

### 5.8.1 Saving drive parameters

This procedure stores the operating parameters for the SM-DeviceNET to the drive's internal memory.

To store parameters in the host drive:

Set Pr **MM.00** to 1000 (a Unidrive SP, Digitax ST or Affinity on 24V supply would require a value of 1001).

2. Press the red RESET button.

The drive will store all parameters, except Menu 20 unless an SM-Applications range (or integrated motion processor) of module is installed and configured appropriately but the operation of the SM-DeviceNET will not be affected. Changes made to the SM-DeviceNET configuration parameters will not take effect until the SM-DeviceNET is reset (Pr **MM.32**).

### 5.8.2 Backup parameters to SM-DeviceNet FLASH memory

This procedure can be used to transfer settings to a new drive from a previously configured SM-DeviceNET module. To store the SM-DeviceNET configuration parameters in the FLASH memory in the SM-DeviceNET:

1. Set Pr **MM.31** to On (1).
2. Set Pr **MM.00** to 1000 (a Mentor MP would require a value of SAVE and a Unidrive SP, Digitax ST, Affinity or Mentor MP on a 24V backup supply requires a value of 1001).
3. Press the red RESET button.

The host drive will store its parameters, and SM-DeviceNET communication will be halted immediately. The SM-DeviceNET configuration parameters will be saved within the FLASH memory. The SM-DeviceNET will then reset and re-initialize using the updated configuration parameter values.

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## 5.9 Restore SM-DeviceNet defaults

Restore SM-DeviceNet defaults		
Pr <b>MM.30</b>	Default	OFF (0)
	Range	OFF (0) or On (1)
	Access	RW

This procedure can be used to default the SM-DeviceNet module to factory settings, this will also default the drive settings. If the SM-DeviceNet detects that the host drive has been restored to default values, it will over-write the slot configuration parameters with the SM-DeviceNet default values.

### NOTE

If the stored values in the drive are for a different type of Solutions Module, the SM-DeviceNet will trip "SLx.DF", but no error code will be set. It will over-write the parameter values with the SM-DeviceNet default values, but will NOT store these values in the drive.

Pr **MM.30** specifies whether the default values should be written to the SM-DeviceNet FLASH memory when the host drive is defaulted. If Pr **MM.30** is set to On (1), the default values will be written into the SM-DeviceNet FLASH memory.

The full sequence of events to restore default settings for a SM-DeviceNet is as follows:

1. Set Pr **MM.30** to 1 (On).
2. Unidrive SP - Set Pr **MM.00** to 1233 to restore European defaults (1244 for USA defaults). **Commander SK** - Set Pr **00.29** to *EUR* for European defaults (*USA* for American defaults). See the relevant drive user guides for restoring defaults.
3. Press the red reset button on the drive.
4. DeviceNet communications will be stopped.
5. The host drive will load and store its default parameter values.
6. Default parameter values for the SM-DeviceNet will be loaded in Pr **MM.xx** parameters.
7. The SM-DeviceNet default parameter values will be stored in the SM-DeviceNet FLASH memory.
8. SM-DeviceNet will reset and re-initialise using the default values.

### NOTE

The drive settings will also be defaulted with the above procedure.

## 5.10 Restore previous SM-DeviceNet configuration

Upload from SM-DeviceNet FLASH memory		
Pr <b>MM.33</b>	Default	OFF (0)
	Range	OFF (0) or On (1)
	Access	RW

If valid configuration parameters have previously been stored in the SM-DeviceNet FLASH memory, these values can be restored to the host drive. When the configuration parameter values have been uploaded to the host drive, the SM-DeviceNet will reset and re-configure itself using the updated parameter values. Object 0x1010 additionally allows the communication object settings sent by a master to be saved.

This feature allows a pre-configured SM-DeviceNet to be installed to a host drive without losing the SM-DeviceNet configuration. If the SM-DeviceNet is unable to upload the configuration parameters to the host drive, or configuration parameters have never been stored in the SM-DeviceNet FLASH memory, the host drive will trip and set the error code (Pr **MM.49**) to 70.

When Pr **MM.33** is set to On (1), the SM-DeviceNet will transfer the configuration parameters from its FLASH memory to the host drive, over-writing the existing values in the host drive.

The full sequence of events for restoring values from a SM-DeviceNet is as follows:

1. Set Pr **MM.33** to On (1).
2. DeviceNet communications will be stopped.
3. The SM-DeviceNet will overwrite all Pr **MM.xx** parameters with the values stored in its internal FLASH memory.
4. Pr **MM.33** will be reset to OFF (0).
5. The SM-DeviceNet will reset and re-initialise using the restored values.

This procedure will NOT store the updated host drive parameters, to do this a drive save must be performed.

**NOTE**

The SM-DeviceNet will restore its configuration parameters to the menu of parameters associated with the slot that it is installed in. If an SM-DeviceNet is moved from slot 3 on one drive, it can be re-installed in any slot on another drive using this procedure.

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## 6 Polled data

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### 6.1 Introduction

Polled data is a method of data transfer that must be setup 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, by relying on local mapping information within the SM-DeviceNet 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/reading data values to and from the registers allocated to the node during network configuration. The flexibility of the SM-DeviceNet means that each polled data OUT channel can be directed to any read-write drive parameter. Similarly, each polled data IN channel can use any drive 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, i.e. after a reset, or at power up. "OUT data" and "IN data" describe the direction of data transfer as seen by the DeviceNet master controller.

### 6.2 SM-DeviceNet data formats

SM-DeviceNet data format		
Pr <b>MM.05</b>	Default	4
	Range	0 to 224
	Access	RW

The SM-DeviceNet 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 11.8 *Block mapping* on page 66) 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 "NPP", where N is the non-cyclic data mode, and PP is the number of polled data words.

**Table 6.1 Valid SM-DeviceNet data formats**

Pr <b>MM.05</b>	N	PP	Non-cyclic mode	Polled words
0	0	0	Explicit only	0
1 to 28	0	1 to 28	Explicit only	1 to 28
100 to 126	1	0 to 26	Explicit plus CT Single Word	0 to 26
200 to 224	2	0 to 24	Explicit plus PPO 4 Word	0 to 24

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 6.2 SM-DeviceNet mapping parameters**

IN channel	Mapping parameter	OUT channel	Mapping parameter
0	Pr <b>MM.10</b>	0	Pr <b>MM.20</b>
1	Pr <b>MM.11</b>	1	Pr <b>MM.21</b>
2	Pr <b>MM.12</b>	2	Pr <b>MM.22</b>
3	Pr <b>MM.13</b>	3	Pr <b>MM.23</b>
4	Pr <b>MM.14</b>	4	Pr <b>MM.24</b>
5	Pr <b>MM.15</b>	5	Pr <b>MM.25</b>
6	Pr <b>MM.16</b>	6	Pr <b>MM.26</b>
7	Pr <b>MM.17</b>	7	Pr <b>MM.27</b>
8	Pr <b>MM.18</b>	8	Pr <b>MM.28</b>
9	Pr <b>MM.19</b>	9	Pr <b>MM.29</b>

“Block Mapping” can be used to map several words to consecutive drive parameters. Full details about “block mapping” can be found in section 11.8 *Block mapping* on page 66.

**NOTE**

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 will indicate “Mapping Error” in the operating status parameter (Pr **MM.06**). The reason for the mapping error will be indicated by the Mapping Error Status parameter, (Pr **MM.49**). Refer to section 10.6 *SM-DeviceNet mapping status* on page 59 for more details.

When the data format is configured using Pr **MM.05**, the SM-DeviceNet will communicate using the same number of data words for IN and OUT data. It is, however, possible to configure the SM-DeviceNet to communicate with different numbers of IN and OUT polled data words.

**NOTE**

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

**6.2.1 2 polled channels only (default)**

This data format provides 2 polled data channels with no non-cyclic data channel. The total data length is 4 words or 8 bytes. To select this data format, set Pr **MM.05** = 4. This data format is selected by default.

**Table 6.3 Mapping for 2 polled channels**

Data word	Parameter	Default mapping status
IN word 0, 1	Pr <b>MM.10</b>	Pr <b>10.40</b> , status word
IN word 2, 3	Pr <b>MM.11</b>	Pr <b>2.01</b> , post-ramp speed reference
OUT word 0, 1	Pr <b>MM.20</b>	Pr <b>6.42</b> , control word
OUT word 2, 3	Pr <b>MM.21</b>	Pr <b>1.21</b> , digital speed reference 1

Block mapping can be used to map the remaining unused data words to drive or Applications module/Motion processor parameters. See section 11.8 *Block mapping* on page 66.

## 6.3 Mapping conflicts

Care must be taken to ensure that there are no clashes between the mapping of the SM-DeviceNet cyclic data, and the analog and digital inputs within the drive itself. The SM-DeviceNet will not indicate if there is a conflict with drive mapping parameters.

This only applies to analog and digital inputs, and OUT cyclic data on the DeviceNet network.

## 6.4 Polled data mapping errors

The SM-DeviceNet will scan and check the mapping parameter configuration for errors. If an error is detected, the operating status parameter will indicate -3, and the mapping status will be indicated in Pr **MM.49**. See section 10.6 *SM-DeviceNet mapping status* on page 59 for full details.

# 7 Control / status word

## 7.1 What are control and status words?

The control and status words allow the digital control and monitoring of the drive to be implemented using a single data word for each function. Each bit in the control word has a particular function and provides a method of controlling the output functions of the drive, such as run and direction. These words can be accessed using either cyclic or non-cyclic data.

Each bit in the status word provides feedback about the drives state of health and operational condition, such as drive OK, drive at speed, etc.

## 7.2 Control word

The SM-DeviceNet control word consists of 16 control bits some of which are reserved. See Table 7.1 for the individual bit function descriptions.

**Table 7.1 Control word bit definitions**

b15	b14	b13	b12	b11	b10	b9	b8
	KEYPAD WDOG	RESET	TRIP			JOG REV	REMOTE
b7	b6	b5	b4	b3	b2	b1	b0
AUTO	NOT STOP	RUN	FWD REV	RUN REV	JOG FWD	RUN FWD	ENABLE

To enable fieldbus control the fieldbus enable signal (Pr **6.43**) and the auto bit (bit7) must both be set to '1'. When the AUTO bit is reset to 0 the drive will revert to terminal control.

For safety reasons, the external HARDWARE ENABLE signal must be present before the fieldbus control word can be used to start the drive. This terminal is normally controlled by an external "Emergency Stop" circuit to ensure that the drive is disabled in an emergency situation.

The control word REMOTE bit directly controls the drive parameter Pr **1.42**, the function of which is to select the digital speed reference as the source of the drives speed reference. When the REMOTE bit is reset to 0 the drive will revert to using the external analog speed reference.

The actual digital speed reference selected when REMOTE is set to 1 will be Pr **1.21**, which is also the default mapping for the fieldbus speed reference. However Pr **1.15** can be used to change which of the digital references is selected. For further details on the drive digital speed references, please refer to the appropriate drive *User Guide*.

Table 7.2 lists in detail the function of each control word bit. For further in-depth details about drive control words and sequencing bits please refer to the appropriate drive *User and Advanced User Guides*.

**NOTE**

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

**NOTE**

By default data compression is off and therefore the control word will be cast as 32 bit with bits 16-31 reserved.

**Table 7.2 Control word bit functions**

Bit	Function	Description
0	ENABLE	Set to 1 to enable the drive. Resetting to 0 will immediately disable the drive, and the motor will <b>coast</b> to a stop. The external HARDWARE ENABLE signal must also be present before the drive can be enabled.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward direction. When reset to 0, the drive will <b>decelerate</b> the motor to a controlled stop.
2	JOG FWD	Set to 1 to jog the motor forward. This signal needs to be used in conjunction with the ENABLE bit. This signal is overridden by a RUN, RUN REV or RUN FWD signal.
3	RUN REV	Set to 1 (with ENABLE set to 1) to run the motor in the reverse direction. When reset to 0, the drive will <b>decelerate</b> the motor to a controlled stop.
4	FWD REV	Set to 1 to select the reverse direction. 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. FWD REV is used to select the direction of motor rotation. When reset to 0, the drive will <b>decelerate</b> the motor to a controlled stop.
6	NOT STOP	Set to 1 to allow the sequencing bit in the drive to be latched. Refer to the drive <i>Advanced User Guide</i> for more details. If NOT STOP is zero, all latches are cleared and held at 0. Pr <b>6.04</b> must be correctly set for this to function.
7	AUTO	Set to 1 to enable fieldbus control of the drive Control Word. The Control Word Enable (Pr <b>6.43</b> ) must also be set to 1. When reset to 0, the drive will operate under terminal control.
8	REMOTE	Set to 1 to select digital speed reference 1 (Pr <b>1.21</b> ), and to 0 to select analog reference 1 (Pr <b>1.36</b> ). REMOTE directly controls Pr <b>1.42</b> , so reference selector (Pr <b>1.14</b> ) and preset selector (Pr <b>1.15</b> ) must both be set to 0 (default) for the REMOTE bit to work properly.
9	JOG REV	Set to 1 to jog the motor in reverse. This signal needs to be used in conjunction with the ENABLE bit. This signal is overridden by a RUN/RUN REV/RUN FWD command.
10	Reserved	-
11	Reserved	-
12	TRIP	Set to 1 to trip the drive at any time. The trip display on drive will be "CL.bit" and the trip code will be 35. AUTO (b7) has no effect on this function. The trip cannot be cleared until TRIP is reset to 0.
13	RESET	A 0-1 transition of the RESET bit will reset the drive from a trip condition. If the reason for the trip is still present, or another fault condition has been detected, the drive will immediately trip again. When resetting the drive, it is recommended to check the status word to ensure that the reset was successful, before attempting to re-start the drive.
14	KEYPAD WDOG	This watchdog is provided for an external keypad or other devices where a break in the communication link must be detected. The watchdog system can be enabled and/or serviced if this bit is changed from zero to one while the control word enabled. Once the watchdog is enabled it must be serviced at least once every second or an "SCL" trip will occur. The watchdog is disabled when an "SLC" trip occurs, and so it must be re-enabled when the trip is reset.
15	Reserved	

## 7.3 Status word

The SM-DeviceNet status word consists of 16 control bits some of which are reserved. See the table below for the individual bit function descriptions.

