Nidec

All for dreams

User Guide

SI-CANopen V2

Part Number: 0478-0101-03
Issue: 3

Compliance Information

Manufacturer: Nidec Control Techniques Limited ("we", "our")
Registered office: The Gro, Newtown, Powys, SY16 3BE United Kingdom
Registered in: England and Wales, company registration number 01236886
Manufacturer's EU Authorised Representative: Nidec Netherlands B.V., Kubus 155, 3364 DG Sliedrecht, the Netherlands, registered at the Dutch Trade Register under number 33213151; Tel. +31 (0)184 420 555, info.nl@mail.nidec.com

Original instructions

With reference to the UK Supply of Machinery (Safety) Regulations 2008 and the EU Machinery Directive 2006/42/EC, the English version of this Manual constitutes the original instructions. Manuals published in other languages are translations of the original instructions and the English language version of this Manual prevails over any other language version in the event of inconsistency.

Documentation and user software tools

Manuals, datasheets and software that we make available to users of our products can be downloaded from: http://www.drive-setup.com.

Warranty and liability

The contents of this Manual are presented for information purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available on request. We reserve the right to modify or improve the designs, specifications or performance of our products at any time without notice. For full details of the warranty terms applicable to the product, contact the supplier of the product.

In no event and under no circumstances shall we be liable for damages and failures due to misuse, abuse, improper installation, or abnormal conditions of temperature, dust, or corrosion, or failures due to operation outside the published ratings for the product, nor shall we be liable for consequential and incidental damages of any kind.

Environmental management

We operate an Environmental Management System which complies with the requirements of ISO 14001:2015. Further information on our Environmental Statement can be found at: **http://www.drive-setup.com/environment**.

Restriction and control of hazardous substances

The products covered by this Manual comply with the following legislation and regulations on the restriction and control of hazardous substances:

UK Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
UK REACH etc. (Amendment etc.) (EU Exit) Regulations 2020, European Union REACH Regulation EC 1907/2006
EU restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) - Directive 2011/65/EU
EC Regulation 1907/2006 on the Registration, Evaluation, authorisation, and restriction of Chemicals (REACH)
Chinese Administrative Measures for Restriction of Hazardous Substances in Electrical and Electronic Products 2016/07/01
U.S. Environmental Protection Agency ("EPA") regulations under the Toxic Substances Control Act ("TSCA")
MEPC 68/21 / Add.1, Annex 17, Resolution MEPC.269(68) 2015 Guidelines for the development of the inventory of hazardous materials

The products covered by this Manual do not contain asbestos.

Further information on REACH and RoHS can be found at: **http://www.drive-setup.com/environment**.

Conflict minerals

With reference to the Conflict Minerals (Compliance) (Northern Ireland) (EU Exit) Regulations 2020, the U.S. Dodd-Frank Wall Street Reform and Consumer Protection Act and Regulation (EU) 2017/821 of the European Parliament and of the European Council:

We have implemented due diligence measures for responsible sourcing, we conduct conflict minerals surveys of relevant suppliers, we continually review due diligence information received from suppliers against company expectations and our review process includes corrective action management. We are not required to file an annual conflict minerals disclosure. Nidec Control Techniques Limited is not an issuer as defined by the U.S. SEC.

Disposal and recycling (WEEE)

The products covered by this Manual fall within the scope of the UK Waste Electrical and Electronic Equipment Regulations 2013, EU Directive 2012/19/EU amended by EU Directive 2018/849 (EU) on Waste Electrical and Electronic Equipment (WEEE).

When electronic products reach the end of their useful life, they must not be disposed of along with domestic waste but should be recycled by a specialist recycler of electronic equipment. Our products are designed to be easily dismantled into their major component parts for efficient recycling. Most materials used in our products are suitable for recycling.

Our product packaging is of good quality and can be re-used. Smaller products are packaged in strong cardboard cartons which have a high recycled fibre content. Cartons can be re-used and recycled. Polythene, used in protective film and bags for the ground screws, can be recycled. When preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

Copyright and trade marks

Contents

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 Important safety information. Hazards. Competence of designers and installers

This guide applies to products which control electric motors either directly (drives) or indirectly (controllers, option modules and other auxiliary equipment and accessories). In all cases the hazards associated with powerful electrical drives are present, and all safety information relating to drives and associated equipment must be observed.

Specific warnings are given at the relevant places in this guide.

Drives and controllers are intended as components for professional incorporation into complete systems. If installed incorrectly they 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/start-up and maintenance must be carried out by personnel who have the necessary training and competence. They must read this safety information and this guide carefully.

1.3 Responsibility

It is the responsibility of the installer to ensure that the equipment is installed correctly with regard to all instructions given in this guide. They must give due consideration to the safety of the complete system, so as to avoid the risk of injury both in normal operation and in the event of a fault or of reasonably foreseeable misuse.

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation of the equipment.

1.4 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 ground (earth) connections.

This guide contains instructions for achieving compliance with specific EMC standards.

All machinery to be supplied within the European Union in which this product is used must comply with the following directives:

2006/42/EC Safety of machinery.

2014/30/EU: Electromagnetic Compatibility.

1.5 Electrical hazards

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. Hazardous voltage may be present in any of the following locations:

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

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

The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

The STOP and Safe Torque Off functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit.

The drive must be installed in accordance with the instructions given in this guide. Failure to observe the instructions could result in a fire hazard.

1.6 Stored electrical charge

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

1.7 Mechanical hazards

Careful consideration must be given to the functions of the drive or controller 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.

With the sole exception of the Safe Torque Off 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.

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

The design of safety-related control systems must only be done by personnel with the required training and experience. The Safe Torque Off function will only ensure the safety of a machine if it is correctly incorporated into a complete safety system. The system must be subject to a risk assessment to confirm that the residual risk of an unsafe event is at an acceptable level for the application.

1.8 Access to equipment

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

1.9 Environmental limits

Instructions in this guide regarding transport, storage, installation and use of the equipment must be complied with, including the specified environmental limits. This includes temperature, humidity, contamination, shock and vibration. Drives must not be subjected to excessive physical force.

1.10 Hazardous environments

The equipment must not be installed in a hazardous environment (i.e. a potentially explosive environment).

1.11 Motor

The safety of the motor under variable speed conditions must be ensured.

To avoid the risk of physical injury, do not exceed the maximum specified speed of the motor.

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

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive must not be relied upon. It is essential that the correct value is entered in the Motor Rated Current parameter.

1.12 Mechanical brake control

Any brake control functions are provided to allow well co-ordinated operation of an external brake with the drive. While both hardware and software are designed to high standards of quality and robustness, they are not intended for use as safety functions, i.e. where a fault or failure would result in a risk of injury. In any application where the incorrect operation of the brake release mechanism could result in injury, independent protection devices of proven integrity must also be incorporated.

1.13 Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

1.14 Electromagnetic compatibility (EMC)

Installation instructions for a range of EMC environments are provided in the relevant Power Installation Guide. If the installation is poorly designed or other equipment does not comply with suitable standards for EMC, the product might cause or suffer from disturbance due to electromagnetic interaction with other equipment. It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the relevant EMC legislation in the place of use.

2 Introduction

2.1 What Is CANopen?

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

Figure 2-1 Traditional cable layout

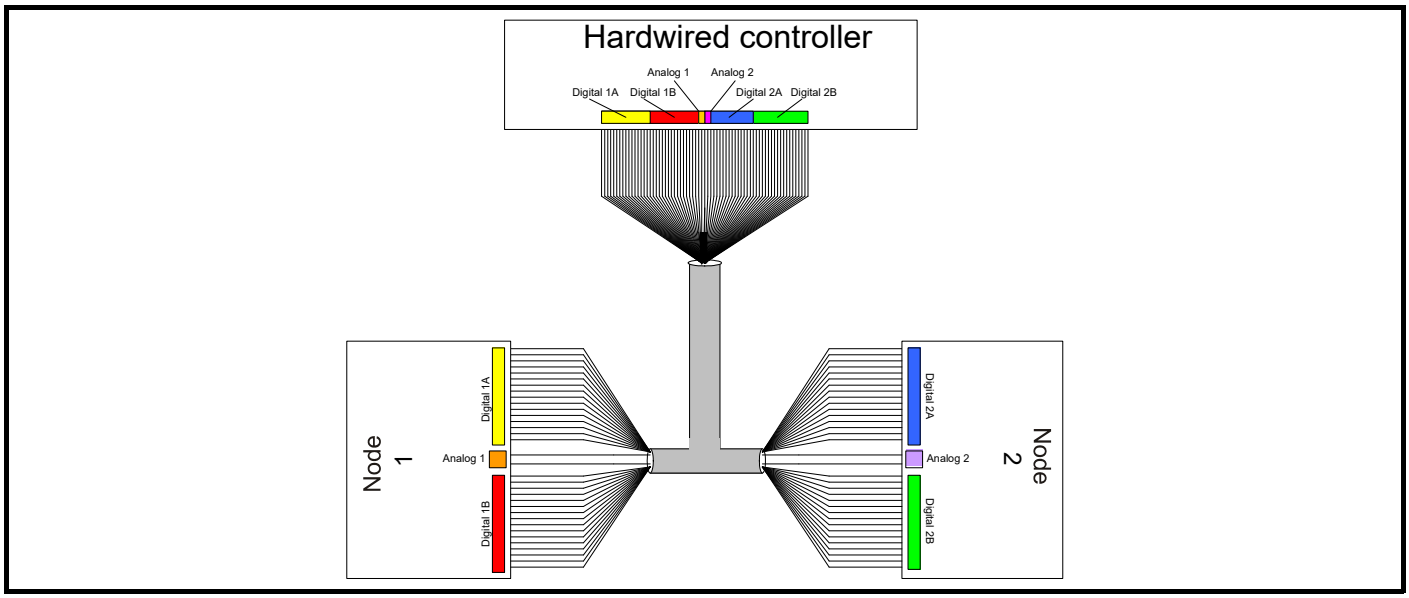


Table 2-1 details how the wiring is used to communicate data between the controller and the nodes. Each signal which is communicated requires one signal wire giving a total of 66 signal wires plus a 0 V return.

Table 2-1 Traditional wiring details

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

A fieldbus topology such as CANopen allows the same configuration to be realized using only two signal wires plus a shield. This method of communication saves significantly on the amount of cabling required and can improve overall system reliability as the number of interconnections is greatly reduced.

Figure 2-2 shows a typical CANopen network system transferring the same signals as given in the traditionally wired example. The signals are now transmitted by converting them into a serial data stream which is received by the master as if they were connected using traditional wiring. The data stream on CANopen allows up to 32 (16 input and 16 output) independent values to be sent or received by the master, there is also a method available to allow a single channel random access (non-cyclic data access) to drive parameters.

Figure 2-2 CANopen cable layout

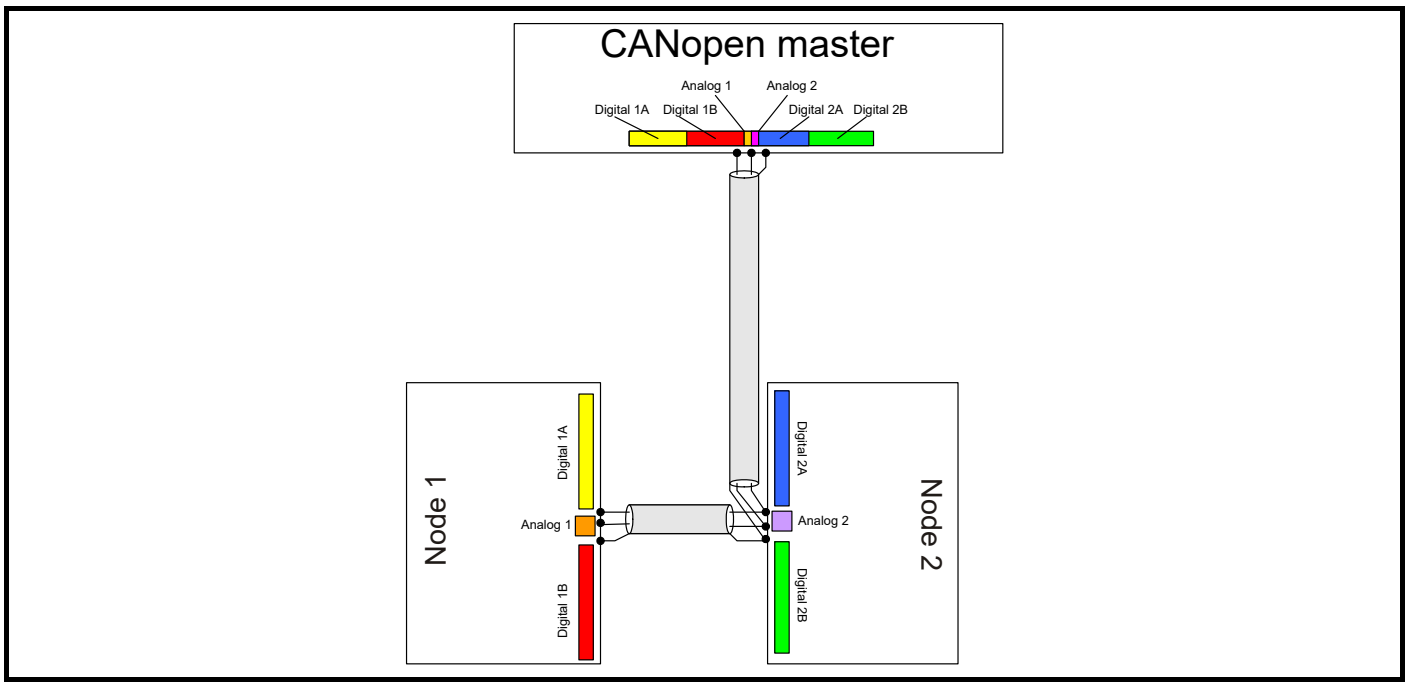


Table 2-2 details the number of data words used to communicate the signals using the CANopen network. It can be seen that the resulting reduction in cabling is significant.

Table 2-2 Data mappings for CANopen

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

SI-CANopen V2 transfers data using two distinct modes. The first of these modes is cyclic where signals are sent in predefined blocks at regular intervals. This is the equivalent of the hard-wired example above in Figure 2-1.

The second method of transfer is called non-cyclic data (SI-CANopen V2 may use SDOs for non-cyclic data) and is used for sending values that only need to be changed occasionally or where the source or destination of the signal changes. This is the equivalent of a temporary ‘patch lead’ that is removed after use.

2.2 What is SI-CANopen V2?

SI-CANopen V2 is a fieldbus option module that can be installed in the expansion slot(s) in any supported drive to provide CANopen connectivity.

In some drives it is possible to use more than one SI-CANopen V2 or a combination of SI-CANopen V2 and other option modules to add additional functionality such as extended I/O, gateway functionality, or additional PLC features.

Figure 2-3 SI-CANopen V2 option module

2.3 List of supported drives

SI-CANopen V2 is supported on the following Control Techniques drives:

- Unidrive M200 to M400 (Frames 2 to 9)
- Commander C200 / C300 (Frames 2 to 9)
- Unidrive M600 / M70X / M88X / HS7X
- Digitax HD
- Unidrive E300 (Elevator)
- F600 Pump Drive

2.4 General specification

SI-CANopen V2 has been designed to offer as much flexibility as possible, in particular the PDO numbering system has been specifically designed to offer maximum versatility while maintaining conformance to CiA specifications.

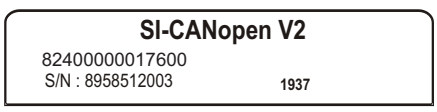
- Supported data rates (bits/s): 1M, 800k, 500k, 250k, 125k, 100k and 50k, all with auto-baud rate detection.
- Four transmit and four receive PDOs (process data objects) A, B, C and D supported.
- Independently configurable transmit and receive PDO numbers (1 to 512) for maximum application flexibility.
- All synchronous and asynchronous PDO communication modes supported.
- Total of 32 bytes (16 words) in each direction using PDOs (4 TxPDOs of 64 bits and four RxPDOs of 64 bits).
- Service Data Objects (SDO) provide access to all drive and option modules.
- Consumer heartbeat.
- Emergency message completed flag.
- 5 way screw terminal connection for ease of wiring.
- RxPDO, SYNC and missed heartbeat event handling.
- RxPDO event triggers.
- TxPDO event triggers.
- Support for CiA402 motion profiles.
- +24 V back-up power supply capability.

2.5 Option module identification

The SI-CANopen V2 module is identified by:

1. The label located on the topside of the option module.
2. The color coding across the front of the option module (light grey).

Figure 2-4 SI-CANopen V2 topside label



2.5.1 Date code format

The date code consists of four digits in the format 'yyww', the first two digits (yy) represent the year of manufacture and the last two digits (ww) represent the calendar full week number within the year.

Example:

A date code of 1937 would correspond to week 37 of year 2019.

2.6 Conventions used in this guide

The drive and option modules configurations are stored in parameters, these parameters are grouped into menus. A menu is a logical collection of parameters that relate to general drive or module functions (e.g. Frequency/speed reference, ramps, torque and current control etc.)
Parameters are addressed uniquely using slot, menu, parameter or menu, parameter notation where the slot address is not required when referring to the host drive parameters.
For the SI-CANopen V2 option module, the set-up parameters in menu 0 will, by default, appear in drive menu 15, 16 or 17, depending on which slot the module is installed in and the setting of the *Option Slot Identifiers* (Pr **11.056**).
The internal menus of the SI-CANopen V2 module will appear before menu 0 and after menu 41.

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

- **S.mm.ppp** - Where **S** signifies the option module slot number and **mm.ppp** signifies the menu and parameter number respectively. If the option module slot number **S** is not specified then the parameter reference **mm.ppp** will be a drive parameter.
- Pr **MM.ppp** - Where **MM** signifies the menu allocated to the option module set-up menu and **ppp** signifies the parameter number within the setup menu.
- Pr **mm.000** - Signifies parameter number 000 in any drive menu.

2.7 Conventions used for SI-CANopen V2

When referring to PDOs (process data objects), a PDO normally refers to both TxPDO (transmit process data object) and RxPDO (receive process data object). Where the differences are important this is quantified using the terms TxPDO and RxPDO.

SI-CANopen V2 references PDOs by a letter (A, B, C & D) to differentiate between the configuration of the PDOs and the actual PDO numbers used. SI-CANopen V2 supports four TxPDOs (A, B, C & D) and four RxPDOs (A, B, C & D) these PDOs have the default PDO numbers of 1, 3, 5 & 6 respectively, however these may be configured to any valid PDO number using a SDO messages from a CANopen master controller.

NOTE

The terms TxPDO and RxPDO are used in relation to the SI-CANopen V2 module, so TxPDO refers to the SI-CANopen V2 transmitted data to the CANopen master controller and RxPDO refers to the SI-CANopen V2 received data from the CANopen master controller.

NOTE

The terms 'Input' and 'Output' used in this document are in relation to the SI-CANopen V2 module functions/features.

2.8 Derivative Awareness

The SI-CANopen V2 module is aware of the customised parameter database that a derivative drive may have, this means that the SI-CANopen V2 module will make available and uses only those drive parameters as defined by the drive derivative.

This allows the SI-CANopen V2 module to better support drive derivatives such as the Elevator E300.

2.9 Network Synchronisation

In previous versions of SI-CANopen, a network synchronisation scheme was available in conjunction with the CiA402 Cyclic Synchronous Positioning (CSP) profile mode, this profile is discontinued and has been removed from SI-CANopen V2 as of firmware version V02.01.00.26.

3 Mechanical installation

Before installing or removing an option module from any drive, ensure the AC supply has been disconnected for at least 10 minutes and refer to section 1 *Safety information* on page 5. If using a DC bus supply ensure this is fully discharged before working on any drive or option module.

3.1 General installation

For information on the installation of the SI-CANopen V2 option module please refer to the installation sheet provided with the option module.

NOTE

Option modules can only be installed on drives that have the option module slot functionality.

4 Electrical

4.1 SI-CANopen V2 terminal descriptions

SI-CANopen V2 has a standard 5-way screw terminal block connector for the CANopen network connection as shown in Figure 4-1.

Figure 4-1 SI-CANopen V2 - connector view

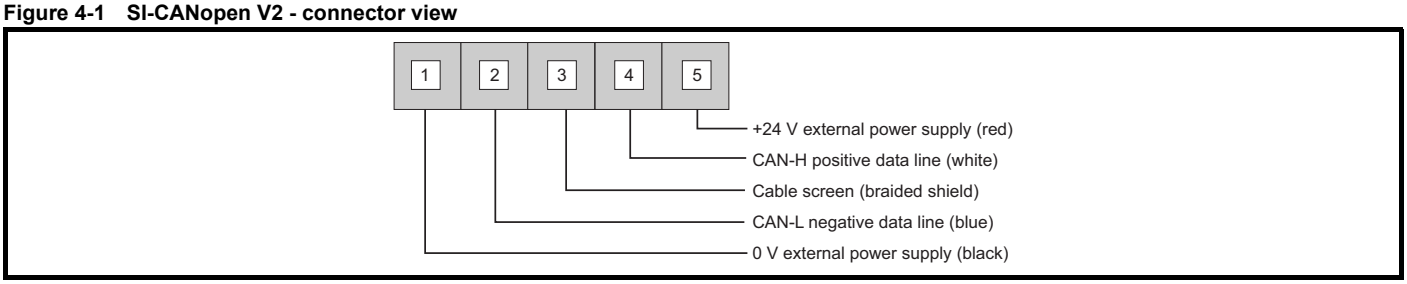


Table 4-1 SI-CANopen V2 terminal descriptions

Terminal Number	Cable Colour	Function	Description
1	Black	0 V	0 V SI-CANopen external supply
2	Blue	CAN-L	Negative data line
3	Braided Shield	Shield	Cable braided shield connection
4	White	CAN-H	Positive data line
5	Red	+24 V	+24 V SI-CANopen external supply

An external 24 V supply can be connected to terminals 1 and 5, this 24 V input allows the line driver circuitry to remain powered if the drive is powered down. This maintains the CANopen network load characteristics but does not allow the SI-CANopen V2 module to communicate with the CANopen master controller whilst the drive is powered down.

WARNING Any external supply must be suitably installed to prevent noise on the network.

4.2 CANopen cable

CANopen cable consists of 2 twisted pairs plus an overall braided shield with the colour coding as shown in Table 4-1. It is important that the colour coding is maintained to minimise the time required if any troubleshooting is required.

The data wires are white and blue, and the network power supply wires are red and black.

CANopen 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 CANopen networks is available on the CAN in Automation (CiA) web site at *www.can-cia.org*.

NOTE Control Techniques can only guarantee correct and reliable operation of SI-CANopen V2 if all other equipment installed on the CANopen network (including the network cable) has been approved by the CiA.

4.3 CANopen network termination

It is vital when dealing with high-speed communications networks, to ensure that the network communications cable is installed with the specified termination resistor network at each end of the cable segment. This prevents signals from being reflected back down the cable and causing interference.

During installation of a CANopen network, 120 Ω 0.25 W termination resistors should be installed across the CAN-H and CAN-L lines at both ends of the network segment.

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

If too many termination resistors are installed on a CANopen network, the network will be over-loaded, resulting in reduced signal levels. This may cause nodes to miss some bits of information, resulting in potential transmission errors.

4.4 SI-CANopen V2 cable shield connections

The SI-CANopen V2 should be wired with the cable shields isolated from ground at each drive. The cable shields should be linked together at the point where they emerge from the cable, and formed into a short pigtail to be connected to terminal 3 on the SI-CANopen V2 terminal connector.

NOTE The CANopen cable can be tie-wrapped to the grounding bar or local convenient mounting that is not live to provide strain relief, but the CANopen cable shield must be kept isolated from ground at each node. The only exception to this is the CANopen ground point as described in section 4.5 below.

4.5 SI-CANopen V2 ground point

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

4.6 Maximum network length

The maximum number of nodes that can be connected to a single CANopen network segment is 32. The maximum length of network cable for a CANopen network is specified by the *(CAN in Automation (CiA)* and depends on the data rate to be used.

Table 4-2 CANopen maximum segment lengths

Data rate (bits/sec)	Maximum network length (m)
1 M	30
800 k	50
500 k	100
250 k	250
125 k	500
100 k (NS)	700
50 k	1000

4.7 Spurs

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

For more detailed information please consult the CiA at *www.can-cia.org*.

4.8 Minimum node to node cable length

The CANopen specification does not specify a minimum node to node distance, however, Control Techniques advises a minimum distance of 1 m (3.3 ft) between nodes to prevent excessive mechanical stress and to reduce network reflections.

5 Getting Started

This section is intended to provide a generic guide for setting up SI-CANopen V2 and a master controller/PLC. Figure 5-1 *PDO Configuration setup overview* on page 24 is intended as the starting point for a new installation. The following pages detail the various methods available to configure SI-CANopen V2. It is recommended that all of this section is read, before attempting to configure a system.

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

NOTE Due to the large number of different PLCs/masters that support CANopen, details cannot be provided for any specific master or PLC. Generic support is available through your supplier or local drive centre. Before contacting your supplier or local drive centre for support ensure you have read Chapter 12 *Diagnostics* on page 168 of this manual and check you have configured all parameters correctly.

Ensure the following information is available before calling:

- A list of all parameters in SI-CANopen V2 module parameter values
- The drive firmware version (*see* the *drive documentation*)
- The SI-CANopen V2 firmware version

5.1 Parameter save and restore

Parameters in the module are saved when a normal drive parameter save is initiated by selecting "Save Parameters" or setting a value of 1000 in Pr **mm.000** and performing a drive reset. (If the drive is in the under voltage state or is supplied from a low voltage power supply then a value of 1001 must be set in Pr **mm.000** and a drive reset performed).

Any user-saved parameters in the option module's internal menus are stored in non-volatile memory on the module and not in the drive. Therefore, if the module is moved to a different slot or to a different drive, then any saved parameter values will follow the module. If a module is to be replaced, ensure that the parameter values for the module have been backed up before replacing it.

5.2 Module reset

A reset of the SI-CANopen V2 module can be performed by the methods detailed below.

- Set Pr **S.00.007** (or **Pr MM.007**) to On (1). This will only reset the module fitted in slot **S**.
- Select "Reset modules" or set a value of 1070 in Pr **mm.000**, and performing a drive reset. This will perform a reset of all option modules installed in the drive.

5.3 Restoring module parameter default values

Setting Pr **S.00.008** (or Pr **MM.008**) to On (1) and performing a module reset by setting Pr **S.00.007** (or Pr **MM.007**) to On (1) will return all parameters in the SI-CANopen V2 module to their default values.

Parameters in the SI-CANopen V2 module will also be set to their default values when drive parameters are returned to their default values.

5.4 Single Line Parameter Descriptions

This section details the SI-CANopen V2 module parameters, the following table shows the parameter type coding used for each parameter in this and the following sections.

RW	Read / Write	RO	Read-only	Bit	Bit parameter	Txt	Text string	Date	Date parameter	Time	Time parameter
Bin	Binary parameter	IP	IP address	Mac	MAC address	Ver	Version number	SMP	Slot, menu, parameter	Num	Number parameter
DE	Destination	ND	No default value	RA	Rating dependent	NC	Non-copyable	PT	Protected	FI	Filtered
US	User save	PS	Power-down save	LZ	Lead zero pad	PR	Pseudo read only				

5.4.1 Menu 0 - SI-CANopen V2 Setup Information

Parameter		Range	Default	Type					
S.00.001	Module ID	0 to 65535		RO	Num	ND	NC	PT	
S.00.002	Software Version	00.00.00.00 to 99.99.99.99		RO	Ver	ND	NC	PT	
S.00.003	Hardware Version	0.00 to 99.99		RO	Num	ND	NC	PT	
S.00.004	Serial Number LS	0 to 99999999		RO	LZ	ND	NC	PT	
S.00.005	Serial Number MS	0 to 99999999		RO	Num	ND	NC	PT	
S.00.006	Module Status	Initialising (0), OK (1), Config (2), Error (3)		RO	Txt	ND	NC	PT	
S.00.007	Module Reset	Off (0) or On (1)	Off (0)	RW	Bit		NC		
S.00.008	Module Default	Off (0) or On (1)	Off (0)	RW	Bit		NC		
S.00.012	Drive stored Node Address enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.00.013	Drive stored Node Address	0 to 127	0	RW	Num				US
S.00.060	Parameter Channel Command	0 to 2	0	RW	Txt		NC		
S.00.061	Parameter Channel Status	0 to 3	0	RO	Txt		NC	PT	
S.00.062	Parameter Channel Parameter Address	0 to 65535	0	RW	Num		NC		
S.00.063	Parameter Channel Value LSW / Error	-32768 to 32767	0	RW	Num		NC		
S.00.064	Parameter Channel Value MSW	-32768 to 32767	0	RW	Num		NC		

5.4.2 Menu 1 - CANopen Interface Setup

Parameter		Range (⇳)	Default (⇨)	Type					
S.01.001	CANopen Interface Mode	Off (0), On (1), On No Bootup (2)	On (1)	RW	Txt				US
S.01.002	Reset CANopen Interface	Off (0) or On (1)	Off (0)	RW	Bit				
S.01.003	Default CANopen Interface	Off (0) or On (1)	Off (0)	RW	Bit				
S.01.004	CANopen Node Address	0 to 127	0	RW	Num				US
S.01.005	Baud rate	1Mbps (0), 800kbps (1), 500kbps (2), 250kbps (3), 125kbps (4), 50kbps (5), Auto detect (6), 100kbps (NS) (7)	500kbps (2)	RW	Txt		NC	PT	US
S.01.006	CANopen Network Diagnostic	Network OK (0), Internal HW Fail (1), Init OK (2), No PDO Cfg (3), Config Error (4), Software Error (5), Baud detecting (6), Device Disabled (7), Initialise Delay (8), Bus Off (9)		RO	Txt	ND	NC	PT	
S.01.007	Cyclic Data Rate	0 to 9999 Messages/s		RO	Num	ND	NC	PT	
S.01.008	PDO Configuration Source	By Menu (0), By Master (1)	By Menu (0)	RW	Txt				US
S.01.010	Timeout Delay	0 to 3000 ms	0 ms	RW	Num				US
S.01.011	Timeout Action	Trip (0), Send flt values (1), Clear output (2), Hold last (3), No action (4)	Trip (0)	RW	Txt				US
S.01.012	Timeout Event Destination	This slot (0), Slot 1 (1), Slot 2 (2), Slot 3 (3), Slot 4 (4)	This slot (0)	RW	Txt				US
S.01.013	Timeout Event Type	No event (0), Event 0 (1), Event1 (2), Event2 (3), Event3 (4), Event4 (5)	No event (0)	RW	Txt				US
S.01.014	PDO Data Alignment	32 bit (0), 16 bit (1), 8 bit (2)	32 bit (0)	RW	Txt				US
S.01.020	CiA 402 profiles Enable	Off (0) or On (1)	Off (0)	RW	Bit				US

Parameter		Range (⇳)	Default (⇨)	Type					
S.01.021	Compatibility Mode	Hybrid (0), UNIDRIVE SP (1), COMMANDER SK (2), UNIDRIVE M (3), SK PDO COMPAT (4), SDO SIZE COMPAT (5), CIA402 Profile (6)	UNIDRIVE M (3)	RW	Txt				US
S.01.022	Compatibility Mode Software Revision	00.00.00.00 to 99.99.99.99	00.00.00.00	RW	Ver			PT	US
S.01.023	Compatibility Mode Serial Number	0 to 999999999	0	RW	Num			PT	US
S.01.024	User Program Object Priority	None (0), Internal (1), User Program (2)	None (0)	RW	Txt			PT	US
S.01.030	CANopen Identification Override	-2147483648 to 2147483647	0	RW	Num			PT	US

5.4.3 Menu 2 - PDOA Setup

Parameter		Range (⇳)	Default (⇨)	Type					
S.02.001	TPDOA Length	0 to 4	4	RW	Num		NC		
S.02.002	RPDOA Length	0 to 4	4	RW	Num		NC		
S.02.003	TPDOA Transmission Type	0 to 255	255	RW	Num				US
S.02.004	TPDOA Mapping Status	Mapping OK (0), Too Many Map (1), No Mapping (2), Read Mismatch (3), Hole In Mapping (4), Duplicate Map (5), Length Mismatch (6), *Reserved* (7), Trans Type (8)	Mapping OK (0)	RO	Txt		NC	PT	
S.02.005	RPDOA Mapping Status	Mapping OK (0), Too Many Map (1), No Mapping (2), Read Mismatch (3), Hole In Mapping (4), Duplicate Map (5), Length Mismatch (6), *Reserved* (7), Trans Type (8), Out of Memory (9)	Mapping OK (0)	RO	Txt		NC	PT	
S.02.006	TPDOA Processing Time	0 to 65535 ms		RO	Num	ND	NC	PT	
S.02.007	RPDOA Processing Time	0 to 65535 ms		RO	Num	ND	NC	PT	
S.02.008	PDOA Input Consistency Enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.02.009	PDOA Input Consistency Trigger Parameter	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.02.010	PDOA Output Consistency Enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.02.011	PDOA Output Consistency Trigger Parameter	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.02.012	PDOA Event Trigger	Off (0) or On (1)	Off (0)	RW	Bit				US
S.02.013	TPDOA Number	1 to 512	1	RW	Num				US
S.02.014	RPDOA Number	1 to 512	1	RW	Num				US
S.02.015	TPDOA Mapping Parameter 1	0.00.000 to 5.99.999	0.10.040	RW	SMP				US
S.02.016	TPDOA Mapping Parameter 2	0.00.000 to 5.99.999	0.02.001	RW	SMP				US
S.02.017	TPDOA Mapping Parameter 3	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.02.018	TPDOA Mapping Parameter 4	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.02.019	RPDOA Mapping Parameter 1	0.00.000 to 5.99.999	0.06.042	RW	SMP				US
S.02.020	RPDOA Mapping Parameter 2	0.00.000 to 5.99.999	0.01.021	RW	SMP				US
S.02.021	RPDOA Mapping Parameter 3	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.02.022	RPDOA Mapping Parameter 4	0.00.000 to 5.99.999	0.00.000	RW	SMP				US

5.4.4 Menu 3 - PDOB Setup

Parameter		Range (⇳)	Default (⇨)	Type					
S.03.001	TPDOB Length	0 to 4	4	RW	Num		NC		
S.03.002	RPDOB Length	0 to 4	4	RW	Num		NC		
S.03.003	TPDOB Transmission Type	0 to 255	255	RW	Num				US
S.03.004	TPDOB Mapping Status	Mapping OK (0), Too Many Map (1), No Mapping (2), Read Mismatch (3), Hole In Mapping (4), Duplicate Map (5), Length Mismatch (6), *Reserved* (7), Trans Type (8), Out of Memory (9)	Mapping OK (0)	RO	Txt		NC	PT	
S.03.005	RPDOB Mapping Status	Mapping OK (0), Too Many Map (1), No Mapping (2), Read Mismatch (3), Hole In Mapping (4), Duplicate Map (5), Length Mismatch (6), *Reserved* (7), Trans Type (8), Out of Memory (9)	Mapping OK (0)	RO	Txt		NC	PT	
S.03.006	TPDOB Processing Time	0 to 65535 ms		RO	Num	ND	NC	PT	
S.03.007	RPDOB Processing Time	0 to 65535 ms		RO	Num	ND	NC	PT	
S.03.008	PDOB Input Consistency Enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.03.009	PDOB Input Consistency Trigger Parameter	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.010	PDOB Output Consistency Enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.03.011	PDOB Output Consistency Trigger Parameter	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.012	PDOB Event Trigger	Off (0) or On (1)	Off (0)	RW	Bit				US
S.03.013	TPDOB Number	1 to 512	3	RW	Num				US
S.03.014	RPDOB Number	1 to 512	3	RW	Num				US
S.03.015	TPDOB Mapping Parameter 1	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.016	TPDOB Mapping Parameter 2	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.017	TPDOB Mapping Parameter 3	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.018	TPDOB Mapping Parameter 4	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.019	RPDOB Mapping Parameter 1	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.020	RPDOB Mapping Parameter 2	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.021	RPDOB Mapping Parameter 3	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.03.022	RPDOB Mapping Parameter 4	0.00.000 to 5.99.999	0.00.000	RW	SMP				US

5.4.5 Menu 4 - PDOC Setup

Parameter		Range (⇳)	Default (⇨)	Type					
S.04.001	TPDOC Length	0 to 4	4	RW	Num		NC		
S.04.002	RPDOC Length	0 to 4	4	RW	Num		NC		
S.04.003	TPDOC Transmission Type	0 to 255	255	RW	Num				US
S.04.004	TPDOC Mapping Status	Mapping OK (0), Too Many Map (1), No Mapping (2), Read Mismatch (3), Hole In Mapping (4), Duplicate Map (5), Length Mismatch (6), *Reserved* (7), Trans Type (8), Out of Memory (9)	Mapping OK (0)	RO	Txt		NC	PT	
S.04.005	RPDOC Mapping Status	Mapping OK (0), Too Many Map (1), No Mapping (2), Read Mismatch (3), Hole In Mapping (4), Duplicate Map (5), Length Mismatch (6), *Reserved* (7), Trans Type (8), Out of Memory (9)	Mapping OK (0)	RO	Txt		NC	PT	
S.04.006	TPDOC Processing Time	0 to 65535 ms		RO	Num	ND	NC	PT	
S.04.007	RPDOC Processing Time	0 to 65535 ms		RO	Num	ND	NC	PT	
S.04.008	PDOC Input Consistency Enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.04.009	PDOC Input Consistency Trigger Parameter	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.010	PDOB Output Consistency Enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.04.011	PDOC Output Consistency Trigger Parameter	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.012	PDOC Event Trigger	Off (0) or On (1)	Off (0)	RW	Bit				US
S.04.013	TPDOC Number	1 to 512	5	RW	Num				US
S.04.014	RPDOC Number	1 to 512	5	RW	Num				US
S.04.015	TPDOC Mapping Parameter 1	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.016	TPDOC Mapping Parameter 2	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.017	TPDOC Mapping Parameter 3	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.018	TPDOC Mapping Parameter 4	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.019	RPDOC Mapping Parameter 1	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.020	RPDOC Mapping Parameter 2	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.021	RPDOC Mapping Parameter 3	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.04.022	RPDOC Mapping Parameter 4	0.00.000 to 5.99.999	0.00.000	RW	SMP				US

5.4.6 Menu 5 - PDOD Setup

Parameter		Range (⇳)	Default (⇨)	Type					
S.05.001	TPDOD Length	0 to 4	4	RW	Num		NC		
S.05.002	RPDOD Length	0 to 4	4	RW	Num		NC		
S.05.003	TPDOD Transmission Type	0 to 255	255	RW	Num				US
S.05.004	TPDOD Mapping Status	Mapping OK (0), Too Many Map (1), No Mapping (2), Read Mismatch (3), Hole In Mapping (4), Duplicate Map (5), Length Mismatch (6), *Reserved* (7), Trans Type (8), Out of Memory (9)	Mapping OK (0)	RO	Txt		NC	PT	
S.05.005	RPDOD Mapping Status	Mapping OK (0), Too Many Map (1), No Mapping (2), Read Mismatch (3), Hole In Mapping (4), Duplicate Map (5), Length Mismatch (6), *Reserved* (7), Trans Type (8), Out of Memory (9)	Mapping OK (0)	RO	Txt		NC	PT	
S.05.006	TPDOD Processing Time	0 to 65535 ms		RO	Num	ND	NC	PT	
S.05.007	RPDOD Processing Time	0 to 65535 ms		RO	Num	ND	NC	PT	
S.05.008	PDOD Input Consistency Enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.05.009	PDOD Input Consistency Trigger Parameter	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.010	PDOD Output Consistency Enable	Off (0) or On (1)	Off (0)	RW	Bit				US
S.05.011	PDOD Output Consistency Trigger Parameter	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.012	PDOD Event Trigger	Off (0) or On (1)	Off (0)	RW	Bit				US
S.05.013	TPDOD Number	1 to 512	6	RW	Num				US
S.05.014	RPDOD Number	1 to 512	6	RW	Num				US
S.05.015	TPDOD Mapping Parameter 1	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.016	TPDOD Mapping Parameter 2	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.017	TPDOD Mapping Parameter 3	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.018	TPDOD Mapping Parameter 4	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.019	RPDOD Mapping Parameter 1	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.020	RPDOD Mapping Parameter 2	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.021	RPDOD Mapping Parameter 3	0.00.000 to 5.99.999	0.00.000	RW	SMP				US
S.05.022	RPDOD Mapping Parameter 4	0.00.000 to 5.99.999	0.00.000	RW	SMP				US

5.4.7 Menu 6 - RPDO Fault

Parameter		Range (⇳)	Default (⇨)	Type					
S.06.001	PDOA Fault Value 1	-2147483648 to 2147483647	0	RW	Num				US
S.06.002	PDOA Fault Value 2	-2147483648 to 2147483647	0	RW	Num				US
S.06.003	PDOA Fault Value 3	-2147483648 to 2147483647	0	RW	Num				US
S.06.004	PDOA Fault Value 4	-2147483648 to 2147483647	0	RW	Num				US
S.06.005	PDOB Fault Value 1	-2147483648 to 2147483647	0	RW	Num				US
S.06.006	PDOB Fault Value 2	-2147483648 to 2147483647	0	RW	Num				US
S.06.007	PDOB Fault Value 3	-2147483648 to 2147483647	0	RW	Num				US
S.06.008	PDOB Fault Value 4	-2147483648 to 2147483647	0	RW	Num				US
S.06.009	PDOC Fault Value 1	-2147483648 to 2147483647	0	RW	Num				US
S.06.010	PDOC Fault Value 2	-2147483648 to 2147483647	0	RW	Num				US
S.06.011	PDOC Fault Value 3	-2147483648 to 2147483647	0	RW	Num				US
S.06.012	PDOC Fault Value 4	-2147483648 to 2147483647	0	RW	Num				US
S.06.013	PDOD Fault Value 1	-2147483648 to 2147483647	0	RW	Num				US
S.06.014	PDOD Fault Value 2	-2147483648 to 2147483647	0	RW	Num				US
S.06.015	PDOD Fault Value 3	-2147483648 to 2147483647	0	RW	Num				US
S.06.016	PDOD Fault Value 4	-2147483648 to 2147483647	0	RW	Num				US

5.4.8 Menu 7 - CAN Master Functions

Parameter		Range (⇳)	Default (⇨)	Type						
S.07.001	Simple master	Off (0) or On (1)	Off (0)	RW	Bit					
S.07.003	DPLCAN Node Address	0 to 127	0	RW	Num					US
S.07.006	DPLCAN Data Rate	0 to 65535		RO	Num		ND	NC	PT	
S.07.034	DPLCAN Trip Behaviour	No CAN Trips (0), Bus Off Only (1), All CAN Trips (2)	1	RO	Txt					US
S.07.036	DPLCAN Overwrite Enable	Off (0) or On (1)	Off (0)	RO	Bit					US

5.4.9 Menu 9 - Resources

Parameter		Range (⇳)	Default (⇨)	Type					
S.09.001	NMT State	0 (Initialising) to 6 (Error)	None	RO	Txt		NC	PT	BU
S.09.002	Using Saved Objects	0 to 1	0 (Off)	RO	Txt		NC	PT	
S.09.030	PCB Temperature 1	-128 to 127 °C		RO	Num	ND	NC	PT	
S.09.031	PCB Temperature 2	-128 to 127 °C		RO	Num	ND	NC	PT	

5.5 PDO number configuration

SI-CANopen V2 provides four TxPDOs and four RxPDOs, these are referred to as PDOs A, B, C & D. By default these are configured as PDOs 1, 3, 5 & 6 respectively.

If a controller/PLC requires PDO numbering to be changed (e.g. the only supported PDOs are 1,2,3 and 4), this can be achieved using object 0x2800 or 0x2801, doing this will result in the existing PDO configuration objects being destroyed and objects for the new PDO being created with default values, this will take effect immediately. If the PDO number is already used within the same object the old PDO will be overwritten. It is now possible to have different numbers for individual TxPDOs and RxPDOs eg. TxPDO 1, 2, 3, 4 and RxPDO 5, 6, 7 and 8.

5.5.1 Object 0x2800 (RxPDO number configuration)

Sub Index 0 : Will return 4 when read indicating the maximum sub-index and number of PDOs supported.

Sub Index 1 – 4 : Are used to read and set the RxPDO number for each of the four configurable RxPDOs. The number is specified as the required number less 1. That is, PDO1 would be represented as 0.

5.5.2 Object 0x2801 (TxPDO number configuration)

Sub Index 0: Will return 4 when read indicating the maximum sub-index and number of PDOs supported.

Sub Index 1 – 4: Are used to read and set the TxPDO number for each of the four configurable TxPDOs. The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address (e.g. for PDO3 use 2).

5.6 PDO structure (PDOs A, B, C & D)

SI-CANopen V2 provides four TxPDOs and four RxPDOs, these are referred to as PDOs A, B, C & D. By default these are configured as PDOs 1, 3, 5 & 6 respectively.

All PDOs may be configured entirely from the module's parameters without the need for a master. All PDOs can also be set up using SDOs from the master.

The benefits of using this scheme are that it allows the four PDOs (A, B, C and D) to be configured to any valid PDO number required while still achieving conformance.

5.7 Types of set-up

SI-CANopen V2 offers two methods of configuring the PDOs, either entirely from the SI-CANopen V2 menus (**S.01.008** = By Menu) or using SDO messages from the master/controller (**S.01.008** = By Master).

For configuring the PDO numbers from the module's parameters, each PDO (A, B, C and D) has its own menu structure, Table 5-1 shows the parameters required to change the PDO numbering from the drive menus.

Table 5-1 SI-CANopen V2 PDO Flexible numbering parameters

PDO	Default Number	Parameter	
		TxPDO	RxPDO
A	1	S.02.013	S.02.014
B	3	S.03.013	S.03.014
C	5	S.04.013	S.04.014
D	6	S.05.013	S.05.014

This will result in the existing PDO configuration objects being destroyed and objects for the new PDO being created with the configured values, this will take effect immediately. If the PDO number is already used within the same object the old PDO will be overwritten.

5.7.1 Configuration by SI-CANopen V2 parameters only (No master/controller)

Any PDO (A, B, C, D) may be configured by just using the SI-CANopen V2 parameters, all communication settings (such as PDO number, transmission type, PDO length and mappings) may be configured directly from the SI-CANopen V2 parameters.

The SI-CANopen V2 menus for the relevant PDOs are shown in the following table.

PDO	Menu
A	2
B	3
C	4
D	5

Configuring the PDOs from the SI-CANopen V2 module parameters allows the full range of PDO numbers (1 to 512) being used, the PDO communication and mapping parameters configuration SDO objects only support PDO numbers 1 to 16 as shown in the following section.

NOTE The default transmission type, asynchronous timer trigger (type 255) for TxPDOA cannot be configured without a controller/PLC, as the SI-CANopen V2 internal timer must be configured to use this feature. For use without a controller/PLC the transmission type should be changed. This default configuration prevents a partially configured node from transmitting on the network.

5.7.2 Configuration by CANopen master/controller via SDOs

SI-CANopen V2 provides the ability to configure any PDO to any one of sixteen PDO numbers (1 to 16) when using SDOs to configure the PDO communication and mapping parameters. Any PDO (A, B, C, D) may be configured by the CANopen master/controller using SDOs, all communication settings (such as PDO number, transmission type, PDO length and mappings) may be configured using the relevant object reference for the numbered PDO.

The required PDO number and related objects are shown in the following table.

Number	RxPDO		TxPDO	
	Communication	Mapping	Communication	Mapping
1 (PDOA default)	0x1400	0x1600	0x1800	0x1A00
2	0x1401	0x1601	0x1801	0x1A01
3 (PDOB default)	0x1402	0x1602	0x1802	0x1A02
4	0x1403	0x1603	0x1803	0x1A03
5 (PDOC default)	0x1404	0x1604	0x1804	0x1A04
6 (PDOD default)	0x1405	0x1605	0x1805	0x1A05
7	0x1406	0x1606	0x1806	0x1A06
8	0x1407	0x1607	0x1807	0x1A07
9	0x1408	0x1608	0x1808	0x1A08
10	0x1409	0x1609	0x1809	0x1A09
11	0x140A	0x160A	0x180A	0x1A0A
12	0x140B	0x160B	0x180B	0x1A0B
13	0x140C	0x160C	0x180C	0x1A0C
14	0x140D	0x160D	0x180D	0x1A0D
15	0x140E	0x160E	0x180E	0x1A0E
16	0x140F	0x160F	0x180F	0x1A0F

5.7.3 Flexible PDO numbering (master required)

SI-CANopen V2 provides a method of reconfiguring the available PDOs while still maintaining conformance (objects 0x2800 and 0x2801). This method allows four TxPDOs (A, B, C & D) and four RxPDOs (A, B, C & D) to be configured individually to any valid PDO number. It is not necessary for the TxPDOs and RxPDOs to have the same PDO numbers, thus allowing for absolute flexibility during configuration. The configuration objects for the configured PDOs are taken from the base address of the object (eg. 0x1800) plus the configured PDO number minus 1 (e.g. TxPDO2 would use 0x1801).

NOTE If an SDO overwrites the settings made in the module's parameters, then the values for the communication objects will be changed. However, the values stored in the parameters will not be altered.

5.7.4 SDO saving

A method for saving the configured PDOs is available by using object (0x1010), which allows all communication settings to be stored in the SI-CANopen V2 module. This allows SI-CANopen V2 to retain the settings sent by the configuration SDOs from the controller/PLC. The node is then able to resume communications without requiring the SDO configuration to be re-sent by the controller/PLC, following a reset or loss of power. This procedure also forces a parameter save in the SI-CANopen V2 module.

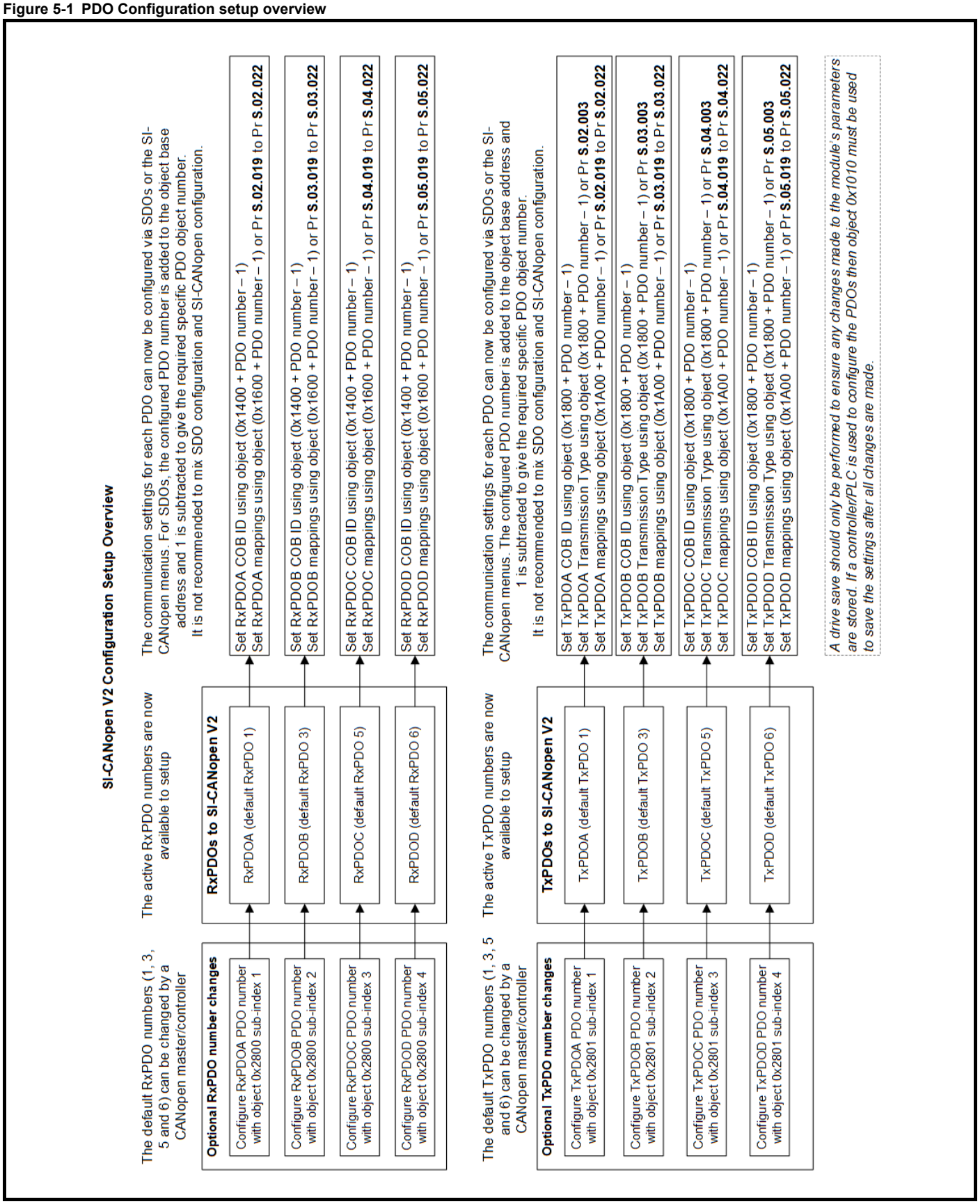
5.7.5 Pre-configuration for a machine (controller/PLC required initially)

The SDO saving option (0x1010) allows SI-CANopen V2 to be pre-configured on a controller/PLC before use on a system. This allows the product to be configured for use with a controller/PLC that does not support SDO configuration of the slave device, or a controller/PLC that requires a specific set of PDO numbers. This effectively allows the module to be pre-configured before installation and allows SI-CANopen V2 to work in existing hardware configurations with different PDO numbering schemes.

5.8 Configuration setup overview

Figure 5-1 *PDO Configuration setup overview* on page 24 gives an overview of the configuration process required for SI-CANopen V2 communication objects, details are given for the key stages of set-up. In particular the stages involved in configuring PDO numbers (if required) and the required set-up parameters/objects are shown. Additional details of the objects can be found in the sections relating to the specific objects. It is recommended that all of this section is read before configuring SI-CANopen V2. This overview is supplemented by the set-up flowcharts that follow.

Figure 5-1 PDO Configuration setup overview



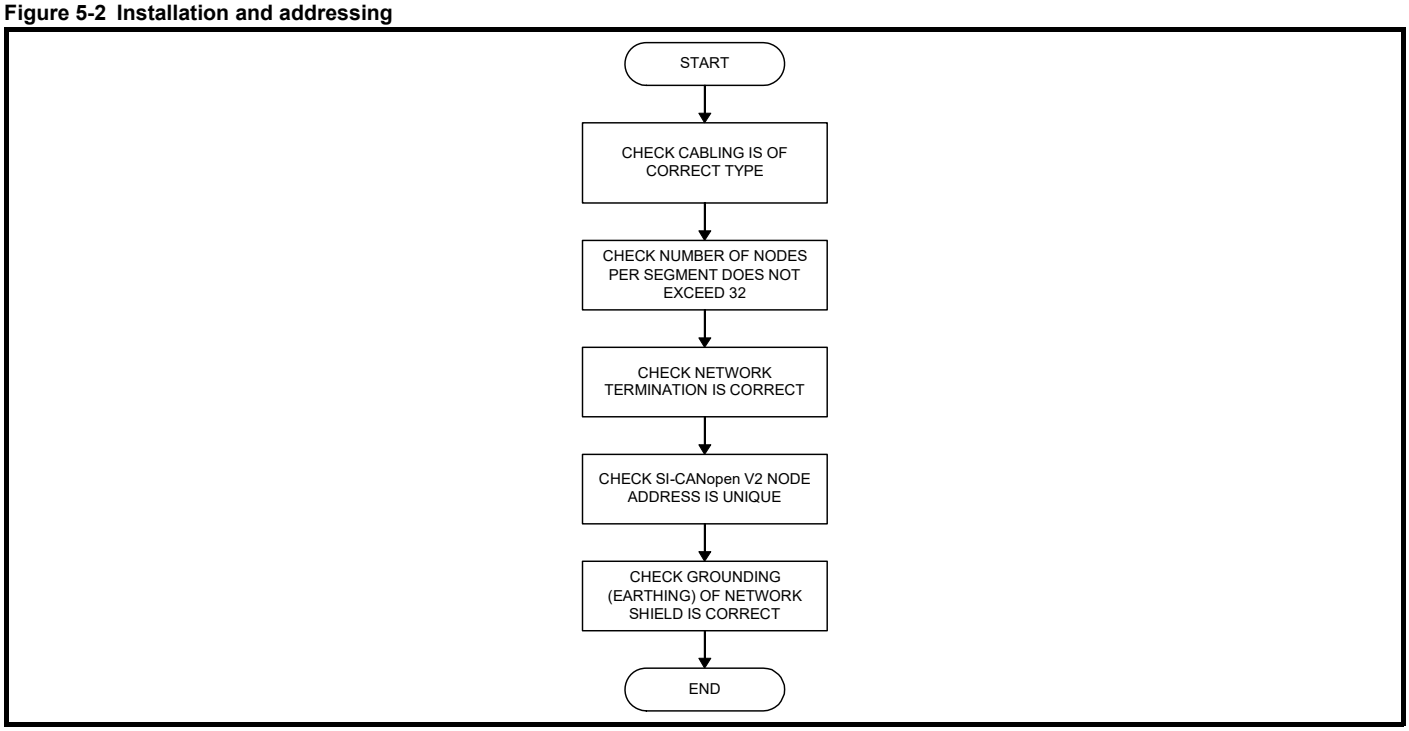
5.9 Setup flowcharts

The following flowcharts should be used as a visual reference to aid with the configuration of a network. Various options are highlighted by decision boxes and sub flowcharts are used to extend the detail within certain sections.

