CONTROL TECHNIQUES

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User Guide

SM-PROFIBUS-DP

Solutions Module for
Unidrive SP

Part Number: 0471-0008-04
Issue Number: 4

General Information

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

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

Drive software version

The SM-PROFIBUS-DP can only be used with Unidrive SP firmware version V1.00.00 and later.

Issue Code: 4
Hardware: Issue 01.00 or later
Firmware: V2.00.00

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1 Safety Information

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, commissioning 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 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 function, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.

Careful consideration must be given to the functions of the drive which might result in a hazard, either through their intended behaviour 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 SECURE DISABLE function has been approved[1] as meeting the requirements of EN954-1 category 3 for the prevention of unexpected starting of the drive. It 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]Independent approval by BIA has been given for sizes 1 to 3.

1.4 Environmental Limits

Instructions in the *Unidrive SP 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 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* contains instruction 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:

98/37/EC: Safety of machinery.

89/336/EEC: Electromagnetic Compatibility.

1.6 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure 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 fitted 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 Pr **0.46** motor rated current. This affects the thermal protection of the motor.

1.7 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.

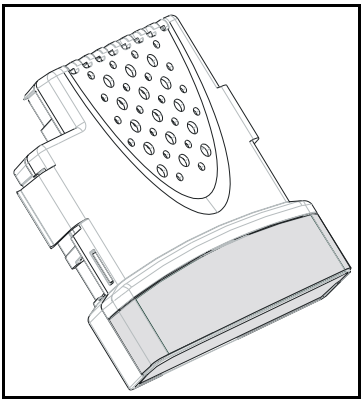
2 Introduction

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

2.1 SM-PROFIBUS-DP for Unidrive SP

The SM-PROFIBUS-DP for Unidrive SP is an option that can be fitted to any one of the three expansion slots in the Unidrive SP. The SM-PROFIBUS-DP uses a 16-bit Processor and is capable of communicating at 12 Mbit/s, currently the fastest data rate available for PROFIBUS-DP.

Figure 2-1 Unidrive SP Solutions Module



The SM-PROFIBUS-DP is powered from the Unidrive SP internal power supply. The Unidrive SP can be connected to a back-up power supply. This keeps the control electronics and options module powered up, allowing the SM-PROFIBUS-DP to continue communicating with the PROFIBUS-DP master controller when the main supply to the Unidrive SP is switched off.

2.2 Product Conformance Certificate

The SM-PROFIBUS-DP has been submitted to the Profibus Nutzerorginization (PNO) to be tested for full PROFIBUS-DP Conformance Certification.

2.3 General specification

- Supported data rates (bit/s): 12M, 6.0M, 3.0M, 1.5M, 500k, 187.5k, 93.75k, 45.45k, 19.2k, 9.6k.
- Maximum of 32 input and 32 output cyclic data words supported
- Parameter Process objects (PPOs) fully supported
- CT Single Word or PPO 4 Word mode non-cyclic data channel (optional)

3 Mechanical Installation

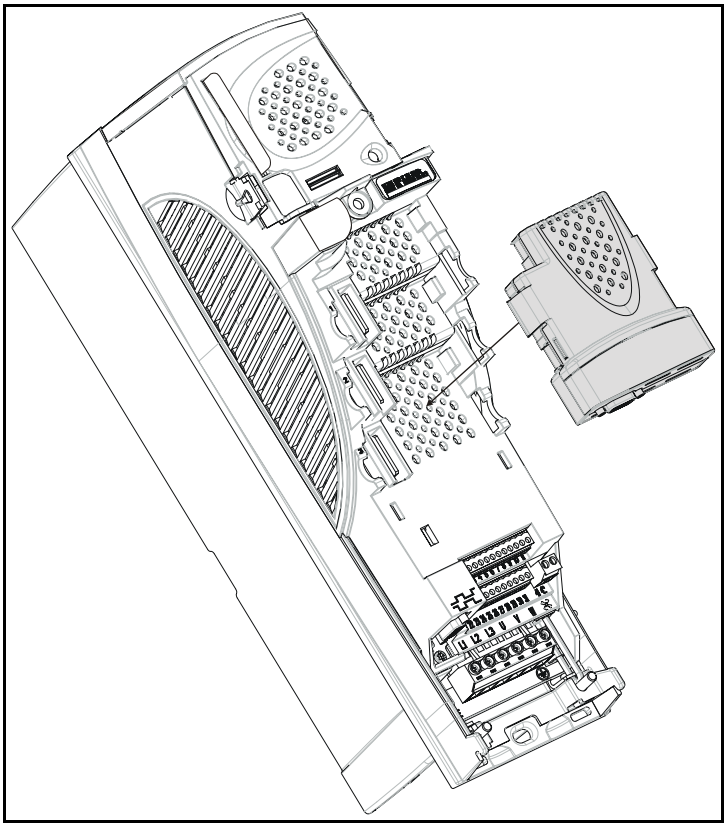
CAUTION

The Unidrive SP must be disconnected from all power supplies before installing or removing the SM-PROFIBUS-DP module.

3.1 Installing the SM-PROFIBUS-DP

- Locate the SM-PROFIBUS-DP into the required slot, and press down until it clicks into place.

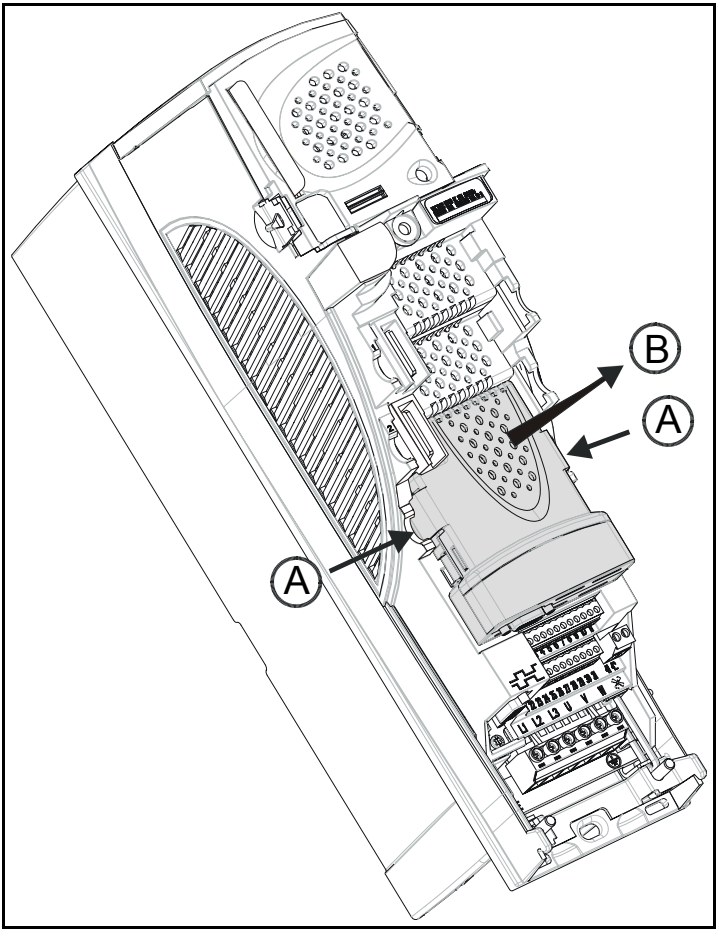
Figure 3-1 Installing the SM-PROFIBUS-DP



3.2 Removing The SM-PROFIBUS-DP

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

Figure 3-2 Removing the SM-PROFIBUS-DP

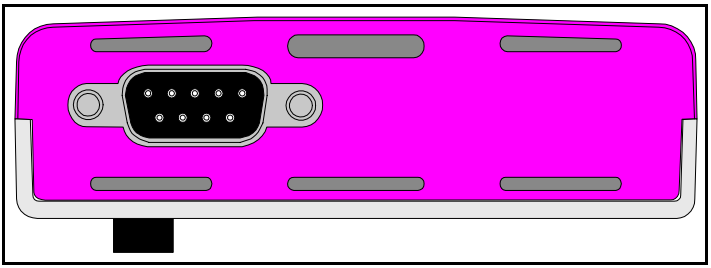


4 Electrical Installation

4.1 SM-PROFIBUS-DP terminal descriptions

The SM-PROFIBUS-DP has a standard 9-way female D-type connector for the PROFIBUS-DP network.

Figure 4-1 SM-PROFIBUS-DP - Front View



The terminal functions are given in the Table 4.1.

Table 4.1 SM-PROFIBUS-DP connections

D-type Terminal	Function	Description
3	RxD/TxD-P	Positive data line (B)
8	RxD/TxD-N	Negative data line (A)
6	+5V ISO	+5V isolated, use only for termination resistors
5	0V ISO	0V isolated, use only for termination resistors
4	CNTR-P	RTS line
1, Shell	Shield	Cable shield connection

Control Techniques strongly recommends that Profibus-recommended connectors are used. These connectors accept 2 PROFIBUS-DP cables and have 4 screw terminals inside, one for each data connection. They also have a shield clamp arrangement to ensure good shield continuity, and help to ensure good noise immunity of the PROFIBUS-DP network.

4.2 SM-PROFIBUS-DP connections

The SM-PROFIBUS-DP has been designed to accept the Erbic “vertical” range of PROFIBUS-DP connectors from ERNI. The grey connector (Part No: 103658L) can be used on all nodes in the middle of the PROFIBUS-DP network, and a special yellow termination connector (Part No: 103659L) containing the necessary PROFIBUS-DP termination resistor network is also available.

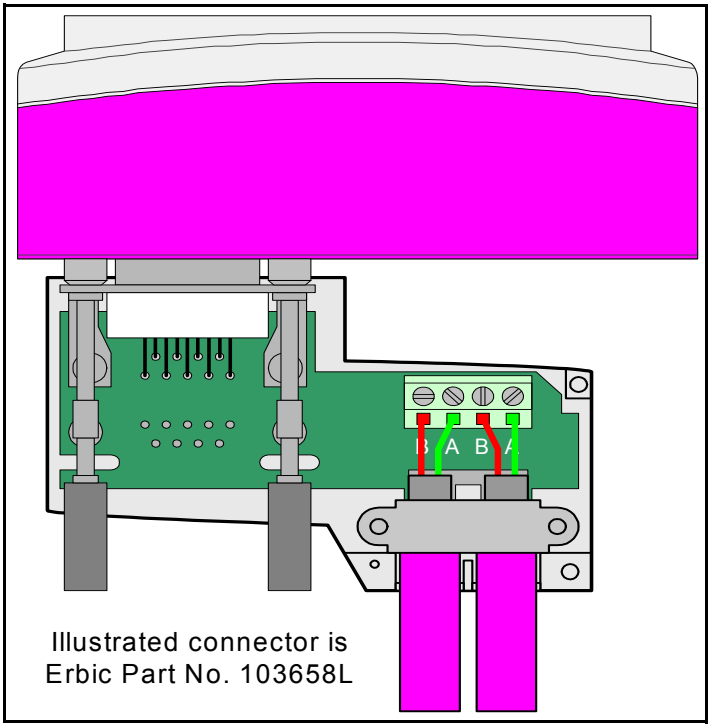
Some Siemens connectors may also be used with the SM-PROFIBUS-DP. Suitable connectors are Part No: 6GK1 500-0FC00 and Part No: 6GK1 500-0EA02.

For further details visit the PROFIBUS web site at www.profibus.com, and search for “network components”.

NOTE Other companies also make PNO-certified PROFIBUS-DP connectors, but the mechanical design of some connectors may make them unsuitable for use with Unidrive SP and SM-PROFIBUS-DP.

Figure 4-2 illustrates a PROFIBUS-DP connection using an Erbic connector from ERNI.

Figure 4-2 PROFIBUS-DP network connections



4.3 PROFIBUS-DP cable

PROFIBUS-DP cable has a single twisted pair with overall shielding. PROFIBUS-DP has a specified colour code, and it is strongly recommended that this code is maintained.

Table 4.2 PROFIBUS-DP cable colour codes

Cable	Data signal	Terminal	Description
Red	RxD/TxD-P	3	Positive data line (B)
Green	RxD/TxD-N	8	Negative data line (A)
Braided Shield	shield	1, Shell	Cable shield

PROFIBUS-DP 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 PROFIBUS-DP networks is available on the Profibus Nutzerorganisation (PNO) web site at www.Profibus.com.

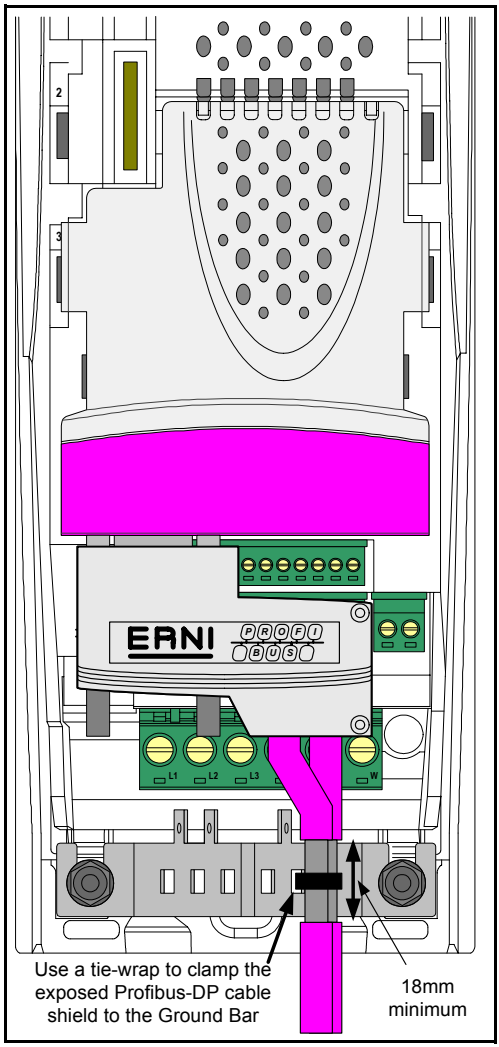
NOTE Control Techniques can only guarantee correct and reliable operation of the SM-PROFIBUS-DP if all other equipment installed on the PROFIBUS-DP network (including the network cable) has been approved by the PNO.

4.4 SM-PROFIBUS-DP cable shield connections

The electrical noise immunity of the PROFIBUS-DP network can be increased if the shields of the PROFIBUS-DP cables are grounded at every Unidrive SP, on their external surfaces before they enter the connector. This precaution is recommended unless there are specific reasons for avoiding grounding.

This can be achieved by exposing the cable shield of each PROFIBUS-DP cable and clamping them to the Grounding Bracket of the Unidrive SP using a tie-wrap. provided that the exposed length of cable shield is at minimum of 18mm, (as shown in Figure 4-3) the tie-wrap will ensure a good ground connection for the PROFIBUS-DP cable shield.

Figure 4-3 PROFIBUS-DP cable shield arrangement

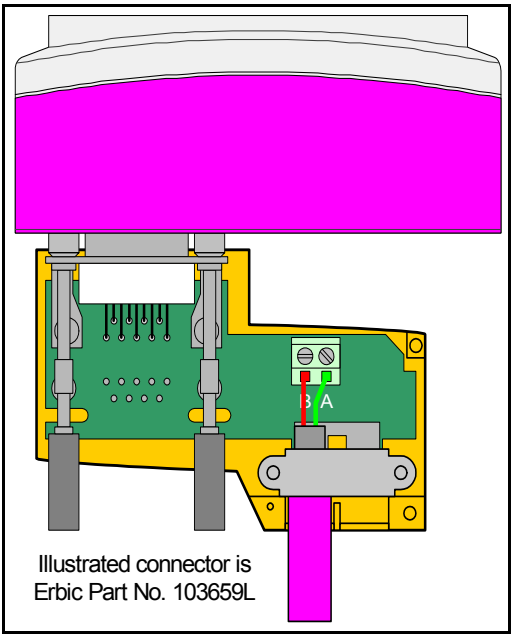


4.5 PROFIBUS-DP network termination

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

Erbic termination connectors are available from ERNI. These terminals (illustrated in Figure 4-4) have the termination resistor network built in, and only a single pair of terminals for the data wires. Siemens connectors have a built-in switch that allows the termination resistor network to be enabled or disabled as required.