<b>b15</b>	<b>b14</b>	<b>b13</b>	<b>b12</b>	<b>b11</b>	<b>b10</b>	<b>b9</b>	<b>b8</b>
Not Used	Mains Loss*	Direction Running	Direction Set	Brake Alarm	Brake Active	Regen	Current Limit
<b>b7</b>	<b>b6</b>	<b>b5</b>	<b>b4</b>	<b>b3</b>	<b>b2</b>	<b>b1</b>	<b>b0</b>
Load Reached	Above Set Speed	At Set Speed	Below Set Speed	Running At Speed	Zero Speed	Drive Active	Drive OK

\*Not Used on Mentor MP

The fieldbus status word is mapped directly from the drive status word, Pr **10.40**.

Pr **10.40**, is generated by the values of several individual drive status bits Table 7.3 shows the function indicated by each bit in the status word when set to 1.

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**Table 7.3 Drive status word bit functions**

Bit	Function	Parameter	Description
0	<b>Drive OK</b>	Pr 10.01	Indicates the drive is not in the trip state.
1	<b>Drive active</b>	Pr 10.02	Indicates that the output stage of the drive is active.
2	<b>Zero speed</b>	Pr 10.03	In Open Loop mode, zero speed indicates that the absolute value of the post-ramp speed reference is at or below the zero speed threshold. <i>Unidrive SP only</i> - In Closed Loop and Servo modes, zero speed indicates that the absolute value of speed feedback is at or below the zero speed threshold.
3	<b>Running at or below minimum speed</b>	Pr 10.04	In bipolar mode (Pr 1.10 = 1) Pr 10.04 is the same as zero speed, Pr 10.03 (see above). In unipolar mode, Pr 10.04 is set if the absolute value of the post-ramp speed reference (Pr 2.01) or speed feedback (Pr 3.02) is at or below minimum speed + 0.5Hz or 5rpm (minimum speed is defined by Pr 1.07). This parameter is only set if the drive is running.
4	<b>Below set speed</b>	Pr 10.05	Only set if the drive is running at below set speed. Refer to Pr 3.06, Pr 3.07 and Pr 3.09 in the drive <i>User Guide</i> for more details.
5	<b>At speed</b>	Pr 10.06	Only set if the drive is running at set speed. Refer to Pr 3.06, Pr 3.07 and Pr 3.09 in the drive <i>User Guide</i> .
6	<b>Above set speed</b>	Pr 10.07	Only set if the drive is running at above set speed. Refer to Pr 3.06, Pr 3.07 and Pr 3.09 in the drive <i>User Guide</i> for more details.
7	<b>Load reached</b>	Pr 10.08	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 drive <i>Advanced User Guide</i> for more details.
8	<b>In current limit</b>	Pr 10.09	Indicates that the current limits are active.
9	<b>Regenerating</b>	Pr 10.10	Unidrive SP Only: regenerating indicates that power is being transferred from the motor to the drive. In regen mode, regenerating indicates that power is being transferred from the Unidrive SP to the supply.
10	<b>Dynamic brake active</b>	Pr 10.11	Indicates that the braking IGBT is active. If the IGBT becomes active, this parameter will remain on for at least one second.
11	<b>Dynamic brake alarm</b>	Pr 10.12	Dynamic brake alarm is set when the braking IGBT is active, and the braking energy accumulator is greater than 75%.
12	<b>Direction commanded</b>	Pr 10.13	Direction commanded is set to 1 if the Pre-ramp speed reference (Pr 1.03) is negative and reset to 0 if the Pre-ramp speed reference is zero or positive.
13	<b>Direction running</b>	Pr 10.14	A 0 indicates forward direction and a 1 indicates reverse direction. The source of this bit is Pr 2.01 for open loop mode and Pr 3.02 for closed loop and servo modes.
14	<b>Mains loss</b>	Pr 10.15*	Mains loss indicates that the drive has detected a mains loss from the level of the DC bus voltage. This parameter can only become active if mains loss ride through or mains loss stop modes are selected. Refer to Pr 6.03 in the drive <i>Advanced User Guide</i> for more details. <i>Unidrive SP only</i> - In regen mode, mains loss is the inverse of Pr 3.07. Refer to the <i>Unidrive SP Advanced User Guide</i> for more details.
15		Not Used	Reserved.

\* Not Used on Mentor MP

# 8 Non cyclic data

## 8.1 Introduction

“Explicit data” is the non cyclic data channel on DeviceNet that provides access to any parameter and DeviceNet object within SM-DeviceNet. As such it is always enabled and active on SM-DeviceNet. 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 mapping is defined.

CT Mode Single Word non-cyclic data is also available on SM-DeviceNet. This method uses an additional polled data word to implement the Single Word protocol to access any drive parameter.

PPO 4 Word non-cyclic data is also available on SM-DeviceNet. This method uses 4 polled data words to access any drive parameter.

**NOTE** 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.

The SM-DeviceNet provides several data formats that allow CT Mode Single Word or PPO 4 Word modes to be used.

**Table 8.1 SM-DeviceNet non-cyclic data modes**

Non-cyclic mode	Format	Pr 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 (Pr **1.21**) has units of Hertz, accurate to 1 decimal place. To write a value of 24.6Hz to Pr **1.21**, the value must be transmitted as 246.

## 8.2 Explicit parameter access

The Control Techniques object (Class 100 or 0x64) provides access to all drive 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. Refer to the master controller documentation for full details about explicit messaging, and how to implement explicit messaging within the particular master controller.

**NOTE** Menu 0 parameters in the drive can be access using instance 200 (0xC8).

When accessing drive parameters using the Control Techniques object, all parameters must be treated as signed 32-bit parameters.

**NOTE** Multiple parameter access (using the Get\_Attribute\_All service) is not supported by SM-DeviceNet.

## 8.3 Mode 1 - CT single word mode

The CT single word (Mode 1) uses one cyclic channel for non-cyclic data. The non-cyclic sub-protocol requires a specific sequence of 4 or 6 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.

**NOTE** If cyclic data compression is disabled, the CT single word non-cyclic channel will be 32 bits wide (i.e. uses 2 words, and data must be transferred on the low word). If cyclic data compression is enabled the CT single word non-cyclic channel will revert to 16 bits and only use 1 word.

### 8.3.1 Mapping For CT Single Word non-cyclic data

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

1. Set Pr **MM.05** to the required mode, 1PP, where PP is the number of cyclic words required.
2. Set Pr **MM.32** to On (1) to reset and reconfigure the SM-DeviceNet.

When the SM-DeviceNet re-initialises, it will map cyclic data IN Word 0 and OUT Word 0 to the CT single word protocol parameter (Pr **61.50**). All existing mapping parameters will be moved down by 1 word, (i.e. the previous mapping set in Pr **17.10** and Pr **17.20** will now appear in Pr **17.11** and Pr **17.21**). The table below shows what happens to the mappings when the data format is changed from 4 cyclic words to 4 cyclic words with CT single word non-cyclic data.

**Table 8.2 CT Single Word non-cyclic data mapping**

Mapping parameter	Before format change (Pr MM.05 = 5)		After format change (Pr MM.05 = 105)	
	Value	Mapping	Value	Mapping
Pr <b>MM.10</b>	1040	Pr <b>10.40</b> , status word	6150	Pr <b>61.50</b> , CT single word
Pr <b>MM.11</b>	201	Pr <b>2.01</b> , post ramp speed ref	1040	Pr <b>10.40</b> , status word
Pr <b>MM.12</b>	0	Not mapped	201	Pr <b>2.01</b> , post ramp speed ref
Pr <b>MM.13</b> to Pr <b>MM.19</b>	0	Not mapped	0	Not mapped
Pr <b>MM.20</b>	642	Pr <b>6.42</b> , control word	6150	Pr <b>61.50</b> , CT single word
Pr <b>MM.21</b>	121	Pr <b>1.21</b> , digital speed ref 1	642	Pr <b>6.42</b> , control word
Pr <b>MM.22</b>	0	Not mapped	121	Pr <b>1.21</b> , digital speed ref 1
Pr <b>MM.23</b> to Pr <b>MM.29</b>	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.



### 8.3.2 CT single word protocol

All parameter values must be written as signed 32-bit data values. Decimal point information is inserted automatically when the data value is written to the drive 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.

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

<b>b7</b>	<b>b6</b>	<b>b5</b>	<b>b4</b>	<b>b3</b>	<b>b2</b>	<b>b1</b>	<b>b0</b>
Data Byte							

**Table 8.3 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, parameter or 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 drive. If 32-BIT is set, telegrams 5 and 6 will be used to transfer the additional data bytes.
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. This bit will also be set if the parameter value is out of range in 16-bit mode.
15	READ	0 = Write 1 = Read	Defines whether the data word is part of a READ or WRITE cycle.

### 8.3.3 16-bit parameter access

16-bit data can be used to access parameters within the drive using only 4 telegrams. If an attempt is made to read a 32-bit parameter from the drive, the parameter value will be returned, provided that the parameter value does not exceed signed 16-bit limits. If the value is larger than a signed 16-bit value, the ERR bit will be set.

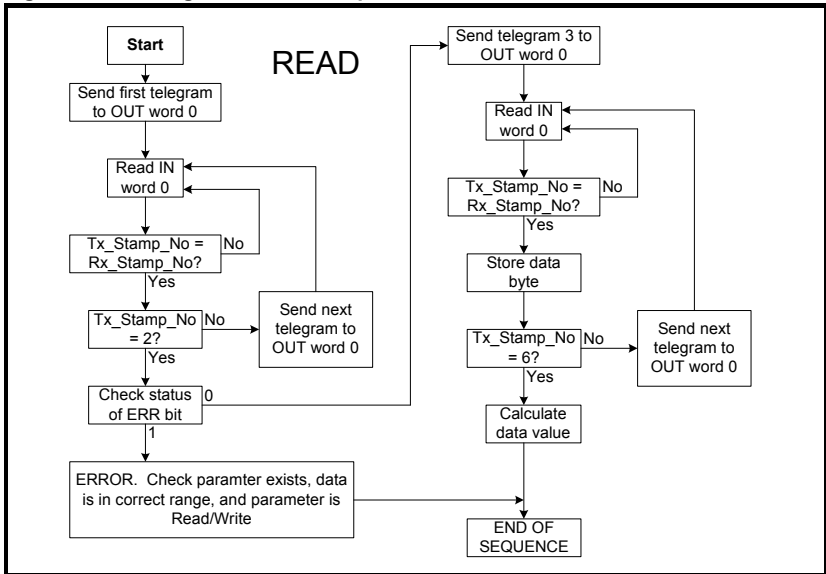
When writing data to a 32-bit parameter, the 16-bit data will be treated as a signed 16-bit data value. This limits the range that can be written to a 32-bit parameter.

### 8.3.4 Reading parameters using CT single word

To read 32-bit 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 8-1 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 Pr **2.01** in the drive.