5.9.1 Cabling and addressing flowchart

Figure 5-2 details the requirements for cabling and addressing. This flowchart should be used as the starting point for all configurations.

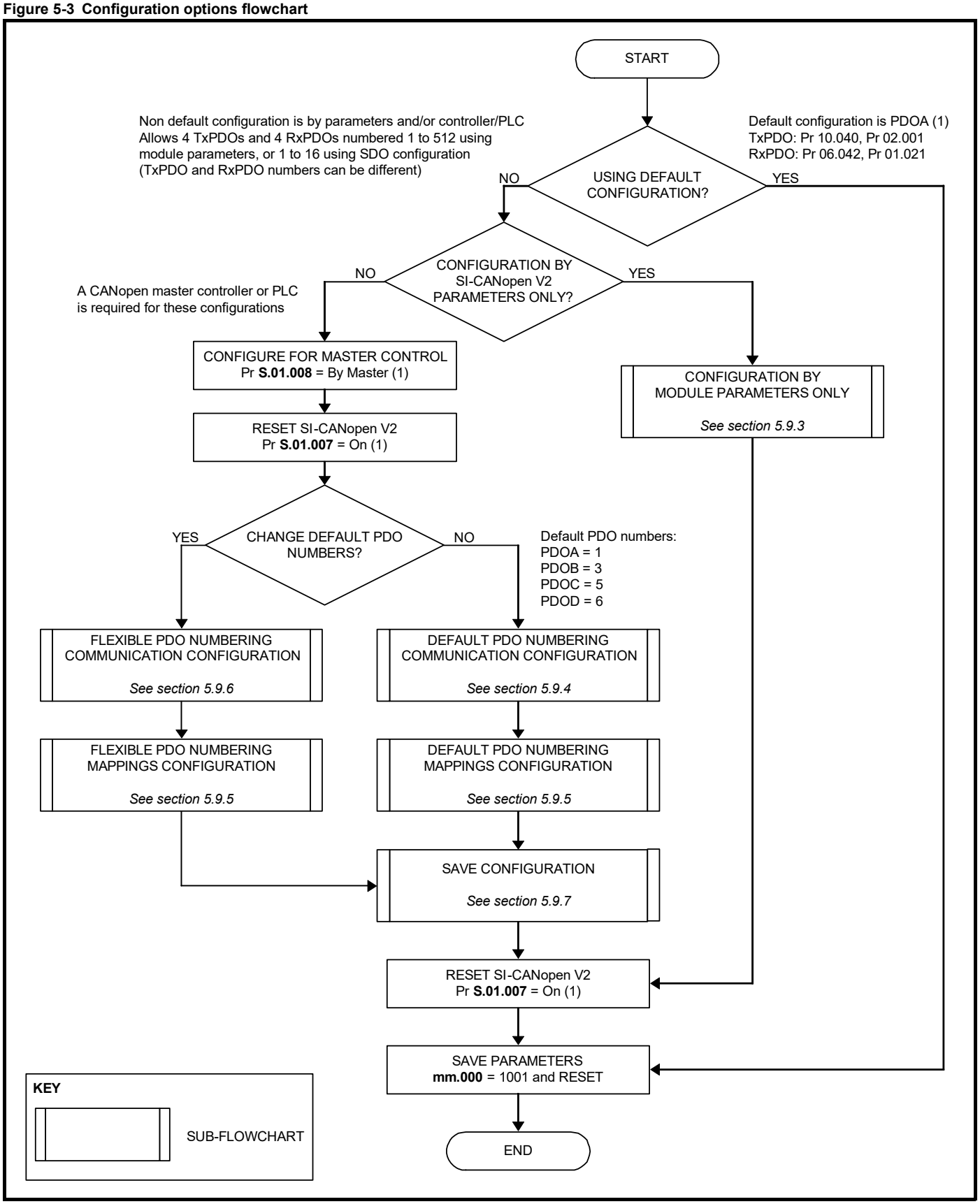
Figure 5-2 Installation and addressing



5.9.2 Configuring SI-CANopen V2

Figure 5-3 details the main setup procedure for the PDO settings on SI-CANopen V2. To break the procedure into manageable sections, additional sub flowcharts are referred to that expand the detail where necessary (always return to this flowchart after completion of a sub flowchart).

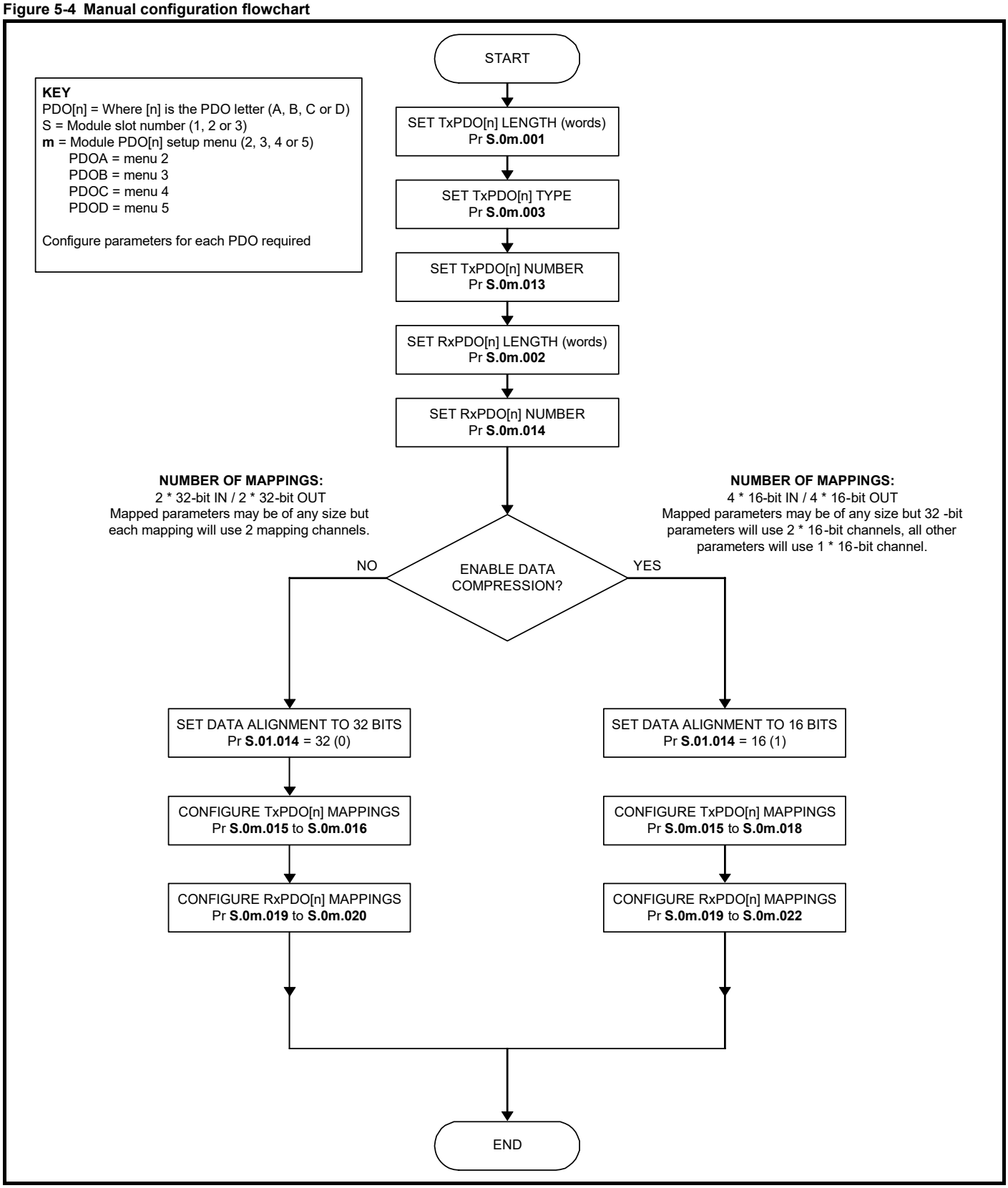
Figure 5-3 Configuration options flowchart



5.9.3 Configuration by module parameters only

Figure 5-4 details the steps required to configure the PDOs entirely from the SI-CANopen V2 menus. This means that a CANopen master controller or PLC is not required to configure the PDOs. The default PDOs in the module are numbered 1, 3, 5 and 6 for both RxPDOs and TxPDOs.

Figure 5-4 Manual configuration flowchart

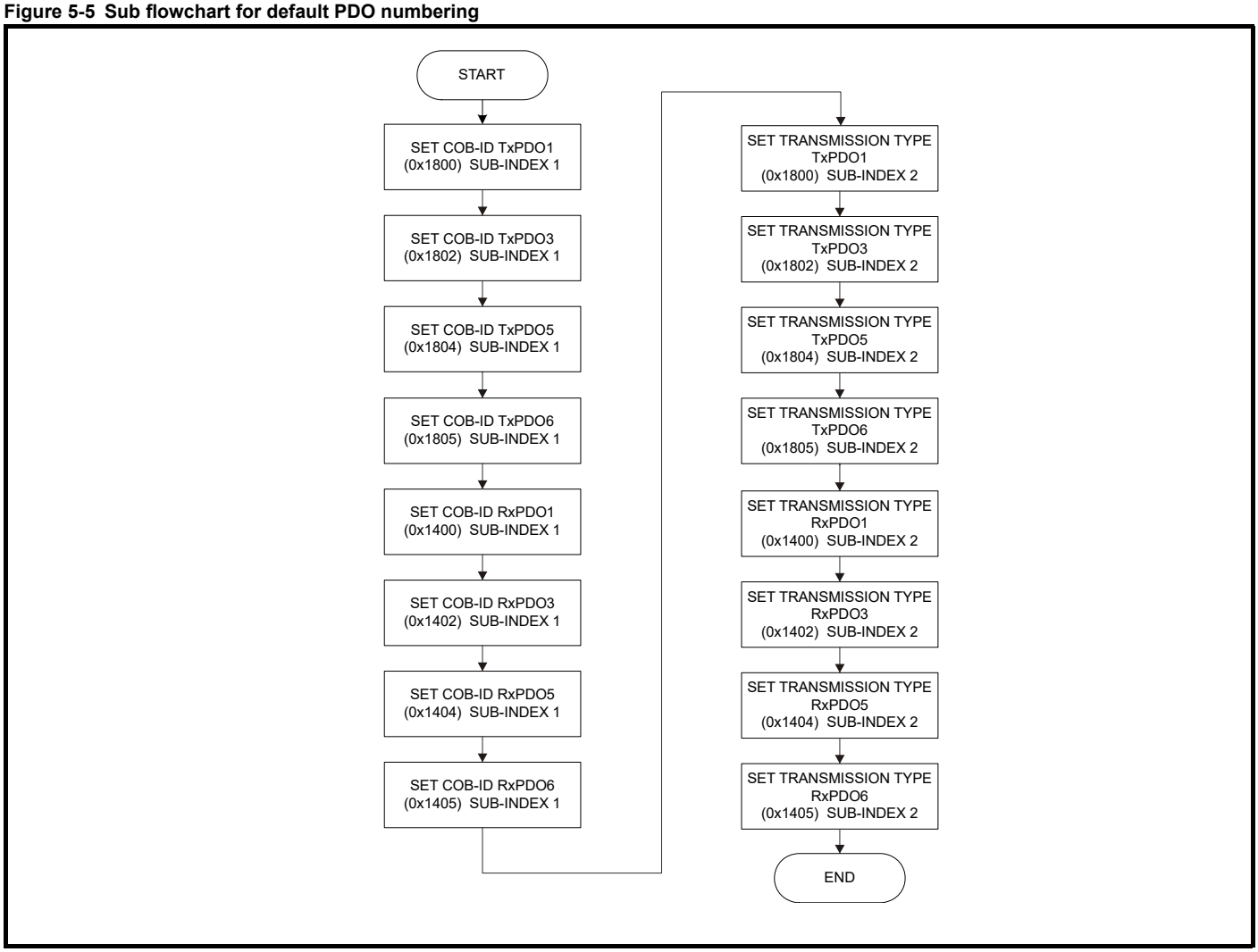


NOTE This chart is used in conjunction with Figure 5-3 *Configuration options flowchart* on page 26.

5.9.4 Configuration of default PDOs (using controller/PLC)

Figure 5-5 details the SDOs required to setup the default RxPDOs and TxPDOs contained within the module. The default PDOs in the module are numbered 1, 3, 5 and 6 for both RxPDOs and TxPDOs.

Figure 5-5 Sub flowchart for default PDO numbering

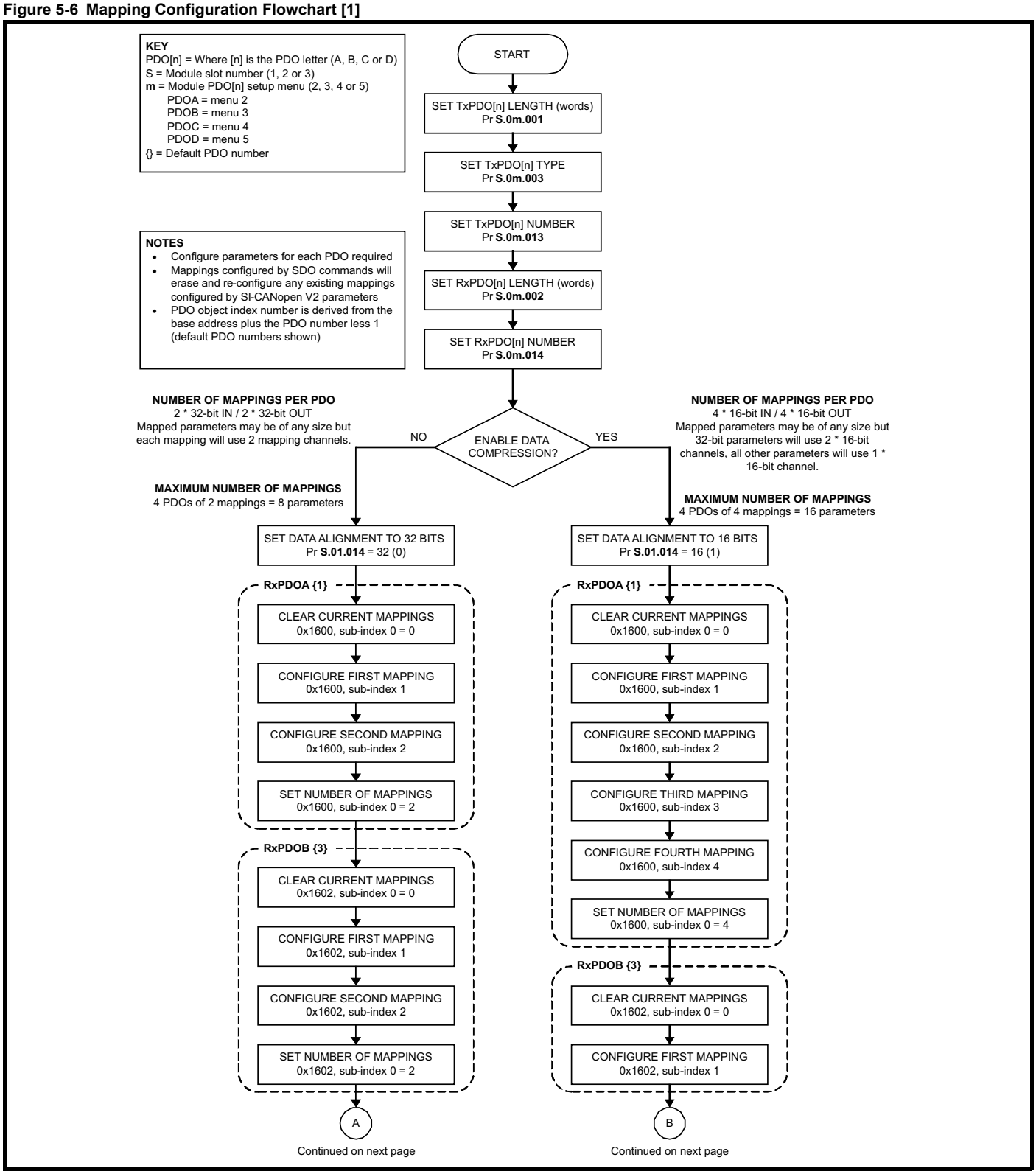


NOTE This chart is used in conjunction with Figure 5-3 *Configuration options flowchart* on page 26.

5.9.5 Mapping Configuration of PDOs

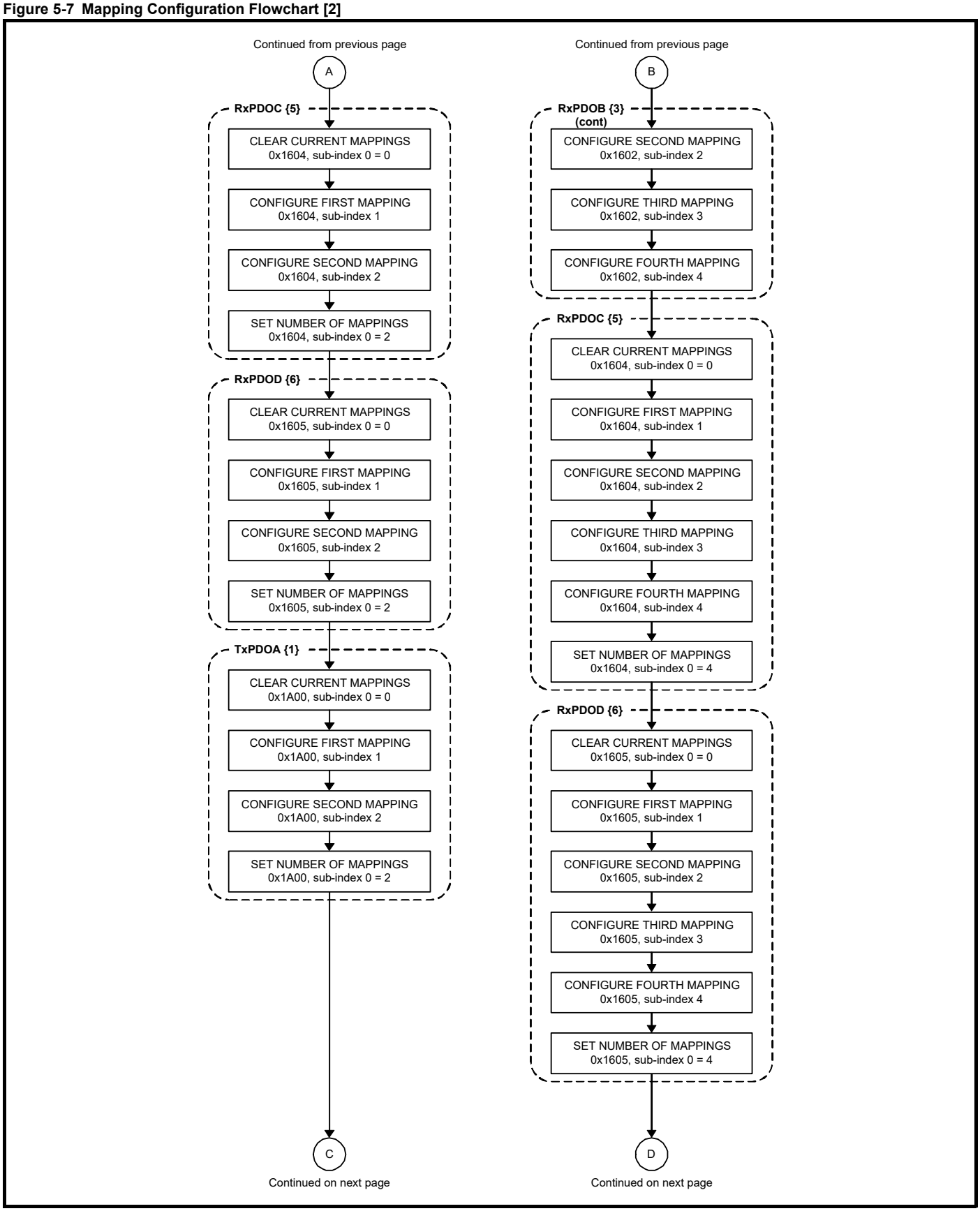
Figure 5-6 shows the configuration of the mappings for PDOs. This is performed using the SDOs shown below. The route through this flowchart will be determined by the size of the parameters that are mapped.

Figure 5-6 Mapping Configuration Flowchart [1]



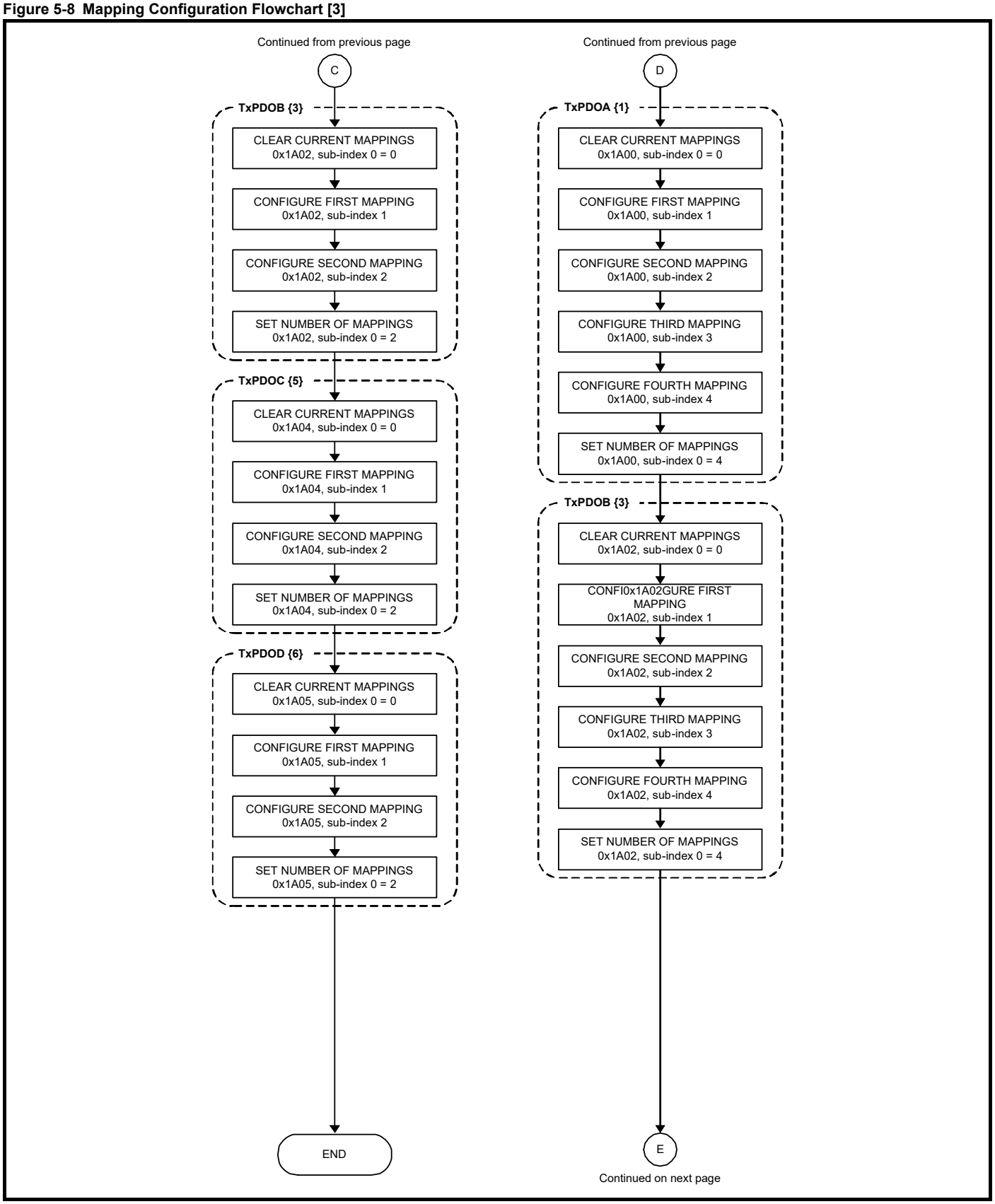
NOTE This chart is used in conjunction with Figure 5-3 *Configuration options flowchart* on page 26. Setting Pr **S.01.014** to 1 (data alignment on) will allow a maximum of four mappings. If data compression is off, or the parameters are 32 bits, then only two mappings will be possible (i.e. each PDO has 64 bits, so the size of the parameters mapped will determine the maximum number of mappings). PDOs A, B, C & D may be configured to any valid PDO number and the TxPDO and RxPDO numbers are independent. The default configuration for PDOA, B, C & D are PDO numbers 1, 3, 5 & 6 respectively.

Figure 5-7 Mapping Configuration Flowchart [2]



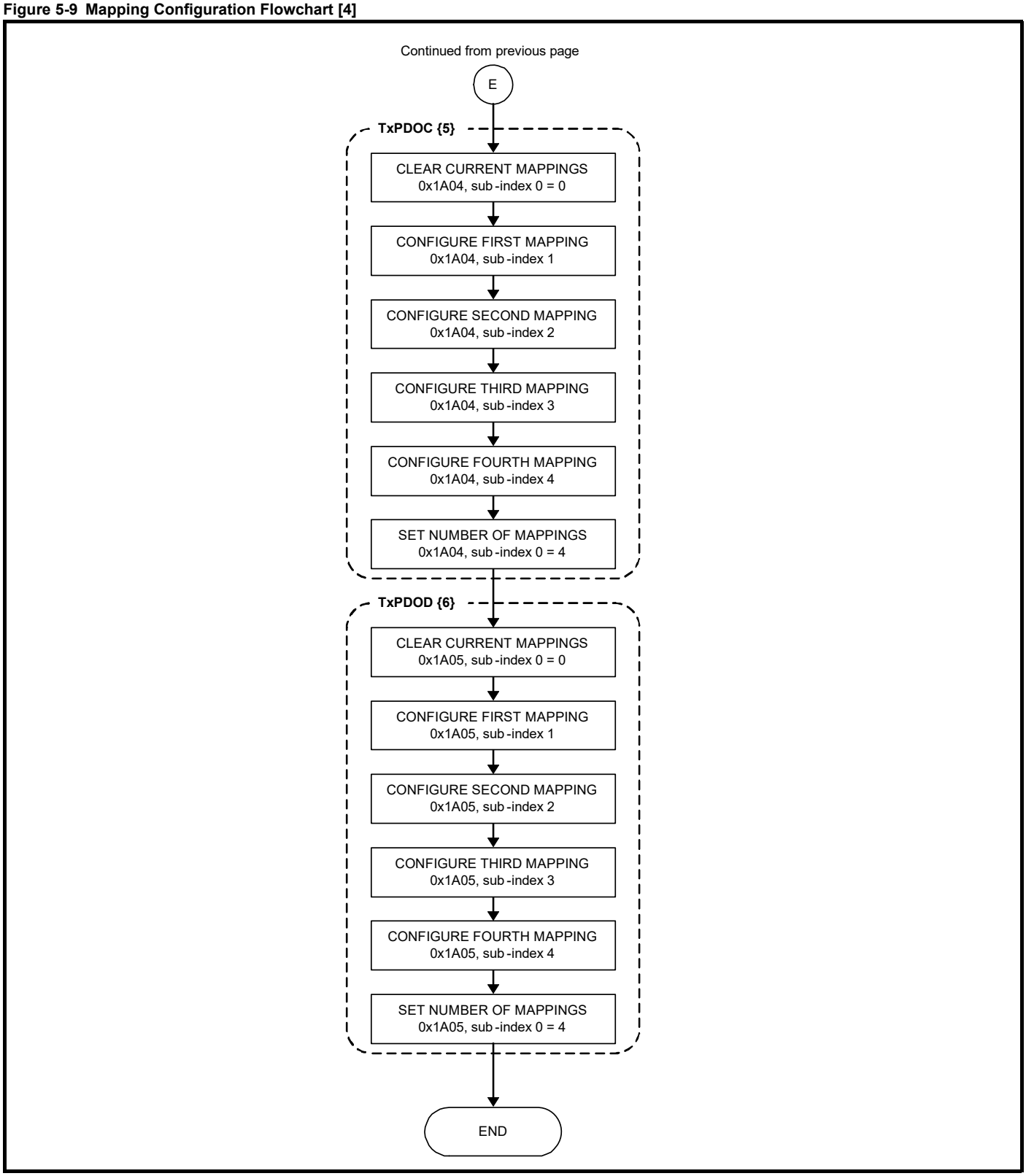
NOTE This chart is used in conjunction with Figure 5-3 *Configuration options flowchart* on page 26. PDOs A, B, C & D may be configured to any valid PDO number, TxPDO and RxPDO numbers are independent. The default configuration for PDOA, B, C & D are PDO numbers 1, 3, 5 and 6 respectively, the default configuration uses the same numbers for both TxPDOs and RxPDOs, although this is not a requirement.

Figure 5-8 Mapping Configuration Flowchart [3]



NOTE Return to Figure 5-3 *Configuration options flowchart* on page 26.
PDOs A, B, C & D may be configured to any valid PDO number, TxPDO and RxPDO numbers are independent. The default configuration for PDO A, B, C & D are PDO numbers 1, 3, 5 & 6 respectively. The default configuration uses the same numbers for both TxPDOs and RxPDOs, although this is not a requirement.

Figure 5-9 Mapping Configuration Flowchart [4]

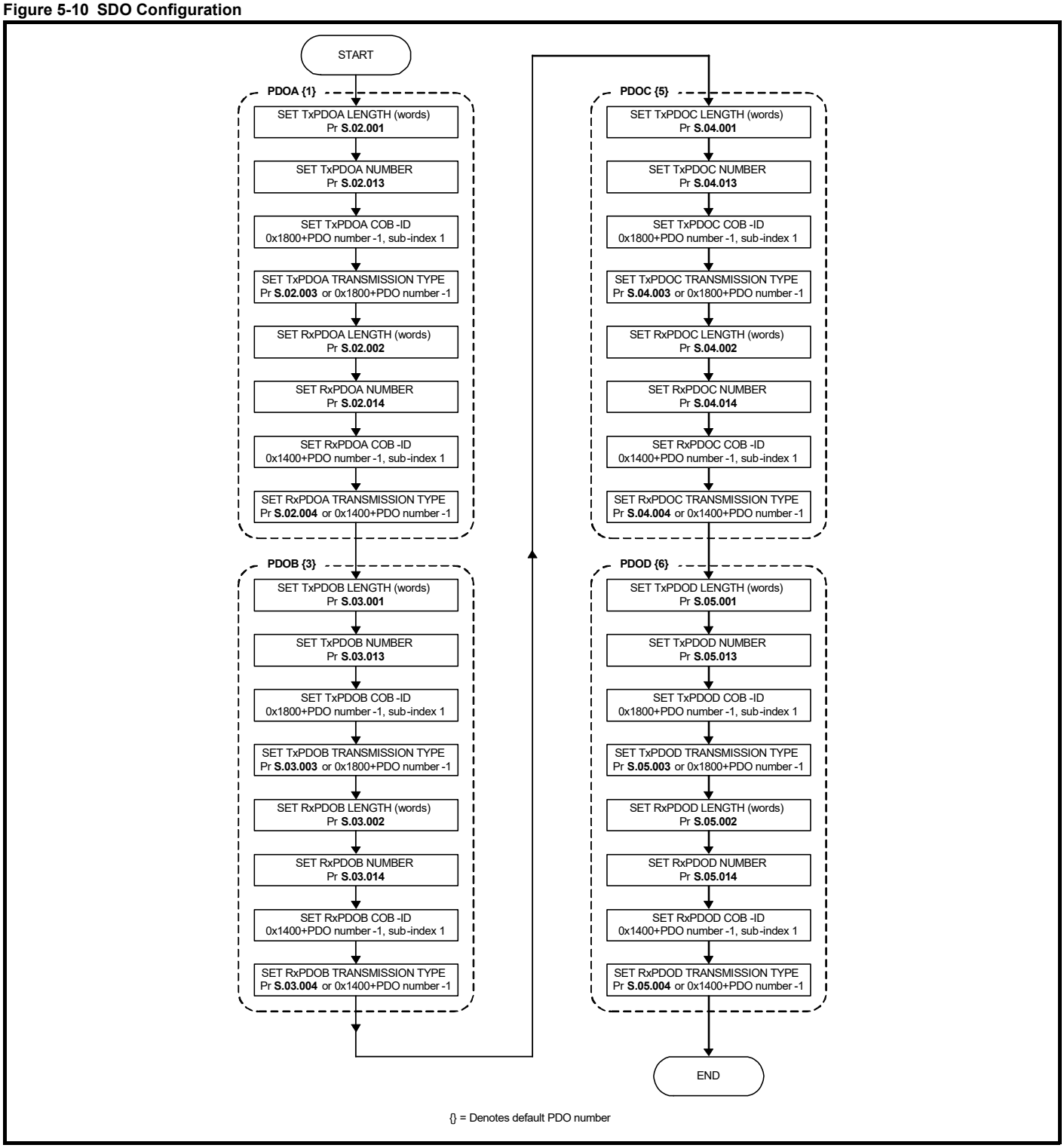


NOTE Return to Figure 5-3 *Configuration options flowchart* on page 26.
PDOs A, B, C & D may be configured to any valid PDO number, TxPDO and RxPDO numbers are independent. The default configuration for PDO A, B, C & D are PDO numbers 1, 3, 5 & 6 respectively. The default configuration uses the same numbers for both TxPDOs and RxPDOs, although this is not a requirement.

5.9.6 Flexible PDO configuration

Figure 5-10 details the stages required to configure SI-CANopen V2 to use custom PDO numbering (any valid PDO number from 1 to 512 may be configured). The required PDO numbers for TxPDO A, B, C & D and RxPDO A, B, C & D are written to the configuration objects shown below (the actual value written is the PDO number minus 1).

Figure 5-10 SDO Configuration



NOTE This chart is used in conjunction with Figure 5-3 *Configuration options flowchart* on page 26.

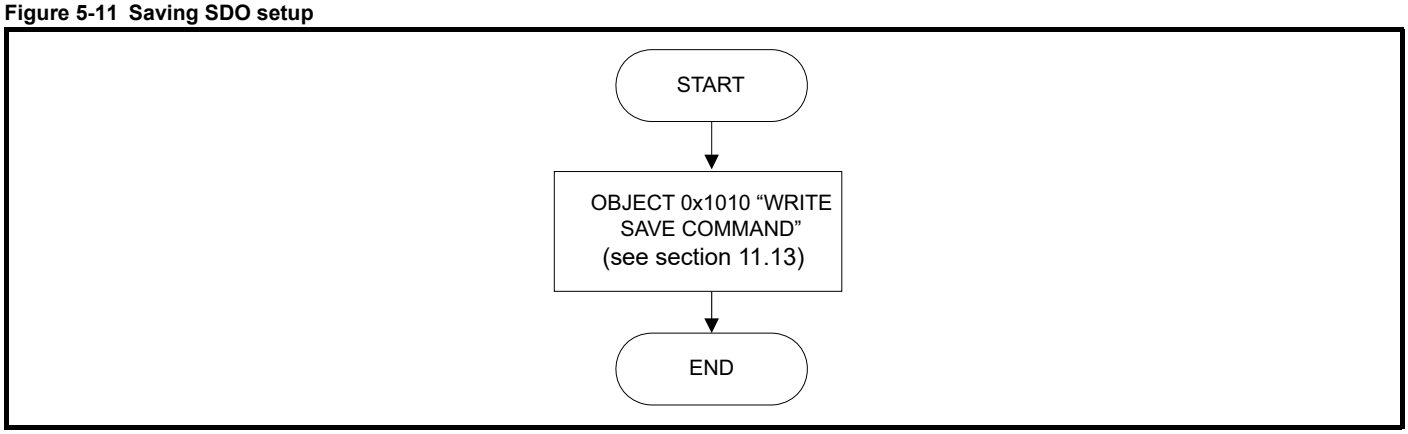
The object references in Figure 5-10 (e.g. object 0x1400) are the base addresses for the communication objects. The actual object must be calculated by adding the PDO number configured for PDO (A, B, C or D) to the base address and then subtracting 1.

For example to set the COB ID for TxPDO 3, object 0x1802 sub-index 1 should be written to.

5.9.7 Saving SDO setup in SI-CANopen V2

Figure 5-11 details the procedure to save previously sent SDO configuration settings to the SI-CANopen V2 internal memory. This removes the requirement to re-send configuration SDOs if the SI-CANopen V2 is reset or powered down.

Figure 5-11 Saving SDO setup



6 Parameters

6.1 Menus

The table below details each of the module's internal menus.

Menu	Description
S.00	SI-CANopen V2 Setup Information
S.01	CANopen Setup
S.02	PDOA Setup
S.03	PDOB Setup
S.04	PDOC Setup
S.05	PDOD Setup
S.06	RPDO Fault values
S.07	CAN Master Functions
S.09	Resources

S is the slot number where the module is installed.

The module's setup menu 0 is also displayed in the drive's slot setup menu 15, 16 or 17 depending on which slot the module in installed in. The table below shows the location of the module's menu 0 on the drive.

Slot Number	Menu 0 location
1	15
2	16
3[1]	17[2]

NOTE

[1] - Not available on Digitax HD.

[2] - Menu 17 is the FFE interface setup menu on Digitax HD M750, it is not available on non-Ethernet enabled Digitax HD drives.

Parameter type coding

The following tables describe the general and type coding used for the parameter tables in this section.

Table 6-1 Parameter type coding

Coding	Description	Comment
BU	Bit default or unipolar	Bit parameters are defaulted to 1 (On) Non-bit parameters are unipolar
DE	Destination parameter	Parameter can be used as a destination parameter
FI	Filtered	Parameter value display is filtered
NC	Non-copyable	Parameter is not copied to or from the NV media card
ND	No default value	Parameter value is not changed if default values are loaded
PT	Protected	Parameter cannot be used as a destination
RA	Rating dependant	Value is dependent upon the drive rating These parameters are not transferred from the NV media card if the destination and source drives are different
RO	Read-only	Parameter is read only
RW	Read / Write	Parameter can be read from or written to
Txt	Text mnemonic string	Parameter value is displayed as a text string

Display Format	Description	Comment
Bin	Binary parameter	Displays a binary value
Date	Date parameter	Parameter values are displayed in date format (DD-MM-YY)
IPAddress	IP address	Value is displayed in IP address format (www.xxx.yyy.zzz)
LeadZeroPad	Leading Zero Padding	Value is displayed padded out with leading zeros
MAC	MAC address	Parameter value is displayed as a 48-bit (6 bytes) hexadecimal number
Number	Numerical	Parameter value is displayed as a numerical value (standard)
SlotMenuParameter	Slot, Menu, Parameter	Parameter value is displayed using the slot/menu/parameter format (s.mm.ppp)
Time	Time formatted	Parameter value is displayed in time format (HH:MM:SS)
Text	Enumerated text	Parameter value displayed as text string
Version	Version number	Parameter value is displayed in version format (ww.xx.yy.zz)

6.2 Menu 0 - Module Set-up

All parameters in **S.00.ppp** (i.e. menu 0 within the option module menus) are also present in menus 15, 16 or 17[2] depending on the slot that the module is installed to e.g. Pr **3.00.007** is also present as 17.007.

The functionality and properties of the parameters are identical between the two menus.

S.00.001	**Module ID**		
Minimum	0	Maximum	65535
Default	448	Units	None
Type	16 Bit Volatile	Update Rate	Power-up write
Display Format	Number	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

Pr **S.00.001** displays the ID number for the Option Module. For SI-CANopen V2, this is 448.

S.00.002	**Software Version**		
Minimum	0 (00.00.00.00)	Maximum	99999999 (99.99.99.99)
Default	None	Units	None
Type	32 Bit Volatile	Update Rate	Power-up write
Display Format	Version	Decimal Places	0
Coding	RO, ND, NC, PT		

The firmware version of the option module is in the format of **ww.xx.yy.zz**.

S.00.003	**Hardware Version**		
Minimum	0.00	Maximum	99.99
Default	0.00	Units	None
Type	32 Bit Volatile	Update Rate	Power-up write
Display Format	Number	Decimal Places	2
Coding	RO, ND, NC, PT		

The hardware version of the option module is in the format of **xx.yy**.

S.00.004	Serial Number LS		
S.00.005	**Serial Number MS**		
Minimum	0	Maximum	99999999
Default	None	Units	None
Type	32 Bit Volatile	Update Rate	Power-up write
Display Format	LeadZeroPad	Decimal Places	0
Coding	RO, ND, NC, PT		

The module serial number is available as a pair of 32-bit values where Serial Number LS (Pr **S.00.004**) provide the least significant 8 decimal digits, and Serial Number MS (Pr **S.00.005**) provides the most significant 8 decimal digits. The reconstructed serial number is ((**S.00.005** x 100000000) + **S.00.004**). For example serial number "0001234567898765" would be stored as **S.00.005** = 123456 and **S.00.004** = 67898765.

S.00.006	Module Status		
Minimum	0 (Initialising)	Maximum	3 (Error)
Default	0	Units	None
Type	8 Bit Volatile	Update Rate	Background read
Display Format	Text	Decimal Places	0
Coding	RO, Txt, ND, NC, PT, BU		

This parameter displays the current status of the module. All possible values are shown in the table below.

Value	Text	Description
0	Initialising	Module is currently initialising.
1	Ok	Module has initialised and has found no errors.
2	Config	A configuration error has been detected in one of the communications protocols or user program.
3	Error	An error has occurred preventing the firmware or user program from running correctly.

S.00.007	Module Reset		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit Volatile	Update Rate	Read every 200 ms
Display Format	Text	Decimal Places	0
Coding	RW, NC		

Changes to the module's configuration will not take effect until the module has been reset.

- To reset the module:
- Set Pr **S.00.007** to On (1).
- When the sequence has been completed, Pr **S.00.007** will be reset to Off (0).

The module will reset using the updated configuration.

NOTE

This sequence does NOT store the module's configuration parameters in the drive or the module's flash memory. This parameter will change back to Off immediately, and as such the change may not be visible in the display.

S.00.008	Module Default		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit Volatile	Update Rate	Read every 200 ms
Display Format	Text	Decimal Places	0
Coding	RW, NC		

If this parameter is set to On (1) when the SI-CANopen V2 module is reset (Pr **S.00.007** = On), the SI-CANopen V2 module will return to the "out of box" configuration, any settings stored will be reset to their default values.

When the reset operation is completed, this parameter will be set to Off (0).

This does not save the module parameters, a drive save must be performed to save the parameters.

NOTE

If the host drive is defaulted then this will also default the SI-CANopen V2 module.

S.00.012	Drive stored Node Address enable		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW		

This parameter is used in conjunction with *Drive stored Node Address* (**S.00.013**) and defines where the SI-CANopen V2 module node address value is taken from at power up or on reset.

If this parameter is set to 0 (Off), the node address stored in the SI-CANopen V2 module parameter *SI-CANopen V2 Node Address* (**S.01.004**) will be copied to *Drive stored Node Address* (**MM.013**) within the host drive and used as the active address.

If this parameter is set to 1 (On), the node address stored in the host drive parameter *Drive stored Node Address* (**MM.013**) will be copied to *SI-CANopen Node Address* (**S.01.004**) and used as the active address.

NOTE

This parameter is not affected by defaulting the module parameters using *Module Default* (**MM.008**) or *Default CANopen Interface* (**S.01.003**), only by performing a drive default will this parameter be defaulted.

S.00.013	Drive stored Node Address		
Minimum	0	Maximum	127
Default	0	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

This parameter is used in conjunction with *Drive stored Node Address* enable (**S.00.012**) and defines the SI-CANopen node address to be used if *Drive stored Node Address enable* (**S.00.012**) is enabled.

This parameter is mirrored in the SI-CANopen module parameter *SI-CANopen Node Address* (**S.01.004**). A change in value in parameter **MM.013** will be reflected in parameter **S.01.004**, similarly, a change in value in parameter **S.01.004** will be reflected in parameter **MM.013**.

A value of 0 will disable the node, however, it will still respond to LSS (Layer Setting Services) messages allowing remote configuration of the node address.

While the node is disabled, *CANopen Network Diagnostic* (**S.01.006**) will indicate a value of 7 (Device disabled) and if *Baud rate* (**S.01.005**) is set to a value of 6 (Auto detect) then the SI-CANopen V2 module will still attempt to detect the baud rate automatically.

NOTE

This parameter is not affected by defaulting the module parameters using *Module Default* (**MM.008**) or *Default CANopen Interface* (**S.01.003**), only by performing a drive default will this parameter be defaulted.

NOTE

A module reset is required to activate a change in value.

Non-cyclic Parameter Channel

From SI-CANopen V2 firmware version V02.04.01.12, a non-cyclic parameter channel has been added to allow a user program access to the internal parameters within the SI-CANopen V2, although designed primarily for use by user programs, it is also possible to access these parameters using the host drive's communication interface or another fieldbus module.

NOTE

The Control Techniques user programming software Machine Control Studio (V01.10.10 or later) includes a library (*Parameter Channel Library*) for the on-board drive application to assist in using the non-cyclic parameter channel.

The non-cyclic parameter channel uses parameters **S.00.060** to **S.00.064** (**MM.060** to **MM.064**) to store the command information and the returned value (or error code).

The non-cyclic parameter channel is created and configured using the following five parameters:

Parameter	Name	Size (bits)	Description
MM.060	Command	8	Channel operation command 0: None 1: Read 2: Write
MM.061	Status	8	Channel status (read only) 0: Idle 1: Busy 2: Done 3: Error
MM.062	Parameter Address	16	Parameter address to read/write Bits b0 to b7: Parameter number (**ppp**) Bits b8 to b15: Menu number (**mm**)
MM.063	Value LSW / Error Code	16	Lower 16 bits (LSW) of 32-bit value read or of 32-bit value to write, or Error code returned from command
MM.064	Value MSW	16	Upper 16 bits (MSW) of 32-bit value read or of 32-bit value to write

S.00.060	**Parameter Channel Command**		
Minimum	0 (None)	Maximum	2 (Write)
Default	0 (None)	Units	None
Type	8 Bit Volatile	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RW, Txt, NC, BU		

This parameter is used to specify the command instruction to determine the operation of the parameter channel.

Possible values for this parameter are:

Value	Text	Description
0	None	No command to be issued
1	Read	Read drive parameter
2	Write	Write drive parameter

S.00.061	**Parameter Channel Status**		
Minimum	0 (Idle)	Maximum	2 (Error)
Default	0 (Idle)	Units	None
Type	8 Bit Volatile	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RO, Txt, NC, PT, BU		

This parameter displays the current status of the parameter channel.

Possible values for this parameter are:

Value	Text	Description
0	Idle	The parameter channel is idle and waiting for a command
1	Busy	The parameter channel is busy executing a command
2	Done	The parameter channel has successfully completed the command
3	Error	The parameter channel command has failed and returned an error code in Pr **S.00.063**

S.00.062	Parameter Channel Parameter Access		
Minimum	0	Maximum	65535
Default	0	Units	None
Type	16 Bit Volatile	Update Rate	Background
Display Format	Number	Decimal Places	0
Coding	RW, NC, BU		

This parameter specifies the parameter address to read from, or write to.

The format of this parameter is equivalent to **mm.ppp**, where the most significant 8 bits represent the menu number and the least significant 8 bits represent the parameter number within that menu.

This means that the maximum number possible for both the menu and parameter is 255.

i.e. **mm.ppp** = 255.255.

The value entered in this parameter is calculated using the formula:

S.00.062 = **mm** * 256 + **ppp**

Example:

To reset the CANopen interface (Pr **01.002**), the decimal value of 258 (0b0000 0001 0000 0010) should be entered.

Please note that a slot number cannot be entered as the parameter channel only provides access to its own module parameters and NOT the host drive's parameters.

S.00.063	Parameter Channel Value LSW / Error Code		
Minimum	-32768	Maximum	32767
Default	0	Units	None
Type	16 Bit Volatile	Update Rate	On operation
Display Format	Number	Decimal Places	0
Coding	RW, NC		

The data in this parameter depends on what command instruction is used and the channel status as shown in the following table:

Command	Parameter Data	
Read	Status (**MM.061**) = 2:	Least significant word of value read from the parameter address set in Pr **MM.062**
	Status (**MM.061**) = 3:	Error code value
Write	Status (**MM.061**) = 2:	Least significant word of value to write to the parameter address set in Pr **MM.062**
	Status (**MM.061**) = 3:	Error code value

Possible error codes are:

Value	Meaning	Description
-1	Reserved	Reserved error code
-2	Reserved	Reserved error code
-3	Reserved	Reserved error code
-4	Does not exist	The specified parameter does not exist
-5	Data Type	The data could not be converted from the specified type
-6	Reserved	The data could not be read (reason unknown)
-7	Reserved	The data could not be written (reason unknown)
-8	Not Readable	The data could not be read as the source does not allow read access
-9	Not Writeable	The data could not be written as the destination does not allow write access
-10	Over Range	The specified value is outside the range of the specified parameter
-11	Reserved	Reserved error code
-12	Reserved	Reserved error code
-13	Decimal Place	The decimal place information is invalid (outside the allowed writeable range for the specified parameter)
-14	Reserved	Reserved error code
-15	Invalid CMD	The command is invalid

Value	Meaning	Description
-16	Reserved	Reserved error code
-17	Unknown Error	An unknown error has been detected
-18	64-bit access	Unsupported read/write access to a 64-bit parameter
-19 to -128	Reserved	Reserved error code

S.00.064	Parameter Channel Value MSW		
Minimum	-32768	Maximum	32767
Default	0	Units	None
Type	16 Bit Volatile	Update Rate	On operation
Display Format	Number	Decimal Places	0
Coding	RW, NC		

The data in this parameter depends on what command instruction is used as shown in the following table:

Command	Parameter Data
Read	Most significant word of value read from the parameter address set in Pr **MM.062**
Write	Most significant word of value to write to the parameter address set in Pr **MM.062**

Using the non-cyclic parameter channel

Figure 6-1 shows the sequence for reading a parameter and Figure 6-2 shows the sequence for a write command.

NOTE

For both read and write operations, the Read or Write command (**MM.061**) must be written last, after all other parameters have been written.

Figure 6-1 Non-cyclic parameter channel read access

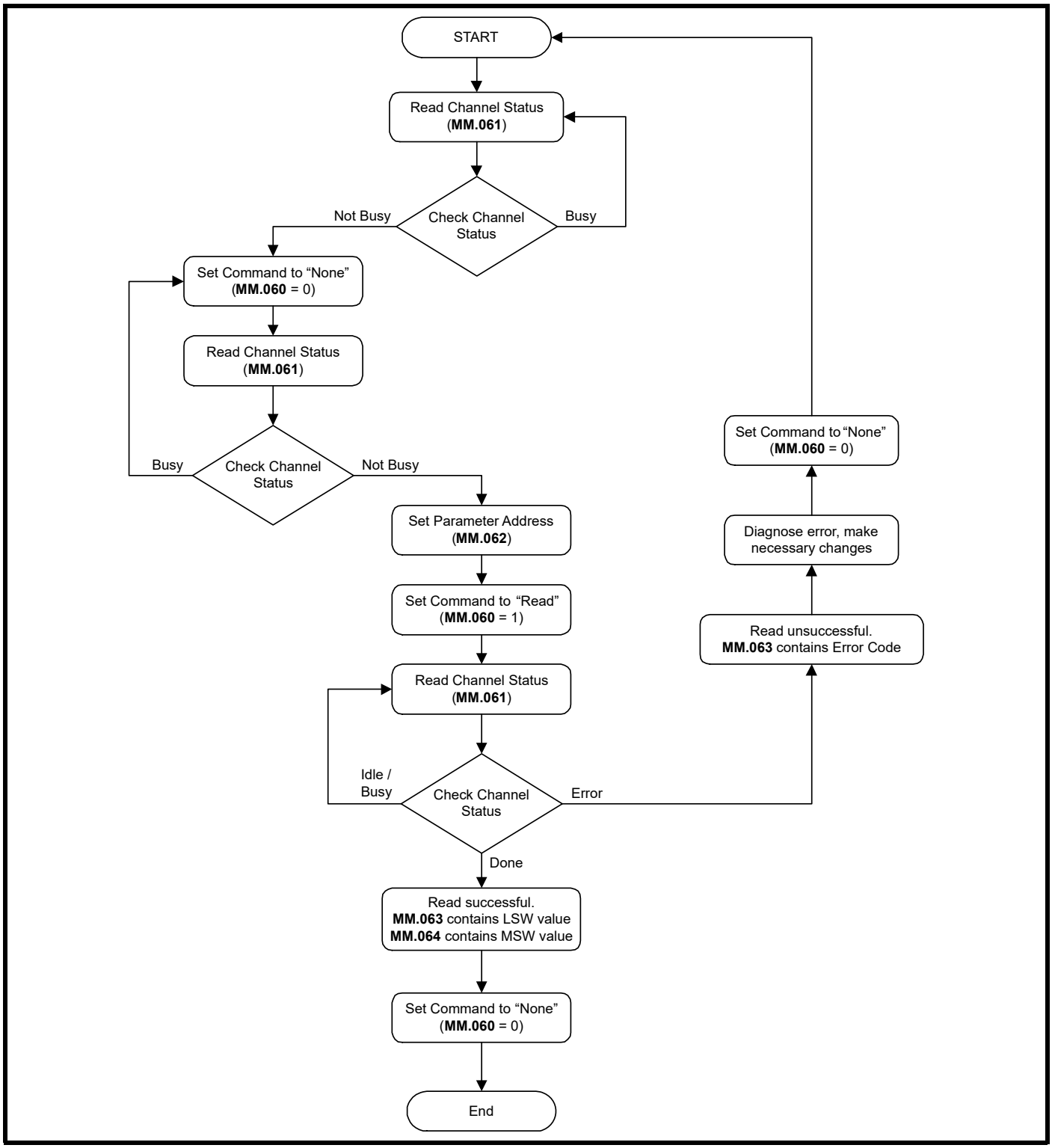
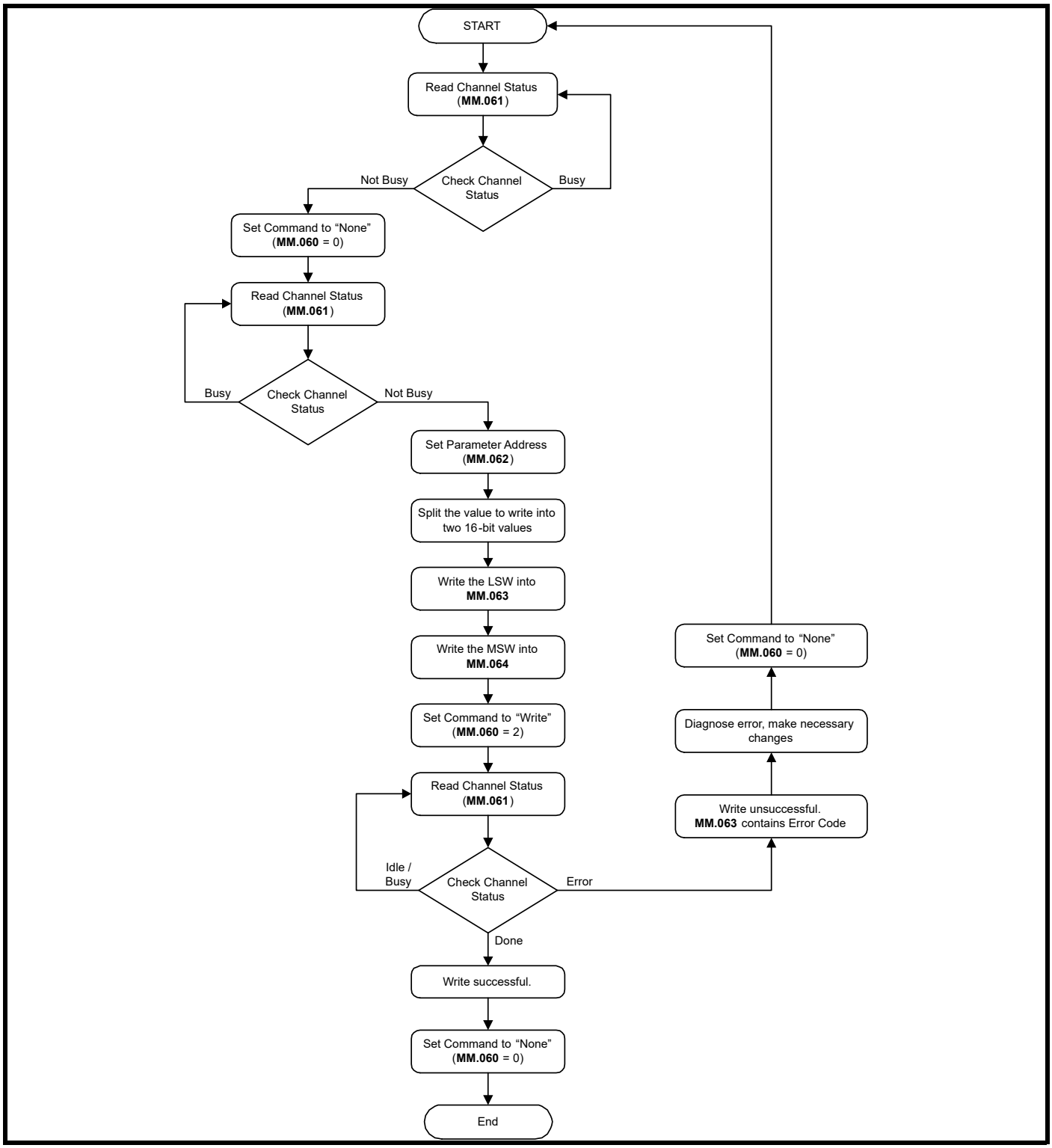


Figure 6-2 Non-cyclic parameter channel write access



Non-cyclic Parameter Channel Worked Example

This example demonstrates using the non-cyclic parameter channel to read the SI-CANopen V2 module *CANopen Network Diagnostic* (Pr **S.01.006**) and write the value 408 to the *CANopen Identification Override* (Pr **S.01.030**).

