Advanced User Guide

SE74-INTERBUS

Commander SE

Part Number: 0452-0027-02
Issue Number: 2

www.controltechniques.com

Safety Information

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

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

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

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

General Information

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

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

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Issue Code: 2
Hardware: 01.00
Firmware: V1.00.00
Commander SE:V0.10.00 or later

Contents

1 Introduction

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

1.1 SE74-INTERBUS Module for Commander SE

The SE74-INTERBUS module for Commander SE is a single option module that fits onto the Commander SE. The SE74-INTERBUS module uses a 16-bit processor and communicates at 500 kbit/s. SESoft V1.04.00 and later provides full support for the SE74-INTERBUS card.

Parameter data is transferred to and from the Commander SE using a 2-wire RS485 link into the RJ-45 serial communications connector on the Commander SE.

Although power is taken from the Commander SE under normal operating conditions, an optional back-up power supply can also be connected to the SE74-INTERBUS module. This ensures that the INTERBUS network is not interrupted when the SE74-INTERBUS module is disconnected from the Commander SE, or when the Commander SE is powered down.

1.2 Product Conformance Certificate

The SE74-INTERBUS module has been awarded full INTERBUS Conformance Certification by the INTERBUS Club. (Certificate No. C263) Further details are available on the INTERBUS Club web site at www.interbus.com.

1.3 Overview Specification

- Auto slave configuration of data format and data consistency during Interbus network initialisation.
- Auto-configuration of the serial communications port when the SE74-INTERBUS module is connected to the Commander SE.
- Choice of two or three 16 bit input/output words.
- PCP V2.0 or CT Single Word non-cyclic data access optional.

2 Mechanical Installation

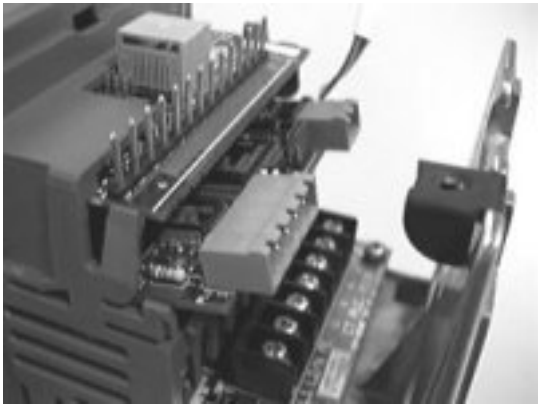
The Commander SE must be disconnected from the mains supply before installing or removing an option module.

NOTE Care should be taken when handling the SE74-INTERBUS card, as it may be damaged by electrostatic discharge. To prevent inadvertent damage, touch an earthed bare metal surface to discharge yourself before removing the SE74-INTERBUS card from the anti-static bag.

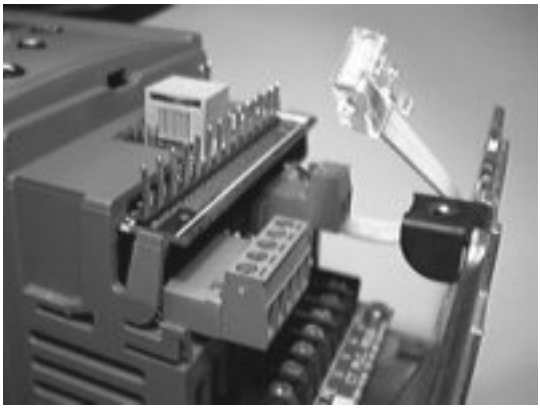
2.1 Commander SE Size 1

1. Remove the two terminal blocks from the option card. Slide the SE74-INTERBUS card diagonally into the Commander SE.

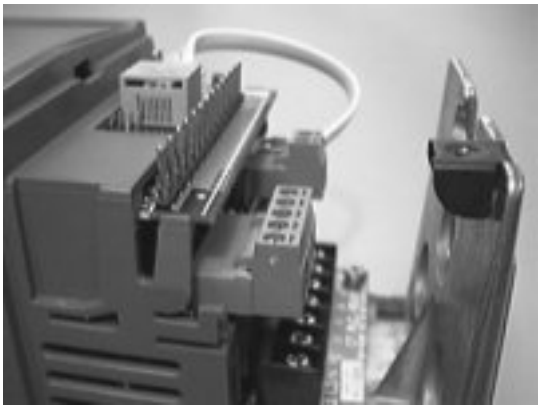
2. Ensure that the SE74-INTERBUS card is aligned between the runners moulded into the plastic casing, and slide into the Commander SE.



3. Push the SE74-INTERBUS card firmly into the Commander SE until the plastic spring clips latch it securely in place.

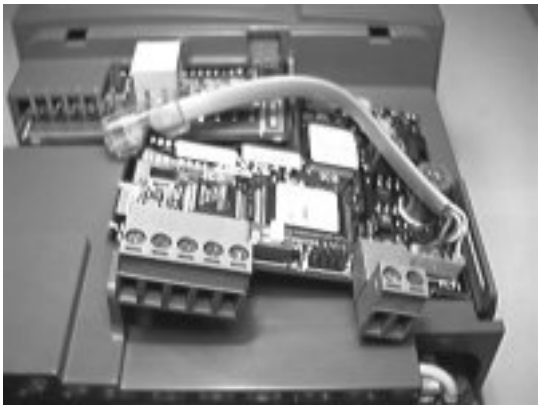


4. Plug the flylead into the RJ45 socket on the Commander SE.



2.2 Commander SE Sizes 2, 3, 4 and 5

1. Locate the right hand side of the SE74-INTERBUS card under the flange.



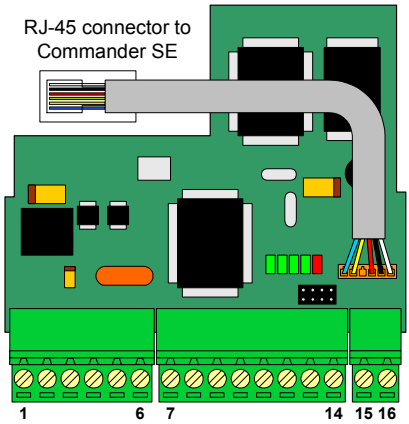
2. Push the left hand side of the SE74-INTERBUS card down to clip into place. Connect the fly-lead to the RJ-45 connector on the Commander SE.

3 Electrical Installation

3.1 SE74-INTERBUS Module

The SE74-INTERBUS module provides 6-way and 8-way screw terminal connectors for the INTERBUS Remote Bus IN and INTERBUS Remote Bus OUT data connections. An additional 2 -way screw connector is provided for a +24V back-up power supply.

Figure 3-1 SE74-INTERBUS Module



The pin connections for the INTERBUS Remote Bus IN and OUT connectors are given in the table below. 0V COM is internally linked to the 0V line of the Commander SE, and 0V ISO is isolated from 0V COM.

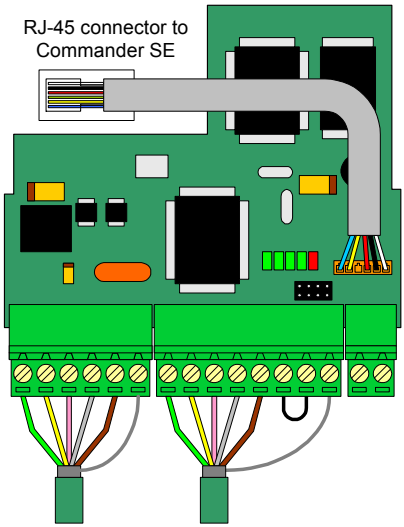
Table 3.1 SE74-INTERBUS Connections

Terminal	Function	Description
1	/DO1	Negative Data IN line, connect to /DO2
2	DO1	Positive Data IN line, connect to DO2
3	/DI1	Negative Data OUT line, connect to /DI2
4	DI1	Positive Data OUT line, connect to DI2
5	0V ISO	0V Isolated
6	RBI Screen	Remote Bus IN cable screen connection
7	/DO2	Negative Data OUT line, connect to /DO1
8	DO2	Positive Data OUT line, connect to DO1
9	/DI2	Negative Data IN line, connect to /DI1
10	DI2	Positive Data IN line, connect to DI1
11	0V COM	0V Common, internally linked to Commander SE 0V
12	RBST	Remote Bus OUT Enable
13	+5V	+5V Comms
14	RBO Screen	Remote Bus OUT cable screen connection
15	+24V BACKUP	+24V Back-up power supply
16	0V BACKUP	0V Backup power supply

3.2 SE74-INTERBUS Connections

To connect a Commander SE to the INTERBUS network, make the connections as shown in the diagram below. The length of the "pigtail" screen connections should be kept as short as possible.

Figure 3-2 SE74-INTERBUS Connections



NOTE The Remote Bus OUT Enable (RBST) must be linked to +5V if the Remote Bus OUT terminals are to be connected to another node "downstream" on the network.

3.3 INTERBUS Cable

INTERBUS cable has three twisted pairs plus overall screening. The colours normally used on INTERBUS networks are shown in the table below.

Table 3.2 INTERBUS Cable Colour Codes

Cable	Data Signal	Terminal	D-type	Description
Green	/DO1, /DO2	1, 7	6	Negative data OUT line
Yellow	DO1, DO2	2, 8	1	Positive data OUT line
Pink	/DI1, /DI2	3, 9	7	Negative data IN line
Grey	DI1, DI2	4, 10	2	Positive data IN line
Brown	0V ISO, 0V COM	5, 11	3	0V
Shield	Screen	6, 14	Shell	Cable screen

INTERBUS cable is 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. A list of suppliers approved by the INTERBUS Club is available from the INTERBUS Club web site at www.INTERBUS.com.