#### 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, the second telegram can now 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 be 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 now 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	0000	0001

*Data word = 0xD201*

*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*

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## 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 mid 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 mid high byte = 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 = 0x9525*

*Stamp number = 5*

*Data mid low byte = 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 = 220

The final value is determined as follows:

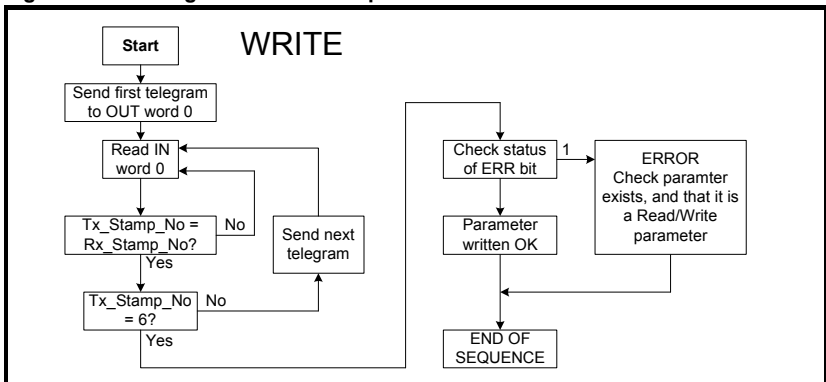
$$\begin{aligned}
 \text{Speed} &= (\text{High byte} * 2^{24}) + (\text{Mid-high byte} * 2^{16}) + (\text{Mid-low byte} * 2^8) + \text{Low byte} \\
 &= (0 * 16777216) + (1 * 65536) + (37 * 256) + 220 \\
 &= 75228 \\
 &= 7522.8 \text{ rpm}
 \end{aligned}$$

### 8.3.5 Writing parameters using CT Single Word

To write to a 32-bit parameter 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 8-2 CT Single Word write sequence



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

### 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.

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## 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 (Pr 1.21 = 12553.9) as transmitted (the decimal point is automatically inserted when the data is transferred to the drive). 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	0110	0011

*Data word = 0x5663*

*Stamp number = 6*

### 8.3.6 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 abandoned by resetting the state machine. This is done by 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*



## 8.4 Mode 2 - PPO 4 Word mode

The PPO 4 Word Format (mode 2) of non-cyclic data uses 4 cyclic data words for non-cyclic data. This allows any drive parameter to be accessed using a single combination of data words.

### 8.4.1 Mapping for PPO 4 Word non-cyclic data

To configure an SM-DeviceNet for PPO 4 word mode non-cyclic data, the following steps must be performed:

1. Set Pr **MM.05** to the required mode, 2PP where PP indicates the number of cyclic words required.
2. Set Pr **MM.32** to On (1) to reset and reconfigure the SM-DeviceNet.

When the SM-DeviceNet re-initialises, it will map IN words 0 to 3 and OUT words 0 to 3 to the PPO 4 Word protocol parameter, Pr **61.51**. All existing mapping parameters will be moved down by 1 channel, i.e. the previous mappings set in Pr **MM.10** and Pr **MM.20** will now appear in Pr **MM.11** and Pr **MM.21** respectively. The table below shows what happens to the mappings when the data format is changed from 10 cyclic words (Pr **MM.05** = 10) to 10 cyclic words with Mode 2 non-cyclic data (Pr **MM.05** = 210).

**Table 8.4 PPO 4 Word mode data mapping**

Mapping parameter	Before format change (Pr 17.05 = 10)		After format change (Pr 17.05 = 210)	
	Value	Mapping	Value	Mapping
Pr 17.10	1040	Pr 10.40, status word	6151	Pr 61.51, PPO 4 Word
Pr 17.11	201	Pr 2.01, post ramp speed ref	1040	Pr 10.40, status word
Pr 17.12	0	Not mapped	201	Pr 2.01, post ramp speed ref
Pr 17.13 to Pr 17.19	0	Not mapped	0	Not mapped
Pr 17.20	642	Pr 6.42, control word	6151	Pr 61.51, PPO 4 Word
Pr 17.21	121	Pr 1.21, digital speed ref 1	642	Pr 6.42, control word
Pr 17.22	0	Not mapped	121	Pr 1.21, digital speed ref 1
Pr 17.24 to Pr 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.

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## 8.4.2 PPO 4 word protocol

Decimal point information is inserted automatically when the data value is written to the drive 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.

The table below shows the data structure required on the OUT data to implement PPO 4 Word request.

**Table 8.5 PPO 4 word OUT data structure**

OUT data word	Function			
	b15-b12	b11	b10-b8	b7-b0
OUT word 0	TASK ID	0	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 RESPONSE ID. The TASK ID specifies the transaction required and the remainder of the data words carry the data for the transaction. The table below lists the possible TASK ID codes.

**Table 8.6 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 the drive. 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 the drive. 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 drive parameters, but the range of values is limited to 16 bits.
8	Change parameter value (32 bit)	Write 32-bit parameter value to the drive. Specify MENU, PARAMETER, DATA HIGH word and DATA LOW word. This function can also be used to write to 16-bit drive 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).

The table below shows the data structure of a PPO 4 Word response that will be returned by SM-DeviceNet.

**Table 8.7 PPO 4 word IN data structure**

IN data word	Function			
	b15-b12	b11	b10-b8	b7-b0
IN word 0	RESPONSE ID	0		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. The table below lists the possible RESPONSE ID codes.

**Table 8.8 RESPONSE ID codes**

RESPONSE ID	Function	Description
0	No task	No non-cyclic transaction active
1	Fieldbus specific	
2	Fieldbus specific	
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 9.
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.
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.

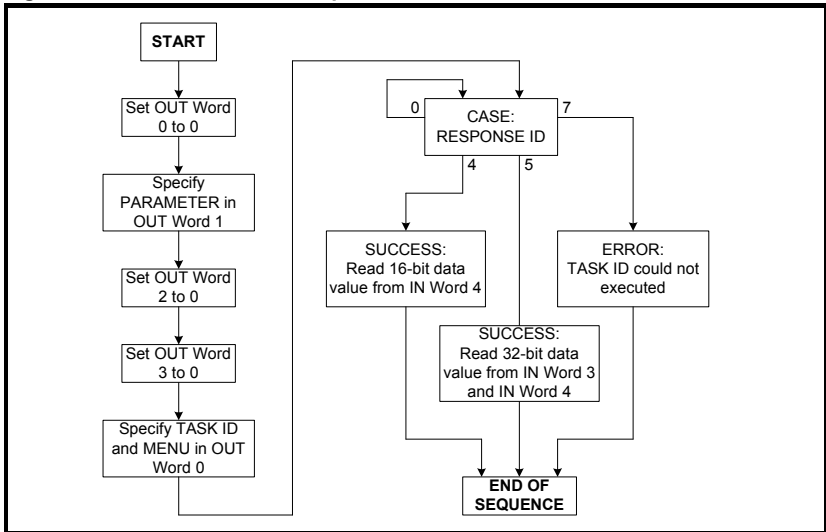
**Table 8.9 PPO 4 word error codes**

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 / menu	The specified parameter does not exist.
18	Parameter error	No last parameter information available.

### 8.4.3 Reading parameters using PPO 4 word mode

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

**Figure 8-3 PPO 4 word Read sequence**



The table below shows the possible TASK ID and RESPONSE ID combinations that may be seen when attempting to read a parameter value from a drive.

**Table 8.10 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.

The table below shows an example set of data words for PPO 4 Word mode. This example will read the value in the post ramp speed reference (Pr 2.01) in the drive.

**Table 8.11 PPO 4 Word Read Request example**

OUT data word	Hex value	Function			
		b15-b12	b11	b10-b8	b7-b0
OUT word 0	0x6002	TASK ID = 6	0	MENU = 2	
OUT word 1	0x0001	PARAMETER = 1		0	
OUT word 2	0x0000	DATA HIGH word = 0			
OUT word 3	0x0000	DATA LOW word = 0			

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

**Table 8.12 PPO 4 Word Read Response example**

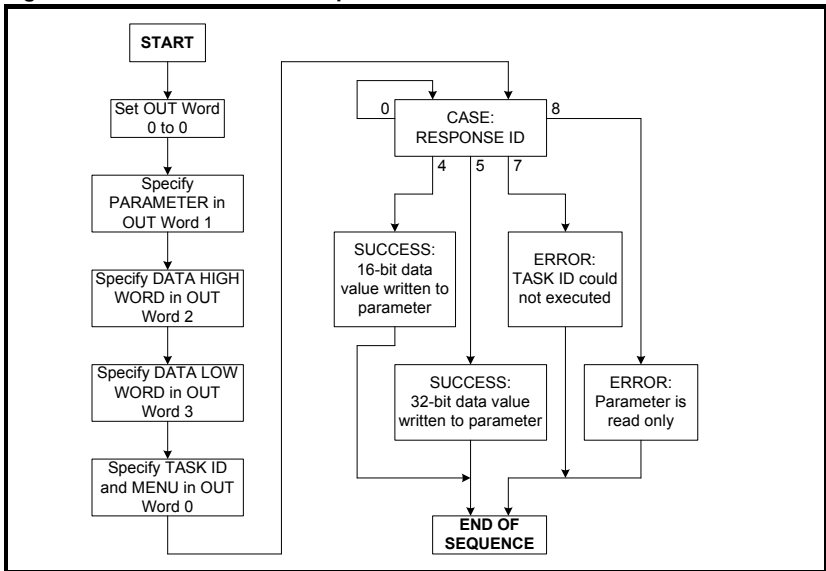
IN data word	Hex value	Function			
		b15-b12	b11	b10-b8	b7-b0
IN word 0	0x5002	RESPONSE ID = 5	0	MENU = 2	
IN word 1	0x0001	PARAMETER = 1		0	
IN word 2	0x0000	DATA HIGH word = 0			
IN word 3	0x3BB4	DATA LOW word = 15284			

**NOTE** If the OUT data words 0 and 1 are left at the same value, the target parameter will be written to whenever the data value in OUT word 2 or 3 is changed.

### 8.4.4 Writing parameters using PPO 4 Word mode

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

**Figure 8-4 PPO 4 Word Write sequence**



The table below shows the possible TASK ID and RESPONSE ID combinations that may be seen when attempting to write to the drive.

**Table 8.13 PPO 4 Word Write TASK ID and RESPONSE ID combinations**

Function	TASK ID	RESPONSE ID	Message status
No Task	0	0	No message active.
Write Parameter Value (16-bit)	7	4	Parameter (16-bit) written successfully.
Write Parameter Value (32-bit)	8	5	Parameter (32-bit) written successfully.
Write 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.
Write 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.
Write Parameter Value (32-bit)	8	8	Parameter is read only, and cannot be written to.

The table below 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 (Pr 1.21) to the drive.

**Table 8.14 PPO 4 Word Write Request example**

OUT data word	Hex value	Function			
		b15-b12	b11	b10-b8	b7-b0
OUT word 0	0x8001	TASK ID = 8	0	MENU = 1	
OUT word 1	0x0015	PARAMETER = 21		0	
OUT word 2	0x0001	DATA HIGH word = 0			
OUT word 3	0x3CB3	DATA LOW word = 15539			

The table below shows an example successful write response to the write instruction illustrated above.

**Table 8.15 PPO 4 Word Write Response example**

IN data word	Hex value	Function			
		b15-b12	b11	b10-b8	b7-b0
IN word 0	0x5001	RESPONSE ID = 5	0	MENU = 1	
IN word 1	0x0015	PARAMETER = 21		0	
IN word 2	0x0000	DATA HIGH word = 0			
IN word 3	0x3CB3	DATA LOW word = 15539			

**NOTE**

If the OUT data words 0 and 1 are left at the same value, the target parameter will be read and the data value in OUT words 2 and 3 updated continuously.

## 8.5 SM-DeviceNet set-up using non-cyclic data

The SM-DeviceNet 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 is located can be accessed as Pr 60.PP.

Changes made to the configuration parameters will not take effect until the SM-DeviceNet has been reset. The SM-DeviceNet can be reset by writing a value of 1 to Pr 60.32. A brief interruption in DeviceNet communications may be seen while the reset sequence is in progress.

# 9 EDS Files

## 9.1 What are EDS files?

EDS (Electronic Data Sheets) files are text files that are used by SM-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 SM-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.

## 9.2 Generic EDS files

Generic EDS files are available for all supported drives. These files are available from your local Control Techniques Drive Centre or supplier.

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

## 9.3 Advanced EDS files

These files are available from your local Control Techniques Drive Centre.

## 9.4 EDS file revisions

Consult your supplier for the latest EDS files and revision information.

## 9.5 Selecting generic or advanced EDS files

Advanced EDS File Enable		
Pr MM.36	Default	OFF (0)
	Range	OFF (0) or On (1)
	Access	RW

SM-DeviceNet configuration tools use the VendorID, ProductType, ProductCode and MajorRevision attributes of the Identity Object ( ) to match a SM-DeviceNet node to the correct EDS file.

Generic files allow a basic file to be used for a drive, irrespective of any minor software updates and the arrangement of options, if any are installed. The down side is that they only provide access to a limited number of parameters that are always available in a particular mode of configuration, e.g. open loop mode.

Advanced EDS files are generated for a specific configuration of drive, and if a node changes it may no longer match the configuration in the master. However, advanced EDS files provide access to all parameters available in the node, including parameters in options installed in other slots in the drive.

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# 10 Diagnostics

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

## 10.1 SM-DeviceNet Module ID code

SM-DeviceNet Module ID code		
Pr MM.01	Default	407
	Range	407
	Access	RO

The module ID code indicates the type of Solutions Module that is installed in the corresponding slot.