The entire program is written in the Freewheeling task POU.

Please note that this example is provided for reference purposes only, it is not intended to be used directly in a user program. It is the user's responsibility to ensure any user program code provided in the example is used correctly and satisfies the application requirements.

Figure 6-3 Freewheeling Task Variables Declaration

```
PROGRAM Freewheeling
VAR
    // Status Constants
    ST_Idle                 : UINT := 0;
    ST_Busy                 : UINT := 1;
    ST_Done                 : UINT := 2;
    ST_Error                : UINT := 3;

    // Command Constants
    CMD_None                : UINT := 0;
    CMD_Read                : UINT := 1;
    CMD_Write               : UINT := 2;

    // General program variables
    ChannelStatus           : UINT;
    SlotMenu                : UINT;
    CANopenID               : UINT := 448;
    ModuleID                : UINT;
    MSW                     : UINT;
    LSW                     : UINT;
    ReadMenu                : UINT := 1;    // Menu to read
    ReadParameter           : UINT := 6;    // Parameter to read
    WriteMenu               : UINT := 1;    // Menu to write
    WriteParameter          : UINT := 30;   // Parameter to write
    WriteValue              : DINT := 408;  // Value to write
    WriteMSW                : INT;          // MSW value to write
    WriteLSW                : INT;          // LSW value to write
    intLSW                  : INT;          // Read LSW value
    intMSW                  : INT;          // Read MSW value
    intError                : INT;          // Error code
    SlotID                  : UINT;         // Slot ID counter
    WriteStatus             : UDINT;        // WriteUserParameter response
    ReadValue               : DINT;         // Value read
END_VAR
```

Figure 6-4 Freewheeling Task Program Code (Read)

```
// Read CANopen diagnostics Pr S.01.006
// Write CANopen ID override S.01.030 to SM-CANopen 408
IF SlotMenu = 0 THEN
    // Slot not known yet - iterate through the slots to find the CANopen ID
    FOR SlotID := 1 TO 3 BY 1 DO
        ModuleID := ReadUserParameterUINT(0,SlotID + 14,1);
        IF ModuleID = CANopenID THEN
            // CANopen ID found in slot
            SlotMenu := SlotID + 14;
            EXIT;
        END_IF
    END_FOR
END_IF

// ========== Read ==========
// Read channel status
REPEAT
    // Wait for Idle, Done or Error status
    ChannelStatus := ReadUserParameterUINT(0,SlotMenu,61);  // Read Status
    UNTIL ChannelStatus <> ST_Busy
END_REPEAT

// Set Command to None
REPEAT
    // Wait for Idle, Done or Error status
    WriteStatus := WriteUserParameterUINT(0,SlotMenu,60,CMD_None);
    ChannelStatus := ReadUserParameterUINT(0,SlotMenu,61);  // Read Status
    UNTIL ChannelStatus <> ST_Busy
END_REPEAT

// Set Parameter, Format menu and parameter (Menu = MSW, Parameter = LSW)
MSW := ReadMenu * 256;
LSW := ReadParameter;
WriteStatus := WriteUserParameterUINT(0,SlotMenu,62,MSW + LSW);

// Set Command Read
REPEAT
    // Wait for Done or Error status
    WriteStatus := WriteUserParameterUINT(0,SlotMenu,60,CMD_Read);
    ChannelStatus := ReadUserParameterUINT(0,SlotMenu,61);  // Read Status
    UNTIL ChannelStatus <> ST_Busy AND ChannelStatus <> ST_Idle
END_REPEAT

// Get Values
IF ChannelStatus = ST_Done THEN
    // Success - get value
    intLSW := ReadUserParameterINT(0,SlotMenu,63);
    intMSW := ReadUserParameterINT(0,SlotMenu,64);
    ReadValue := UINT_TO_DINT(INT_TO_UINT(intMSW)) * 65536 + UINT_TO_DINT(INT_TO_UINT(intLSW));
ELSE
    // Error
    intError := ReadUserParameterINT(0,SlotMenu,63);
END_IF

// Reset Command to None
WriteUserParameterUINT(0,SlotMenu,60,CMD_None);
REPEAT
    // Wait for Idle status
    ChannelStatus := ReadUserParameterUINT(0,SlotMenu,61);  // Read Status
    UNTIL ChannelStatus = ST_Idle
END_REPEAT
```

Figure 6-5 Freewheeling Task Program Code (Write)

```
// ========== Write ==========
// Read channel status
REPEAT
    // Wait for Idle, Done or Error status
    ChannelStatus := ReadUserParameterUINT(0,SlotMenu,61);  // Read Status
    UNTIL ChannelStatus <> ST_Busy
END_REPEAT

// Set Command to None
REPEAT
    // Wait for Idle, Done or Error status
    WriteStatus := WriteUserParameterUINT(0,SlotMenu,60,CMD_None);
    ChannelStatus := ReadUserParameterUINT(0,SlotMenu,61);  // Read Status
    UNTIL ChannelStatus <> ST_Busy
END_REPEAT

// Set Parameter, Format menu and parameter (Menu = MSW, Parameter = LSW)
MSW := WriteMenu * 256;
LSW := WriteParameter;
WriteStatus := WriteUserParameterUINT(0,SlotMenu,62,MSW + LSW);

// Write Value
WriteLSW := DINT_TO_INT(UnSigned_Bottom_Word(WriteValue));
WriteMSW := DINT_TO_INT(UnSigned_Top_Word(WriteValue));
WriteStatus := WriteUserParameterINT(0,SlotMenu,63, WriteLSW);
WriteStatus := WriteUserParameterINT(0,SlotMenu,64, WriteMSW);

// Set Command Write
REPEAT
    // Wait for Done or Error status
    WriteStatus := WriteUserParameterUINT(0,SlotMenu,60,CMD_Write);
    ChannelStatus := ReadUserParameterUINT(0,SlotMenu,61);  // Read Status
    UNTIL ChannelStatus <> ST_Busy AND ChannelStatus <> ST_Idle
END_REPEAT

// Get Values
IF ChannelStatus = ST_Done THEN
    // Success
ELSE
    // Error
    intError := ReadUserParameterINT(0,SlotMenu,63);
END_IF

// Reset Command to None
WriteUserParameterUINT(0,SlotMenu,60,CMD_None);
REPEAT
    // Wait for Idle status
    ChannelStatus := ReadUserParameterUINT(0,SlotMenu,61);  // Read Status
    UNTIL ChannelStatus = ST_Idle
END_REPEAT
```

6.3 Menu 1 - CANopen Setup

Menu 1 contains all the parameters relating to the setup of the CANopen interface on the SI-CANopen V2 module.

S.01.001	CANopen Interface Mode		
Minimum	0 (Off)	Maximum	2 (On No Bootup)
Default	1 (On)	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW, Txt		

As of SI-CANopen V2 firmware V02.01.00.26 the functionality of this parameter has changed, previously this parameter only enabled or disabled the CANopen interface. The maximum value has been increased to 2 and the data type changed to 8 bit User Save.

This parameter now determines the SI-CANopen V2 module startup behaviour, by default the SI-CANopen V2 will send the BOOTUP message at startup or after a reset, if no other active node is on the network to acknowledge the BOOTUP message, SI-CANopen V2 will enter the BUS Passive state. Setting this parameter to the value 2 will enable the CANopen interface but the BOOTUP message at startup will not be sent.

The possible values are shown in the following table.

Value	Text	Description
0	Off	CANopen functionality is disabled. CAN bus is enabled and available for use with user CAN functionality provided by SI-Applications (Plus/Compact) or MCi2xx.
1	On	CANopen functionality is enabled. CAN bus shared between CANopen slave functionality and user CAN functionality provided by SI-Applications (Plus/Compact) or MCi2xx.
2	On No Bootup	CANopen functionality is enabled. The SI-CANopen V2 module will not send CANopen BOOTUP message at startup, this is to avoid the CAN bus entering the PASSIVE state if this is the first CAN node to power up on the CAN bus.

Setting Pr **S.01.001** to a value of 0 will disable CANopen functionality and allow the SI-CANopen V2 module function in a similar manner to that of the SM-CAN option module.

User (raw) CAN Level

As of firmware V02.01.00.26 the SI-CANopen V2 module supports the user (raw) CAN functionality, this allows users to use CAN level communication messages with an SI-Applications Plus (or SI-Applications Compact) or MCi2xx using the programming software SyPT Pro or Machine Control Studio respectively.

For more information on the CAN functionality please refer to the online help in the appropriate programming software.

NOTE

It is possible to have both CANopen level and user CAN level functionality enabled simultaneously. In this case users must consider any implications this may cause.

NOTE

SI-CANopen V2 does not support the *AssociatedIntOpComms* function when used with the MCi2x0 option module.

S.01.002	Reset CANopen Interface		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit Volatile	Update Rate	Read every 200 ms
Display Format	Text	Decimal Places	0
Coding	RW		

This parameter is the same as Pr **MM.007** *Module Reset*, on a transition from 0 (Off) to 1 (On), the SI-CANopen V2 module will reset the value to 0 (Off) and write 1 (On) to Pr **MM.007**.

Changes to the module's configuration will not take effect until the module has been reset.

To reset the module:

- Set Pr **S.01.002** to On (1).
- When the sequence has been completed, Pr **S.01.002** will be reset to Off (0).
- The module will reset using the updated configuration.

NOTE

This sequence does NOT store the module's configuration parameters in the drive or the module's flash memory. This parameter will change back to Off immediately, and as such the change may not be visible in the display.

S.01.003	Default CANopen Interface		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit Volatile	Update Rate	Read every 200 ms
Display Format	Text	Decimal Places	0
Coding	RW		

This parameter is the same as Pr **MM.008** *Module Default*, on a transition from 0 (Off) to 1 (On), the SI-CANopen V2 module will reset the value to 0 (Off) and write 1 (On) to Pr **MM.008**.

If the host drive is defaulted (see the drive user guide for details), it will also clear the current configuration for the slot the module is installed to.

This can be performed as follows:

- Set Pr **S.01.003** to On.
- Reset the module by setting Pr **S.01.002** to On.
- Default parameter values for the module will be loaded.

The module will reset using the default values.

S.01.004	CANopen Node Address		
Minimum	0	Maximum	127
Default	0	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

Every node on a CANopen network must be given a unique network node address. To activate a change in the node address value, the module must be reset (Pr **S.01.002** or **MM.007** = On).

Note: If an invalid address is set, the module will over-write the value in Pr **S.01.004** with 0. When the module is reset, this value will be used as the node address. A node address of 0 will disable the CANopen communications layer but the DSP305 V1.1 Layer Setting Service (LSS) will still be active.

This parameter is the same as Pr **MM.013** (*Drive stored Node Address*)

S.01.005	Baud Rate		
Minimum	0 (1Mbps)	Maximum	7 (100kbps (NS))
Default	2 (500kbps)	Units	None
Type	8 Bit User Save	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RW, NC, PT, PR		

Every node on a CANopen network must be configured to run at the same network data rate. If a node is configured with the wrong data rate, it may cause errors on the CANopen network. The module must be reset to make a change of data rate take effect (**S.01.002** or **MM.007** = On).

As of SI-CANopen V2 firmware V02.01.00.26 the maximum value for this parameter has increased to 7, this value will set the baud rate to the non-standard rate of 100 kbps.

The possible values are shown in the following table.

Value	Baud Rate
0	1Mbps
1	800kbps
2	500kbps
3	250kbps
4	125kbps
5	50kbps
6	Auto detect
7	100kbps (NS)

This parameter can be changed indirectly via the CANopen LSS protocol. A reset is not required for the change to take effect in this case.

Auto Baud rate detection is supported with standard Baud rates only, non-standard rates will not be automatically detected.

The user (raw) CAN does not support automatic detection of the network baud rate. Therefore, this feature should only be used as a set-up tool and not as a system run-time feature. The time that the SI-CANopen V2 module will take to detect the system baud rate depends on the volume of network traffic, the more traffic present, the quicker it will be. The user can abort the protocol at any time by setting this parameter to a specific baud rate and resetting the module. During the detection process the *CANopen Network Diagnostics* (Pr **S.01.006**) will indicate 'Baud detecting' (6).

SI-CANopen V2 may be configured to automatically detect the network data rate by setting Pr **S.01.005** to "Auto detect" (6). SI-CANopen V2 will monitor the CANopen network, and if the data rate is detected, it will set Pr **S.01.005** to indicate the detected data rate. However, it should be noted that the new value of Pr **S.01.005** will NOT be stored.

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

1. Power up the drive.
2. Set Pr **S.01.005** to "Auto detect" (6).
3. Reset the module by setting Pr **MM.007** to On.
4. Connect the module to the CANopen network.
5. Wait for Pr **S.01.006** to change from "Baud detecting".
6. Store the parameters by performing a drive save (Pr **mm.000** to "Save parameters").

NOTE

SI-CANopen V2 will not be able to reliably detect the network data rate if there is little or no traffic on the network. Auto detection of the data rate is ideal when connecting a new node to an existing network, but may not work reliably if a network is powered up with all nodes attempting to detect the data rate.

S.01.006	CANopen Network Diagnostic		
Minimum	0 (Network OK)	Maximum	9 (Bus Off)
Default	None	Units	None
Type	8 Bit Volatile	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

The CANopen network activity can be monitored using the *CANopen Network Diagnostic* parameter, Pr **S.01.006**. All possible values of Pr **S.01.006** are shown below.

Value	Text	Description
0	Network OK	CAN network is healthy
1	Internal HW Fail	The SI-CANopen V2 module initialisation sequence has failed
2	Init OK	The SI-CANopen V2 module has initialised and waiting for the CANopen master to initialise communications
3	No PDO Cfg	The SI-CANopen V2 module is waiting for the PDO configuration from the CANopen master (when PDOs configured by CANopen master)
4	Config Error	Indicates an invalid CANopen configuration setting. (e.g. mapping error)
5	Software Error	An internal software error has occurred. Reset the SI-CANopen V2 module and if the problem persists replace the module
6	Baud detecting	The SI-CANopen V2 module is attempting to detect the CANopen baud rate
7	Device Disabled	The SI-CANopen V2 communication layer is disabled by setting the node address to 0
8	Initialise Delay	The SI-CANopen V2 module is being initialised and is waiting for the MCi2xx or SI-Applications module to complete its *Initia*l task
9	Bus Off	The CAN module used by the SI-CANopen V2 module is in the 'Bus Off' state due to an error on the CAN bus

S.01.007	Cyclic Data Rate		
Minimum	0	Maximum	9999
Default	None	Units	Messages/s
Type	16 Bit Volatile	Update Rate	Background
Display Format	Number	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

When the SI-CANopen V2 is in data exchange with the CANopen master controller, Pr **S.01.007** will give an indication of the number of cyclic data messages that are being processed per second. The messages included in the count are as follows:

- Every Sync object on the network.
- Every Tx or Rx PDO handled.

S.01.008	PDO Configuration Source		
Minimum	0 (By Menu)	Maximum	1 (By Master)
Default	0 (By Menu)	Units	None
Type	8 Bit User Save	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RW		

Value	Text
0	By Menu
1	By Master

The function of this parameter is used to indicate the source used to configure PDO mapping. It is defaulted to "By Menu" (0), which means the PDO mapping is configured by the SI-CANopen V2 setup menus. If this parameter is set to "By Master" (1), then the mapping parameters will be cleared and the SI-CANopen V2 module will wait for the CANopen master to configure it, or will use the saved configuration.

S.01.010	Timeout Delay		
Minimum	0	Maximum	3000
Default	0	Units	ms
Type	16 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

The module will reset an internal timer when a valid message (SYNC or RPDO message) is received from the CANopen network. The network loss trip is triggered when no new messages are received before the timer reaches the designated value.

S.01.011	Timeout Action		
Minimum	0 (Trip)	Maximum	4 (No action)
Default	0 (Trip)	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW, TE, BU		

Value	Text	Description
0	Trip	Trip the drive.
1	Send flt values	Send fault values to PLC output parameters.
2	Clear output	Set all PLC output parameters to zero.
3	Hold last	Hold the last values in the PLC output parameters.
4	No action	No action with PLC output parameters.

Pr **S.01.011** is used to determine the action to take when a CANopen timeout error occurs.

S.01.012	Timeout Event Destination		
Minimum	0 (This slot)	Maximum	4 (Slot 4)
Default	0 (This slot)	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW, BU		

Value	Text	Description
0	This slot	This slot
1	Slot 1	Slot 1
2	Slot 2	Slot 2
3	Slot 3	Slot 3
4	Slot 4	Slot 4

This parameter deines the destination to trigger the event specified by Pr **S.01.011** (*Timeout Action*) when a timeout event occurs.

S.01.013	Timeout Event Type		
Minimum	0 (No event)	Maximum	5 (Event4)
Default	0 (No event)	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW, BU		

Value	Text	Description
0	No event	This slot
1	Event 0	Event 0
2	Event1	Event 1
3	Event2	Event 2
4	Event3	Event 3
5	Event4	Event 4

Pr **S.01.013** defines the event to trigger when a CANopen event occurs. Pr **S.01.012** must specify an appropriate consumer of the event.

S.01.014	PDO Data Alignment		
Minimum	0 (32 bit)	Maximum	2 (8 bit)
Default	0 (32 bit)	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW, BU		

Value	Text	Description
0	32 bits	Sets the PDO data alignment to 32 bits, all PDOs are 32 bits
1	16 bits	Sets the PDO data alignment to 16 bits, all PDOs are 16 bits except for 32 bit PDOs which are 32 bits
2	8 bit	Sets the PDO data alignment to 8 bits, all PDOs are set to their natural sizes except for 1 bit parameters which are set to 1 byte

As of firmware V02.01.00.26 an 8-bit option has been added to Pr **S.01.014** to allow 1-bit and 8-bit parameters to only use 1 byte of data rather than the 16 bits as in previous versions.

The SI-CANopen V2 module by default, uses 32 bits for each mapped PDO value (when CiA 402 is not enabled, i.e. Pr **S.01.020** = Off), even if the target parameter in the drive is a 16-bit, 8-bit or 1-bit parameter. Additional padding bytes are added to pad the value to the data alignment size. This strategy ensures that the cyclic data transmitted over the network is kept aligned with memory locations in 32-bit PLCs.

The following table shows the actual sizes of the mapped data with different data alignment.

Parameter Size (Bits)	Actual Data Size (Bits)		
	Data Alignment = 8	Data Alignment = 16	Data Alignment = 32
1	8	16	32
8			
16	16		
32	32	32	

32-bit parameters will always use 32 bits for the PDO mapping, but the PDO mapping size for other parameter sizes will depend on this parameter setting.

With ’16 bit’ set, parameters of 16 bits or less will use 16 bits.

With ‘8 bit’ set, 16-bit parameters will use 16 bits, and 1-bit or 8-bit parameters will use 8 bits.

The PDO Alignment parameter is ignored if CiA 402 is enabled (Pr **S.01.020** = On), in this case the PDO mapping size will follow the CiA 402 standard.

S.01.020	CiA402 profiles Enable		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW		

Setting this parameter to ‘Off’ (0) causes the SI-CANopen V2 module to take the default configuration for PDO1 from the PDOA setup menu (**S.02.xxx**), the other PDOs contain no mapping by default. It also disables the CiA 402 profile state machine and access to profile objects.

Setting this parameter to ‘On’ (1) will mean all PDOs take the default configuration as defined in the CiA 402 specification (V2.0 section 7.3). No manufacturer specific mappings will be used, avoid mixed use of CiA 402 and manufacturer specific mappings. Additional PDO data alignment will follow the CiA specification and the value in Pr **S.01.014** (*PDO Data Alignment*) will be ignored.

If Pr **S.01.024** (*User Program Object Priority*) is set for ‘User Application’ then this parameter is ignored and the CiA 402 profiles are disabled.

In both cases the default mappings can be over-written by the user through the SDO protocol. Also objects defined by the profile and re-implemented in an SI-Applications module can be accessed in both cases.

A user wishing to implement a new profile, or profile mode, should implement the entire profile on the SI-Applications module and disable the in-built profiles.

When the module is fitted on an E300 drive, this parameter value is ignored and the option always works as if it is set to 'Off'.

S.01.021	**Compatibility Mode**		
Minimum	0 (Hybrid)	Maximum	6 (CIA402 Profile)
Default	3 (Unidrive M)	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW, BU		

Value	Text	Description
0	Hybrid	SI-CANopen V2 uses a generic format product code except when fitted to Unidrive M70X drives using M70X EDS files, in this case the product code used will be 448
1	UNIDRIVE SP	SI-CANopen V2 will use the Unidrive SP product code and corresponding Unidrive SP EDS file
2	COMMANDER SK	SI-CANopen V2 will use the Commander SK product code and corresponding EDS file
3	UNIDRIVE M	SI-CANopen V2 will use the generic format product code for Unidrive M drives
4	SK PDO COMPAT	SI-CANopen V2 will use the Commander SK product code and corresponding EDS file. All PDO mappings are limited to 16 bits in size. PDO mappings using values in Hertz are scaled to match the Commander SK units.
5	SDO SIZE COMPAT	As mode 3 (UNIDRIVE M) but in this mode the data size of the SDO response will follow the PDO data alignment in Pr **S.01.014**
6	CIA 402 Profile	CiA 402 motion profile support

As of SI-CANopen V2 firmware V02.03.02.02, the compatibility mode options have been modified as follows:

- The displayed text for mode 0 has also been changed from 'Auto' to 'Hybrid' to more clearly indicate the functionality
- A Commander SK PDO Compatibility mode (4) has been added. No guarantee is made that PDO compatibility is met in all circumstances.
- An option to set the SDO response data size in accordance with the setting of the PDO Data Alignment (Pr **S.01.014**) has been added (SDO SIZE COMPAT (5)). This option only applies to objects mapped to drive parameters, all other objects are not affected by this setting.

As of SI-CANopen V2 firmware V02.04.01.12, an additional option (CIA 402 Profile (6)) has been added to the compatibility mode options, this setting is used when the CiA 402 Position Profile motion profile is required.

When this parameter is set to "UNIDRIVE SP (1)" or "COMMANDER SK (2)" Pr **S.01.022** (*Compatibility Mode Software Revision*) should be set to the software revision number of the replaced SM-CANopen module and Pr **S.01.023** (*Compatibility Mode Serial Number*) should be set to the serial number of the replaced SM-CANopen module. Therefore if either of these modes are selected, then the CANopen master project/program based on the SM-CANopen module can be used without changes.

For example, if a Unidrive SP fitted with an SM-CANopen module (firmware version V03.02.05 and serial number 123456) is replaced for a Unidrive M fitted with SI-CANopen V2 then to avoid changes to the CANopen master, the following parameters should be changed:

- **S.01.021** (*Compatibility Mode*) = "UNIDRIVE SP"
- **S.01.022** (*Compatibility Mode Software Revision*) = "03.02.05.00", note that only the first 3 revision numbers are required.
- **S.01.023** (*Compatibility Mode Serial Number*) = "123456"
- Save parameters and reset the configuration for the changes to be made active.

S.01.022	**Compatibility Mode Software Revision**		
Minimum	00.00.00.00	Maximum	99.99.99.99
Default	00.00.00.00	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Version	Decimal Places	0
Coding	RW, BU, PT		

S.01.023	Compatibility Mode Serial Number		
Minimum	0	Maximum	999999999
Default	0	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	
Coding	RW, PT		

When the compatibility mode parameter (Pr **S.01.021**) is set to "UNIDRIVE SP" (1) or "COMMANDER SK" (2), the Compatibility Mode Software Revision parameter (Pr **S.01.022**) is used to set the version of firmware that was on the SM-CANopen module that is being replaced. Also, the Compatibility Mode Serial Number parameter (Pr **S.01.023**), is used to set the serial number of the SM-CANopen module that is being replaced.

Setting these parameters will allow compatibility using previous CANopen master projects that utilised SM-CANopen modules.

S.01.024	User Program Object Priority		
Minimum	0 (None)	Maximum	2 (User Program)
Default	0 (None)	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	BU, RW, PT		

When DPL (user program) variables are linked to the CANopen object dictionary entries, there is no restriction placed on which objects can be created between objects 0x2100 and 0x25FF and above object 0x3000. A complete profile would need to be written in DPL code, only CANopen objects outside these ranges will exist in the SI-CANopen V2 module. This parameter specifies which objects are priority according to the following table.

Value	Priority	Description
0	None	SI-CANopen V2 will check its internal object dictionary for the presence of the specified object. If the specified object does not exist in the SI-CANopen V2, an error message will be returned. SI-CANopen V2 will NOT check the user program module's dictionary.
1	Internal	SI-CANopen V2 will check its internal object dictionary first for the presence of the specified object. If the specified object does not exist, SI-CANopen V2 will next check the user program module's dictionary. If the specified object does not exist in either module, an error message will be returned.
2	User Program	SI-CANopen V2 will check the user program module's object dictionary, if the specified object does not exist, an error message will be returned.

S.01.030	CANopen Identification Override		
Minimum	-2147483648	Maximum	2147483647
Default	0	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, PT		

When this parameter is set to 0, SI-CANopen V2 will return in object 0x1000 the device code appropriate for the host drive. In situations where a previous Control Techniques drive (e.g. Unidrive SP) is being replaced by a Unidrive M, then this parameter can be set to the SM-CANopen Device ID code, this will override the SI-CANopen V2 Device ID code returned via object 0x1000.

6.4 Menu 2 - PDOA Setup

Menu 2 contains all the parameters relating the setup of PDOA.

S.02.001	**TPDOA Length**		
S.02.002	**RPDOA Length**		
Minimum	0	Maximum	4
Default	4	Units	None
Type	8 Bit Volatile	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, NC		

Parameters **S.02.001** and **S.02.002** define the length (in words) of TPDOA and RPDOA respectively.

The values specified in Pr **S.02.001** and **S.02.002** will be compared with the actual TPDOA and RPDOA lengths respectively after applying the mappings, if the length is exceeded a Length Mismatch error will be shown in the relevant PDO status parameter.

Any attempt to set a value outside the defined range will cause the module to reset the value to the relevant minimum or maximum value.

S.02.003	**TPDOA Transmission Type**		
Minimum	0	Maximum	255
Default	255	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

Pr **S.02.003** sets the current transmission type of TPDOA. Because all PDOs are handled in the same way, if the master changes this setting through the PDO configuration object, the parameter will not be updated.

Transmission type	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0	No	Yes	Yes	No	No
1 to 240	Yes	No	Yes	No	No
241 to 251	Reserved	Reserved	Reserved	Reserved	Reserved
252	No	No	Yes	No	Yes
253	No	No	No	Yes	Yes
254	No	No	No	Yes	No
255	No	No	No	Yes	No

- Type 0 transmits after a sync message, only when data has changed.
- Types 1 to 240 transmit every n sync messages.
- (*Types 241 to 251 are reserved and will therefore produce an error if selected)*. See Pr **S.02.004**).
- Type 252 transmits only on remote request, data is updated on receipt of the sync message.
- Type 253 data updated and transmits only on remote request.
- Type 254 transmits when the TxPDO trigger objects event occurs (0x2850) or in response to an event timer.
- Type 255 TxPDO will be transmitted depending on the Profile Specific Mode value in object 0x2832.

The manufacturer specific (254) and profile specific even type (255) will be implemented to transmit the PDO every n ms where n is specified by sub-index 5 of the PDO communication parameter. This value will default to 0, which disables the transmission.

S.02.004	TPDOA Mapping Status		
S.02.005	RPDOA Mapping Status		
Minimum	0 (Mapping OK)	Maximum	9 (Out of Memory)
Default	0 (Mapping OK)	Units	None
Type	8 Bit Volatile	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RO, NC, PT, BU		

The module will scan and check the CANopen mapping parameter configuration for errors during initialisation. If an error is detected, the CANopen Network Diagnostic parameter (Pr **S.01.006**) will indicate "Config Error" (4) and the mapping error detected will be indicated in the relevant input or output mapping status parameter.

The table below shows all possible values for Prs **S.02.004** and **S.02.005**.

Value	Text	Description
0	Mapping OK	No error detected with cyclic data mapping configuration.
1	Too Many Map	Too many cyclic data parameters configured.
2	No Mapping	Cyclic data length is 0 or there are no mappings.
3	Read Mismatch	Invalid parameter or insufficient resources to perform the mapping.
4	Hole In Mapping	The cyclic data mapping parameters are not contiguous.
5	Duplicate Map	Two or more cyclic data mapping configuration parameters have been configured with the same destination.
6	Length Mismatch	The actual data length exceeds the configured length.
7	*Reserved*	Reserved for future use.
8	Trans Type[1]	The transmission type selected is not supported.
9	Out of Memory	Indicates there is insufficient memory to perform the mapping

NOTE

[1] - Not implemented for Pr **S.02.005** (RPDOA)

S.02.006	TPDOA Processing Time		
S.02.007	RPDOA Processing Time		
Minimum	0	Maximum	65535
Default	0	Units	ms
Type	16 Bit Volatile	Update Rate	Background
Display Format	Number	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

Pr **S.02.006** displays the time between receiving the output value from the drive and being sent successfully to the master.

Pr **S.02.007** displays the time between receiving the input value from the master and being sent successfully to the drive.

S.02.008	PDOA Input Consistency Enable		
S.02.010	PDOA Output Consistency Enable		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW		

S.02.009	PDOA Input Consistency Trigger Parameter		
S.02.011	PDOA Output Consistency Trigger Parameter		
Minimum	0.00.000	Maximum	5.99.999
Default	0.00.000	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	SlotMenuParameter	Decimal Places	0
Coding	RW, BU		

The SI-CANopen V2 module provides an input/output consistency feature which ensures that the data in the input or output mappings is only transferred between the SI-CANopen V2 module and the master when the mapped parameters are ready. This prevents data skew between parameters in the input/output mappings.

If PDOA Input Consistency Enable (Pr **S.02.008**) and PDOA Output Consistency Enable (Pr **S.02.010**) are set to 0 (i.e. default settings), then the input/output consistency features are disabled in order that input and output data is always read from or written to the master/ module.

If PDOA Input Consistency Enable (Pr **S.02.008**) is set to On (1), the SI-CANopen V2 module will check the value of the parameter specified by the PDOA Input Consistency Trigger Parameter (Pr **S.02.009**). If the PDOA Input Trigger Parameter defined by Pr **S.02.009** is set to a non-zero value (for example by a user program in an applications module), this indicates to the SI-CANopen V2 module that all the mapped parameters are ready to be read. The module will then read the mapped parameters, transfer them to the master, and then clear the input trigger source parameter to zero. When the input trigger source parameter is set to zero, the SI-CANopen V2 module will continue to transfer the previously read data to the master.

If PDOA Output Consistency Enable (Pr **S.02.010**) is set to On (1), the SI-CANopen V2 module will check the value of the parameter specified by the PDOA Output Consistency Trigger Parameter (Pr **S.02.011**). The PDOA Output Trigger Parameter defined by Pr **S.02.011** will initially be set to 1.

If the output trigger source parameter is set to zero (for example by a user program in an applications module), this indicates to the SI-CANopen V2 module that all the mapped parameters are ready to be written to. The module will then write the data from the master into the mapped parameters, and will then set the output trigger source parameter to 1. When the output trigger source parameter is set to 1, it indicates to the SI-CANopen V2 module that the mapped parameters are not ready to be written to, and therefore any new data from the master will not be written to the mapped parameters in the drive until the output trigger source parameter is again set to zero.

S.02.012	PDOA Event Trigger		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	When processed
Display Format	Text	Decimal Places	0
Coding	RW		

When the transmission type (Pr **S.02.003**) is set to 254 (Manufacturer specific event), setting this parameter to On (1) triggers any PDOs configured to be transmitted or received PDOs acted upon. Once triggered, the module will reset the parameter to Off (0).

S.02.013	TPDOA Number		
S.02.014	RPDOA Number		
Minimum	1	Maximum	512
Default	1	Units	None
Type	16 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

There are four TPDOs and four RPDOs available in the SI-CANopen V2. These PDOs are referred to as PDOs A, B, C and D. Each of these PDOs can be configured to be any of the 512 available PDO numbers (1 to 512). By default the configuration will be PDOA = 1, PDOB = 3, PDOC = 5 and PDOD = 6 (for both TPDOs and RPDOs).

If a configuration using non-default or flexible numbering is required, the index number for the PDO communication objects must be derived by subtracting 1 from the PDO number and adding this number to the base address. E.g. for 0x1600 PDO3 = 0x1602 (mapping information for RPDOs).

S.02.015	**TPDOA Mapping Parameter 1**		
S.02.016	**TPDOA Mapping Parameter 2**		
S.02.017	**TPDOA Mapping Parameter 3**		
S.02.018	**TPDOA Mapping Parameter 4**		
S.02.019	**RPDOA Mapping Parameter 1**		
S.02.020	**RPDOA Mapping Parameter 2**		
S.02.021	**RPDOA Mapping Parameter 3**		
S.02.022	**RPDOA Mapping Parameter 4**		
Minimum	0.00.000	Maximum	5.99.999
Default	See below	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	SlotMenuParameter	Decimal Places	0
Coding	RW, BU		

Parameters **S.02.015** - **S.02.018** are used to define the application objects which are mapped to TPDOA.

Parameters **S.02.019** - **S.02.022** are used to define the application objects which are mapped to RPDOA.

NOTE

By default, SI-CANopen V2 will use 32 bits for each mapped parameter data, irrespective of the actual data size of the parameter. For more information please see Pr **S.01.014** (*Data Alignment*).

The defaults of all the mapping parameters are as follows:

Parameter	Default	Description
TPDOA Mapping Parameter 1 (Pr **S.02.015**)	0.10.040	Status Word
TPDOA Mapping Parameter 2 (Pr **S.02.016**)	0.02.001	Post Ramp Reference
TPDOA Mapping Parameter 3 (Pr **S.02.017**)	0.00.000	Not used
TPDOA Mapping Parameter 4 (Pr **S.02.018**)	0.00.000	Not used
RPDOA Mapping Parameter 1 (Pr **S.02.019**)	0.06.042	Control Word
RPDOA Mapping Parameter 2 (Pr **S.02.020**)	0.01.021	Preset Reference 1
RPDOA Mapping Parameter 3 (Pr **S.02.021**)	0.00.000	Not used
RPDOA Mapping Parameter 4 (Pr **S.02.022**)	0.00.000	Not used

6.5 Menu 3 - PDOB Setup

Menu 3 contains all the parameters relating to the PDOB setup.

S.03.001	TPDOB Length		
S.03.002	**RPDOB Length**		
Minimum	0	Maximum	4
Default	0	Units	None
Type	8 Bit Volatile	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, NC		

Parameters **S.03.001** and **S.03.002** define the length (in words) of TPDOB and RPDOB respectively.

The values specified in Pr **S.03.001** and **S.03.002** will be compared with the actual TPDOB and RPDOB lengths respectively after applying the mappings, if the length is exceeded a Length Mismatch error will be shown in the relevant PDO status parameter.

Any attempt to set a value outside the defined range will cause the module to reset the value to the relevant minimum or maximum value.

S.03.003	TPDOB Transmission Type		
Minimum	0	Maximum	255
Default	255	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

Pr **S.03.003** sets the current transmission type of TPDOB. As all PDOs are handled in the same way if the master changes this setting through the PDO configuration object the parameter will not be updated.

Transmission type	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0	No	Yes	Yes	No	No
1 to 240	Yes	No	Yes	No	No
241 to 251	Reserved	Reserved	Reserved	Reserved	Reserved
252	No	No	Yes	No	Yes
253	No	No	No	Yes	Yes
254	No	No	No	Yes	No
255	No	No	No	Yes	No

- Type 0 transmits after a sync message, only when data has changed.
- Types 1 to 240 transmit every *n* sync messages.
- *(Types 241 to 251 are reserved and will therefore produce an error if selected. See Pr* **S.03.004***).*
- Type 252 transmits only on remote request, data is updated on receipt of the sync message.
- Type 253 data updated and transmits only on remote request.
- Type 254 transmits when the TxPDO trigger objects event occurs (0x2851) or in response to an event timer.
- Type 255 TxPDO will be transmitted depending on the Profile Specific Mode value in object 0x2832.

The manufacturer specific (254) and profile specific even type (255) will be implemented to transmit the PDO every *n* ms where *n* is specified by sub-index 5 of the PDO communication parameter. This value will default to 0, which disables the transmission.

S.03.004	TPDOB Mapping Status		
S.03.005	**RPDOB Mapping Status**		
Minimum	0 (Mapping OK)	Maximum	9 (Out of Memory)
Default	0 (Mapping OK)	Units	None
Type	8 Bit Volatile	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RO, NC, PT, BU		

The module will scan and check the CANopen mapping parameter configuration for errors during initialisation. If an error is detected, the CANopen Network Diagnostic parameter (Pr **S.01.006**) will indicate “Config Error” (4) and the mapping error detected will be indicated in the relevant input or output mapping status parameter.

The table below shows all possible values for Prs **S.03.004** and **S.03.005**.

Value	Text	Description
0	Mapping OK	No error detected with cyclic data mapping configuration.
1	Too Many Maps	Too many cyclic data parameters configured.
2	No Mapping	Cyclic data length is 0 or there are no mappings.
3	Read Mismatch	Invalid parameter or insufficient resources to perform the mapping.
4	Hole In Mapping	The cyclic data mapping parameters are not contiguous.
5	Duplicate Map	Two or more cyclic data mapping configuration parameters have been configured with the same destination.
6	Length Mismatch	The actual data length exceeds the configured length.
7	*Reserved*	Reserved for future use.
8	Trans Type[1]	The transmission type selected is not supported.
9	Out of Memory	Indicates there is insufficient memory to perform the mapping.

[1] - Not implemented for Pr **S.03.005** (RPDOB)

S.03.006	TPDOB Processing Time		
S.03.007	**RPDOB Processing Time**		
Minimum	0	Maximum	65535
Default	0	Units	ms
Type	16 Bit Volatile	Update Rate	Background
Display Format	Number	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

Pr **S.03.006** displays the time between receiving the output value from the drive and being sent successfully to the master.

Pr **S.03.007** displays the time between receiving the input value from the master and being sent successfully to the drive.

S.03.008	PDOB Input Consistency Enable		
S.03.010	**PDOB Output Consistency Enable**		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW		

S.03.009	PDOB Input Consistency Trigger Parameter		
S.03.011	**PDOB Output Consistency Trigger Parameter**		
Minimum	0.00.000	Maximum	5.99.999
Default	0.00.000	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	SlotMenuParameter	Decimal Places	0
Coding	RW, BU		

The SI-CANopen V2 module provides an input/output consistency feature which ensures that the data in the input or output mappings is only transferred between the SI-CANopen V2 module and the master when the mapped parameters are ready. This prevents data skew between parameters in the input/output mappings.

If PDOB Input Consistency Enable (Pr **S.03.008**) and PDOB Output Consistency Enable (Pr **S.03.010**) are set to 0 (i.e. default settings), then the input/output consistency features are disabled so that input and output data is always read from or written to the master/ module.

If PDOB Input Consistency Enable (Pr **S.03.008**) is set to On (1), the SI-CANopen V2 module will check the value of the parameter specified by the PDOB Input Consistency Trigger Parameter (Pr **S.03.009**). If the PDOB Input Trigger Parameter defined by Pr **S.03.009** is set to a non-zero value (for example by a user program in an applications module), this indicates to the SI-CANopen V2 module that all the mapped parameters are ready to be read. The module will then read the mapped parameters, transfer them to the master and will then clear the input trigger source parameter to zero. When the input trigger source parameter is set to zero, the SI-CANopen V2 module will continue to transfer the previously read data to the master.

If PDOB Output Consistency Enable (Pr **S.03.010**) is set to On (1), the SI-CANopen V2 module will check the value of the parameter specified by the PDOB Output Consistency Trigger Parameter (Pr **S.03.011**). The PDOB Output Trigger Parameter defined by Pr **S.03.011** will initially be set to 1.

If the output trigger source parameter is set to zero (for example by a user program in an applications module), this indicates to the SI-CANopen V2 module that all the mapped parameters are ready to be written to. The module will then write the data from the master into the mapped parameters, and will then set the output trigger source parameter to 1. When the output trigger source parameter is set to 1, it indicates to the SI-CANopen V2 module that the mapped parameters are not ready to be written to, and therefore any new data from the master will not be written to the mapped parameters in the drive until the output trigger source parameter is again set to zero.

S.03.012	**PDOB Event Trigger**		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	When processed
Display Format	Text	Decimal Places	0
Coding	RW		

When the transmission type (Pr **S.03.003**) is set to 254 (Manufacturer specific event), setting this parameter to On (1) triggers any PDOs configured to be transmitted or received PDOs acted upon. Once triggered, the module will reset the parameter to Off (0).

S.03.013	**TPDOB Number**		
S.03.014	**RPDOB Number**		
Minimum	1	Maximum	512
Default	3	Units	None
Type	16 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

There are four TPDOs and four RPDOs available in the SI-CANopen V2. These PDOs are referred to as PDOs A, B, C and D. Each of these PDOs can be configured to be any of the 512 available PDO numbers (1 to 512). By default the configuration will be PDOA = 1, PDOB = 3, PDOC = 5 and PDOD = 6 (for both TPDOs and RPDOs).

If a configuration using non-default or flexible numbering is required, the index number for the PDO communication objects must be derived by subtracting 1 from the PDO number and adding this number to the base address, e.g. for 0x1600 PDO3 = 0x1602 (mapping information for RPDOs).

S.03.015	**TPDOB Mapping Parameter 1**		
S.03.016	**TPDOB Mapping Parameter 2**		
S.03.017	**TPDOB Mapping Parameter 3**		
S.03.018	**TPDOB Mapping Parameter 4**		
S.03.019	**RPDOB Mapping Parameter 1**		
S.03.020	**RPDOB Mapping Parameter 2**		
S.03.021	**RPDOB Mapping Parameter 3**		
S.03.022	**RPDOB Mapping Parameter 4**		
Minimum	0.00.000	Maximum	5.99.999
Default	0.00.000	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	SlotMenuParameter	Decimal Places	0
Coding	RW, BU		

Parameters **S.03.015** – **S.03.018** are used to define the application objects which are mapped to TPDOB.

Parameters **S.03.019 – S.03.022** are used to define the application objects which are mapped to RPDOB.

NOTE

By default, SI-CANopen V2 will use 32 bits for each mapped parameter data, irrespective of the actual data size of the parameter. For more information please see Pr **S.01.014** (*Data Alignment*).

6.6 Menu 4 - PDOC Setup

Menu 4 contains all the parameters relating to the setup of PDOC.

S.04.001	**TPDOC Length**		
S.04.002	**RPDOC Length**		
Minimum	0	Maximum	4
Default	0	Units	None
Type	8 Bit Volatile	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, NC		

Parameters **S.04.001** and **S.04.002** define the length (in words) of TPDOC and RPDOC respectively.

The values specified in Pr **S.04.001** and **S.04.002** will be compared with the actual TPDOC and RPDOC lengths respectively after applying the mappings, if the length is exceeded a Length Mismatch error will be shown in the relevant PDO status parameter.

Any attempt to set a value outside the defined range will cause the module to reset the value to the relevant minimum or maximum value.

S.04.003	**TPDOC Transmission Type**		
Minimum	0	Maximum	255
Default	255	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

Pr **S.04.003** sets the current transmission type of TPDOC. As all PDOs are handled in the same way if the master changes this setting through the PDO configuration object the parameter will not be updated.

Transmission type	**Cyclic**	**Acyclic**	**Synchronous**	**Asynchronous**	**RTR only**
0	No	Yes	Yes	No	No
1 to 240	Yes	No	Yes	No	No
241 to 251	Reserved	Reserved	Reserved	Reserved	Reserved
252	No	No	Yes	No	Yes
253	No	No	No	Yes	Yes
254	No	No	No	Yes	No
255	No	No	No	Yes	No

- Type 0 transmits after a sync message, only when data has changed.
- Types 1 to 240 transmit every *n* sync messages.
- *(Types 241 to 251 are reserved and will therefore produce an error if selected. See Pr* **S.04.004***.*
- Type 252 transmits only on remote request, data is updated on receipt of the sync message.
- Type 253 data updated and transmits only on remote request.
- Type 254 transmits when the TxPDO trigger objects event occurs (0x2852) or in response to an event timer.
- Type 255 TxPDO will be transmitted depending on the Profile Specific Mode value in object 0x2832.

The manufacturer specific (254) and profile specific even type (255) will be implemented to transmit the PDO every *n* ms where *n* is specified by sub-index 5 of the PDO communication parameter. This value will default to 0, which disables the transmission.

S.04.004	TPDOC Mapping Status		
S.04.005	RPDOC Mapping Status		
Minimum	0 (Mapping OK)	Maximum	9 (Out of Memory)
Default	0 (Mapping OK)	Units	None
Type	8 Bit Volatile	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RO, NC, PT, BU		

The module will scan and check the CANopen mapping parameter configuration for errors during initialisation. If an error is detected, the CANopen Network Diagnostic parameter (Pr **S.01.006**) will indicate “Config Error” (4) and the mapping error detected will be indicated in the relevant input or output mapping status parameter.

The table below shows all possible values for Prs **S.04.004** and **S.04.005**.

Value	Text	Description
0	Mapping OK	No error detected with cyclic data mapping configuration.
1	Too Many Maps	Too many cyclic data parameters configured.
2	No Mapping	Cyclic data length is 0 or there are no mappings.
3	Read Mismatch	Invalid parameter or insufficient resources to perform the mapping.
4	Hole In Mapping	The cyclic data mapping parameters are not contiguous.
5	Duplicate Map	Two or more cyclic data mapping configuration parameters have been configured with the same destination.
6	Length Mismatch	The actual data length exceeds the configured length.
7	*Reserved*	Reserved for future use.
8	Trans Type[1]	The transmission type selected is not supported.
9	Out of Memory	Indicates there is insufficient memory to perform the mapping.

[1] - Not implemented for Pr **S.04.005** (RPDOC)

S.04.006	TPDOC Processing Time		
S.04.007	RPDOC Processing Time		
Minimum	0	Maximum	65535
Default	0	Units	ms
Type	16 Bit Volatile	Update Rate	Background
Display Format	Number	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

Pr **S.04.006** displays the time between receiving the output value from the drive and being sent successfully to the master.

Pr **S.04.007** displays the time between receiving the input value from the master and being sent successfully to the drive.

S.04.008	PDOC Input Consistency Enable		
S.04.010	PDOC Output Consistency Enable		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW		

S.04.009	PDOC Input Consistency Trigger Parameter		
S.04.011	PDOC Output Consistency Trigger Parameter		
Minimum	0.00.000	Maximum	5.99.999
Default	0.00.000	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialization
Display Format	SlotMenuParameter	Decimal Places	0
Coding	RW, BU		

The SI-CANopen V2 module provides an input/output consistency feature which ensures that the data in the input or output mappings is only transferred between the SI-CANopen V2 module and the master when the mapped parameters are ready. This prevents data skew between parameters in the input/output mappings.

If PDOC Input Consistency Enable (Pr **S.04.008**) and PDOC Output Consistency Enable (Pr **S.04.010**) are set to 0 (i.e. default settings), then the input/output consistency features are disabled so that input and output data is always read from or written to the master/ module.

If PDOC Input Consistency Enable (Pr **S.04.008**) is set to On (1), the SI-CANopen V2 module will check the value of the parameter specified by the PDOC Input Consistency Trigger Parameter (Pr **S.04.009**). If the PDOC Input Trigger Parameter defined by Pr **S.04.009** is set to a non-zero value (for example by a user program in an applications module), this indicates to the SI-CANopen V2 module that all the mapped parameters are ready to be read. The module will then read the mapped parameters, transfer them to the master and will then clear the input trigger source parameter to zero. When the input trigger source parameter is set to zero, the SI-CANopen V2 module will continue to transfer the previously read data to the master.

If PDOC Output Consistency Enable (Pr **S.04.010**) is set to On (1), the SI-CANopen V2 module will check the value of the parameter specified by the PDOC Output Consistency Trigger Parameter (Pr **S.04.011**). The PDOC Output Trigger Parameter defined by Pr **S.04.011** will initially be set to 1.

If the output trigger source parameter is set to zero (for example by a user program in an applications module), this indicates to the SI-CANopen V2 module that all the mapped parameters are ready to be written to. The module will then write the data from the master into the mapped parameters, and will then set the output trigger source parameter to 1. When the output trigger source parameter is set to 1, it indicates to the SI-CANopen V2 module that the mapped parameters are not ready to be written to, and therefore any new data from the master will not be written to the mapped parameters in the drive until the output trigger source parameter is again set to zero.

S.04.012	**PDOC Event Trigger**		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	When processed
Display Format	Text	Decimal Places	0
Coding	RW		

When the transmission type (Pr **S.04.003**) is set to 254 (Manufacturer specific event), setting this parameter to On (1) triggers any PDOs configured to be transmitted or received PDOs acted upon. Once triggered, the module will reset the parameter to Off (0).

S.04.013	**TPDOC Number**		
S.04.014	**RPDOC Number**		
Minimum	1	Maximum	512
Default	5	Units	None
Type	16 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

There are four TPDOs and four RPDOs available in the SI-CANopen V2. These PDOs are referred to as PDOs A, B, C and D. Each of these PDOs can be configured to be any of the 512 available PDO numbers (1 to 512). By default the configuration will be PDOA = 1, PDOB = 3, PDOC = 5 and PDOD = 6 (for both TPDOs and RPDOs).

If a configuration using non-default or flexible numbering is required, the index number for the PDO communication objects must be derived by subtracting 1 from the PDO number and adding this number to the base address. e.g. for 0x1600 PDO3 = 0x1602 (mapping information for RPDOs).

S.04.015	**TPDOC Mapping Parameter 1**		
S.04.016	**TPDOC Mapping Parameter 2**		
S.04.017	**TPDOC Mapping Parameter 3**		
S.04.018	**TPDOC Mapping Parameter 4**		
S.04.019	**RPDOC Mapping Parameter 1**		
S.04.020	**RPDOC Mapping Parameter 2**		
S.04.021	**RPDOC Mapping Parameter 3**		
S.04.022	**RPDOC Mapping Parameter 4**		
Minimum	0.00.000	Maximum	5.99.999
Default	0.00.000	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	SlotMenuParameter	Decimal Places	0
Coding	RW, BU		

Parameters **S.04.015** – **S.04.018** are used to define the application objects which are mapped to TPDOC.

Parameters **S.04.019 – S.04.022** are used to define the application objects which are mapped to RPDOC.

NOTE

By default, SI-CANopen V2 will use 32 bits for each mapped parameter data, irrespective of the actual data size of the parameter. For more information please see Pr **S.01.014** (*Data Alignment*).

6.7 Menu 5 - PDOD Setup

Menu 5 contains all the parameters relating the setup of PDOD.

S.05.001	**TPDOD Length**		
S.05.002	**RPDOD Length**		
Minimum	0	Maximum	4
Default	0	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, NC		

Parameters **S.05.001** and **S.05.002** define the length (in words) of TPDOD and RPDOD respectively.

The values specified in Pr **S.05.001** and **S.05.002** will be compared with the actual TPDOD and RPDOD lengths respectively after applying the mappings, if the length is exceeded a Length Mismatch error will be shown in the relevant PDO status parameter.

Any attempt to set a value outside the defined range will cause the module to reset the value to the relevant minimum or maximum value.

S.05.003	**TPDOD Transmission Type**		
Minimum	0	Maximum	255
Default	255	Units	None
Type	8 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

Pr **S.05.003** sets the current transmission type of TPDOD. As all PDOs are handled in the same way if the master changes this setting through the PDO configuration object the parameter will not be updated.

Transmission type	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0	No	Yes	Yes	No	No
1 to 240	Yes	No	Yes	No	No
241 to 251	Reserved	Reserved	Reserved	Reserved	Reserved
252	No	No	Yes	No	Yes
253	No	No	No	Yes	Yes
254	No	No	No	Yes	No
255	No	No	No	Yes	No

- Type 0 transmits after a sync message, only when data has changed.
- Types 1 to 240 transmit every *n* sync messages.
- *(Types 241 to 251 are reserved and will therefore produce an error if selected. See Pr* **S.05.004**).
- Type 252 transmits only on remote request, data is updated on receipt of the sync message.
- Type 253 data updated and transmits only on remote request.
- Type 254 transmits when the TxPDO trigger objects event occurs (0x2853) or in response to an event timer.
- Type 255 TxPDO will be transmitted depending on the Profile Specific Mode value in object 0x2832.

The manufacturer specific (254) and profile specific even type (255) will be implemented to transmit the PDO every *n* ms where *n* is specified by sub-index 5 of the PDO communication parameter. This value will default to 0, which disables the transmission.

S.05.004	**TPDOD Mapping Status**		
S.05.005	**RPDOD Mapping Status**		
Minimum	0 (Mapping OK)	Maximum	9 (Out of Memory)
Default	0 (Mapping OK)	Units	None
Type	8 Bit Volatile	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RO, NC, PT, BU		

The module will scan and check the CANopen mapping parameter configuration for errors during initialisation. If an error is detected, the CANopen Network Diagnostic parameter (Pr **S.01.006**) will indicate “Config Error” (4) and the mapping error detected will be indicated in the relevant input or output mapping status parameter.

The table below shows all possible values for Prs **S.05.004** and **S.05.005**.

Value	Text	Description
0	Mapping OK	No error detected with cyclic data mapping configuration.
1	Too Many Maps	Too many cyclic data parameters configured.
2	No Mapping	Cyclic data length is 0 or there are no mappings.
3	Read Mismatch	Invalid parameter or insufficient resources to perform the mapping.
4	Hole In Mapping	The cyclic data mapping parameters are not contiguous.
5	Duplicate Map	Two or more cyclic data mapping configuration parameters have been configured with the same destination.
6	Length Mismatch	The actual data length exceeds the configured length.
7	*Reserved*	Reserved for future use.
8	Trans Type[1]	The transmission type selected is not supported.
9	Out of Memory	Indicates there is insufficient memory to perform the mapping.

[1] - Not implemented for Pr **S.05.005** (RPDOD)

S.05.006	**TPDOD Processing Time**		
S.05.007	**RPDOD Processing Time**		
Minimum	0	Maximum	65535
Default	0	Units	ms
Type	16 Bit Volatile	Update Rate	Background
Display Format	Number	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

Pr **S.05.006** displays the time between receiving the output value from the drive and being sent successfully to the master.

Pr **S.05.007** displays the time between receiving the input value from the master and being sent successfully to the drive.

S.05.008	**PDOD Input Consistency Enable**		
S.05.010	**PDOD Output Consistency Enable**		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW		

S.05.009	**PDOD Input Consistency Trigger Parameter**		
S.05.011	**PDOD Output Consistency Trigger Parameter**		
Minimum	0.00.000	Maximum	5.99.999
Default	0.00.000	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	SlotMenuParameter	Decimal Places	0
Coding	RW, BU		

The SI-CANopen V2 module provides an input/output consistency feature which ensures that the data in the input or output mappings is only transferred between the SI-CANopen V2 module and the master when the mapped parameters are ready. This prevents data skew between parameters in the input/output mappings.

If PDOD Input Consistency Enable (Pr **S.05.008**) and PDOD Output Consistency Enable (Pr **S.05.010**) are set to 0 (i.e. default settings), then the input/output consistency features are disabled so that input and output data is always read from or written to the master/ module.