NOTE Control Techniques can only guarantee correct and reliable operation of the SE74-INTERBUS module if all other equipment installed (including the network cable) has been approved by the INTERBUS Club.

3.4 SE74-INTERBUS Cable Screen Connections

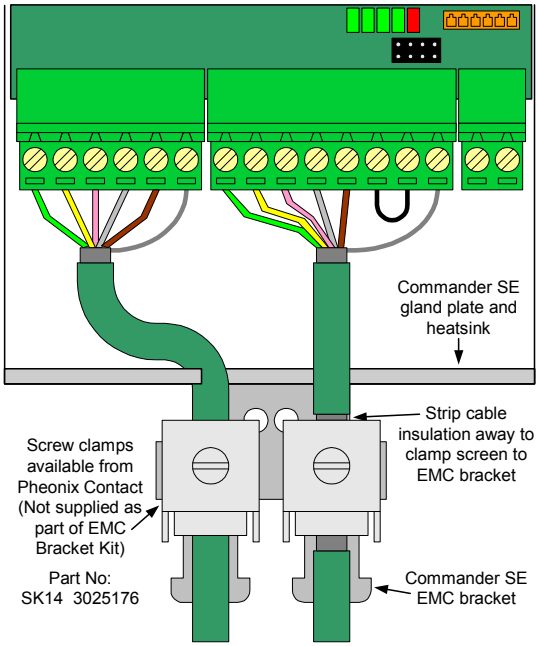
An EMC Bracket Kit is available for each size of Commander SE. This plate must be fastened to the Commander SE gland plate, and provides a path to earth via the Commander SE heatsink.

Table 3.3 EMC Bracket Kits

Commander SE	Kit Part No	Kit Name	Commander SE	Kit Part No	Kit Name
Size 1	9500-0014	SE11	Size 4	9500-0018	SE14
Size 2	9500-0016	SE12	Size 5	9500-0041	SE15
Size 3	9500-0017	SE13			

Ensure that the Commander SE heatsink is in close contact with the backplate. The end of the Remote Bus IN and OUT cable screens should be formed into "pigtails" and connected to pin 6 and pin 14 respectively on the INTERBUS connector.

Figure 3-3 SE74-INTERBUS Screen Connections



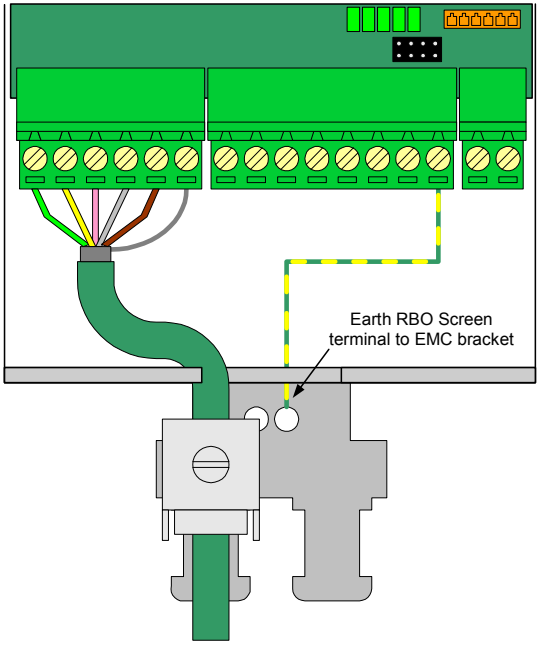
The screen of the Remote Bus OUT cable should be exposed and clamped to the EMC bracket, which is in turn fastened to the Commander SE gland plate. The screen of the Remote Bus IN cable should NOT be connected to the EMC bracket.

With this arrangement, the SE74-INTERBUS module will work equally well when powered by the Commander SE internal power supply, or from an external 24V supply, with the external supply earthed or left floating.

3.5 INTERBUS Network Termination

External termination resistors are not required on INTERBUS networks, as each section of cable is automatically terminated on every INTERBUS node. The connections required for the last node on the network are in Figure 3-4. The RBO Screen (pin 14) should be earthed to the EMC bracket.

Figure 3-4 SE74-INTERBUS Termination



3.6 Back-up Power Supply

Usually, the SE74-INTERBUS module will draw power via the RJ-45 communications lead from the unregulated +28V rail of the Commander SE. If the SE74-INTERBUS module is disconnected form the Commander SE, e.g. to check and update the configuration of the Commander SE using SESoft, the SE74-INTERBUS module will power down, breaking the INTERBUS network ring, and causing the INTERBUS network to stop communicating.

By connecting a +24V back-up power-supply to the SE74-INTERBUS module, the INTERBUS ring is not broken, and the node will continue to communicate with the master controller. The SE74-INTERBUS module will indicate (using the status word) to the master controller that it is not currently communicating with the Commander SE.

When the SE74-INTERBUS module is re-connected to the Commander SE, communications will be re-established automatically.

Table 3.4 Backup Power Supply Terminals

Terminal	Function	Description
15	+24V BACKUP	This allows a back-up power supply to keep the INTERBUS network operating if the Commander SE is switched off
16	0V BACKUP	0V for the back-up power supply

NOTE A+24V back-up power supply is strongly recommended with the SE74-INTERBUS module. If a Commander SE is powered down with an SE74-INTERBUS module connected, the INTERBUS network ring will be broken, causing the network to stop communicating.

The back-up power supply should be +24V ±20%, and should have sufficient current capability to supply all SE74-INTERBUS nodes connected to it. This condition will occur if the main power supply to the Commander SE is lost. The consumption of the SE74-INTERBUS module is dependent on the supply voltage, with typical and maximum currents listed in Table 3.5.

Under normal operating conditions, the Commander SE and the back-up power supply share the power supply requirements of the SE74-INTERBUS module. An in-rush current of 2.0 times the nominal current should be allowed for at powe-up, although this factor will typically be nearer 1.7.

Table 3.5 SE74-INTERBUS Current Consumption

Back-up Supply Voltage	Nominal Current (Commander SE is off)	Typical Current (Commander SE is off)
19.2V (24V -20%)	70mA	0mA
21.6V (24V -10%	65mA	10mA
24V nominal	60mA	35mA
26.4V (24V +10%	55mA	48mA
28.8V (24V+20%)	50mA	45mA

NOTE Control Techniques strongly recommends that a dedicated external +24V back-up power supply should be used, as electrical noise from other external sources may cause disturbance to the INTERBUS system.

3.7 Maximum Network Length

The maximum length of cable is 1200m between INTERBUS nodes. Hence, the maximum total length of the INTERBUS network depends entirely on the number of nodes connected to the network.

4 Getting Started

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

NOTE The Commander SE must be fitted with firmware V1.08.00 or later for use with an SE74-INTERBUS module. SESoft V1.04.00 or later provides support for all Commander SE fieldbus cards.

4.1 SESoft Wizard

The SESoft Wizard guides the user through the basic configuration of the Commander SE. Specify the power supply and motor details in pages 1 and 2 of the Wizard. For the "Speed Input References" screen (page 3), follow the instructions below:

- Set the Speed Input to "**Fieldbus**".
- Set the Fieldbus Type to **"**INTERBUS**"**.
- Specify the Node Address for the Commander SE. (Not required for the SE74-INTERBUS module.)
- Specify the Data Rate to be used. (Not required for SE73-Profibus-DP or SE74-INTERBUS modules.)

Complete the remainder of the Wizard, and click **DOWNLOAD** to download the configuration to the Commander SE. When complete, click **FINISH** to exit the Wizard.

The Wizard will download all appropriate information to the Commander SE, configure it to use the digital speed reference #1.21, change the communications mode to "FbuS", and save all parameters in the Commander SE.

- Power down the Commander SE.
- Plug the SE74-INTERBUS card into the Commander SE.
- Power up the Commander SE.

The SE74-INTERBUS module is now ready to communicate with the INTERBUS master controller.

4.2 Basic Communications Quick Start

The SE74-INTERBUS card will operate simply by connecting it to the Commander SE, and powering up the Commander SE. It will read the configuration parameters from the Commander SE, and configure itself accordingly.

Table 4.1 Basic Configuration Parameters

Function	Parameter	Recommended Setting
Communications Mode	#0.41	“Fbus”
Not Used	#0.45	No node address setting required for SE74-INTERBUS module
Data Rate	#0.46 (RO)	4
Network Status	#0.47 (RO)	Indicates the current status of the SE74-INTERBUS module

NOTE "FbuS" mode must be selected to allow keypad access to #0.45, #0.46 and #0.47.

4.3 Commander SE Communications Mode

Name	Commander SE Communications Mode		
Param	#0.41	Default	ANSI (0)
Access	RW	Range	ANSI (0), RTU (1), FBUS (2)

The Commander SE has several communications mode that can be selected by #0.41. When a SE74-INTERBUS module is connected to the Commander SE, it will automatically change the communications mode to "FbuS". This change will take effect immediately without any need to store the parameters or reset the Commander SE.

4.4 SE74-INTERBUS Node Address

Node addresses are determined by the physical position of a node on the network. During network initialisation, the INTERBUS network master scans the network, and determines the position and type of node on the INTERBUS network.