Figure 4-4 PROFIBUS-DP network termination



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

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

4.6 Maximum network length

The maximum number of nodes that can be connected to a single PROFIBUS-DP network segment is 32. The maximum lengths of cable for a segment depend on the data rate and are shown in Table 4.3.

Repeaters can be used to extend the network to allow more than 32 nodes to be connected and/or to extend the maximum length of the PROFIBUS-DP network.

For full details on designing and installing a PROFIBUS-DP network, refer to "Installation Guidelines for Profibus-DP/FMS". This document is available from the Profibus web site at www.profibus.com.

Table 4.3 PROFIBUS-DP maximum network lengths

Data rate (bit/s)	Maximum trunk length (m)		Data rate (bit/s)	Maximum trunk length (m)
12M	100		187.5k	1000
6.0M	100		93.75k	1000
3.0M	100		45.45k	1000
1.5M	200		19.2k	1000
500k	400		9.6K	1000

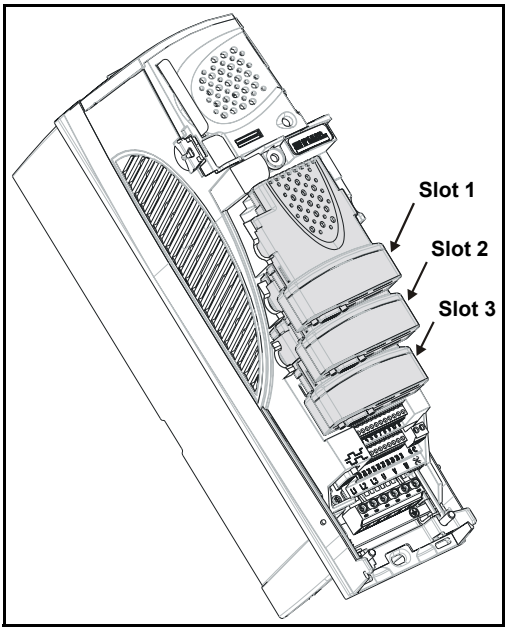
5 Getting Started

Full explanations of the cyclic data functions and supported data formats are given in Chapter 6 *Cyclic Data* on page 15. Non-cyclic data and node configuration using non-cyclic data are described in Chapter 8 *Non-Cyclic Data* on page 27.

NOTE The Unidrive SP must be fitted with firmware V1.00.00 or later for use with the SM-PROFIBUS-DP.

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

Figure 5-1 Unidrive SP Slot Arrangement



The SM-PROFIBUS-DP can be fitted to any slot and each slot has a corresponding menu of parameters. When referring to a specific parameter for any slot, e.g. PROFIBUS-DP node address, the parameter will be referred to as Pr **MM.03**.

Table 5.1 Slot configuration menu

Slot	Menu
1	Pr **15.PP**
2	Pr **16.PP**
3	Pr **17.PP**

5.1 CTSoft Wizard

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

5.2 SM-PROFIBUS-DP node address

Name	SM-PROFIBUS-DP node address		
Slot 1	Pr **15.03**	Default	126
Slot 2	Pr **16.03**	Range	0 to 126
Slot 3	Pr **17.03**	Access	RW

Every node on a PROFIBUS-DP network must be given a unique network node address. If two or more nodes are assigned the same address, they will attempt to transmit at the same time, leading to corrupt messages on the PROFIBUS-DP network. The SM-PROFIBUS-DP must be reset to make a change of node address take effect.

If an invalid node address is set, the SM-PROFIBUS-DP will over-write the value in Pr **MM.03** to 126. When the SM-PROFIBUS-DP is reset, this value will be used as the PROFIBUS-DP node address.

5.3 SM-PROFIBUS-DP data rate

Name	PROFIBUS-DP data rate		
Slot 1	Pr **15.04**	Default	N/A
Slot 2	Pr **16.04**	Range	-1 to 9
Slot 3	Pr **17.04**	Access	RO

The SM-PROFIBUS-DP will automatically detect the PROFIBUS-DP network data rate, and synchronise to it. For this reason, the data rate is controlled by the PROFIBUS-DP master controller. Pr **MM.04** will indicate the data rate that has been detected by the SM-PROFIBUS-DP.

NOTE The PROFIBUS-DP Data Rate parameter can be changed from the Unidrive SP keypad, but this will not affect the data rate at which the SM-PROFIBUS-DP communciates. The Data Rate display will be updated when the PROFIBUS-DP network is re-initialised.

-1 indicates that the SM-PROFIBUS-DP has not detected any activity on the PROFIBUS-DP network, and is waiting for the master controller to start communicating.

Table 5.2 SM-PROFIBUS-DP data rates

Pr MM.04	bit/s		Pr MM.04	bit/s
-1	Auto-detecting		5	187.5k
0	12M		6	93.75k
1	6.0M		7	45.45k
2	3.0M		8	19.2k
3	1.5M		9	9.6k
4	500k			

5.4 SM-PROFIBUS-DP data format

Name	SM-PROFIBUS-DP data format		
Slot 1	Pr **15.05**	**Default**	4
Slot 2	Pr **16.05**	**Range**	0 to 228
Slot 3	Pr **17.05**	**Access**	RO

The default data format is 4 cyclic words. Each cyclic data channel is mapped to a Unidrive SP parameter, with default mappings as shown in the table below.

Table 5.3 Default data mapping

Cyclic word	Data word	Default mapping status
IN channel 0	word 0, 1	Pr **10.40**, status word
IN channel 1	word 1, 2	Pr **2.01**, post-ramp speed reference
OUT channel 0	word 0, 1	Pr **6.42**, control word
OUT channel 1	word 2, 3	Pr **1.21**, digital speed reference 1

Other data formats are also supported. For further details. see section 6.2 *SM-PROFIBUS-DP data formats* on page 15.

5.5 SM-PROFIBUS-DP operating status

Name	PROFIBUS-DP operating status		
Slot 1	Pr **15.06**	**Default**	N/A
Slot 2	Pr **16.06**	**Range**	-3 to 9999
Slot 3	Pr **17.06**	**Access**	RO

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

Table 5.4 PROFIBUS-DP operating status codes

Pr MM.06	Parameter	Description
>0	Network healthy	Indicates the number of Processed cyclic messages per second.
0	Network healthy, no data transfer	Indicates that the PROFIBUS-DP master has established communications with the SM-PROFIBUS-DP. If operating status changes briefly to -1 and returns to 0, the slave configuration does not match the configuration in the master controller.
-1	Initialised	Indicates that the SM-PROFIBUS-DP has initialised correctly, and is waiting for the PROFIBUS-DP master to initialise communications.
-2	Internal hardware failure	Indicates that part of the SM-PROFIBUS-DP initialisation sequence was not successful. If this fault persists after a power cycle, replace the SM-PROFIBUS-DP.
-3	Configuration error	Indicates that there is an invalid setting in the SM-PROFIBUS-DP configuration parameters.

If a mapping configuration error (see 10.6*SM-PROFIBUS-DP mapping status* on page 50) or network error (see 10.8*SM-PROFIBUS-DP error codes* on page 53) is detected, the Unidrive SP may trip. Refer to section 10.7 *Unidrive SP trip display codes* on page 52 for details about the Unidrive SP trip display.

5.6 Resetting the SM-PROFIBUS-DP

Name	SM-PROFIBUS-DP reset		
Slot 1	Pr **15.32**	**Default**	0 (OFF)
Slot 2	Pr **16.32**	**Range**	0 (OFF) to 1 (ON)
Slot 3	Pr **17.32**	**Access**	RW

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

To reset an SM-PROFIBUS-DP in slot 3:

1. Set Pr **17.32** to ON.
2. When the reset sequence has been completed, Pr **17.32** will be reset to OFF.
3. The SM-PROFIBUS-DP will re-initialise using the updated configuration.

NOTE This sequence does NOT store the SM-PROFIBUS-DP configuration parameters in the Unidrive SP or the SM-PROFIBUS-DP FLASH memory.

5.7 Reset all Solutions Modules

To reset all Solutions Modules fitted on a Unidrive SP:

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

NOTE This sequence does NOT store the SM-PROFIBUS-DP configuration parameters in the Unidrive SP or the SM-PROFIBUS-DP FLASH memory.

6 Cyclic Data

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

6.1 What is cyclic data?

Cyclic data is a method of data transfer that must be set-up during network configuration and is transmitted automatically once configuration is complete. The high-speed data transfer is achieved by transmitting only data bytes over the PROFIBUS-DP network and relying on local mapping information within the SM-PROFIBUS-DP and PROFIBUS-DP master controller to ensure that the correct data is sent to the correct locations. The flexibility of the SM-PROFIBUS-DP means that each cyclic data OUT channel can be directed to any read-write Unidrive SP parameter. Similarly each cyclic data IN channel can use any Unidrive SP parameter as a source of data.

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

6.2 SM-PROFIBUS-DP data formats

Name	SM-PROFIBUS-DP data format		
Slot 1	Pr **15.05**	**Default**	4
Slot 2	Pr **16.05**	**Range**	0 to 228
Slot 3	Pr **17.05**	**Access**	RW

The SM-PROFIBUS-DP can be configured with up to 32 cyclic IN and OUT data words. IN and OUT cyclic data words are mapped using 10 mapping parameters each, with a "block mapping" mode (see section 11.6 *Block mapping* on page 59) available for the additional data words. CT Single Word or PPO 4 Word modes of non-cyclic data using cyclic data can also be enabled.

The SM-PROFIBUS-DP data format is specified as "NNPP", where NN is the non-cyclic data mode, and PP is the number of cyclic data words.

Table 6.1 Valid PROFIBUS-DP data formats

Pr MM.05	NN	PP	Non-cyclic mode	Cyclic words
1 to 32	0	1 to 32	None	1 to 32
100 to 131	1	0 to 31	CT Single Word	1 to 31
200 to 228	2	0 to 28	PPO 4 Word	1 to 28

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

Table 6.2 SM-PROFIBUS-DP mapping parameters

IN channel	Mapping parameter			OUT channel	Mapping parameter		
	Slot 1	Slot 2	Slot 3		Slot 1	Slot 2	Slot 3
0	Pr **15.10**	Pr **16.10**	Pr **17.10**	0	Pr **15.20**	Pr **16.20**	Pr **17.20**
1	Pr **15.11**	Pr **16.11**	Pr **17.11**	1	Pr **15.21**	Pr **16.21**	Pr **17.21**
2	Pr **15.12**	Pr **16.12**	Pr **17.12**	2	Pr **15.22**	Pr **16.22**	Pr **17.22**
3	Pr **15.13**	Pr **16.13**	Pr **17.13**	3	Pr **15.23**	Pr **16.23**	Pr **17.23**
4	Pr **15.14**	Pr **16.14**	Pr **17.14**	4	Pr **15.24**	Pr **16.24**	Pr **17.24**
5	Pr **15.15**	Pr **16.15**	Pr **17.15**	5	Pr **15.25**	Pr **16.25**	Pr **17.25**
6	Pr **15.16**	Pr **16.16**	Pr **17.16**	6	Pr **15.26**	Pr **16.26**	Pr **17.26**
7	Pr **15.17**	Pr **16.17**	Pr **17.17**	7	Pr **15.27**	Pr **16.27**	Pr **17.27**
8	Pr **15.18**	Pr **16.18**	Pr **17.18**	8	Pr **15.28**	Pr **16.28**	Pr **17.28**
9	Pr **15.19**	Pr **16.19**	Pr **17.19**	9	Pr **15.29**	Pr **16.29**	Pr **17.29**

"Block mapping" can be used to map several words to consecutive Unidrive SP parameters. Full details about "block mapping" can be found in section 11.6 *Block mapping* on page 59

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-PROFIBUS-DP will indicate a mapping error in the operating status parameter (Pr **MM.06)**. The reason for the mapping error will be indicated by the mapping status parameter (Pr **MM.49**). Refer to section 10.6 *SM-PROFIBUS-DP mapping status* on page 50 for more details.

When the data format is configured using Pr **MM.05**, the SM-PROFIBUS-DP will communicate using the same number of data words for IN and OUT data. It is, however, possible to configure the SM-PROFIBUS-DP to communicate with different numbers of IN and OUT cyclic data words. Refer to section 11.13 *Custom SM-PROFIBUS-DP data formats* on page 66 for full details.

NOTE The cyclic data channels do not use decimal points. For example, in Open Loop mode, the Unidrive SP 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 cyclic channels only (default)

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

Table 6.3 Mapping for 4 cyclic data words

Data word	Slot 1	Slot 2	Slot 3	Default mapping status
IN word 0, 1	Pr **15.10**	Pr **16.10**	Pr **17.10**	Pr **10.40**, status word
IN words 2, 3	Pr **15.11**	Pr **16.11**	Pr **17.11**	Pr **2.01**, post-ramp speed reference
OUT word 0, 1	Pr **15.20**	Pr **16.20**	Pr **17.20**	Pr **6.42**, control word
OUT word 2, 3	Pr **15.21**	Pr **16.21**	Pr **17.21**	Pr **1.21**, digital speed reference 1

6.2.2 3 cyclic channels with CT Single Word non-cyclic data

This data format provides three cyclic data channels, plus an additional channel for CT Single Word (mode 1) non-cyclic data (See section 8.1 *Mode 1 - CT Single Word mode* on page 27). The total data length is 8 words. To select this data format, set Pr **MM.05** = 106.

Table 6.4 Mapping for 3 cyclic channels with CT Single Word non-cyclic data

Data word	Slot 1	Slot 2	Slot 3	Default mapping status
IN word 0, 1	Pr **15.10**	Pr **16.10**	Pr **17.10**	Pr **61.50**, CT Single Word
IN word 2, 3	Pr **15.11**	Pr **16.11**	Pr **17.11**	Pr **10.40**, status word
IN word 4, 5	Pr **15.12**	Pr **16.12**	Pr **17.12**	Pr **2.01**, post-ramp speed reference
IN word 6, 7	Pr **15.13**	Pr **16.13**	Pr **17.13**	0, not mapped
OUT word 0, 1	Pr **15.20**	Pr **16.20**	Pr **17.20**	Pr **61.50**, CT Single Word
OUT word 2, 3	Pr **15.21**	Pr **16.21**	Pr **17.21**	Pr **6.42**, control word
OUT word 4, 5	Pr **15.22**	Pr **16.22**	Pr **17.22**	Pr **1.21**, digital speed reference 1
OUT word 6, 7	Pr **15.23**	Pr **16.23**	Pr **17.23**	0, not mapped

6.2.3 5 cyclic channels only

This data format provides five cyclic data channels, with no non-cyclic data channel. The total data length is 10 words. To select this data format, set Pr **MM.05** = 10.

Table 6.5 Mapping for 5 cyclic channels

Data word	Slot 1	Slot 2	Slot 3	Default mapping status
IN word 0, 1	Pr **15.10**	Pr **16.10**	Pr **17.10**	Pr **10.40**, status word
IN word 2, 3	Pr **15.11**	Pr **16.11**	Pr **17.11**	Pr **2.01**, post-ramp speed reference
IN word 4-9	Pr **15.12** to Pr **15.14**	Pr **16.12** to Pr **16.14**	Pr **17.12** to Pr **17.14**	0, not mapped
OUT word 0, 1	Pr **15.20**	Pr **16.20**	Pr **17.20**	Pr **6.42**, control word
OUT word 2, 3	Pr **15.21**	Pr **16.21**	Pr **17.21**	Pr **1.21**, digital speed reference 1
OUT word 4-9	Pr **15.22** to Pr **15.24**	Pr **16.22** to Pr **16.24**	Pr **17.22** to Pr **17.24**	0, not mapped

6.2.4 8 cyclic channels with PPO 4 Word (Mode 2) non-cyclic data

This data format provides eight cyclic data channels, plus an additional 4 words for PPO 4 Word (mode 2) non-cyclic data (See section 8.2 *Mode 2 - PPO 4 Word mode* on page 37). The total data length is 20 words. To select this data format set Pr **MM.05** = 216.