If PDOD Input Consistency Enable (Pr **S.05.008**) is set to On (1), the SI-CANopen V2 module will check the value of the parameter specified by the PDOD Input Consistency Trigger Parameter (Pr **S.05.009**). If the PDOD Input Trigger Parameter defined by Pr **S.05.009** is set to a non-zero value (for example by a user program in an applications module), this indicates to the SI-CANopen V2 module that all the mapped parameters are ready to be read. The module will then read the mapped parameters, transfer them to the master and will then clear the input trigger source parameter to zero. When the input trigger source parameter is set to zero, the SI-CANopen V2 module will continue to transfer the previously read data to the master.

If PDOD Output Consistency Enable (Pr **S.05.010**) is set to On (1), the SI-CANopen V2 module will check the value of the parameter specified by the PDOD Output Consistency Trigger Parameter (Pr **S.05.011**). The PDOD Output Trigger Parameter defined by Pr **S.05.011** will initially be set to 1.

If the output trigger source parameter is set to zero (for example by a user program in an applications module), this indicates to the SI-CANopen V2 module that all the mapped parameters are ready to be written to. The module will then write the data from the master into the mapped parameters, and will then set the output trigger source parameter to 1. When the output trigger source parameter is set to 1, it indicates to the SI-CANopen V2 module that the mapped parameters are not ready to be written to, and therefore any new data from the master will not be written to the mapped parameters in the drive until the output trigger source parameter is again set to zero.

S.05.012	PDOD Event Trigger		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit User Save	Update Rate	When processed
Display Format	Text	Decimal Places	0
Coding	RW		

When the transmission type (Pr **S.05.003**) is set to 254 (Manufacturer specific event), setting this parameter to On (1) triggers any PDOs configured to be transmitted or received PDOs acted upon. Once triggered, the module will reset the parameter to Off (0).

S.05.013	TPDOD Number		
S.05.014	RPDOD Number		
Minimum	1	Maximum	512
Default	6	Units	None
Type	16 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW, BU		

There are four TPDOs and four RPDOs available in the SI-CANopen V2. These PDOs are referred to as PDOs A, B, C and D. Each of these PDOs can be configured to be any of the 512 available PDO numbers (1 to 512). By default the configuration will be PDOA = 1, PDOB = 3, PDOC = 5 and PDOD = 6 (for both TPDOs and RPDOs).

If a configuration using non-default or flexible numbering is required, the index number for the PDO communication objects must be derived by subtracting 1 from the PDO number and adding this number to the base address. E.g. for 0x1600 PDO3 = 0x1602 (mapping information for RPDOs).

S.05.015	TPDOD Mapping Parameter 1		
S.05.016	TPDOD Mapping Parameter 2		
S.05.017	TPDOD Mapping Parameter 3		
S.05.018	TPDOD Mapping Parameter 4		
S.05.019	RPDOD Mapping Parameter 1		
S.05.020	RPDOD Mapping Parameter 2		
S.05.021	RPDOD Mapping Parameter 3		
S.05.022	RPDOD Mapping Parameter 4		
Minimum	0.00.000	Maximum	5.99.999
Default	0.00.000	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	SlotMenuParameter	Decimal Places	0
Coding	RW, BU		

Parameters **S.05.015** – **S.05.018** are used to define the application objects which are mapped to TPDOD.

Parameters **S.05.019 – S.05.022** are used to define the application objects which are mapped to RPDOD.

NOTE

By default, SI-CANopen V2 will use 32 bits for each mapped parameter data, irrespective of the actual data size of the parameter. For more information please see Pr **S.01.014** (*Data Alignment*).

6.8 Menu 6 - RPDO Fault

Menu 6 contains all the parameters relating to the fault values for all RPDOs A, B, C and D.

S.06.001	**PDOA Fault Value 1**		
S.06.002	**PDOA Fault Value 2**		
S.06.003	**PDOA Fault Value 3**		
S.06.004	**PDOA Fault Value 4**		
S.06.005	**PDOB Fault Value 1**		
S.06.006	**PDOB Fault Value 2**		
S.06.007	**PDOB Fault Value 3**		
S.06.008	**PDOB Fault Value 4**		
S.06.009	**PDOC Fault Value 1**		
S.06.010	**PDOC Fault Value 2**		
S.06.011	**PDOC Fault Value 3**		
S.06.012	**PDOC Fault Value 4**		
S.06.013	**PDOD Fault Value 1**		
S.06.014	**PDOD Fault Value 2**		
S.06.015	**PDOD Fault Value 3**		
S.06.016	**PDOD Fault Value 4**		
Minimum	-2147483648	Maximum	2147483647
Default	0	Units	None
Type	32 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Number	Decimal Places	0
Coding	RW		

These parameters are used to define the value sent to the mapped RPDO destination when fault values have been configured to be sent using a timeout action parameter.

6.9 Menu 7 - CAN Master Functions

As of SI-CANopen V2 firmware V02.01.00.26 a new menu number 7 has been added, this menu provides access to the SI-CANopen V2 Master CAN functionality configuration parameters.

S.07.001	Simple Master		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit Volatile	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RW		

This parameter is used to enable or disable the 'Simple master' functionality.

After the SI-CANopen V2 module has initialised and transmitted it's 'Boot Up' message, if this parameter is set to 1 (On), the SI-CANopen V2 module transmits a 'Start remote node' NMT message with a CAN node ID of 0, this message instructs all available CAN devices (including itself) to start and enter the OPERATIONAL state.

If any CAN device initialises after the SI-CANopen V2 module then it's 'Boot Up' message will be processed and SI-CANopen V2 will transmit the 'Start remote node' NMT message with the specific CAN device ID, this message will instruct the specific CAN device to start and enter the operational state.

NOTE

The startup NMT message is sent whether the SI-CANopen V2 module is operational or not (i.e. Mapping errors and configuration errors do not prevent the transmission of the NMT message).

NOTE

This parameter is ignored if CANopen functionality is disabled (Pr **S.01.001** = Off).

S.07.003	DPLCAN Node Address		
Minimum	0	Maximum	127
Default	0	Units	None
Type	8 Bit User Save	Update Rate	Set/read when using the appropriate MCS/SyPT Pro function
Display Format	Number	Decimal Places	0
Coding	RW		

DPLCAN refers to the CAN functionality available within user applications hosted on the MCi2xx or SI-Applications Plus/Compact modules.

This parameter has the same functionality as Pr **MM.03** in the SM-CAN option module.

The value passed by the *CANSetup* function and returned by the *CANGetNodeAddr* function are stored in this parameter. These functions are available within Machine Control Studio (MCS) for MCi2xx modules and SyPT Pro for the SI-Applications Plus/Compact modules.

The DPLCAN Node Address has no function within the SI-CANopen V2 module and is used solely for the purpose of storing and recalling the CAN node address used by the user application in the MCi2xx or SI-Applications Plus/Compact module.

NOTE

This is not the CANopen node address.

S.07.006	DPLCAN Data Rate		
Minimum	0	Maximum	65535
Default	None	Units	Messages per second
Type	16 Bit Volatile	Update Rate	Background
Display Format	Number	Decimal Places	0
Coding	RO, NC, PT, BU, ND		

DPLCAN refers to the CAN functionality available within user applications hosted on the MCi2xx or SI-Applications Plus/Compact modules.

This parameter indicates the CAN message rate (msg/s) for user CAN functions.

S.07.034	DPLCAN Trip Behaviour		
Minimum	0 (No CAN Trips)	Maximum	2 (ALL CAN Trips)
Default	1 (BUS Off Only)	Units	None
Type	8 Bit User Save	Update Rate	Read on error detection
Display Format	Text	Decimal Places	0
Coding	RO		

DPLCAN refers to the CAN functionality available within user applications hosted on the MCi2xx or SI-Applications Plus/Compact modules.

This parameter can be used by the *CANEnableTrips* function within Machine Control Studio (MCS) for MCi2xx modules and SyPT Pro for the SI-Applications Plus/Compact modules to configure if and how a DPLCAN trip state is raised.

The following table details the trip behaviour values.

Table 6-2 DPLCAN Trip Behaviour

Value	Text	Description
0	No CAN Trips	The SI-CANopen V2 module will not trip the drive in the event of any CAN BUS error, however a warning will be raised.
1	Bus Off Only	The SI-CANopen V2 module will trip the drive only in the event of a BUS OFF error.
2	All CAN Trips	The SI-CANopen V2 module will trip the drive in the event of any CAN Bus error (i.e. When entering the BUS OFF or BUS PASSIVE states.

NOTE

The BUS PASSIVE trip has been added to the trip states, previously the SI-CANopen V2 (and SI-CANopen) module would not raise a trip if it was in this state.

S.07.036	DPLCAN Overwrite Enable		
Minimum	0 (Off)	Maximum	1 (On)
Default	1 (On)	Units	None
Type	1 Bit User Save	Update Rate	Module reset / initialisation
Display Format	Text	Decimal Places	0
Coding	RO		

DPLCAN refers to the CAN functionality available within user applications hosted on the MCi2xx or SI-Applications Plus/Compact modules.

This parameter specifies how the SI-CANopen V2 module behaves if a new CAN message has been received before the associated MCi2xx or SI-Applications Plus/Compact has used the *GETCAN* function to retrieve the previously received message.

With Over-write disabled (Pr **S.07.036 =** 0 (Off)) then CAN messages are queued up to a maximum of 6 messages.

With Over-write enabled (Pr **S.07.036 =** 1 (On)) then every new CAN message will over-write the previous message.

6.10 Menu 9 - Resources

S.09.001	NMT State		
Minimum	0 (Initialising)	Maximum	6 (Error)
Default	None	Units	None
Type	8 Bit Volatile	Update Rate	Background
Display Format	Text	Decimal Places	0
Coding	RO, NC, PT, BU		

This parameter displays the current NMT state in accordance with the following table.

Value	Text	Description
0	Initialising	The NMT state machine is initialising
1	Bus Off	The CAN bus is in the 'BUS OFF' state
2	Reset	The NMT state machine is resetting
3	PreOperational	The NMT state machine is in the PREOPERATIONAL state
4	Stopped	The NMT state machine is in the STOPPED state
5	Operational	The NMT state machine is in the OPERATIONAL state
6	Error	The NMT state machine has encountered an error

S.09.002	Using Saved Objects		
Minimum	0 (Off)	Maximum	1 (On)
Default	0 (Off)	Units	None
Type	1 Bit Volatile	Update Rate	Initialisation
Display Format	Text	Decimal Places	0
Coding	RO, NC, PT		

This parameter indicates if the CANopen objects have been saved via object 0x1010 (*Store parameters*).

Value	Text	Description
0	Off	CANopen objects have not been saved via 0x1010 SI-CANopen V2 is using the default configuration
1	On	CANopen objects have been saved via 0x1010 SI-CANopen V2 is using the saved configuration

S.09.030	PCB Temperature 1		
S.09.031	PCB Temperature 2		
Minimum	-128	Maximum	127
Default	None	Units	°C
Type	8 Bit Volatile	Update Rate	Background write
Display Format	Number	Decimal Places	0
Coding	RO, ND, NC, PT		

Parameters **S.09.030** and **S.09.031** display the current temperature of the 2 internal thermistors inside the module.

The CANopen module will initiate a warning message to the host drive when either parameter indicates a value of 95 ^{o}C or higher. If either parameter value reaches 102 ^{o}C, then the CANopen module will force a SlotX drive trip error.

7 Cyclic Data

7.1 What is a “Process Data Object”?

Cyclic data is implemented on CANopen networks by using “Process Data Objects” or PDOs. Separate data objects are used for transmitting (TxPDOs) and receiving (RxPDOs) data. PDO configuration objects are usually pre-configured in the CANopen master controller and downloaded to the CANopen device during initialisation using SDOs.

Mapping parameters are provided that can be used to configure each transmit and receive PDO separately. These parameters are used to set default values in the PDO mapping objects during initialisation.

NOTE Slot parameters (Pr **S.mm.ppp**) are only required for configuration of the first PDO when configuration is done without SDOs. Configuration should normally be done with SDOs, if supported by the master.

NOTE If the CANopen master controller over-writes the mapping objects, the mapping parameters are NOT automatically updated to indicate the new mappings, in the corresponding slot menus. TxPDO and RxPDO describe the direction of data transfer as seen by the nodes on a SI-CANopen network. By default TxPDOA (default TxPDO1) is configured as transmission type 255.

7.1.1 Additional PDOs and device profiles

SI-CANopen V2 supports a total of four PDOs, plus 4 device profiles. For further information on the CiA402 Device Profiles refer to section 11.41.

7.1.2 Duplicate mapping

Care must be taken to ensure that there are no conflicts between the mapping of cyclic data and the analog and digital inputs within the drive itself. SI-CANopen V2 will not indicate if there is a conflict with drive mapping parameters.
If a parameter is written to from two different sources, the value of this parameter will depend entirely upon the scan time for the parameter and the CANopen network cycle. This may cause the value in the parameter to change continuously between 2 values.

7.2 PDO data mapping errors

SI-CANopen V2 will scan and check the mapping parameter configuration for errors. If an error is detected, the drive will display an alarm; either ‘In Mapping’ or ‘Out Mapping’.

7.3 Unused PDO data channels

If any data words are not being used in an application, the un-used mapping parameters should be set to 0. Although the data word will still be transmitted over the CANopen network, any incoming data will be discarded by SI-CANopen V2, and unmapped data words being passed back to the CANopen master controller will be set to 0.

7.4 Changing PDO mapping parameters (via controller/PLC)

The mapping parameters for a PDO can only be modified when the number of mapped application objects in PDO (sub-index 0) is set to 0. This effectively disables the PDO while the mapping is modified using SDO communications.

Once all mapping parameters have been updated, the PDO sub-index 0 is set to specify the total number of defined mappings (normally 4 or 2). SI-CANopen V2 will calculate the PDO length from the mappings, and activate the changes to the PDO mappings.

7.5 Blank mapping parameters (via controller/PLC)

If multiple CANopen nodes are configured with the same COB-ID for an RxPDO, they will all receive the RxPDO at the same time. For example, in a system comprising four drives, RxPDO1 could be used to transmit a 16-bit speed reference to each node.

However, the RxPDO1 mapping in each node must be configured to use only one word received on RxPDO1, and discard all other words. This can be achieved by creating a “blank mapping”. For an RxPDO, data with a blank mapping will simply be discarded. TxPDO data values with a blank mapping will be set to 0.

Table 7-1 Blank mapping objects

Index	Object code	Name	Type	Access	PDO mapping
0x0002	DEFTYPE	***INTEGER8***	INTEGER8	RW	Yes
0x0003	DEFTYPE	***INTEGER16***	INTEGER16	RW	Yes
0x0004	DEFTYPE	***INTEGER32***	INTEGER32	RW	Yes
0x0005	DEFTYPE	***UNSIGNED8***	UNSIGNED8	RW	Yes
0x0006	DEFTYPE	***UNSIGNED16***	UNSIGNED16	RW	Yes
0x0007	DEFTYPE	***UNSIGNED32***	UNSIGNED32	RW	Yes

Unwanted data should be mapped to the DEFTYPE object of appropriate size. Bytes, words and double words are supported, but the BOOLEAN TYPE IS NOT SUPPORTED. The only other limitation is that there are only four mapping parameters per PDO, due to memory restrictions.

For example, consider RxPDOA (by default PDO1) containing four 16-bit speed references, one each for four different nodes. If a node needs to access only the 3rd word of RxPDOA and map it to Pr **18.011**, while ignoring the remaining words, the mapping configuration required is shown in Table 7-2.

Table 7-2 Example of blank mapping objects

Word	Object	Value
0	0x1600sub1	0x00030010
1	0x1600sub2	0x00030010
2	0x1600sub3	0x20120B10
3	0x1600sub4	0x00030010

NOTE Blank mapping objects allow the mappings to contain null references that are not possible by other means.

8 Non Cyclic Data

The “Service Data Object” or SDO provides the non-cyclic data channel on an CANopen system, and allows access to all objects in the CANopen object dictionary. Object access using SDO is controlled entirely by the controller/PLC.

Non-cyclic data transfer is implemented entirely in the CANopen controller/PLC. Control Techniques is unable to offer any specific technical support with regard to the implementation of non-cyclic data transfer with any particular CANopen system.

NOTE The non-cyclic data channel does not use decimal points. For example, in open loop mode, digital speed reference 1 (Pr **01.021**) has units of Hertz, accurate to one decimal place. To write a value of 24.6Hz to Pr **01.021**, the value must be transmitted as 246.

8.1 Service data object (SDO) parameter access

The service data object (SDO) provides access to all objects in the SI-CANopen V2 object dictionary, the drive and option module parameters are mapped into the object dictionary as 0x2XXX objects in the following way:

Index: 0x2000 + (0x100 * **S**) + *menu*

Sub-index: Parameter

Where **S** is the slot number, a value of 0 represents the drive, 1 to 4 represents slots 1 to 4 respectively and 5 represents the local slot

For example, Pr **20.021** would be index *0x2014* and the sub-index would be *0x15.* The values are usually expressed in base 16, so care must be taken to enter the correct parameter number.

All other supported entries in the CANopen object dictionary can also be accessed using SDOs. See Chapter 11 *CANopen reference* on page 81 for a full list of supported objects. Refer to the master controller documentation for full details about implementing SDO transfers within the particular master controller.

When accessing drive parameters using an SDO, all parameters will be treated as signed 32-bit parameters (unless Pr **S.01.021** (*Compatibility Mode*) is set to SDO SIZE COMPAT). If the target parameter is a 16-bit parameter, the data value will be cast to a 32-bit integer. The sign of the 16-bit value will be preserved.

The following SDO services are supported:

- Initiate SDO Download (*Write*)
- Initiate SDO Upload (*Read*)
- Abort SDO Transfer (*Error*)

All menu objects are treated as record types and therefore sub-index 0 will contain the number of the last parameter in that menu, this means that it is not possible to access parameter 0 in this way, to access parameter 0 the following SDO format must be used:

Index: 0x2**S**01Where **S** specifies the SI-CANopen V2 slot number

Sub-index: 0x64

SDO access to parameter 0 is only possible via the SI-CANopen V2 module, it is not possible to access parameter 0 from any other slot in this way.

The slot number specified can be either the specific slot the SI-CANopen V2 module is installed into (1, 2 or 3) or the local slot identifier value (5); using the local slot identifier value (5) simplifies the CAN master program by negating the need to know the specific slot the SI-CANopen V2 module is installed in.

8.1.1 SDO abort codes (errors)

SDO messages use a request-response mechanism and the CANopen master will always expect a response from the slave device. If an error occurs with an SDO transfer SI-CANopen V2 will return an SDO abort code to indicate the reason for the failure, the SDO abort codes are listed in Table 8-1.

Table 8-1 SDO abort codes

Abort code (in hex.)	Description
0x05030000	Toggle bit not alternated.
0x05040000	SDO protocol timed out.
0x05040001	Client/server command specifier not valid or unknown.
0x05040002	Invalid block size (block mode only).
0x05040003	Invalid sequence number (block mode only).
0x05040004	CRC error (block mode only).
0x05040005	Out of memory.
0x06010000	Unsupported access to an object.
0x06010001	Attempt to read a write only object.
0x06010002	Attempt to write a read only object.
0x06020000	Object does not exist in the object dictionary.
0x06040041	Object cannot be mapped to the PDO.
0x06040042	The number and length of the objects to be mapped would exceed PDO length.
0x06040043	General parameter incompatibility.
0x06040047	General internal incompatibility in the device.
0x06060000	Access failed due to a hardware error.
0x06070010	Data type does not match, length of service parameter does not match.
0x06070012	Data type does not match, length of service parameter too high.
0x06070013	Data type does not match, length of service parameter too low.
0x06090011	Sub-index does not exist.
0x06090030	Value range of parameter exceeded (only for write access).
0x06090031	Value of parameter written too high.
0x06090032	Value of parameter written too low.
0x06090036	Maximum value is less than minimum value.
0x08000000	General error.
0x08000020	Data cannot be transferred or stored to the application.
0x08000021	Data cannot be transferred or stored to the application because of local control.
0x08000022	Data cannot be transferred or stored to the application because of the present device state.
0x08000023	Object dictionary dynamic generation fails or no object dictionary is present.

9 Control / status word

9.1 What are control and status words?

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

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

9.2 Control word

The SI-CANopen V2 control word consists of sixteen control bits some of which are reserved. See Table 9-1 for the individual bit function descriptions.

Table 9-1 Control word bit definitions

b15	b14	b13	b12	b11	b10	b9	b8
	KEYPAD WDOG	RESET	TRIP			JOG REV	REMOTE

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

To enable fieldbus control, the Control Word Enable (Pr **06.043**) and the AUTO bit (b7) must both be set to '1'. When the AUTO bit is reset to 0 the drive will revert to terminal control.

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

The control word REMOTE bit directly controls the drive parameter Pr **01.042**, the function of which is to select the digital speed reference as the source of the drive's speed reference. When the REMOTE bit is reset to 0 the drive will revert to using the external analog speed reference.

The actual digital speed reference selected when REMOTE is set to 1 will be Pr **01.021**, which is also the default mapping for the fieldbus speed reference. However Pr **01.015** can be used to change which of the digital references is selected. For further details on the drive digital speed reference, please refer to the appropriate drive user guide.

Table 9-2 lists in detail the function of each control word bit. For further in-depth details about drive control words and sequencing bits please refer to the appropriate drive documentation.

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

NOTE By default data alignment is set to 32 and therefore the control word will be cast as 32-bit with bits 16 to 31 reserved.

Table 9-2 Control word bit functions

Bit	Function	Description
0	ENABLE	Set to 1 to enable the drive. Resetting to 0 will immediately disable the drive, and the motor will coast to a stop. The external SAFE TORQUE OFF signal must also be present before the drive can be enabled.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward direction. When reset to 0, the drive will decelerate the motor to a controlled stop.
2	JOG FWD	Set to 1 to jog the motor forward. This signal needs to be used in conjunction with the ENABLE bit. This signal is overridden by a RUN, RUN REV or RUN FWD signal.
3	RUN REV	Set to 1 (with ENABLE set to 1) to run the motor in the reverse direction. When reset to 0, the drive will decelerate the motor to a controlled stop.
4	FWD REV	Set to 1 to select the reverse direction. Set to 0 to run in the forward direction. The RUN signal is used to start and stop the motor.
5	RUN	Set to 1 to run the motor. FWD REV is used to select the direction of motor rotation. When reset to 0, the drive will decelerate the motor to a controlled stop.
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 **06.004** must be correctly set for this to function.
7	AUTO	Set to 1 to enable fieldbus control of the drive Control Word. The Control Word Enable (Pr **06.043**) must also be set to 1. When reset to 0, the drive will operate under terminal control.
8	REMOTE	Set to 1 to select digital speed reference 1 (Pr **01.021**), and reset to 0 to select analog reference 1 (Pr **01.036**). REMOTE directly controls Pr **01.042**, so reference selector (Pr **01.014**) and preset selector (Pr **01.015**) must both be set to 0 (default) for the REMOTE bit to work properly.
9	JOG REV	Set to 1 to jog the motor in reverse. This signal needs to be used in conjunction with the ENABLE bit. This signal is overridden by a RUN/RUN REV/RUN FWD command.
10	Reserved	
11	Reserved	
12	TRIP	Set to 1 to trip the drive at any time. The trip display on drive will be CL.bit and the trip code will be 35. AUTO (b7) has no effect on this function. The trip cannot be cleared until TRIP is reset to 0.

Bit	Function	Description
13	RESET	A 0-1 transition of the RESET bit will reset the drive from a trip condition. If the reason for the trip is still present, or another fault condition has been detected, the drive will immediately trip again. When resetting the drive, it is recommended to check the status word to ensure that the reset was successful, before attempting to re-start the drive.
14	KEYPAD WDOG	This watchdog is provided for an external keypad or other devices where a break in the communication link must be detected. The watchdog system can be enabled and/or serviced if this bit is changed from zero to one while the control word enabled. Once the watchdog is enabled it must be serviced at least once every second or an SCL trip will occur. The watchdog is disabled when an SLC trip occurs, and so it must be re-enabled when the trip is reset.
15	Reserved	

9.3 Status word

The SI-CANopen V2 status word consists of sixteen control bits some of which are reserved. See Table 9-3 for the individual bit function descriptions.

Table 9-3 Status word bit definitions

b15	b14	b13	b12	b11	b10	b9	b8
(Not used)	Supply loss	Reverse direction running	Reverse direction commanded	Brake resistor alarm	Braking IGBT active	Regenerating	Current limit active

b7	b6	b5	b4	b3	b2	b1	b0
Rated load reached	Above set speed	At set speed	Below set speed	Running at or below minimumspeed	Zero speed	Drive active	Drive OK/healthy

The fieldbus status word is mapped directly from the drive status word, Pr **10.040**.

Pr **10.040** contains the values of several individual drive status bits; Table 9-4 shows the function indicated by each bit in the status word when set to 1.

Table 9-4 Drive status word bit functions

Bit	Parameter	Description
0	Pr **10.001**	bit 0 = 0: Drive not ok (tripped). bit 0 = 1: Drive ok.
1	Pr **10.002**	**Drive active** When bit 1 = 1, the drive is in run mode.
2	Pr **10.003**	**Zero speed** In Open Loop mode, zero speed indicates that the absolute value of the post-ramp speed reference is at or below the zero speed threshold. In RFC-A and RFC-A modes, zero speed indicates that the absolute value of speed feedback is at or below the zero speed threshold.
3	Pr **10.004**	**Running at or below minimum speed** In bipolar mode (Pr **01.010** = 1) Pr **10.004** is the same as zero speed, Pr **10.003**. (See above.) In unipolar mode, Pr **10.004** is set if the absolute value of the post-ramp speed reference (Pr **02.001**) or speed feedback (Pr **03.002**) is at or below minimum speed + 0.5Hz or 5 rpm. (Minimum speed is defined by Pr **01.007**.) This parameter is only set if the drive is running.
4	Pr **10.005**	**Below set speed** Only set if the drive is running at below set speed. Refer to Pr **03.006**, Pr **03.007** and Pr 0**3.009** in the drive documentation for more details.
5	Pr **10.006**	**At speed** Only set if the drive is running at set speed. Refer to Pr **03.006**, Pr **03.007** and Pr **03.009** in the drive documentation.
6	Pr **10.007**	**Above set speed** Only set if the drive is running at above set speed. Refer to Pr **03.006**, Pr **03.007** and Pr **03.009** in the drive documentation for more details.
7	Pr **10.008**	**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 drive documentation for more details.
8	Pr **10.009**	**In current limit** Indicates that the current limits are active.
9	Pr **10.010**	**Regenerating** Indicates that power is being transferred from the motor to the drive. Regen mode: Indicates that power is being transferred from the drive to the supply.
10	Pr **10.011**	**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.

Bit	Parameter	Description
11	Pr **10.012**	**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 **10.013**	**Reverse direction commanded** Direction commanded is set to 1 if the Pre-ramp speed reference (Pr **01.003**) is negative and reset to 0 if the Pre-ramp speed reference is zero or positive.
13	Pr **10.014**	**Reverse direction running** A 0 indicates forward direction and a 1 indicates reverse direction. The source of this bit is Pr **02.001** for open loop mode and Pr **03.002** for RFC-A and RFC-S modes.
14	Pr **10.015**	**Supply loss** Supply loss indicates that the drive has detected a supply loss from the level of the DC bus voltage. This parameter can only become active if supply loss ride through or supply loss stop modes are selected. In regen mode, supply loss is the inverse of Pr **03.007**.
15	(Not Used)	**Reserved**

10 EDS Files

10.1 What are EDS files?

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

EDS files are not downloaded to the PLC or scanner, and are only used during network configuration. It is actually possible to configure a network without the EDS files.

10.2 Generic EDS files

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

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

10.3 EDS File names

Control Techniques currently provide EDS files for the following products, note that other products may be added to the list as they become available.

- Commander C200/C300
- Elevator E300
- Unidrive M200/M300/M400
- Unidrive M700/M701/M702/M708/M709
- Digitax HD M750/M751/M753
- F600 Pump Drive

The file names use the following naming convention:

<Derivative>_<Options>_<Drive Mode>

- <Derivative> specifies the drive derivative as indicated in Pr **11.028**, e.g. M700, M751, etc.
- <Options> specifies the appropriate CANopen setup options, the following options are used:

Option	Description
CIA417	Elevator E300 with SI-CiA417 option module (slot 3)
G	Generic file - SI-CANopen module only fitted • SI-Applications options module not fitted • SI-IO options module not fitted • SI-Universal Encoder options module not fitted • Data compression is disabled (Pr **S.01.014** = 32) • CiA 402 protocol disabled (Pr **S.01.020** = Off)
GAP	SI-Applications module fitted • Bit b28 of the Device Type object (0x1000) set to 1
GIO	Elevator E300 with SI-IO option module
GIOUE	Elevator E300 with SI-IO and SI-Universal Encoder option modules
DC	Data compression is enabled (alignment set to 16-bit) • Bit b27 of the Device Type object (0x1000) set to 1 (see Pr **S.01.014)**
DP	Device Profiles enabled (see Pr **S.01.020**)

- <Drive Mode> specifies the drive operating mode (Pr **11.084**), the possible modes are:
  - Open-loop
  - RFC-A
  - RFC-S

10.4 Selecting the correct EDS Files

The correct EDS file must be used for the drive and any option modules fitted to be accessed correctly by the SI-CANopen V2 module, failure to use the correct file may result in either incorrect and unexpected operation, or unexpected errors and trip conditions.

The main reasons for using the correct EDS file are:

- The drive product information (type, number etc.) returned from CANopen objects must match the expected information in the associated EDS file (if the relevant checks are enabled in the CANopen master)
- Access to option module (SI-Applications, SI-IO or SI-Universal Encoder) parameters will result in errors if the relevant EDS file is not used

By default, the EDS file name used will match the drive derivative type indicated in Pr **11.028** (M700, C200, etc.), the exception to this is if the SI-

CANopen V2 is configured in one of the compatibility modes (not mode 5 "SDO SIZE COMPAT"), (Pr **S.01.021** <> 3 "UNIDRIVE M" for V2 firmware, or "UNIDRIVE M AUTO" for V1 firmware).

Compatibility Mode

If Pr **S.01.021** (*Compatibility Mode*) is not set to the default "UNIDRIVE M" AND not set to "SDO SIZE COMPAT" then the following apply:

- For Unidrive M700/M701/M702 drives in Hybrid mode (0) then the EDS files M70X must be used, all other drives should use the relevant drive derivative EDS files
- For all other compatibility modes (1,2, and 4) then the relevant drive derivative EDS files must be used

This is shown in the following table:

Table 10-1 Compatibility Mode

Compatibility Mode (Pr S.01.021)		
Value	**Display**	**EDS File**
0	Hybrid	Unidrive M700/M701/M702: Use M70X file All other drives: Use generic derivative files
1	UNIDRIVE SP	Use Unidrive SP files
2	COMMANDER SK	Use Commander SK files
3	UNIDRIVE M	Use generic Unidrive M derivative files
4	SK PDO COMPAT	Use Commander SK files
5	SDO SIZE COMPAT	Use generic Unidrive M derivative files
6	CIA 402 Profile	CiA 402 Motion profile support

11 CANopen reference

11.1 CANopen object dictionary

The CANopen Object Dictionary defines a series of objects which contain data values in order to configure SI-CANopen V2.

11.1.1 Standard CiA301 CANopen supported objects

Table 11-1 Standard CiA301 CANopen objects

Object (0x)	Name	PDO mapping
1000	Device type	No
1001	Error register	No
1002	Manufacturer status register	No
1003	Pre-defined error field	No
1005	COB-ID SYNC	No
1006	Communication cycle period	No
1007	Synchronous window length	No
1008	Manufacturer device name	No
1009	Manufacturer hardware version	No
100A	Manufacturer software version	No
1010	Store parameters	No
1011	Restore default parameters	No
1014	COB-ID EMCY	No
1016	Consumer heartbeat time	No
1017	Producer heartbeat time	No
1018	Identity object	No
1400 to140F	Communication parameters for RxPDO[n]	No
1600 to 160F	Mapping parameters for RxPDO[n]	No
1800 to 180F	Communication parameters for TxPDO[n]	No
1A00 to 1A0F	Mapping parameters for TxPDO[n]	No

Table 11-2 Manufacturer specific objects

Object (0x)	Name
2000 to 2029	Drive menus 0 to 41
2SMM	Slot specific drive menus (S = slot number, MM = menu number)
25MM	Local SI-CANopen V2 option menu, MM = menu number (00 to 09)
2800	RxPDO number configuration
2801	TxPDO number configuration
2820	RxPDO-A event configuration
2821	RxPDO-B event configuration
2822	RxPDO-C event configuration
2823	RxPDO-D event configuration
2830	SYNC event configuration
2831	Missed heartbeat event configuration
2832	TxPDO profile specific mode
2840	RxPDO-A trigger configuration
2841	RxPDO-B trigger configuration
2842	RxPDO-C trigger configuration
2843	RxPDO-D trigger configuration
2850	TxPDO-A trigger configuration
2851	TxPDO-B trigger configuration
2852	TxPDO-C trigger configuration
2853	TxPDO-D trigger configuration
2860	Startup object list
2862	Background associations
3000	Position feedback encoder source
3003	Homing source configuration
3004	Additional position loop scaling
3008	Velocity mode redirection enable
3009	Manufacturer enhanced scaling

Table 11-3 Supported CiA 402 device profile object dictionary

Object (0x)	Name	Operating Mode				
		Interpolated Position	VL Velocity	Profile Torque	Profile Position	Homing
6007	Abort connection option code	✓	✓	✓	✓	✓
603F	Error code	✓	✓	✓	✓	✓
6040	Control word	✓	✓	✓	✓	✓
6041	Status word	✓	✓	✓	✓	✓
6042	VL target velocity	x	✓	x	x	x
6043	VL velocity demand	x	✓	x	x	x
6044	VL velocity actual value	x	✓	✓	✓	✓
6046	VL velocity min max amount	x	✓	x	x	x
6048	VL velocity acceleration	x	✓	x	x	x
6049	VL velocity deceleration	x	✓	x	x	x
604A	VL velocity quickstop	✓	✓	✓	✓	✓

Object (0x)	Name	Operating Mode				
		Interpolated Position	VL Velocity	Profile Torque	Profile Position	Homing
604B	VL setpoint factor	x	✓	x	x	x
604C	VL velocity dimension factor	x	✓	x	x	x
604D	VL pole number	x	✓	x	x	x
605A	Quick stop option code	✓	✓	✓	✓	✓
605B	Shutdown option code	✓	✓	✓	✓	✓
605C	Disable operation option code	✓	✓	✓	✓	✓
605D	Halt option code	✓	✓	✓	✓	✓
605E	Fault reaction option code	✓	✓	✓	✓	✓
6060	Modes of operation	✓	✓	✓	✓	✓
6061	Modes of operation display	✓	✓	✓	✓	✓
6062	Position demand value	✓	x	x	✓	x
6064	Position actual value	✓	✓	✓	✓	✓
6065	Following error window	✓	x	x	✓	x
6067	Position window	✓	x	x	✓	x
6068	Position window time	x	x	x	✓	x
606B	Velocity demand value	✓	x	x	✓	x
606C	Velocity actual value	✓	✓	✓	✓	✓
6071	Target torque	x	x	✓	x	x
6073	Max current	✓	✓	✓	✓	✓
6075	Motor rated current	✓	✓	✓	✓	✓
6077	Torque actual value	✓	✓	✓	✓	✓
6078	Current actual value	✓	✓	✓	✓	✓
607A	Target position	✓	x	x	✓	x
607B	Position range limit	x	x	x	✓	x
607C	Home offset	x	x	x	x	✓
607D	Software position limit	x	x	x	✓	x
607F	Max profile velocity	✓	x	x	✓	x
6080	Max motor speed	✓	✓	✓	✓	✓
6081	Profile velocity	x	x	x	✓	x
6083	Profile acceleration	x	x	x	✓	x
6084	Profile deceleration	x	x	x	✓	x
6085	Quickstop deceleration	✓	x	x	✓	✓
6086	Motion profile type	x	x	x	✓	x
6087	Torque slope	x	x	✓	x	x

Object (0x)	Name	Operating Mode				
		Interpolated Position	VL Velocity	Profile Torque	Profile Position	Homing
6088	Torque profile type	x	x	✓	x	x
608F	Position encoder resolution	✓	✓	✓	✓	✓
6091	Gear ratio	✓	✓	✓	✓	✓
6092	Feed constant	✓	✓	✓	✓	✓
6098	Homing method	x	x	x	x	✓
6099	Homing speeds	x	x	x	x	✓
609A	Homing acceleration	x	x	x	x	✓
60A4	Profile jerk	x	x	x	✓	x
60B1	Velocity offset	✓	x	x	✓	x
60B2	Torque offset	✓	x	x	✓	x
60C0	Interpolation sub mode select	✓	x	x	x	x
60C1	Interpolation data record	✓	x	x	x	x
60C2	Interpolation time period	✓	x	x	x	x
60C5	Max acceleration	✓	x	x	✓	x
60C6	Max deceleration	✓	x	x	✓	x
60F2	Positioning option code	x	x	x	✓	x
60F4	Following error actual value	✓	x	x	✓	x
60FA	Control effort	✓	x	x	✓	x
60FB	Position control parameter set	✓	✓	✓	✓	✓
60FF	Target velocity	✓	✓	x	✓	x
6502	Supported drive modes	✓	✓	✓	✓	✓

11.2 Basic data types

These are basic data types and are available in order to facilitate the need to set mappings to parameters of null values (i.e. when creating blank mappings). 'In' mappings or TxPDOs to these objects will return 0. An 'out' mapping or RxPDO will reference a null object of predefined size. For example, if only a single 16 bit word is used within a PDO the remaining words that are unused within the particular drive should be mapped to a null data type of the appropriate size.

Index	Name	Size (bits)	Range	Description
0x0002	INTEGER8	8	-128 to 127	Signed short integer (SINT)
0x0003	INTEGER16	16	-32768 to 32767	Signed integer (INT)
0x0004	INTEGER32	32	-2^{31} to $2^{31}-1$	Signed double integer (DINT)
0x0005	UNSIGNED8	8	0 to 255	Unsigned short integer (USINT)
0x0006	UNSIGNED16	16	0 to 65535	Unsigned integer (UINT)
0x0007	UNSIGNED32	32	0 to $2^{32}-1$	Unsigned double integer (UDINT)

11.3 0x1000 - Device type

Index	0x1000	**Sub-index**	0	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32	**Object code**	VAR

Device type indicates the current configuration of the drive and SI-CANopen V2 module and is used by some CANopen master controllers to ensure that the correct EDS file is being used.

Reserved	Apps Module	PDO Data Alignment	Drive Mode	Device Type	Device Profile Number
b31-b29	b28 See Table 11-8	b27 See Table 11-7	b26-b24 See Table 11-6	b23-b16 See Table 11-5	b15-b0 See Table 11-4

Device type is constructed using the values as indicated in the following tables.

Table 11-4 Device profile number

Value	Description
0 (0x0)	CiA 402 disabled (Pr **S.01.020** = Off)
402 (0x192)	CiA 402 enabled (Pr **S.01.020** = On)

Table 11-5 Device Type

Value	Description
0 (0x0)	CiA 402 disabled
1 (0x1)	CiA 402 enabled and drive in Open-loop or Regen mode
2 (0x2)	CiA 402 enabled and drive in RFC-A or RFC-S mode

Table 11-6 Drive Mode

Mode	Description
0 (0x0)	Commander SK compatibility mode and not in open-loop mode
1 (0x1)	Open-loop mode
2 (0x2)	RFC-A mode
3 (0x3)	RFC-S mode
4 (0x4)	Regen mode

Table 11-7 PDO Data Alignment

Value	Description
0 (0x0)	Pr **S.01.014** (*PDO Data Alignment*) is set to 32 or 8
1 (0x1)	Pr **S.01.014** (*PDO Data Alignment*) is set to 16

Table 11-8 Applications Module

Value	Description
0 (0x0)	No SI-Applications/MCi2x0 option fitted
1 (0x1)	At least one SI-Applications/MCi2x0 option fitted

NOTE

If the drive mode is changed then SI-CANopen V2 will automatically reset itself to initialise with the appropriate parameter database.

11.4 0x1001 - Error register

Index	0x1001	**Sub-index**	0	**Access**	RO
Default	N/A	**Data type**	UNSIGNED8	**Object code**	VAR

The ***error register*** is used by SI-CANopen V2 to indicate that an error has occurred. If a bit is set to 1, the specified error has occurred. The ***error register*** is part of the emergency object, refer to *section 11.39 0x1014 - Emergency object* on page 124 for further details.

Bit	Error
0	Generic error
1	Current
2	Voltage
3	Temperature
4	Reserved
5	Reserved
6	Reserved
7	Manufacturer specific

11.5 0x1002 - Manufacturer status register

Index	0x1002	**Sub-index**	0	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32	**Object code**	VAR

The ***manufacturer status register*** is mapped directly to the status word (Pr **10.040)** in the drive. See section 9.3 *Status word* on page 77 for more details about the drive status word.

11.6 0x1003 - Pre-defined error field

Index	0x1003
Object code	ARRAY
Data type	UNSIGNED32

The ***pre-defined error field*** returns a 32-bit error code containing data from the last four emergency messages that were sent. If less than four emergency objects have been sent, the higher sub-indexes will not exist.

Byte 3	Byte 2	Byte 1	Byte 0
Drive trip code (Pr **10.020**)	SI-CANopen V2 error code	Emergency object error code	

number of errors

Index	0x1003	**Sub-index**	0	**Access**	RO
Default	4	**Data type**	UNSIGNED8	**Object code**	VAR

Sub-index 0 is an unsigned8 data type which indicates the highest sub-index for the ***pre-defined error field***. The rest of the array are unsigned32 data types.

error field 1

Index	0x1003	**Sub-index**	1	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32	**Object code**	VAR

Returns the last emergency object codes.

error field 2

Index	0x1003	**Sub-index**	2	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32	**Object code**	VAR

Returns the 2nd last emergency object codes.

error field 3

Index	0x1003	**Sub-index**	3	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32	**Object code**	VAR

Returns the 3rd last emergency object codes.

error field 4

Index	0x1003	**Sub-index**	4	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32	**Object code**	VAR

Returns the 4th last emergency object codes.

11.7 0x1005 - COB-ID SYNC

Index	0x1005	**Sub-index**	0	**Access**	RW
Default	0x00000080	**Data type**	UNSIGNED32	**Object code**	VAR

COB-ID SYNC defines the COB-ID that will be used for the synchronisation (SYNC) object. The SI-CANopen V2 receives the SYNC message, but it cannot be used to generate the SYNC object.

b31	**b30**	**b29**	**b28 - b11**	**b10 - b0**
0	0	0	00000000000000000	11-bit CAN-ID

The upper 3 bits (b31-b29) are used to specify the SYNC behaviour of SI-CANopen V2.

Bit	**Value**	**Comment**
31	0	Reserved.
30	0	SI-CANopen V2 consumes the SYNC message.
29	0	11-bit CAN identifier.

Refer to section 11.21.3 *RxPDO transmission type* on page 97 and section 11.23.3 *TxPDO transmission type* on page 100 for details of the transmission types that use the SYNC object.

11.8 0x1006 - Communication cycle period

Index	0x1006	**Sub-index**	0	**Access**	RW
		Data type	UNSIGNED32	**Default**	4000

This is set by the CANopen master to specify the period (µs) between SYNC messages transmitted to SI-CANopen V2 module.

The value is specified in units of microseconds (µs) with a 1000 µs resolution and a minimum value of 1000 µs.

11.9 0x1007 - Synchronous window length

Index	0x1007	**Sub-index**	0	**Access**	RW
		Data type	UNSIGNED32	**Default**	2000

This is set by the CANopen master to specify the period (µs) at which the SI-CANopen V2 module should write the received RxPDO data and transmit the TxPDO data.

The value is specified in units of microseconds (µs) with a 1000 µs resolution and a minimum value of 1000 µs.

11.10 0x1008 - Manufacturer device name

Index	0x1008	**Sub-index**	0	**Access**	CONST
Default	SI-CANopen	**Data type**	STRING	**Object code**	VAR

Returns the string “SI-CANopen” to indicate the product name.

11.11 0x1009 - Manufacturer hardware version

Index	0x1009	**Sub-index**	0	**Access**	CONST
Default	UF707	**Data type**	STRING	**Object code**	VAR

Returns the string “UF707” to indicate the product hardware.

11.12 0x100A - Manufacturer software version

Index	0x100A	**Sub-index**	0	**Access**	CONST
Default		**Data type**	STRING	**Object code**	VAR

Returns a string to indicate the SI-CANopen V2 firmware version installed. The string will be formatted as “Ver. ww.xx.yy" where ww, xx and yy represent the first three sets of numbers of the SI-CANopen V2 firmware version displayed in Pr **MM.002**.

11.13 0x1010 - Store parameters

This object (0x1010) supports the saving of the CiA 301 and CiA 402 objects including all SI-CANopen V2 module parameters in non-volatile memory.

If this object is used then, to avoid invalidating the configuration, it is recommended that the user does not perform a parameter save by any other means (keypad, drive communication interface etc.).

Index	Sub-index	Description
0x1010	0	Will return 1 when read to indicate that the “save all parameters” option is supported.
0x1010	1	Will return 1 when read to indicate that the module can save parameters. Writing the save signature of 0x65766173 will cause the following actions. Pr **mm.000** = 1000 Set the drive to save its parameters. Pr **10.038** = 100 Reset the drive to perform the save. Writing this signature will also save all objects where storage is supported.

The module reset that follows the parameter save will be inhibited to prevent loss of communications. It is recommended that this procedure is done once during commissioning/start up.

Due to Legacy operation complexities, the save and restore of CANopen objects using objects 0x1010 and 0x1011 respectively, has dependencies on parameter configuration. Parameters are used to define the PDO ordering and if the configuration should take settings from internal menu/parameter setup or via Master setup. Local module parameters will be stored when the save command is executed to ensure correct operation.

Save, default and restore for drive parameters can be performed using the standard Unidrive M approach via parameter **mm.000**. The default will also remove any objects stored if a save is performed using object 0x1010.

To access parameter 0, use SDO Object 0x2S01:100 where S = slot number of the CANopen module.

For CANopen objects including CiA 301 and CiA 402 objects, the user will need to perform a save via CANopen object 0x1010, and to default the CANopen module, object 0x1011. The save command also forces a parameter save in the SI-CANopen V2 module. The default will force a full default of the parameters and objects in the CANopen module.

NOTE

Parameter **S.09.001** (*Using Saved Objects*) indicates whether the SI-CANopen V2 objects are being stored as a result of writing to this object.

11.14 0x1011 - Restore default parameters

With this object (0x1011) the default values of the host drive and SI-CANopen V2 module parameters according to the communication or device profile are restored.

Index	Sub-index	Description
0x1011	0	Will return 1 when read to indicate that the “restore default parameters” option is supported.
0x1011	1	Will return 1 when read to indicate that the module can restore parameters. Writing the save signature of 0x64616F6C will cause the following actions: • The SI-CANopen V2 module parameters will be set to their default values (**S.01.003** = 1) • All supported objects will be defaulted

The module reset that follows the parameter save will be inhibited to prevent loss of communications. This will allow the communication parameters to be configured prior to a reset.

Stored objects

The following objects will always be stored in internal flash.

0x1005 - COB-ID SYNC
0x1014 - COB-ID EMCY
0x1016 - Consumer Heartbeat Time
0x1017 - Producer Heartbeat time
0x1400 - 0x1BFF – PDO configuration objects
0x2820 - 0x2833 - RxPDO event configuration
0x2830 - SYNC event configuration
0x2831 - Missed Heartbeat event configuration
0x2832 - TxPDO profile specific mode
0x2840 - 0x2843 - RxPDO trigger configuration
0x2850 - 0x2853 - TxPDO trigger configuration

The following objects will only be stored in internal memory if profiles are enabled and SI-CANopen V2 over-riding is not enabled.

0x3003 - Homing source configuration
0x3004 - Additional position loop scaling
0x6046 - VL min max amount
0x6048 - VL velocity acceleration
0x6049 - VL velocity deceleration
0x604C - VL dimension factor

0x605A - Quick stop option code
0x605B - Shutdown option code
0x605C - Disable operation option code
0x605D - Halt option code
0x605E - Fault reaction option code
0x6060 - Modes of operation
0x6065 - Following error window
0x6067 - Position window
0x607C - Home offset
0x607D - Software position limit
0x6083 - Profile acceleration
0x6084 - Profile deceleration
0x6085 - Quick stop deceleration
0x6087 - Torque slope
0x6091 - Gear ratio
0x6092 - Feed constant
0x60B1 - Velocity offset
0x60B2 - Torque offset
0x60C5 - Max acceleration
0x60C6 - Max deceleration
0x60FB - Position control parameter set
0x6098 - Homing method
0x6099 - Homing speeds
0x609A - Homing acceleration

Objects defined by object association in an SI-Applications module will not get saved in internal flash due to the time required to discover available objects and the space that would be required to store the potentially large number of objects. If these objects need saving then it will be the responsibility of the user program to ensure they are stored.

11.15 0x1014 - COB-ID EMCY

Index	0x1014	**Sub-index**	0	**Access**	RW
Default	0x00000080 + node address	**Data type**	UNSIGNED32	**Object code**	VAR

COB-ID EMCY defines the COB-ID to be used for the emergency object.

b31	b30	b29	b28 - b11	b10 - b0
0	0	0	00000000000000000	11-bit ID

The upper 3 bits (b31-b29) are used to specify the emergency object behaviour of SI-CANopen V2.

Table 11-9 COB-ID SYNC configuration

Bit	Value	Comment
31	0	EMERGENCY object always exists
30	0	Reserved
29	0	11-bit CAN identifier

Refer to *section 11.39 0x1014 - Emergency object* on page 124 for full details about the emergency object.

11.16 0x1016 - Consumer heartbeat time

The “heartbeat protocol” is a node protection system or error control service. A “heartbeat consumer” is usually a CANopen master controller device which transmits a heartbeat message cyclically. This message is received by one or more “heartbeat producer” devices (e.g SI-CANopen V2), and indicates to these devices that the CANopen master controller is communicating successfully.

If the heartbeat message is not received within the defined time period, a “heartbeat event” will be generated in the SI-CANopen V2, allowing it to take appropriate action to ensure system safety is maintained.

This object defines the CANopen node address to monitor and cyclic time period (in milliseconds) that the CANopen master controller is expected to transmit it’s heartbeat message. A value of 0 disables the heartbeat monitoring.

Last sub-index

Index	0x1016	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	1				

Indicates the number of the last sub-index in the object.

Consumer heartbeat cycle time

Index	0x1016	**Object code**	VAR	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	No
Default	0	**Units**	ms	**Maximum**	8388607

Sub-index 1 specifies the CANopen master controller node address to monitor and the consumer heartbeat cycle time in milliseconds (ms).

The consumer heartbeat cycle time must be greater than the corresponding producer heartbeat time configured on the SI-CANopen V2 module (object 0x1017).

If the consumer heartbeat message is not received within the specified time then the SI-CANopen V2 module will return to the PRE-OPERATIONAL state and the configured object 0x2831 actions will be performed.

If the specified node address is incorrect (i.e. not the CANopen master controller node address) or set to 0 then the configured object 0x2831 actions will not be performed.

The following tables illustrates the bit significance of the consumer heartbeat cycle time value.

b31	**b30**	**b29**	**b28**	**b27**	**b26**	**b25**	**b24**	**b23**	**b22**	**b21**	**b20**	**b19**	**b18**	**b17**	**b16**
Reserved								CANopen master node address							
0															

b15	**b14**	**b13**	**b12**	**b11**	**b10**	**b9**	**b8**	**b7**	**b6**	**b5**	**b4**	**b3**	**b2**	**b1**	**b0**
Consumer Heartbeat Cycle Time (ms)															

For example, if the CANopen master node address is 127 and a timeout value of 16 ms is required then sub-index 1 should be set to the value 0x007F0010.

11.17 0x1017 - Producer heartbeat time

Index	0x1017	**Sub-index**	0	**Access**	RW
Default	0	**Data type**	UNSIGNED16	**Object code**	VAR

The “heartbeat protocol” is a node protection system or error control service. A “heartbeat producer” is usually a CANopen slave device which transmits a heartbeat message cyclically. This message is received by one or more “heartbeat consumer” devices, usually the CANopen master controller, and indicates to the master controller that the slave device is communicating successfully.

If the heartbeat message is not received within the defined time period, a “heartbeat event” will be generated in the master controller, allowing it to take appropriate action to ensure system safety is maintained.

The producer heartbeat time defines the cyclic time period (in milliseconds) for SI-CANopen V2 to transmit the heartbeat message. A value of 0 disables the heartbeat message. The heartbeat message also includes the current NMT state of the SI-CANopen V2.

Table 11-10 SI-CANopen V2 operating states

State	Operating state
0	BOOTUP
4	STOPPED
5	OPERATIONAL
127	PRE-OPERATIONAL

The SI-CANopen V2 will start transmitting the heartbeat message as soon as it is enabled. If the ***producer heartbeat time*** is set >0 at power up, SI-CANopen V2 will start transmitting the heartbeat message when the transition from BOOTUP to PRE-OPERATIONAL occurs. In this case, the boot-up message is regarded as the first heartbeat message.

11.18 0x1018 - Identity object

Index	0x1018
Object code	RECORD
Data type	UNSIGNED32

Identity object returns general information about the SI-CANopen V2.

Number of entries

Index	0x1018	**Sub-index**	0	**Access**	RO
Default	4	**Data type**	UNSIGNED8		

Returns the highest sub-index available for the identity object.

Vendor ID

Index	0x1018	**Sub-index**	1	**Access**	RO
Default	0xF9	**Data type**	UNSIGNED32		

Returns the SI-CANopen V2 vendor ID (0xF9) for Control Techniques.

Product code

Index	0x1018	**Sub-index**	2	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32		

This sub-index, by default, returns the drive product code. If the SI-CANopen V2 module is configured in one of the compatibility modes then it will return the CANopen module ID code for the selected drive.

The following tables shows how this value is determined if the SI-CANopen V2 is not configured in compatibility mode, i.e. Pr **S.01.021** = UNIDRIVE M (0), SDO SIZE COMPAT (5) or CIA 402 Profile (6).

Product code value for non-compatibility modes

Byte			
3 (MSB)	**2**	**1**	**0 (LSB)**
Drive Generation	**Drive Mode**	**Drive Derivative**	**Drive Type**
1	Derived from Pr **11.084**	Derived from Pr **11.028**	See below

Drive Type (byte0)

Value	Description
0	Leroy Somer
1	Mentor MP
2	Unidrive M600/M7xx, Digitax HD
3	Unidrive M200/M400, Commander C200/C300
4	MEV
5	E300

Drive Derivative (byte1)

Value	Description
1	Unidrive M700
2	Unidrive M701
3	Unidrive M702 / Unidrive M200
4	Unidrive M800 / Unidrive M201
5	Unidrive M600 / Unidrive M300
6	Unidrive M810 / Unidrive M400
7	Unidrive HS30
8	Elevator E200 / Commander C200
9	Elevator E300 / Commander C300
10	H300
11	F600
12	HS70
13	HS71
14	HS72
15	Digitax HD M753
16	Digitax HD M751
17	Digitax HD M750
18	Digitax HD M754
19	Digitax HD M750S
20	Digitax HD M751S
21	Digitax HD M753S
22	Digitax HD M754S
23	F600 Pump Drive
24	Unidrive M880
25	Unidrive M881
26	Unidrive M882
27	Unidrive M888
28	Unidrive M889
29	*Reserved*
30	*Reserved*
31	Unidrive M708
32	Unidrive M709

Drive Mode (byte2)

Value	Description
1	Open loop
2	RFC-A
3	RFC-S
4	Regen

When the SI-CANopen V2 module is configured in compatibility mode (Pr **S.01.021** = Hybrid (0), UNIDRIVE SP (1), COMMANDER SK (2) or SK PDO COMPAT (4)), SI-CANopen V2 will return the CANopen module ID code for the selected drive as shown in the following table.

Product code value for compatibility modes

Mode	Value	Description
Hybrid (0)	448	SI-CANopen V2 module ID code is returned
UNIDRIVE SP (1)	408	SM-CANopen module ID code is returned
COMMANDER SK (2)	408	SM-CANopen module ID code is returned
SK PDO COMPAT (4)	408	SM-CANopen module ID code is returned

Revision number

Index	0x1018	**Sub-index**	3	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32		

Returns the SI-CANopen V2 firmware version.

The CANopen specification only allows for 6 digits (WWXXYY) to represent the **Revision number**, the SI-CANopen V2 firmware version in Pr **MM.002** is in the form WW.XX.YY.ZZ, SI-CANopen V2 will take the upper 16 bits of the firmware version as the WWXX portion of the **Revision number** and the upper 8 bits of the lower 16 bits of the firmware version as the YY portion of the **Revision number**.