4.5 SE74-INTERBUS Data Rate

Name	SE74-INTERBUS Data Rate		
Param	#0.46	Default	4
Access	RO	Range	4

The data rate for INTERBUS networks is fixed at 500 kbit/s. #0.46 will always display 4.

4.6 SE74-INTERBUS Data Format

Name	Commander SE Communications Mode		
Param	#0.41	Default	1.03
Access	RW	Range	0.00 to 2.03

The default data format is 3 Cyclic Words with PCP V2.0 (Mode 1) non-cyclic data. The INTERBUS ID Code for this data format is 0xF3 (243), with a Process Data Channel width is 48 bits.

Each cyclic data word is mapped to a Commander SE parameter with default mappings as shown in the table below.

Table 4.2 Default Mappings

Cyclic Channel	Default Mapping Status
IN Word 0	Reserved for non-cyclic PCP communications
IN Word 0	Status word
IN Word 0	Post-ramp speed reference
IN Word 0	Motor load current as % of rated load current
OUT Word 0	Reserved for non-cyclic PCP communications
OUT Word 0	Control word
OUT Word 0	Digital speed reference 1
OUT Word 0	Not mapped

Other data formats are also supported. See Section 5.3 for details.

4.7 INTERBUS Network Status

Name	INTERBUS Netowrk Status		
Param	#0.47	Default	N/A
Access	RO	Range	-2 to 999

The status of the SE74-INTERBUS module and INTERBUS network is displayed in #0.47, and can be viewed on the display on the Commander SE.

Table 4.3 INTERBUS Network Status

#0.47	Status	Description
>0	Network healthy	Indicates the number of network cycles per second, and the slave is exchanging data with the master controller.
0	Network healthy, no data transfer	Indicates that the master controller has established communications with the node, but data transfer has not yet started.
-1	No network master	Indicates that the INTERBUS interface has initialised correctly, and is waiting for the master controller to initialise communications
-2	Internal failure	Indicates that part of INTERBUS interface initialisation test was not successful. Replace the module if this error persists.

4.8 Network Loss Trip

4.8.1 Loss of INTERBUS Network

If the INTERBUS network stops operating, the SE74-INTERBUS module will trip the Commander SE on “t60”. The default time delay between network loss and Commander SE trip is 200ms, so the actual delay trip time will be between 200 and 400ms. (See Section 10.1 for more details.) The master controller will automatically detect that the slave node is no longer communicating on the network, and will update its own internal status registers. Refer to the master controller documentation for details.

4.8.2 Loss of RS485 "FbuS" Link

The Commander SE has a serial communications watchdog that must be updated at least once every second. The SE74-INTERBUS module ensures that the watchdog is updated regularly while the RS485 link is healthy. If the RS485 link is broken, the watchdog in the Commander SE will not get updated, and the Commander SE will trip "SCL".

If the SE74-INTERBUS module remains powered up, it will continue to communicate with the INTERBUS master controller. The loss of the RS485 link to the Commander SE is indicated by bit 15 of the status word being set to 1. (All other bits in the status word are reset to 0 in this state.) Bit 15 is reset to 0 when the RS485 link is re-established.

NOTE If bit 15 of the status word is set to 1, the remaining IN polled data words will continue to hold the last values read from the Commander SE. Bit 15 is an important check for the validity of the IN data.

4.9 Restore SE74-INTERBUS Default Values

Name	Restore Default Values		
Param	#15.30	Default	0
Access	RW	Range	0 or 1

Default SE74-INTERBUS values can be restored using either SESoft or the Universal Keypad. This resets ALL SE74-INTERBUS configuration parameters (including node address) back to the factory default values.

Table 4.4 Restore Defaults

#15.30	Status
0	No action
1	Restore default settings

NOTE To restore communications to the node, the node address (#0.45) must be set to the required value, and the Commander SE powered down. Communications will be re-established (with default settings) when power is re-applied to the Commander SE. (This does not apply to the INTERBUS module.)

The +24V bac-up power supply should be switched off or switched while default parameters are restored.

4.9.1 SESoft

- Power down the Commander SE and disconnect the SE74-INTERBUS module.
- Connect the SESoft communications lead, and power up the Commander SE.
- In SESoft, go to **MENU 15**, and click **LOAD DEFAULTS**.
- Power down the Commander SE and re-connect the SE74-INTERBUS module.
- Re-apply power to the Commander SE.
- The SE74-INTERBUS module will overwrite all #15.PP parameters with their default values. The default values will take effect immediately.

4.9.2 Universal Keypad

- Set #15.30 to 1.
- Store the Commander SE parameters from the Universal Keypad by setting #MM.00 to 1000, and pressing the red **RESET** button.
- Power down the Commander SE, and re-connect the SE74-INTERBUS module.
- The SE74-INTERBUS module will overwrite all #15.PP parameters with their default values. The default values will take effect immediately.

4.10 Restore Previous SE74-INTERBUS Configuration

The SE74-INTERBUS module stores the last set of configuration parameters in its own FLASH memory. These values can be restored to the Commander SE using SESoft or the Universal Keypad.

NOTE A brand new Commander SE will have #15.01 set to 0 by default. When a previously confiured SE74-INTERBUS module is connected, it will detect that #15.01 is set to 0, and will automatically revert to the configuration values stored in its internal FLASH memory.

4.10.1 SESoft

- Go to the Menu 15 Screen
- Set the Fieldbus Type to "**None**" and click on the **PROGRAM** button. SESoft will set #15.01 to 0 and store all parameters.
- Power down the Commander SE, and re-connect the SE74-INTERBUS module.
- Re-apply power to the Commander SE.
- The SE74-INTERBUS module will detect that #15.01 is 0, and download the previously stored values (including the node address) to all #15.PP parameters. The stored values will take effect immediately.

4.10.2 Universal Keypad

- Set #15.01 to 0.
- Store the Commander SE parameters from the Universal Keypad by setting #MM.00 to 1000, and pressing **RESET**.
- Power down the Commander SE, and re-connect the SE74-INTERBUS module.
- Re-apply power to the Commander SE.
- The SE74-INTERBUS module will detect that #15.01 is 0, and download the previously stored values (including the node address) to all #15.PP parameters. The stored values will take effect immediately.

NOTE Universal Keypads must have V1.04.00 or later fitted to allow access to #15.01.

5 Cyclic Data

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

5.1 What is Cyclic Data?

Cyclic data is a method of data transfer that must be set-up during network configuration, but is transmitted automatically once configuration is complete. The high-speed data transfer is achieved by transmitting only a 16-bit data value for each cyclic channel over the INTERBUS network, and relying on local mapping information within the Commander SE to ensure the correct data is sent to the correct locations. This method relies on the master controller program writing and reading data values to and from the registers allocated to the node during network configuration, and the source and destination of IN and OUT data being set-up correctly in the Commander SE itself.

The flexibility of the SE74-INTERBUS module means that each cyclic data OUT channel can be directed to any read-write Commander SE parameter. Similarly, each cyclic data IN channel can use any Commander SE parameter as a source of data.

NOTE The cyclic data mappings cannot be changed dynamically, as changes to the mapping parameters will only take effect during initialisation of the SE74-INTERBUS module, i.e. at power up.

5.2 Mapping Parameters on Commander SE

The mapping for the cyclic data channels on Commander SE can be changed using either the SESoft configuration software, or a Universal Keypad.

The mapping method is similar to the method used in Commander SE for mapping analog inputs and outputs. The value entered in the mapping parameter takes the form MMPP, where MM = menu number of the target parameter and PP = parameter number of the target parameter.

NOTE If a mapping parameter is set to an invalid value, e.g. destination parameter is read only, or parameter does not exist, the Commander SE will reset the mapping parameter (#15.PP) to 0.

If a cyclic data channel is not required, setting the mapping value to 0 will disable it. The data word will still be transmitted over the network to the SE74-INTERBUS module, but no data value will be written to any Commander SE parameter. This helps to improve the update time of all parameters by reducing the number of messages that must be transmitted over the RS485 link to the Commander SE.

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

5.3 SE74-INTERBUS Data Formats

Name	SE74-INTERBUS Data Format		
Param	#15.05	Default	1.03
Access	RW	Range	0.02 to 2.03

The default data format for the SE74-INTERBUS module is 3 Cyclic Words with PCP V2.0 (Mode 1) non-cyclic communications.

Table 5.1 SE74-INTERBUS Data Formats

Format (#15.05)	Non-cyclic data mode	Cyclic Words	INTERBUS ID Code	Process Data Channel Width	CMD Tool Reference
0.02	0	2	0x03 (3)	32 bits	F_002
0.03	0	3	0x03 (3)	48 bits	F_003
1.02	1	2	0xF3 (243)	32 bits	F_102
1.03	1	3	0xF3 (243)	48 bits	F_103
2.02	2	2	0x03 (3)	48 bits	F_202
2.03	2	3	0x03 (3)	64 bits	F_203

NOTE To implement a change in the data format, the SE74-INTERBUS module must be powered down. If a back-up power supply is connected, this must also be removed to allow changes to take effect.

The mapping for the cyclic data channels on Commander SE can be changed using either the SESoft configuration software, or a Universal Keypad. The mapping method is similar to the method used in Commander SE for mapping analogue inputs and outputs. The value entered in the mapping parameter takes the form MMPP, where MM = menu number of the target parameter and PP = parameter number of the target parameter.

NOTE If a mapping parameter is set to an invalid value, e.g. destination parameter is read only, or parameter does not exist, the Commander SE will reset the mapping parameter (#15.PP) to 0.