## 10.2 SM-DeviceNet firmware version

SM-DeviceNet firmware - major version		
Pr MM.02	Default	N/A
	Range	00.00 to 99.99
	Access	RO

SM-DeviceNet firmware - minor version		
Pr MM.51	Default	N/A
	Range	0 to 99
	Access	RO

### Unidrive SP (sizes 1 to 6) / Unidrive SPM / Mentor PM

The software version of the Solutions Modules can be identified by looking at Pr **15.02** or Pr **16.02** or Pr **17.02** and Pr **15.51** or Pr **16.51** or Pr **17.51**. Menu 15,16 or 17 is Solutions Module slot dependent with menu 17 being the lowest position nearest the control terminal connections.

The software version takes the form of xx.yy.zz, where Pr **15.02** or Pr **16.02** or Pr **17.02** displays xx.yy and Pr **15.51** or Pr **16.51** or Pr **17.51** displays zz (e.g. for software version 01.01.00 on a module in the middle Solutions Module slot, Pr **16.02** will display 1.01 and Pr **16.51** will display 0).

### Unidrive SP (size 0) / Digitax ST / Unidrive ES / Affinity

The software version of the Solutions Modules can be identified by looking at Pr **15.02** or Pr **16.02** and Pr **15.51** or Pr **16.51**.

Menu 15 or 16 is Solutions Module slot dependent with menu 15 (Unidrive SP size 0 and Digitax ST) or menu 16 (Unidrive ES and Affinity) being the position nearest the control terminal connections.

The software version takes the form of xx.yy.zz, where Pr **15.02** or Pr **16.02** displays xx.yy and Pr **15.51** or Pr **16.51** displays zz (e.g. for software version 01.01.00 on a module in the middle Solutions Module slot (Unidrive ES and Affinity) or for Unidrive SP size 0 and Digitax ST, the Solutions Module slot nearest the incoming supply terminals), Pr **16.02** will display 1.01 and Pr **16.51** will display 0).

### Commander SK (sizes B to D and 2 to 6)

The software version of the Solutions Module can be identified by looking at Pr **15.02** and Pr **15.51**.



The software version takes the form of xx.yy.zz, where Pr **15.02** displays xx.yy and Pr **15.51** displays zz (e.g. for software version 01.01.00 Pr **15.02** will display 1.01 and Pr **15.51** will display 0).

The full version of the SM-DeviceNet firmware can be read for the corresponding slot. Table 10.1 shows how to construct the full firmware version from these values.

**Table 10.1 SM-DeviceNet firmware version example**

Major version	Minor version	Firmware version
1.01	5	V1.01.05

## 10.3 SM-DeviceNet MAC-ID

SM-DeviceNet MAC-ID		
Pr <b>MM.03</b>	Default	63
	Range	0 to 63
	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.

A protection mechanism called Duplicate MAC-ID check. Prevents 2 nodes with same MAC-ID from communicating on network. If another node blocks a node from joining, it will trip SLx.Er, with error code 66 and operating status -3.

## 10.4 SM-DeviceNet data rate

SM-DeviceNet data rate		
Pr <b>MM.04</b>	Default	0
	Range	-1 to 2
	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 DeviceNet network. Ideally, every node should be configured to operate at the same data rate BEFORE it is connected to the DeviceNet network.

**Table 10.2 SM-DeviceNet data rates**

Pr <b>MM.04</b>	bits/s	Pr <b>MM.04</b>	bits/s
-1	Auto	1	250K
0	125K	2	500K

The SM-DeviceNet can automatically detect the network data rate by setting Pr **MM.04** to -1. The SM-DeviceNet will monitor the DeviceNet network, and if the data rate is detected, it will set Pr **MM.04** to the indicate the detected data rate. The recommended sequence of events using auto-detection of the data rate as follows:

1. Power up the drive.
2. Set Pr **MM.04** to -1

3. Reset the SM-DeviceNet by setting Pr **MM.32** to On (1).
4. Connect the SM-DeviceNet to the DeviceNet network.
5. Wait for Pr **MM.04** to change from -1.
6. Save the drive parameters as described in section 5.8.1 on page 29.

**NOTE**

The SM-DeviceNet may have problems detecting the network data rate if there is little traffic on the DeviceNet network (e.g. on a new network where all nodes are in auto detect mode).

## 10.5 SM-DeviceNet operating status

SM-DeviceNet operating status		
Pr <b>MM.06</b>	Default	N/A
	Range	-10 to 9999
	Access	RO

The operating status of the SM-DeviceNet module is displayed in parameter, Pr **MM.06**. When the SM-DeviceNet 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.

Errors are indicated by negative values in Pr **MM.06**, see Table 10.3 for a complete list of operating status codes.

**Table 10.3 SM-DeviceNet operating status codes**

#MM.06	Parameter	Description
>0	Network OK	Indicates the number of successful network cycles per second.
0	Network OK, no data transfer	Indicates that the DeviceNet master has established communications with the SM-DeviceNet, but there is currently no data transfer in progress.
-1	Initialised	Indicates that the SM-DeviceNet has initialised correctly, and is waiting for the DeviceNet master to initialise communications.
-2	Internal hardware failure	Indicates that part of the SM-DeviceNet initialisation sequence was not successful. If this fault persists after a power cycle, replace the SM-DeviceNet.
-3	Configuration error	Indicates that there is an invalid setting in the SM-DeviceNet configuration parameters.
-4	Unrecoverable software error	An internal software error has occurred. Reset the SM-DeviceNet to clear, if error persists, replace the SM-DeviceNet
-8	Data rate detection in progress	The SM-DeviceNet is currently attempting to detect the DeviceNet network data rate.
-10	External power supply error	Indicates that the external DeviceNet +24V power supply is missing. The SM-DeviceNet will not communicate unless the DeviceNet power supply is present and correct.

## 10.6 SM-DeviceNet mapping status

SM-DeviceNet mapping status		
Pr <b>MM.49</b>	Default	0
	Range	0 to 255
	Access	RO

If the SM-DeviceNet operating status parameter (Pr **MM.06**) indicates -3, a mapping configuration error has been detected. The reason for the error is indicated by the SM-DeviceNet mapping status parameter, Pr **MM.49**. When a mapping error has been corrected, reset the SM-DeviceNet by setting Pr **MM.32** to On (1).

**Table 10.4 Generic mapping error codes**

Error	Mapping status	Description
No error detected	0	No error detected with IN or OUT cyclic 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 in Pr <b>MM.05</b> .
Invalid mode value	5	The value entered in Pr <b>MM.05</b> is not supported.
Multiple non-cyclic mapping error	104	A non-cyclic data mode has been mapped more than once in the IN data mapping configuration parameters (Pr <b>MM.10</b> to Pr <b>MM.19</b> ).
Configuration read error	110	An error has occurred reading the IN cyclic data mapping configuration parameters (Pr <b>MM.10</b> to Pr <b>MM.19</b> ) from the drive.
Invalid source parameter	111	One or more parameters specified in the IN cyclic data mapping configuration (Pr <b>MM.10</b> to Pr <b>MM.19</b> ) is outside of the allowed range for DeviceNet. The allowable parameter range is from Pr <b>0.00</b> to Pr <b>199.99</b> .
Read mismatch	112	One or more parameters specified in the IN cyclic data mapping configuration (Pr <b>MM.10</b> to Pr <b>MM.19</b> ) cannot be used as a source parameter for IN data. The parameter may not exist.
Hole in IN data mapping configuration	113	IN cyclic data mapping parameters (Pr <b>MM.10</b> to Pr <b>MM.19</b> ) are not contiguous. It is not possible have an un-used parameter in the middle of the cyclic data.
Inter-option communications error	115	A request to set up an inter-option communications block failed. Either the server does not support block transfer or parameters were not legal.
Too many IN data objects mapped	120	After expanding ranges of block mappings, too many IN cyclic data channels configured.
Mapping over length	121	Total size of all IN cyclic data mappings has exceeded the total size of the cyclic data.
Register mode objects exceeded	122	More than 10 cyclic IN data channels have been selected with direct data mapping mode.
Multiple non-cyclic mapping error	204	A non-cyclic data mode has been mapped more than once in the OUT cyclic data mapping configuration parameters (Pr <b>MM.20</b> to Pr <b>MM.29</b> )
Configuration read error	210	An error has occurred reading the OUT cyclic data mapping configuration parameters (Pr <b>MM.20</b> to Pr <b>MM.29</b> ) from the drive.

**Table 10.4 Generic mapping error codes**

Error	Mapping status	Description
Invalid destination parameter	211	One or more parameters specified in the OUT cyclic data mapping configuration (Pr <b>MM.20</b> to Pr <b>MM.29</b> ) is outside of the allowed range for SM-DeviceNet. The allowable parameter range is from Pr <b>0.00</b> to Pr <b>199.99</b> .
Write mismatch	212	One or more parameters specified in the OUT cyclic data mapping configuration (Pr <b>MM.20</b> to Pr <b>MM.29</b> ) 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 is configured in register mode, i.e. Pr <b>MM.09</b> = On (1).
Hole in OUT data mapping configuration	213	OUT data mapping parameters (Pr <b>MM.20</b> to Pr <b>MM.29</b> ) are not contiguous. It is not possible have an un-used parameter in the middle of the cyclic data.
Duplicate mapping error	214	Two or more OUT cyclic data mapping configuration parameters (Pr <b>MM.20</b> to Pr <b>MM.29</b> ) have been configured with the same destination parameter reference.
Inter-option communications error	215	A request to set up an inter-option communications block failed. Either the server does not support block transfer or parameters were not legal.
Too many OUT data objects mapped	220	After expanding ranges of block mappings, too many OUT cyclic data channels configured.
Mapping over length	221	Total size of all OUT cyclic data mappings has exceeded the total size of the cyclic data.
Register mode objects exceeded	222	More than 10 cyclic OUT data channels have been selected with direct data mapping mode.

There are some additional error codes that are specific to the SM-DeviceNet. These are listed in Table 10.5.

**Table 10.5 SM-DeviceNet 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	131	An invalid input assembly object has been specified.
Invalid Output Assembly Object	231	An invalid output assembly object has been specified.
Assembly Objects Incompatible	32	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.

## 10.7 SM-DeviceNet error codes

SM-DeviceNet error code		
Pr <b>MM.50</b>	Default	N/A
	Range	0 to 255
	Access	RO

If the SM-DeviceNet detects an error during operation, it will force a trip drive trip, and update the SM-DeviceNet error code parameter, Pr **MM.49**. Table 10.6 shows the SM-DeviceNet error codes.

**Table 10.6 SM-DeviceNet error codes**

Error code	Fault	Description
0	No error detected	Indicates that the trip was not caused by the SM-DeviceNet. It is possible to trip the drive externally via various communication channels.
52	User control word trip	The TRIP bit has been set in the drive control word.
61	Configuration error	An invalid configuration has been detected. Refer to mapping status parameter (Pr <b>MM.49</b> ) for the configuration error code.
64	Expected packet rate timeout	The expected packet rate (EPR) is a time-out mechanism built in to the DeviceNet specification. If the timeout occurs and Pr <b>MM.37</b> is set to "On (1)", the SM-DeviceNet will trip the drive with error code 64.
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. This error can be caused by incorrect network wiring, wrong data rate configured, or a duplicate MAC_ID has been set.
70	FLASH transfer error	The SM-DeviceNet module was unable to upload the configuration parameters from its FLASH memory to the drive.
74	SM-DeviceNet overtemperature	If the temperature inside the SM-DeviceNet exceeds 82 <sup>o</sup> C, it will trip the drive with error code 74.
80	Inter-option communication error	Communications time-out has occurred, but SM-DeviceNet is unable to determine the reason for the error.
81	Communication error to slot 1	Direct communications between the SM-DeviceNet and an SM-Applications in another slot has timed out. This can occur when the SM-DeviceNet has been mapped to directly read or write <u>P</u> , <u>Q</u> , <u>T</u> or <u>U</u> registers in an Applications Module/ Motion Processor, and the Applications Module/Motion Processor has been reset.
82	Communication error to slot 2	
83	Communication error to slot 3	
98	Internal watchdog error	Internal error. Cycle power to the drive to reset from this trip.
99	Internal software error	If trip persists, replace the SM-DeviceNet.

# 11 Advanced Features

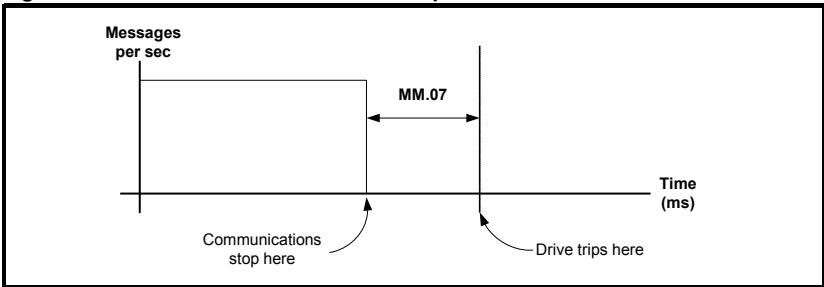
## 11.1 SM-DeviceNet network loss trip

SM-DeviceNet network loss trip timeout		
Pr MM.07	Default	200
	Range	0 to 3000
	Access	RW

SM-DeviceNet resets an internal timer when a valid message is received from the DeviceNet network. The network loss trip is triggered when no new messages are received before the timer times out. The SM-DeviceNet error code parameter (Pr **MM.50**) will show 65 when a network loss trip has occurred.