For example, if the SI-CANopen V2 firmware displayed in Pr **MM.002** is 02.04.01.12, then the value returned in sub-index 3 will be 0x00CC0001.

0x00CC = 204 (WWXX)

0x0001 = 1 (YY)

The remaining SI-CANopen V2 firmware version value 12 (ZZ) is discarded.

NOTE

If in compatibility mode, the value specified in Pr **S.01.022** (*Compatibility Mode Software Revision)* will be used in place of the actual SI-CANopen V2 firmware version in Pr **MM.002.**

Serial number

Index	0x1018	**Sub-index**	4	**Access**	RO
Default	N/A	**Data type**	UNSIGNED32		

This sub-index returns the last 8 digits of the SI-CANopen V2 module serial number. If SI-CANopen V2 is not in compatibility mode, this value is taken from Pr **MM.004**, if in compatibility mode, this value is taken from Pr **S.01.023** (*Compatibility Mode Serial Number*).

11.19 Flexible PDO numbering (0x2800 and 0x2801)

This functionality is supported from Version 02.01.00 onwards. The behaviour of the PDO configuration objects will be changed in order to conform to the CANopen specification, while still offering as much flexibility as possible.There are four Tx and four Rx PDOs available in the module, these PDOs will be referred to as PDOs A, B, C and D. Each of these PDOs can be configured to be any of the 512 available PDOs, by default the configuration will be PDOA = 1, PDOB = 3, PDOC = 5 and PDOD = 6 (for both TxPDOs and RxPDOs). The configuration of available PDOs will be possible through 2 new manufacturer specific objects accessible by the SDOs.

If a configuration using non-default or flexible numbering is required, the index number for the PDO communication objects must be derived by subtracting 1 from the PDO number and adding this number to the base address e.g. for 0x1600 PDO3 = 0x1602 (mapping information for RxPDOs).

11.20 PDO mapping parameters

When setting up cyclic data to contain specific parameters this may be done in two ways, using the SI-CANopen V2 menus (Pr **S.01.008** (*PDO Configuration Source*) = By Menu) or from the CANopen master (Pr **S.01.008** (*PDO Configuration Source*) = By Master).

If any of the PDO mapping objects are configured by the CANopen master then Pr **S.01.008** (*PDO Configuration Source*) will be automatically changed to indicate 'By Master', all existing PDO mapping objects will be deleted in favour of the new mappings.

1. From the SI-CANopen V2 menus by setting Pr **S.01.008** (*PDO Configuration Source*) = By Menu, this is the default setting, all PDO mappings will be configured from the SI-CANopen V2 menus as shown in the following table.

PDO numbering parameters (By Menu)

The following table shows the relevant SI-CANopen V2 menu parameters to change the PDO numbers and mappings for both the Tx and Rx PDOs. This method allows any PDO number from 1 to 512 to be used. It is not necessary to use the same PDO number for both Rx and Tx PDOs.

PDO	Option Menu (mm)	Parameter (S.mm.ppp)										
		Transmit						Receive				
				Mapping					Mapping			
		Type	PDO Number	1	2	3	4	PDO Number	1	2	3	4
A	2	3	13	15	16	17	18	14	19	20	21	22
B	3											
C	4											
D	5											

2. From the CANopen master via SDOs, this will automatically set Pr **S.01.008** (*PDO Configuration Source*) to 'By Master' and delete any existing PDO mappings created from the SI-CANopen V2 menus.
   The SDO will take the following form:

b31 - b16	b15 - b8	b7 - b0
Index	Sub-index	Object length (in bits)

These are used with object 0x1600 - 0x160F and object 0x1A00 - 0x1A0F for RxPDO and TxPDO mapping respectively. To map RxPDOA(1) to Pr **01.021,** the mapping parameter would be set to 0x20011520 (index = 0x2001, sub-index = 0x15, object length = 0x20, i.e. 32 bits).
Refer to section 8.1 *Service data object (SDO) parameter access* on page 74 for details on how to access drive parameters.
The following tables show the RxPDO and TxPDO mapping parameter objects when using SDOs.

RxPDO Mapping parameter objects by SDO

PDO Number	RxPDO Object		PDO Number	RxPDO Object
1	0x1600		9	0x1608
2	0x1601		10	0x1609
3	0x1602		11	0x160A
4	0x1603		12	0x160B
5	0x1604		13	0x160C
6	0x1605		14	0x160D
7	0x1606		15	0x160E
8	0x1607		16	0x160F

TxPDO Mapping parameter objects by SDO

PDO Number	TxPDO Object		PDO Number	TxPDO Object
1	0x1A00		9	0x1A08
2	0x1A01		10	0x1A09
3	0x1A02		11	0x1A0A
4	0x1A03		12	0x1A0B
5	0x1A04		13	0x1A0C
6	0x1A05		14	0x1A0D
7	0x1A06		15	0x1A0E
8	0x1A07		16	0x1A0F

11.20.1 RxPDO number configuration

This object will be used for configuring the available RxPDOs.

Index	0x2800	**Sub-index**	0	**Access**	RO
Largest sub-index supported		Value = 4			

Index	0x2800	**Sub-index**	1	**Access**	RW
PDO number for RxPDO A*		**Range 1 to 512**			

Index	0x2800	**Sub-index**	2	**Access**	RW
PDO number for RxPDO B*		**Range 1 to 512**			

Index	0x2800	**Sub-index**	3	**Access**	RW
PDO number for RxPDO C*		**Range 1 to 512**			

Index	0x2800	**Sub-index**	4	**Access**	RW
PDO number for RxPDO D*		**Range 1 to 512**			

Index	Sub-index	Description
0x2800	0	Will return 4 when read indicating the maximum sub-index and number of PDOs supported.
0x2800	1- 4	Are used to read and set the RxPDO number for each of the four configurable RxPDOs. The number is specified as required number less 1. That is PDO1 would be represented as 0.

NOTE * The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for RxPDO3 mapping parameters, 0x1600 + 3 - 1 = 0x1602

11.20.2 TxPDO number configuration

This object will be used for configuring the available TxPDOs.

Index	0x2801	**Sub-index**	0	**Access**	RO
Largest sub-index supported		Value = 4			

Index	0x2801	**Sub-index**	1	**Access**	RW
PDO number for TxPDO A*		**Range 1 to 512**			

Index	0x2801	**Sub-index**	2	**Access**	RW
PDO number for TxPDO B*		**Range 1 to 512**			

Index	0x2801	**Sub-index**	3	**Access**	RW
PDO number for TxPDO C*		**Range 1 to 512**			

Index	0x2801	**Sub-index**	4	**Access**	RW
PDO number for TxPDO D*		**Range 1 to 512**			

Index	Sub-index	Description
0x2801	0	Will return 4 when read indicating the maximum sub-index and number of PDOs supported.
0x2801	1- 4	Are used to read and set the TxPDO number for each of the four configurable TxPDOs. The number is specified as required number less 1. That is PDO1 would be represented as 0.

NOTE * The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3 mapping parameters, 0x1A00 + 3 - 1 = 0x1A02

11.21 RxPDO communication parameters

This section contains the communication parameters for the receive PDOs.

Index	0x1400-0x140F	**Sub-index**	0	**Access**	RO
Largest sub-index supported		Size			

Index	0x1400-0x140F	**Sub-index**	1	**Access**	RO
COB-ID used by PDO		**Size**			

Index	0x1400-0x140F	**Sub-index**	2	**Access**	RW
Transmission type		**Size**			

Index	0x1400-0x140F	**Sub-index**	3	**Access**	RW
Inhibit time (not used for RxPDO)		**Size**			

Index	0x1400-0x140F	**Sub-index**	5	**Access**	RW
Event timer		**Size**			

SI-CANopen V2 supports a total of four RxPDOs. Each PDO has a base index assigned to it, with individual parameters for the PDO accessed using sub-indexes.

Table 11-11 Supported RxPDOs

RxPDO	Index
A	0x1400-0x140F
B	0x1400-0x140F
C	0x1400-0x140F
D	0x1400-0x140F

All RxPDO configuration parameters are dynamic (any changes made to these parameters will take effect immediately).

11.21.1 Number of entries

Index	0x1400-0x140F	**Sub-index**	0
Data type	UNSIGNED8	**Access**	RO

Defines the largest sub-index supported for the specified RxPDO.

Table 11-12 RxPDO number of entries

RxPDO	Index	Value
A	0x1400-0x140F	5
B	0x1400-0x140F	5
C	0x1400-0x140F	5
D	0x1400-0x140F	5

11.21.2 RxPDO COB-ID

Index	0x1400-0x140F	**Sub-index**	1
Data type	UNSIGNED32	**Access**	RW

The COB-ID is the CAN identifier used by the CANopen master controller to send RxPDO messages over the CANopen network. The COB-ID is usually calculated using the target device node address, allowing each node to determine which RxPDO message it should use.

RxPDO COB-IDs do not have to be unique in CANopen devices on a CANopen network, as they can only originate from the CANopen master controller. It is common for a master controller to send a single RxPDO message containing four different speed or position references and have four different CANopen nodes configured to receive the same RxPDO. Each node simply extracts the reference it requires and discards the remaining data.

This makes efficient use of the available bandwidth of the CANopen network, as a single message is used to update four CANopen devices with new speed or position references, instead of four messages.

b31	b30	b29	b28 - b11	b10 - b0
RxPDO Disable	Reserved	29-bit ID Enable	00000000000000000	11-bit ID

The upper 3 bits (b31-b29) are used to enable certain functions of the RxPDO.

Function	Comment
PDO Disable	Set to 1 to disable the PDO. SI-CANopen V2 will ignore any messages that are received with the specified 11-bit ID
29-bit ID Enable	SI-CANopen V2 hardware does not support 29-bit CAN identifiers.so this bit must always be 0

BS EN 61800-7 specifies default COB-ID values for RxPDO1 to RxPDO4, while all higher RxPDOs must be disabled by default. Default values for the RxPDO COB-IDs are shown in Table 11-13.

Table 11-13 Default RxPDO COB-IDs

PDO	Index	Default COB-ID
A	0x1400	0x00000200 + node address.
B	0x1402	0x80000400 + node address.
C	0x1404	0x80000000
D	0x1405	0x80000000

NOTE RxPDO numbers above four are defaulted to a COB-ID of 0x80000000.

11.21.3 RxPDO transmission type

Index	0x1400-0x140F	**Sub-index**	2
Data type	UNSIGNED8	**Access**	RW

The transmission type defines when data received in an RxPDO is processed and passed though to the target parameters. SI-CANopen V2 supports all CANopen transmission modes.

Transmission type	Timing	Description
0 to 240	Synchronous	The RxPDO data is written to the target parameters when the next SYNC message is received.
241 to 251		Reserved.
252 to 253		Not used for RxPDOs.
254	Asynchronous	The RxPDO data is written to the target parameters when an OFF-to-ON (0-to-1) transition occurs in Pr **S.MM.012** (where **MM** = 2, 3, 4 or 5). Pr **S.MM.012** (where **MM** = 2, 3, 4 or 5) must be reset to OFF for a minimum of 1 ms to allow the RxPDO to be updated on the next OFF-ON transition. This allows the RxPDO update to be controlled by a digital input.
255	Asynchronous	The RxPDO data is written immediately to the target parameters.

As of SI-CANopen V2 firmware V02.03.03.02, a FIFO buffer has been implemented for each RxPDO.

If the RxPDO transmission type is event driven (0x140n:2 = 254 or 255), up to 6 messages shall be queued in the buffer. If the receive rate is higher than the SI-CANopen V2 module can write to the mappings, the data will be extracted from the buffer in the background as soon the previous copy to the mappings completes. The queue handling shall ensure the data is written to the mappings in the same order that they arrive. Any RxPDO messages received when the queue is full will be discarded.

The limit of 6 messages is based on the maximum mapping size of 8 bytes.

The buffer is flushed if the respective RxPDO transmission type is changed to synchronous or if the RxPDO is disabled.
Default values for the RxPDO transmission type are shown in Table 11-14.

Table 11-14 Default RxPDO transmission types

RxPDO	Index	Default
A	0x1400	255
B	0x1402	255
C	0x1404	255
D	0x1405	255

11.21.4 RxPDO inhibit time

Index	0x1400-0x140F	**Sub-index**	3
Data type	UNSIGNED16	**Access**	RW

Inhibit time is not used for RxPDOs.

11.21.5 RxPDO event timer

Index	0x1400-0x140F	**Sub-index**	5
Data type	UNSIGNED16	**Access**	RW

Event timer is not used for RxPDOs.

11.22 RxPDO mapping parameters

The default configuration for SI-CANopen is RxPDOs 1, 3, 5 & 6 and TxPDOs 1, 3, 5 & 6, this however may be changed using objects 0x2800 and 0x2801 (*section 11.20.1 RxPDO number configuration* on page 94). The destination parameters for data received from an RxPDO are specified in the RxPDO mapping parameters.

Four mapping parameters are provided for each RxPDO, allowing data to be mapped to all drive and SI-Applications parameters. RxPDO data can also be mapped to all SI-CANopen V2 object dictionary entries that allow PDO mapping.

The default mappings for RxPDOA (1) are derived from the mapping parameters (Pr **S.02.019** to Pr **S.02.022**) during initialisation however, the mappings for all RxPDOs are dynamic, so changes made to the CANopen object dictionary mapping parameters (using SDO messages will override settings made in the drive menu. Default mappings for RxPDOA(1) are shown in Table 11-15. RxPDO1 is enabled by default.

Index	Sub-index	Description	Data type	Access
0x1600	0	No of mapped application objects in RxPDO	UNSIGNED8	RW
0x1600	1	Channel 0 mapping	UNSIGNED32	RW*
0x1600	2	Channel 1 mapping	UNSIGNED32	RW*
0x1600	3	Channel 2 mapping	UNSIGNED32	RW*
0x1600	4	Channel 3 mapping	UNSIGNED32	RW*

NOTE * - read/write only if the number of mapped application objects in RxPDO (0x1600 + PDO number - 1, sub-index 0) is set to 0.

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for RxPDO3 mapping parameters, 0x1600 + 3 - 1 = 0x1602.

Table 11-15 RxPDOA (by default RxPDO 1) default mapping

Index	Sub-index	Description	Default	Mapping destination
0x1600	0	Number of mapped objects in RxPDO1	2	2 objects mapped by default
0x1600	1	Channel 0 mapping	0x20062A20	Pr **06.042**
0x1600	2	Channel 1 mapping	0x20011520	Pr **01.021**
0x1600	3	Channel 2 mapping	0x00000000	Not used with default mappings
0x1600	4	Channel 3 mapping	0x00000000	

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for RxPDO3 mapping parameter, 0x1600 + 3 - 1 = 0x1602.

Table 11-16 RxPDOD (by default RxPDO 6) default mapping

Index	Sub-index	Description	Default	Mapping destination
0x1605	0	Number of mapped objects in RxPDO6	2	2 objects mapped by default
0x1605	1	Channel 0 mapping	0x60400010	*Control word*
0x1605	2	Channel 1 mapping	0x60420010	*VL target velocity*
0x1605	3	Channel 2 mapping	0x00000000	Not used with default mappings
0x1605	4	Channel 3 mapping	0x00000000	

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for RxPDO3 mapping parameter, 0x1600 + 3 - 1 = 0x1602.

11.23 TxPDO communication parameters

Index	0x1800-0x180F
Object code	Record
Data type	PDOCommPar

This section contains the communication parameters for the TxPDOs.

SI-CANopen V2 supports a total of four TxPDOs. Each PDO has a base index assigned to it, with individual parameters for the PDO accessed using sub-indexes.

Table 11-17 Supported TxPDOs (default settings)

TxPDO	Index
A	0x1800-0x180F
B	0x1800-0x180F
C	0x1800-0x180F
D	0x1800-0x180F

All TxPDO configuration parameters are dynamic, i.e. any changes made to these parameters will take effect immediately.

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3, 0x1800 + 3 - 1 = 0x1802.

11.23.1 Number of entries

Index	0x1800-0x180F	**Sub-index**	0	**Access**	RO
Default	5	**Data type**	UNSIGNED8		

Defines the largest sub-index supported for the specified TxPDO.

TxPDO	Index	Value
A	0x1800-0x180F	5
B	0x1800-0x180F	5
C	0x1800-0x180F	5
D	0x1800-0x180F	5

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. TxPDO3, 0x1800 + 3 - 1 = 0x1802.

11.23.2 TxPDO COB-ID

Index	0x1800-0x19FF	**Sub-index**	1
Data type	UNSIGNED32	**Access**	RW

The COB-ID is the CAN identifier used by the CANopen master controller to transmit TxPDO messages over the CANopen network. The COB-ID is usually calculated using the target device address, as this will ensure that the TxPDO COB-ID is unique on the CANopen network.

b31	b30	b29	b28 - b11	b10 - b0
PDO Disable	RTR Disable	29-bit ID Enable	00000000000000000	11-bit ID

The upper 3 bits (b31-b29) are used to enable certain functions of the TxPDO.

Table 11-18 PDO COB-ID configuration

Function	Comment
PDO Disable	Set to 1 to disable the TxPDO. SI-CANopen V2 will not transmit the TxPDO.
RTR Disable	Set to 1 to disable RTR with the TxPDO.
29-bit ID Enable	SI-CANopen V2 hardware does not support 29-bit CAN identifiers so this bit must always be 0.

DSP301 V4.1 specifies default COB-ID values for TxPDO1 to TxPDO4, while all higher TxPDOs must be disabled by default. Default values for the TxPDO COB-IDs are shown in Table 11-19.

Table 11-19 TxPDO COB-ID default values

TxPDO	Index	Default COB-ID
A	0x1800-0x180F	0x00000180 + node address
B	0x1800-0x180F	0x80000380 + node address
C	0x1800-0x180F	0x80000000
D	0x1800-0x180F	0x80000000

11.23.3 TxPDO transmission type

Index	0x1800-0x180F	**Sub-index**	2
Data type	UNSIGNED8	**Access**	RW

The transmission type defines when the TxPDO data is read from the source parameters and when it is transmitted over the CANopen network. SI-CANopen V2 supports all CANopen transmission modes.

Table 11-20 Supported TxPDO transmission types

Transmission type	Timing	Description
0	Acyclic, synchronous	The source data is read when the SYNC message is received. If the source data has changed, the TxPDO is transmitted.
1 to 240	Cyclic, synchronous	The source data is read and the TxPDO is transmitted every n SYNC messages, where n = transmission type.
252	Synchronous, RTR only	The source data is read when the SYNC message is received, but the TxPDO will only be transmitted when an RTR message is received. The RTR message must have the correct COB-ID for the required TxPDO.
253	Asynchronous, RTR only	The source data is read and the TxPDO is transmitted when an RTR message is received. The RTR message must have the correct COB-ID for the required TxPDO.
254	Asynchronous, event trigger	The source data is read and the TxPDO is transmitted in response to 2 events: 1. An OFF-to-ON (0-to-1) transition in Pr **S.MM.012** (where MM = 2, 3, 4 or 5). Pr **S.MM.012** (where MM = 2, 3, 4 or 5) must be reset to OFF for a minimum of 1 ms to allow the TxPDO to be transmitted on the next OFF-ON transition. This allows the TxPDO to be controlled by a digital input. 2. Event timer. Refer to Figure 11.23.5 *TxPDO event timer* on page 101 for more details.
255	Asynchronous timer trigger / Acyclic	In SI-CANopen versions earlier than V03.02.05 the source data is read and the TxPDO is transmitted in response to the event timer. In SI-CANopen versions V03.02.05 (or later) and SI-CANopen V2, the TxPDO will be transmitted depending on the value in 0x2832 (see section 11.25 *TxPDO mapping parameters* on page 101 for more information).

Transmission types 241 to 251 are reserved and will produce a Transmission Type error (8) if selected.

If a TxPDO has transmission type 0 to 240, 254 or 255, the CANopen master controller can use an RTR message (with the COB-ID of the required PDO) to get the SI-CANopen V2 to re-transmit the required TxPDO. SI-CANopen V2 does NOT update the data values for the requested TxPDO; data update will only occur when specified for the TxPDO transmission type.

If a TxPDO is configured with transmission type 252 or 253, it can only be transmitted in response to an RTR message from the CANopen master controller.

Default values for the TxPDO transmission types are shown in Table 11-21.

Table 11-21 TxPDO transmission type default values

TxPDO	Index	Default	Comment
A (default = 1)	0x1800-0x180F	255	Specified in Pr **S.02.003**/SDO configuration
B (default = 3)	0x1800-0x180F	255	SDO configuration
C (default = 5)	0x1800-0x180F	255	SDO configuration
D (default = 6)	0x1800-0x180F	255	SDO configuration

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3, 0x1800 + 3 - 1 = 0x1802.

11.23.4 TxPDO inhibit time

Index	0x1800-0x180F	**Sub-index**	3	**Access**	RW
Default	0	**Data type**	UNSIGNED16		

The TxPDO time inhibit time specifies the time period (in multiples of 100µs) of the minimum interval between PDO transmissions of the same PDO. The inhibit time defines the minimum time that has to elapse between two consecutive invocations of a PDOs service. This can be used to help limit traffic on the network.

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3 inhibit time, 0x1800 + 3 - 1 = 0x1802, sub-index 3.

11.23.5 TxPDO event timer

Index	0x1800-0x180F	**Sub-index**	5	**Access**	RW
Default	0	**Data type**	UNSIGNED16		

The TxPDO event timer specifies the time period (in ms) between transmission of TxPDOs with transmission type 254 or 255 (see *section 11-21 TxPDO transmission type default values* on page 100). Set the TxPDO event timer to 0 to disable the event timer.

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3 event timer, 0x1800 + 3 - 1 = 0x1802, sub-index 5.

11.24 TxPDO profile specific mode

Index	0x2832	Sub-index	0	Access	RW
TxPDO profile specific mode		Data type	BYTE	Default	0

If a TxPDO is configured with a transmission type of 255 the TxPDO will be transmitted dependant on the values detailed in Table 11-22 below.

Table 11-22 Supported TxPDO Transmission type 255 modes

Value	Mode	Description
0	Timed	PDO will be transmitted each time the event timer expires.
1	Change OR Timed	PDO will be transmitted when data has changed unless an event timer is specified.
2	Change AND Timed	PDO will be transmitted when mapped data values change as well as each time the event timer expires.

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3, 0x1800 + 3 - 1 = 0x1802.

11.25 TxPDO mapping parameters

The source parameters for data transmitted on a TxPDO are specified in the TxPDO mapping parameters. Four mapping parameters are provided for each TxPDO, allowing data to be mapped to all drive and SI-Applications parameters. TxPDO data can also be mapped to all SI-CANopen V2 object dictionary entries that allow PDO mapping.

The default mappings for TxPDOA (1) are derived from the mapping parameters (Pr **S.02.015** to Pr **S.02.018**) during initialisation and configured via the menu, therefore changes made via these parameters will require a reset in order to take effect. However, the mappings for all four TxPDOs can be changed via the appropriate CANopen object dictionary mapping objects (using SDO messages), changes made via this method will take effect immediately.

NOTE The SI-CANopen V2 will NOT update the drive mapping parameters if the CANopen object dictionary mapping parameters are changed after the SI-CANopen V2 has initialised. This means that the SI-CANopen V2 will revert to the drive parameter-defined mappings during the next initialisation.

Table 11-23 TxPDO mapping parameters

Index	Sub-index	Description	Data type	Access
0x1A00-0x1A0F	0	Number of mapped objects in TxPDO	UNSIGNED8	RW
0x1A00-0x1A0F	1	Channel 0 mapping	UNSIGNED32	RW*
0x1A00-0x1A0F	2	Channel 1 mapping	UNSIGNED32	RW*
0x1A00-0x1A0F	3	Channel 2 mapping	UNSIGNED32	RW*
0x1A00-0x1A0F	4	Channel 3 mapping	UNSIGNED32	RW*

NOTE * - read/write only if the number of mapped application objects in TxPDO 0x1A00 + PDO number - 1, sub-index 0 is set to 0.

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3, 0x1A00 + 3 - 1 = 0x1A02.

The default mappings for TxPDO1 are shown in Table 11-24. TxPDO1 is enabled by default. The default configuration for SI-CANopen is RxPDOs 1, 3, 5 & 6 and TxPDOs 1, 3, 5 & 6, this however may be changed using objects 0x2800 and 0x2801 (section 11.20.1 *RxPDO number configuration* on page 94). The source parameters for data transmitted in a TxPDO are specified in the TxPDO mapping parameters.

Four mapping parameters are provided for each TxPDO, allowing data to be mapped to all drive and SI-Applications parameters. TxPDO data can also be mapped to all SI-CANopen V2 object dictionary entries that allow PDO mapping.

Table 11-24 TxPDOA (by default TxPDO 1)

Index	Sub-index	Description	Default	Mapping destination
0x1A00	0	Number of entries	2	N/A
0x1A00	1	Channel 0 mapping	0x200A2820	Pr **10.040**
0x1A00	2	Channel 1 mapping	0x20020120	Pr **02.001**
0x1A00	3	Channel 2 mapping	0x00000000	Not used with default mappings
0x1A00	4	Channel 3 mapping	0x00000000	

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3, 0x1A00 + 3 - 1 = 0x1A02.

Table 11-25 TxPDOB (by default TxPDO 3)

Index	Sub-index	Description	Default	Mapping destination
0x1A02	0	Number of entries	2	N/A
0x1A02	1	Channel 0 mapping	0x00000000	Not used with default mappings
0x1A02	2	Channel 1 mapping	0x00000000	
0x1A02	3	Channel 2 mapping	0x00000000	
0x1A02	4	Channel 3 mapping	0x00000000	

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO3, 0x1A00 + 3 - 1 = 0x1A02.

By default, TxPDO5 is disabled, so the mapping objects are all set to 0. When CiA402 profiles are enabled, the specified mappings for profile torque mode are shown in Table 11-26.

Table 11-26 TxPDOC (by default TxPDO 5) default mapping

Index	Sub-index	Description	Default	Mapping destination
0x1A04	0	Number of entries	2	N/A
0x1A04	1	Channel 0 mapping	0x60410010	*Status word*
0x1A04	2	Channel 1 mapping	0x60770010	*Torque actual value*
0x1A04	3	Channel 2 mapping	0x00000000	Not used with default mappings
0x1A04	4	Channel 3 mapping	0x00000000	

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO5, 0x1A00 + 5 - 1 = 0x1A04.

By default, TxPDO6 is disabled, so the mapping objects are all set to 0. When CiA402 profiles are enabled, the specified mappings for velocity mode are shown in Table 11-27.

Table 11-27 TxPDOD (by default TxPDO 6) default mapping

Index	Sub-index	Description	Default	Mapping destination
0x1A05	0	Number of entries	2	N/A
0x1A05	1	Channel 0 mapping	0x60410010	*Status word*
0x1A05	2	Channel 1 mapping	0x60440010	*VL control effort*
0x1A05	3	Channel 2 mapping	0x00000000	Not used with default mappings
0x1A05	4	Channel 3 mapping	0x00000000	

NOTE The actual index number is calculated by subtracting 1 from the PDO number and adding this number to the base address e.g. for TxPDO6, 0x1A00 + 6 - 1 = 0x1A05.

11.26 RxPDO, SYNC and missed heartbeat event handling

11.26.1 0x2820 - RxPDOA event configuration

This object defines the event that will occur following the reception of RxPDOA. All events defined by these objects will be carried out in the background task after the message has been processed, this means that depending on the modules loading and the configuration of PDOs the delay before handling may vary, however it will always be within one background task cycle of the module.

Index	0x2820	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	5

Will return 5 when read, indicating the maximum sub-index of the object.

Index	0x2820	**Sub-index**	1	**Access**	RO
Count		**Data type**	UNSIGNED32	**Default**	0

The number of times RxPDOA has been received. This value will increment every time the event occurs and will rollover once the maximum value for a unsigned 32 bit integer has been exceeded.

Index	0x2820	**Sub-index**	2	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	0

When the RxPDOA event occurs the specified parameter in sub-index three will be manipulated depending on the specified mode value.

Value	Mode	Description
0	None	No parameter manipulation will occur.
1	Set	The specified parameter will be set to a value of 1.
2	Clear	The specified parameter will be set to a value of 0.
3	Toggle	The specified parameter will be read and if non-zero a value of 0 will be written, otherwise a value of 1 will be written.
4	Count	The value of the count sub-index will be written to the specified parameter in sub-index 3. The value will be masked to the parameter size.

Index	0x2820	**Sub-index**	3	**Access**	RW
Parameter		**Data type**	UNSIGNED32	**Default**	0

The value of the parameter used for modes 1 to 4 will be in the format:

(Slot * 100,000) + (Menu * 1000) + Parameter

A value of 0 will inhibit the operation.

Index	0x2820	**Sub-index**	4	**Access**	RW
Event task number		**Data type**	UNSIGNED32	**Default**	0

The SI-Applications event task to trigger following the RxPDOA event. The event task will always be triggered after any specified parameter manipulation has completed.

Value	Event task to trigger
0	None
1	Event
2	Event1
3	Event2
4	Event3

Index	0x2820	**Sub-index**	5	**Access**	RW
Event task slot		**Data type**	UNSIGNED32	**Default**	0

The option module slot where the event task should be triggered.

Value	Slot
0	Lowest slot
1	Slot 1
2	Slot 2
3	Slot 3

11.26.2 0x2821 - RxPDOB event configuration

This object defines the event that will occur following the reception of RxPDOB. All events defined by these objects will be carried out in the background task after the message has been processed, this means that depending on the modules loading and the configuration of PDOs the delay before handling may vary, however it will always be within one background task cycle of the SI-Applications module.

Index	0x2821	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	5

Will return 5 when read, indicating the maximum sub-index of the object.

Index	0x2821	**Sub-index**	1	**Access**	RO
Count		**Data type**	UNSIGNED32	**Default**	0

The number of times RxPDOB has been received. This value will increment every time the event occurs and will rollover once the maximum value for a unsigned 32 bit integer has been exceeded.

Index	0x2821	**Sub-index**	2	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	0

When the RxPDOB event occurs the specified parameter in sub-index 3 will be manipulated depending on the specified mode value.

Value	Mode	Description
0	None	No parameter manipulation will occur.
1	Set	The specified parameter will be set to a value of 1.
2	Clear	The specified parameter will be set to a value of 0.
3	Toggle	The specified parameter will be read and if non-zero a value of 0 will be written, otherwise a value of 1 will be written.
4	Count	The value of the count sub-index will be written to the specified parameter in sub-index 3. The value will be masked to the parameter size.

Index	0x2821	**Sub-index**	3	**Access**	RW
Parameter		**Data type**	UNSIGNED32	**Default**	0

The parameter to use for modes 1-4, this value will be in the format (Slot * 100,000) + (Menu * 1000) + Parameter. A value of 0 will inhibit the operation.

Index	0x2821	**Sub-index**	4	**Access**	RW
Event task number		**Data type**	UNSIGNED32	**Default**	0

The SI-Applications event task to trigger following the RxPDOB event. The event task will always be triggered after any specified parameter manipulation has completed.

Value	Event task to trigger
0	None
1	Event
2	Event1
3	Event2
4	Event3

Index	0x2821	**Sub-index**	5	**Access**	RW
Event task slot		**Data type**	UNSIGNED32	**Default**	0

The option module slot where the event task should be triggered.

Value	Slot
0	Lowest slot
1	Slot 1
2	Slot 2
3	Slot 3
4	Slot 4

11.26.3 0x2822 - RxPDOC event configuration

This object defines the event that will occur following the reception of RxPDOC. All events defined by these objects will be carried out in the background task after the message has been processed, this means that depending on the modules loading and the configuration of PDOs the delay before handling may vary, however it will always be within one background task cycle.

Index	0x2822	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	0

Will return 5 when read, indicating the maximum sub-index of the object.

Index	0x2822	**Sub-index**	1	**Access**	RO
Count		**Data type**	UNSIGNED32	**Default**	0

The number of times RxPDOC has been received. This value will increment every time the event occurs, and will rollover once the maximum value for an unsigned 32 bit integer has been exceeded.

Index	0x2822	**Sub-index**	2	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	0

When the RxPDOC event occurs the specified parameter in sub-index 3 will be manipulated depending on the specified mode value.

Value	Mode	Description
0	None	No parameter manipulation will occur.
1	Set	The specified parameter will be set to a value of 1.
2	Clear	The specified parameter will be set to a value of 0.
3	Toggle	The specified parameter will be read and if non-zero a value of 0 will be written, otherwise a value of 1 will be written.
4	Count	The value of the count sub-index will be written to the specified parameter in sub-index 3. The value will be masked to the parameter size.

Index	0x2822	**Sub-index**	3	**Access**	RW
Parameter		**Data type**	UNSIGNED32	**Default**	0

The parameter to use for modes 1-4, this value will be in the format (Slot x 100,000) + (Menu x 1000) + Parameter. A value of 0 will inhibit the operation.

Index	0x2822	**Sub-index**	4	**Access**	RW
Event task number		**Data type**	UNSIGNED32	**Default**	0

The SI-Applications event task to trigger following the RxPDOC event. The event task will always be triggered after any specified parameter manipulation has completed.

Value	Event task to trigger
0	None
1	Event
2	Event1
3	Event2
4	Event3

Index	0x2822	**Sub-index**	5	**Access**	RW
Event task slot		**Data type**	UNSIGNED32	**Default**	0

The option module slot where the event task should be triggered.

Value	Slot
0	Lowest slot
1	Slot 1
2	Slot 2
3	Slot 3
4	Slot 4

The option module slot where the event task should be triggered.

11.26.4 0x2823 - RxPDOD event configuration

This object defines the event that will occur following the reception of RxPDOD. All events defined by these objects will be carried out in the background task after the message has been processed, this means that depending on the modules loading and the configuration of PDOs the delay before handling may vary, however it will always be within one background task cycle of the SI-Applications module.

Index	0x2823	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	0

Will return 5 when read, indicating the maximum sub-index of the object.

Index	0x2823	**Sub-index**	1	**Access**	RO
Count		**Data type**	UNSIGNED32	**Default**	0

The number of times RxPDOD has been received. This value will increment every time the event occurs and will rollover once the maximum value for a unsigned 32 bit integer has been exceeded.

Index	0x2823	**Sub-index**	2	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	0

When the RxPDOD event occurs the specified parameter in sub-index 3 will be manipulated depending on the specified mode value.

Value	Mode	Description
0	None	No parameter manipulation will occur.
1	Set	The specified parameter will be set to a value of 1.
2	Clear	The specified parameter will be set to a value of 0.
3	Toggle	The specified parameter will be read and if non-zero a value of 0 will be written, otherwise a value of 1 will be written.
4	Count	The value of the count sub-index will be written to the specified parameter in sub-index 3. The value will be masked to the parameter size.

Index	0x2823	**Sub-index**	3	**Access**	RW
Parameter		**Data type**	UNSIGNED32	**Default**	0

The parameter to use for modes 1-4, this value will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

Index	0x2823	**Sub-index**	4	**Access**	RW
Event task number		**Data type**	UNSIGNED32	**Default**	0

The SI-Applications event task to trigger following the RxPDOD event. The event task will always be triggered after any specified parameter manipulation has completed.

Value	Event task to trigger
0	None
1	Event
2	Event1
3	Event2
4	Event3

Index	0x2823	**Sub-index**	5	**Access**	RW
Event task slot		**Data type**	UNSIGNED32	**Default**	0

The option module slot where the event task should be triggered.

Value	Slot
0	Lowest slot
1	Slot 1
2	Slot 2
3	Slot 3
4	Slot 4

11.26.5 0x2830 - SYNC event configuration

This object defines the event that will occur following the reception of SYNC messages. All events defined by these objects will be carried out in the background task after the message has been processed, this means that depending on the modules loading and the configuration of PDOs the delay before handling may vary, however it will always be within one background task cycle of the SI-Applications module.

Index	0x2830	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	5

Will return 5 when read, indicating the maximum sub-index of the object.

Index	0x2830	**Sub-index**	1	**Access**	RO
Count		**Data type**	UNSIGNED32	**Default**	0

The number of times the SYNC message has been received. This value will increment every time a SYNC message occurs and will rollover once the maximum value for a unsigned 32 bit integer has been exceeded.

Index	0x2830	**Sub-index**	2	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	0

When the SYNC message occurs the specified parameter in sub-index 3 will be manipulated depending on the specified mode value:

Value	Mode	Description
0	None	No parameter manipulation will occur.
1	Set	The specified parameter will be set to a value of 1.
2	Clear	The specified parameter will be set to a value of 0.
3	Toggle	The specified parameter will be read and if non-zero a value of 0 will be written, otherwise a value of 1 will be written.
4	Count	The value of the count sub-index will be written to the specified parameter in sub-index 3. The value will be masked to the parameter size.

Index	0x2830	**Sub-index**	3	**Access**	RW
Parameter		**Data type**	UNSIGNED32	**Default**	0

The parameter to use for modes 1-4, this value will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

Index	0x2830	**Sub-index**	4	**Access**	RW
Event task number		**Data type**	UNSIGNED32	**Default**	0

The SI-Applications event task to trigger following a SYNC messages. The event task will always be triggered after any specified parameter manipulation has completed.

Value	Event task to trigger
0	None
1	Event
2	Event1
3	Event2
4	Event3

Index	0x2830	**Sub-index**	5	**Access**	RW
Event task slot		**Data type**	UNSIGNED32	**Default**	0

The option module slot where the event task should be triggered.

Value	Slot
0	Lowest slot
1	Slot 1
2	Slot 2
3	Slot 3
4	Slot 4

11.26.6 0x2831 - Missed heartbeat

This object defines the event that will occur following a missed heartbeat message. All events defined by these objects will be carried out in the background task of the SI-Applications module after the message has been processed, this means that depending on the modules loading and the configuration of PDOs the delay before handling may vary, however it will always be within one background task cycle.

Index	0x2831	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	6

Will return 6 when read, indicating the maximum sub-index of the object.

Index	0x2831	**Sub-index**	1	**Access**	RO
Count		**Data type**	UNSIGNED32	**Default**	0

The number of times a missed heartbeat has occurred. This value will increment every time a missed heartbeat message occurs and will rollover once the maximum value for a unsigned 32 bit integer has been exceeded.

Index	0x2831	**Sub-index**	2	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	0

When a missed heartbeat occurs the specified parameter in sub-index 3 will be manipulated depending on the specified mode value.

Value	Mode	Description
0	None	No parameter manipulation will occur.
1	Set	The specified parameter will be set to a value of 1.
2	Clear	The specified parameter will be set to a value of 0.
3	Toggle	The specified parameter will be read and if non-zero a value of 0 will be written, otherwise a value of 1 will be written.
4	Count	The value of the count sub-index will be written to the specified parameter in sub-index 3. The value will be masked to the parameter size.

Index	0x2831	**Sub-index**	3	**Access**	RW
Parameter		**Data type**	UNSIGNED32	**Default**	0

The parameter to use for modes 1-4, this value will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

Index	0x2831	**Sub-index**	4	**Access**	RW
Event task number		**Data type**	UNSIGNED32	**Default**	0

The SI-Applications event task to trigger following a missed heartbeat message. The event task will always be triggered after any specified parameter manipulation has completed.

Value	Event task to trigger
0	None
1	Event
2	Event1
3	Event2
4	Event3

Index	0x2831	**Sub-index**	5	**Access**	RW
Event task slot		**Data type**	UNSIGNED32	**Default**	0

The option module slot where the event task should be triggered.

Value	Slot
0	Lowest slot
1	Slot 1
2	Slot 2
3	Slot 3
4	Slot 4

Index	0x2831	**Sub-index**	6	**Access**	RW
Trip enable		**Data type**	UNSIGNED32	**Default**	0

Enable the trip associated with the event. When an event occurs that has a trip enable the drive will trip with a slot error displayed.

NOTE For the heartbeat system to operate correctly, object 0x2831 (*Consumer heartbeat time*) must also be configured.

11.27 RxPDO event triggers

11.27.1 0x2840 - RxPDOA trigger configuration

This object will be used to configure an RxPDOA trigger.

Index	0x2840	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	2

Will return 2 when read, indicating the maximum sub-index of the object.

Index	0x2840	**Sub-index**	1	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	1

When the RxPDOA transmission type (0x1400 - 0x140F, sub-index 2) is set to 254 (Asynchronous, event trigger), the event trigger parameter specified in 0x2840, sub-index 2 will trigger the event depending on the specified mode value in 0x2840, sub-index 1.

Value	Mode	Description
0	None	No triggering will occur.
1	Non-zero	The event will be triggered when the specified parameter changes from 0 to any non-zero value. It must be set back to 0 to re-arm the trigger.
2	Reset	The event will be triggered when the specified parameter changes from 0 to any non-zero value. The parameter will then automatically be set back to 0.
3	Change	The event will be triggered any time the specified parameter changes value.

If a read-only parameter is currently set then the mode cannot be set to Reset. The mode is defaulted to Non-zero (1) for backward compatibility.

Index	0x2840	**Sub-index**	2	**Access**	RW
Event Trigger Parameter		**Data type**	UNSIGNED32	**Default**	**<S.02.012>**

The event trigger parameter for the RxPDOA when its transmission type is set to 254 (asynchronous, event trigger) will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

If the Reset mode is selected a read-only parameter cannot be set. The parameter is defaulted to Pr **S.02.012** for backward compatibility.

11.27.2 0x2841 - RxPDOB trigger configuration

This object will be used to configure an RxPDOB trigger.

Index	0x2841	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	2

Will return 2 when read, indicating the maximum sub-index of the object.

Index	0x2841	**Sub-index**	1	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	1

When the RxPDOA transmission type (0x1400 - 0x140F, sub-index 2) is set to 254 (Asynchronous, event trigger), the event trigger parameter specified in 0x2841, sub-index 2 will trigger the event depending on the specified mode value in 0x2841, sub-index 1.

Value	Mode	Description
0	None	No triggering will occur.
1	Non-zero	The event will be triggered when the specified parameter changes from 0 to any non-zero value. It must be set back to 0 to re-arm the trigger.
2	Reset	The event will be triggered when the specified parameter changes from 0 to any non-zero value. The parameter will then automatically be set back to 0.
3	Change	The event will be triggered any time the specified parameter changes value.

If a read-only parameter is currently set then the mode cannot be set to Reset. The mode is defaulted to Non-zero (1) for backward compatibility.

Index	0x2841	**Sub-index**	2	**Access**	RW
Event Trigger Parameter		**Data type**	UNSIGNED32	**Default**	**<S.03.012>**

The event trigger parameter for the RxPDOB when its transmission type is set to 254 (asynchronous, event trigger) will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

If the Reset mode is selected a read-only parameter cannot be set. The parameter is defaulted to Pr **S.03.012** for backward compatibility.

11.27.3 0x2842 - RxPDOC trigger configuration

This object will be used to configure an RxPDOC trigger.

Index	0x2842	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	2

Will return 2 when read, indicating the maximum sub-index of the object.

Index	0x2842	**Sub-index**	1	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	1

When the RxPDOA transmission type (0x1400 - 0x140F, sub-index 2) is set to 254 (Asynchronous, event trigger), the event trigger parameter specified in 0x2842, sub-index 2 will trigger the event depending on the specified mode value in 0x2842, sub-index 1.

Value	Mode	Description
0	None	No triggering will occur.
1	Non-zero	The event will be triggered when the specified parameter changes from 0 to any non-zero value. It must be set back to 0 to re-arm the trigger.
2	Reset	The event will be triggered when the specified parameter changes from 0 to any non-zero value. The parameter will then automatically be set back to 0.
3	Change	The event will be triggered any time the specified parameter changes value.

If a read-only parameter is currently set then the mode cannot be set to Reset. The mode is defaulted to Non-zero (1) for backward compatibility.

Index	0x2842	**Sub-index**	2	**Access**	RO
Event Trigger Parameter		**Data type**	UNSIGNED32	**Default**	<**S.04.012**>

The event trigger parameter for the RxPDOC when its transmission type is set to 254 (asynchronous, event trigger) will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

If the Reset mode is selected a read-only parameter cannot be set. The parameter is defaulted to Pr **S.04.012** for backward compatibility.

11.27.4 0x2843 - RxPDOD trigger configuration

This object will be used to configure an RxPDOD trigger.

Index	0x2843	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	2

Will return 2 when read, indicating the maximum sub-index of the object.

Index	0x2843	**Sub-index**	1	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	1

When the RxPDOA transmission type (0x1400 - 0x140F, sub-index 2) is set to 254 (Asynchronous, event trigger), the event trigger parameter specified in 0x2842, sub-index 2 will trigger the event depending on the specified mode value in 0x2842, sub-index 1.

Value	Mode	Description
0	None	No triggering will occur.
1	Non-zero	The event will be triggered when the specified parameter changes from 0 to any non-zero value. It must be set back to 0 to re-arm the trigger.
2	Reset	The event will be triggered when the specified parameter changes from 0 to any non-zero value. The parameter will then automatically be set back to 0.
3	Change	The event will be triggered any time the specified parameter changes value.

If a read-only parameter is currently set then the mode cannot be set to reset. The mode is defaulted to non-zero (1) for backward compatibility.

Index	0x2843	**Sub-index**	2	**Access**	RW
Event Trigger Parameter		**Data type**	UNSIGNED32	**Default**	<**S.05.012**>

The event trigger parameter for the RxPDOD when its transmission type is set to 254 (asynchronous, event trigger) will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

If the Reset mode is selected a read-only parameter cannot be set. The parameter is defaulted to Pr **S.05.012** for backward compatibility.

11.28 TxPDO event triggers

11.28.1 0x2850 - TxPDOA trigger configuration

This object will be used to configure a TxPDOA trigger.

Index	0x2850	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	2

Will return 2 when read, indicating the maximum sub-index of the object.

Index	0x2850	**Sub-index**	1	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	1

When the TxPDOA transmission type (0x1800 - 0x180F, sub-index 2) is set to 254 (Asynchronous, event trigger), the event trigger parameter specified in 0x2850, sub-index 2 will trigger the event depending on the specified mode value in 0x2850, sub-index 1.

Value	Mode	Description
0	None	No triggering will occur.
1	Non-zero	The event will be triggered when the specified parameter changes from 0 to any non-zero value. It must be set back to 0 to re-arm the trigger.
2	Reset	The event will be triggered when the specified parameter changes from 0 to any non-zero value. The parameter will then automatically be set back to 0.
3	Change	The event will be triggered any time the specified parameter changes value.

If a read-only parameter is currently set then the mode cannot be set to reset. The mode is defaulted to Non-zero (1) for backward compatibility.

Index	0x2850	**Sub-index**	2	**Access**	RW
Event Trigger parameter		**Data type**	UNSIGNED32	**Default**	**<S.02.012>**

The event trigger parameter for the TxPDOA when its transmission type is set to 254 (asynchronous, event trigger) will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

If the Reset mode is selected a read-only parameter cannot be set. The parameter is defaulted to Pr **S.02.012** for backward compatibility.

11.28.2 0x2851 - TxPDOB trigger configuration

This object will be used to configure a TxPDOB trigger.

Index	0x2851	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	2

Will return 2 when read, indicating the maximum sub-index of the object.

Index	0x2851	**Sub-index**	1	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	1

When the TxPDOB transmission type (0x1800 - 0x180F, sub-index 2) is set to 254 (Asynchronous, event trigger), the event trigger parameter specified in 0x2851, sub-index 2 will trigger the event depending on the specified mode value in 0x2851, sub-index 1.

Value	Mode	Description
0	None	No triggering will occur.
1	Non-zero	The event will be triggered when the specified parameter changes from 0 to any non-zero value. It must be set back to 0 to re-arm the trigger.
2	Reset	The event will be triggered when the specified parameter changes from 0 to any non-zero value. The parameter will then automatically be set back to 0.
3	Change	The event will be triggered any time the specified parameter changes value.

If a read-only parameter is currently set then the mode cannot be set to reset. The mode is defaulted to non-zero (1) for backward compatibility.

Index	0x2851	**Sub-index**	2	**Access**	RW
Event Trigger parameter		**Data type**	UNSIGNED32	**Default**	**<S.03.012>**

The event trigger parameter for the TxPDOB when its transmission type is set to 254 (asynchronous, event trigger) will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

If the Reset mode is selected a read-only parameter cannot be set. The parameter is defaulted to Pr **S.03.012** for backward compatibility.

11.28.3 0x2852 - TxPDOC trigger configuration

This object will be used to configure a TxPDOC trigger.

Index	0x2852	**Sub-index**	0	**Access**	RO
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	2

Will return 2 when read, indicating the maximum sub-index of the object.

Index	0x2852	**Sub-index**	1	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	1

When the TxPDOC transmission type (0x1800 - 0x180F, sub-index 2) is set to 254 (Asynchronous, event trigger), the event trigger parameter specified in 0x2852, sub-index 2 will trigger the event depending on the specified mode value in 0x2852, sub-index 1.

Value	Mode	Description
0	None	No triggering will occur.
1	Non-zero	The event will be triggered when the specified parameter changes from 0 to any non-zero value. It must be set back to 0 to re-arm the trigger.
2	Reset	The event will be triggered when the specified parameter changes from 0 to any non-zero value. The parameter will then automatically be set back to 0.
3	Change	The event will be triggered any time the specified parameter changes value.

If a read-only parameter is currently set then the mode cannot be set to reset. The mode is defaulted to Non-zero (1) for backward compatibility.

Index	0x2852	**Sub-index**	2	**Access**	RW
Event Trigger parameter		**Data type**	UNSIGNED32	**Default**	<**S.04.012**>

The event trigger parameter for the TxPDOC when its transmission type is set to 254 (asynchronous, event trigger) will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

If the Reset mode is selected a read-only parameter cannot be set. The parameter is defaulted to Pr **S.04.012** for backward compatibility.

11.28.4 0x2853 - TxPDOD trigger configuration

This object will be used to configure a TxPDOD trigger.

Index	0x2853	**Sub-index**	0	**Access**	RW
Maximum sub-index		**Data type**	UNSIGNED32	**Default**	2

Will return 2 when read, indicating the maximum sub-index of the object.

Index	0x2853	**Sub-index**	1	**Access**	RW
Mode		**Data type**	UNSIGNED32	**Default**	1

When the TxPDOD transmission type (0x1800 - 0x180F, sub-index 2) is set to 254 (Asynchronous, event trigger), the event trigger parameter specified in 0x2853, sub-index 2 will trigger the event depending on the specified mode value in 0x2853, sub-index 1.

Value	Mode	Description
0	None	No triggering will occur.
1	Non-zero	The event will be triggered when the specified parameter changes from 0 to any non-zero value. It must be set back to 0 to re-arm the trigger.
2	Reset	The event will be triggered when the specified parameter changes from 0 to any non-zero value. The parameter will then automatically be set back to 0.
3	Change	The event will be triggered any time the specified parameter changes value.

If a read-only parameter is currently set then the mode cannot be set to reset. The mode is defaulted to non-zero (1) for backward compatibility.

Index	0x2853	**Sub-index**	2	**Access**	RW
Event Trigger parameter		**Data type**	UNSIGNED32	**Default**	<**S.05.012**>

The event trigger parameter for the TxPDOD when its transmission type is set to 254 (asynchronous, event trigger) will be in the format (Slot * 100,000) + (Menu * 1,000) + Parameter. A value of 0 will inhibit the operation.

If the Reset mode is selected a read-only parameter cannot be set. The parameter is defaulted to Pr **S.05.012** for backward compatibility.

11.29 Inter-option DPLCAN Interface

The inter-option DPLCAN interface between the SI-CANopen V2 and Applications modules provide the Applications modules with simple CAN Master functionality allowing the Applications modules to request from the SI-CANopen V2 module to send and receive raw CAN frames.

The following Applications modules are supported:

- SI-Applications Plus
- SI-Applications Compact
- MCi2x0

The following Applications DPLCAN commands are supported:

- EnableCANTrips
- CANStatus
- ResetCANTimer
- GETCAN
- PUTCAN
- CANStatusAll
- CANSetup
- CANGetNodeAddr
- CANReady
- CANConfigEvent

For more information and use of these functions, please refer to the online help provided in the Applications module configuration tool (SyPTPro or Machine Control Studio).

In order to use the DPLCAN interface, the list of DPL parameters to be associated with a CANopen object must be created, object 0x2860 (*Startup Object List*) is provided for this purpose.

11.29.1 Associating CANopen objects to DPL variables

Integer variables in an Applications user program can be associated with an object in the CANopen object dictionary, allowing the CANopen master controller to directly read from and write to DPL user program variables.

These associations must be made within the *Initial* task of the user program. If they are executed in any other task, then the function will return the error status 6 (*task error*).

The association is made using the *AssociateIntOpComms* function, this function creates and defines the attributes of the associated object as defined in Table 11-28.

DPL variables can be either 1, 8, 16 or 32-bit integers (signed or unsigned), if a DPL variable is associated with an object of less than 32 bits or the value of the DPL variable exceeds the permissible associated object value range, then the user must ensure the DPL variable value does not exceed the associated object size or range.

The format for the association function is:

Status% = *AssociateIntOpComms*(Index%, Subindex%, Variable%, Sign%, Size%, Read%, Write%).

Table 11-28 AssociateIntOpComms attributes

Argument	Range	Description
Index%	0x1000, 0x2101 to 0x25FF, 0x3000 to 0x9FFF	Specifies the CANopen object index to associate with the DPL variable (*Variable%*)
SubIndex%	0x00 to 0xFF	Specifies the CANopen object sub-index to associate with the DPL variable (*Variable%*)
Variable%	N/A	Specifies the DPL variable to associate with the CANopen object (*Index%:Subindex%*)
Sign%	0 or 1	0 = unsigned 1 = signed
Size%	1, 8, 16 or 32	Specifies the CANopen object size in bits
Read%	0 or 1	0 = object cannot be read by SI-CANopen V2 1 = object can be read by SI-CANopen V2
Write%	0 or 1	0 = object cannot be written by SI-CANopen V2 1 = object can be written by SI-CANopen V2

Examples

The following function call can be used in an Applications user program to create an association between a CANopen object (0x6000, sub-index 1) and a DPL variable (MyVar%), making a signed 16-bit read-only object. The DPL variable Status% will contain the function's return status value.

Status% = *AssociateIntOpComms*(0x6000, 1, MyVar%, 1, 16, 1, 0).

If the object is required to be a read/write object then the following function call can be used:

Status% = *AssociateIntOpComms*(0x6000, 1, MyVar%, 1, 16, 1, 1).

11.29.2 Maintaining DPL variables

When an association is created, the size and format attributes are used to control access to the DPL variable from the SI-CANopen module. The Applications module will restrict access to the DPL variable, based on the specified attributes (i.e. it will not allow a value to be written to a read-only association).

The Applications module does not automatically maintain the associated DPL variables. The DPL program still has full access and control over all DPL variables, so it is possible for the Applications program to write a full 32-bit value to a DPL variable, even though it has been associated with an 8-bit CANopen object. If the CANopen object is subsequently read, the DPL variable will be masked, and the Applications module will only pass the low 8-bits to the SI-CANopen module. The same principle applies to Boolean and 16-bit objects.

If an association has been created declaring an 8-bit read-only object, the DPL program can still write a new value to the DPL variable, and the complete 32-bit range is still available.

It is possible to have multiple associations with different attributes made to the same DPL variable, provided that the index and sub-index references are unique in each case.

If an error occurs with the association, for example, the object size is declared incorrectly, then the invalid background association error (108) will trip the drive.

11.29.3 0x2860 - Startup Object List

Object 0x2860 is not defined in the SI-CANopen V2 module, but can be defined in an associated DPL user program on an SI-Applications (Plus/ Compact) module or an MCi2x0 module. This object, if associated, will be read by the SI-CANopen V2 module during the initialisation stage and can be used to initialise any writable object dictionary entries.

Table 11-29 Startup object list

Sub-index	Description	Example usage
0	Maximum sub-index	Should be set to 2 * number of objects
1	1st Object definition	0x12345620 Object 0x1234, sub-index 0x56, length 32 bits
2	1st Object value	Value to be written to object 0x1234, sub-index 0x56
…	…	…
2 * n - 1	nth Object definition	0x18000108 Object 0x1800, sub-index 0x01, length 8 bits
2 * n	nth Object value	Value to be written to object 0x1800, sub-index 0x01

The sub-index is used to set the maximum number of sub-indexes for the object, each object definition uses two sub-indexes, the first sub-index is the object definition reference and the second sub-index is the value to be written, so to define two objects to initialise the maximum number of sub-indexes should be set to four.

Example

The following code is written for the SI-Applications Plus (or Compact) and demonstrates how the startup object can be used to set other object values during initialisation, this code is provided as an example only, no error checking is performed.