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

5.3.1 2 Cyclic Words Only

This data format provides two 16-bit cyclic data words only. To select this data format, set #15.05 to 0.02.

Table 5.2 2 Cyclic Words Only

Data Word	Mapping Parameter	Default Mapping Status
IN Word 0	----	Status word
IN Word 1	#15.11	#2.01, post-ramp speed reference
OUT Word 0	----	Control word
OUT Word 1	#15.21	#1.21, digital speed reference 1

5.3.2 3 Cyclic Words Only

This data format provides three 16-bit cyclic data words only. To select this data format, set #15.05 to 0.03.

Table 5.3 3 Cyclic Words Only

Data Word	Mapping Parameter	Default Mapping Status
IN Word 0	----	Status word
IN Word 1	#15.11	#2.01, post-ramp speed reference
IN Word 2	#15.12	#4.20, motor load as % of rated motor load
OUT Word 0	----	Control word
OUT Word 1	#15.21	#1.21, digital speed reference 1
OUT Word 2	#15.22	Not mapped

5.3.3 2 Cyclic Words with PCP V2.0 (Mode 1)

This data format provides two 16-bit cyclic data words, plus PCP V2.0 non-cyclic data communcations. PCP communications can be used to access any parameter in the Commander SE. To select this data format, set #15.05 to 1.02.

Table 5.4 2 Cyclic Words with PCP V2.0

Data Word	Mapping Parameter	Default Mapping Status
IN Word 0	----	Reserved for PCP communications
IN Word 1	----	Status word
IN Word 2	#15.11	#2.01, post-ramp speed reference
OUT Word 0	----	Reserved for PCP communications
OUT Word 1	----	Control word
OUT Word 2	#15.21	#1.21, digital speed reference 1

5.3.4 3 Cyclic Words with PCP V2.0 (Mode 1)

This data format provides three 16-bit cyclic data words, plus PCP V2.0 non-cyclic data communcations. PCP communications can be used to access any parameter in the Commander SE. To select this data format, set #15.05 to 1.03.

Table 5.5 3 Cyclic Words with PCP V2.0

Data Word	Mapping Parameter	Default Mapping Status
IN Word 0	----	Reserved for PCP communications
IN Word 1	----	Status word
IN Word 2	#15.11	#2.01, post-ramp speed reference
IN Word 3	#15.12	#4.20, motor load as % of rated motor load
OUT Word 0	----	Reserved for PCP communications
OUT Word 1	----	Control word
OUT Word 2	#15.21	#1.21, digital speed reference 1
OUT Word 3	#15.22	Not mapped

5.3.5 2 Cyclic Words with CT Single Word (Mode 2)

This data format provides four 16-bit cyclic data words, with CT Single Word non-cyclic data. CT Single Word can be used to access any parameter in the Commander SE. (See section 6.2) To select this data format, set #15.05 to 2.02.

Table 5.6 2 Cyclic Words with CT Single Word

Data Word	Mapping Parameter	Default Mapping Status
IN Word 0	----	Reserved for CT Mode communications
IN Word 1	----	Status word
IN Word 2	#15.11	#2.01, post-ramp speed reference
OUT Word 0	----	Reserved for CT Mode communications
OUT Word 1	----	Control word
OUT Word 2	#15.21	#1.21, digital speed reference 1

5.3.6 3 Cyclic Words with CT Single Word (Mode 2)

This data format provides four 16-bit cyclic data words, with CT Single Word non-cyclic data. CT Single Word can be used to access any parameter in the Commander SE. (See section 6.2) To select this data format, set #15.05 to 2.03.

Table 5.7 3 Cyclic Words with CT Single Word

Data Word	Mapping Parameter	Default Mapping Status
IN Word 0	----	Reserved for CT Mode communications
IN Word 1	----	Status word
IN Word 2	#15.11	#2.01, post-ramp speed reference
IN Word 3	#15.12	#4.20, motor load as % of rated motor load
OUT Word 0	----	Reserved for CT Mode communications
OUT Word 1	----	Control word
OUT Word 2	#15.21	#1.21, digital speed reference 1
OUT Word 3	#15.22	Not mapped

5.4 Storing SE74-INTERBUS Parameters

Menu 15 parameters are stored in the Commander SE and the SE74-INTERBUS module. If the Commander SE has previously stored SE74-INTERBUS settings, these will always be used by the SE74-INTERBUS module. All #15.PP parameters will be read and stored automatically in FLASH memory on the SE74-INTERBUS module.

NOTE If the stored values in the Commander SE are for a different type of fieldbus module, the SE74-INTERBUS module will download its stored values to the Commander SE, and configure itself using those values.

5.4.1 Commander SE

Menu 0 parameters are automatically stored when they are edited using the keypad on the Commander SE. All other parameters can be stored using SESoft by selecting **TOOLS** and **SAVE PARAMETERS IN DRIVE**.

If a Universal Keypad is being used, set #MM.00 to 1000 and press the red **RESET** button to store all Commander SE parameters.

5.4.2 SE74-INTERBUS Module

When the SE74-INTERBUS module establishes the "FbuS" communications link, it checks the value in #15.01.

1. If this is set to 1, it uploads all menu 15 parameters from the Commander SE and stores them in the FLASH memory.
2. If #15.01 is not set to 1 and #15.30 is set to 0, the previous set of values stored in the FLASH memory are downloaded to theCommander SE.
3. If #15.01 is not set to 1, and #15.30 is set to 1, default values are downloaded to the Commander SE, and these values are stored in the FLASH memory.

5.5 Mapping Conflicts

When the mapping parameters for the SE74-INTERBUS cyclic channels are set, care must be taken to ensure that there are no clashes with the mapping of the analogue and digital inputs within the Commander SE. The SE74-INTERBUS module will not indicate if there is a conflict of mapping parameters. This only applies to analogue and digital inputs, and OUT data on the INTERBUS network.

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

Table 5.8 Commander SE Destination Parameters

Function	Mapping Parameter		Function	Mapping Parameter
Analogue Input 1	#7.10		Logic Output 1	#9.10
Analogue Input 2	#7.14		Motorised Pot Output	#9.25
Digital Input 1	#8.21		Comparator 1 Output	#12.07
Digital Input 2	#8.22		Source Select Output	#12.11
Digital Input 3	#8.23		PID Output	#14.16
Digital Input 4	#8.24		Cyclic OUT Word 2	#15.21
Digital Input 5	#8.25		Cyclic OUT Word 3	#15.22
Digital Input 6	#8.26			

The Linking Screen in SESoft displays all mapping parameters within the Commander SE, allowing the user to easily check that there are no mapping conflicts.

5.6 Disabling Data Channels

If any data words are not being used in an application, the mapping parameter should be set to 0. Although the data word will still be transmitted over the INTERBUS network, no corresponding message will be generated to read or write a parameter over the "FbuS" RS485 link to the Commander SE. This reduces the number of "FbuS" messages required to complete a single data cycle, and improves the efficiency of data transfer over the RS485 link, allowing each parameter to be updated more frequently.

6 Control and Status Words

NOTE The SE74-INTERBUS module must have firmware V1.01.00 or later (see Section 9.2) installed for the DIG REF function to be used. The DIG REF bit was not implemented in in V1.00.00 and earlier versions of firmware.

6.1 SE74-INTERBUS Control Word

Name	SE74-INTERBUS Control Word		
Param	#90.12	**Default**	0
Access	WO	**Range**	0 to 255

The SE74-INTERBUS control word allows digital control of the Commander SE to be implemented using a single data word. Each bit in the SE74-INTERBUS control word has a particular function, and provides a method of controlling the output functions of the Commander SE (RUN FWD, JOG, TRIP, etc.) with a single data word.

b15	b14	b13	b12b	b11	b10	b9	b8
Reserved							

b7	b6	b5	b4	b3	b2	b1	b0
TRIP	RESET	DIG REF	FBUS CTRL	RUN REV	JOG	RUN FWD	ENABLE

To enable fieldbus control of the Commander SE, set the FBUS CTRL bit to 1. The 0-1 transition of the FBUS CTRL bit will cause the SE74-INTERBUS module to set #6.43 to 1 in the Commander SE, and enable fieldbus control of the Commander SE. When the FBUS CTRL bit is reset to 0, the SE74-INTERBUS module will reset #6.43 to 0, thus putting the Commander SE back into terminal control mode.

NOTE For safety reasons, the HARDWARE ENABLE signal (terminal 9) must be present (connected to +24V, terminal 7) before the SE74-INTERBUS control word can be used to start the Commander SE. This signal is usually linked to the external Emergency Stop circuit to ensure that the Commander SE is disabled in an emergency situation.

The DIG REF bit allows the source of the speed reference to be changed via the fieldbus. The 0-1 transition of the DIG REF will cause the SE74-INTERBUS module to set #1.14 to 3, selecting digital speed reference as the source of the speed reference. (By default, this will Digital Speed Reference 1, #1.21.) When the DIG REF bit is reset to 0, the SE74-INTERBUS module will set #1.14 to 1, selecting the analogue input as the source of the speed reference. (The actual digital speed reference selected will depend on the setting of the Digital Speed Reference Selector, #1.15)

A full description of each bit in the control word is given in the table below.