Table 6.6 Mapping for 8 cyclic channels with PPO 4 Word non-cyclic data

Data word	Slot 1	Slot 2	Slot 3	Default mapping status
IN word 0-3	Pr **15.10**	Pr **16.10**	Pr **17.10**	Pr **61.51**, Mode 2 non-cyclic data
IN word 4, 5	Pr **15.11**	Pr **16.11**	Pr **17.11**	Pr **10.40**, status word
IN word 6, 7	Pr **15.12**	Pr **16.12**	Pr **17.12**	Pr **2.01**, post-ramp speed reference
IN word 8-19	Pr **15.13** to Pr **15.19**	Pr **16.13** to Pr **16.19**	Pr **17.13** to Pr **17.19**	0, not mapped
OUT word 0-3	Pr **15.20**	Pr **16.20**	Pr **17.20**	Pr **61.51**, Mode 2 non-cyclic data
OUT word 4, 5	Pr **15.21**	Pr **16.21**	Pr **17.21**	Pr **6.42**,control word
OUT word 6, 7	Pr **15.22**	Pr **16.22**	Pr **17.22**	Pr **1.21**, digital speed reference 1
OUT word 8-19	Pr **15.23** to Pr **15.29**	Pr **16.23** to Pr **16.29**	Pr **17.23** to Pr **17.29**	0, not mapped

Block mapping can be used to map the remaining un-used data words to Unidrive SP or SM-Applications parameters. See section 11.6 *Block mapping* on page 59.

6.2.5 Parameter Process Data Objects (PPOs)

Five Parameter Process Data Objects are fully supported by the SM-PROFIBUS-DP. Refer to Chapter 12 *PROFIDRIVE Profile* on page 68 for full details about these PPOs.

6.3 Unidrive SP mapping conflicts

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

This only applies to analog and digital inputs, and OUT cyclic data on the PROFIBUS-DP network. The table below shows the parameters that need to be checked for possible mapping conflicts.

Table 6.7 Unidrive SP destination mapping parameters

Function	Mapping parameter	Function	Mapping parameter
Analog input 1	Pr **7.10**	Cyclic OUT slot 1 channel 7	Pr **15.27**
Analog input 2	Pr **7.14**	Cyclic OUT slot 1 channel 8	Pr **15.28**
Analog input 3	Pr **7.18**	Cyclic OUT slot 1 channel 9	Pr **15.29**
Digital input 1	Pr **8.21**	Cyclic OUT slot 2 channel 0	Pr **16.20**
Digital input 2	Pr **8.22**	Cyclic OUT slot 2 channel 1	Pr **16.21**
Digital input 3	Pr **8.23**	Cyclic OUT slot 2 channel 2	Pr **16.22**
Digital input 4	Pr **8.24**	Cyclic OUT slot 2 channel 3	Pr **16.23**
Digital input 5	Pr **8.25**	Cyclic OUT slot 2 channel 4	Pr **16.24**
Digital input 6	Pr **8.26**	Cyclic OUT slot 2 channel 5	Pr **16.25**
Logic output 1	Pr **9.10**	Cyclic OUT slot 2 channel 6	Pr **16.26**
Logic output 2	Pr **9.20**	Cyclic OUT slot 2 channel 7	Pr **16.27**
Motorised pot output	Pr **9.25**	Cyclic OUT slot 2 channel 8	Pr **16.28**

Table 6.7 Unidrive SP destination mapping parameters

Function	Mapping parameter	Function	Mapping parameter
Comparator 1 output	Pr **12.07**	Cyclic OUT slot 2 channel 9	Pr **16.29**
Comparator 2 output	Pr **12.27**	Cyclic OUT slot 3 channel 0	Pr **17.20**
Variable select 1 output	Pr **12.11**	Cyclic OUT slot 3 channel 1	Pr **17.21**
Variable select 2 output	Pr **12.31**	Cyclic OUT slot 3 channel 2	Pr **17.22**
PID output	Pr **14.16**	Cyclic OUT slot 3 channel 3	Pr **17.23**
Cyclic OUT slot 1 channel 0	Pr **15.20**	Cyclic OUT slot 3 channel 4	Pr **17.24**
Cyclic OUT slot 1 channel 1	Pr **15.21**	Cyclic OUT slot 3 channel 5	Pr **17.25**
Cyclic OUT slot 1 channel 2	Pr **15.22**	Cyclic OUT slot 3 channel 6	Pr **17.26**
Cyclic OUT slot 1 channel 3	Pr **15.23**	Cyclic OUT slot 3 channel 7	Pr **17.27**
Cyclic OUT slot 1 channel 4	Pr **15.24**	Cyclic OUT slot 3 channel 8	Pr **17.28**
Cyclic OUT slot 1 channel 5	Pr **15.25**	Cyclic OUT slot 3 channel 9	Pr **17.29**
Cyclic OUT slot 1 channel 6	Pr **15.26**		

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

6.4 Cyclic data mapping errors

The SM-PROFIBUS-DP will scan and check the PROFIBUS-DP mapping parameter configuration for errors during initialisation. If an error is detected, the PROFIBUS-DP operating status parameter (Pr **MM.06**) will indicate -3, and the mapping error detected will be indicated in mapping status parameter, Pr **MM.49**. See section 10.6 *SM-PROFIBUS-DP mapping status* on page 50 for full details.

6.5 Storing SM-PROFIBUS-DP configuration parameters

Name	Store to SM-PROFIBUS-DP FLASH memory		
Slot 1	Pr **15.31**	**Default**	OFF
Slot 2	Pr **16.31**	**Range**	OFF (0) to ON (1)
Slot 3	Pr **17.31**	**Access**	RW

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

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

The SM-PROFIBUS-DP configuration parameters can also be stored in the FLASH memory on the SM-PROFIBUS-DP. If the Unidrive SP is replaced, the SM-PROFIBUS-DP configuration parameters can subsequently be restored to the Unidrive SP.

6.5.1 Saving Unidrive SP parameters

To store Unidrive SP parameters:

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

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

NOTE Unidrive SP parameters are NOT stored in the SM-PROFIBUS-DP.

6.5.2 Storing parameters to SM-PROFIBUS-DP FLASH memory

To store the SM-PROFIBUS-DP configuration parameters in the FLASH memory in the SM-PROFIBUS-DP in slot 3:

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

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

6.6 Disabling cyclic data channels

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

7 Control and Status Words

7.1 Unidrive SP control word

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

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

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

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

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

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

To select the PROFIBUS-DP speed reference, set the REMOTE bit to 1. As the REMOTE bit directly controls Pr **1.42**, this will select the digital speed reference as the main speed reference for the Unidrive SP. When REMOTE is reset to 0, the Unidrive SP will revert to using the external analog speed reference.

NOTE By default, the digital speed reference will be Pr **1.21**, which is also the default mapping for the fieldbus speed reference. The actual digital speed reference selected when REMOTE is set to 1 will depend on the setting of the digital speed reference selector, Pr **1.15**.

Table 7.1 Unidrive SP control word bit functions

Bit	Function	Description
0	ENABLE	Set to 1 to enable the Unidrive SP. Resetting to 0 will immediately disable the Unidrive SP, and the motor will coast to stop. The external HARDWARE ENABLE signal must also be present before the Unidrive SP can run.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward direction. When reset to 0, the Unidrive SP will decelerate the motor to a controlled stop before the PWM output stack is disabled
2	JOG	Set to 1 to jog the motor FORWARD. This signal needs to be used in conjunction with the ENABLE bit. This signal is overridden by a RUN/RUN REV/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 Unidrive SP will decelerate the motor to a controlled stop before the PWM output stack is disabled

Table 7.1 Unidrive SP control word bit functions

Bit	Function	Description
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 Unidrive SP will decelerate the motor to a controlled stop before the PWM output stack is disabled.
6	NOT STOP	Set to 1 to allow the sequencing bit to be latched. If NOT STOP is zero, all latches are cleared and held at 0. Pr **6.04** must be correctly set for this to function.
7	AUTO	Set to 1 to enable the Unidrive SP Control Word. The Control Word Enable (Pr **6.43**) must also be set to 1. When reset to 0, the Unidrive SP will operate under terminal control.
8	REMOTE	Set to 1 to select digital speed reference 1 (Pr **1.21**), and reset to 0 to select analog reference 1 (Pr **1.36**). REMOTE directly controls Pr **1.42**, so reference selector (Pr **1.14**) and preset selector (Pr **1.15**) must both be set to 0 (default) for the REMOTE bit to work properly.
9	JOG REV	Set to 1 to REVERSE jog the motor . This signal needs to be used in conjunction with the ENABLE bit. This signal is overridden by a RUN/RUN REV/RUN FWD command.
10-11	Reserved	
12	TRIP	Set to 1 to trip the Unidrive SP at any time. The trip display on Unidrive SP 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 Unidrive SP from a trip condition. If the reason for the trip is still present, or another fault condition has been detected, the Unidrive SP will immediately trip again. When resetting the Unidrive SP, it is recommended to check the status word to ensure that the reset was successful, before attempting to re-start the Unidrive SP.
14	KEYPAD WDOG	Reserved for use with external keypads.
15	Reserved	

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

The diagram below shows the key for the Unidrive SP control word sequencing logic diagram.

Figure 7-1 Control sequencer logic diagram key

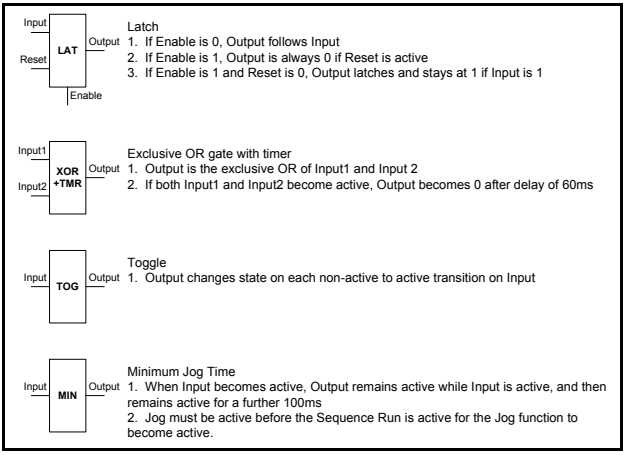
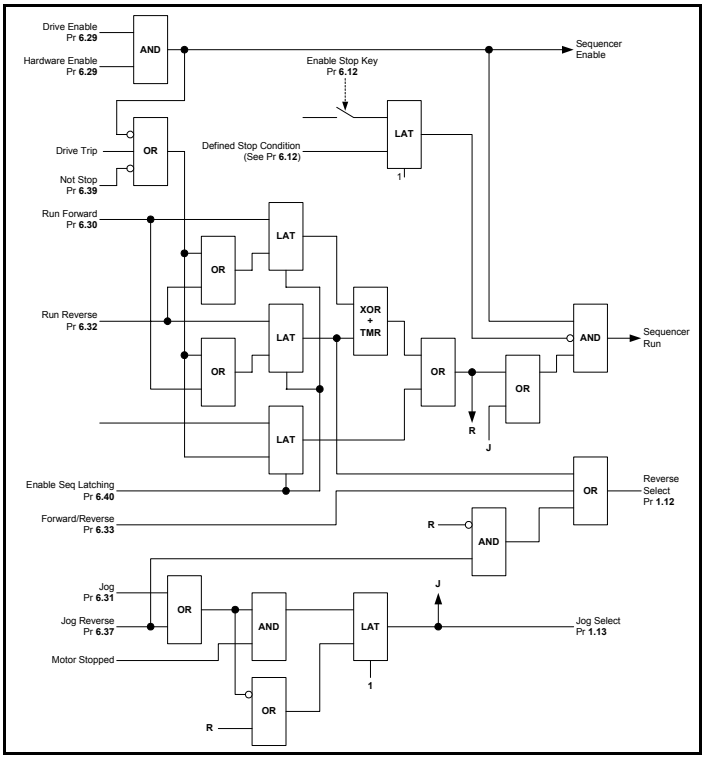


Figure 7-2 Control sequencer logic diagram



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

Table 7.2 Example Unidrive SP control words

Control word (Hex)	Control word (Dec.)	Action
0x0000	0	Control word disabled, Unidrive SP will operate under terminal control
0x0080	128	Disabled
0x0081	129	Enabled, stopped
0x0183	387	Enabled, run fwd, digital speed ref
0x0189	393	Enabled, run rev, digital speed ref
0x0083	131	Enabled, run fwd, analog speed ref
0x0089	137	Enabled, run rev, analog speed ref
0x01A1	417	Enabled, run fwd, digital speed ref
0x01B1	433	Enabled, run rev, digital speed ref
0x00A1	161	Enabled, run fwd, analog speed ref
0x00B1	177	Enabled, run rev, analog speed ref
0x0085	133	Enabled, jog fwd
0x0281	641	Enabled, jog rev
0x1000	4096	Trip Unidrive SP
0x2080	8320	Reset Unidrive SP into fieldbus control, disabled
0x2000	8192	Reset Unidrive SP into terminal control

7.2 Unidrive SP status word

The status word returns the status of multiple functions within the Unidrive SP, e.g. At speed, Zero speed, Drive healthy, etc., and provides a quick method of checking the current status of the Unidrive SP. The status word is mapped to cyclic data as Pr **10.40**.

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

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

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

Table 7.3 Unidrive SP status word bit functions

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

Table 7.3 Unidrive SP status word bit functions

Bit	Parameter	Description
2	Pr **10.03**	**Zero speed** In Open Loop mode, zero speed indicates that the absolute value of the post-ramp speed reference (Pr **2.01**) is at or below the zero speed threshold defined by Pr **3.05**. In Closed Loop and Servo modes, zero speed indicates that the absolute value of speed feedback (Pr **3.02**) is at or below the zero speed threshold defined by Pr **3.05**.
3	Pr **10.04**	**Running at or below minimum speed** 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 Unidrive SP is running.
4	Pr **10.05**	**Below set speed** Only set if the Unidrive SP is running. Refer to Pr **3.06**, Pr **3.07** and Pr **3.09** in the *Unidrive SP Advanced User Guide*.
5	Pr **10.06**	**At speed** Only set if the Unidrive SP is running. Refer to Pr **3.06**, Pr **3.07** and Pr **3.09** in the *Unidrive SP Advanced User Guide*.
6	Pr **10.07**	**Above set speed** Only set if the Unidrive SP is running. Refer to Pr **3.06**, Pr **3.07** and Pr **3.09** in the *Unidrive SP Advanced User Guide*.
7	Pr **10.08**	**Load reached** Indicates that the modulus of the active current is greater or equal to the rated active current, as defined in menu 4. Refer to the *Unidrive SP Advanced User Guide* for more details.
8	Pr **10.09**	**In current limit** Indicates that the current limits are active.
9	Pr **10.10**	**Regenerating** In Open Loop, Closed Loop and Servo modes, regenerating indicates that power is being transferred from the motor to the Unidrive SP. In Regen mode, regenerating indicates that power is being transferred from the supply to the Unidrive SP.
10	Pr **10.11**	**Dynamic brake active** Indicates that the braking IGBT is active. If the IGBT becomes active, this parameter will remain on for at least one second.
11	Pr **10.12**	**Dynamic brake alarm** Dynamic brake alarm is set when the braking IGBT is active, and the braking energy accumulator is greater than 75%.
12	Pr **10.13**	**Direction commanded** 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	Pr **10.14**	**Direction running** In Open Loop mode, direction running is set to 1 if the post-ramp speed reference (Pr **2.01**) is negative, and reset to 0 if the post-ramp speed reference is zero or positive. In Closed Loop Vector and Servo modes, direction running is set to 1 if the Speed Feedback (Pr **3.02**) is negative and reset to 0 if the speed feedback is zero or positive.