When the Initial task in the SI-Applications Plus module is run, the example code below would configure RxPDO1 with two mappings (Pr **0.20.021** and Pr **0.20.022**), TxPDO1 with two mappings (Pr **0.20.023** and Pr **0.20.024**).

```
$AUTHOR   My Name
$COMPANY  My Company
$TITLE    SIAPLUS1
$VERSION  V1.0
$DRIVE    SI-Applications

CONST ObjArray% {
16                      // Max sub-index = 16 (8 objects)
0x16000008,0            // Set RxPDO1 maximum sub-index to 0
0x16000120, 0x20141520  // Set RxPDO1 sub-index 1 to Pr 0.20.021 (1st object)
0x16000220, 0x20141620  // Set RxPDO1 sub-index 2 to Pr 0.20.022 (2nd object)
0x16000008,2            // Set RxPDO1 maximum sub-index to 2

0x1a000008,0            // Set TxPDO1 maximum sub-index to 0
0x1a000120, 0x20141720  // Set TxPDO1 sub-index 1 to Pr 0.20.023 (1st object)
0x1a000220, 0x20141820  // Set TxPDO1 sub-index 2 to Pr 0.20.024 (2nd object)
0x1a000008,2            // Set TxPDO1 maximum sub-index to 2
}

Initial{
// Associate start-up object list
FOR Index% = 0 To ObjArray%[0]
    Status% = ASSOCIATEINTOPCOMMS (0x2860, Index%, ObjArray%[Index%], 0, 32, 1, 0)
LOOP

} //Initial
```

If an error occurs during the handling of object 0x2860, an ‘SLx.Er’ will occur and the diagnostics will report a Configuration Error (4) in Pr **S.01.006**.

11.30 0x2862 - Background Associations

Background associations allow access to internal values of the SI-CANopen V2 module which are not normally accessible to a CANopen master or SI-Applications module.

By defining a set of associations to object 0x2862 applications module variables can be linked to CANopen internal values.

If an error occurs with the association, for example, the object size is declared incorrectly, then the invalid background association error (108) will trip the drive.

NOTE This object is only accessible from within the associated SI-Applications DPL program and not over the CANopen network.

NOTE This object is not supported on the MCi2x0 module.

To access the NMT State, EMCY Counter, NMT RESET Counter and NMT Communications Reset Counter objects, an association must first be made with 0x2862 sub-index 0.

The following associations are available:

0x2862 Sub-index	Data Type	Access	Default	Description
0	INTEGER32	RO	2	Maximum sub-index of object
1	INTEGER8	RW	N/A	NMT State
2	INTEGER32	RW	0	EMCY Counter
3	INTEGER8	RW	0	NMT RESET Counter
4	INTEGER8	RW	0	NMT Communications Reset Counter

Background associations (0x2862)
This object can only be accessed from within the DPL program, the SI-CANopen V2 module can't read or write this object.

Maximum sub-index

Index	0x2862	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	No
Default	4	**Units**	None		

This sub-index will return the maximum sub-index number when read from an associated DPL program.

NMT State

Index	0x2862	**Object code**	VAR	**Access**	RW
Sub-index	1	**Data type**	INTEGER8	**PDO mapping**	No
Default	None	**Units**	None		

When associated in a DPL program, this object sub-index will return the current NMT state of the CANopen module in accordance with the following table:

Value	NMT State
4	STOPPED
5	OPERATIONAL
127	PRE-OPERATIONAL

Emergency Message Counter (EMCY)

Index	0x2862	**Object code**	VAR	**Access**	RW
Sub-index	2	**Data type**	INTEGER32	**PDO mapping**	No
Default	0	**Units**	None		

When associated in a DPL program, this object sub-index will increment by one each time an Emergency (EMCY) message has successfully been sent by the CANopen module error register object 0x1001.

NMT Reset Counter

Index	0x2862	**Object code**	VAR	**Access**	RW
Sub-index	3	**Data type**	INTEGER8	**PDO mapping**	No
Default	0	**Units**	None		

When associated in a DPL program, this object sub-index will increment by one each time an NMT RESET (NMT command 129) occurs.

NMT Communications Reset Counter

Index	0x2862	**Object code**	VAR	**Access**	RW
Sub-index	4	**Data type**	INTEGER8	**PDO mapping**	No
Default	0	**Units**	None		

When associated in a DPL program, this object sub-index will increment by one each time an NMT Communications Reset (NMT command 130) occurs.

11.31 0x3000 - Position Feedback Encoder Source

Index	0x3000	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	Yes
Default	0	**Units**	None		

This object is used to select the source for the position controller feedback and CiA 402 position feedback objects even if position control is not being used.

The following table shows the possible values.

Table 11-30 Position feedback encoder source

Value	Description
0	The feedback source will use the drive motor controller feedback source selected in Pr **03.026**
1	Drive feedback source P1 interface
2	Drive feedback source P2 interface
3	Slot 1 position feedback module P1 interface
4	Slot 1 position feedback module P2 interface
5	Slot 2 position feedback module P1 interface
6	Slot 2 position feedback module P2 interface
7	Slot 3 position feedback module P1 interface
8	Slot 3 position feedback module P2 interface
9	Slot 4 position feedback module P1 interface
10	Slot 4 position feedback module P2 interface
11	Sensorless (the sensorless algorithm estimates the position feedback), this will be ignored if no encoder input is present

This object is evaluated on a change of drive operation mode.

11.32 0x3003 - Homing Source

This object is used to select the digital input source for the homing switch and the freeze or marker source for homing.

Last sub-index

Index	0x3003	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index will return 2 when read, indicating the last sub-index of the object.

Homing switch source

Index	0x3003	**Object code**	VAR	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED8	**PDO mapping**	Yes
Default	5	**Units**	None		

This sub-index selects the digital input/output number (1 to 6) to be used as the source for the homing switch. The selected digital input/output must be configured as an input.

This value is read when the CiA 402 homing operation mode is enabled.

Index source

Index	0x3003	**Object code**	VAR	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED8	**PDO mapping**	Yes
Default	0	**Units**	None		

This sub-index selects the source trigger signal for the homing mode.

The following table shows the possible values.

Table 11-31 Homing mode Freeze or Marker Source

Value	Description
0	Use the marker signal of the position feedback source selected by object 0x3000
1	Use the F1 freeze signal of the position feedback source selected by object 0x3000
2	Use the F2 freeze signal of the position feedback source selected by object 0x3000

If either of the Freeze options is selected (1 or 2) then the appropriate drive parameters (Pr **03.101** to Pr **03.103**, or Pr **03.105** to Pr **03.107**) must be configured correctly.

This object is read in the following conditions:

- The mode of operation is changed and the state is ‘SWITCHED ON’ or ‘OPRERATION ENABLED’.
- State transitions from ‘READY TO SWITCH ON’ to ‘SWITCHED ON’
- State transitions from ‘OPERATION ENABLED’ to ‘SWITCHED ON’
- State transitions from ‘QUICK STOP ENABLED’ to ‘OPERATION ENABLED’

11.33 0x3004 - Additional Position Loop Scaling

This object is used to select the source for the position controller feedback and CiA 402 position feedback objects even if position control is not being used.

Last sub-index

Index	0x3004	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Output scaling numerator

Index	0x3004	**Object code**	VAR	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index sets/returns the output scaling numerator value (0 to $2^{32} – 1$).

Output scaling denominator

Index	0x3004	**Object code**	VAR	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index sets/returns the output scaling denominator value (0 to $2^{32} – 1$).

11.34 0x3008 – Velocity Mode Redirection Enable

In velocity mode, object 0x6042 (*VL target velocity*) is normally used as the velocity reference, object 0x3008 can be used to change this to select object 0x60FF (*Target Velocity*) instead.

Velocity mode redirection enable

Index	0x3008	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	BOOLEAN	**PDO mapping**	No
Default	FALSE	**Units**	None		

This object is read on a transition in state from ‘READY TO SWITCH ON’ to ‘SWITCHED ON’.

11.35 0x3009 - Manufacturer enhanced scaling

Setting this object to 1 increases the velocity loop resolution within the AMC, to match as close as possible to the resolution of the encoder as defined via 0x608F, using both the AMC Master input and AMC Slave user unit's ratios.

Index	0x3009	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	BOOLEAN	**PDO mapping**	Yes
Default	0	**Units**	None	**Maximum**	1

If the Profile Position (PP) mode is active and the Manufacturer enhanced scaling is enabled by object 0x3009, the scale factor is pre-multiplied by a power of 2 until the denominator is lower than 2 times the numerator; in this case the AMC internal unit doesn't correspond to the user units.

11.36 Network management objects (NMT)

SI-CANopen V2 uses the standard CANopen network management state machine to determine the behaviour of the communication objects. Figure 11-1 shows the NMT state machine, and the different state transitions that are possible.

Figure 11-1 NMT state machine

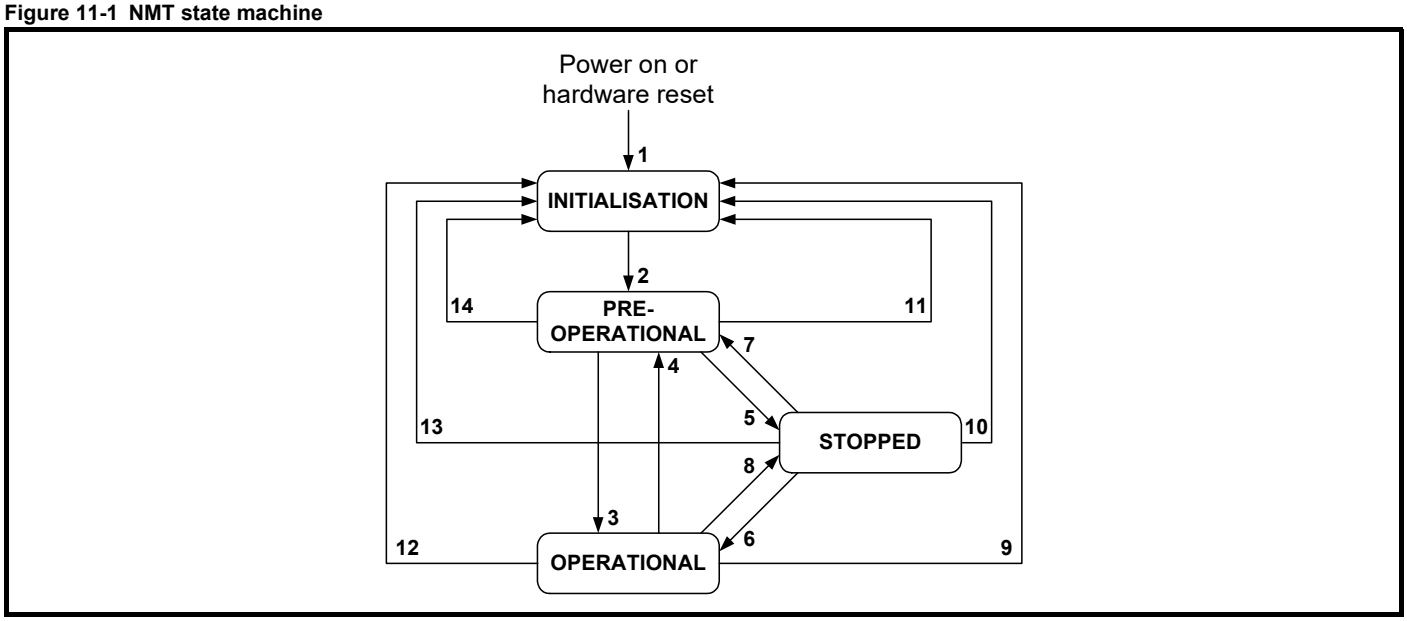


Table 11-32 NMT state machine transitions

Transition	Transition initiated by
1	At power on or hardware reset, enter INITIALISATION automatically
2	INITIALISATION complete, enter PRE-OPERATIONAL automatically
3, 6	START_REMOTE_NODE
4, 7	ENTER_PRE_OPERATIONAL
5, 8	STOP REMOTE NODE
9, 10, 11	RESET_NODE
12, 13, 14	RESET_COMMUNICATION

11.36.1 NMT states

SI-CANopen V2 has various different communication objects, but some objects are only active in certain NMT states. Table 11-33 lists the communication objects supported by SI-CANopen V2, and the NMT states in which each object is active.

Table 11-33 NMT states and active messages

Object	INITIALISATION	PRE-OPERATIONAL	OPERATIONAL	STOPPED
PDO	-	-	Active	-
SDO	-	Active	Active	-
SYNC	-	Active	Active	-
Emergency	-	Active	Active	-
Boot-up	Active	-	-	-
NMT		Active	Active	Active

11.36.2 Initialisation

SI-CANopen V2 may be switched into ***Initialisation*** from any other state using the RESET_NODE or RESET_COMMUNICATION commands.

11.36.3 Pre-operational

The synchronisation object, emergency object, NMT objects and SDO communications are all active in the PRE-OPERATIONAL state, allowing device configuration to take place. PDOs do not exist in the PRE-OPERATIONAL state and are inactive. This allows PDO configuration and mapping objects to be configured without interfering with active communications.

SI-CANopen V2 may be switched into PRE-OPERATIONAL from OPERATIONAL (transition 4) or STOPPED (transition 7) using the ENTER_PRE-OPERATIONAL command.

11.36.4 Operational

All communication objects are active in the OPERATIONAL state. All configured PDOs are created when SI-CANopen V2 enters the OPERATIONAL state, using the parameter values in the object dictionary. SDO communications remain active in the OPERATIONAL state.

SI-CANopen V2 may be switched into OPERATIONAL from PRE-OPERATIONAL (transition 3) or STOPPED (transition 6) using the START_REMOTE_NODE command.

11.36.5 Stopped

All communications (except NMT and heartbeat) are stopped when the SI-CANopen V2 is switched into the STOPPED state. SI-CANopen V2 will only respond to NMT messages while in the STOPPED state, so it must be switched into the PRE-OPERATIONAL or OPERATIONAL state to re-start communications. The heartbeat error control protocol remains active during the STOPPED state.

SI-CANopen V2 may be switched into STOPPED from PRE-OPERATIONAL (transition 5) or OPERATIONAL (transition 8) using the STOP_REMOTE_NODE command.

11.37 NMT commands

Network Management (NMT) commands are low-level CANopen commands that are used to switch SI-CANopen V2 between the different NMT states. NMT messages always have a CAN identifier of 0x000 and contain 2 data bytes.

Table 11-34 NMT message structure

CAN identifier	Command (See Table 11-35)	Node ID
0x000	See Table 11-35	Target node

Table 11-35 NMT commands

Command	Code
START_REMOTE_NODE	1
STOP_REMOTE_NODE	2
ENTER_PRE_OPERTATIONAL	128
RESET_NODE	129
RESET_COMMUNICATION	130

11.38 Layer setting services (LSS)

SI-CANopen V2 supports the complete CANopen Layer Setting Service protocol, as defined in DSP205 V1.1. LSS provides the ability for a CANopen device with LSS Master capabilities to enquire and change the settings of certain parameters of the local layers on a LSS Slave CANopen device via the CAN network.

The following parameters can be enquired and/or changed by the use of LSS:

- Node-ID of the CANopen slave
- Bit timing parameters of the physical layer (baud rate)
- LSS address (Identity Object, Index 0x1018). The LSS address consists of Vendor ID, Product Code, Revision Number and Serial Number, and is unique to every SI-CANopen V2.

11.38.1 Enabling LSS

LSS functionality is enabled automatically if SI-CANopen V2 initialises without an active node address, or when an NMT Stop command is issued. In default configuration, SI-CANopen V2 will have LSS enabled. There is no NMT functionality when LSS is active.

When LSS is active, all CANopen devices will receive LSS commands on COB-ID 2021 (0x07E5) and respond on COB-ID 2020 (0x07E4). All LSS messages are 8 bytes long.

11.38.2 Configuring SI-CANopen V2 via LSS

When SI-CANopen V2 enters LSS mode, it is in an “operational” state, and no configuration can take place. SI-CANopen V2 must be switched into “configuration” by:

1. addressing an SI-CANopen V2 using its complete (and unique) LSS address.
2. switching all LSS devices into the “configuration” state.

Switching “all” devices into the “configuration” state should only be used when there is a single node on the network in LSS mode, or a bit timing change is required. This can be used for adding a single node at a time to the network without knowing its LSS address, configuring and activating it before adding another new device.

11.38.3 Switch mode global

The switch mode global command is used to change the LSS state of all nodes currently in LSS.

Table 11-36 Global Modes

COB-ID	Byte		
	0	1	2 - 7
0x7E5	0x04	Mode	Reserved (set to 0)

Mode 0 - switches all devices into “operational” mode.

Mode 1 - switches all devices into “configuration” mode.

If a device has a node address, the switch mode global command to “operational” will cause the device to re-initialise and activate with the new settings.

11.38.4 Switch mode selective

The switch mode selective commands are used to change a single device into the “configuration” state. A series of four commands are issued containing the four values of the LSS address. If all four values match the local values, and are received in the correct sequence, SI-CANopen V2 will enter the “configuration” state and respond with a message to indicate that is now in this state.

All parts of the LSS address are obtained from the identity object (0x1018).

11.38.5 Select vendor ID

Command to specify the Vendor ID of the target SI-CANopen V2.

Table 11-37 Vendor ID

COB-ID	Byte		
	0	1 - 4	5 - 7
0x7E5	0x40	Vendor ID	Reserved (set to 0)

11.38.6 Select product code

Command to specify the Product Code of the target SI-CANopen V2.

Table 11-38 Product Code

COB-ID	Byte		
	0	1 - 4	5 - 7
0x7E5	0x41	Product Code	Reserved (set to 0)

11.38.7 Select revision number

Command to specify the Revision Number of the target SI-CANopen V2.

Table 11-39 Revision Number

COB-ID	Byte		
	0	1 - 4	5 - 7
0x7E5	0x42	Revision Number	Reserved (set to 0)

11.38.8 Select serial number

Command to specify the Serial Number of the target SI-CANopen V2.

Table 11-40 Serial Number specification

COB-ID	Byte		
	0	1 - 4	5 - 7
0x7E5	0x43	Serial Number	Reserved (set to 0)

11.38.9 Response

When a device has been identified, it will respond to acknowledge the mode change.

Table 11-41

COB-ID	Byte	
	0	1 - 7
0x7E4	0x44	Reserved (set to 0)

11.38.10 Configure node-ID

Configure node-ID is used to assign a new node address to the device currently in “configuration” state. For SI-CANopen V2, the new node address will be written to Pr **S.01.004**. Once a device has a configured node ID, it will reset and start up using the new address when it is next switched in “operational” state.

Table 11-42 Node configuration

COB-ID	Byte		
	0	1	2 - 7
0x7E5	0x11	Node ID	Reserved (set to 0)

The device will respond to acknowledge the new node-ID.

Table 11-43 Node-ID acknowledgement

COB-ID	Byte			
	0	1 (see table 12.50)	2	3 - 7
0x7E4	0x11	Error code	Spec error	Reserved (set to 0)

Table 11-44 Error Types

Error Type	Byte	Description
Error code	0	Node-ID accepted
Error code	1	Node-ID out of range
Spec error	0	Always 0

11.38.11 Changing data rate

LSS allows the network data rate to be changed safely without any bus-off errors occurring. Every device node on the network must be in the “configuration” state. LSS protocol specifies a delay period before and after the data rate change during which devices are not allowed to place any message on the CAN network. This ensures that every node is able to change data rate safely without causing bus-off errors.

11.38.12 Configure bit timing

This is used to set a new value for the data rate. When a new data rate is specified

SI-CANopen V2 will update Pr **S.01.007**, but the new setting will not take effect until the communications are re-initialised, or *Activate Bit Timings* command is issued.

Table 11-45 Configure bit timing

COB-ID	Byte			
	0	1	2	3 - 7
0x7E5	0x13	Table sel	Table ind	Reserved (set to 0)

Table sel 0 = standard CiA bit timings.

Table ind 0 to 8 = standard data rate settings. Refer to section (Pr **S.01.005**).

The devices will respond to acknowledge receipt of the new bit timings.

Table 11-46 Bit acknowledgement

COB-ID	Byte			
	0	1	2	3 - 7
0x7E4	0x13	Err code	Spec error	Reserved (set to 0)

Err code 0 = bit timing accepted.

Err code 1 = bit timing not supported.

Spec error = always 0.

11.38.13 Activate bit timing

This command tells all devices to change to the new data rate. If any of the devices have different data rate settings, or are not in “Configuration”, a conflict will occur and a bus-off error may occur. The switch delay time is specified in milliseconds, and specifies the idle time before and after the data rate change during which no devices are allowed to communicate on the network.

Table 11-47 Bit activation

COB-ID	Byte		
	0	1 - 2	3 - 7
0x7E5	0x15	Switch delay	Reserved (set to 0)

11.38.14 Store configuration

The store configuration command will force all drive parameters to be saved, provided the drive is not in a tripped state.

Table 11-48 Store configuration

COB-ID	Byte	
	0	1 - 7
0x7E5	0x17	Reserved (set to 0)

SI-CANopen V2 will respond to acknowledge the save request.

Table 11-49 Configuration acknowledgement

COB-ID	Byte			
	0	1	2	3 - 7
0x7E4	0x17	Err code	Spec error	Reserved (set to 0)

Err code 0 = parameters saved.

Err code 1 = drive tripped, parameters were not saved.

Spec error = always 0.

11.38.15 Inquire Service

The Inquire Service command can be used to receive information about a device that is in the “configuration” state. Only one device may be in this state when this command is used.

If new devices are added to the SI-CANopen network one at a time, their default mode will be LSS. By using the Switch Mode Global and Inquire Service commands, the master can retrieve the information that is needed for addressing each device before configuring it and switching it out of LSS.

11.38.16 Inquire vendor ID

Request message:

Table 11-50 Request message

COB-ID	Byte	
	0	1 - 7
0x7E5	0x5A	Reserved (set to 0)

Response message:

Table 11-51 Response message

COB-ID	Byte		
	0	1 - 4	5 - 7
0x7E4	0x5A	Vendor ID	Reserved (set to 0)

11.38.17 Inquire product code

Request message:

Table 11-52 Request message

COB-ID	Byte	
	0	1 - 7
0x7E5	0x5B	Reserved (set to 0)

Response message:

Table 11-53 Response message

COB-ID	Byte		
	0	1 - 4	5 - 7
0x7E4	0x5B	Product Code	Reserved (set to 0)

11.38.18 Inquire revision number

Request message:

Table 11-54 Request message

COB-ID	Byte	
	0	1 - 7
0x7E5	0x5C	Reserved (set to 0)

Response message:

Table 11-55 Response message

COB-ID	Byte		
	0	**1 - 4**	**5 - 7**
0x7E4	0x40	Revision Number	Reserved (set to 0)

11.38.19 Inquire serial number

Request message:

Table 11-56 Request message

COB-ID	Byte	
	0	**1 - 7**
0x7E5	0x5D	Reserved (set to 0)

Response message

Table 11-57 Response message

COB-ID	Byte		
	0	**1 - 4**	**5 - 7**
0x7E4	0x40	Serial Number	Reserved (set to 0)

11.38.20 Inquire node-ID

Request message:

Table 11-58 Request message

COB-ID	Byte	
	0	**1 - 7**
0x7E5	0x5A	Reserved (set to 0)

Response message:

Table 11-59 Response message

COB-ID	Byte			
	0	**1**	**2**	**3**
COB-ID EMCY (Index 0x1014)	Emergency error code (See Table 11-61)		Error register (Index 0x1001)	Drive trip code (Pr **0.10.020**)
	4	**5**	**6**	**7**
	SI-CANopen V2 Error code (Pr **0.10.070**)	Manufacturer specific byte (0x1001, sub 0)	Manufacturer specific bytes (0x1001, sub 1)	

11.39 0x1014 - Emergency object

11.39.1 What is the emergency object?

Emergency objects are transmitted by the SI-CANopen V2 when it detects that the drive has tripped. They are high priority messages that inform the CANopen master controller that some sort of error has occurred. It is up to the CANopen master controller to take appropriate action.

Emergency objects are suitable for interrupt-type error alerts. An emergency object is transmitted only once per error event and provided that no new errors occur, no further emergency objects will be transmitted.

11.39.2 Emergency object format

The emergency object consists of a total of eight data bytes. The first 3 bytes are defined by the CANopen specification, and the remaining five bytes are manufacturer-specific.

SI-CANopen V2 will return the drive trip code and the SI-CANopen V2 error code, allowing the CANopen master controller to determine exactly what fault has occurred.
Bytes 5 to 7 are always transmitted, but will always be set to 0.

Table 11-60 Emergency object format

COB-ID	Byte				
	0	1	2	3	4
COB-ID EMCY (Index 0x1014)	Emergency error code (See Table 11-61)		Error register (Index 0x1001)	Drive trip code (Pr **0.10.020**)	CANopen error (Pr **0.10.070**)

The CANopen specification defines a list of standard error codes. Supported CANopen emergency error codes (and the drive trips that will produce the emergency error code) are listed in Table 11-61. All other drive trips will produce the generic error code, 0x1000.

Table 11-61 Emergency error codes

Error Category	Error Code	Drive Trip Code		Trip Name
		M7XX	M2XX/M4XX C200/C300	
Error reset / No error	0x0000	-	-	None
Short circuit / earth leakage (Device)	0x2230	5		PSU
		9	-	PSU_24V
		92		OI_SNUBBER
Short circuit (Motor)	0x2340	3		OI_AC
Phase failure	0x3130	32		PHASE_LOSS
		98		OUT_PHASE_LOSS
		198	-	
DC link over-voltage	0x3210	2		OVER_VOLTS
Load error	0x3230	38	-	LOW_LOAD
Excess temperature	0x4310	21		OHT_INVERTER
	0x4311	22		OHT_POWER
	0x4312	23	219	OHT_CONTROL
	0x4313	24		THERMISTOR
	0x4314	27		OHT_DC_BUS
	0x4315	101	-	OHT_BRAKE
	0x431F	S.213		OHT_OPTION_MODULE
Control device hardware	0x5112	91	-	USER_24V
	0x5200	200		SLOT1_HF
	0x5201	203		SLOT1_NOT_FITTED
	0x5202	204		SLOT1_DIFFERENT
	0x5203	205	-	SLOT2_HF
	0x5204	208	-	SLOT2_NOT_FITTED
	0x5205	209	-	SLOT2_DIFFERENT
	0x5206	210	-	SLOT3_HF
	0x5207	213	-	SLOT3_NOT_FITTED
	0x5208	214	-	SLOT3_DIFFERENT
	0x5209	250	-	SLOT4_HF
	0x520A	253	-	SLOT4_NOT_FITTED
	0x520B	254	-	SLOT4_DIFFERENT

Error Category	Error Code	Drive Trip Code		Trip Name
		M7XX	M2XX/M4XX C200/C300	
Power section	0x5400	111	-	CONFIGURATION
		220		POWER_DATA
		223	-	RATING_MISMATCH
Input stages	0x5430	94	-	RECTIFIER_SETUP
Contacts	0x5440	226		SOFT_START
RAM	0x5510	227	-	SUB_ARRAY_RAM
Data storage (Non-volatile data memory)	0x5530	31		EEPROM_FAIL
		36		USER_SAVE
		37		POWER_DOWN_SAVE
Software reset (watchdog)	0x6010	30		WATCHDOG
Parameter error	0x6320	199		DESTINATION
		216	-	SLOT_APP_MENU
		217	-	APP_MENU_CHANGED
Brake chopper over-current	0x7112	4		OI_BRAKE
		19		BRAKE_R_TOO_HOT
Protective circuit brake chopper	0x7113	10	-	TH_BRAKE_RES
Motor	0x7120	11		AUTOTUNE_1
		12	-	AUTOTUNE_2
		13	-	AUTOTUNE_3
Motor or commutation error	0x7122	14	-	AUTOTUNE_4
		15	-	AUTOTUNE_5
		16	-	AUTOTUNE_6
		20	-	MOTOR_TOO_HOT
		25		TH_SHORT_CIRCUIT
		33		RESISTANCE
Sensor	0x7300	17	-	AUTOTUNE_7
		162	-	ENCODER_12
		163	-	ENCODER_13
		176	-	NAME_PLATE
		189	-	ENCODER_1
		190	-	ENCODER_2
		191	-	ENCODER_3
		192	-	ENCODER_4
		193	-	ENCODER_5
		194	-	ENCODER_6
		195	-	ENCODER_7
		196	-	ENCODER_8
		197	-	ENCODER_9
		218		TEMP_FEEDBACK
Sensor (speed)	0x7310	7		OVER_SPEED
Communication	0x7500	90	93	POWER_COMMS
		103	-	INTER_CONNECT

Error Category	Error Code	Drive Trip Code		Trip Name
		M7XX	M2XX/M4XX C200/C300	
Data storage	0x7600	174	-	CARD_SLOT
	0x7601	175		CARD_PRODUCT
	0x7603	177	-	CARD_USER_PROG
	0x7604	178		CARD_BUSY
	0x7605	179		CARD_DATA_EXISTS
	0x7606	180		CARD_OPTIONS
	0x7607	181		CARD_READ_ONLY
	0x7608	182		CARD_ERROR
	0x7609	183		CARD_NO_DATA
	0x760A	184		CARD_FULL
	0x760B	185		CARD_FILE_ERROR
	0x760C	186		CARD_RATING
	0x760D	187	-	CARD_FILE_DATA
	0x760E	188	-	CARD_DERIVATIVE
General communication errors (Drive trip)	0x8101	Option module specific		
	0x8102			
	0x8103			
	0x8104			
	0x8105			
General communication errors (No drive trip)	0x8606	PDO loss		
	0x8607	Network link loss		
	0x8608	Drive control by the CiA 402 profile disabled		
Manufacturer specific	0xFF01	Any trip code not listed		

The object 0x603F is automatically cleared when the fault condition is reset.

For full details about each trip, refer to the drive documentation.

Error register (byte 2)

The error register byte contains the current Error Register object (0x1001) value and is used by the SI-CANopen V2 to indicate that an error has occurred, and can be mapped to TxPDOs if required. If a bit is set to 1, the specified error has occurred according to the following table.

Table 11-62 Error register byte

Bit	Name	Description
b0	Generic error	Set if any other bits in the register are set
b1	Current	Set if a current error has occurred
b2	Voltage	Set when the drive is in the under-voltage (UU) state
b3	Temperature	Set if a temperature error has occurred
b4	*Reserved*	Always set to 0
b5		
b6		
b7	Manufacturer specific	Set if Pr **0.10.019** is set

Drive trip code (byte 3)

The drive trip code byte contains the current value of the last stored trip code in Pr **0.10.020**.

In the event that the drive is in the under-voltage (UU) state, this byte will contain the value 0x01 as the UU state is not stored as a trip.

For more details on the drive trips please refer to the relevant drive documentation.

Slot error code (byte 4)

In the case of a slot error trip (SL.x.Er) this byte contains the error code from the relevant slot.

For more details on the option module errors please refer to the relevant option module documentation.

Associated Emergency Triggering

Using the object association it is possible to trigger Emergency Messages from DPL code within the SI-Applications module. An association must be made to Error Register object (0x1001) sub-index 0, this should be a 32-bit read-only association. When Inter option association is enabled this will be polled in the background task and used to trigger the emergency handler.

The object is formatted as follows.

MSB							LSB
Reserved		*User specific*	Slot Error	Drive Trip	Error Reg	Error Code	

A change of the error code will cause the emergency object error handler to trigger. The emergency object will be formatted as normal, but containing the error code specified in the associated object. The error register value will be a logical “OR” with the value produced by the emergency handler in the module. The user specific byte will be placed in the 5th manufacturer specific byte of the emergency object.

For the error-free (all zeros) emergency object to be transmitted, both the emergency handler in the module and the associated object must signify the error is cleared.

11.40 Emergency object state

The SI-CANopen V2 may be in one of two emergency states, as shown in Figure 11-2.

Figure 11-2 Emergency object states

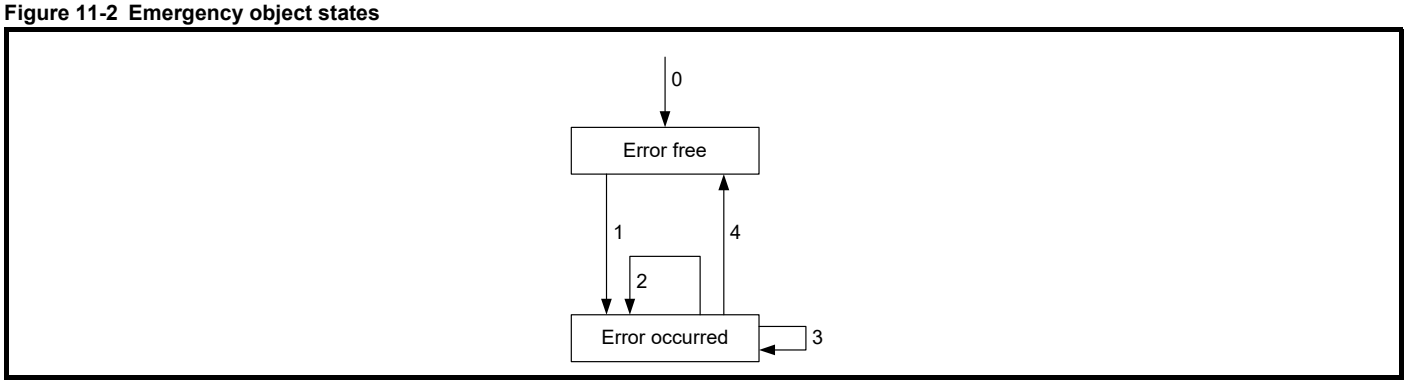


Table 11-63 Emergency object state transitions

Transition	Reference	Description
0	Initialisation	After initialisation, SI-CANopen V2 enters the error free state if no error is detected. The emergency object is not transmitted.
1	Error occurred	SI-CANopen V2 detects an error, transmits the emergency object once, and enters the error state.
2	Reset, new error occurred	One error (but not all errors) have been cleared. SI-CANopen V2 will transmit another emergency object with information about the remaining error.
3	New error occurred	SI-CANopen V2 has detected a new error condition, while in the error state. SI-CANopen V2 remains in error state and transmits another emergency object with the appropriate error codes.
4	Reset, error cleared	All errors have been cleared. SI-CANopen V2 will return to the error free state, and transmit an emergency object with the emergency error code set to 0x0000.

11.41 Device profiles

This section details the supported CiA 402 device profiles and the supporting objects.

In addition to the basic position mode operation, the following CiA 402 device profiles are supported in SI-CANopen V2:

- Profile torque mode
- Velocity mode
- Homing mode
- Profile Position (CiA 402 mode only - Pr **S.01.021** = CIA 402 Profile)

11.41.1 Conversion factors

The velocity mode profile specifies velocity parameters in rpm or percent, time parameters in seconds, and ramps in rpm/second. The drive uses different units for the different types of parameter, so conversion factors must be used.

Hz/rpm functions

The Hz/rpm functions are used when the drive is in open loop mode, as all speed reference parameters within the drive have units of Hz. The number of motor pole pairs is read from the drive whenever these equations are used.

Hz = rpm x PolePairs / 60

rpm = Hz x 60 / PolePairs

Ramp conversion functions

The ramp conversion functions are used to convert between rpm/s (specified using DeltaSpeed and DeltaTime) and the ramp specification used by the drive.

In open loop and SE mode, drive ramp units are specified in s/100 Hz.

Secs / 100 Hz = DeltaTime x (100 x 6 / PolePairs) x 100 / DeltaSpeed

In closed loop and servo modes, drive ramp units are specified in s/1000 rpm.

Secs / 1000 rpm = DeltaTime x 1000 x 1000 / DeltaSpeed

11.41.2 Parameter data object mapping

The *control word* and *status word* used by the device profile modes are not the standard drive control and status words. They are defined in CiA DSP-402 V1.1, “Device Profile for Drive and Motion Control”.

11.41.3 Profile torque mode PDO mapping

When the profile torque mode is selected, RxPDO5 and TxPDO5 consist of two 16-bit words. The specified mappings for profile torque mode are shown in Table 11-64.

Table 11-64 PDO5 mapping

Data word	Mapped object	Mapped object name
RxPDO5 Word 0	0x6040	*Control word*
RxPDO5 Word 1	0x6071	*Target torque*
TxPDO5 Word 0	0x6041	*Status word*
TxPDO5 Word 1	0x6077	*Torque actual value*

11.41.4 Velocity mode PDO mapping

When the velocity mode profile is selected, RxPDO6 and TxPDO6 consists of two 16-bit words. The specified mappings for velocity mode are shown in Table 11-65.

Table 11-65 PDO6 mapping

Data word	Mapped object	Mapping status
RxPDO6 Word 0	0x6040	*Control word*
RxPDO6 Word 1	0x6042	*VL target velocity*
TxPDO6 Word 0	0x6041	*Status word*
TxPDO6 Word 1	0x6044	*VL control effort*

11.41.5 Common device profile objects

The common objects may be used by all supported profiles.

Table 11-66 Supported common objects

Index	Name	Type	Access	PDO mapping
0x3000	Position feedback encoder source	UNSIGNED8	RW	Yes
0x3004	Additional position loop scaling	Various	RO/RW	Yes
0x6007	Abort connection option code	INTEGER16	RW	No
0x603F	Error code	UNSIGNED16	RO	Yes
0x6040	Control word	UNSIGNED16	RW	Yes
0x6041	Status word	UNSIGNED16	RW	Yes
0x6044	VL velocity actual value	INTEGER16	RO	Yes
0x604A	VL velocity quick stop	Various	RO/RW	Yes
0x605A	Quick stop option code	INTEGER16	RW	No
0x605B	Shutdown option code	INTEGER16	RW	No
0x605C	Disable operation option code	INTEGER16	RW	No
0x605D	Halt option code	INTEGER16	RW	Yes
0x605E	Fault reaction option code	INTEGER16	RW	No
0x6060	Modes of operation	INTEGER8	RW	Yes
0x6061	Modes of operation display	INTEGER8	RW	Yes
0x6064	Position actual value	INTEGER32	RO	Yes
0x606C	Velocity actual value	INTEGER32	RO	Yes
0x6073	Max current	UNSIGNED16	RW	Yes
0x6075	Motor rated current	UNSIGNED32	RW	No
0x6077	Torque actual value	INTEGER16	RO	Yes
0x6078	Current actual value	INTEGER16	RO	Yes
0x6080	Max motor speed	UNSIGNED32	RW	Yes
0x608F	Position encoder resolution	Various	RO	Yes
0x6091	Gear ratio	Various	RO/RW	Yes
0x6092	Feed constant	Various	RO/RW	Yes
0x60FB	Position control parameter set	Various	RO/RW	Yes
0x60FF	Target velocity	INTEGER32	RW	Yes
0x6502	Supported drive modes	UNSIGNED32	RO	Yes

11.41.6 0x6007 - Abort connection option code

Index	0x6007	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	No
Default	1	**Units**	None		

This object configures the CiA 402 state machine behaviour in the event of a network loss being detected by the SI-CANopen V2 module.

The possible values are shown in Table 11-67.

Table 11-67 Abort connection option codes

Value	Action
-3	Execute the quick stop according to the *Quick stop option code* (0x605A), then trip the drive
-2	Immediately disable the drive (DISABLE VOLTAGE command), then trip the drive
-1	Execute the fault reaction according to the *Fault reaction option code* (0x605E), then trip the drive
0	No action
1	Execute the fault reaction according to the *Fault reaction option code* (0x605E), no drive trip
2	Immediately disable the drive (DISABLE VOLTAGE command), no drive trip
3	Execute the quick stop according to the *Quick stop option code* (0x605A), no drive trip

11.41.7 0x603F - Error code

Index	0x603F	Object code	VAR	Access	RO
Sub-index	0	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	N/A	**Units**	None		

The *Error code* captures the code of the last error that occurred in the drive. It corresponds to the value of the low 16 bits of object 0x1003, *Pre defined error field*.

11.41.8 0x6040 - Control word

Index	0x6040	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	0	**Units**	None		

Control word provides the commands for logical control (enable, run, reset, etc.) of the drive, according to the pre-defined ***Control word*** state machine. In each state, the SI-CANopen V2 will convert *Control word* and set the drive control word (Pr **06.042**) as required to attain the required operating state.

NOTE The drive control word must be enabled by setting Pr **06.043** to ON (or 1) to allow *Control word* to control Pr **06.042**.

Table 11-68 *Control word* bit descriptions

Bit	Name	Description
0	SWITCH ON	Used to sequence the drive through the CiA 402 state machine
1	ENABLE VOLTAGE	
2	QUICK STOP	
3	ENABLE OPERATION	
4	*OPERATION MODE SPECIFIC*	NEW SETPOINT (Profile Position) START (Homing)
5		CHANGE SETPOINT IMMEDIATELY (Profile Position)
6		ABSOLUTE/RELATIVE (Profile Position)
7	FAULT RESET	Resets a fault condition on a positive transition
8	HALT	Interrupts the motion in progress as specified in the *Halt option code* (0x605D) setting
9	*OPERATION MODE SPECIFIC*	CHANGE ON SETPOINT (Profile Position)
10	*Reserved*	These bits are reserved for future use
11		
12		
13		
14		
15		

Seven device commands are used to switch between different control states, and these are listed in Table 11-69 below.

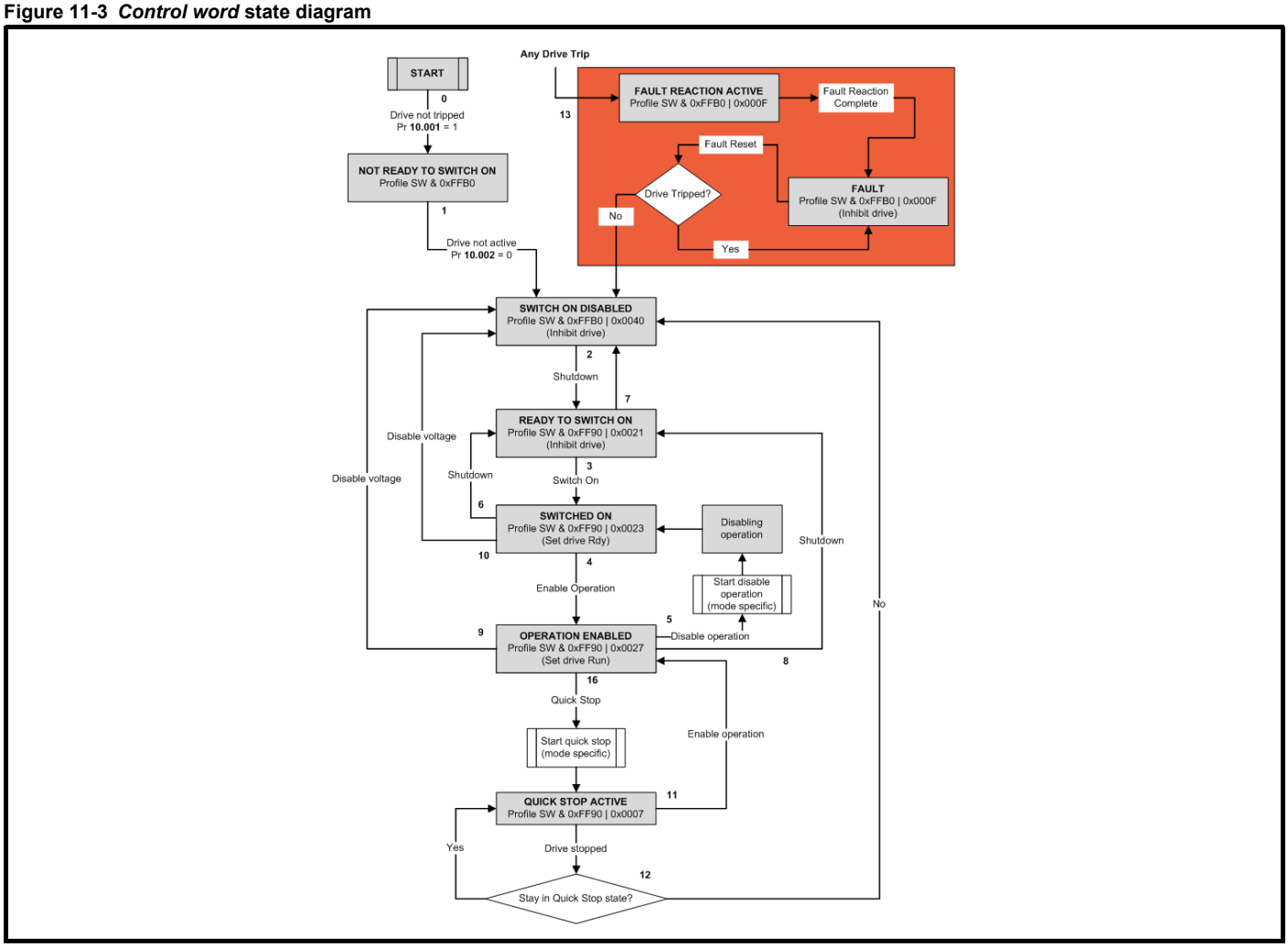
Table 11-69 Example control words

Command	***Control word* bit**				
	b7	**b3**	**b2**	**b1**	**b0**
SHUTDOWN	0	0	1	1	0
SWITCH ON	0	0	1	1	1
SWITCH ON + ENABLE OPERATION	0	1	1	1	1
DISABLE VOLTAGE	0	X	X	0	X
QUICK STOP	0	X	0	1	X
DISABLE OPERATION	0	0	1	1	1
ENABLE OPERATION	0	1	1	1	1
FAULT RESET		X	X	X	X

X = Don't care

States may be changed using the *Control word* and/or internal events. The current state can be read using the *Status word*.

Figure 11-3 *Control word* state diagram



State transitions are caused by internal events in the drive or by commands received from the host via the *Control word* (refer to Figure 11-3 *Control word state diagram* on page 131).

Table 11-70 State transitions for profile control

State transition	Event	Action
0	Pr **10.01** = 1	Drive must not be tripped when *Control word* initialises.
1	Pr **10.02** = 0	Drive must be disabled when *Control word* initialises.
2	*Control word* = “Shutdown”	Specified ramp mode selected in drive.
3	*Control word* = “Switch on”	Select decel ramp 1, Pr **02.020** = 1 Set decel ramp rate, Pr **02.021** as required Set Pr **06.042** bit 0 to 1.
4	*Control word* = “Enable operation”	Select decel ramp 1, Pr **02.020** = 1 Set decel ramp rate, Pr **02.021** as required Set Pr **06.042** bit 1 to 1.
5	*Control word* = “Disable operation”	Specified ramps selected in drive Reset Pr **06.042** bit 1 to 0.
6	*Control word* = “Shutdown”	Specified ramps selected in drive Reset Pr **06.042** bit 1 to 0.
7	*Control word* = “Quick stop”	Move to Switch On Disabled.
8	*Control word*= “Shutdown”	Specified ramps selected in drive Reset Pr **06.042** bit 0 and bit 1 to 0.
9	*Control word* = “Disable voltage”	Reset Pr **06.042** bit 0 and bit 1 to 0.
10	*Control word* = “Disable voltage” or “Quick stop”	Specified ramps selected in drive Reset Pr **06.042** bit 0 to 0.
11	*Control word* = “Quick stop”	Specified ramps selected in drive Reset Pr **06.042** bit 1 to 0.
12	Quick stop complete or *Control word* = “Disable voltage”	Reset Pr **06.042** bit 0 to 0.
13	Pr **10.01** = 1	drive trip.

Table 11-70 State transitions for profile control

State transition	Event	Action
14	Fault reaction complete	Reset Pr **06.042** bit 0 and bit 1 to 0.
15	***Control word*** = "Fault reset"	Specified ramps selected in drive.
16	***Control word*** = "Enable operation"	Specified ramps selected in drive Reset Pr **06.042** bit 1 to 1.

If a command is received which causes a change of state, this command must be processed completely and the new state attained before the next command can be processed.

NOTE State transition 16 is only available if the *Quick stop option code* is set to 5, 6, 7 or 8. Specified ramps are defined by *Shutdown option code*, *Quick stop option code* and *Disable operation option code*.

11.41.9 0x6041 - Status word

Index	0x6041	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	N/A	**Units**	None		

The *Status word* indicates the current status of the drive. The *Status word* bits are defined in Table 11-71.

Table 11-71 *Status word* bit descriptions

Bit	Name	Description
0	READY TO SWITCH ON	Controlled by the CiA 402 state machine
1	SWITCHED ON	
2	OPERATION ENABLED	
3	FAULT	
4	VOLTAGE ENABLED	Indicates the presence of the main supply voltage
5	QUICK STOP	Controlled by the CiA 402 state machine
6	SWITCH ON DISABLED	
7	WARNING	Indicates a drive warning is active, the error code is returned in object 0x603F
8	*Reserved*	*Reserved for future use (always 0)*
9	REMOTE	This bit is cleared (0) when the *Control word* is not processed (CiA 402 profiles disabled)
10	TARGET REACHED	Setpoint reached, this bit is also set (1) if: • Operation mode changed • The motor stopped after a Quick stop or Halt operation
11	INTERNAL LIMIT ACTIVE	This bit indicates if a hardware limit switch is active or the target position is limited by object 0x607D (*Software position limit*)
12	OPERATION MODE SPECIFIC	Setpoint acknowledge (Profile Position) Homing attained (Homing)
13		Following error (Profile Position) Homing error (Homing)
14	MANUFACTURER SPECIFIC	*Reserved for future use (always 0)*
15		

Table 11-72 shows the values of S*tatus word* in each state. Bits marked X are not applicable for that state, and other combinations are not allowed.

Table 11-72 *Status word* value

State	***Status word* bit**					
	b6	**b5**	**b3**	**b2**	**b1**	**b0**
NOT READY TO SWITCH ON	0	X	0	0	0	0
SWITCH ON DISABLED	1	X	0	0	0	0
READY TO SWITCH ON	0	1	0	0	0	1
SWITCHED ON	0	1	0	0	1	1
OPERATION ENABLED	0	1	0	1	1	1
QUICK STOP ACTIVE	0	0	0	1	1	1
FAULT REACTION ACTIVE	0	X	1	1	1	1
FAULT	0	X	1	0	0	0

X = Don't care, all other bits = X

11.41.10 0x6044 – VL Velocity actual value

Index	0x6044	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	0	**Units**	User Units		

This object is updated by the SI-CANopen V2 module independent of the active mode of operation, so is available in all profile modes. It is calculated from a drive parameter dependent on the drive mode and type.

11.41.11 0x604A - VL velocity quick stop

This object specifies the slope of the deceleration ramp when *Quick stop* is activated. It is calculated by dividing *Delta speed* by *Delta time* and converted before writing to Pr **02.022** (*Deceleration Rate 2*).

Last sub-index

Index	0x604A	**Object code**	RECORD	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Delta speed

Index	0x604A	**Object code**	RECORD	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	10000	**Units**	rpm		

Delta speed specifies the velocity reduction in the time specified by *Delta time* when a *Quick stop* is activated.

Delta time

Index	0x604A	**Object code**	RECORD	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	2	**Units**	Seconds		

Delta time specifies the time (seconds) in which the velocity reduction specified by *Delta speed* will occur.

This object is linked to Pr **02.021** (*Deceleration Rate 1*), any change in the object value will be reflected in Pr **02.021** and vice versa. If both object and parameter are changed at the same time then the parameter value takes priority.

The CiA 402 specification defines this object in VL velocity mode only, but the SI-CANopen V2 module updates this object in all profile modes.

11.41.12 0x605A – Quick stop option code

Index	0x605A	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	No
Default	2	**Units**	User Units		

This object specifies the action to perform in the event of a *Quick stop* being activated.

The possible values and actions are shown in Table 11-73.

Table 11-73 Quick stop actions

Value	Action
0	Disable drive function Select Coast stop (Pr **06.001** = Coast)
1	Slow down using slow ramp and transit to SWITCH ON DISABLED Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 2 (Pr **02.020** = 2) Select Standard ramp (Pr **02.004** = Standard)
2	Slow down using quick ramp and transit to SWITCH ON DISABLED Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 3 (Pr **02.020** = 3) Select Fast ramp (Pr **02.004** = Fast)
3	*Reserved*
4	*Reserved*
5	Slow down using slow ramp and remain in QUICK STOP ENABLED Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 2 (Pr **02.020** = 2) Select Standard ramp (Pr **02.004** = Standard)
6	Slow down using *Quick stop* ramp and remain in QUICK STOP ENABLED Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 3 (Pr **02.020** = 3) Select Fast ramp (Pr **02.004** = Fast)

Ramps must be enabled (Pr **02.002** = On) for the ramp functions to work correctly.

11.41.13 0x605B - Shutdown option code

Index	0x605B	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	No
Default	0	**Units**	None		

The *Shutdown option code* parameter determines what action should be taken if there is a transition from OPERATION ENABLE to READY TO SWITCH ON, state transition 8. Refer to Table 11-74 for full details of all stopping modes available. Ramps must be enabled (Pr **02.002** = ON or 1) for the ramp functions to work correctly.

Table 11-74 *Shutdown option code* codes

Value	Action
-1	Slow down with normal ramp, then disable the drive power stage. If the brake control is enabled (Pr **12.041**) the drive power stage remains enabled until Pr **6.008** (*Hold Zero Speed*) is cleared. This option is only available on Unidrive M600/M70X/M88X and Digitax HD in RFC-A or RFC-S mode
0	Disable drive function (switch off the drive power stage) Select Coast stop mode (Pr **06.001** = Coast)
1	Slow down with normal ramp then disable drive function Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 2 (Pr **02.020** = 2) Select Standard ramp (Pr **02.004** = Standard)

11.41.14 0x605C - Disable operation option code

Index	0x605C	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	No
Default	0	**Units**	None		

The *Disable operation option code* parameter determines what action should be taken if there is a transition from OPERATION ENABLE to SWITCHED ON, state transition 5. Refer to Table 11-75 for full details of all stopping modes available. Ramps must be enabled (Pr **02.002** = ON or 1) for the ramp functions to work correctly.

Table 11-75 *Disable operation option code* codes

Value	Action
0	Disable drive function (switch off the drive power stage) Select Coast stop mode (Pr **06.001** = Coast)
1	Slow down with slow ramp then disable drive function Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 2 (Pr **02.020** = 2) Select Standard ramp (Pr **02.004** = Standard)

11.41.15 0x605D - Halt option code

Index	0x605D	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	0	**Units**	None		

This object is used to control what action is taken when a HALT is requested by the *Control word* bit 8.

The possible values and actions are shown in Table 11-76.

Table 11-76 Halt option code codes

Value	Action
0	*Reserved* (no action taken)
1	Slow down with slow ramp and remain in OPERATION ENABLED Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 2 (Pr **02.020** = 2) Select Standard ramp (Pr **02.004** = Standard)
2	Slow down using quick ramp and remain in OPERATION ENABLED Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 3 (Pr **02.020** = 3) Select Fast ramp (Pr **02.004** = Fast)

11.41.16 0x605E - Fault reaction option code

Index	0x605E	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	No
Default	2	**Units**	None		

This object is used to control what action is taken when a fault (PDO loss) is detected, it is ignored if the drive is already in a tripped state.

The possible values and actions are shown in Table 11-77.

Table 11-77 Fault reaction option code values

Value	Action
0	Disable drive function Select Coast stop (Pr **06.001** = Coast)
1	Slow down using slow ramp and transit to SWITCH ON DISABLED Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 2 (Pr **02.020** = 2) Select Standard ramp (Pr **02.004** = Standard)
2	Slow down using quick ramp and transit to SWITCH ON DISABLED Select Ramp stop mode (Pr **06.001** = Ramp) Select Deceleration Rate 3 (Pr **02.020** = 3) Select Fast ramp (Pr **02.004** = Fast)

11.41.17 0x6060 - Modes of operation

Index	0x6060	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER8	**PDO mapping**	Yes
Default	0	**Units**	None		

The *Modes of operation* parameter selects the internal profile which should be used. SI-CANopen V2 profiles must be enabled by setting Pr **S.01.020** to 1 (ON). See parameter **S.01.020** in Section 6.3. for more information. Additional features may be implemented in an SI-Applications DPL program. (where supported).

Table 11-78 Modes of operation codes

Value	Action
-128 to -1	*Reserved*
0	No profile enabled
1	Profile position mode (Pr **S.01.020** = On, Pr **S.01.021** = CIA402 Profile)
2	VL velocity mode
3	Profile velocity mode (not supported)
4	Profile torque mode
5	*Reserved*
6	Homing mode (Pr **S.01.020** = On)
7	Interpolated position mode
8	Cyclic sync position mode (not supported)
9	Cyclic sync velocity mode (not supported)
10	Cyclic sync torque mode (not supported)
11 to 127	*Reserved*

As of SI-CANopen V2 firmware version V02.04.05.06, the following applies:

The change of the active operating mode can be requested by writing the value corresponding to the new mode in object 0x6060. If the motor is moving, this object is not evaluated until the speed is below the Zero Speed Threshold (Pr **03.005**).

If the brake controller is enabled (Pr **12.041**) and the drive is enabled, the mode change is blocked until the CiA402 state changes to SWITCH ON DISABLED, READY TO SWITCH ON or SWITCHED ON, or until the FAULT state activates. For selected operating modes it is possible to move to and from Homing whilst in OPERATION ENABLED.