Table 6.1 SE74-INTERBUS Control Word

Bit	Function	Description
0	ENABLE	Must be set to 1 to put the Commander SE in READY mode. Resetting to 0 will immediately disable the Commander SE, and the motor will coast to stop. The external HARDWARE ENABLE signal (terminal 9) must also be present before the Commander SE can be enabled and run.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward direction. When reset to 0, the Commander SE will decelerate the motor to a controlled stop before the outputs disabled
2	JOG	Set to 1 with RUN FWD or RUN REV bit also set to one to jog the motor in the appropriate direction. The Commander SE will ramp the motor to the normal speed reference if the bit is reset to 0
3	RUN REV	Set to 1 (with ENABLE set to 1) to run the motor in the reverse direction. When reset to 0, the Commander SE will decelerate the motor to a controlled stop before the outputs disabled
4	FBUS CTRL	A 0-1 transition of this bit will set #6.43 to 1 to enable fieldbus control of the Commander SE. #6.43 can subsequently be over-written by a digital input if a terminal or fieldbus control selector switch is required. A 1-0 transition will reset #6.43 to 0, setting the Commander SE back into terminal control.)
5	DIG REF	A 0-1 transition of this bit will set #1.14 to 3 to select digital speed reference control. #1.14 can subsequently be over-written by a digital input controlling #1.42 if an analogue/digital reference select switch is required. A 1-0 transition will reset #1.14 to 1 to select analogue reference control.
6	RESET	A 0-1 transition will reset the Commander SE from a trip condition. If the cause of the trip has not been cleared, the Commander SE will trip again immediately
7	TRIP	A 0-1 transition will force a “t52” trip on the Commander SE. If the RESET and TRIP bits change from 0 to 1 on the same cycle, the TRIP bit will take priority
8-15	Reserved	

When a trip occurs, the Commander SE will automatically reset the control word (#6.42) to 0. This ensures that, for safety reasons, the Commander SE is in a safe, disabled state and cannot re-start immediately when it is reset.

However, the control word in the SE74-INTERBUS module is not affected by a Commander SE trip. As the SE74-INTERBUS module will only update the Commander SE control word (#6.42) when it sees a change in the SE74-INTERBUS control word, if the Commander SE control word is not updated. Hence. the Commander SE will not automatically restart when full communications is re-established. A change to the SE74-INTERBUS control word is required before the Commander SE will restart.

For this reason, it is necessary (and good safety practice!!) for the master controller program to monitor the status word, and reset the SE74-INTERBUS control word to a safe state if any Commander SE trip, SE74-INTERBUS fault or RS485 "FbuS" link loss error is detected. When both INTERBUS and “FbuS” communications links are healthy again, and it is safe to re-start the Commander SE, the appropriate SE74-INTERBUS control word can be set, a change of SE74-INTERBUS control word is detected, the SE74-INTERBUS module will update the Commander SE control word (#6.42) and the Commander SE will restart.

Some example SE74-INTERBUS control words are shown in the table below..

Table 6.2 Example SE74-INTERBUS Control Words

Control Word (Hex)	Control Word (Dec)	Action
0x0000	0	Control word disabled, Commander SE will run under terminal control
0x0010	16	Disabled
0x0011	17	Enabled, stopped
0x0033	51	Enabled, run fwd, digital speed ref
0x0039	57	Enabled, run rev, digital speed ref
0x0013	19	Enabled, run fwd, analogue speed ref
0x0019	25	Enabled, run rev, analogue speed ref
0x0017	23	Enabled, jog fwd
0x001D	29	Enabled, jog rev
0x0080	128	Trip Commander SE
0x0070	112	Reset Commander SE into fieldbus control
0x0040	64	Reset Commander SE into terminal control

6.2 SE74-INTERBUS Status Word

Name	SE74-INTERBUS Status Word		
Param	#90.12	**Default**	0
Access	RO	**Range**	0x0 to 0xFFFF

The status word returns the status of multiple functions within the Commander SE, e.g. At Speed, Zero Speed, Drive Healthy, etc., and provides a quick method of checking the current operating status of the Commander SE. The status word is mapped to cyclic data as #90.12.

b15	b14	b13	b12b	b11	b10	b9	b8
FBUS LOSS	#10.15	#10.14	#10.13	#10.12	#10.11	#10.10	#10.09

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

Bit 15 will be set to 1 (with all other bits reset to 0) if the "FbuS" communications link between the SE74-INTERBUS module and the Commander SE is lost.

NOTE Bit 15 of the status word effectively indicates that the master controller does not have control of the Commander SE. Under this condition, it is the User's responsibility to ensure that the master controller takes appropriate action to ensure system safety is maintained, in all respects.

Table 6.3 shows the function indicated by each bit in the status word when set to 1. A bit set to 0 indicates that the condition is false

Table 6.3 SE74-INTERBUS Status Word

Bit	Parameter	Description
0	#10.01	Drive Healthy
1	#10.02	Drive Running
2	#10.03	Zero Speed
3	#10.04	Running At Or Below Minimum Speed
4	#10.05	Below Set Speed
5	#10.06	At Speed
6	#10.07	Above Set Speed
7	#10.08	Load Reached
8	#10.09	In Current Limit
9	#10.10	Regenerating
10	#10.11	Dynamic Brake Active
11	#10.12	Dynamic Brake Alarm
12	#10.13	Direction Commanded
13	#10.14	Direction Running
14	#10.15	Mains Loss
15	FBUS LOSS	“FbuS” Communications Link lost

6.3 Selecting Control Source Externally

A selector switch can be used to select whether the RUN FWD, JOG, RUN REV functions are controlled externally by the digital inputs, or remotely INTERBUS master. This allows a machine to be run in a “manual” mode temporarily, e.g. while feeding new material though a machine, and switched to “automatic” mode, running under PLC control once material loading has been completed.

Another switch can also be used to select the source of the speed reference for the Commander SE. This may allow the speed of the machine to be controlled manually while new material fed through at a slow speed, and switched to automatic PLC control once material is flowing freely.

6.3.1 FBUS CTRL

When a 0-1 transition of the FBUS CTRL bit in the INTERBUS control word occurs, the SE74-INTERBUS module will set #6.43 to 1. This will disable terminal control of the Commander SE, and allow the fieldbus to control the ENABLE, RUN FWD, JOG and RUN REV functions of the Commander SE. Similarly, when FBUS CTRL is reset to 0, the SE74-INTERBUS module will set #6.43 to 0 to enable terminal control again.

If a digital input is configured to directly control #6.43 in the Commander SE, the value written to #6.43 by the SE74-INTERBUS module will be immediately overwritten by the digital input. This allows the source of the ENABLE, RUN FWD, JOG and RUN REV functions of the Commander SE to be selected externally.

NOTE Use SESoft or the Universal Keypad to configure a spare digital input to control #6.43.

6.3.2 DIG REF

When a 0-1 transition of the DIG REF bit in the INTERBUS control word occurs, the SE74-INTERBUS module will set #1.14 to 3. This will select the digital speed references as the source of the Commander SE speed reference. When DIG REF is reset to 0, the SE74-INTERBUS module will set #1.14 to 1 to re-select the analogue reference as the source of the speed reference.

If a digital input is configured to directly control #6.43 in the Commander SE, the value written to #6.43 by the SE74-INTERBUS module will be immediately overwritten by the digital input. This allows the source of the ENABLE, RUN FWD, JOG and RUN REV functions of the Commander SE to be selected externally.

NOTE #1.14 cannot be controlled directly by a digital input, but #1.42 can be used to select digital speed reference externally. Use SESoft or the Universal Keypad to configure a spare digital input to control #1.42.

Refer to the Commander SE User Guide for details on how to configure digital inputs.

7 Non-Cyclic Data

The non-cyclic data channel provides a method for the master controller to read from or write to any parameter within the Commander SE. This channel can be used for single infrequent data transfers, or uploading and downloading parameter sets to or from a particular node.

The SE74-INTERBUS module provides two non-cyclic data formats, plus the option to disable non-cyclic data.

1. Non-cyclic data access to Commander SE parameters using PCP communications (Mode 1) is controlled by the master controller program, and uses macros defined using the Interbus CMD Network Configuration Tool. (See section 7)
2. Parameter access using the CT Single Word Format (Mode 2) non-cyclic data is controlled entirely by the master controller program.

Table 7.1 SE74-INTERBUS Non-Cyclic Modes

Non-Cyclic Mode	Data Format (#15.05)	Description
Disabled	0.xx	Non-cyclic data disabled
PCP V2.0	1.xx	Peripheral Communications Protocol (PCP) V2.0, as used in Unidrive. This uses a single non-cyclic data (Word 0) for each node
CT Single Word	2.xx	CT Single Word Format.

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

To configure the PCP channel in the INTERBUS CMD Tool, use the following settings:

Message Length Transmit: 64 bytes

Message Length Receive: 64 bytes

Client services supported are READ, WRITE and GET OD LONG.

7.1 Peripheral Communications Protocol V2.0 (Mode 1)

The Peripheral Communication Protocol (PCP) Version 2.0 has server functionality only on the SE74-INTERBUS module. When an INTERBUS network is initialised, each node supporting PCP is assigned a Communication Reference, or CR. Supported services are listed in Table 7.2.

Table 7.2 PCP Supported Services

Function	Description
INITIATE	Opens a PCP connection with the node at the defined CR
ABORT	Closes the PCP connection to the node at the defined CR
READ	Reads a number of data bytes from an Index and Sub-Index reference in the remote device with the defined CR

Table 7.2 PCP Supported Services

Function	Description
WRITE	Writes a specified number of data bytes to an Index and Sub-Index reference in the remote device with the defined CR
STATUS	Returns the current state and current operating state of the remote device at the defined CR
IDENTIFY	Returns the "ID plates" of the device at the defined CR. The following is returned: Manufacturer's_Name: “Control Techn." Device_Name: "SE RD-74" Revision: "Version 01.00"

Commander SE parameters are not addressed directly using the PCP channel. Three special objects are used to access the Commander SE parameters.