Table 7.3 Unidrive SP status word bit functions

Bit	Parameter	Description
14	Pr **10.15**	**Mains loss** In Open Loop, Closed Loop Vector and Servo modes, mains loss indicates that the drive has detected mains loss from the level of the DC 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 *Unidrive SP Advanced User Guide* the for more details. In Regen mode, mains loss is the inverse of Pr **3.07**. Refer to the *Unidrive SP Advanced User Guide* the for more details.
15	Not Used	Reserved

8 Non-Cyclic Data

CT Single Word non-cyclic data is available on the SM-PROFIBUS-DP. This method uses an additional polled data channel to implement the CT Single Word protocol to access any Unidrive SP parameter.

NOTE If polled data compression is disabled the non-cyclic channel will be 32-bits wide, (i.e. uses 2 words, and data must be transferred on the low word). If polled data compression is enabled, the non-cyclic channel will revert to 16-bits and only use 1 word (See section 11.8 *Cyclic data compression* on page 61).

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

NOTE As non-cyclic data control is implemented entirely in the PROFIBUS-DP master controller the method used will depend entirely on the type of master controller used. For this reason Control Techniques is only able to offer basic guidance when implementing non-cyclic data transfer for any particular PROFIBUS-DP scanner and PLC combination.

The SM-PROFIBUS-DP provides several data formats that allow CT Single Word or PPO 4 Word modes to be used. Refer to section 6.2 *SM-PROFIBUS-DP data formats* on page 15 for more details.

Table 8.1 SM-PROFIBUS-DP non-cyclic data modes

Non-cyclic mode	Format	Pr MM.05
Disabled	None	0PP
Mode 1	CT Single Word	1PP
Mode 2	PPO 4 Word	2PP

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.

8.1 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 for Unidrive SP 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.

8.1.1 Mapping For CT Single Word non-cyclic data

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

1. Set Pr **17.05** to the required mode.
2. Set Pr **17.32** to ON to reset and reconfigure the SM-PROFIBUS-DP.

When the SM-PROFIBUS-DP 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 17.05 = 5)		After format change (Pr 17.05 = 105)	
	Value	Mapping	Value	Mapping
Pr **17.10**	1040	Pr **10.40**, status word	6150	Pr **61.50**, CT Single 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	6150	Pr **61.50**, CT Single 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 **17.23** 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.

8.1.2 CT Single Word protocol

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

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

b7	b6	b5	b4	b3	b2	b1	b0
Data Byte							

Table 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 Unidrive SP. 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.

8.1.3 16-bit parameter access

16-bit data can be used to access parameters within the Unidrive SP using only 4 telegrams. If an attempt is made to read a 32-bit parameter from the Unidrive SP 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.

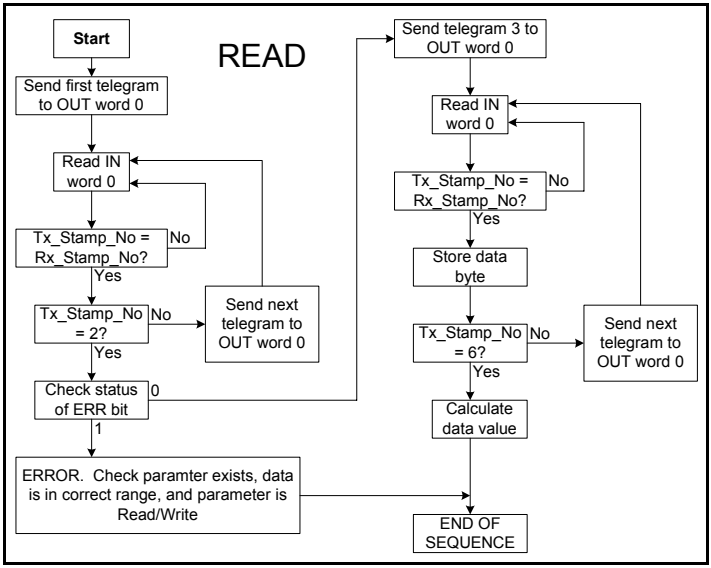
When writing data to a 32-bit parameter, the 16-bit data will be treated as a signed 16-bit data value. This limits the range that can be written to a 32-bit parameter.

8.1.4 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 Unidrive SP.

TELEGRAM 1

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

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

Data word = 0x9300

Stamp number = 3

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

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

Data word = 0x9300

Stamp number = 3

Data high byte = 0x00 = 0

TELEGRAM 4

The fourth telegram from the PROFIBUS-DP 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 = 0x01 = 1

TELEGRAM 5

The fifth telegram from the PROFIBUS-DP 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 = 0x25 = 37

TELEGRAM 6

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

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

Data word = 0x9600

Stamp number = 6

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

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

Data word = 0x96DC

Stamp number = 6

Data low byte = 0xDC = 220

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

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

= 75228

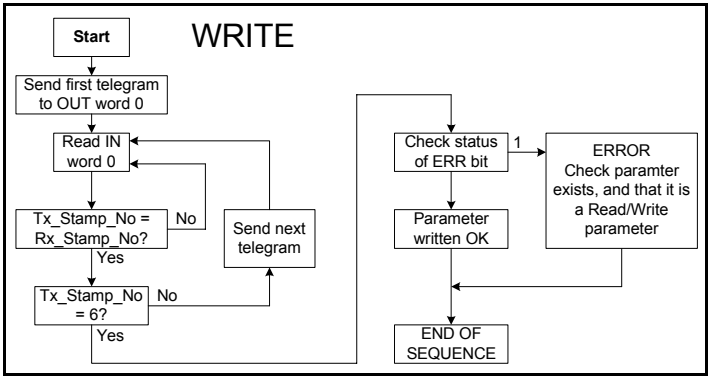
= 7522.8 rpm

8.1.5 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 Unidrive SP.

TELEGRAM 1

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

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

Data word = 0x15EA

Stamp number = 5

Data mid-low byte = 0xEA = 234

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

TELEGRAM 6

The sixth telegram from the PROFIBUS-DP 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 Unidrive SP.) If the operation is successful, the ERR bit is reset to 0 and the telegram is reflected in the non-cyclic IN word.

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

Data word = 0x1663

Stamp number = 6

Data low byte = 0x63 = 99

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0101	0110	0110	0011

Data word = 0x5663

Stamp number = 6

8.1.6 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 be setting the non-cyclic word to 0.

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

Data word = 0x0000

Stamp number = 0

8.2 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 Unidrive SP parameter to be accessed using a single combination of data words.

8.2.1 Mapping for PPO 4 Word non-cyclic data

To configure an SM-PROFIBUS-DP in slot 3 for PPO 4 word mode non-cyclic data, the following steps must be performed:

1. Set Pr **17.05** to the required mode.
2. Set Pr **17.32** to ON to reset and reconfigure the SM-PROFIBUS-DP.

When the SM-PROFIBUS-DP 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 **17.10** and Pr **17.20** will now appear in Pr **17.11** and Pr **17.21** 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.

8.2.2 PPO 4 Word protocol

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

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 Unidrive SP. Specify MENU and PARAMETER, set DATA HIGH word and DATA LOW word to 0.
7	Change parameter value (16 bit)	Write 16-bit parameter value to Unidrive SP. Specify MENU, PARAMETER and DATA LOW word. (Any value in DATA HIGH word will be discarded.) This function can be used to write to 32-bit Unidrive SP parameters, but the range of values is limited to 16-bits.
8	Change parameter value (32 bit)	Write 32-bit parameter value to Unidrive SP. Specify MENU, PARAMETER, DATA HIGH word and DATA LOW word. This function can also be used to write to 16-bit Unidrive SP parameters, but if DATA HIGH word is not set to 0, a value over-range error will be reported.
9	Request last parameter reference	Returns the last parameter for the specified menu. Specify MENU. (Values in PARAMETER, DATA HIGH word and DATA LOW word will be discarded.)

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

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.

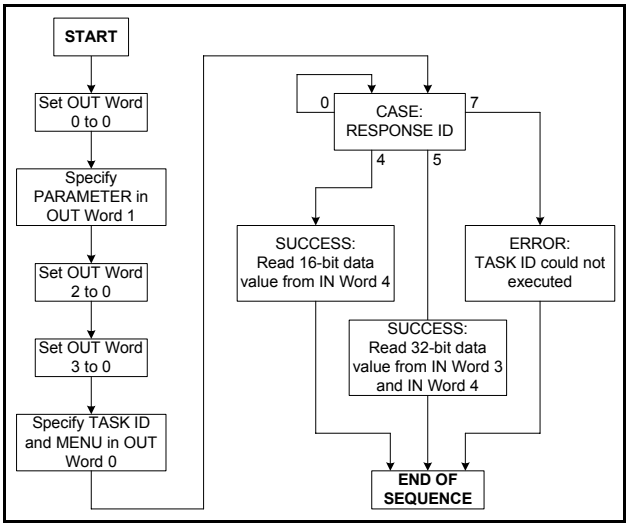
Table 8.9 PPO 4 Word error codes

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

8.2.3 Reading parameters using PPO 4 Word mode

The diagram below shows the sequence of events required to read a Unidrive SP 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 Unidrive SP.

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 Unidrive SP.

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

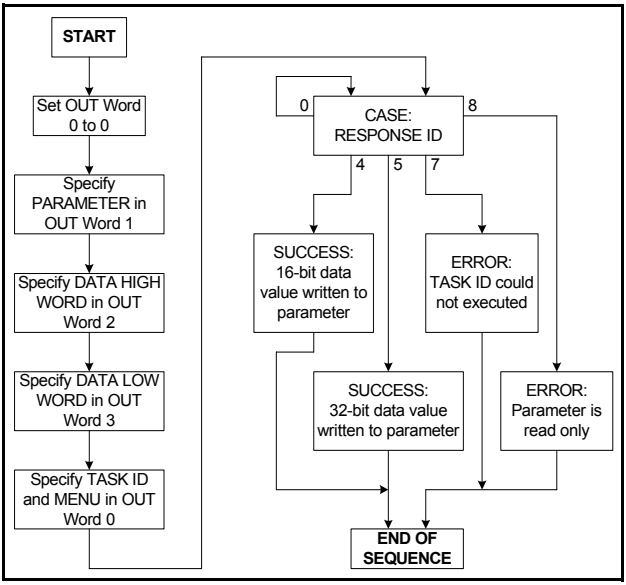
IN data word	Hex value	Function			
		b15-b12	b11	b10-b8	b7-b0
IN word 0	0x5002	RESPONSE ID = 5	0	MENU = 2	
IN word 1	0x0001	PARAMETER = 1			0
IN word 2	0x0000	DATA HIGH word = 0			
IN word 3	0x3BB4	DATA LOW word = 15284			

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.

8.2.4 Writing parameters using PPO 4 Word mode

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

Figure 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 Unidrive SP.

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 Unidrive SP.

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.

8.3 SM-PROFIBUS-DP set-up using non-cyclic data

The SM-PROFIBUS-DP can also be configured using CT Single Word or PPO 4 Word non-cyclic data. The configuration parameters for the slot in which the SM-PROFIBUS-DP is located can be accessed as Pr **60.PP**.

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

9 GSD Files

9.1 What are GSD Files?

GSD files are text files that are used by the PROFIBUS-DP network configuration software tools. They contain information about the device timings, features supported and available data formats for the PROFIBUS-DP device. GSD files are available from your local Control Techniques Drive Centre.

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

9.2 Data consistency

There is a potential problem with “data skew” when transferring blocks of data to a PROFIBUS-DP master controller. If the PLC operating system interrupts the transfer of data to the PROFIBUS-DP master controller, there is a possibility that the master controller will send a PROFIBUS-DP message containing a mixture of “new” and “old” data values. This effect is known as “data skew”.

To prevent data skew PROFIBUS-DP has a feature known as “data consistency”. Consistent data defines a block or data words that must ALL be updated in the PROFIBUS-DP master controller before ANY of the “new” data values are transmitted. Consequently, the message sent over the PROFIBUS-DP network will have all “old” or all “new” data values.

Some PLCs have special functions implemented within their operating systems to transfer blocks of “consistent data” to a PROFIBUS-DP master controller and guarantee that “data skew” cannot occur. For example, the Siemens S7 range of PLCs requires the use of SFC14 and SFC15 to transfer data to a blocks of consistent registers.

9.2.1 Using CT Single Word non-cyclic data

CT Single Word non-cyclic data uses only 1 word of data, so there are no problems with consistency. The GSD file provides the “CT Single Word” which consists of 1 IN/OUT word without consistency.

9.2.2 Using PPO 4 Word non-cyclic data

Data consistency is important when using PPO4 word (Mode 2) non-cyclic data as each non-cyclic message consists of 4 words. If there is data skew between any of the non-cyclic words, this could result is the wrong data value being written to the wrong parameter.

The GSD file provides the “PPO 4 Word” which consists of 4 IN/OUT words with consistency.

9.3 Data configuration

The flexibility of the SM-PROFIBUS-DP allows 2372 different data formats to be configured and used. Obviously, this is too many formats to list in the GSD file, so each data format can be configured using up to 8 different modules. This reduces the number of modules that must be defined in the GSD file to 76.

The total number of cyclic IN and OUT data words configured in the master and the SM-PROFIBUS-DP must be the same to establish communications over PROFIBUS-DP network. If non-cyclic data is required, the non-cyclic “CT Single Word” and/or the “PPO 4 Word” modules must be selected. A total of 8 different modules can be selected to configure the data format required.

9.3.1 Using data format parameter (Pr MM.05)

The data format parameter takes the form of Pr **MM.05** = NNCC, where:

NN = non-cyclic mode

CC = number of cyclic data words.

- If non-cyclic data is required select the desired non-cyclic mode.
- If the data format is specified using Pr **MM.05**, the number of IN and OUT cyclic data words will be equal.
- For 1 to 16 cyclic words simply choose the IN module with the appropriate number of IN words. Repeat for the OUT module.
- For 17 to 32 cyclic words choose 2 IN modules so that the total number of IN words from both modules is correct. Repeat for the OUT modules.
- If consistency is required ensure that selected modules are listed as having consistency enabled.

Table 9.1 Example configuration using Pr MM.05

Data format (Pr MM.05)	IN/OUT cyclic words	Non-cyclic mode	Consistency	Possible modules
4	4	None	None	4 IN words 4 OUT words
30	30	None	None	16 IN words 14 IN words 16 OUT words 14 OUT words
109	9	CT Single Word	Full	CT Single Word 9 IN words - Consistency 9 OUT words - Consistency
118	18	CT Single Word	None	CT Single Word 6 IN words 12 IN words 6 OUT words 12 OUT words
210	10	PPO 4 Word	None	PPO 4 Word 10 IN words 10 IN words
224	24	PPO 4 Word	Full	PPO 4 Word 16 IN words - Consistency 8 IN words - Consistency 16 OUT words - Consistency 8 OUT words - Consistency

9.3.2 Using PPO format parameter (Pr MM.38)

When a PPO is selected the data format is pre-defined by the PROFIDRIVE profile. Simply select the required PPO with or without consistency.

Table 9.2 Example configuration using Pr MM.38

PPO selected (Pr MM.38)	Consistency	Modules
1	None	PPO 1
2	None	PPO 2
3	Full	PPO 3 - Consistency
4	None	PPO 4
5	Full	PPO 5 - COnsistency

For further details about selecting PPOs, refer to section 12.1 *PPO Types* on page 68.