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

**Figure 11-1 SM-DeviceNet network loss trip**



As the trip delay time is reduced, the network loss trip will occur more quickly in the event of a loss of network. 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.

**NOTE** The network loss trip can be disabled by setting Pr **MM.07** to 0. In this case, the drive will continue to operate using the last received values. It is the user's responsibility to ensure that adequate safety precautions are taken to prevent damage or injury by disabling the drive in the event of a loss of communications.

## 11.2 SM-DeviceNet Expected Packet Rate timeout trip

SM-DeviceNet EPR timeout trip enable		
Pr MM.37	Default	OFF (0)
	Range	OFF (0) or On (1)
	Access	RW

The DeviceNet specification has a built-in mechanism for slave devices to determine when the connection to the master controller has been lost. The time delay before the loss of connection is indicated is the "Expected Packet Rate" or "EPR", and is specified in the configuration of the master controller.

When the DeviceNet EPR timeout trip is enabled, the SM-DeviceNet will trip the drive with error code 64 when the EPR timeout occurs. This is an alternative network loss trip mechanism to the Network Loss Trip described in status word.

## 11.3 SM-DeviceNet Bus Off trip disable

SM-DeviceNet Bus Off trip disable		
Pr MM.41	Default	0
	Range	0 or 1
	Access	RW

The CAN hardware layer used by DeviceNet has a built-in safety mechanism where nodes experiencing regular problem with receiving or transmitting CAN frames will go off line. In this case, the SM-DeviceNet will trip the drive with error code 66, and it will not be possible to communicate with the drive via DeviceNet until the SM-DeviceNet has been reset.

Bus Off errors will generally only occur if the DeviceNet network is broken, the wiring becomes faulty or there is noise on the network. However, in some applications, such as a continuous casting process, there is a requirement for the drive to continue to run in the event of a major network failure.

When Pr **MM.41** is set to 1, the BUS OFF condition may still be entered, but the SM-DeviceNet does not trip the drive. Some external provision must be made to disable the drive when the process has reached a point at which it is safe to stop.

## 11.4 SM-DeviceNet data endian format

SM-DeviceNet data endian format		
Pr MM.08	Default	On
	Range	N/A
	Access	RO

Some parameters are 32-bit double word parameters, while other drive 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".

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**Table 11.1 Data endian format**

Data endian format	Pr 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, Pr 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 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.

## 11.5 Unidrive SP: Menu 60 - Local Solutions parameter access

The menu used to configure the SM-DeviceNet depends on the slot in the drive where the SM-DeviceNet is installed. Menu 60 can be used to ensure that the DeviceNet configuration parameters can be accessed without necessarily knowing in which drive slot the SM-DeviceNet is installed.

When a Menu 60 parameter is accessed from DeviceNet, the SM-DeviceNet will re-direct it to the menu in the drive that is associated with the slot where the SM-DeviceNet is installed.

**Table 11.2 Local slot configuration parameter access**

Parameter	SM-DeviceNet in slot 1	SM-DeviceNet in slot 2	SM-DeviceNet in slot 3
Pr 60.01 - Pr 60.51	Pr 15.01 - Pr 15.51	Pr 16.01 - Pr 16.51	Pr 17.01 - Pr 17.51

Menu 60 parameters are only accessible from the DeviceNet network using non-cyclic data access methods.

## 11.6 Menu 61- Fieldbus Virtual Menu

Additional parameters have been added to allow easy access to additional functions.

Mapping parameter	Description
Pr 61.01	Parameter 1.00 shortcut
Pr 61.20	Course and turns position feedback
Pr 61.21	Fine and turns position feedback
Pr 61.35	Serial number
Pr 61.40	SM-Applications Event task trigger lowest slot
Pr 61.41	SM-Applications Event task trigger slot1
Pr 61.42	SM-Applications Event task trigger slot 2
Pr 61.43	SM-Applications Event task trigger slot 3
Pr 61.50	CT Non-cyclic single word
Pr 61.51	CT Non-cyclic PPO 4 word mode

## 11.7 Mapping To SM-Applications parameters

This section is applicable to Unidrive SP, or drives which support SM-Applications - DST or Mentor MP. The SM-DeviceNet reads and writes data directly to and from internal registers in an Applications Module or Motion Processor. 6 sets of 32-bit registers are accessible in the Applications Module or Motion Processor, and block mapping to these registers is supported. Each register in the Applications Module or Motion Processor can be accessed as a virtual parameter.



The SM-DeviceNet can be configured to read data from and write data to an Applications Module or Motion Processor installed in any slot in the drive simply by specifying the target parameter as shown in Table 11.3.

**Table 11.3 Applications Module or Motion Processor parameters**

Applications Module or Motion Processor parameters	Parameter reference	Direct to slot 1	Direct to slot 2	Direct to slot 3
_Pxx% PLC Registers	Pr 70.xx	Pr 100.xx	Pr 130.xx	Pr 160.xx
_Qxx% PLC Registers	Pr 71.xx	Pr 101.xx	Pr 131.xx	Pr 161.xx
_Rxx% PLC Registers	Pr 72.xx	Pr 102.xx	Pr 132.xx	Pr 162.xx
_Sxx% PLC Registers	Pr 73.xx	Pr 103.xx	Pr 133.xx	Pr 163.xx
_Txx% PLC Registers	Pr 74.xx	Pr 104.xx	Pr 134.xx	Pr 164.xx
_Uxx% PLC Registers	Pr 75.xx	Pr 105.xx	Pr 135.xx	Pr 165.xx
Local Configuration Parameters	Pr 81.xx	Pr 111.xx	Pr 141.xx	Pr 171.xx
Timer Function Parameters	Pr 85.xx	Pr 115.xx	Pr 145.xx	Pr 175.xx
Digital I/O Parameters	Pr 86.xx	Pr 116.xx	Pr 146.xx	Pr 176.xx
Status Parameters	Pr 88.xx	Pr 118.xx	Pr 148.xx	Pr 178.xx
General Parameters	Pr 90.xx	Pr 120.xx	Pr 150.xx	Pr 180.xx
Fast Access Parameters	Pr 91.xx	Pr 121.xx	Pr 151.xx	Pr 181.xx

If the SM-DeviceNet is configured to map data to Pr 70.xx to Pr 91.xx parameters data will be exchanged with the SM-Applications installed in the lowest slot number. This method is convenient to use if there is only one SM-Applications installed to the Unidrive SP as it guarantees that data will always be written to the SM-Applications even if it is moved to a different slot. If two SM-Applications are installed it is best to map directly to the required slot.

### 11.7.1 Single SM-Applications installed

Consider a Unidrive SP with the following configuration:

- Slot 1 - Vacant
- Slot 2 - SM-Applications.
- Slot 3 - SM-DeviceNet.

If a parameter read request comes over DeviceNet to read Pr 71.08, this will be re-directed to the SM-Applications in the lowest slot number, i.e. the SM-Applications in slot 2. The value in \_Q08% from slot 2 will be returned.

If a parameter read request comes over DeviceNet to read Pr 131.08, this will be sent straight to the SM-Applications in slot 2. The value in \_Q08% from slot 2 will be returned.

If a parameter read request comes over DeviceNet to read Pr 101.08, this will be sent straight to the SM-Applications in slot 1. As there is no SM-Applications installed in slot 1 an error message will be returned indicating that the parameter does not exist.

**NOTE**

If a single SM-Applications is installed to the Unidrive SP, normal SM-Applications parameter references can be used without problem, as the SM-DeviceNet will automatically divert them to the SM-Applications.

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## 11.7.2 Dual SM-Applications installed

Consider a Unidrive SP with the following configuration:

- Slot 1 - Applications Module or Motion Processor.
- Slot 2 - Applications Module or Motion Processor.
- Slot 3 - SM-DeviceNet.

If a parameter read request comes over DeviceNet to read Pr **71.08** this will be re-directed to the SM-Applications in the lowest slot number (i.e. the SM-Applications in slot 1). The value in `_Q08%` from slot 1 will be returned.

If a parameter read request comes over DeviceNet to read Pr **131.08** this will be sent straight to the SM-Applications in slot 2. The value in `_Q08%` from slot 2 will be returned.

If a parameter read request comes over DeviceNet to read Pr **101.08** this will be sent straight to the SM-Applications in slot 1. The value in `_Q08%` from slot 1 will be returned.

### NOTE

If dual SM-Applications are installed to the Unidrive SP it is best to access SM-Applications parameters using the direct slot parameter references. If normal SM-Applications parameter references are used and the SM-Applications is removed from slot 1 these parameter references will be re-directed to slot 2 instead.

## 11.8 Block mapping

The drive provides 10 mapping parameters each for IN data and OUT data. However, some Solutions Modules are 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 be used when mapping data to drive user parameters in Pr **18.PP**, Pr **19.PP** and Pr **20.PP** and to the PLC registers in an SM-Applications. If successive mapping parameters are mapped to different higher parameters within the same drive user menu or SM-Applications PLC register menu the mappings will be interpreted as indicating a range of parameters.

If it is required to map to individual parameters within the same menu ensure that the target registers are listed in descending order. Refer to section 11.8.3 *Avoiding block mapping* on page 67.

### 11.8.1 IN data

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

- Slot 1 - SM-Applications.
- Slot 2 - SM-Applications.
- Slot 3 - SM-DeviceNet, configured for data format = 10.

To map the five IN 32-bit parameters from registers `_P11%` through to `_P15%`, the following mapping values can be set.

**Table 11.4 IN data block mapping example**

Mapping parameter	Mapping value	Description
Pr <b>MM.10</b>	7011	Block mapping to registers <code>_P11%</code> to <code>_P15%</code> in the SM-Applications in the lowest slot, i.e. in slot 1.
Pr <b>MM.11</b>	7015	
Pr <b>MM.12</b> to Pr <b>MM.19</b>	0	Not mapped

**Table 11.5 IN data block mapping data structure example**

Data word	Target parameter	Data word	Target parameter
IN word 0, 1	_P11% slot 1	IN word 6, 7	_P14% slot 1
IN word 2, 3	_P12% slot 1	IN word 8, 9	_P15% slot 1
IN word 4, 5	_P13% slot 1		

**11.8.2 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 drive. Consider a drive with the following configuration:

- Slot 1 - SM-Applications.
- Slot 2 - SM-Applications.
- Slot 3 - SM-DeviceNet, configured for data format = 10.

To map the five IN 32-bit parameters from registers \_P11% through to \_P15%, the following mapping values can be set.

**Table 11.6 OUT data block mapping example**

Mapping parameter	Mapping value	Description
Pr MM.20	2031	Block mapping to drive parameters Pr 20.31 to Pr 20.35
Pr MM.21	2035	
Pr MM.22 to Pr MM.29	0	Not mapped

**Table 11.7 OUT data block mapping data structure example**

Data word	Target parameter	Data word	Target parameter
OUT word 0, 1	Pr 20.31	OUT word 6, 7	Pr 20.34
OUT word 2, 3	Pr 20.32	OUT word 8, 9	Pr 20.35
OUT word 4, 5	Pr 20.33		

**11.8.3 Avoiding block mapping**

In the above sections block mapping was used to define mapping ranges. In order to avoid this the target parameters should be entered in descending order. This means that SM-DeviceNet will not recognise a range of parameters and only 2 channels will be mapped.

**Table 11.8 Non-block data mapping example**

Mapping parameter	Mapping value	Description
Pr MM.10	7015	Map to _P15% in the SM-Applications in the lowest slot, i.e. slot 1.
Pr MM.11	7011	Map to _P11% in the SM-Applications in the lowest slot, i.e. slot 1.
Pr MM.12 to Pr MM.19	0	Not mapped
Pr MM.20	2035	Map to Pr 20.35 in the SM-Applications in the lowest slot, i.e. slot 1.
Pr MM.21	2031	Map to Pr 20.31 in the SM-Applications in the lowest slot, i.e. slot 1.
Pr MM.22 to Pr MM.29	0	Not mapped

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**Table 11.9 Non-block data structure example**

Data word	Target parameter	Data word	Target parameter
IN word 0, 1	_P15% slot 1	OUT word 0, 1	Pr <b>20.35</b>
IN word 2, 3	_P11% slot 1	OUT word 2, 3	Pr <b>20.31</b>
IN word 4-9	Not mapped	OUT word 4-9	Not mapped

## 11.9 Direct data mapping

SM-DeviceNet Direct data mapping enable		
Pr <b>MM.09</b>	Default	OFF (0)
	Range	OFF (0) or On (1)
	Access	RW

By default, Pr **MM.10** to Pr **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 Pr **MM.10** to Pr **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 Pr **MM.20** to Pr **MM.29**.

**NOTE**

Non-cyclic data cannot be used when direct data mapping mode is enabled.

When direct data mapping mode is enabled all mapping parameters (Pr **MM.10** to Pr **MM.29**) will be reset to 0. When data compression is OFF the number of data words specified in Pr **MM.05** must be an even number. If an odd number is specified the appropriate parameter will be set to specify the next lowest even number of data words (i.e. a value of 7 in Pr **MM.05** will only handle 6 data words or 3 data channels). This will not however change the value in Pr **MM.05**.