7.1.1 WRITE Object

Index: 0x5000 Sub-Index:0x00

This WRITE object is used to send a data value to a parameter within the Commander SE. Four bytes are written to this object.

1. Menu number
2. Parameter number
3. Data high-byte
4. Data low-byte

To check that the WRITE object command has been successfully implemented, use the STATUS object to check the status byte returned.

7.1.2 READ Object

Index: 0x5001 Sub-Index:0x00

Reading a parameter value from the Commander SE is done is two stages. The data bytes written to the READ object defines the target parameter to be read, but does not return the actual parameter value. Two bytes are written to this object.

1. Menu number
2. Parameter number

The actual value returned from the value must be read using the STATUS object. Once a READ parameter has been defined, the READ object is not required again until the target parameter needs to be changed.

7.1.3 STATUS Object

Index: 0x5002 Sub-Index:0x00

This object returns the menu, parameter and data value of the last object sent, plus a status byte. The Commander SE parameter specified by the READ object is actually read on receipt of the STATUS object. Re-reading the STATUS object will re-read the Commander SE parameter and return the updated parameter value.

1. Menu number
2. Parameter number
3. Data high-byte
4. Data low-byte
5. Status byte

The status byte indicates whether the READ or WRITE message was implemented successfully.

Table 7.3 Status Byte

Status Byte	Indication	Description
0x80	READY	The previous PCP message was implemented successfully in the Commander SE
0xC0	ERROR	An error occurred with the previous PCP message. This can be caused writing a value of range, writing to a read-only parameter of reading from a write-only parameter

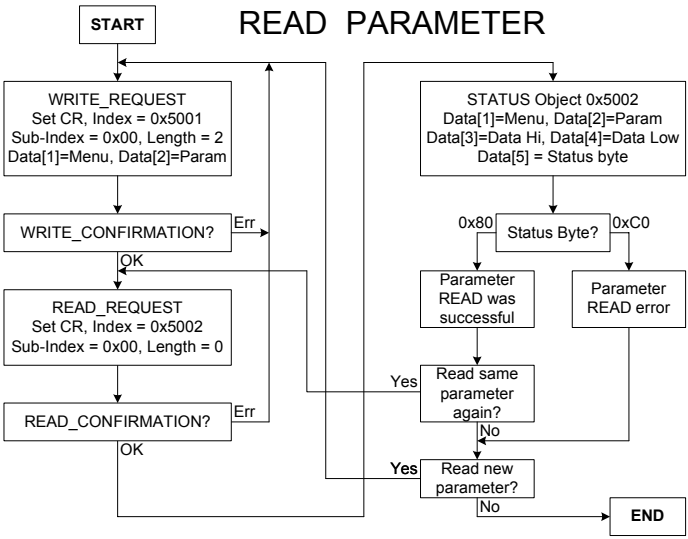
NOTE The decimal point is ignored with data values transferred using INTERBUS. A Commander SE parameter with a value of 1.23 will return the value 123 or 0x7B.

7.1.4 Reading parameters using PCP (Mode 1)

To read a parameter from a Commander SE using the PCP channel, the READ and STATUS objects must be used. The menu and parameter references are written to the READ object, with the data value and status byte returned when the STATUS object is read.

The sequence of events required is shown in the diagram below.

Figure 7-1 PCP Read Sequence



A parameter error can occur with the STATUS object, but this is not due to any INTERBUS network error. A parameter will occur if the target parameter specified in the READ object does not exist or is WRITE only. A parameter error will be indicated as Error Class 0x08, Error 0x00, with the Additional Error Code of 0x01.

Table 7.4 SE74-INTERBUS Read Error Codes

Error Class	Error Code	Additional Code	Parameter Write Status
0x00	0x00	N/A	Parameter read was implemented OK
0x08	0x00	0x01	Parameter access error. Parameter did not exist, or was write only

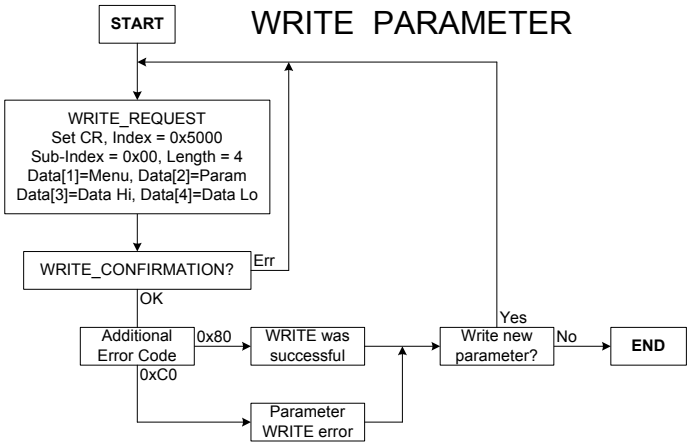
An INITIATE_REQUEST command must be used to establish a PCP connection to each node on the network to which PCP commands will be sent. Once a PCP connection has been established, the INITIATE_REQUEST command is not required again unless a network error causes the PCP connection to be aborted by the master controller.

7.1.5 Writing parameters using PCP (Mode 1)

To write a parameter to the Commander SE using the PCP channel, the WRITE object must be used. The menu and parameter references, plus the data high and data low bytes are written to the WRITE object.

The sequence of events required is shown in the diagram below.

Figure 7-2 PCP Write Sequence



A parameter error can occur with a WRITE object, but this is not due to any error on the Interbus network. A parameter will occur if the target parameter does not exist or is read only, or the data value sent is out of the permitted range for that parameter.

A parameter error will be indicated as Error Class 0x08, Error 0x00, with the Additional Error Code of 0x01.

Table 7.5 SE74-INTERBUS Write Error Codes

Error Class	Error Code	Additional Code	Parameter Write Status
0x00	0x00	N/A	Parameter read was implemented OK
0x08	0x00	0x01	Parameter access error. Parameter did not exist, or was read only

An INITIATE_REQUEST command must be used to establish a PCP connection to each node on the network to which PCP commands will be sent. When a PCP connection has been established, the INITIATE_REQUEST command is not required again unless a network error causes the PCP connection to be aborted by the master controller.

7.2 CT Single Word Mode (Mode 1)

The CT Single Word Format (Mode 1) of non-cyclic data uses one word for non-cyclic data. The non-cyclic sub-protocol requires a specific sequence of 4 words or "telegrams" to implement the parameter access. Each non-cyclic word or telegram is split into 2 bytes to implement the sub-protocol, with the high byte containing the control codes for each telegram, and the low byte containing the data for each telegram.

b15	b14	b13	b12	b11	b10	b9	b8
READ	ERROR	Reserved		Stamp Number			

b7	b6	b5	b4	b3	b2	b1	b0
Data Byte							

Table 7.6 CT Single Word Control

Bit	Function	Values	Description
0 to 7	Data	0 to 255	Depending on the stamp number of the telegram, this byte contains the menu or parameter number, or high data or low data byte
8 to 11	Stamp number	0 to 4	Indicates the stamp number of the word. This shows which part of the message is currently in progress. Setting the stamp number to 0 resets the internal non-cyclic state machine
12, 13	Not Used	0	These should be set to 0
14	ERROR	0 = Data OK 1 = Error	Indicates the success or failure of the message. Failure could occur if the parameter does not exist, or is a read-only or write-only parameter
15	READ	0 = Write 1 = Read	SPecifies a READ message when set to 1, and a WRITE message when set to 0

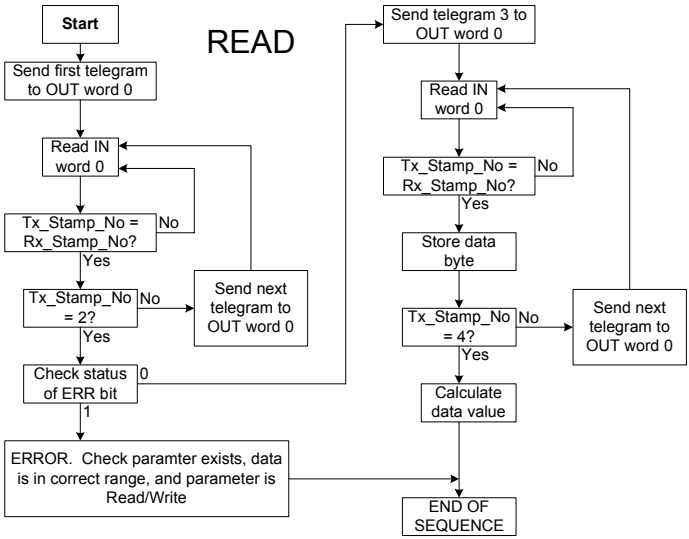
NOTE X = don't care. Generally, these bits should be set to 0. If a message is aborted part way through, the non-cyclic OUT word should be reset to 0. This will reset the non-cyclic state machine, and allow the message sequence to be restarted.

7.2.1 Reading parameters using Mode 1

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

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

Figure 7-3 CT Single Word Read Sequence



The following example telegrams show how to read the post-ramp frequency reference (in Hz) from #2.01 in the Commander SE.