9.3.3 User-defined data formats

The number of IN words is specified in Pr **MM.39** and the number of OUT words is specified by Pr **MM.40**. (See section 11.13 *Custom SM-PROFIBUS-DP data formats* on page 66 for more details.)

- If non-cyclic data is required specify the CT Single Word and/or PPO 4 Word.
- If CT Single Word mode is used this will account for 2 IN and 2 OUT words of the cyclic words specified in Pr **MM.39** and Pr **MM.40**.
- If PPO 4 Word mode is used, this will account for 4 IN and 4 OUT words of the cyclic data words specified in Pr **MM.39** and Pr **MM.40**.
- For IN words specify up to 3 INs such that the total number of specified IN data words is equal to the cyclic words remaining when non-cyclic data has been accounted for.
- For OUT words specify up to 3 OUT modules such that the total number of specified OUT data words is equal to the cyclic words remaing when non-cyclic data has been accounted for.

Table 9.3 Example configuration using Pr MM.39 and Pr MM.40

IN words (Pr MM.39)	Non-cyclic mode	Non-cyclic words	IN cyclic words	Consistency	Possible modules
4	None	0	4	None	4 IN words 4 OUT words
12	CT Single Word	1	11	None	CT Single Word 11 IN words 11 OUT words
18	None	0	18	Full	12 IN words - Consistency 6 IN words - Consistency 12 OUT words - Consistency 6 OUT words - Consistency
26	PPO 4 Word	4	22	None	PPO 4 Word 12 IN words 10 IN words 12 OUT words 10 OUT words

Table 9.4

OUT words (Pr MM.40)	Non-cyclic mode	Non-cyclic words	OUT cyclic words	Consistency	Possible modules
9	None	0	9	None	9 IN words 9 OUT words
17	CT Single Word	1	16	None	CT Single Word 16 IN words 16 OUT words
18	None	0	18	Full	9 IN words - Consistency 9 IN words - Consistency 9 OUT words - Consistency 9 OUT words - Consistency
24	PPO 4 Word	4	20	None	PPO 4 Word 7 IN words 13 IN words 7 OUT words 13 OUT words

10 Diagnostics

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

10.1 Module ID code

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

The module ID code indicates the type of solutions module that is fitted in the corresponding slot. The table below shows a list of the solutions modules available for Unidrive SP.

Table 10.1 Solution module ID codes

Module code	Module type	Category
0	None fitted	None
101	SM-Resolver	Position feedback
102	SM-Universal Encoder Plus	Position feedback
103	SM-SLM	Position feedback
201	SM-I/O Plus	I/O expansion
301	SM-Applications	Applications module
302	SM-Applications Lite	Applications module
403	SM-PROFIBUS-DP	Fieldbus
404	SM-INTERBUS	Fieldbus
406	SM-CAN	Fieldbus
407	SM-DeviceNet	Fieldbus
408	SM-CANopen	Fieldbus

10.2 SM-PROFIBUS-DP firmware version

Name	SM-PROFIBUS-DP firmware - major version		
Slot 1	Pr **15.02**	Default	N/A
Slot 2	Pr **16.02**	Range	00.00 to 99.99
Slot 3	Pr **17.02**	Access	RO

Name	SM-PROFIBUS-DP firmware - minor version		
Slot 1	Pr **15.51**	Default	N/A
Slot 2	Pr **16.51**	Range	0 to 99
Slot 3	Pr **17.51**	Access	RO

The full version of the SM-PROFIBUS-DP firmware can be read for the corresponding slot. Table 10.2 shows how to construct the full firmware version from these values.

Table 10.2 SM-PROFIBUS-DP firmware version

Major version	Minor version	Firmware version
1.01	5	V1.01.05

10.3 SM-PROFIBUS-DP node address

Name	PROFIBUS-DP node address		
Slot 1	Pr **15.03**	Default	126
Slot 2	Pr **16.03**	Range	0 to 126
Slot 3	Pr **17.03**	Access	RW

Every node on a PROFIBUS-DP network must be given a unique network node address. If two or more nodes are assigned the same address they will attempt to transmit at the same time leading to corrupt messages on the PROFIBUS-DP network. The SM-PROFIBUS-DP must be reset to make a change of node address take effect.

If an invalid node address is set the SM-PROFIBUS-DP will over-write the value in Pr **MM.03** to 126. When the SM-PROFIBUS-DP is reset this value will be used as the PROFIBUS-DP node address.

10.4 SM-PROFIBUS-DP data rate

Name	PROFIBUS-DP data rate		
Slot 1	Pr **15.04**	Default	N/A
Slot 2	Pr **16.04**	Range	-1 to 9
Slot 3	Pr **17.04**	Access	RO

The SM-PROFIBUS-DP will automatically detect the PROFIBUS-DP network data rate and synchronise to it. For this reason, the data rate is controlled by the PROFIBUS-DP master controller. Pr **MM.04** will indicate the data rate that has been detected by the SM-PROFIBUS-DP.

NOTE The PROFIBUS-DP Data Rate parameter can be changed from the Unidrive SP keypad but this will not affect the data rate at which the SM-PROFIBUS-DP communicates. The Data Rate display will be updated when the PROFIBUS-DP network is re-initialised.

-1 indicates that the SM-PROFIBUS-DP has not detected any activity on the PROFIBUS-DP network and is waiting for the master controller to start communicating.

Table 10.3 PROFIBUS-DP data rates

Pr MM.04	bit/s		Pr MM.04	bit/s
-1	Auto-detecting		5	187.5k
0	12M		6	93.75k
1	6.0M		7	45.45k
2	3.0M		8	19.2k
3	1.5M		9	9.6k
4	500k			

10.5 SM-PROFIBUS-DP operating status

Name	SM-PROFIBUS-DP operating status		
Slot 1	Pr **15.06**	**Default**	N/A
Slot 2	Pr **16.06**	**Range**	-3 to 9999
Slot 3	Pr **17.06**	**Access**	RO

The operating status of the SM-PROFIBUS-DP can be viewed in the operating status parameter (Pr **MM.06)**. When the SM-PROFIBUS-DP is communicating successfully with the PROFIBUS-DP master controller Pr **MM.06** will give an indication of the number of cyclic data messages that are being processed per second.

Table 10.4 PROFIBUS-DP operating status codes

Pr MM.06	Parameter	Description
>0	Network Healthy	Indicates the number of processed cyclic messages per second.
0	Network Healthy, No Data Transfer	Indicates that the PROFIBUS-DP master has established communications with the SM-PROFIBUS-DP. If operating status changes briefly to -1 and returns to 0, the slave configuration does not match the configuration in the master controller.
-1	Initialised	Indicates that the SM-PROFIBUS-DP has initialised correctly, and is waiting for the PROFIBUS-DP master to initialise communications.
-2	Internal Hardware Failure	Indicates that part of the SM-PROFIBUS-DP initialisation sequence was not successful. If this fault persists after a power cycle, replace the SM-PROFIBUS-DP.
-3	Configuration Error	Indicates that there is an invalid setting in the SM-PROFIBUS-DP configuration parameters.

If a mapping configuration error (see 10.6*SM-PROFIBUS-DP mapping status* on page 50) or network error (see 10.8*SM-PROFIBUS-DP error codes* on page 53) is detected the Unidrive SP may trip. Refer to section 10.7 *Unidrive SP trip display codes* on page 52 for details about the Unidrive SP trip display.

10.6 SM-PROFIBUS-DP mapping status

Name	SM-PROFIBUS-DP mapping status		
Slot 1	Pr **15.49**	**Default**	0
Slot 2	Pr **16.49**	**Range**	0 to 255
Slot 3	Pr **17.49**	**Access**	RO

If the SM-PROFIBUS-DP 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-PROFIBUS-DP mapping status parameter, Pr **MM.49**. When an mapping error has been corrected, reset the SM-PROFIBUS-DP by setting Pr **MM.32** to ON (1).

Table 10.5 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 **MM.05**.

Table 10.5 Generic mapping error codes

Error	Mapping status	Description
Invalid mode value	5	The value entered in Pr **MM.05** 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 **MM.10** to Pr **MM.19**).
Configuration read error	110	An error has occurred reading the IN cyclic data mapping configuration parameters (Pr **MM.10** to Pr **MM.19**) from the Unidrive SP.
Invalid source parameter	111	One or more parameters specified in the IN cyclic data mapping configuration (Pr **MM.10** to Pr **MM.19**) is outside of the allowed range for PROFIBUS-DP. The allowable parameter range is from Pr **0.00** to Pr **199.99**.
Read mismatch	112	One or more parameters specified in the IN cyclic data mapping configuration (Pr **MM.10** to Pr **MM.19**) 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 **MM.10** to Pr **MM.19**) 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 **MM.20** to Pr **MM.29**)
Configuration read error	210	An error has occurred reading the OUT cyclic data mapping configuration parameters (Pr **MM.20** to Pr **MM.29**) from the Unidrive SP.
Invalid destination parameter	211	One or more parameters specified in the OUT cyclic data mapping configuration (Pr **MM.20** to Pr **MM.29**) is outside of the allowed range for PROFIBUS-DP. The allowable parameter range is from Pr **0.00** to Pr **199.99**.
Write mismatch	212	One or more parameters specified in the OUT cyclic data mapping configuration (Pr **MM.20** to Pr **MM.29**) cannot be used as a destination parameter for OUT data. The parameter may not exist, or is a read-only parameter. This error will also occur if an attempt is made to map OUT data to the configuration parameters of a fieldbus option in another slot, unless that fieldbus is configured in register mode, i.e. Pr **MM.09** = ON (1).
Hole in OUT data mapping configuration	213	OUT data mapping parameters (Pr **MM.20** to Pr **MM.29**) 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 **MM.20** to Pr **MM.29**) have been configured with the same destination parameter reference.

Table 10.5 Generic mapping error codes

Error	Mapping status	Description
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.

Some additional error codes are also available with the SM-PROFIBUS-DP. These are listed in Table 10.6.

Table 10.6 SM-PROFIBUS-DP specific mapping error codes

Error	Mapping status	Description
Configuration error	30	No data format has been selected. Data format (Pr **MM.05**), Parameter Process Object (Pr MM.38) and PROFIBUS-DP IN and OUT cyclic words (Pr **MM.39** and Pr **MM.40**) are all set to 0.
PPO error	31	The pre-defined PPOs (1 to 5) cannot be used when direct data mapping is enabled.
PPO and data format error	32	PPOs can only be selected if the data format parameter (Pr **MM.05**) is set to 0.
Data compression disbaled with PPO	33	PPOs can only be selected if data compression (Pr **MM.34**) is enabled.

10.7 Unidrive SP trip display codes

If the SM-PROFIBUS-DP detects an error during operation, it will force a trip on the Unidrive SP. However, the trip code displayed on the Unidrive SP will only indicate which slot initiated the trip. The exact reason for the trip will be indicated in the SM-PROFIBUS-DP error code parameter, Pr **MM.50**.

Table 10.7 below shows the possible trip codes that will be displayed on the Unidrive SP when a problem is detected with the SM-PROFIBUS-DP or when the SM-PROFIBUS-DP initiates a trip.

Table 10.7 Unidrive SP trip display codes

Slot where trip was initiated			Fault	Description
Slot 1	Slot 2	Slot 3		
SL1.HF	SL2.HF	SL3.HF	Hardware fault	Unidrive SP has detected that a solutions module is present, but is unable to communicate with it. This trip will also occur if the SM-PROFIBUS-DP is removed from the Unidrive SP while it is powered up.
SL1.tO	SL2.tO	SL3.tO	Watchdog timeout	Not used by SM-PROFIBUS-DP.

Table 10.7 Unidrive SP trip display codes

Slot where trip was initiated			Fault	Description
Slot 1	Slot 2	Slot 3		
SL1.Er	SL2.Er	SL3.Er	Error	User trip generated by the SM-PROFIBUS-DP
SL1.nF	SL2.nF	SL3.nF	Not fitted	This trip will occur if a Unidrive SP slot is configured for a SM-PROFIBUS-DP, but a different module is fitted in the slot.
SL1.dF	SL2.dF	SL3.dF	Different module fitted	The slot configuration parameters stored in the Unidrive SP are not valid SM-PROFIBUS-DP configuration parameters. This trip will also occur when an SM-PROFIBUS-DP is fitted to a previously un-used slot.

NOTE If Unidrive SP has V1.00.xx firmware fitted, the SLx.nF trip will be seen if the SM-PROFIBUS-DP is removed while the Unidrive SP is powered up.

10.8 SM-PROFIBUS-DP error codes

Name	SM-PROFIBUS-DP error code		
Slot 1	Pr **15.50**	**Default**	N/A
Slot 2	Pr **16.50**	**Range**	0 to 255
Slot 3	Pr **17.50**	**Access**	RO

If the SM-PROFIBUS-DP detects an error during operation, it will force a trip on the Unidrive SP and update the error code parameter, (Pr **MM.50**). The table below shows the SM-PROFIBUS-DP error codes.

Table 10.8 SM-PROFIBUS-DP error codes

Error code	Fault	Description
0	No error detected	Indicates that the trip was not caused by the SM-PROFIBUS-DP. It is possible to trip the Unidrive SP externally via various communication channels.
52	User control word trip	The TRIP bit has been set in the Unidrive control word.
61	Configuration error	An invalid configuration has been detected. Refer to **#MM.49** for mapping error codes.
65	Network loss	No new messages have been received for the specified network loss trip time.
70	FLASH transfer error	The SM-PROFIBUS-DP was unable to upload the configuration parameters from its FLASH memory to the Unidrive SP.
74	SM-PROFIBUS-DP overtemperature	If the temperature inside the SM-PROFIBUS-DP exceeds 82°C, the SM-PROFIBUS-DP will trip the Unidrive SP.
80	Inter-option communication error	Communications time-out has occurred, but SM-PROFIBUS-DP Is unable to determine the reason for the error.

Table 10.8 SM-PROFIBUS-DP error codes

Error code	Fault	Description
81	Communication error to slot 1	Direct communications between the SM-PROFIBUS-DP and an SM-Applications in another slot has timed out. This can occur when the SM-PROFIBUS-DP been mapped to directly read or write _P, _Q, _T or _U registers in an SM-Applications and the SM-Applications 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 Unidrive SP to reset from this trip. If trip persists, replace the SM-PROFIBUS-DP.
99	Internal software error	

10.9 SM-PROFIBUS-DP serial number

Name	SM-PROFIBUS-DP serial number		
Slot 1	Pr **15.35**	**Default**	N/A
Slot 2	Pr **16.35**	**Range**	32-bit
Slot 3	Pr **17.35**	**Access**	RO

The serial number is a loaded into the SM-PROFIBUS-DP during manufacture and cannot be changed. It contains the last 6 digits of the 10-digit serial number of the label.

11 Advanced Features

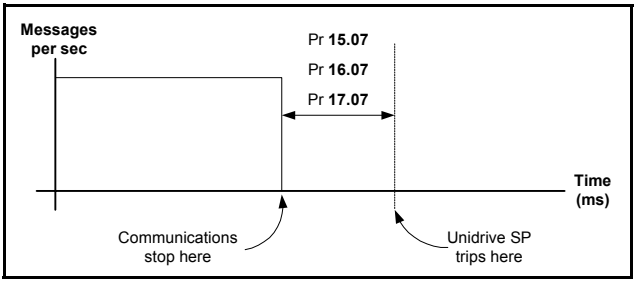
11.1 SM-PROFIBUS-DP network loss trip

Name	SM-PROFIBUS-DP network loss trip timeout		
Slot 1	Pr **15.07**	Default	200
Slot 2	Pr **16.07**	Range	0 to 3000
Slot 3	Pr **17.07**	Access	RW

The SM-PROFIBUS-DP resets an internal timer when a valid message is received from the PROFIBUS-DP network. The network loss trip is triggered when no new messages are received before the timer times out. When the SM-PROFIBUS-DP forces the trip, the trip display on the Unidrive SP will be “SLx.Er”, where “x” is the slot number where the trip originated. The SM-PROFIBUS-DP 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 PROFIBUS-DP master controller is initialising the PROFIBUS-DP network.