**Table 11.10 Direct data mapping configurations (data compression OFF)**

Pr <b>MM.05</b>	Description
2 to 10	The first 10 IN channels will be written directly to Pr <b>MM.10</b> to Pr <b>MM.19</b> , and the first 10 OUT channels will be read directly from Pr <b>MM.20</b> to Pr <b>MM.29</b> .
100 to 109 200 to 206 300 to 309	Non-cyclic data cannot be used in direct data mapping mode. The SM-DeviceNet operating status parameter (Pr <b>MM.49</b> ) will indicate -3, and mapping error code (Pr <b>MM.50</b> ) will indicate 2.

Parameters Pr **MM.10** to Pr **MM.29** are all 16-bit parameters, each data channel will be reduced to 16 bits when Data compression is enabled. Hence, a maximum of 10 data channels can be specified in Pr **MM.05**, or Pr **MM.39** and Pr **MM.40**.

**Table 11.11 Direct data mapping configurations (data compression ON)**

Pr <b>MM.05</b>	Description
1 to 10	The first 10 OUT channels will be written directly to Pr <b>MM.10</b> to Pr <b>MM.19</b> , and the first 10 IN channels will be read directly from Pr <b>MM.20</b> to Pr <b>MM.29</b> .
100 to 109 200 to 206 300 to 309	Non-cyclic data cannot be used in direct data mapping mode. The SM-DeviceNet operating status parameter (Pr <b>MM.49</b> ) will indicate -3, and mapping error code (Pr <b>MM.50</b> ) will indicate 2.

## 11.10 Cyclic data compression: data size on the network

SM-DeviceNet Cyclic data compression enable		
Pr <b>MM.34</b>	Default	OFF (0)
	Range	OFF (0) or On (1)
	Access	RW

By default SM-DeviceNet uses 32 bits (i.e. 2 data words, for each data channel) even if the target source parameter in the drive is a 16-bit parameter. This strategy ensures that the cyclic data transmitted over the DeviceNet network is kept aligned with memory locations in new 32-bit PLCs.

Depending upon the size of the source/destination parameter, the size of the data on the network will vary according to the state of Pr **MM.34** (data compression). When data compression is enabled [by setting Pr **MM.34** = On (1)] a mapping will use 32 bits if the target drive parameter is a 32-bit parameter. If the target drive parameter for a mapping is only 1, 8 or 16 bits, only 16 bits will be used for that particular mapping.

**Figure 11-2 Data compression - parameters / network data size**

Source/Destination Parameter Size	Size of Data on Network	
	MM.34 = 0 (OFF)	MM.34 = 1 (On)
32 bit *	32 bit *	32 bit *
16 bit	32 bit	16 bit
8 bit	32 bit	16 bit
1 bit	32 bit	16 bit

\* 32 bit parameters do not compress  
16 bit parameters (or less) compress to 16 bit

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## 11.11 EVENT task trigger in Applications Module or Motion Processor

SM-Applications EVENT task trigger		
Pr 61.43	Default	0
	Range	0 to 4
	Access	WO

The Applications Module or Motion Processor has 4 EVENT tasks available for use in the DPL Program and the SM-DeviceNet can be configured to trigger one of these tasks.

An EVENT task is triggered when the trigger parameter is actually written to, while the value written (1 to 4) determines which task is actually triggered. The task trigger parameter can be written to using cyclic or non-cyclic data.

**Table 11.12 EVENT task trigger parameters**

Trigger parameter	Value written to trigger parameter				
	0	1	2	3	4
Pr 61.40*	No action	EVENT*	EVENT1*	EVENT2*	EVENT3*
Pr 61.41	No action	EVENT task in slot 1	EVENT1 task in slot 1	EVENT2 task in slot 1	EVENT3 task in slot 1
Pr 61.42	No action	EVENT task in slot 2	EVENT1 task in slot 2	EVENT2 task in slot 2	EVENT3 task in slot 2
Pr 61.43	No action	EVENT task in slot 3	EVENT1 task in slot 3	EVENT2 task in slot 3	EVENT3 task in slot 3

\* - the specified EVENT task will be triggered in the Applications Module or Motion Processor module installed in the lowest slot number on the Unidrive SP.

When an EVENT task runs in the Applications Module or Motion Processor the reason Code parameter (Pr 90.12 to Pr 90.15 for EVENT to EVENT3 task respectively) will indicate why the event task was triggered. The reason codes for Solution Modules are given in Chapter 11.13 *EVENT task reason codes* on page 70. (Refer to the *Applications Module or Motion Processor User Guide* for full details.)

**Table 11.13 EVENT task reason codes**

Solution Module	Reason code
SM-DeviceNet	1
SM-PROFIBUS-DP	2
SM-CANOpen	3
SM-INTERBUS	4
SM-CAN	5

**NOTE**

If cyclic data is used to trigger an EVENT task in an SM-Applications or Motion Processor it is best to map the last OUT cyclic data word to the EVENT task trigger parameter. As cyclic data is written to destination parameters in the order in which it is received. This guarantees that all received cyclic data will have been written to the target parameters BEFORE the EVENT task runs in the SM-Applications or Motion Processor.

## 11.12 Restore SM-DeviceNet defaults

Restore SM-DeviceNet defaults		
Pr MM.30	Default	OFF (0)
	Range	OFF (0) or On (1)
	Access	RW

This procedure can be used to default the SM-DeviceNet module to factory settings, this will also default the drive settings. If the SM-DeviceNet detects that the host drive has been restored to default values, it will over-write the slot configuration parameters with the SM-DeviceNet default values. This will also clear any SDO configuration previously saved with object 0x1010.

**NOTE** If the stored values in the drive are for a different type of Solutions Module, the SM-DeviceNet will trip “SLx.DF”, but no error code will be set. It will over-write the parameter values with the SM-DeviceNet default values, but will NOT store these values in the drive.

Pr **MM.30** specifies whether the default values should be written to the SM-DeviceNet FLASH memory. If Pr **MM.30** is set to On (1), the default values will be written into the SM-DeviceNet FLASH memory.

1. Set Pr **MM.30** to 1 (On).
2. On the Unidrive SP, Digitax ST and Affinity set Pr **MM.00** to 1233 to restore European defaults (1244 for USA defaults). Commander SK - Set Pr **00.29** to EUR for European defaults (USA for American defaults). Mentor MP - Set Pr **MM.00** to EUR for European defaults (USA for American defaults).
3. Press the red reset button on the drive.
4. CANopen communications will be stopped.
5. The host drive will load and store its default parameter values.
6. Default parameter values for the SM-DeviceNet will be loaded in Pr **MM.xx** parameters.
7. The SM-DeviceNet default parameter values will be stored in the SM-DeviceNet FLASH memory.
8. SM-DeviceNet will reset and re-initialise using the default values.

**NOTE** The drive settings will also be defaulted with the above procedure.

## 11.13 Restore previous SM-DeviceNet configuration

Upload from SM-DeviceNet FLASH memory		
Pr MM.33	Default	OFF (0)
	Range	OFF (0) or On (1)
	Access	RW

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

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This feature allows a pre-configured SM-DeviceNet to be installed to a drive without losing the SM-DeviceNet configuration.

**NOTE**

If the SM-DeviceNet is unable to upload the configuration parameters to the drive or configuration parameters have never been stored in the SM-DeviceNet FLASH memory the drive will trip and set the error code (Pr **MM.49**) to 70.

When Pr **MM.33** is set to On (1) the SM-DeviceNet will transfer the configuration parameters from its FLASH memory to the drive over-writing the existing values in the drive.

The full sequence of events for restoring values from a SM-DeviceNet is as follows:

1. Set Pr **MM.33** to On (1).
2. DeviceNet communications will be stopped.
3. The SM-DeviceNet will overwrite all Pr **MM.PP** parameters with the values stored in its internal FLASH memory.
4. Pr **MM.33** will be reset to OFF (0).
5. The SM-DeviceNet will reset and re-initialise using the restored values.

This procedure will NOT store the updated drive parameters.

**NOTE**

The SM-DeviceNet will restore its configuration parameters to the menu of parameters associated with the slot that it is installed in. On a drive with more than one slot, if an SM-DeviceNet module is moved from one slot to another, the configuration parameters will be restored into the parameters relating to the slot the module was moved to..

## 11.14 Selecting input and output assembly objects

SM-DeviceNet input assembly object		
Pr <b>MM.39</b>	Default	114
	Range	70 to 73 106 to 160 (even numbers only)
	Access	RW

SM-DeviceNet output assembly object		
Pr <b>MM.40</b>	Default	115
	Range	20 to 23 107 to 161 (odd numbers only)
	Access	RW

If the number of polled words is specified using the SM-DeviceNet data format parameter, Pr **MM.05**, the number of IN and OUT polled words will be the same. When Pr **MM.05** is set to 0, the input and output assembly objects can be specified separately in Pr **MM.39** and Pr **MM.40** respectively. This allows different numbers of IN and OUT polled data words to be specified.



**Table 11.14 SM-DeviceNet input and output assembly objects**

Polled words	Input assembly object	Output assembly object	Polled words	Input assembly object	Output 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)

## 11.15 Supported Drive assembly objects

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

**Table 11.15 Pre-defined SM-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 feedback
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 (Pr **MM.05**) to 0.
2. Specify the input assembly object required in Pr **MM.39**.
3. Specify the output assembly object required in Pr **MM.40**.
4. Set Pr **MM.32** to On to reset the SM-DeviceNet, and make the changes take effect.

**NOTE**

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

### 11.15.1 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 11.16 Basic speed control**

Data word	Function
Word 0	Basic control word (See below)
Word 1	SpeedRef (See status word)

The basic control word uses a full 16-bit word, with the bits having functions as shown below.

b15	b14	b13	b12	b11	b10	b9	b8
b7	b6	b5	b4	b3	b2	b1	b0
					FaultRst		RunFwd

### 11.15.2 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 11.17 Extended speed control**

Data word	Function
Word 0	Extended control word (see below).
Word 1	SpeedRef (see status word).

The extended control word uses a full 16-bit word, with the bits having functions as shown below.

b15	b14	b13	b12	b11	b10	b9	b8
b7	b6	b5	b4	b3	b2	b1	b0
	NetRef	NetCtrl			FaultRst	RunRev	RunFwd

### 11.15.3 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 11.18 Basic speed and torque control**

Data Word	Function
Word 0	Basic control word (See below)
Word 1	SpeedRef (See status word)
Word 2	TorqueRef (See status word)

The basic control word uses a full 16-bit word, with the bits having functions as shown below.

<b>b15</b>	<b>b14</b>	<b>b13</b>	<b>b12</b>	<b>b11</b>	<b>b10</b>	<b>b9</b>	<b>b8</b>
<b>b7</b>	<b>b6</b>	<b>b5</b>	<b>b4</b>	<b>b3</b>	<b>b2</b>	<b>b1</b>	<b>b0</b>
					FaultRst		RunFwd

### 11.15.4 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 11.19 Extended speed and torque control**

Data word	Function
Word 0	Extended control word (See below)
Word 1	SpeedRef (See status word)
Word 2	TorqueRef (See status word)

The extended control word uses a full 16-bit word, with the bits having functions as shown below.

<b>b15</b>	<b>b14</b>	<b>b13</b>	<b>b12</b>	<b>b11</b>	<b>b10</b>	<b>b9</b>	<b>b8</b>
<b>b7</b>	<b>b6</b>	<b>b5</b>	<b>b4</b>	<b>b3</b>	<b>b2</b>	<b>b1</b>	<b>b0</b>
	NetRef	NetCtrl			FaultRst	RunRev	RunFwd

### 11.15.5 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 11.20 Basic speed feedback**

Data word	Function
Word 0	Basic status word (See below)
Word 1	SpeedActual (See status word)

The basic status word uses a full 16-bit word, with the bits having functions as shown below.

<b>b15</b>	<b>b14</b>	<b>b13</b>	<b>b12</b>	<b>b11</b>	<b>b10</b>	<b>b9</b>	<b>b8</b>
<b>b7</b>	<b>b6</b>	<b>b5</b>	<b>b4</b>	<b>b3</b>	<b>b2</b>	<b>b1</b>	<b>b0</b>
					Running1		Faulted

### 11.15.6 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 11.21 Extended speed feedback**

Data word	Function
Word 0	Basic status word (see below).
Word 1	SpeedActual (see status word).

The basic status word uses a full 16-bit word, with the bits having functions as shown below.

b15	b14	b13	b12	b11	b10	b9	b8
DriveState							
b7	b6	b5	b4	b3	b2	b1	b0
At Reference	RefFrom Net	CtrlFrom Net	Ready	Running2	Running1	Warning	Faulted

### 11.15.7 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 11.22 Basic speed and torque feedback**

Data word	Function
Word 0	Basic status word (see below).
Word 1	SpeedActual (see status word).
Word 2	TorqueActual (see status word).