TELEGRAM 1

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1000	0001	0000	0010

Data word = 0x8102

Stamp number = 1

Menu = 2

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

TELEGRAM 2

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1000	0010	0000	0001

Data word = 0x8201

Stamp number = 2

Parameter = 1

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

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1100	0010	XXXX	XXXX

Data word = 0xC2XX

Stamp number = 2

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

TELEGRAM 3

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1000	0010	0000	0000

Data word = 0x8300

Stamp number = 3

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1000	0011	0000	0101

Data word = 0x8305

Stamp number = 3

Data high byte = 5

TELEGRAM 4

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1000	0100	0000	0000

Data word = 0x8400

Stamp number = 4

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	1000	0100	1101	1100

Data word = 0x84DC

Stamp number = 4

Data low byte = 220

Speed feedback= (Data high byte * 256) + Data low byte

= (5 * 256) + 220

= 1500

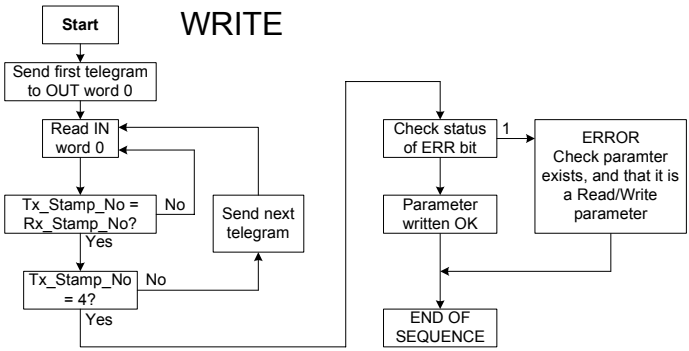
= 150.0 Hz

7.2.2 Writing parameters using Mode 1

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

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

Figure 7-4 CT Single Word Read Sequence



The following example telegrams show how to set the digital speed reference 1 (#1.21) to 40.0Hz (400) in the Commander SE.

TELEGRAM 1

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

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

Data word = 0x0101

Stamp number = 1

Menu = 1

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

TELEGRAM 2

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

Bit	b15-b12	b11-b8	b7-b4	b3-b0
Value	0000	0010	0001	0101

Data word = 0x0215

Stamp number = 2

Parameter = 21

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

TELEGRAM 3

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

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

Data word = 0x0301

Stamp number = 3

Data high byte = 1

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

TELEGRAM 4

The fourth telegram from the INTERBUS master has the stamp number set to 4. The data bits contain the low data byte for the parameter that is being written to.

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

Data word = 0x0490

Stamp number = 4

Data low byte = 144

When the fourth telegram has been received and processed in the slave node, it will write the data (#1.21 = 40.0) as transmitted. (The decimal point is automatically inserted iwhen the data is transferred to the Commander SE.) If the operation is successful, the ERR bit is reset to 0 and the telegram is reflected in the non-cyclic IN word.

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

Data word = 0x0490

Stamp number = 4

Data low byte = 144

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

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

Data word = 0x44XX

Stamp number = 4

7.2.3 Abort Mode 1 Non-cyclic Message

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

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

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

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

Data word = 0x0000

Stamp number = 0

7.3 SE74-INTERBUS Set-up using Non-Cyclic Data

The SE74-INTERBUS module can also be configured via the non-cyclic data channel. Menu 15 in the Commander SE contains the parameter values currently being used, and these can be modified as required using a non-cyclic data WRITE command.

Cyclic data mapping parameters can be edited via the non-cyclic data. Any changes made to the data mapping will take effect immediately, but changes are not stored automatically. Setting #15.31 (not available in Commander SE) to 1 will store the mapping changes in the SE74-INTERBUS module, and reset the SE74-INTERBUS module. This will cause a temporary interruption in communications with the master controller.

The parameters listed below are the parameters that can be written to configure the SE74-INTERBUS module. However, care must be taken when writing to certain parameters. For example, if the master changes the node address parameter (#15.03 or #0.45) controller, and the SE74-INTERBUS module is forced to re-configure, the node will appear on the Interbus network at the new address.

Table 7.7 SE74-INTERBUS Configuraton Parameters

Parameter	Default	Description
#15.03	63	Node Address Also displayed in menu zero #0.45
#15.04	4	Data Rate Also displayed in #0.46
#15.05	0.03	Data Format Indicates the number of non-cyclic and cyclic data words as X.Y, where X = non-cyclic data mode, Y = cyclic data words
#15.07	200	Trip Delay Time (ms) Specifies the time-out period for the Interbus network. If no network messages are received in this time period, the network loss trip is invoked. (See section 9.1)
#15.08	0	Advanced EDS File Select See section 7 for more details
#15.11	2.01	IN Channel 2 Mapping
#15.12	4.20	IN Channel 3 Mapping
#15.21	1.21	OUT Channel 2 Mapping
#15.22	0	OUT Channel 3 Mapping
#15.30	0	Load Option Defaults

The parameters listed in the table below return information about the SE74-INTERBUS module. Writing to these parameters will not affect the operation of the node.

Table 7.8 SE74-INTERBUS Status Parameters

Parameter	Description
#15.01	Option ID Code Interbus = 5
#15.02	Software Version Vxx.yy (See Section 9.2)
#15.06	Fieldbus Diagnostic Indicates the status of the node, also displayed in #0.47
#15.50	Software Version - zz (See Section 9.2)

Other parameters are available (and stored) in the SE74-INTERBUS module, but not in the Commander SE. These can only be accessed using the PCP or CT Single Word non-cyclic data channels.

Table 7.9 SE74-INTERBUS Internal Parameters

Parameter	Default	Description
#15.10	90.12	IN Channel 1 Mapping
#15.20	90.12	OUT Channel 1 Mapping
#15.31	0	Save Option Parameters. (See section 9.2)

7.4 SE74-INTERBUS Parameter Store/Reset

Name	SE74-INTERBUS Parameter Store/Reset		
Param	#15.31	**Default**	0
Access	RW	**Range**	0 to 1

Set #15.31 to 1 to store the current configuration parameters, and reset the SE74-INTERBUS module to make the changes take effect. #15.31 is not available in the Commander SE, and can only be accessed using non-cyclic data.

7.5 Restore SE74-INTERBUS Defaults

Default values can be restored using the INTERBUS non-cyclic data channel. This resets ALL fieldbus parameters back to the default values.

- Set #15.30 to 1.
- Set #15.31 to 1. (See Section 7.4)

The SE74-INTERBUS module will restore default values in all #15.PP parameters, download these values to the Commander SE, and reset. The default values will take effect immediately.

7.6 Restore Previous SE74-INTERBUS Configuration

The SE74-INTERBUS module itself stores the last set of configuration parameters that were used. These values can be restored to the Commander SE using the non-cyclic data channel.

- Set #15.01 to 0.
- Set #15.31 to 1 to store the parameters. (See Section 7.4)
- The SE74-INTERBUS module will store all values and reset.

On re-initialisation, the SE74-INTERBUS module will detect that #15.01 is 0, and write it's stored values to all #15.PP parameters. The stored values will take effect immediately.

8 INTERBUS CMD Tool Support Files

8.1 INTERBUS CMD Tool

The CMD Tool is the software package used to configure and diagnose the Generation 4 INTERBUS master controllers. An external database file is available from Control Techniques that contains full product descriptions and bitmaps for Commander SE, allowing easy inclusion of the Commander SE in INTERBUS networks.

CT_IBS.ZIP is available from your local Control Techniques Drive Centre. The ZIP file contains a text file (README_CT.TXT) with instructions on how to install the Commander SE support files to the appropriate directories, and import them into the CMD Configuration Tool.

NOTE The INTERBUS CMD Tool support files are not essential when configuring an Interbus network. Each node can be entered manually, or the master controller can scan the network to determine which nodes are connected.

8.2 INTERBUS Data Formats

The data formats supported by the SE74-INTERBUS module are listed in Table 8.1.

Table 8.1 INTERBUS Data Formats

Format (#15.05)	Non-cyclic data mode	Cyclic Words	INTERBUS ID Code	Process Data Channel Width	CMD Tool Reference
0.02	0	2	0x03 (3)	32 bits	F_002
0.03	0	3	0x03 (3)	48 bits	F_003
1.02	1	2	0xF3 (243)	32 bits	F_102
1.03	1	3	0xF3 (243)	48 bits	F_103
2.02	2	2	0x03 (3)	48 bits	F_202
2.03	2	3	0x03 (3)	64 bits	F_203

9 Diagnostics

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

9.1 Fieldbus Module Codes

Name	Fieldbus Module ID Code		
Param	#15.01	**Default**	N/A
Access	RO	**Range**	0 to 6

The fieldbus code identifies the type of fieldbus option module last fitted to the Commander SE. 0 indicates that the Commander SE does not have any valid fieldbus module configuration parameters in #15.PP,.

Table 9.1 Fieldbus Module Codes

Fieldbus Code (#15.01)	Fieldbus Module Type
0	No module fitted
1	Profibus-DP
2	INTERBUS
3	Reserved
4	Reserved
5	DeviceNet
6	CANopen

9.2 SE74-INTERBUS Firmware Version

Name	SE74-INTERBUS Major Firmware Version		
Param	#15.02	**Default**	N/A
Access	RO	**Range**	0 to 999

Name	SE74-INTERBUS Minor Firmware Version		
Param	#15.50	**Default**	N/A
Access	RO	**Range**	0 to 99

The SE74-INTERBUS module firmware version can be read from #15.02 and #15.50 in the Commander SE. Thiese parameters shoudl always be checked before contacting Control Techniques for technical support.