Figure 11-1 SM-PROFIBUS-DP 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.

WARNING

The network loss trip can be disabled by setting Pr **15.07**, Pr **16.07** or Pr **17.07** to 0. In this case, the Unidrive SP 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 Unidrive SP in the event of a loss of communications.

11.2 SYNC and FREEZE Mode

The SM-PROFIBUS-DP supports the SYNC and FREEZE modes available with most PROFIBUS-DP master controllers.

Cyclic data is put in to groups by the PLC allowing multiple cyclic channels to be suspended and updated using the SYNC and FREEZE commands. Data to the drive is controlled by the SYNC command and data from the drive controlled by the FREEZE command. The SYNC command is used in conjunction with the UNSYNC command and the FREEZE command is used in conjunction with the UNFREEZE command.

The SYNC command will cause a single transfer of the previously grouped data and stop any more data from being received by the drive. The SYNC command may be repeated while in this state to allow another single transfer of data to the drive. Issuing an UNSYNC command will revert the drive to continuous cyclic update of the received data.

The FREEZE command will cause a single transfer of the previously grouped data and stop any more data from being transmitted by the drive. The FREEZE command may be repeated while in this state to allow another single transfer of data from the drive. Issuing an UNFREEZE command will revert the drive to continuous cyclic update of the transmitted data.

11.3 SM-PROFIBUS-DP data endian format

Name	SM-PROFIBUS-DP data endian format		
Slot 1	Pr **15.08**	**Default**	OFF
Slot 2	Pr **16.08**	**Range**	OFF (0) or ON (1)
Slot 3	Pr **17.08**	**Access**	RW

All UT70 parameters (and some Unidrive SP parameters) are 32-bit double word parameters, while most Unidrive SP parameters are 16-bit word parameters. However when data is sent over the PROFIBUS-DP 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”.

Data endian format	**Pr MM.08**	**16-bit value**	**32-bit value**	
		Byte order	**Word order**	**Byte order**
Big	0	High byte first Low byte second	High word first Low word second	High byte first Mid high byte second Mid low byte third Low byte fourth
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. By default, the SM-PROFIBUS-DP uses the “big endian” data format so OUT word 1 will contain the high data word and OUT word 2 will contain the low data word.

Most PROFIBUS-DP master controllers use the “big endian” format by default and many also allow the “little endian” to be selected. However, some older PLCs are known to use “little endian” format and do not offer any facility to select “big endian” format. Contact the manufacturer of the master controller to be find out which endian format is used.

11.4 Menu 60 - Local Solutions Module parameter access

The menu used to configure the SM-PROFIBUS-DP depends on the slot in the Unidrive SP where the SM-PROFIBUS-DP is fitted. Menu 60 can be used to ensure that the PROFIBUS-DP configuration parameters can be accessed without necessarily knowing in which Unidrive SP slot the SM-PROFIBUS-DP is fitted.

When a Menu 60 parameter is accessed from PROFIBUS-DP, the SM-PROFIBUS-DP will re-direct it to the menu in the Unidrive SP that is associated with the slot where the SM-PROFIBUS-DP is fitted.

Table 11.1 Local slot configuration parameter access

Parameter	SM-PROFIBUS-DP in slot 1	SM-PROFIBUS-DP in slot 2	SM-PROFIBUS-DP 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 PROFIBUS-DP network using non-cyclic data access methods.

11.5 Mapping To SM-Applications parameters

The SM-PROFIBUS-DP reads and writes data directly to and from internal registers in an SM-Applications. 6 sets of 32-bit registers are accessible in the SM-Applications and block mapping to these registers is supported. Each register in the SM-Applications can be accessed as a virtual parameter.

The SM-PROFIBUS-DP can be configured to read data from and write data to an SM-Applications fitted in any slot in the Unidrive SP simply by specifying the target parameter as shown in Table 11.2.

Table 11.2 SM-Applications internal parameters

SM-Applications 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.x**x	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-PROFIBUS-DP is configured to map data to Pr **70.xx** to Pr **91.xx** parameters data will be exchanged with the SM-Applications fitted in the lowest slot number. This method is convenient to use if there is only one SM-Applications fitted 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 fitted it is best to map directly to the required slot.

11.5.1 Single SM-Applications fitted

Consider a Unidrive SP with the following configuration:

- Slot 1 - Vacant
- Slot 2 - SM-Applications.
- Slot 3 - SM-PROFIBUS-DP.

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

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

11.5.2 Dual SM-Applications fitted

Consider a Unidrive SP with the following configuration:

- Slot 1 - SM-Applications.
- Slot 2 - SM-Applications.
- Slot 3 - SM-PROFIBUS-DP.

If a parameter read request comes over PROFIBUS-DP 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 PROFIBUS-DP 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 PROFIBUS-DP 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 fitted 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.

11.6 Block mapping

The Unidrive SP provides 10 mapping parameters each for IN data and OUT data. However, some Unidrive SP 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 Unidrive SP 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 Unidrive SP 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 11.6.3 *Avoiding block mapping* on page 60.

11.6.1 IN data

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

- Slot 1 - SM-Applications.
- Slot 2 - SM-Applications.
- Slot 3 - SM-PROFIBUS-DP, 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 11.3 IN data block mapping example

Mapping parameter	Mapping value	Description
Pr **17.10**	7011	Block mapping to registers _P11% to _P15% in the SM-Applications in the lowest slot, i.e. in slot 1.
Pr **17.11**	7015	
Pr **17.12** to Pr **17.19**	0	Not mapped

Table 11.4 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			

11.6.2 OUT data

“OUT” refers to cyclic data as seen by the PROFIBUS-DP master controller. Hence, OUT data is data that is being transmitted from the PROFIBUS-DP master controller to the Unidrive SP. Consider a Unidrive SP with the following configuration:

- Slot 1 - SM-Applications.
- Slot 2 - SM-Applications.
- Slot 3 - SM-PROFIBUS-DP, 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 11.5 OUT data block mapping example

Mapping parameter	Mapping value	Description
Pr **17.20**	2031	Block mapping to Unidrive SP parameters Pr **20.31** to Pr **20.35**
Pr **17.21**	2035	
Pr **17.22** to Pr **17.29**	0	Not mapped

Table 11.6 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**			

11.6.3 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-PROFIBUS-DP will not recognise a range of parameters and only 2 channels will be mapped.

Table 11.7 Non-block data mapping example

Mapping parameter	Mapping value	Description
Pr **17.10**	7015	Map to _P15% in the SM-Applications in the lowest slot, i.e. slot 1.
Pr **17.11**	7011	Map to _P11% in the SM-Applications in the lowest slot, i.e. slot 1.
Pr **17.12** to Pr **17.19**	0	Not mapped
Pr **17.20**	2035	Map to Pr **20.35** in the SM-Applications in the lowest slot, i.e. slot 1.
Pr **17.21**	2031	Map to Pr **20.31** in the SM-Applications in the lowest slot, i.e. slot 1.
Pr **17.22** to Pr **17.29**	0	Not mapped

Table 11.8 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 **20.35**
IN word 2, 3	_P11% slot 1		OUT word 2, 3	Pr **20.31**
IN word 4-9	Not mapped		OUT word 4-9	Not mapped

11.7 Direct data mapping

Name	Direct data mapping enable		
Slot 1	Pr **15.09**	Default	OFF (0)
Slot 2	Pr **16.09**	Range	OFF (0) or ON (1)
Slot 3	Pr **17.09**	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 11.9 Direct data mapping configurations (data compression OFF)

Pr MM.05	Description
2 to 10	The first 10 IN channels will be written directly to Pr **MM.10** to Pr **MM.19**, and the first 10 OUT channels will be read directly from Pr **MM.20** to Pr **MM.29**.
100 to 109 200 to 206 300 to 309	Non-cyclic data cannot be used in direct data mapping mode. The SM-PROFIBUS-DP operating status parameter (Pr **MM.49**) will indicate -3, and mapping error code (Pr **MM.50**) 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 can be specified in Pr **MM.05**, or Pr **MM.39** and Pr **MM.40**.

Table 11.10 Direct data dapping configurations (data compression ON)

Pr MM.05	Description
1 to 10	The first 10 OUT channels will be written directly to Pr **MM.10** to Pr **MM.19**, and the first 10 IN channels will be read directly from Pr **MM.20** to Pr **MM.29**.
100 to 109 200 to 206 300 to 3098	Non-cyclic data cannot be used in direct data mapping mode. The SM-PROFIBUS-DP operating status parameter (Pr **MM.49**) will indicate -3, and mapping error code (Pr **MM.50**) will indicate 2.

11.8 Cyclic data compression

Name	Cyclic data compression enable		
Slot 1	Pr **15.34**	Default	OFF (0)
Slot 2	Pr **16.34**	Range	OFF (0) or ON (1)
Slot 3	Pr **17.34**	Access	RW

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

Table 11.11 shows an example set of mapping parameters where 5 IN and 5 OUT cyclic data channels are required. With data compression disabled each data channel uses 32-bits, (2 data words, so a total of 10 words are required, i.e. Pr **MM.05** = 10).

Table 11.11 Example cyclic data channel mapping

Data channel	Data words used	Mapping for slot 3	Setting	Data width	Mapping status
IN channel 0	IN word 0, 1	Pr **17.10**	1040	16-bit	Pr **10.40**, status word
IN channel 1	IN word 2, 3	Pr **17.11**	201	32-bit	Pr **2.01**, post-ramp speed ref
IN channel 2	IN word 4, 5	Pr **17.12**	420	16-bit	Pr **4.20**, motor load as % of rated motor load
IN channel 3	IN word 6, 7	Pr **17.13**	1421	16-bit	Pr **14.21**, PID feedback
IN channel 4	IN word 8, 9	Pr **17.14**	1401	16-bit	Pr **14.01**, PID output
OUT channel 0	OUT word 0, 1	Pr **17.20**	642	16-bit	Pr **6.42**, control word
OUT channel 1	OUT word 2, 3	Pr **17.21**	121	32-bit	Pr **1.21**, digital speed ref 1
OUT channel 2	OUT word 4, 5	Pr **17.22**	211	32-bit	Pr **2.11**, acceleration ramp
OUT channel 3	OUT word 6, 7	Pr **17.23**	221	32-bit	Pr **2.21**, deceleration ramp
OUT channel 4	OUT word 8, 9	Pr **17.24**	1420	16-bit	Pr **14.20**, PID reference

When data compression is enabled by setting Pr **MM.34** = ON a data channel will only use 32 bits if the target Unidrive SP parameter is a 32 bit parameter. If the target Unidrive SP parameter for a data channel is only 1, 8 or 16 bits wide only 16 bits will be used for that particular data channel. Hence, the IN data will only use a total of 6 words and the OUT data will only use a total of 8 words. Pr **MM.05** can now be set to 8.

It is also advisable to keep 16-bit parameters paired together. This prevents mis-alignment of cyclic data with 32-bit PLC registers when using auto-mapping facilities to configure the PROFIBUS-DP network. By swapping the mappings for IN channel 1 with IN channel 2 and moving OUT channel 4 to OUT channel 1, the data channel structure will appear as shown in Table 11.12.

Table 11.12 compressed cyclic data channel mapping

Data channel	Data words used	Mapping for slot 3	Setting	Data width	Mapping status
IN channel 0	IN word 0	Pr **17.10**	1040	16-bit	Pr **10.40**, status word
IN channel 1	IN word 1	Pr **17.11**	420	16-bit	Pr **4.20**, motor load as % of rated motor load
IN channel 2	IN word 2, 3	Pr **17.12**	201	32-bit	Pr **2.01**, post-ramp speed ref
IN channel 3	IN word 4	Pr **17.13**	1421	16-bit	Pr **14.21**, PID feedback
IN channel 4	IN word 5	Pr **17.14**	1401	16-bit	Pr **14.01**, PID output
OUT channel 0	OUT word 0	Pr **17.20**	642	16-bit	Pr **6.42**, control word
OUT channel 1	OUT word 1	Pr **17.21**	1420	16-bit	Pr **14.20**, PID reference
OUT channel 2	OUT word 2, 3	Pr **17.22**	121	32-bit	Pr **1.21**, digital speed ref 1
OUT channel 3	OUT word 4, 5	Pr **17.23**	211	32-bit	Pr **2.11**, acceleration ramp
OUT channel 4	OUT word 6, 7	Pr **17.24**	221	32-bit	Pr **2.21**, deceleration ramp

11.8.1 Unidrive SP 32-bit parameters

The table below lists the 32-bit parameters in the Unidrive SP that can be set as target parameters for cyclic data.

Table 11.13 Unidrive SP 32-bit parameters

Menu	32-bit parameters							
Menu 1	Pr **1.01**	Pr **1.02**	Pr **1.03**	Pr **1.04**	Pr **1.06**	Pr **1.07**	Pr **1.17**	Pr **1.18**
	Pr **1.21**	Pr **1.22**	Pr **1.23**	Pr **1.24**	Pr **1.25**	Pr **1.26**	Pr **1.27**	Pr **1.28**
	Pr **1.36**	Pr **1.37**	Pr **1.39**					
Menu 2	Pr **2.01**	Pr **2.07**	Pr **2.11**	Pr **2.12**	Pr **2.13**	Pr **2.14**	Pr **2.15**	Pr **2.16**
	Pr **2.17**	Pr **2.18**	Pr **2.19**	Pr **2.21**	Pr **2.22**	Pr **2.23**	Pr **2.24**	Pr **2.25**
	Pr **2.26**	Pr **2.27**	Pr **2.28**	Pr **2.29**				
Menu 3	Pr **3.01**	Pr **3.02**	Pr **3.03**	Pr **3.10**	Pr **3.18**	Pr **3.22**	Pr **3.27**	
Menu 4	Pr **4.01**	Pr **4.02**	Pr **4.08**	Pr **4.17**				
Menu 5	Pr **5.01**	Pr **5.03**	Pr **5.04**	Pr **5.07**	Pr **5.08**	Pr **5.24**	Pr **5.25**	
Menu 7	Pr **7.51**							
Menu 11	Pr **11.32**							
Menu 15	Pr **15.03**	Pr **15.19**	Pr **15.35**					
Menu 16	Pr **16.03**	Pr **16.19**	Pr **16.35**					
Menu 17	Pr **17.03**	Pr **17.19**	Pr **17.35**					
Menu 20	Pr **20.21**	Pr **20.22**	Pr **20.23**	Pr **20.24**	Pr **20.25**	Pr **20.26**	Pr **20.27**	Pr **20.28**
	Pr **20.29**	Pr **20.30**	Pr **20.31**	Pr **20.32**	Pr **20.33**	Pr **20.34**	Pr **20.35**	Pr **20.36**
	Pr **20.37**	Pr **20.38**	Pr **20.39**	Pr **20.40**				
Menu 21	Pr **21.01**	Pr **21.02**	Pr **21.04**	Pr **21.05**	Pr **21.07**	Pr **21.08**	Pr **21.14**	Pr **21.24**
Menu 70 to Menu 75	Pr **70.00** to Pr **70.99**			Pr **71.00** to Pr **71.99**			Pr **72.00** to Pr **72.99**	
	Pr **73.00** to Pr **73.99**			Pr **74.00** to Pr **74.99**			Pr **75.00** to Pr **75.99**	
Menu 100 to Menu 105	Pr **100.00** to Pr **100.99**			Pr **101.00** to Pr **101.99**			Pr **102.00** to Pr **102.99**	
	Pr **103.00** to Pr **103.99**			Pr **104.00** to Pr **104.99**			Pr **105.00** to Pr **105.99**	
Menu 130 to Menu 135	Pr **130.00** to Pr **130.99**			Pr **131.00** to Pr **131.99**			Pr **132.00** to Pr **132.99**	
	Pr **133.00** to Pr **133.99**			Pr **134.00** to Pr **134.99**			Pr **135.00** to Pr **135.99**	
Menu 160 to Menu 165	Pr **160.00** to Pr **160.99**			Pr **161.00** to Pr **161.99**			Pr **162.00** to Pr **162.99**	
	Pr **163.00** to Pr **163.99**			Pr **164.00** to Pr **164.99**			Pr **165.00** to Pr **165.99**	

Parameters in menus 15, 16 and 17 are only 32-bit if one of the intelligent encoders is fitted in the appropriate Unidrive SP slot. Menu 70 to menu 165 parameters are only available if an SM-Applications module is fitted in the appropriate slot.