Only the modes of operation reported by the object 0x6502 can be selected.

Regarding the START bit (bit 4) of the control word during mode change. If the START bit is active (on) before the mode change, then it will be ignored until it is set to 'On' again.

11.41.18 0x6061 - Modes of operation display

Index	0x6061	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER8	**PDO mapping**	Yes
Default	N/A	**Units**	None		

The *Modes of operation display* parameter shows the currently selected profile. See section 11.41.17 *0x6060 - Modes of operation*.

11.41.19 0x6064 – Position actual value

Index	0x6064	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	N/A	**Units**	User Units		

The *Position actual value* object shall provide the actual value of the position measurement device. It will contain the value supplied by position mode (in user units). It will be updated every sync cycle.

P1 Normalised Position (Pr **03.058**) / *P2 Normalised Position* (Pr **03.158**) / *Sensorless Position* (Pr **03.080**) is the position taken from the position feedback device including the effect of the marker function.

This object is updated in all operating modes, provided the feedback source is configured via object 0x3000 (*Position encoder feedback source*) and that it is supported by the drive.

11.41.20 0x606C – Velocity actual value

Index	0x606C	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	N/A	**Units**	User Units/s		

The *Velocity actual value* object shall provide the actual velocity feedback value of the position measurement device. It will be updated every 250 µs.

This object is updated in all operating modes, provided the feedback source is configured via object 0x3000 (*Position encoder feedback source*) and that it is supported by the drive. It is not available on drives without a position feedback device or on drives operating in open-loop mode.

11.41.21 0x6073 – Max current

Index	0x6073	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	<Pr 04.007>	**Units**	0.1 %		

This object specifies the maximum current value in 0.1 % units.

e.g. A value of 1000 equates to 100.0 %.

This object is linked to Pr **04.007** (*Symmetrical Current Limit*), any change in the object value will be reflected in Pr **04.007** and vice versa. If both object and parameter are changed at the same time then the parameter value takes priority.

This object is initialised with the value of Pr **04.007** on startup.

11.41.22 0x6075 – Motor rated current

Index	0x6075	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	No
Default	<Pr 05.007>	**Units**	mA		

This object specifies the motor rated current in mA and is linked to Pr **05.007** (*Rated Current*).

Any change in the object value will be reflected in Pr **05.007** and vice versa. If both object and parameter are changed at the same time then the parameter value takes priority.

This object is initialised with the value of Pr **05.007** on startup.

11.41.23 0x6077 – Torque actual value

Index	0x6077	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	<Pr 04.020> or <Pr 04.003>	**Units**	0.1% rated torque		

This object returns the estimated torque value on the motor shaft, it is obtained from the torque producing current represented as a percentage of the rated value for the motor.

For a drive operating in open-loop mode, this object value is copied from Pr **04.020** (*Percentage Load*), in RFC-A mode this object value is copied from Pr **04.003** (*Final Torque Reference*).

11.41.24 0x6078 - Current actual value

Index	0x6078	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	<Pr 04.001>	**Units**	0.1% rated current		

This object indicates the actual instantaneous value of current in 0.1 % units derived from Pr **04.001** (*Current Magnitude*).

e.g. A value of 1000 equates to 100.0 % in Pr **04.001**.

11.41.25 0x6080 – Max motor speed

Index	0x6080	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	N/A	**Units**	User Units/s		

This object indicates the configured maximum allowed motor speed in either direction. It is initialised with the value from Pr **01.006** (*Maximum Reference Clamp*) after the appropriate conversion factors in the following circumstances:

- Startup
- CiA 402 profiles re-enabled
- Operating mode changed

When this object is written, the value is copied and converted using the appropriate conversion factors, before being written to Pr **01.006** (*Maximum Reference Clamp*) and Pr **39.011** (*AMC Output Speed Clamp*) within 40 ms.

This object is not updated if the drive parameters Pr **01.006** or Pr **39.011** are changed after initialisation, users should refrain from changing the parameter values when CiA 402 profiles are enabled.

NOTE

As of SI-CANopen V2 firmware V02.04.05.06 this object is updated in the background when the value of Pr **01.006** (*Maximum Reference Clamp*) changes.

11.41.26 0x608F - Position encoder resolution

Last sub-index

Index	0x608F	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Encoder increments

Index	0x608F	**Object code**	ARRAY	**Access**	RO
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	65536	**Units**	None		

This sub-index returns the number of encoder increments derived from the normalisation turns of the associated encoder channel.

Motor revolutions

Index	0x608F	**Object code**	ARRAY	**Access**	RO
Sub-index	2	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	1	**Units**	None		

This read only object indicates the configured encoder increments per number of motor shaft revolutions. The value is calculated from the *Normalisation Turns* parameter as $2^{\text{NormalisationTurns}}$. The actual parameter used depends on the feedback source selected in object 0x3000 (*Position Feedback Encoder Source*) as shown in the following table.

Table 11-79 Position encoder resolution source parameter

Object 0x3000	Pr 03.026	Source	Description	Normalisation Turns Parameter (Pr)
0	0	P1 Drive	P1 on drive connector	03.057
	1	P2 Drive	P2 on drive connector	03.157
	2	P1 Slot1	P1 on Option in slot 1	15.057
	3	P2 Slot1	P2 on Option in slot 1	25.157
	4	P1 Slot2	P1 on Option in slot 2	16.057
	5	P2 Slot2	P2 on Option in slot 2	26.157
	6	P1 Slot3	P1 on Option in slot 3	17.057
	7	P2 Slot3	P2 on Option in slot 3	27.157
1	N/A	P1 Drive	P1 on drive connector	03.057
2		P2 Drive	P2 on drive connector	03.157
3		P1 Slot1	P1 on Option in slot 1	15.057
4		P2 Slot1	P2 on Option in slot 1	25.157
5		P1 Slot2	P1 on Option in slot 2	16.057
6		P2 Slot2	P2 on Option in slot 2	26.157
7		P1 Slot3	P1 on Option in slot 3	17.057
8		P2 Slot3	P2 on Option in slot 3	27.157
11		None	Encoder less	N/A

This object can be used in conjunction with *Gear ratio* (0x6091) and *Feed constant* (0x6092) to provide a position scaling control.

11.41.27 0x6091 - Gear ratio

Last sub-index

Index	0x6091	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Motor revolutions

Index	0x6091	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index sets/returns the number of motor revolutions (numerator) for the object.

Shaft revolutions

Index	0x6091	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index sets/returns the number of shaft revolutions (denominator) for the object.

This object can be used in conjunction with *Position encoder resolution* (0x608F) and *Feed constant* (0x6092) to provide a position scaling control.

The *Gear ratio* object is used to apply scaling. When configured, appropriate user units can be used to control the position of the motor shaft beyond a gearbox.

The gear ratio is calculated using the following formula:

$$\textbf{Gear ratio} = \frac{\textbf{Motor shaft revolutions}}{\textbf{Driving shaft revolutions}} = \frac{\textbf{0x6091:1}}{\textbf{0x6091:2}}$$

11.41.28 0x6092 - Feed constant

Last sub-index

Index	0x6092	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Feed

Index	0x6092	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	65536	**Units**	None		

This sub-index sets/returns the Feed value (numerator) for the object.

Shaft revolutions

Index	0x6092	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index sets/returns the number of shaft revolutions (denominator) for the object.

The *Feed constant* is the measurement distance for one revolution of the gearbox output shaft.

The feed constant value is calculated using the following formula:

$$\textbf{Feed Constant} = \frac{\textbf{Feed units}}{\textbf{Driving shaft revolutions}} = \frac{\textbf{0x6092:1}}{\textbf{0x6092:2}}$$

This object can be used in conjunction with *Position encoder resolution* (0x608F) and *Gear ratio* (0x6091) to provide a position scaling control.

AMC Scaling

A scaling ratio is calculated from the *Normalisation Turns* parameter associated with the configured encoder source, and by the gear ratio and feed constant objects (0x6091 and 0x6092 respectively).

The encoder step per revolution is calculated as:

EncoderSteps = 32 - Normalisation Turns

The scaling factor is then defined as:

$$\textbf{Scaling factor} = \frac{\textbf{Feed constant}}{\textbf{Encoder Steps * Gear ratio}}$$

The feedback position is normally scaled to User Units by the AMC slave scaling ratio (Pr **31.006** and Pr **31.007**).

The AMC master scaling ratio is always set equal to 1 when the CiA 402 profiles are enabled. The scaling settings, as used to calculate the AMC slave unit ratio parameter, are shown in Figure 11-4.

The AMC Output ratio is set equal to the inverse of the slave ratio, the user can apply an additional scaling to the AMC output using the object 0x3004 (*Additional Position Loop Scaling*).

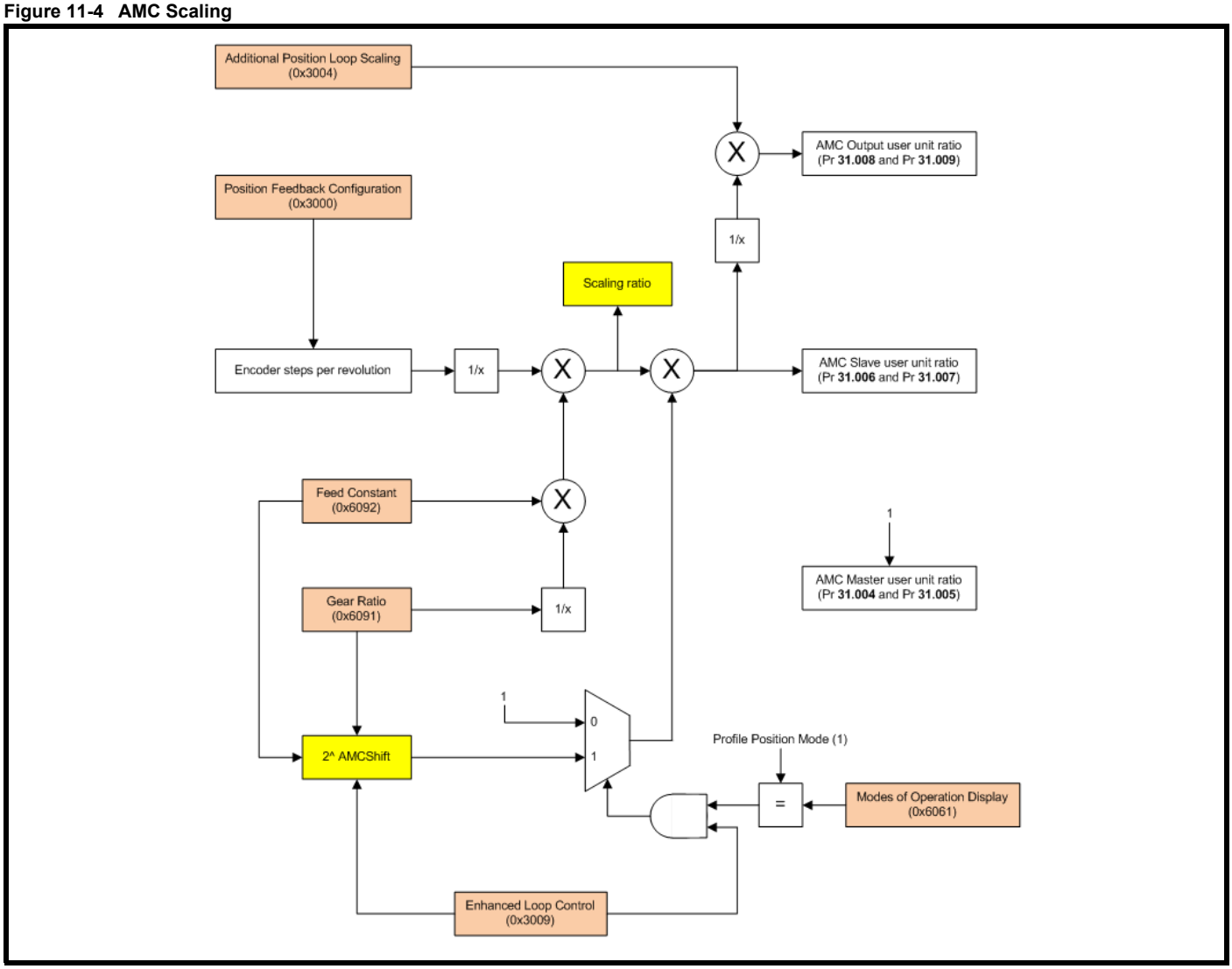
The scaling parameters are always written, independent of the operating mode, during the NOT READY TO SWITCH ON state and the transition from READY TO SWITCH ON and SWITCHED ON states.

The initial values of the gear ratio, feed constant and additional position loop scaling objects are checked during the transition from READY TO SWITCH ON and SWITCHED ON states, any changes in these objects will not become active until this state transition occurs.

If any scaling results in a mathematical overflow, the AMC parameters are not updated and the drive is tripped with one of the following errors:

- Additional position loop scaling (APLS): Error calculating the output scaling ratio
- Scaling failure: Any other scaling calculation error

Figure 11-4 AMC Scaling



11.41.29 0x60FB - Position control parameter set

Last sub-index

Index	0x60FB	**Object code**	RECORD	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	N/A		

This sub-index returns the last sub-index number for the object.

Position controller proportional gain

Index	0x60FB	**Object code**	RECORD	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	<Pr **39.007**>	**Units**	<Pr **39.007**> * 1000		

This sub-index sets/returns the position controller proportional (Kp) gain value for the object.

Position controller speed feed-forwards gain

Index	0x60FB	**Object code**	RECORD	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	<Pr **39.010**>	**Units**	<Pr **39.010**> * 1000		

This sub-index sets/returns the position controller speed feed-forwards gain value for the object.

Sub-index 1 and 2 of this object configure Pr **39.007** (*AMC Position Loop P Gain*) and Pr **39.010** (*AMC Speed Feed-fwds Gain*) respectively. They are initialised with the respective parameter values in the following conditions:

- Startup
- CiA 402 profiles re-enabled
- Operating mode changed

When this object is written, the value is reflected in the associated parameter within 40 ms.

This object is not updated if the associated drive parameters are changed after initialisation, users should refrain from changing the parameter values when CiA 402 profiles are enabled.

NOTE

As of SI-CANopen V2 firmware V02.04.05.06 this object is updated in the background if its value differs from the current value.

11.41.30 0x60FF – Target velocity

Index	0x60FF	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	rpm		

This object sets/returns the target velocity used when *Velocity mode redirection enable* (0x3008) is selected.

The object 0x6042 (*VL target velocity*) is normally used as the reference value for the velocity mode. If *Velocity mode redirection enable* (0x3008) is active object 0x60FF (*Target velocity*) is used as velocity reference. The selection takes effect only on transition from READY TO SWITCH ON to SWITCHED ON states.

11.41.31 0x6502 – Supported drive modes

Index	0x6502	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	No
Default	None	**Units**	N/A		

This object returns the supported drive operating modes.

Each bit of this object represents support for a specific profile mode, if the value of the bit is 1 then the associated profile mode is supported.

Table 11-80 SI-CANopen V2 supported drive profile modes

Value	Description	Supported drives	Drive mode
0	No profile enabled	-	-
Bit			
b0	Profile position mode	M70X, M88X, M75X, HS7X	RFC-A, RFC-S
b1	VL velocity mode	C200/C300, M400, M600, M70X, M88X, M75X, HS7X	OL, RFC-A, RFC-S
b2	Profile velocity mode	NOT SUPPORTED	
b3	Profile torque mode	M70X, M88X, M75X, HS7X	RFC-A, RFC-S
b4	*Reserved*	ALWAYS ZERO	
b5	Homing mode	M70X, M88X, M75X, HS7X	RFC-A, RFC-S
b6	Interpolated position mode	M70X, M88X, M75X, HS7X	RFC-A, RFC-S
b7	Cyclic sync position mode	NOT SUPPORTED	
b8	Cyclic sync velocity mode	NOT SUPPORTED	
b9	Cyclic sync torque mode	NOT SUPPORTED	
b10	Cyclic sync torque mode with commutation angle	NOT SUPPORTED	
b11 to b15	*Reserved*	ALWAYS ZERO	
b16 to b31	*Manufacturer specific*	NOT SUPPORTED	

11.41.32 Profile torque mode

This profile will operate on the control loop cycle time, using the drive's torque reference. On Unidrive M70x/Digitax HD this is updated every 250 µs, on Unidrive M200 - M400 or Commander C200/C300 this is updated every 1 ms and the torque reference will also be written to the drive user torque reference.

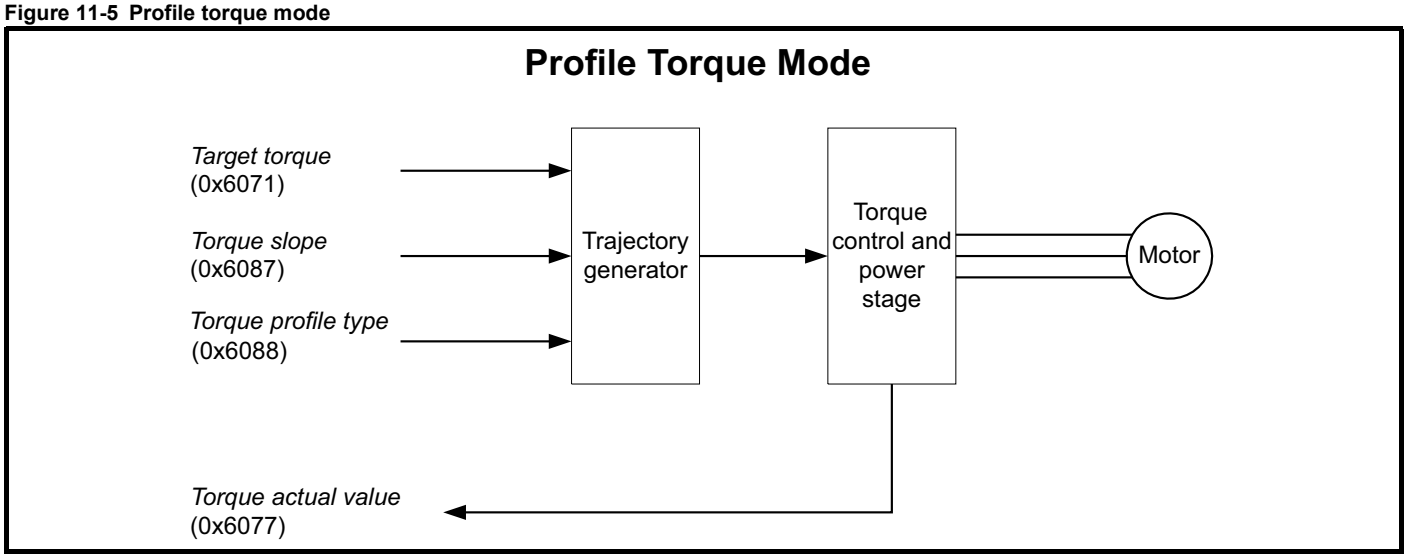
Table 11-81 shows the profile torque mode specific objects supported, in addition to the common objects shown in Table 11-66. Profile torque mode must be enabled by setting *Modes of operation* to 4 (see *section 11.41.17 0x6060 - Modes of operation* on page 136).

Table 11-81 Profile torque mode specific supported objects

Index	Object	Name	Type	Access	PDO mapping
0x6071	VAR	*Target torque*	INTEGER16	RW	Yes
0x6087	VAR	*Torque slope*	UNSIGNED32	RW	Yes
0x6088	VAR	*Torque profile type*	INTEGER16	RW	Yes

The *Target torque* object will be read every new control loop cycle. The *Torque slope* will also be read, and this will be used by the ramp generator to produce the next internal torque value; a torque slope of zero will disable the torque ramp, so that a new *Target torque* value will be used immediately. This internal torque value will be limited by the *Max current* object (which is read in the background).

Figure 11-5 Profile torque mode



11.41.33 0x6071 - Target torque

Index	0x6071	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	0	**Units**	per thousand of rated torque		

Target torque is the input value for the torque controller. This object is multiplied by 100 and written directly to Pr **04.008** when *Control word* is in the power enabled group of states. Refer to Figure 11-3 on page 131.

11.41.34 0x6086 - Motion profile type

Index	0x6086	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNISIGNED32	**PDO mapping**	Yes
Default	0	**Units**	None	**Maximum**	3

This object is used to configure the velocity profile type used in the Profile Position (PP) mode as shown in the following table

Value	Description
0	Linear ramp (trapezoidal profile)
1	Not supported
2	Not supported
3	Jerk limited ramp (s-ramp profile)

Only the linear and jerk limited ramps are supported, if a non-supported ramp mode is selected, then the linear ramp mode will be used.

Please note that when the jerk profile limited ramp profile is used, then the position loop execution period increases from 250 µs to 1 ms.

Any changes have effect only in the following cases:

- The mode of operation is changed, and the state is SWITCHED ON or OPERATION ENABLED
- State transition from READY TO SWITCH ON to SWITCHED ON
- State transition from OPERATION ENABLED to SWITCHED ON
- State transition from QUICK STOP ENABLED to OPERATION ENABLED

11.41.35 0x6087 - Torque slope

Index	0x6087	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	0	**Units**	per thousand of rated torque per second		

Torque slope describes the maximum rate of change of torque permitted. When a change in *Target torque* is seen, SI-CANopen V2 will apply a ramp to the torque reference before updating the torque reference parameter, Pr **04.008**.

11.41.36 0x6088 - Torque profile type

Index	0x6088	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	0	**Units**	None		

The *Torque profile type* is used to select the type of torque profile used to perform a torque change. Only linear ramps are supported.

Table 11-82 *Torque profile type* codes

Profile code	Profile type
0	Linear ramp (trapezoidal profile)
1	Not supported

11.41.37 Velocity mode objects

The velocity mode is supported on all drive types and modes, except in regen modes. The drive's speed handling and ramps are always used; the data flow partially depends however on the drive type and mode, and the configured position feedback source where available.

Table 11-83 shows a summary of all supported objects of the velocity mode. Velocity mode must be enabled by setting the *Modes of operation* object to 2 (see *section 11.41.17 0x6060 - Modes of operation* on page 136).

Table 11-83 Velocity mode specific objects

Index	Name	Type	Access	PDO mapping
0x3008	Velocity mode redirection enable	BOOLEAN	RW	Yes
0x6042	VL target velocity	INTEGER16	RW	Yes
0x6043	VL velocity demand	INTEGER16	RO	Yes
0x6046	VL velocity min max amount	Various	RO/RW	Yes
0x6048	VL velocity acceleration	Various	RO/RW	Yes
0x6049	VL velocity deceleration	Various	RO/RW	Yes
0x604B	VL setpoint factor	Various	RO/RW	Yes
0x604C	VL dimension factor	Various	RO/RW	Yes

The VL velocity mode operates differently between open loop and closed loop (RFC-A and RFC-S) modes as shown in the following diagrams

Figure 11-6 Velocity mode (Open loop)

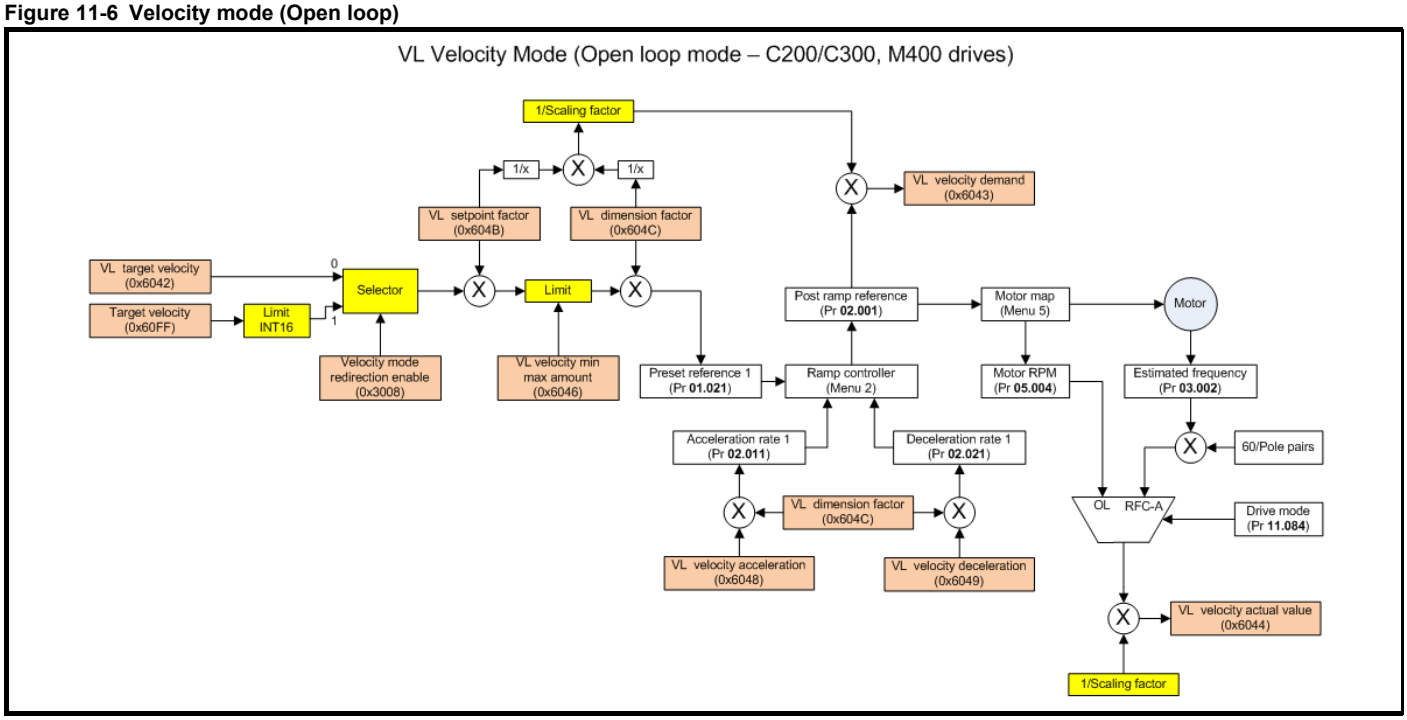
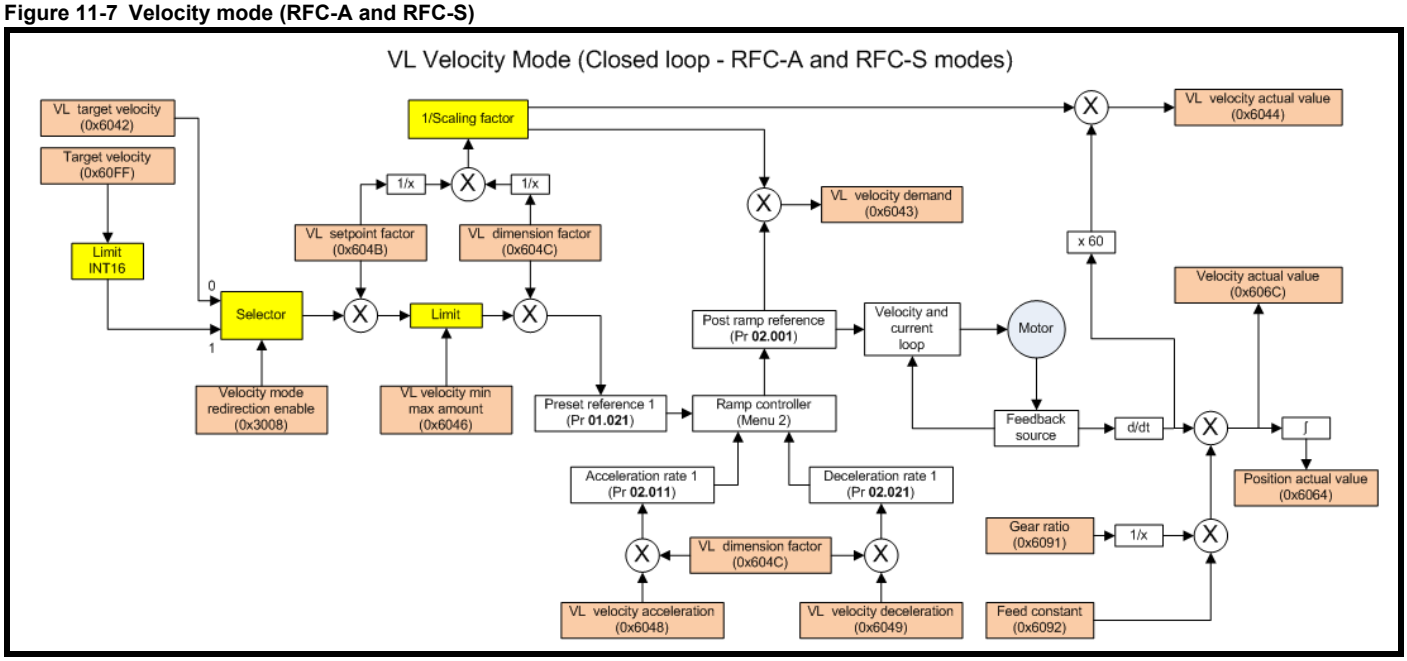


Figure 11-7 Velocity mode (RFC-A and RFC-S)



11.41.38 0x6042 – VL target velocity

Index	0x6042	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	None	**Units**	User Units		

This object sets/returns the target velocity in velocity mode and is scaled in User Units.

11.41.39 0x6043 – VL velocity demand

Index	0x6043	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	None	**Units**	User Units		

This object returns the actual velocity demand value generated by the ramp function in velocity mode and is scaled in User Units.

11.41.40 0x6046 – VL velocity min max amount

This object configures the minimum and maximum speeds that the system can operate within, both in the forward and reverse directions. The output speed is automatically limited by these values to satisfy the system constraints.

Last sub-index

Index	0x6046	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

VL Velocity min amount

Index	0x6046	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	0	**Units**	User Units		

This sub-index specifies the absolute minimum speed in both forward and reverse directions.

VL Velocity max amount

Index	0x6046	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	40000	**Units**	User Units		

This sub-index specifies the absolute maximum speed in both forward and reverse directions. It is initialised from Pr **01.006** (*Maximum Reference Clamp*).

If this sub-index value is changed then Pr **01.006** will not be updated with the new value.

11.41.41 0x6048 - VL velocity acceleration

This object specifies the slope of the acceleration ramp. It is calculated by dividing *Delta speed* by *Delta time* and converted before writing to Pr **02.011** (*Acceleration Rate 1*).

Last sub-index

Index	0x6048	**Object code**	RECORD	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

Indicates the number of the last sub-index in the object.

Delta speed

Index	0x6048	**Object code**	RECORD	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	10000	**Units**	User Units		

Delta speed specifies the velocity increase in the time specified by *Delta time*.

Delta time

Index	0x6048	**Object code**	RECORD	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	2	**Units**	Seconds		

Delta time specifies the time (seconds) in which the velocity increase specified by *Delta speed* will occur.

This object is linked to Pr **02.011** (*Acceleration Rate 1*) for any mode of operation, any change in the object value will be reflected in Pr **02.011** and vice versa. If both object and parameter are changed at the same time then the parameter value takes priority.

11.41.42 0x6049 – VL velocity deceleration

This object specifies the slope of the deceleration ramp to be used if the target velocity changes or a controlled stop is required using the slow down ramp. It is calculated by dividing *Delta speed* by *Delta time* and converted before writing to Pr **02.021** (*Deceleration Rate 1*).

Last sub-index

Index	0x6049	**Object code**	RECORD	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

Indicates the number of the last sub-index in the object.

Delta speed

Index	0x6049	**Object code**	RECORD	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	10000	**Units**	User Units		

Delta speed specifies the velocity reduction in the time specified by *Delta time*.

Delta time

Index	0x6049	**Object code**	RECORD	**Access**	RW
Sub-index	2	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	2	**Units**	Seconds		

Delta time specifies the time (seconds) in which the velocity reduction specified by *Delta speed* will occur.

This object is linked to Pr **02.021** (*Deceleration Rate 1*) for any mode of operation, any change in the object value will be reflected in Pr **02.021** and vice versa. If both object and parameter are changed at the same time then the parameter value takes priority.

11.41.43 0x604B - VL setpoint factor

This object specifies any scaling factor to be applied to the setpoint value, it is also included in the calculation of the *VL target velocity* (0x6042), and *VL velocity demand* (0x6043) objects, it does not influence the velocity limit function or the ramp function.

Last sub-index

Index	0x604B	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Numerator

Index	0x604B	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index specifies the numerator of the scaling factor.

If a value of 0 is written to this sub-index, the value 1 will be used in the calculation.

Denominator

Index	0x604B	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index specifies the denominator of the scaling factor.

If a value of 0 is written to this sub-index, the value 1 will be used in the calculation.

11.41.44 0x604C - VL dimension factor

The *VL dimension factor* object can be used to convert the specific velocity units to rpm, it is used in objects 0x6042 (*VL target velocity*), 0x6043 (*VL velocity demand*) and 0x6044 (*VL velocity actual value*) before being written to the drive's preset speed parameter (Pr **01.021**).

This object is also used in the velocity limit and ramp functions.

Last sub-index

Index	0x604C	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

Indicates the number of the last sub-index in the object.

Numerator

Index	0x604C	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index specifies the numerator of the scaling factor.

If a value of 0 is written to this sub-index, the value 1 will be used in the calculation.

Denominator

Index	0x604C	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	1	**Units**	None		

This sub-index specifies the denominator of the scaling factor.

If a value of 0 is written to this sub-index, the value 1 will be used in the calculation.

Every user specific velocity used by the VL mode consists of specific units referred to specific units of time (e.g. 1/second, bottles/minute, metres/second, etc.). The purpose of this object is to convert the specific velocity units to rpm.

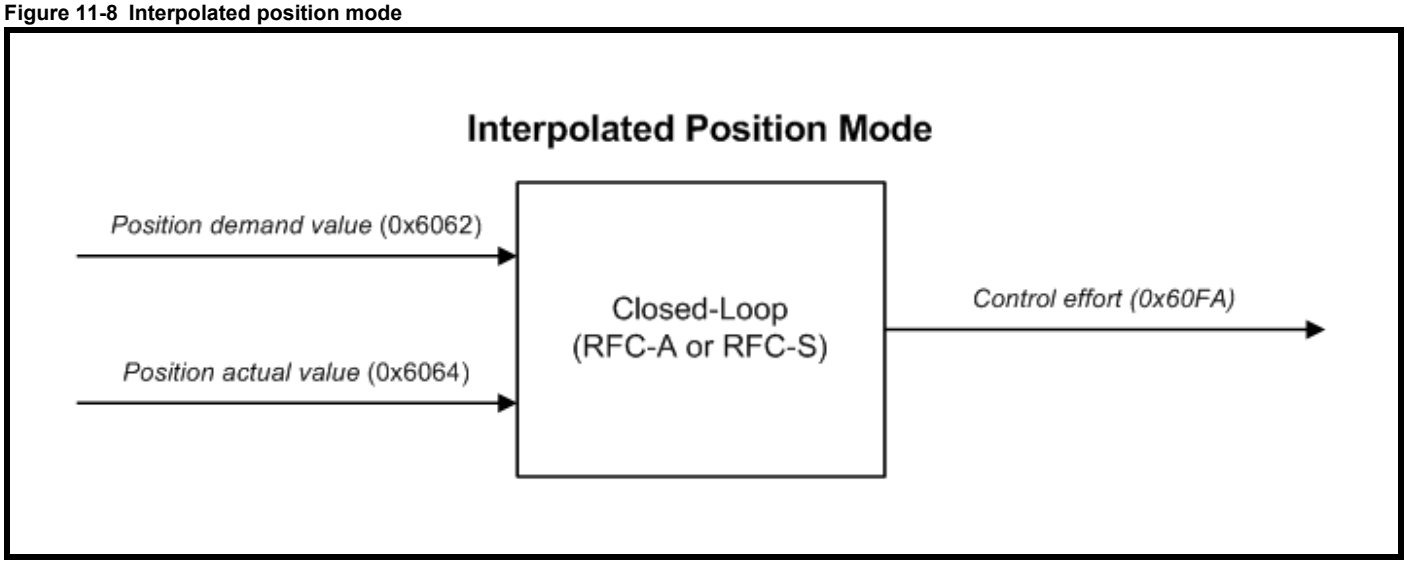
$$\textbf{Velocity}_{\textbf{uu}} = \frac{\textbf{VL dimension factor (numerator)}}{\textbf{VL dimension factor (denominator)}} = \textbf{Velocity}_{\textbf{rpm}}$$

11.41.45 Interpolated Position Control

Interpolated position control will be supported on Unidrive M70X, HS7X and Digitax HD in RFC-S or RFC-A mode. It will not be available on any drive operating in either open-loop or regen mode, this includes the Unidrive M200 - M400 and Commander C200/300.

The *Control effort* may be a velocity demand value, a position demand value or any other output value, depending on the modes of operation implemented in the drive.

Figure 11-8 Interpolated position mode



The position control described here will be used under the interpolated position mode of operation.

The following objects are supported in the interpolated position mode:

Table 11-84 Interpolated position mode specific supported objects

Index	Name	Type	Access	PDO mapping
0x6062	Position demand value	INTEGER32	RO	Yes
0x6065	Following error window	UNSIGNED32	RW	Yes
0x6067	Position window	UNSIGNED32	RW	Yes
0x606B	Velocity demand value	INTEGER32	RO	Yes
0x607A	Target position	INTEGER32	RW	Yes
0x607D	Software position limit	Various	RO/RW	Yes
0x607F	Max profile velocity	UNSIGNED32	RW	Yes
0x6081	Profile velocity	UNSIGNED32	RW	Yes
0x6083	Profile acceleration	UNSIGNED32	RW	Yes
0x6084	Profile deceleration	UNSIGNED32	RW	Yes
0x6085	Quick stop deceleration	UNSIGNED32	RW	Yes
0x60B1	Velocity offset	INTEGER32	RW	Yes
0x60B2	Torque offset	INTEGER16	RW	Yes
0x60C0	Interpolation sub mode select	INTEGER16	RW	Yes
0x60C1	Interpolation data record	Various	RO/RW	Yes
0x60C2	Interpolation time period	Various	RO/RW	Yes
0x60C5	Max acceleration	UNSIGNED32	RW	Yes
0x60C6	Max deceleration	UNSIGNED32	RW	Yes
0x60F4	Following error actual value	INTEGER32	RO	Yes
0x60FA	Control effort	INTEGER32	RO	Yes

The following sections detail the objects supported in the interpolated position mode, not including the common objects listed in Section 11.41.5.

11.41.46 0x6062 - Position demand value

Index	0x6062	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	None	**Units**	User Units		

The *Position demand value* object shall provide the demanded position value and will contain the value supplied by position mode (in user units). It will be updated every sync cycle.

The value of this object will be taken from Pr **38.008** (*AMC Profile Output Position*).

11.41.47 0x6065 - Following error window

Index	0x6065	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	2^{31} - 1	**Units**	User Units		

The *Following error window* object shall indicate the configured range of tolerated position values symmetrically to the position demand value. If *Following error actual value* is outside the *Following error window* value, a following error has occurred and the statusword will be modified accordingly. The *Following error window* value shall be given in user defined position units. If the value of the following error window is more than 0x7FFFFFFF, the following control shall be switched off.

The value of this object is converted to drive units and written to Pr **41.007** (*AMC Following Error Window*). Pr **41.008** (*AMC Following Error Flag*) is read every 250 µs and if the following error threshold is exceeded then bit b13 (*Following error*) of the *Status word* will be set.

11.41.48 0x6067 - Position window

Index	0x6067	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	2^{31} - 1	**Units**	User Units		

The *Position window* object is compared every 250 µs with the *Position error*; the *Control word* bit b10 (*Target reached*) is set if the absolute value of the position error remains less than or equal to the *Position window* for the time specified in 0x6068 (*Position window time*).

This object is read every 40 ms.

11.41.49 0x606B – Velocity demand value

Index	0x606B	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	None	**Units**	User Units/s		

The *Velocity demand value* object indicates the actual output value of the velocity profile generator.

11.41.50 0x607A – Target position

Index	0x607A	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	User Units		

The *Target position* object sets/returns the position that the motor should move to.

11.41.51 0x607D – Software position limit

This object allows the user to configure maximum and minimum position limits expressed in User Units and relative to the Home position.

This object is ignored if the SI-CANopen V2 module is fitted on a Unidrive M600, Commander C200/C300 or if the drive is in open-loop mode.

Last sub-index

Index	0x607D	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Minimum position limit

Index	0x607D	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	-2^{31}	**Units**	User Units		

This sub-index sets/returns the minimum software position limit relative to the home position. It is scaled and written to Pr **41.027** (*AMC Negative Limit Position*).

If this position limit is reached then the drive behaviour is specified by Pr **41.024** (*AMC Software Limit Stop Mode*) or object 0x2029:24.

Maximum position limit

Index	0x607D	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	2^{31} - 1	**Units**	User Units		

This sub-index sets/returns the maximum software position limit relative to the home position. It is scaled and written to Pr **41.026** (*AMC Positive Limit Position*).

If this position limit is reached then the drive behaviour is specified by Pr **41.024** (*AMC Software Limit Stop Mode*) or object 0x2029:24.

11.41.52 0x607F – Max profile velocity

Index	0x607F	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	2^{31} - 1	**Units**	User Units/s		

This object specifies and limits the maximum velocity allowed for the given profile.

11.41.53 0x6081 – Profile velocity

Index	0x6081	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	0	**Units**	User Units/s		

This object is used to configure the velocity normally attained at the end of the acceleration ramp, the value is used to configure Pr **38.003** (*AMC Profile Maximum Speed*) when a new setpoint is commanded.

The absolute value of the effective velocity applied is limited by the object 0x6080 (*Max motor speed*), if they differ then the lower value is used.

11.41.54 0x6083 – Profile acceleration

Index	0x6083	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	65536	**Units**	User Units/s^2		

This object is used to configure the acceleration ramp, it is written to Pr **38.001** (*AMC Profile Acceleration*) when a new setpoint is commanded.

11.41.55 0x6084 – Profile deceleration

Index	0x6084	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	65536	**Units**	User Units/s^2		

This object is used to configure the deceleration ramp, it is written to Pr **38.002** (*AMC Profile Deceleration*) in the following circumstances:

- The profile position mode is active and a new setpoint position is commanded
- The profile position mode is active and the *Control word* bit b8 (HALT) is set
- A state change from OPERATION ENABLED to READY TO SWITCH ON and object 0x605B is set to 1
- A state change from OPERATION ENABLED to SWITCHED ON and object 0x605C is set to 1

11.41.56 0x6085 – Quick stop deceleration

Index	0x6085	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	65536	**Units**	User Units/s^2		

This object is used to configure the deceleration ramp rate when the Quick stop function is active and object 0x605A (*Quick stop option code*) is set to 2 or 6. This object is also used in the following circumstances when the Quick stop is activated:

- The fault reaction is activated and the *Fault reaction option code* (0x605E) is set to 2
- The halt function is activated and the *Halt option code* (0x605D) is set to 2
- The SI-CANopen V2 module triggers a network link loss and the *Abort connection option code* (0x6007) is set to 3

11.41.57 0x60B1 – Velocity offset

Index	0x60B1	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	User Units/s		

This object is summed with the *Target velocity* (0x60FF), before it is forwarded to the linear interpolator.

11.41.58 0x60C0 - Interpolated sub mode select

Index	0x60C0	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	0	**Units**	None	**Maximum**	0

This object is used to select the linear interpolation mode as shown in the following table, all other values are unused.

Value	Description
-1	Linear extrapolation is performed on data loss
0	Hold the previous value on data loss

If interpolated position cyclic mode is selected (IP), the controlled output variable (position, velocity or torque) is linear interpolated every 250 µs. If the new target is not available at the end of the interpolation period because of data loss, the current position is held by default. this behaviour may cause mechanical damages due to an infinite acceleration or jerk requirement: in this case the user can set this object to linearly extrapolate the target value on data loss, from the last two valid target values until a valid target is supplied.

This object is evaluated only in the following cases:

- The mode of operation is changed, and the state is SWITCHED ON or OPERATION ENABLED
- State transition from READY TO SWITCH ON to SWITCHED ON
- State transition from OPERATION ENABLED to SWITCHED ON
- State transition from QUICK STOP ENABLED to OPERATION ENABLED

11.41.59 0x60C1 - Interpolated data record

Last sub-index

Index	0x60C1	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	1	**Units**	None	**Maximum**	1

Indicates the number of the last sub-index in the object.

Interpolation position

Index	0x60C1	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	User Units	**Maximum**	$2^{31} - 1$

This sub-index specifies the target position when the interpolation position mode is active.

The value can range from -2^{31} to $2^{31} - 1$.

11.41.60 0x60C2 - Interpolation time period

This object defines the interpolation period used in the interpolated position mode. The SI-CANopen V2 module expects a new target position to be provided at the rate specified by this object; if new data is not available the reaction (hold or extrapolate) depends on the value of object 0x60C0.

The period value shall be defined in sub-index 1 and expressed in the unit selected by sub-index 2.

Last sub-index

Index	0x60C2	**Object code**	RECORD	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None	**Maximum**	2

Indicates the number of the last sub-index in the object.

Time period

Index	0x60C2	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED8	**PDO mapping**	Yes
Default	5	**Units**	<Sub-index2>	**Maximum**	$2^{31} - 1$

This sub-index specifies the interpolation time period expressed in units specified by sub-index 2.

The value can range from -2^{31} to $2^{31} - 1$.

Time index

Index	0x60C2	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	INTEGER8	**PDO mapping**	Yes
Default	-4	**Units**	None	**Maximum**	3

This sub-index specifies the Time period units in accordance with the following table.

0x60C2 Sub-index 2	**Time period units**
3	1000 s
2	100 s
1	10 s
0	1 s
-1	100 ms
-2	10 ms
-3	1 ms
-4	100 µs
-5	10 µs
-6	1 µs

This object is evaluated only in the following cases:

- The mode of operation is changed, and the state is SWITCHED ON or OPERATION ENABLED
- State transition from READY TO SWITCH ON to SWITCHED ON
- State transition from OPERATION ENABLED to SWITCHED ON
- State transition from QUICK STOP ENABLED to OPERATION ENABLED

To ensure a synchronous operation, the interpolation period shall be set to be an integer multiple of the control loop cycle (250 µs) otherwise the effective period will be approximated to the closest lowest value.

If the interpolation is set exactly equal to on control loop cycle, the interpolation algorithm is disabled, and the target position is directly applied with the appropriate scaling where it is required.

11.41.61 0x60B2 – Torque offset

Index	0x60B2	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER16	**PDO mapping**	Yes
Default	0	**Units**	%		

The *Torque offset* is summed with the *Target torque* (0x6071), before it is written to Pr **04.008** (*Torque Reference*).

11.41.62 0x60C5 – Max acceleration

Index	0x60C5	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	0	**Units**	User Units/s		

This object specifies the maximum acceleration for the *Profile acceleration* (0x6083) object.

The value of *Profile acceleration* is compared with *Max acceleration* and if it is larger, it is limited to the *Max acceleration* value before being converted and written to Pr **38.001** (*AMC Profile Acceleration*).

11.41.63 0x60C6 – Max deceleration

Index	0x60C6	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	0	**Units**	User Units/s		

This object specifies the maximum deceleration for the *Profile deceleration* (0x6084) object.

The value of *Profile deceleration* is compared with *Max deceleration* and if it is larger, it is limited to the *Max deceleration* value before being converted and written to Pr **38.002** (*AMC Profile Deceleration*).

11.41.64 0x60F4 - Following error actual value

Index	0x60F4	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	None	**Units**	User Units		

The *Following error actual value* object shall provide the actual value of the following error. The value shall be given in user-defined position units. If *Following error actual value* is outside the *Following error window* value, a following error has occurred, and the *Status word* will be modified accordingly. *AMC Position Error* (Pr **39.008**) gives the difference between the final position reference and the *AMC Slave Position* (Pr **33.004**) in User Units.

11.41.65 0x60FA - Control effort

Index	0x60FA	**Object code**	VAR	**Access**	RO
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	None	**Units**	User Units/s		

The *Control effort* object shall provide the control effort as the output of the position control loop and is derived from the *AMC Output Speed* (Pr **39.012**) and converted to User Units/s.

11.41.66 Profile position mode

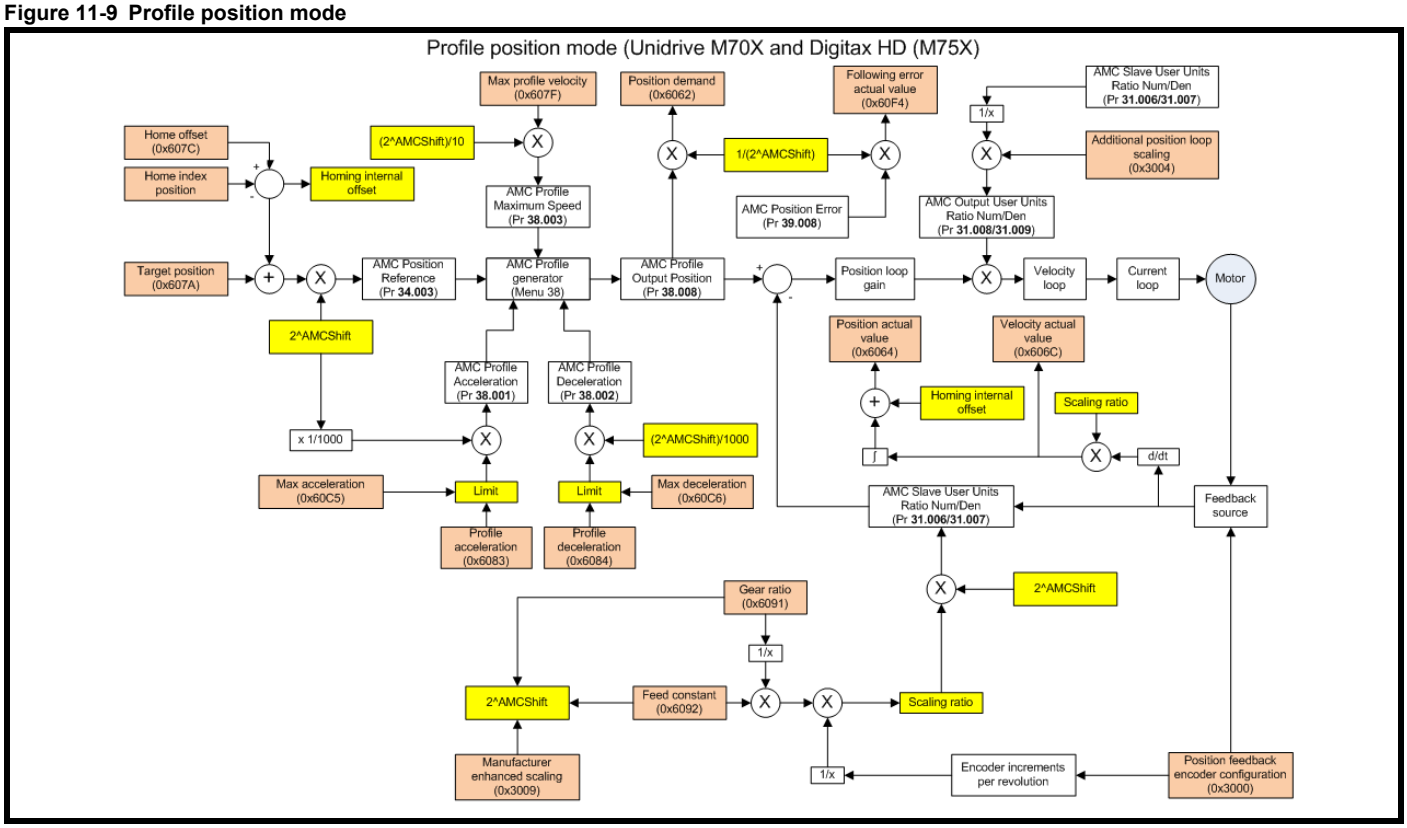
The profile position mode is only supported on Unidrive M70X and Digitax HD (M75X) drives in RFC-A or RFC-S modes and Pr **S.01.021** (*Compatibility Mode*) set to “CIA 402 Profile”.

The profile position mode allows the user to execute point-to-point positioning using the drive position profile generator. The setting of setpoints is controlled by the timing of the *Control word* bits b4 (NEW SETPOINT) and b5 (CHANGE SETPOINT IMMEDIATELY). It is possible to request an absolute position or position relative to the previous absolute position.

The position profile mode allows the handling of a rotary axis setting the axis period in object 0x607B:02 (*Position range limits*).If either of the sub-index values are zero, this will disable the function, otherwise the object 0x60F2 (*Positioning option code*) allows the user to configure the rotation direction; relative positioning is not allowed for all option settings. If a relative position is requested but is not allowed due to the setting of object 0x60F2, the setpoint will be discarded on the rising edge of the NEW SETPOINT bit (b4) and the *Status word* acknowledge bit (b12) will not be set.

The data flow between the objects and drive parameters is shown in Figure 11-9.

Figure 11-9 Profile position mode



Control word usage

The *Control word* for the profile position mode differs from the standard configuration as shown below.

Bits	b15 – b10	b9	b8	b7	b6	b5	b4	b3 – b0
Name		CHANGE ON SETPOINT	HALT		ABSOLUTE or RELATIVE	CHANGE SETPOINT IMMEDIATELY	NEW SET-POINT	

b9	b5	b4	Description
0	0		Process a new setpoint value. If the motor shaft is moving, the new position is buffered (unless the buffer is already busy), the buffered movement will start after the current movement completes.
X	1		Process a new setpoint value. The target position is immediately updated even if an existing movement is in progress.
1	0		Not supported. The new setpoint value is ignored.

Bit	Value	Description
b6	0	The target position in object 0x607A is absolute
	1	The target position is relative to the previous setpoint value
b8	0	The motor shaft can move, the *Control word* bit b4 is evaluated
	1	The motor decelerates according to the object 0x605D (*Halt option code*)

Status word usage

The *Status word* for the profile position mode differs from the standard configuration as shown below.

Bits	b15 – b14	b13	b12	b11	b10	b9 – b0
Name		FOLLOWING ERROR	SETPOINT ACKNOWLEDGE		TARGET REACHED	

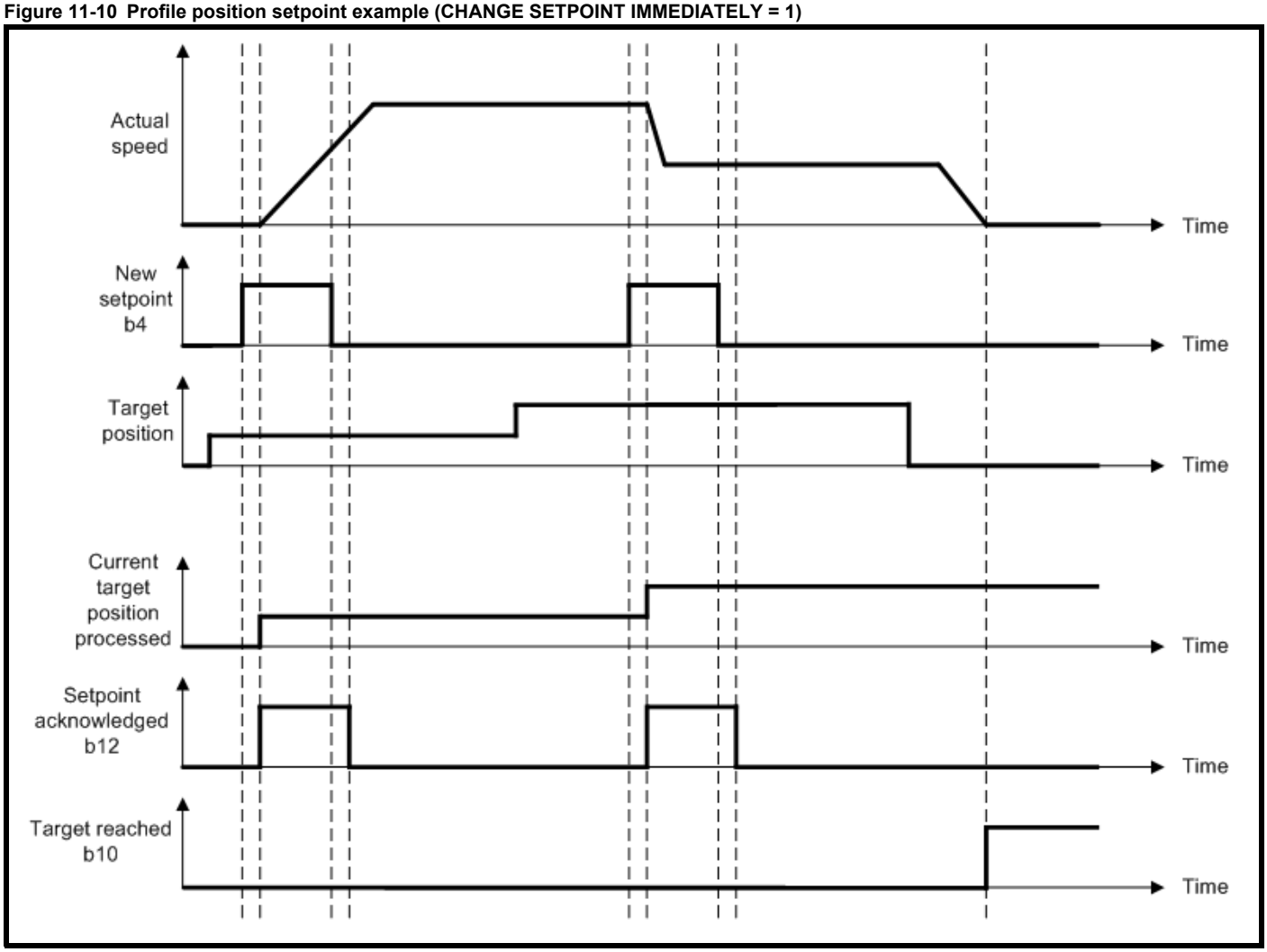
Process a new setpoint

The target position, profile velocity, acceleration, deceleration and jerk to be used for the movement are set in objects 0x607A, 0x6081, 0x6083, 0x6084 and 0x60A4 respectively, the CANopen master controller requests a new valid setpoint value by a rising edge on the *Control word* bit b4. The SI-CANopen V2 module then signals the setpoint has been accepted by setting the SETPOINT ACKNOWLEDGE bit b12 in the *Status word*. No new setpoint can be accepted until this bit is cleared, this bit is cleared when the CANopen master controller clears the *Control word* bit b4 unless the new setpoint is buffered and another movement is in progress, in this case the *Status word* bit b12 remains set until the previous movement completes.