The extended status word uses a full 16-bit word, with the bits having functions as shown below.

b15	b14	b13	b12	b11	b10	b9	b8
b7	b6	b5	b4	b3	b2	b1	b0
					Running1		Faulted

### 11.15.8 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 11.23 Extended speed and torque feedback**

Data word	Function
Word 0	Basic status word (See below).
Word 1	SpeedActual (See status word).
Word 2	TorqueActual (See status word).

The extended status word uses a full 16-bit word, with the bits having functions as shown below.

<b>b15</b>	<b>b14</b>	<b>b13</b>	<b>b12</b>	<b>b11</b>	<b>b10</b>	<b>b9</b>	<b>b8</b>
DriveState							
<b>b7</b>	<b>b6</b>	<b>b5</b>	<b>b4</b>	<b>b3</b>	<b>b2</b>	<b>b1</b>	<b>b0</b>
At Reference	RefFrom Net	CtrlFrom Net	Ready	Running2	Running1	Warning	Faulted

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# 12 DeviceNet Objects

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The Object Model has the following object classes present.

**Table 12.1 Supported Objects**

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

## 12.1 Identity Object

**Class: 0x01 (1)**

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

### 12.1.1 VendorID

<b>Name:</b>	<b>VendorID</b>		
<b>Class</b>	0x01	<b>Default</b>	257
<b>Instance</b>	0x01	<b>Data Type</b>	UINT
<b>Attribute</b>	0x01	<b>Access</b>	Get

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

### 12.1.2 DeviceType

<b>Name:</b>	<b>DeviceType</b>		
<b>Class</b>	0x01	<b>Default</b>	2
<b>Instance</b>	0x01	<b>Data Type</b>	UINT
<b>Attribute</b>	0x02	<b>Access</b>	Get

Returns the Device Type code.

### 12.1.3 ProductCode

<b>Name:</b>	<b>ProductCode</b>		
<b>Class</b>	0x01	<b>Default</b>	See below
<b>Instance</b>	0x01	<b>Data Type</b>	UINT
<b>Attribute</b>	0x03	<b>Access</b>	Get

Identifies the current drive configuration, and is used to link a node to the installed EDS files.

In generic mode, ProductCode is calculated as shown below.

**Table 12.2 Generic ProductCode**

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Product			$(Pr\ 11.29/100) * 3$				Pr 5.49			0					

Product returns the code for the product (i.e. the drive).

Pr 11.29 returns the major software revision number.

Pr 5.49 returns the drive operating mode, e.g. open loop, closed loop, servo, etc.

In advanced mode, ProductCode is calculated as shown below (see section 9.3 *Advanced EDS files* on page 55).

**Table 12.3 Advanced ProductCode**

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Product			$((Pr\ 11.29/100) * 3) +$ Local Slot				Pr 5.49			Slot X			Slot Y		

Pr 11.29 returns the major software revision number.

Local Slot indicates the slot in which the SM-DeviceNet is installed. 0 = slot 1, 1 = slot 2, 2 = slot 3.

Pr 5.49 returns the drive operating mode, e.g. open loop, closed loop, servo, etc.

Slot X indicates the family of installed in the lowest numbered slot, excluding the slot where this SM-DeviceNet is installed. Slot X = Pr MM.01/100.

Slot Y indicates the family of installed in the highest numbered slot, excluding the slot where this SM-DeviceNet is installed. Slot Y = Pr MM.01/100.

## 12.1.4 Revision

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

Returns 2 bytes to indicate the major and minor revision code. The first byte returned is the major revision, and the second byte is the minor revision. In generic mode, the major and minor revisions are calculated as shown below.

Major Revision							
b7	b6	b5	b4	b3	b2	b1	b0
0							127

Minor Revision							
b7	b6	b5	b4	b3	b2	b1	b0
$(Pr\ 11.29\ Mod\ 100) + 1$							

In advanced mode, the major and minor revisions are calculated as shown below.

Major Revision							
b7	b6	b5	b4	b3	b2	b1	b0
0							$(Pr\ 11.29\ Mod\ 100) + 1$

Minor Revision							
b7	b6	b5	b4	b3	b2	b1	b0
$Pr\ 11.34 + 1$							

## 12.1.5 SerialNumber

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

Returns a serial number of the SM-DeviceNet. This value is entered during production, and cannot be edited. The serial number of the SM-DeviceNet can also be read from Pr **61.35**, and a shortened version is also displayed in Pr **MM.35**.

## 12.1.6 ProductName

<b>Name:</b>	<b>ProductName</b>		
<b>Class</b>	0x01	<b>Default</b>	SM DeviceNet
<b>Instance</b>	0x01	<b>Data Type</b>	SHORT_STRING
<b>Attribute</b>	0x07	<b>Access</b>	Get

Returns a short string to indicate the Product Name. The SM-DeviceNet returns the string "SM DeviceNet".

## 12.2 SM-DeviceNet Object

**Class: 0x03 (3)**

The DeviceNet Object provides the configuration and status of the SM-DeviceNet port. The MAC-ID and Data Rate can also be set in Pr **0.45** and Pr **0.46** on the drive keypad.

### 12.2.1 MAC-ID

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

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

### 12.2.2 DataRate

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

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

The Table 12.4 shows the attribute values for each data rate.

**Table 12.4 DeviceNet data rate**

<b>Setting</b>	<b>bits/sec</b>
0	125K
1	250K
2	500K



## 12.2.3 AllocationByte

<b>Name:</b>	<b>AllocationByte</b>		
<b>Class</b>	0x03	<b>Default</b>	0
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x05	<b>Access</b>	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. A value of 255 means the pre-defined Master/Slave connection set has not yet been allocated.

**Table 12.5 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

## 12.3 Motor Data Object

**Class: 0x28 (40)**

### 12.3.1 MotorType

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

<b>Name:</b>	<b>MotorType2</b>		
<b>Class</b>	0x28	<b>Default</b>	7
<b>Instance</b>	0x02	<b>Data Type</b>	USINT
<b>Attribute</b>	0x03	<b>Access</b>	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 Pr 21.15. Pr 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.

MotorType1 is linked directly to Pr **MM.44**, and MotorType2 is linked directly to Pr **MM.45**.

**Table 12.6 Supported motor types**

Pr <b>MM.44</b> , Pr <b>MM.45</b>	Motor Type
6	Wound Rotor Induction motor.
7	Squirrel Cage Induction Motor (default).
9	Sinusoidal PM BL motor.
10	Trapezoidal PM BL motor.

### 12.3.2 RatedCurrent

<b>Name:</b>	<b>RatedCurrent1</b>		
<b>Class</b>	0x28	<b>Default</b>	Pr <b>5.07</b>
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x06	<b>Access</b>	Get/Set

<b>Name:</b>	<b>RatedCurrent2</b>		
<b>Class</b>	0x28	<b>Default</b>	Pr <b>21.07</b>
<b>Instance</b>	0x02	<b>Data Type</b>	USINT
<b>Attribute</b>	0x06	<b>Access</b>	Get/Set

Specifies the rated current of the motor in Amps. Instance 1 is mapped to Pr **5.07** in the drive, while instance 2 is mapped to Pr **21.07**.

Set Pr **5.07** = RatedCurrent1 \* 10

Get RatedCurrent1 = Pr **5.07** / 10

Set Pr **21.07** = RatedCurrent2 \* 10

Get RatedCurrent2 = Pr **21.07** / 10

### 12.3.3 RatedVoltage

<b>Name:</b>	<b>RatedVoltage1</b>		
<b>Class</b>	0x28	<b>Default</b>	Pr <b>5.09</b>
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x07	<b>Access</b>	Get/Set

<b>Name:</b>	<b>RatedVoltage2</b>		
<b>Class</b>	0x28	<b>Default</b>	Pr <b>21.09</b>
<b>Instance</b>	0x02	<b>Data Type</b>	USINT
<b>Attribute</b>	0x07	<b>Access</b>	Get/Set

Specifies the rated motor voltage in Volts. Instance 1 is mapped directly to Pr **5.09** in the drive, and instance 2 is mapped directly to Pr **21.09**.

### 12.3.4 RatedFreq

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

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

Specifies the rated motor frequency in Hertz. Instance 1 is linked to Pr **5.06** in the Undrive SP, and instance 2 is linked to Pr **21.06**.

Set Pr **5.06** = RatedFreq1 \* 10

Get RatedFreq1 = Pr **5.06** / 10

Set Pr **21.06** = RatedFreq2 \* 10

Get RatedFreq2 = Pr **21.06** / 10

### 12.3.5 BaseSpeed

<b>Name:</b>	<b>BaseSpeed1</b>		
<b>Class</b>	0x28	<b>Default</b>	Pr <b>5.08</b>
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x0F	<b>Access</b>	Get/Set

<b>Name:</b>	<b>BaseSpeed2</b>		
<b>Class</b>	0x28	<b>Default</b>	Pr <b>21.08</b>
<b>Instance</b>	0x02	<b>Data Type</b>	USINT
<b>Attribute</b>	0x0F	<b>Access</b>	Get/Set

Specifies the base speed of the motor in rpm. Instance 1 is mapped directly to Pr **5.08** in the drive, and instance 2 is mapped directly to Pr **21.08**.

### 12.3.6 Motor2Select

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

Selects between Motor Map 1 and Motor Map 2 in the drive.

Set Pr **11.45**

Get Pr **21.15**

## 12.4 Control Supervisor

Class: 0x29 (41)

### 12.4.1 RunFwd

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

Set to 1 to run the drive in the forward direction.

Get/Set Pr 6.42 bit 1

### 12.4.2 RunRev

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

Set to 1 to run the drive in the reverse direction.

Get/Set Pr 6.42 bit 3

### 12.4.3 NetCtrl

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

Switches the drive between terminal and fieldbus control.

Get/Set Pr 6.42 bit 7

Set False terminal control

Set True fieldbus control

### 12.4.4 State

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

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

Table 12.7 Device state

State	DeviceNet state	Drive state
1	Startup	This state is skipped on.
2	Not_Ready	Inhibit.
3	Ready	Ready.
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 drive states, e.g. Scan, Orienting, Regen Active, etc.

## 12.4.5 RunningFwd

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

Indicates that the drive is running in the forward direction.

Get True (Pr **10.40** & 0x2002) == 0x0002

Get False (Pr **10.40** & 0x2002) != 0x0002

## 12.4.6 RunningRev

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

Indicates that the drive is running in the reverse direction.

Get True (Pr **10.40** & 0x2002) == 0x2002

Get False (Pr **10.40** & 0x2002) != 0x2002

## 12.4.7 Faulted

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

Indicates that the drive is tripped, i.e. not OK

Get !Pr **10.01**

## 12.4.8 FaultRst

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

Resets the drive from a tripped condition.

Set True Pr **10.38** = 100

Set False No action

## 12.4.9 FaultCode

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

If the drive is tripped, the fault code is obtained from parameter Pr **10.20** in the drive. If the fault code in Pr **10.20** is one of the following, the table gives the appropriate ODVA code, otherwise the error code will be returned as 0x1000 + Pr **10.20**.

**Table 12.8 Fault codes**

<b>Drive fault code</b>	<b>ODVA fault code</b>
1	0x3220
2	0x3210
3	0x2300
4	0x7112
6	0x9000
20	0x2310
21	0x4300
26	0x5112
32	0x3130

## 12.4.10 CtrlFromNet

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

Indicates that the drive is operating under fieldbus control.

Get Pr **6.42** bit 7 & Pr **6.43**

## 12.4.11 DriveEnable

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

Enables the drive. This puts the Drive into the "Ready" state, allowing the RunFwd and RunRev attributes to control the drive. RunFwd and RunRev will have no effect if DriveEnable is not set to 1.

Get/Set Pr **6.42** bit 0

**NOTE**

The external hardware enable signal must also be present before the drive will go to the Ready state.

## 12.5 AC/DC Drive Object

Class: 0x2A (42)

### 12.5.1 AtReference

<b>Name:</b>	AtReference		
<b>Class</b>	0x2A	<b>Default</b>	
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x03	<b>Access</b>	Get

Indicates that the drive is running at the requested speed.

Get Pr 10.06

### 12.5.2 NetRef

<b>Name:</b>	NetRef		
<b>Class</b>	0x2A	<b>Default</b>	
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x04	<b>Access</b>	Get/Set

Selects the source of the speed reference. Analog 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 Pr 6.42 bit 8

Set False analog speed reference

Set True digital speed reference

The reference can only be changed between local and remote when the drive 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.

### 12.5.3 DriveMode

<b>Name:</b>	DriveMode		
<b>Class</b>	0x2A	<b>Default</b>	
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x06	<b>Access</b>	Get/Set

DriveMode does not allow the operating mode of the drive to be changed. Pr 4.11 will be written to as shown in Table 12.9, provided that the drive is already in the correct operating mode.