11.9 EVENT task trigger in SM-Applications

Slot	SM-Applications EVENT task trigger		
Slot 1	Pr **61.41**	**Default**	0
Slot 2	Pr **61.42**	**Range**	0 to 4
Slot 3	Pr **61.43**	**Access**	WO

The SM-Applications has 4 EVENT tasks available for use in the DPL Program and the SM-PROFIBUS-DP 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 11.14 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 SM-Applications fitted in the lowest slot number on the Unidrive SP.

When an EVENT task runs in the SM-Applications 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 11.15 *EVENT task reason codes* on page 64.(Refer to the *SM-Applications User Guide* for full details.)

Table 11.15 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 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.

11.10 Multi-master operation

The SM-PROFIBUS-DP can be used on PROFIBUS-DP networks containing 2 or more master controllers. Consult your master controller and network configuration software documentation for information on how to configure a multi-master PROFIBUS-DP network.

NOTE The VPC3+ currently used in the SM-PROFIBUS-DP shows some deviations from the behaviour described in the PROFIBUS FMS/DP/PA specification according to the European Fieldbus Standard EN50170. Users must ensure that in networks with multiple master devices, only one master controller is configured to access the SM-PROFIBUS-DP.

11.11 Restore SM-PROFIBUS-DP defaults

Name	**Restore SM-PROFIBUS-DP defaults**		
Slot 1	Pr **15.30**	**Default**	OFF (0)
Slot 2	Pr **16.30**	**Range**	OFF (0) or ON (1)
Slot 3	Pr **17.30**	**Access**	RW

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

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

Pr **MM.30** specifies whether the default values should be written to the SM-PROFIBUS-DP FLASH memory. If Pr **MM.30** is set to ON, the default values will be written into the SM-PROFIBUS-DP FLASH memory.

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

1. Set Pr **17.00** to 1233 to restore European defaults (1244 for USA defaults).
2. PROFIBUS-DP communications will be stopped.
3. The Unidrive SP will load and store its default parameter values.
4. Default parameter values for the SM-PROFIBUS-DP will be loaded in Pr **17.PP** parameters.
5. If Pr **17.30** is set to ON (1) the SM-PROFIBUS-DP default parameter values will be stored in the SM-PROFIBUS-DP FLASH memory.
6. The SM-PROFIBUS-DP will reset and re-initialise using the default values.

11.12 Restore previous SM-PROFIBUS-DP configuration

Name	Upload from SM-PROFIBUS-DP FLASH memory		
Slot 1	Pr **15.33**	**Default**	OFF (0)
Slot 2	Pr **16.33**	**Range**	OFF (0) or ON (1)
Slot 3	Pr **17.33**	**Access**	RW

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

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

NOTE If the SM-PROFIBUS-DP is unable to upload the configuration parameters to the Unidrive SP or configuration parameters have never been stored in the SM-PROFIBUS-DP FLASH memory the Unidrive SP will trip “SLx.ER” and set the error code (Pr **MM.49**) to 70.

When Pr **MM.33** is set to ON the SM-PROFIBUS-DP will transfer the configuration parameters from its FLASH memory to the Unidrive SP over-writing the existing values in the Unidrive SP.

The full sequence of events for restoring values from a SM-PROFIBUS-DP fitted in slot 3 is as follows:

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

This procedure will NOT store the updated Unidrive SP parameters.

NOTE The SM-PROFIBUS-DP will restore its configuration parameters to the menu of parameters associated with the slot that it is installed in. If an SM-PROFIBUS-DP is moved from slot 3 on a Unidrive SP it can be re-installed in any slot on another Unidrive SP.

11.13 Custom SM-PROFIBUS-DP data formats

Name	**SM-PROFIBUS-DP IN cyclic words**		
Slot 1	Pr **15.39**	**Default**	4
Slot 2	Pr **16.39**	**Range**	0 to 32
Slot 3	Pr **17.39**	**Access**	RW

Name	**SM-PROFIBUS-DP OUT cyclic words**		
Slot 1	Pr **15.40**	**Default**	4
Slot 2	Pr **16.40**	**Range**	0 to 32
Slot 3	Pr **17.40**	**Access**	RW

If the number of cyclic words is specified using the data format parameter (Pr **MM.05**) the number of IN and OUT cyclic words will be the same. (See section 6.2 *SM-PROFIBUS-DP data formats* on page 15.) Pr **MM.39** and Pr **MM.40** will always display the current number of IN and OUT cyclic data words being used.

When the data format (Pr **MM.05**) and the PPO Type (Pr **MM.38**) are both set to 0, the number of IN and OUT data words can be specified separately in Pr **MM.39** and Pr **MM.40** respectively. This allows different numbers of IN and OUT cyclic data words to be specified.

CT Single Word or PPO 4 Word non-cyclic data can also be enabled by mapping IN and OUT words to the appropriate source/destination parameter.

Table 11.16 Customised non-cyclic channel mapping

Source/destination parameter	Non-cyclic mode	Description
Pr **61.50**	CT Single Word	1 IN and 1 OUT word must be assigned for use as the CT Single Word non-cyclic channel.
Pr **61.51**	PPO 4 Word	4 IN and 4 OUT words must be assigned for use as the PPO 4 Word non-cyclic channel.

12 PROFIDRIVE Profile

NOTE SM-PROFIBUS-DP must be fitted with V1.00.03 firmware or later to use the parameter process objects and PROFIDRIVE profile.

12.1 PPO Types

Name	Parameter Process Data Object (PPO)		
Slot 1	Pr **15.38**	**Default**	0
Slot 2	Pr **16.38**	**Range**	0 to 5
Slot 3	Pr **17.38**	**Access**	RW

All defined Parameter Process Data Objects (PPOs) are supported by the SM-PROFIBUS-DP. It is not possible to have different IN and OUT PPOs configured at the same time.

NOTE Full details about supported aspects of the PROFIDRIVE profile will be included in later versions of this manual. For further details about the PROFIDRIVE profile and Parameter Process Objects please refer to the PROFIBUS web site at www.profibus.com.

The data formats of the PPOs are shown in Table 12.1.

Table 12.1 PPO formats

PPO mode (Pr MM.38)	Total words	Non-cyclic mode	Cyclc words
0	Mapping dependant	Mapping dependant	Specified by Pr **MM.05**, or Pr **MM.39** and Pr **MM.40**
1	6	PPO 4 Word	2
2	10	PPO 4 Word	6
3	2	None	2
4	6	None	6
5	14	PPO 4 Word	10

The data mapping for the first 2 IN and OUT cyclic words in each PPO is fixed and cannot be changed. However, if a PPO has additional cyclic data words included these IN and OUT words can be mapped as normal using the IN and OUT data mapping parameters (see section 6.2 *SM-PROFIBUS-DP data formats* on page 15).

NOTE A single mapping parameter will map 2 cyclic words if the target parameter specified is a 32 bit parameter. See section 11.8 *Cyclic data compression* on page 61 for a list of 32 bit parameters.

When a PPO data word has fixed mapping the corresponding mapping parameter will indicate -1. This shows that the word is in use for a PPO and the mapping cannot be modified.

When a PPO is selected existing mappings are over-written by the PPO fixed mappings. The table below shows the change in a set of mapping parameters when the SM-PROFIBUS-DP configuration is changed from 10 cyclic words with PPO 4 Word

(Mode 2) non-cyclic data to PPO 5. The actual data format over the PROFIBUS-DP remains the same, but the mappings for the first 6 words in PPO5 mode are fixed.

Table 12.2 CT Single Word non-cyclic Data Mapping

Mapping parameter	Before format change (Pr 17.05 = 210)		After format change (Pr 17.05 = 0, Pr 17.38 = 5))	
	Value	Mapping	Value	Mapping
Pr **17.10**	6051	PPO 4 Word non-cyclic data	-1	PPO 4 Word non-cyclic data
Pr **17.11**	1040	Pr **10.40**, status word	-1	PROFIBUS-DP status word
Pr **17.12**	201	Pr **2.01**, post ramp speed ref	-1	Main Actual Value (See section 12.6 on page 77)
Pr **17.13**	420	Pr **4.20**, motor load as % of rated load	420	Pr **4.20**, motor load as % of rated load
Pr **17.14**	1401	Pr **14.01**, PID output	1401	Pr **14.01**, PID output
Pr **17.15**	401	Pr **4.01**, motor current	401	Pr **4.01**, motor current
Pr **17.15** to Pr **17.19**	0	Not mapped	0	Not mapped
Pr **17.20**	9051	PPO 4 Word non-cyclic data	-1	PPO 4 Word non-cyclic data
Pr **17.21**	642	Pr **6.42**, control word	-1	PROFIBUS-DP control word
Pr **17.22**	121	Pr **1.21**, digital speed ref 1	-1	Main Setpoint (See section 12.5 on page 77)
Pr **17.23**	408	Pr **4.08**, torque reference	408	Pr **4.08**, torque reference
Pr **17.24**	1410	Pr **14.10**, PID loop P gain	1410	Pr **14.10**, PID loop P gain
Pr **17.25** to Pr **17.29**	0	Not mapped	0	Not mapped

12.1.1 PPO 1

The data frame format for PPO1 is shown below. Set Pr **MM.38** to 1 to select this data format.

OUT data word	Function
OUT word 0	PPO 4 Word non-cyclic data See section 8.2 *Mode 2 - PPO 4 Word mode* on page 37
OUT word 1	
OUT word 2	
OUT word 3	
OUT word 4	PROFIDRIVE control word
OUT word 5	Main Setpoint

IN data word	Function
IN word 0	PPO 4 Word non-cyclic data See section 8.2 *Mode 2 - PPO 4 Word mode* on page 37
IN word 1	
IN word 2	
IN word 3	
IN word 4	PROFIDRIVE status word
IN word 5	Main Actual Value

12.1.2 PPO 2

The data frame format for PPO2 is shown below. Set Pr **MM.38** to 2 to select this data format.

OUT data word	Function
OUT word 0	PPO 4 Word non-cyclic data See section 8.2 *Mode 2 - PPO 4 Word mode* on page 37
OUT word 1	
OUT word 2	
OUT word 3	
OUT word 4	PROFIDRIVE control word
OUT word 5	Main Setpoint
OUT word 6	Mapped using Pr MM.23 to Pr MM.26. Refer to section 6.2 *SM-PROFIBUS-DP data formats* on page 15.
OUT word 7	
OUT word 8	
OUT word 9	

IN data word	Function
IN word 0	PPO 4 Word non-cyclic data See section 8.2 *Mode 2 - PPO 4 Word mode* on page 37
IN word 1	
IN word 2	
IN word 3	
IN word 4	PPROFIDRIVE status word
IN word 5	Main Actual Value
IN word 6	Mapped using Pr MM.13 to Pr MM.16. Refer to section 6.2 *SM-PROFIBUS-DP data formats* on page 15.
IN word 7	
IN word 8	
IN word 9	

12.1.3 PPO 3

The data frame format for PPO3 is shown below. Set Pr **MM.38** to 3 to select this data format.

OUT data word	Function
OUT word 0	PROFIDRIVE control word
OUT word 1	Main Setpoint

IN data word	Function
IN word 0	PROFIDRIVE status word
IN word 1	Main Actual Value

12.1.4 PPO 4

The data frame format for PPO4 is shown below. Set Pr **MM.38** to 4 to select this data format.

OUT data word	Function
OUT word 0	PROFIDRIVE control word
OUT word 1	Main Setpoint
OUT word 2	Mapped using Pr MM.23 to Pr MM.26. Refer to section 6.2 *SM-PROFIBUS-DP data formats* on page 15.
OUT word 3	
OUT word 4	
OUT word 5	

IN data word	Function
IN word 0	PROFIDRIVE status word
IN word 1	Main Actual Value
IN word 2	Mapped using Pr MM.13 to Pr MM.16. Refer to section 6.2 *SM-PROFIBUS-DP data formats* on page 15.
IN word 3	
IN word 4	
IN word 5	

12.1.5 PPO 5

The data frame format for PPO5 is shown below. Set Pr **MM.38** to 5 to select this data format.

OUT data word	Function
OUT word 0	PPO 4 Word non-cyclic data See section 8.2 *Mode 2 - PPO 4 Word mode* on page 37
OUT word 1	
OUT word 2	
OUT word 3	
OUT word 4	PROFIDRIVE control word
OUT word 5	Main Setpoint
OUT word 6	Mapped using Pr MM.22 to Pr MM.29. Refer to section 6.2 *SM-PROFIBUS-DP data formats* on page 15.
OUT word 7	
OUT word 8	
OUT word 9	
OUT word 10	
OUT word 11	
OUT word 12	
OUT word 13	

IN data word	Function
IN word 0	PPO 4 Word non-cyclic data See section 8.2 *Mode 2 - PPO 4 Word mode* on page 37
IN word 1	
IN word 2	
IN word 3	

IN data word	Function
IN word 4	PROFIDRIVE status word
IN word 5	Main Actual Value
IN word 6	Mapped using Pr MM.12 to Pr MM.19. Refer to section 6.2 *SM-PROFIBUS-DP data formats* on page 15.
IN word 7	
IN word 8	
IN word 9	
IN word 10	
IN word 11	
IN word 12	
IN word 13	

12.2 PROFIDRIVE control word

Table 12.3 gives the description of the function of each bit in the PROFIDRIVE status word.

Table 12.3 PROFIDRIVE control word bit functions

Bit	Value	Function	Description
0	1	ON	Ready; Voltage connected to the converter (i.e., main contactor on, if available); Unidrive SP goes into the "switch-on inhibit" status. DC bus is charged; Unidrive SP is inhibited
	0	OFF2	Shutdown (returns to status "not ready to switch on"); ramps-down along the ramp-function generator ramp or along the DC bus voltage limit. At Speed=0 and Current=0, voltage is disconnected; main contactor off (if available).
1	1	Operating condition	All "OFF 2" commands are withdrawn.
	0	OFF2	Voltage disconnected; inhibit Unidrive SP output stage. Main contactor is de-energized (if available), and the Unidrive SP goes into the “switch-on inhibit” status: Motor coasts down
2	1	Operating condition	All "OFF 3" commands are withdrawn.
	0	OFF3	Fast stop: If necessary, remove operating inhibit, fastest possible deceleration; at Speed=0 or Current=0, inhibit Unidrive SP and go to “switch on inhibit” state
3	1	Operation	Enable Unidrive SP and accelerate to the specified set point
	0	Inhibit operation	Inhibit Unidrive SP. Drive coasts down (ramp-function generator to zero or tracking), and into the "ready" status (refer to control word, bit 0).
4	1	Operating condition	---
	0	Inhibit ramp function generator	Ramp-function generator output is set to zero. Main contactor remains in, Unidrive SP is not isolated from the supply, drive ramps down along the current limit or at the DC bus voltage limit.
5	1	Enable ramp function generator	---
	0	Stop ramp function generator	Freeze the current set point from the ramp-function generator.