If the new movement requires a change in velocity, acceleration, deceleration or jerk then a minimum delay of 4 ms after the *Control word* bit b4 is written and the *Status word* bit b12 being set will be seen, this delay will increase further if the jerk setting is changed depending on the background task rate. No delay is used if none of the values mentioned are changed.

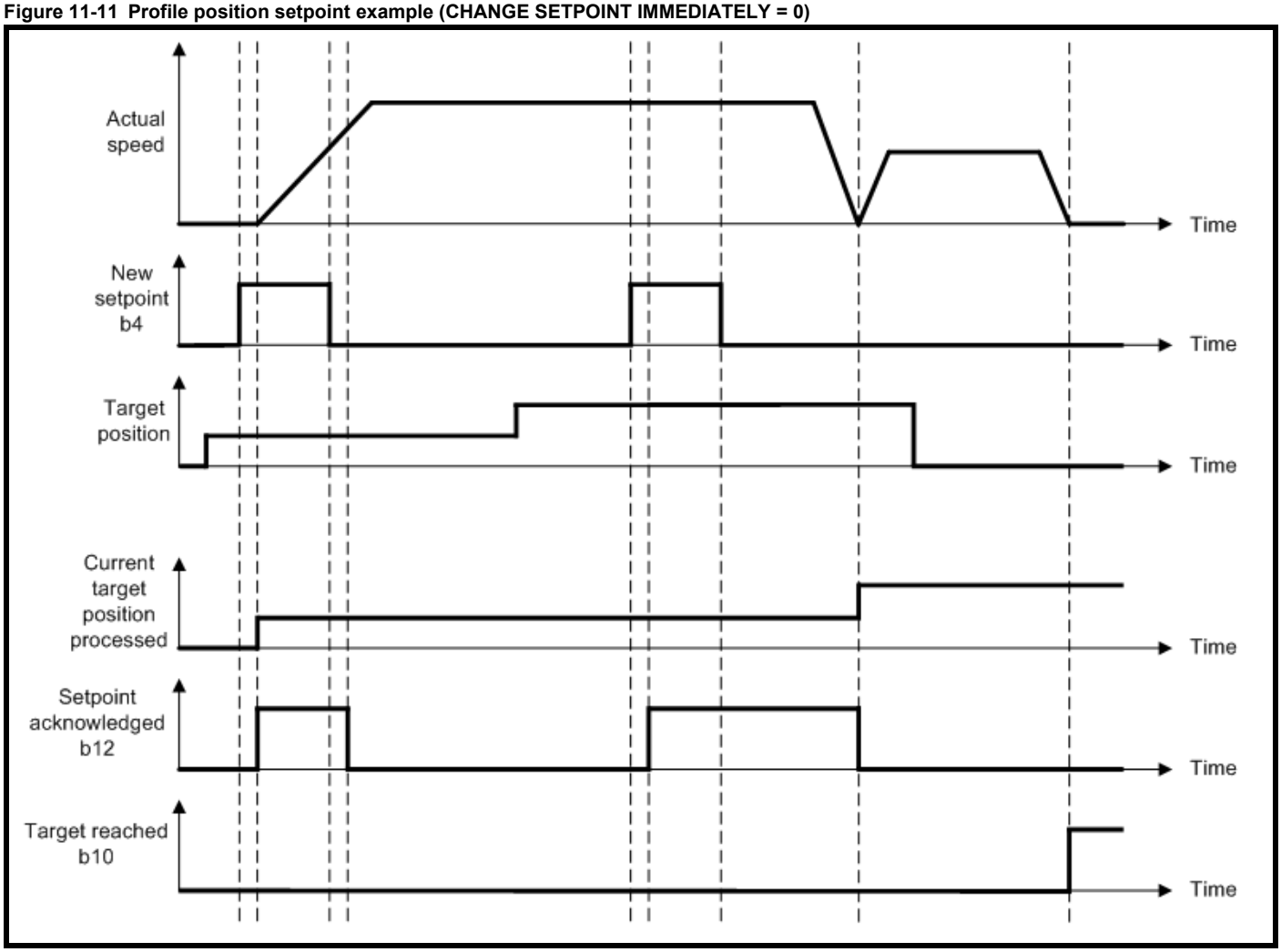
The following diagram shows an example of the setpoint process when the CHANGE SETPOINT IMMEDIATELY bit (b5) is set.

Figure 11-10 Profile position setpoint example (CHANGE SETPOINT IMMEDIATELY = 1)



The following diagram shows an example of the setpoint process when the CHANGE SETPOINT IMMEDIATELY bit (b5) is cleared.

Figure 11-11 Profile position setpoint example (CHANGE SETPOINT IMMEDIATELY = 0)



In addition to the common objects listed in section 11.41.5 and the basic position objects listed in section 11.41.44, the following objects are specific to the profile position mode:

Table 11-85 Profile position mode specific supported objects

Index	Name	Type	Access	PDO mapping
0x6067	Position window	UNSIGNED32	RW	Yes
0x6068	Position window time	UNSIGNED16	RW	Yes
0x606C	Velocity actual value	INTEGER32	RO	Yes
0x607B	Position range limit	Various	RO/RW	Yes
0x60A4	Profile jerk	Various	RO/RW	Yes
0x60F2	Positioning option code	UNSIGNED16	RW	Yes

The following objects are unique to this profile, all other objects are detailed elsewhere in this document.

11.41.67 0x6068 – Position window time

Index	0x6068	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	0	**Units**	ms		

The *Position window time* object specifies the duration of time (milliseconds) in which the actual motor shaft position must remain within the *Position window* (0x6067) threshold to consider the target position reached.

11.41.68 0x607B – Position range limit

This object allows the user to configure the numerical range limit of the position, on reaching or exceeding the limits, the target, actual and demand position values internally wrap to the other end of the range.

A value of 0 in both minimum and maximum range limits will disable the limit function.

The movement direction can be configured using object 0x60F2 (*Positioning option code*).

This implementation is particularly targeted to rotary axes.

Last sub-index

Index	0x607B	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Minimum position range limit

Index	0x607B	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	User Units		

This sub-index specifies the minimum position range limit.

Values other than 0 are not supported for this sub-index.

Maximum position range limit

Index	0x607B	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	User Units		

This sub-index specifies the maximum position range limit.

Negative values are not supported for this sub-index.

11.41.69 0x60A4 – Profile jerk

This object is supported in the profile position mode only and specifies the jerk rate to be applied.

Last sub-index

Index	0x60A4	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	1	**Units**	None		

This sub-index returns the last sub-index number for the object.

Profile jerk

Index	0x60A4	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	User Units/s^3		

This sub-index specifies the profile jerk rate to be applied. It is linked to Pr **38.011** (*AMC Profile Jerk 1*).

11.41.70 0x60F2 – Positioning option code

Index	0x60F2	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED16	**PDO mapping**	Yes
Default	0	**Units**	None		

This object is supported in the profile position mode only, it allows the user to configure the behaviour of the positioning system and is evaluated when the profile position mode is selected and on a transition in state from READY TO SWITCH ON to SWITCHED ON.

The bits b6 and b7 configure the movement for rotary axes, the position range limit is enabled, setting object 0x607B:2 (*Maximum position range limit*) to a value other than 0.

This object is ignored if the value of 0x607B:2 (*Maximum position range limit*) is set to 0.

Table 11-86 describes the positioning action depending on the value of this object. Only bits b6 and b7 are supported, all other bits are ignored.

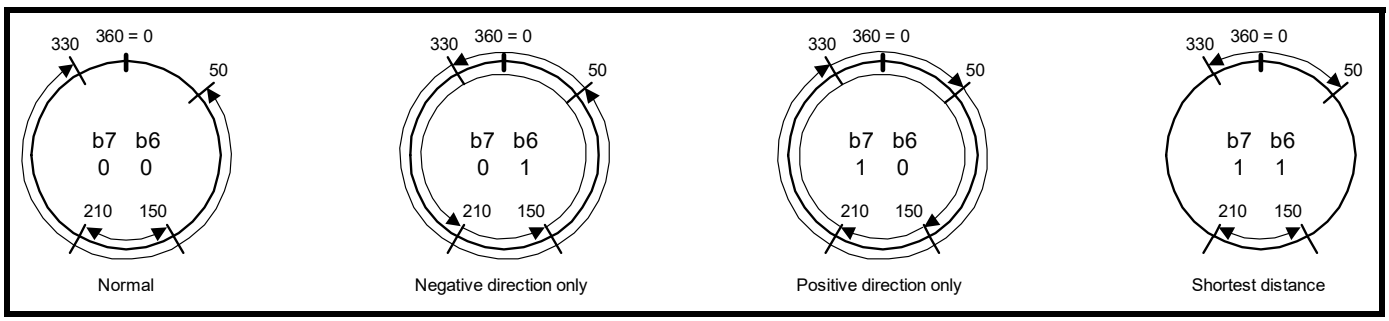
Table 11-86 Positioning option code actions

Bit		Description
b7	**b6**	
0	0	Normal positioning. If reaching or exceeding the position range limits (0x607B) the input value wraps to the other end of the range. Positioning can be absolute or relative.
0	1	Positioning only in the negative (reverse) direction. If the requested target position exceeds the actual position, the motor will reverse direction to the requested target position.
1	0	Positioning only in the positive (forward) direction. If the requested target position is lower than the actual position, the motor will move forward using the maximum position limit (0x607B:2) to the requested target position.
1	1	Positioning with the shortest distance to the target position. The motor will move either forward or backwards to attain the requested position in the shortest distance possible. If the distance between the actual and target positions are equal in both directions (the distance is half of the maximum position limit), the motor will move forward.

The following diagrams illustrate the movements depending on the selected configuration. In this example the maximum position range limit (0x607B:2) is set to 360º.

All units in the following examples are in degrees (º).

Figure 11-12 Positioning options



A movement greater than the limit (more than 1 revolution) is allowed only if both bits b6 and b7 are set to 0 (i.e. normal mode). If the target position is larger than the maximum position range limit, or it is negative, it is automatically converted to the equivalent modulo position.

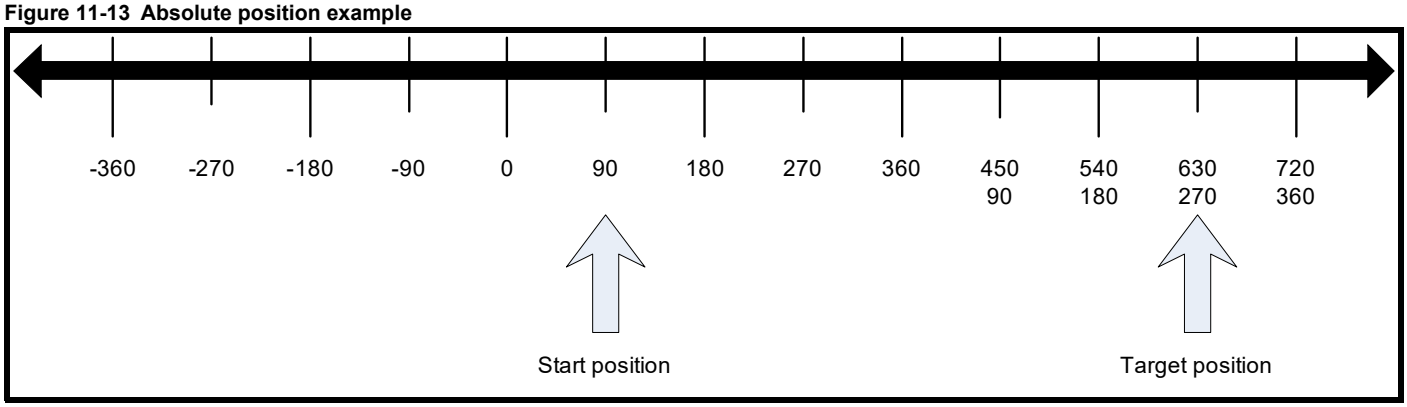
For example, referring to the Normal example above, if the target position requested was 450, then the converted target position would be:

$$\text{Converted target position} = \text{mod}\ \frac{\text{Requested target position}}{\text{Maximum position range limit}} = \text{mod}\ \frac{450}{360} = 90$$

Figure 11-13 shows an example for an absolute positioning system using the Normal mode and a target position larger than the limit (360 in this example). The actual position is 90 and absolute target position is 630.

The axis will move in the positive (forward) direction from 90, once through the maximum position range limit of 360 to finish at the converted target position of 270 (absolute 630).

Figure 11-13 Absolute position example



The relative positioning is allowed only if the Normal mode is selected (bits b6 and b7 are both 0).

If bits b6 and b7 are not 0 and *Control word* bit b6 (*Abs/Rel*) is set when a new setpoint is applied by *Control word* bit b4 (NEW SETPOINT), the new setpoint will not be processed.

11.41.71 Homing mode

Homing mode will operate on Unidrive M70X/M88X and Digitax HD drives in either RFC-S mode or RFC-A mode. It will not be available on any drive in open-loop or regen mode, this includes Unidrive M200 - M400 and Commander C200/C300.

Table 11-87 shows the Homing mode specific objects not detailed elsewhere in this User Guide. Homing mode is enabled by setting the *Modes of operation* object to 6 (see Table 11-78 *Modes of operation codes*).

The homing switch source, if required, will be taken from object 0x3003. The limit switch values, if required, will be read from the drive; the limit switches are inputs mapped to Pr **06.035** and Pr **06.036**, the user must ensure these parameters are mapped to the proper I/O.

If an index pulse is necessary, SI-CANopen V2 will read the marker or freeze from the currently selected feedback source (object 0x3000). If the freeze function is selected, the appropriate drive parameters Pr **03.100** (*F1 Freeze Trigger Source*), Pr **03.101** (*F1 Freeze Mode*), Pr **03.102** (*F1 Freeze Position Source*), Pr **03.105** (*F2 Freeze Trigger Source*), Pr **03.106** (*F2 Freeze Mode*), Pr **03.107** (*F2 Freeze Position Source*), should be set correctly before use.

Table 11-87 Homing mode specific objects

Index	Name	Type	Access	PDO mapping
0x607C	Home offset	INTEGER32	RW	Yes
0x6098	Homing method	INTEGER8	RW	Yes
0x6099	Homing speeds	Various	RO/RW	Yes
0x609A	Homing acceleration	UNSIGNED32	RW	Yes

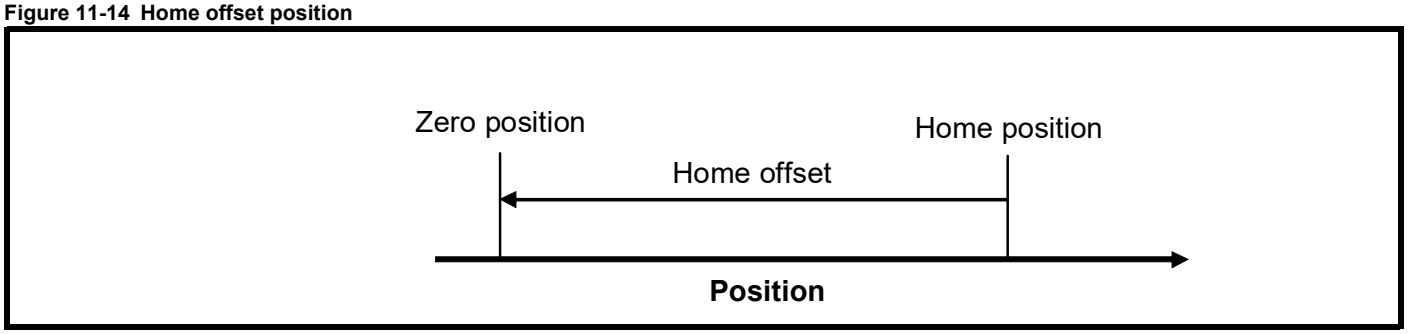
11.41.72 0x607C - Home offset

Index	0x607C	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	User Units		

This object indicates the configured difference between the zero position for the application and the machine home position (found during homing). During homing, the machine home position is found and once the homing is completed, the zero position is offset from the home position by adding *Home offset* to the home position.

All subsequent absolute moves will be taken relative to this new zero position. This is shown in Figure 11-14. Negative values will indicate the opposite direction.

Figure 11-14 Home offset position



The homing mode is controlled by *Control word* bits b4 and b8, and the homing status is indicated in *Status word* bits b10, b12 and b13.

Control word usage

The *Control word* for the homing mode differs from the standard configuration as shown below.

Bits	**b15 – b10**	**b9**	**b8**	**b7**	**b6**	**b5**	**b4**	**b3 – b0**
Name			HALT				START	

Bit	**Value**	**Description**
b4	0	No operation
	1	Start or continue the homing sequence (enabled by bit b8)
b8	0	Enable bit b4
	1	Stop axis according to object 0x605D (*Halt option code*)

Status word usage

The *Status word* for the homing mode differs from the standard configuration as shown below.

Bits	**b15 – b14**	**b13**	**b12**	**b11**	**b10**	**b9 – b0**
Name		HOMING ERROR	HOMING ATTAINED		TARGET REACHED	

Bit			**Description**
b13	**b12**	**b10**	
0	0	0	Homing sequence in progress
0	0	1	Homing sequence interrupted or not started
0	1	0	Homing is attained but target position in not reached
0	1	1	Homing sequence completed successfully
1	0	0	Homing error occurred, velocity is not zero
1	0	1	Homing error occurred, velocity is zero
1	1	X	*Reserved*

11.41.73 0x6098 – Homing method

Index	0x6098	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	INTEGER8	**PDO mapping**	Yes
Default	0	**Units**	User Units		

This object specifies the homing method used according to Table 11-88

Table 11-88 Homing mode values

Value	Description
0	No homing method assigned - Homing function fails signalling error in *Status word*
1	Homing on negative limit switch and index pulse
2	Homing on positive limit switch and index pulse
3..4	Homing on positive home switch and index pulse
5..6	Homing on negative home switch and index pulse
7..14	Homing on home switch and index pulse
15..16	*Reserved* - Homing function fails signalling error in *Status word*
17..30	Homing without index pulse
31..32	*Reserved* - Homing function fails signalling error in *Status word*
33..34	Homing on index pulse
35	Homing on current position (legacy)
36	*Reserved* - Homing function fails signalling error in *Status word*
37	Homing on current position

11.41.74 0x6099 – Homing speeds

This object configures the speed used during the search for the limit switches (sub-index 1) and the zero signal (sub-index 2). The values are sampled when the homing mode is selected and at the start of the homing sequence. Changes made after this time, while the homing sequence is in progress will not take effect until the currently active homing sequence is completed and another homing sequence is started.

The homing speed values are set to zero by default and must be set to the appropriate values otherwise the homing function will not complete.

Last sub-index

Index	0x6099	**Object code**	ARRAY	**Access**	RO
Sub-index	0	**Data type**	UNSIGNED8	**PDO mapping**	No
Default	2	**Units**	None		

This sub-index returns the last sub-index number for the object.

Speed during search for switch

Index	0x6099	**Object code**	ARRAY	**Access**	RW
Sub-index	1	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	0	**Units**	User Units/s		

This sub-index specifies the homing speed during the search for the limit switches.

When searching for the limit switches, this value is converted to drive units and written to Pr **34.006** (*AMC Speed Reference*).

Speed during search for zero

Index	0x6099	**Object code**	ARRAY	**Access**	RW
Sub-index	2	**Data type**	INTEGER32	**PDO mapping**	Yes
Default	0	**Units**	User Units		

This sub-index specifies the homing speed during the search for the zero (home) signal.

When searching for the zero signal, this value is converted to drive units and written to Pr **34.006** (*AMC Speed Reference*).

11.41.75 0x609A – Homing acceleration

Index	0x609A	**Object code**	VAR	**Access**	RW
Sub-index	0	**Data type**	UNSIGNED32	**PDO mapping**	Yes
Default	65535	**Units**	User Units/s^2		

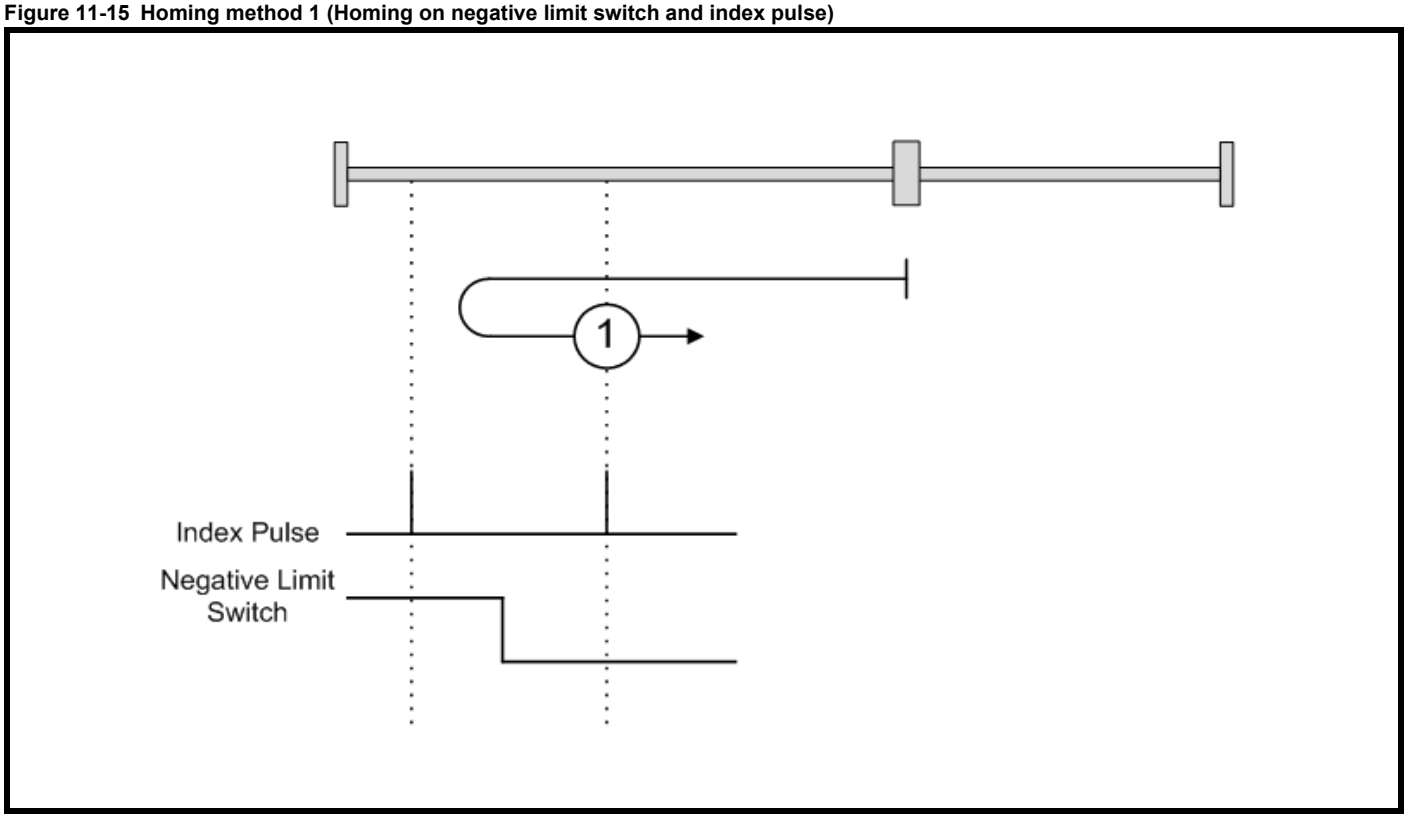
This object specifies both the acceleration and deceleration ramps used during the homing sequence. It is converted to drive units and written to Pr **38.001** (*AMC Profile Acceleration*) and Pr **38.002** (*AMC Profile Deceleration*) when the homing mode is selected or when the homing sequence is started.

Changes made to this object during a homing sequence will not take effect until the active homing sequence has completed and another homing sequence is started.

11.41.76 Homing method 1 (Homing on negative limit switch and index pulse)

Using this method as shown in Figure 11-15, the direction of movement is leftward if the negative limit switch is inactive. The home position will be at the first index pulse to the right of the position where the negative limit switch becomes inactive.

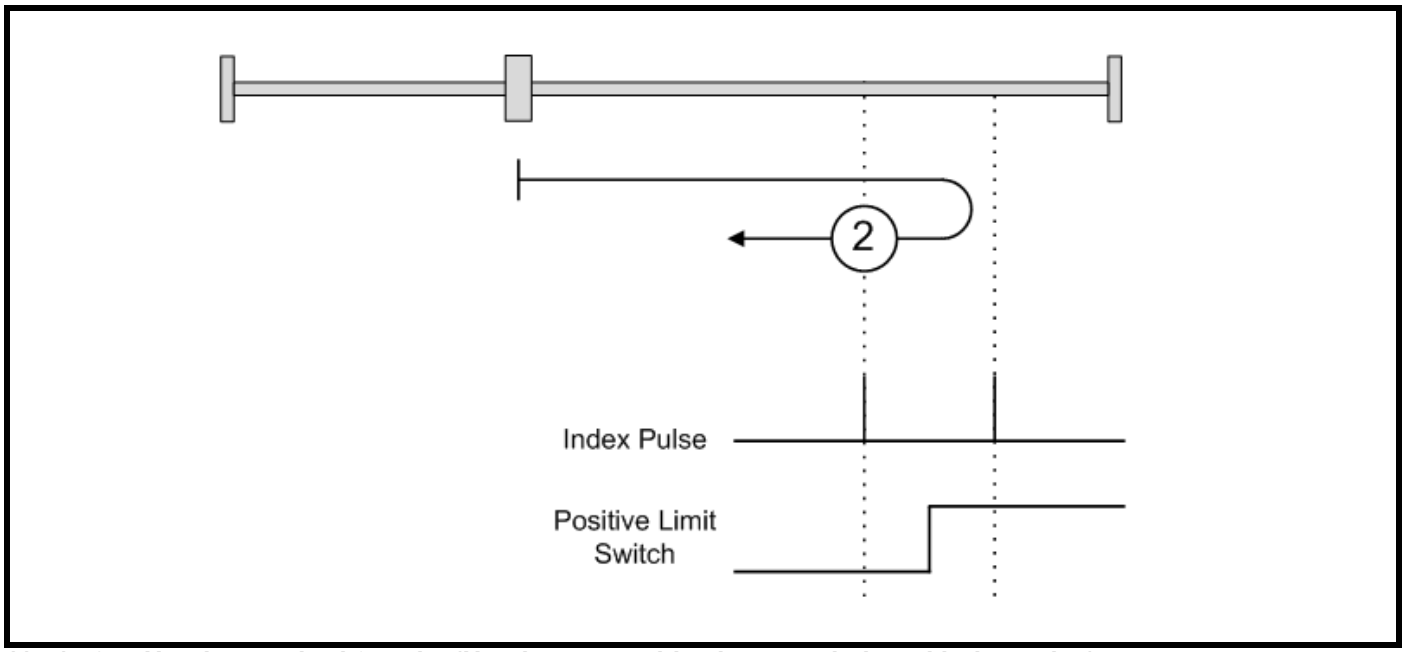
Figure 11-15 Homing method 1 (Homing on negative limit switch and index pulse)



11.41.77 Homing method 2 (Homing on positive limit switch and index pulse)

Using this method, as shown in , the initial direction of movement is rightward if the positive limit switch is inactive. The home position will be at the first index pulse to the left of the position where the positive limit switch becomes inactive.

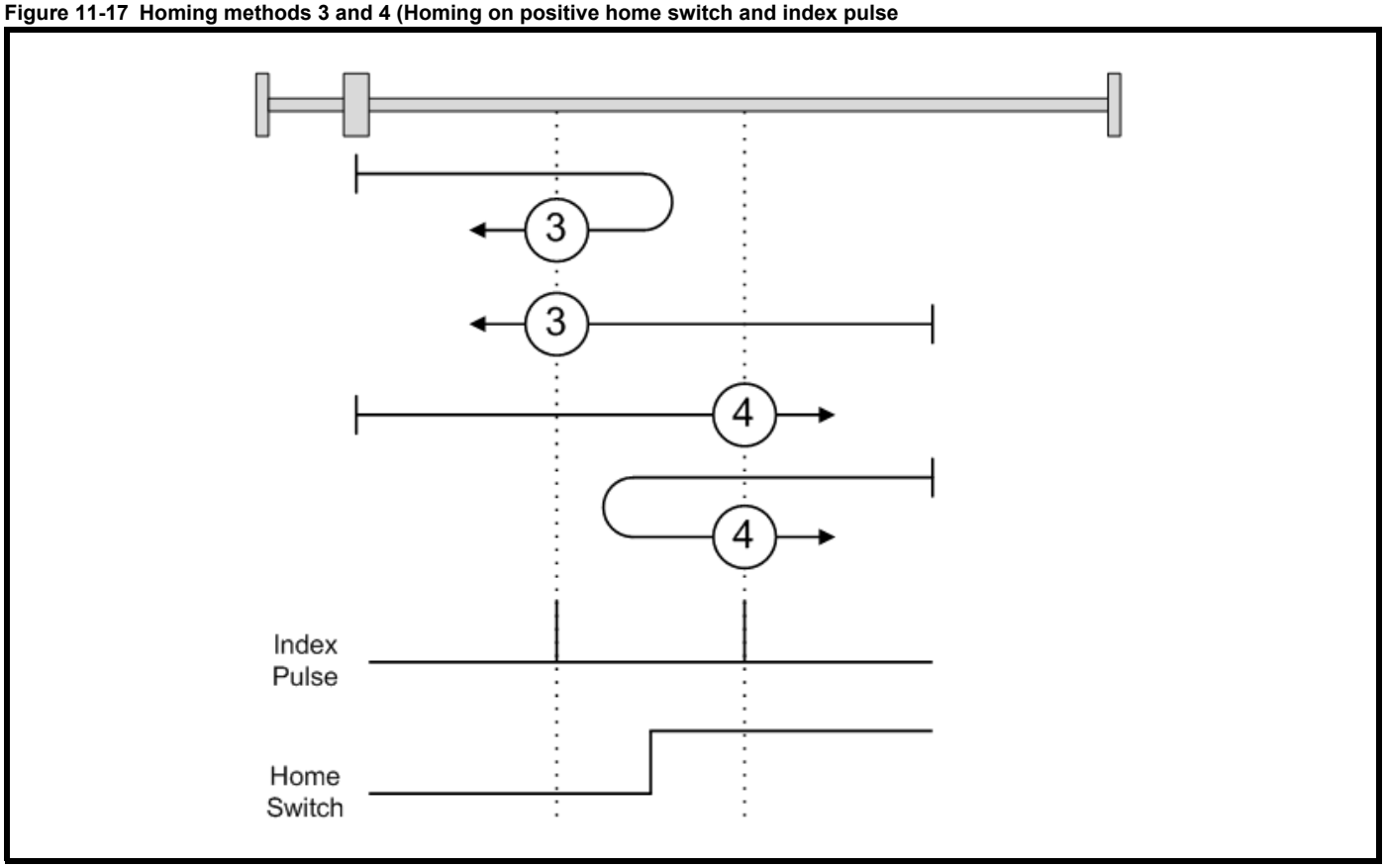
Figure 11-16 Homing method 2 (Homing on positive limit switch and index pulse)



11.41.78 Homing method 3 and 4 (Homing on positive home switch and index pulse)

The initial direction of movement depends on the state of the home switch. The home position is at the index pulse either to the left or right of the point where the home switch changes state. If the initial position is sited so that the direction of movement shall reverse during homing, the point at which the reversal takes place is anywhere after a change of state of the home switch.

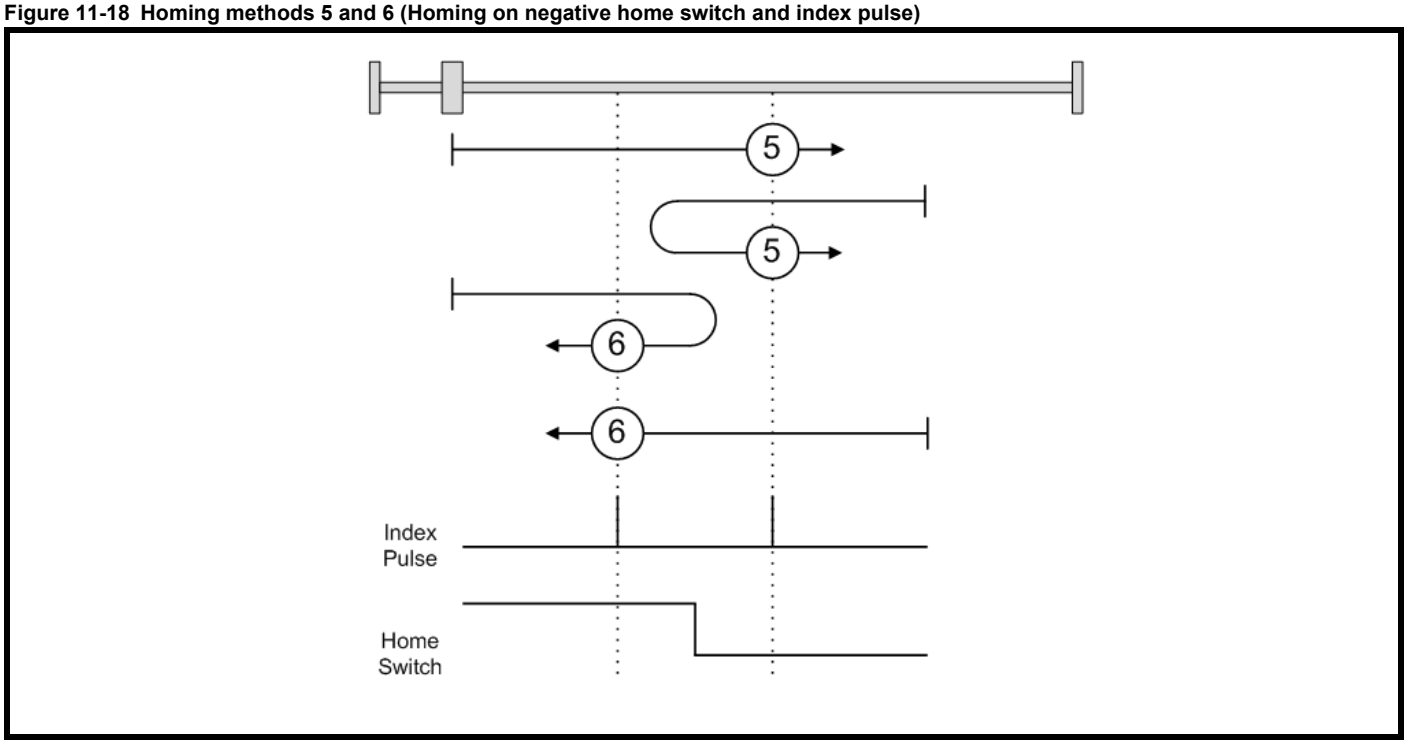
Figure 11-17 Homing methods 3 and 4 (Homing on positive home switch and index pulse



11.41.79 Homing method 5 and 6 (Homing on negative home switch and index pulse)

The initial direction of movement depends on the state of the home switch. The home position is at the index pulse either to the left or right of the point where the home switch changes state. If the initial position is sited so that the direction of movement shall reverse during homing, the point at which the reversal takes place is anywhere after a change of state of the home switch.

Figure 11-18 Homing methods 5 and 6 (Homing on negative home switch and index pulse)



11.41.80 Homing method 7 to 14 (Homing on home switch and index pulse)

These methods use a home switch which is only active over a portion of the travel; in effect, the switch has a ‘momentary’ action as the axis’s position travels past the switch.

Using the methods 7 to 10, the initial direction of movement will be to the right and using methods 11 to 14, the initial direction of movement will be to the left, except if the home switch is active at the start of the motion. In this case, the initial direction of movement will be dependent on the edge being sought.

The home position will be at the index pulse on either side of the rising or falling edge of the home switch, as shown in Figure 11-19 and Figure 11-20. If the initial direction of movement leads away from the home switch, the drive will reverse direction on encountering the relevant limit switch.

Figure 11-19 Homing methods 7 to 10 (Homing on home switch and index pulse – positive initial motion)

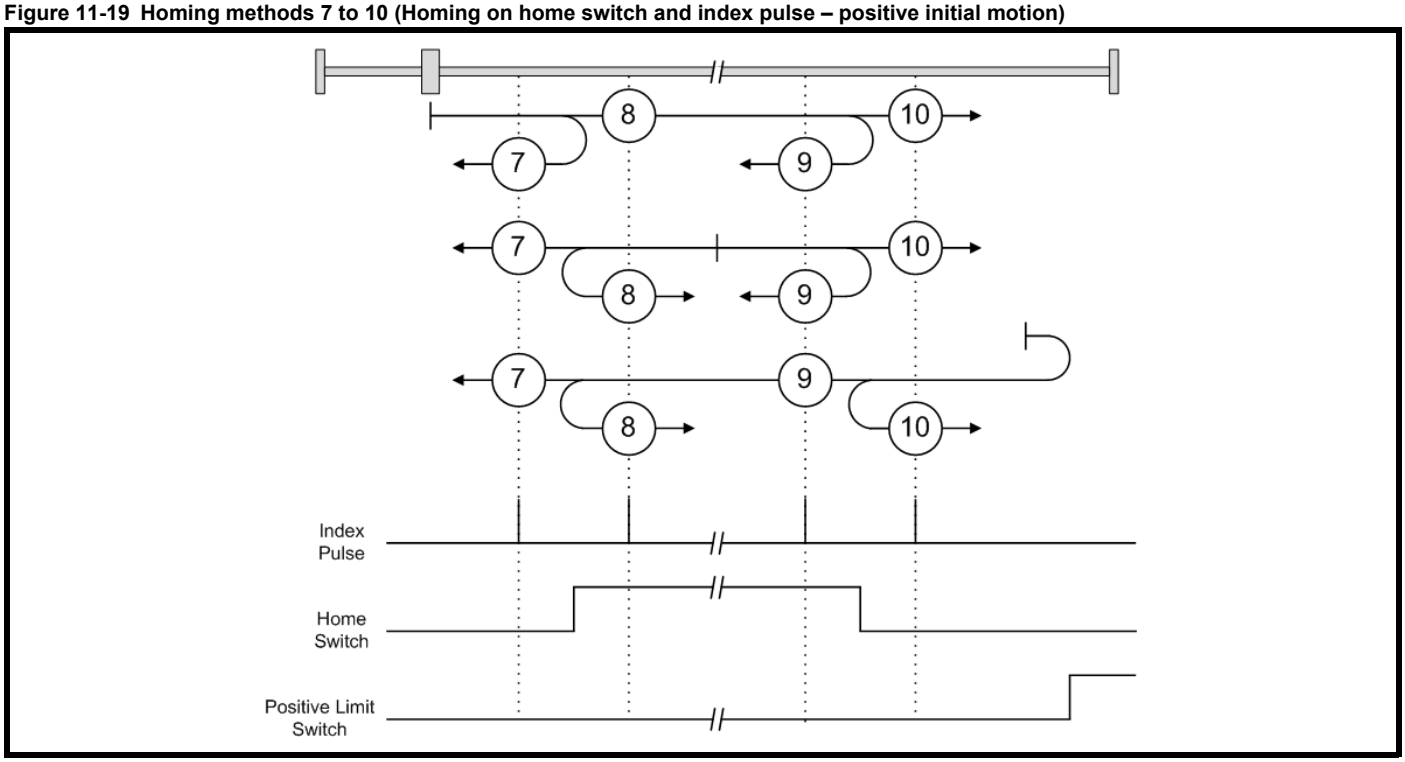
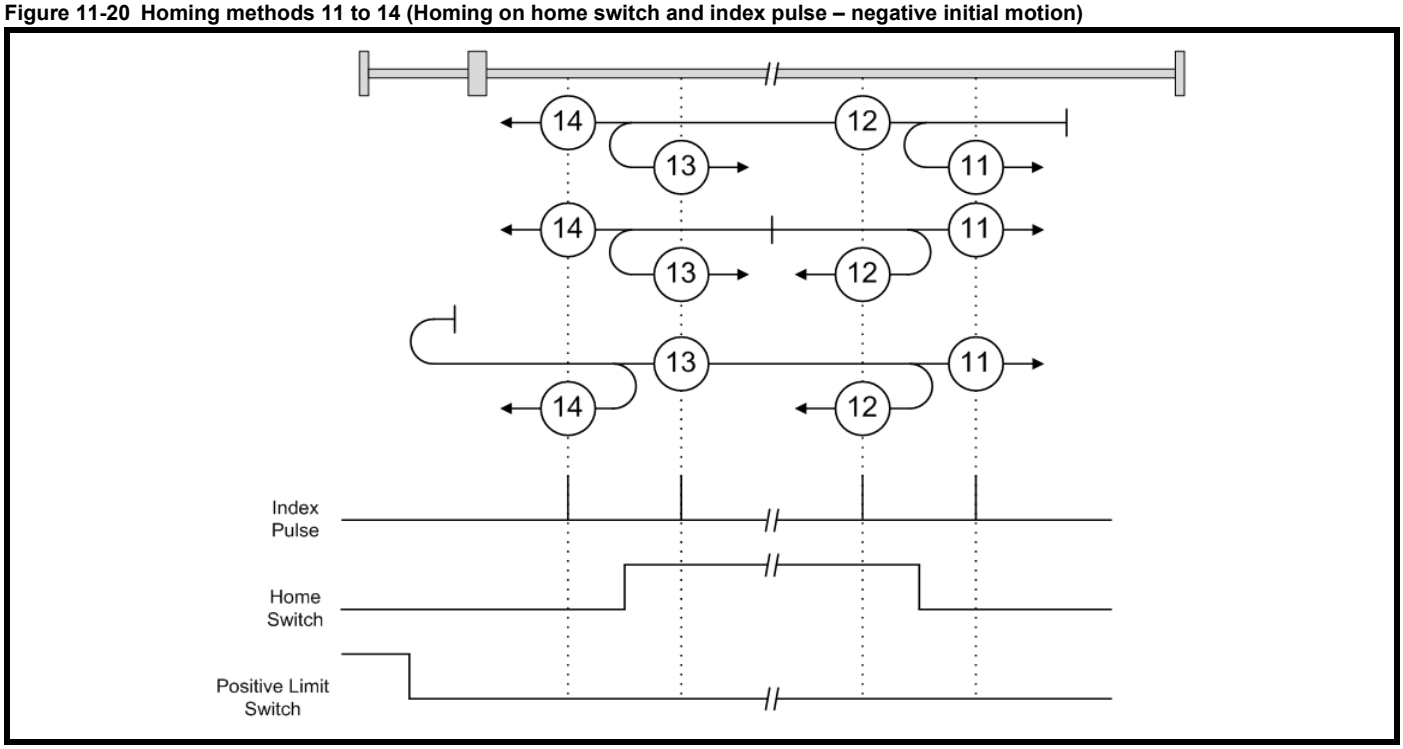


Figure 11-20 Homing methods 11 to 14 (Homing on home switch and index pulse – negative initial motion)

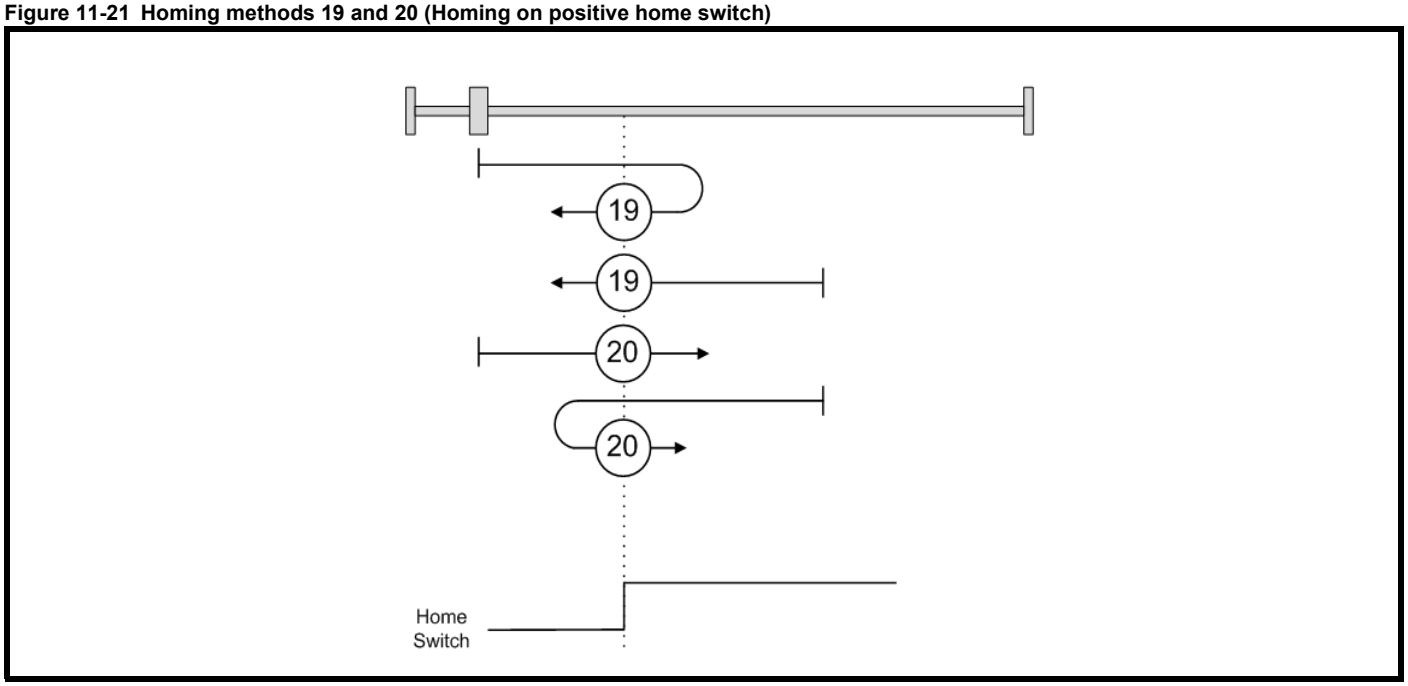


11.41.81 Homing method 17 to 30 (Homing without index pulse)

These methods are similar to methods 3 to 14 except that the home position is not dependent on the index pulse, but only on the relevant home transitions.

For example, methods 19 and 20 are similar to methods 3 and 4 as shown in Figure 11-21.

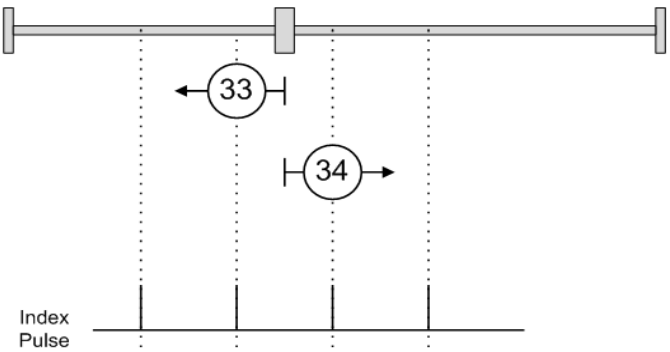
Figure 11-21 Homing methods 19 and 20 (Homing on positive home switch)



11.41.82 Homing methods 33 and 34 (Homing on index pulse)

Using homing methods 33 and 34, the direction of homing is negative or positive respectively. The home position will be at the index pulse found in the selected direction as shown in Figure 11-22.

Figure 11-22 Homing methods 33 and 34 (Homing on index pulse)



11.41.83 Homing method 35 and 37 (Homing on current position)

The homing methods 35 and 37 are equivalent, in these methods the current position is taken to be the home position; they do not require the drive to be in OPERATION ENABLED state.

12 Diagnostics

12.1 Overview

This section provides basic diagnostic information intended to resolve the most common problems encountered when setting up an SI-CANopen V2 module on a CANopen network.

A high percentage of problems reported are basic set-up problems which can usually be solved by reading the information in this chapter. If after reading this chapter you are still experiencing problems, please contact your supplier for support.

12.1.1 Drive trip display codes

If the option module detects an error during operation, it will force a trip on the drive. However, the trip string displayed on the drive will only indicate which slot initiated the trip. The exact reason for the trip will be indicated in the drive trip code parameters (Pr **10.020** and Pr **10.070**).

Table 12-1 shows the possible trips that will be displayed on the drive when a problem is detected with the option module or when the option module initiates a trip.

Table 12-1 Drive trip display codes

Trip	Description
SlotX HF	The drive has detected that an option module is present but is unable to communicate with it due to a hardware fault.
SlotX Error	User trip generated by the option module
SlotX Not Fitted	This trip will occur if a drive slot was previously configured with an option module but on power up, no option module was detected.
SlotX Different	This trip will occur if a drive slot was previously configured with an option module but on power up, a different option module was detected. Replacing the option module with another one of the same ID number will not initiate this trip. The trip will also occur if an option module is installed to a previously unused slot.

Emergency error code 0x8210 is a predefined CANopen error code as defined in the CANopen protocol specification, it is not an error code generated by the SI-CANopen V2 option module.

The CANopen protocol gives the definition of 0x8210 as that of the PDO producer (Master) that is writing a PDO which is shorter than that which is defined in the module (consumer).

So the consumer will not handle the PDO if it is shorter than the configured length, and will then inform the producer with the error code 0x8210 that a PDO is shorter than expected and has then been received and discarded.

12.1.2 Module error codes

If the option module detects an internal error during operation, it will force a trip on the drive and provide a sub-trip string for a clearer definition of the trip. Table 12-2 below shows the possible module error codes.

Table 12-2 Module error codes

Value	Text	Description
200	SW fault	Software fault
201	BG overrun	The background task has overrun
202	*Unassigned*	*Reserved for future use*
203	*Unassigned*	*Reserved for future use*
204	*Unassigned*	*Reserved for future use*
205	*Unassigned*	*Reserved for future use*
206	Mode unsupported	The drive operating mode is not supported
207	*Unassigned*	*Reserved for future use*
208	*Unassigned*	*Reserved for future use*
209	*Unassigned*	*Reserved for future use*
210	*Unassigned*	*Reserved for future use*
211	Filesystem	The file system is corrupted
212	Configuration	An error occurred saving the configuration file
213	OHt	The SI-CANopen V2 module has overheated
214	*Unassigned*	*Reserved for future use*
215	*Unassigned*	*Reserved for future use*
216	*Unassigned*	*Reserved for future use*
217	*Unassigned*	*Reserved for future use*
218	*Unassigned*	*Reserved for future use*
219	*Unassigned*	*Reserved for future use*
220	*Unassigned*	*Reserved for future use*
221	Factory Settings	The factory settings file is missing
222	Functional Test	Error during functional self-test
223	Config Restore	Error loading the configuration file
224	Self Test Error	Error during power-on test (e.g. thermistors failed)
225	Read Param	Error reading parameter
226	Write Param	Error writing to parameter
227	CAN Config	Error with the CAN interface configuration
228	CAN Init	Error initialising the CAN interface
229	CAN Baud	Error configuring the CAN interface baud rate

12.1.3 SI-CANopen V2 error codes

If the SI-CANopen V2 module detects a SI-CANopen error during operation, it will force a trip on the drive and provide a sub-trip string for a clearer definition of the trip. The table below shows all possible SI-CANopen V2 error codes.

Table 12-3 SI-CANopen V2 network error codes

Value	Text	Description
0	No trip	The SI-CANopen V2 module is healthy and not tripped.
100	Link Loss	The connection to the CANopen network has been lost.
101	Bus Off	The CAN layer of the module has entered the BUS OFF state.
102	Heartbeat error	SI-CANopen V2 has missed the CANopen master's heartbeat message
103	*Unassigned*	*Reserved for future use*
104	Startup object	SI-CANopen V2 failed to use the startup object list (0x2860) when defined in a MCi2xx or SI-Applications user program
105	Comm slot 1 err	SI-CANopen V2 failed to access DPL associated objects in the MCi2xx or SI-Applications module fitted in slot 1 due to a module error, or has encountered an error communicating with the module is slot 1
106	Comm slot 2 err	SI-CANopen V2 failed to access DPL associated objects in the MCi2xx or SI-Applications module fitted in slot 2 due to a module error, or has encountered an error communicating with the module is slot 2
107	Comm slot 3 err	SI-CANopen V2 failed to access DPL associated objects in the MCi2xx or SI-Applications module fitted in slot 3 due to a module error, or has encountered an error communicating with the module is slot 3
108	Bkg object	The background association object could not be activated
109	Scaling Failure	The configured CiA 402 gear ratio or feed constant values are not within range and could not be implemented in the AMC
110	APLS Failure	The configured CiA 402 Additional Position Loop Scaling values are not within range and could not be implemented in the AMC
111	Bus Passive	The CAN bus is in the PASSIVE state and not transmitting messages

12.1.4 SI-CANopen V2 network diagnostic

The operating status of the SI-CANopen V2 module can be viewed in the network diagnostic parameter (Pr **S.01.006**). All possible values for this parameter are described in Table 12-4 .

Table 12-4 SI-CANopen V2 network operating status

Value	Text	Description
0	Network OK	CAN network is healthy
1	Internal HW Fail	The SI-CAnopen V2 module initialisation sequence has failed
2	Init OK	The SI-CANopen V2 module has initialised and waiting for the CANopen master to initialise communications
3	No PDO Cfg	The SI-CANopen V2 module is waiting for the PDO configuration from the CANopen master (when PDOs configured by CANopen master)
4	Config Error	Indicates an invalid CANopen configuration setting. (e.g. mapping error)
5	Software Error	An internal software error has occurred. Reset the SI-CANopen V2 module and if the problem persists replace the module
6	Baud detecting	The SI-CANopen V2 module is attempting to detect the CANopen baud rate
7	Device Disabled	The SI-CANopen V2 communication layer is disabled by setting the node address to 0
8	Initialise Delay	The SI-CANopen V2 module is being initialised and is waiting for the MCi2xx or SI-Applications module to complete its *Initia*l task
9	Bus Off	The CAN module used by the SI-CANopen V2 module is in the ‘Bus Off’ state due to an error on the CAN bus

12.1.5 Alarms

If the SI-CANopen V2 detects an alarm during operation, it will cause the drive to display the appropriate alarm on the drive keypad. If more than one alarm is present, it will be shown as “first-in-first-out” (FIFO) order.

Value	Text	Description
0	No alarm	The SI-CANopen V2 module is not indicating an alarm condition
1	*Unassigned*	Reserved for future use
2	eCMP	eCMP warning
3	FS Usage	Alarm generated accessing the SI-CANopen V2 module file system
4	Too Hot	The SI-CANopen V2 module temperature is too high
5	In Mapping	An input mapping error has been detected
6	Out Mapping	An output mapping error has been detected
7	*Unassigned*	Reserved for future use
8	*Unassigned*	Reserved for future use
9	*Unassigned*	Reserved for future use
10	Event Task	Failed to trigger the destination event task
11	*Unassigned*	Reserved for future use
12	Bus Passive	The CAN bus is in the PASSIVE state and not transmitting
13	Bus Off	The CAN bus is in the ‘BUS OFF’ state

13 Glossary of terms

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

Alignment: By default SI-CANopen V2 transmits values as 32 bits on the network. It is possible by using alignment to reduce the number of bits transmitted when sending 16-bit (or smaller) values on the network to 16-bit (32-bit values will still be transmitted as 32-bit values). This has the advantage of reducing the volume of traffic on the network and allowing more parameters to be mapped within SI-CANopen V2.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Scan rate: See Poll rate in this section.

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

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

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

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

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

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

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

Word: A collection of 16 binary digits.

Index

0478-0101-03