Table 12.9 Get DriveMode

DriveMode	Drive Mode	Pr 11.31	Pr 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 12.10 Set DriveMode**

DriveMode	Drive Mode	Pr 11.31	Pr 4.11	Comment
0	Vendor Specific	4	N/A	Pr 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 drive 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		

**12.5.4 SpeedActual**

<b>Name:</b>	<b>SpeedActual</b>		
<b>Class</b>	0x2A	<b>Default</b>	
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x07	<b>Access</b>	Get

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

Get Pr **5.04** (Open Loop)

Get Pr **3.02** (Closed Loop, Servo)

**12.5.5 SpeedRef**

<b>Name:</b>	<b>SpeedRef</b>		
<b>Class</b>	0x2A	<b>Default</b>	
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x08	<b>Access</b>	Get/Set

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

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

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

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

**12.5.6 TorqueActual**

<b>Name:</b>	<b>TorqueActual</b>		
<b>Class</b>	0x2A	<b>Default</b>	
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x0B	<b>Access</b>	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 Pr **4.20**



## 12.5.7 TorqueRef

<b>Name:</b>	<b>TorqueRef</b>		
<b>Class</b>	0x2A	<b>Default</b>	
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x0C	<b>Access</b>	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 Pr **4.08** = TorqueRef / 10

Get Torque Ref = Pr **4.08** \* 10

## 12.5.8 RefFromNet

<b>Name:</b>	<b>RefFromNet</b>		
<b>Class</b>	0x2A	<b>Default</b>	
<b>Instance</b>	0x01	<b>Data Type</b>	USINT
<b>Attribute</b>	0x0C	<b>Access</b>	Get

Indicates the source of the speed reference.

TRUE if Pr **1.49** = 3 and Pr **1.50** = 1

FALSE otherwise.

## 12.6 Control Techniques Object

Class code: 0x64 (100)

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

**Table 12.11 Supported objects**

Instance	Menu	Name
1 (0x01)	1	Speed reference.
2 (0x02)	2	Ramp control.
3 (0x03)	3	Speed control.
4 (0x04)	4	Current control.
5 (0x05)	5	Motor control.
6 (0x06)	6	Sequencing.
7 (0x07)	7	Analog I/O.
8 (0x08)	8	Digital I/O.
9 (0x09)	9	Logic.
10 (0x0A)	10	Drive status.
11 (0x0B)	11	Drive set-up.
12 (0x0C)	12	Programmable thresholds.
13 (0x0D)	13	Position control.
14 (0x0E)	14	Process PID loop.
15 (0x0F)	15	Slot 1 configuration.
16 (0x10)	16	Slot 2 configuration.
17 (0x11)	17	Slot 3 configuration.
18 (0x12)	18	User application menu 1.
19 (0x13)	19	User application menu 2 (not on SK).
20 (0x14)	14	User application menu 3 (not on SK).
21 (0x15)	15	Second motor map.
60 (0x3C)	60	Configuration parameter access for local module.
61 (0x3D)	61	Virtual parameter menu for local module.
70 to 75	70 to 75	PLC registers of SM-Applications installed in the lowest numbered slot.
100 to 105	100 to 105	PLC registers of SM-Applications installed in slot 1.
130 to 135	130 to 135	PLC registers of SM-Applications installed in slot 2 (not on SK).
160 to 165	160 to 165	PLC registers of SM-Applications installed in slot 3 (not on SK).
200	0	Menu 0.

# 13 Quick Reference

## 13.1 Complete parameter reference

Table 13.1 shows every parameter available in the Unidrive SP for configuring the SM-DeviceNet, plus a cross-reference to the section in the manual where more information can be found.

**Table 13.1 SM-DeviceNet parameter reference**

Slot	Default	Cross reference	Description
Pr <b>MM.01</b>	----	Section 10.1 on page 56	Module ID code
Pr <b>MM.02</b>	----	Section 10.2 on page 56	Major firmware version
Pr <b>MM.03</b>	63	Section 5.2 on page 26	MAC-ID
Pr <b>MM.04</b>	0	Section 5.3 on page 26	Data rate
Pr <b>MM.05</b>	4	Section 5.4 on page 27	Data format
Pr <b>MM.06</b>	----	Section 10.5 on page 58	Operating status
Pr <b>MM.07</b>	200	Section 11.1 on page 62	Network loss trip timeout
Pr <b>MM.08</b>	On (1)	Section 11.4 on page 63	Data endian format select
Pr <b>MM.09</b>	OFF (0)	Section 11.9 on page 68	Direct data mapping enable
Pr <b>MM.10</b>	1040	Section 6.1 on page 32	IN polled mapping 0
Pr <b>MM.11</b>	201		IN polled mapping 1
Pr <b>MM.12</b>	0		IN polled mapping 2
Pr <b>MM.13</b>	0		IN polled mapping 3
Pr <b>MM.14</b>	0		IN polled mapping 4
Pr <b>MM.15</b>	0		IN polled mapping 5
Pr <b>MM.16</b>	0		IN polled mapping 6
Pr <b>MM.17</b>	0		IN polled mapping 7
Pr <b>MM.18</b>	0		IN polled mapping 8
Pr <b>MM.19</b>	0		IN polled mapping 9
Pr <b>MM.20</b>	642	Section 6.1 on page 32	OUT polled mapping 0
Pr <b>MM.21</b>	121		OUT polled mapping 1
Pr <b>MM.22</b>	0		OUT polled mapping 2
Pr <b>MM.23</b>	0		OUT polled mapping 3
Pr <b>MM.24</b>	0		OUT polled mapping 4
Pr <b>MM.25</b>	0		OUT polled mapping 5
Pr <b>MM.26</b>	0		OUT polled mapping 6
Pr <b>MM.27</b>	0		OUT polled mapping 7
Pr <b>MM.28</b>	0		OUT polled mapping 8
Pr <b>MM.29</b>	0		OUT polled mapping 9
Pr <b>MM.30</b>	OFF	Section 5.9 on page 30	Restore SM-DeviceNet defaults
Pr <b>MM.31</b>	OFF	-	Store to SM-DeviceNet FLASH memory
Pr <b>MM.32</b>	OFF	Section 5.6 on page 28	Reset SM-DeviceNet
Pr <b>MM.33</b>	OFF	Section 5.10 on page 30	Restore previous configuration from SM-DeviceNet FLASH memory
Pr <b>MM.34</b>	OFF	Section 11.10 on page 69	Polled data compression enable
Pr <b>MM.35</b>	----	---	Serial number

**Table 13.1 SM-DeviceNet parameter reference**

Slot	Default	Cross reference	Description
Pr <b>MM.36</b>	OFF		Reserved
Pr <b>MM.37</b>	OFF		
Pr <b>MM.38</b>	0		
Pr <b>MM.39</b>	5	Section 11.14 on page 72	Input assembly object
Pr <b>MM.40</b>	5		Output assembly object
Pr <b>MM.41</b>	0	Section 11.3 on page 63	Bus Off trip disable
Pr <b>MM.42</b>	0		Reserved
Pr <b>MM.43</b>	0		
Pr <b>MM.44</b>	0		
Pr <b>MM.45</b>	0		
Pr <b>MM.46</b>	0		
Pr <b>MM.47</b>	0		
Pr <b>MM.48</b>	0		
Pr <b>MM.49</b>	----	Section 10.6 on page 59	SM-DeviceNet mapping status
Pr <b>MM.50</b>	----	Section 10.7 on page 61	SM-DeviceNet error codes
Pr <b>MM.51</b>	----	Section 10.2 on page 56	Minor firmware version

Table 13.2 shows every virtual parameter available in the SM-DeviceNet, plus a cross-reference to the section in this manual where more information can be found. Virtual parameters can only be accessed from the DeviceNet network using non-cyclic communications.

**Table 13.2 SM-DeviceNet virtual parameter reference**

Slot 1	Default	Cross Reference	Description
Pr <b>61.01</b>	0	---	Parameter 1.00 Shortcut
Pr <b>61.20</b>	0	---	Coarse and Turns Position Feedback
Pr <b>61.21</b>	0	---	Turns and Fine Position Feedback
Pr <b>61.35</b>	----	---	Serial number
Pr <b>61.40</b>	0	Section 11.11 on page 70	SM-Applications event task trigger (lowest slot)
Pr <b>61.41</b>	0		SM-Applications event task trigger (slot 1)
Pr <b>61.42</b>	0		SM-Applications event task trigger (slot 2)
Pr <b>61.43</b>	0		SM-Applications event task trigger (slot 3)
Pr <b>61.50</b>	0	Section 8.3 on page 40	CT Single Word (Mode 1) non-cyclic data mapping parameter
Pr <b>61.51</b>	0	Section 8.4 on page 49	PPO 4 Word (Mode 2) non-cyclic data mapping parameter

# 14 Glossary Of Terms

**Address:** This is the unique network identification given to a networked device to allow communication on a network. When a device sends or receives data the address is used to determine the source and the destination of the message.

**Bit:** A binary digit, this may have the value of 1 or 0.

**Block mapping:** A method of mapping a range of consecutive parameters using only two ascending parameters. This means that by using two mapping parameters up to 32 consecutive mappings may be made. See section 11.11 *EVENT task trigger in Applications Module or Motion Processor* on page 70 for more information.

**Byte:** A collection of 8 binary digits that collectively store a value. This may be signed or unsigned.

**CAN:** The base network used for DeviceNet. The DeviceNet module does not support CAN commands.

**DeviceNet:** Builds on the basic CAN protocol by offering higher level functionality.

**Casting:** The process of changing between data sizes without changing the value represented, e.g. changing from 16-bit to 32-bit.

**Compression:** By default SM-DeviceNet transmits values as 32 bits on the network. It is possible by using compression to reduce the number of bits transmitted when sending 16-bit (or smaller) values on the network to 16-bit (32-bit values will still be transmitted as 32-bit values). This has the advantage of reducing the volume of traffic on the network and allowing more parameters to be mapped within SM-DeviceNet.

**Consistency:** Describes how data is transmitted between nodes on the network. If data is consistent it is transmitted from node to node as a single entity. Thus preventing data corruption where multiple bytes are transmitted or received individually.

**Control word:** A collection of binary digits that are used to control the drive. Features typically include directional controls, run controls and other similar functions.

**CT Single Word non-cyclic:** *see mode 1 non-cyclic in this section.*

**Cyclic data:** This consists of values that are sent at regular or cyclic intervals across the network. A typical use of cyclic data would be the transmission of a speed reference or a control word.

**Data format:** Determines the quantity and function of the data sent and received across the network.

**Data rate:** Determines the communication speed of the network, the higher the value the more data can be sent across the network in the same time period.

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**Device:** A piece of equipment connected to a network, this may be any type of equipment including repeaters, hubs, masters or slaves.

**Object Dictionary:** A collection of the objects that are supported by the product.

**Direct data mapping:** Data is sent directly to the mapping parameters in the drive rather than the parameters redirecting the data to another parameter.

**Double word:** A 32-bit word, this may be signed or unsigned.

**Earthing/Grounding:** Describes the electrical safety or shielding connections for the module.

**Endian format:** When a value uses more than 8 bits to represent its value it needs to be sent in sets of 8 bits (bytes) across the network, the endian format determines the order the bytes that constitute the whole value are transmitted.

**Event task:** A special way to use a message or change of state to trigger a software routine.

**IN data:** Data that is returned from a slave device to the DeviceNet master.

**Long word:** A 32-bit data word that may be signed or unsigned.

**Mapping:** The process of linking DeviceNet values to parameters within the drive.

**Master:** The controlling device on the network, generally this will include programming features.

**Mode 1 non-cyclic:** A method of sending non-cyclic data using a single word.

**Mode 2 non-cyclic:** A method of sending non-cyclic data using 4 words.

**Network Loss Trip:** A method to determine when a node has lost contact with the master.

**Node:** A device on the network. This may be either a device such as a drive or part of the network such as a repeater.

**Non-Cyclic Data:** Data that is requested or sent by the master as required. This is not sent on a regular basis and generally allows access to any parameter. This is useful for occasional changes or configuration purposes.

**Poll rate:** The rate at which cyclic data is sent and received on the network.

**PPO 4 Word non-cyclic mode:** see Mode 2 non-cyclic in this section. This is not the same as PPO4 mode.

**Response ID:** The response code of the message received when using PPO4 word non-cyclic communication.

**Scan rate:** See Poll rate in this section.

**Shielding:** A connection to provide additional immunity to noise used on a network cable.

**Segment:** An electrically separate part of the network. Each segment requires correct termination to ensure reliable operation. Due to electrical limitations the maximum number of devices on a segment is limited to 32.

**Slave:** A device on the DeviceNet network such as a drive or sensor. A slave device will only respond to messages from a master.

**Status word:** A value that denotes the status of the drive. Each bit within the word will have a specific meaning.

**Task ID:** The code used to describe the purpose of a message using PPO 4 word non-cyclic communication.

**Telegram:** A message used within mode 1 non-cyclic data communication. This term is some times used to represent a generic message on the network.

**Termination:** This is used at both ends of a network segment to prevent reflections and reduce noise.

**Watchdog:** A method used to determine if a communication system is OK. A typical watchdog scheme uses a handshaking system to check both the master and slave are participating in communications.

**Word:** A collection of 16 binary digits.

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