Table 12.3 PROFIDRIVE control word bit functions

Bit	Value	Function	Description
6	1	Enable setpoint	Selected value at the ramp-function generator input is switched in.
	0	Inhibit setpoint	Selected value at the ramp-function generator input is set to 0.
7	1	Acknowledge	Group signal is acknowledged at a positive edge; Unidrive SP is in the "fault" status until the fault has been removed and then goes into "switch-on inhibit" state.
	0	No meaning	
8	1	INCH1 ON	Prerequisite: Operation is enabled and Main Setpoint=0. Unidrive SP accelerates as fast as possible to inching setpoint in the forward direction.
	0	INCH1 OFF	Unidrive SP brakes as fast as possible, if "INCH1" was previously ON, and with Speed=0 and Current=0 goes into the status "operation enabled".
9	1	INCH2 ON	Prerequisite: Operation is enabled and Main Setpoint=0. Unidrive SP accelerates as fast as possible to inching setpoint in the reverse direction.
	0	INCH2 OFF	Unidrive SP brakes as fast as possible, if "INCH2" was previously ON, and with Speed=0 and Current=0 goes into the status "operation enabled".
10	1	Network control	Control from the PROFIBUS-DP network, process (cyclic) data is valid.
	0	No control	Process data invalid. Last received valid process data values are retained.
11-15	0	Reserved	

12.3 PROFIDRIVE status word

Table 12.4 gives the description of the function of each bit in the PROFIDRIVE status word.

Table 12.4 PROFIDRIVE status word bit functions

Bit	Value	Function	Description
0	1	Ready to switch on	Power supply switched on, Unidrive SP inhibited.
	0	Not ready to switch on	---
1	1	Ready	Refer to Control word bit 0.
	0	Not ready	No action.
2	1	Operating condition	Refer to Control word bit 3.
	0	---	---
3	1	Fault	Drive faulted, and thus not operational, goes into the switch-on inhibit status after acknowledgment and the fault has been removed. Fault numbers in the fault parameter.
	0	Fault free	---
4	1	No OFF2	---
	0	OFF2	“OFF2” command present.
5	1	No OFF3	---
	0	OFF3	“OFF2” command Present.
6	1	Switch-on inhibit	Re-close only with “OFF1” and then “ON”.
	0	No switch-on inhibit	---
7	1	Alarm	Drive still operational: alarm in service parameter, no acknowledge.
	0	No alarm	Alarm not preset or alarm has disappeared again.
8	1	Setpoint/actual value monitoring in the tolerance range	Actual value within a tolerance range.
	0	As above, but not in the tolerance range	---
9	1	Control requested	The automation system is requested to accept control.
	0	Local operation	Control only possible on the device itself.
10	1	Speed or Current reached	Actual value = comparison value (setpoint), set via the parameter number.
	0	Speed or Current fallen below	---
11-15	0	Reserved	

12.4 PROFIDRIVE state diagram

The state machine for the PROFIDRIVE control and status words is shown below in Figure 12-1 with a description of each state given in Table 12.5 on page 76. Refer to section 12.2 *PROFIDRIVE control word* on page 72 and section 12.4 *PROFIDRIVE status word bit functions* on page 74 for full details about the PROFIDRIVE control and status words.

Figure 12-1 PROFIDRIVE control word

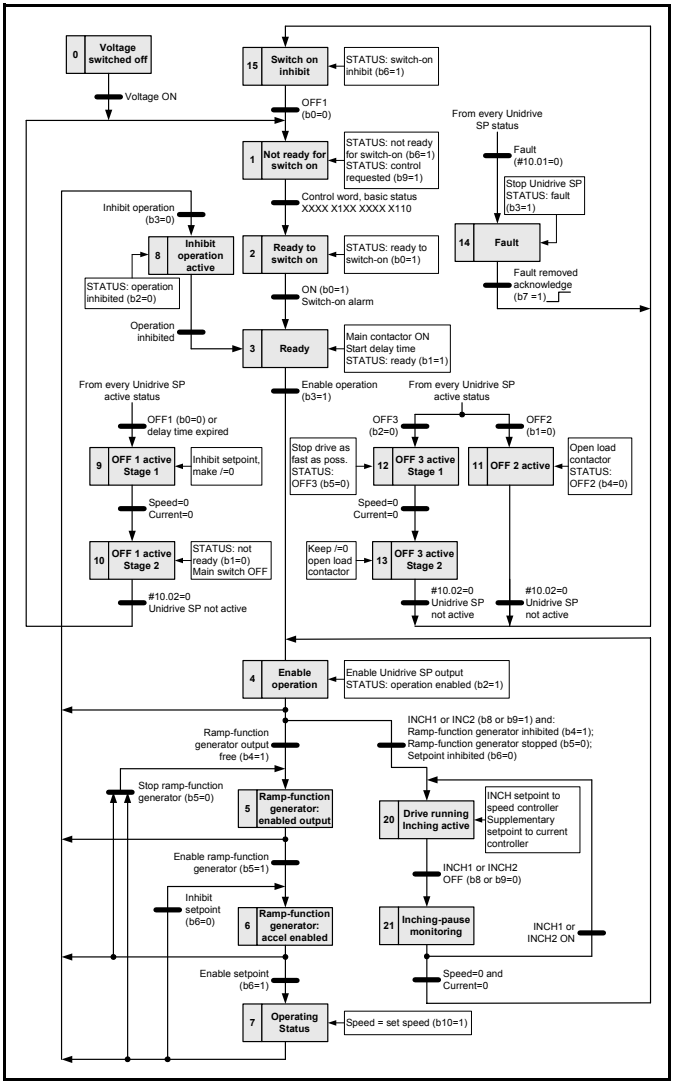


Table 12.5 PROFIDRIVE control states

State	Title	Control word update (Pr 6.42)	Other actions
0	Voltage switched off	None	---
1	Not ready for switch on	None	---
2	Ready to switch on	AUTO set to 1 All other bits reset to 0	Pr **6.43** set to 1
3	Ready	ENABLE, JOG and RUN reset to 0	Read and cache Pr **1.06** for speed reference calculations
4	Enable operation	ENABLE set to 1 JOG and RUN reset to 0	Select STOP RAMP mode (Set Pr **6.01**=1) Set preset ref 1 to 0 (Set Pr **1.21**=0) Select preset ref (Set Pr **1.14**=3) Select preset ref 1 (Set Pr **1.15**=1) Disable ramps (Set Pr **2.02**=0)
5	Ramp-function generator enabled output	ENABLE and RUN set to 1	Set preset ref 1 to 0 (Set Pr **1.21**=0) Enable ramps (Set Pr **2.02**=1)
6	Ramp-function generator acceleration enabled	ENABLE and RUN set to 1	Set preset ref 1 to 0 (Set Pr **1.21**=0) Set Ramp Hold (Set Pr **2.03**=1)
7	Operating status	ENABLE and RUN set to 1	Convert MAIN SETPOINT to Hz or rpm and set Pr **1.21** Release ramp hold (Set Pr **2.03** = 0)
8	Inhibit operation active	ENABLE, JOG and RUN reset to 0	Select STOP RAMP mode (Set Pr **6.01**=1)
9	OFF 1 active stage 1	ENABLE set to 1 JOG and RUN reset to 0	Select STOP RAMP mode (Set Pr **6.01**=1)
10	OFF 1 active stage 2	ENABLE reset to 0	
11	OFF 2 active	ENABLE reset to 0	Select COAST mode (Set Pr **6.01**=0)
12	OFF 3 active stage 1	ENABLE set to 1 JOG and RUN reset to 0	Select RAMP WITH DC INJECTION mode (Set Pr **6.01**=2)
13	OFF 3 active stage 2	ENABLE reset to 0	
14	Fault	JOG and RUN reset to 0	Select STOP RAMP mode (Set Pr **6.01**=1) Set RESET to 1 when ACK bit is set to 1
15	Switch on inhibit	No change	---
20	Drive running, inching active	JOG and RUN set to 1 FWD REV is set to 1 if INCH2 (b9) is set to 1, reset to 0 if INCH1 (b8) is set to 1	---
21	Inching-pause monitoring	JOG, FWD REV and RUN reset to 0	---

12.5 Main Setpoint

Main Setpoint is the speed reference defined in the PROFIDRIVE profile. It is scaled such that -32768 to +32767 is -200% to +200% of the maximum speed clamp (Pr **1.06)**. The converted value is written to Pr **1.21**.

$$\textbf{Pr 1.21} = \frac{\textbf{Main Setpoint} \times \textbf{Max Speed Clamp}}{\textbf{16384}}$$

12.6 Main Actual Value

Main Actual Value is the speed reference defined in the PROFIDRIVE profile. It is scaled such that -32768 to +32767 is -200% to +200% of the maximum speed clamp (Pr **1.06)**. The actual speed value is read from (Pr **2.01**).

$$\textbf{Main Actual Value} = \frac{\textbf{Pr 2.01} \times \textbf{16384}}{\textbf{Max Speed Clamp}}$$

13 Quick Reference

13.1 Complete parameter reference

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

Table 13.1 SM-PROFIBUS-DP parameter reference

Slot 1	Slot 2	Slot 3	Default	Cross reference	Description
Pr **15.01**	Pr **16.01**	Pr **17.01**	----	Section 10.1 on page 48	Module ID code.
Pr **15.02**	Pr **16.02**	Pr **17.02**	----	Section 10.2 on page 48	Major firmware version.
Pr **15.03**	Pr **16.03**	Pr **17.03**	0	Section 5.2 on page 12	Node address.
Pr **15.04**	Pr **16.04**	Pr **17.04**	----	Section 5.3 on page 12	Data rate.
Pr **15.05**	Pr **16.05**	Pr **17.05**	4	Section 6.2 on page 15	Data format.
Pr **15.06**	Pr **16.06**	Pr **17.06**	----	Section 10.5 on page 50	Operating status.
Pr **15.07**	Pr **16.07**	Pr **17.07**	200	Section 11.1 on page 55	Network loss trip timeout.
Pr **15.08**	Pr **16.08**	Pr **17.08**	Big (0)	Section 11.3 on page 56	Endian format select.
Pr **15.09**	Pr **16.09**	Pr **17.09**	OFF (0)	Section 11.7 on page 61	Direct data mapping enable
Pr **15.10**	Pr **16.10**	Pr **17.10**	1040	Section 6.2 on page 15	IN cyclic mapping 0.
Pr **15.11**	Pr **16.11**	Pr **17.11**	201		IN cyclic mapping 1.
Pr **15.12**	Pr **16.12**	Pr **17.12**	0		IN cyclic mapping 2.
Pr **15.13**	Pr **16.13**	Pr **17.13**	0		IN cyclic mapping 3.
Pr **15.14**	Pr **16.14**	Pr **17.14**	0		IN cyclic mapping 4.
Pr **15.15**	Pr **16.15**	Pr **17.15**	0		IN cyclic mapping 5.
Pr **15.16**	Pr **16.16**	Pr **17.16**	0		IN cyclic mapping 6.
Pr **15.17**	Pr **16.17**	Pr **17.17**	0		IN cyclic mapping 7.
Pr **15.18**	Pr **16.18**	Pr **17.18**	0		IN cyclic mapping 8.
Pr **15.19**	Pr **16.19**	Pr **17.19**	0		IN cyclic mapping 9.
Pr **15.20**	Pr **16.20**	Pr **17.20**	642	Section 6.2 on page 15	OUT cyclic mapping 0.
Pr **15.21**	Pr **16.21**	Pr **17.21**	121		OUT cyclic mapping 1.
Pr **15.22**	Pr **16.22**	Pr **17.22**	0		OUT cyclic mapping 2.
Pr **15.23**	Pr **16.23**	Pr **17.23**	0		OUT cyclic mapping 3.
Pr **15.24**	Pr **16.24**	Pr **17.24**	0		OUT cyclic mapping 4.
Pr **15.25**	Pr **16.25**	Pr **17.25**	0		OUT cyclic mapping 5.
Pr **15.26**	Pr **16.26**	Pr **17.26**	0		OUT cyclic mapping 6.
Pr **15.27**	Pr **16.27**	Pr **17.27**	0		OUT cyclic mapping 7.
Pr **15.28**	Pr **16.28**	Pr **17.28**	0		OUT cyclic mapping 8.
Pr **15.29**	Pr **16.29**	Pr **17.29**	0		OUT cyclic mapping 9.

Table 13.1 SM-PROFIBUS-DP parameter reference

Slot 1	Slot 2	Slot 3	Default	Cross reference	Description
Pr **15.30**	Pr **16.30**	Pr **17.30**	0	Section 11.11 on page 65	Restore SM-PROFIBUS-DP defaults.
Pr **15.31**	Pr **16.31**	Pr **17.31**	0	Section 6.5 on page 19	Store to SM-PROFIBUS-DP FLASH memory.
Pr **15.32**	Pr **16.32**	Pr **17.32**	0	Section 5.6 on page 14	Reset SM-PROFIBUS-DP.
Pr **15.33**	Pr **16.33**	Pr **17.33**	0	Section 11.12 on page 65	Restore previous configuration from SM-PROFIBUS-DP FLASH memory.
Pr **15.34**	Pr **16.34**	Pr **17.34**	0	Section 11.8 on page 61	Cyclic data compression enable.
Pr **15.35**	Pr **16.35**	Pr **17.35**	----	Section 10.9 on page 54	Serial Number.
Pr **15.36**	Pr **16.36**	Pr **17.36**	0	----	Reserved.
Pr **15.37**	Pr **16.37**	Pr **17.37**	0		
Pr **15.38**	Pr **16.38**	Pr **17.38**	0	Section 12.1 on page 68	PPO selected.
Pr **15.39**	Pr **16.39**	Pr **17.39**	5	Section 11.13 on page 66	IN cyclic data words.
Pr **15.40**	Pr **16.40**	Pr **17.40**	5		OUT cyclic data words.
Pr **15.41**	Pr **16.41**	Pr **17.41**	0	----	Reserved.
Pr **15.42**	Pr **16.42**	Pr **17.42**	0		
Pr **15.43**	Pr **16.43**	Pr **17.43**	0		
Pr **15.44**	Pr **16.44**	Pr **17.44**	0		
Pr **15.45**	Pr **16.45**	Pr **17.45**	0		
Pr **15.46**	Pr **16.46**	Pr **17.46**	0		
Pr **15.47**	Pr **16.47**	Pr **17.47**	0		
Pr **15.48**	Pr **16.48**	Pr **17.48**	0		
Pr **15.49**	Pr **16.49**	Pr **17.49**	----	Section 10.6 on page 50	Cyclic data mapping status.
Pr **15.50**	Pr **16.50**	Pr **17.50**	----	Section 10.8 on page 53	SM-PROFIBUS-DP error codes.
Pr **15.51**	Pr **16.51**	Pr **17.51**	----	Section 10.2 on page 48	Minor firmware version.

Table 13.2 shows every virtual parameter available in the SM-PROFIBUS-DP plus a cross-reference to the section in this manual where more information can be found.

Table 13.2 SM-PROFIBUS-DP virtual parameter reference

Slot 1	Default	Cross reference	Description
Pr **61.35**	----	Section 10.9 on page 54	Serial number.

Table 13.2 SM-PROFIBUS-DP virtual parameter reference

Slot 1	Default	Cross reference	Description
Pr **61.40**	0	Section 11.9 on page 64	SM-Applications event task trigger (lowest slot).
Pr **61.41**	0		SM-Applications event task trigger (slot 1).
Pr **61.42**	0		SM-Applications event task trigger (slot 2).
Pr **61.43**	0		SM-Applications event task trigger (slot 3).
Pr **61.50**	0	Section 8.1 on page 27	CT Single Word (Mode 1) non-cyclic data mapping parameter.
Pr **61.51**	0	Section 8.2 on page 37	PPO 4 Word (Mode 2) non-cyclic data mapping parameter.