Table 9.2 SE74-INTERBUS Firmware Version

Major Code (#15.02)	Minor Code (#15.50)	Firmware Version
1.01	2	V1.01.02

9.3 SE74-INTERBUS Node Address

The master controller automatically assigns the node address during network initialisation. The address assigned to a node depends on the physical connection position within the INTERBUS network ring.

9.4 SE74-INTERBUS Data Rate

Name	Fieldbus Module ID Code		
Param	#15.04	Default	4
Access	RO	Range	4

The data rate for INTERBUS networks is fixed at 500 kbit/s. #15.04 is also displayed in #0.46, allowing the data rate to be viewed on the Commander SE display.

9.5 INTERBUS Network Status

Name	INTERBUS Network Status		
Param	#15.06	Default	N/A
Access	RO	Range	-2 to 999

The network activity can be monitored in #15.06. #15.06 is also displayed in #0.47, allowing the network status to be monitored on the Commander SE display. When the SE74-INTERBUS module is communicating with the INTERBUS network, the approximate number of messages per second is displayed. If cyclic data transfer is stopped by the master, but is not due to any network errors, #0.47 will show 0.

-1 indicates that the SE74-INTERBUS module has initialised correctly, but is waiting for the master to initiate communications.

- Check that the INTERBUS cables and screens have been wired correctly, and the physical connections are good.
- Ensure that the SE74-INTERBUS module is connected to the RJ-45 communications connector on the Commander SE, and that the network status parameter indicates that the network is running.
- Check that the node has been configured correctly in the master.
- Check that the selected data format is correct.

-2 indicates an SE74-INTERBUS module initialisation failure. If this fault persists, replace the SE74-INTERBUS module.

9.6 No Data Transfer

If data is not being transferred from the master controller to the Commander SE, make the following checks:

- The mapping parameters have been programmed correctly. If an incorrect mapping was entered, it will have been reset to 0.
- Check that there are no mapping parameter conflicts, i.e. an analogue input is not trying to control the same parameter as a cyclic OUT channel. The "Linking Screen" in SESoft shows all input and output mapping parameters on a single screen for this purpose.
- Check that the Network Status (#0.47) is >0. (See Section 4.7)

9.7 SE74-INTERBUS Trip Codes

If certain errors occur, the Commander SE will trip and show the trip code in the upper window.

Table 9.3 SE74-INTERBUS Trip Codes

Trip Code	Error
t52	This code indicates that the trip was caused by bit 7 in the control word being set to 1. The trip is initiated by a 0-1 transition of bit 7 in the control word. (See Section 6.1)
t60	Interbus Network Loss. The node has not received a cyclic data message for a time period specified in #15.07. This trip can be caused by a network fault, e.g. broken wire, disconnected node, missing termination resistors, etc. "t60" may also occur if the master controller stops the network while it is being re-programmed or reset. (See Section 10.1)
SCL	RS485 "FbuS" link failure. Communications between the SE74-INTERBUS card card and the Commander SE (RJ45) port have been interrupted. (See Section 4.8.2)

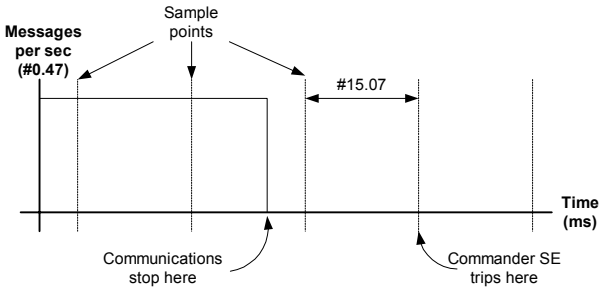
10 Advanced Features

10.1 INTERBUS Network Loss Trip

Name	SE74-INTERBUS Node Address		
Param	#15.07	**Default**	200
Access	RW	**Range**	0 to 2000

The SE74-INTERBUS module counts the number of valid network cycles received in a time period specified by #15.07. The Network Loss trip (t62) is triggered if no messages are received in a given sample period, and messages were received in the previous sample period. The default setting for #15.07 is 200ms.

Figure 10-1 Network Loss Trip



As can be seen from the diagram, the actual time from the network loss to the Network Loss trip actually occurring will range from #15.07 ms to 2 * #15.07 ms. By decreasing #15.07, the maximum trip time will be reduced, but if the trip time is set too low, spurious network loss trips will be seen.

The actual network loss trip time that should be set depends entirely on the number of messages per second being received under normal operation. As a rough guide, the Network Loss Trip time (#15.07) should be set such that a minimum of 5 messages will be received in any given sample period under normal operating conditions.

The Network Loss trip can be disabled by setting #15.07 to 0, but the Commander SE may continue to operate using the last received values in the case of a network loss. It is the User's responsibility to ensure that adequate safety precautions are taken to prevent damage or injury by disabling the Commander SE in the event of any loss of the INTERBUS network.

10.2

11 Quick Reference

11.1 Complete Parameter Reference

Table 11.1 SE74-INTERBUS Configuration Parameters

Parameter	Default Value	Cross Reference	Description
#15.01	----	Section 9.1	Option ID Code.
#15.02	----	Section 9.2	Major Software Version
#15.03	----	----	Reserved
#15.04	4	Section 4.5	Data Rate
#15.05	1.03	Section 5.3	SE74-INTERBUS Data Format
#15.06	----	Section 9.5	INTERBUS Network Status, also displayed in #0.47
#15.07	200	Section 10.1	Trip Delay Time in ms
#15.08	0	----	Reserved
#15.11	2.01	Section 5.2	IN Channel 2 Mapping
#15.12	4.20		IN Channel 3 Mapping
#15.21	1.21		OUT Channel 2 Mapping
#15.22	0.00		OUT Channel 3 Mapping
#15.30	0	Section 4.9	Load Option Defaults
#15.50	----	Section 9.2	Minor Software Version

11.2 SE74-INTERBUS Data Formats

Table 11.2 SE74-INTERBUS Data Formats

Format (#15.05)	Non-cyclic data mode	Cyclic Words	INTERBUS ID Code	Process Data Channel Width	CMD Tool Reference
0.02	0	2	0x03 (3)	32 bits	F_002
0.03	0	3	0x03 (3)	48 bits	F_003
1.02	1	2	0xF3 (243)	32 bits	F_102
1.03	1	3	0xF3 (243)	48 bits	F_103
2.02	2	2	0x03 (3)	48 bits	F_202
2.03	2	3	0x03 (3)	64 bits	F_203

11.3 SE74-INTERBUS Control Word

Table 11.3 SE74-INTERBUS Control Word

Bit	Function	Description
0	ENABLE	Must be set to 1 to put the Commander SE in READY mode. Resetting to 0 will immediately disable the Commander SE, and the motor will coast to stop. The external HARDWARE ENABLE signal (terminal 9) must also be present before the Commander SE can be enabled and run.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward direction. When reset to 0, the Commander SE will decelerate the motor to a controlled stop before the outputs disabled
2	JOG	Set to 1 with RUN FWD or RUN REV bit also set to one to jog the motor in the appropriate direction. The Commander SE will ramp the motor to the normal speed reference if the bit is reset to 0
3	RUN REV	Set to 1 (with ENABLE set to 1) to run the motor in the reverse direction. When reset to 0, the Commander SE will decelerate the motor to a controlled stop before the outputs disabled
4	FBUS CTRL	A 0-1 transition of this bit will set #6.43 to 1 to enable fieldbus control of the Commander SE. #6.43 can subsequently be over-written by a digital input if a terminal or fieldbus control selector switch is required. A 1-0 transition will reset #6.43 to 0, setting the Commander SE back into terminal control.)
5	DIG REF	A 0-1 transition of this bit will set #1.14 to 3 to select digital speed reference control. #1.14 can subsequently be over-written by a digital input controlling #1.42 if an analogue/digital reference select switch is required. A 1-0 transition will reset #1.14 to 1 to select analogue reference control.
6	RESET	A 0-1 transition will reset the Commander SE from a trip condition. If the cause of the trip has not been cleared, the Commander SE will trip again immediately
7	TRIP	A 0-1 transition will force a “t52” trip on the Commander SE. If the RESET and TRIP bits change from 0 to 1 on the same cycle, the TRIP bit will take priority
8-15	Reserved	

NOTE The DIG REF bit is not implemented in SE74-INTERBUS modules with V1.00.00 or earlier firmware.

11.4 SE74-INTERBUS Status Word

Table 11.4 SE74-INTERBUS Status Word

Bit	Parameter	Description
0	#10.01	Drive Healthy
1	#10.02	Drive Running
2	#10.03	Zero Speed
3	#10.04	Running At Or Below Minimum Speed
4	#10.05	Below Set Speed
5	#10.06	At Speed
6	#10.07	Above Set Speed
7	#10.08	Load Reached
8	#10.09	In Current Limit

Table 11.4 SE74-INTERBUS Status Word

Bit	Parameter	Description
9	#10.10	Regenerating
10	#10.11	Dynamic Brake Active
11	#10.12	Dynamic Brake Alarm
12	#10.13	Direction Commanded
13	#10.14	Direction Running
14	#10.15	Mains Loss
15	FBUS LOSS	“FbuS” Communications Link lost

11.5 SE74-INTERBUS Trip Codes

Table 11.5 SE74-INTERBUS Trip Codes

Trip Code	Error
t52	This code indicates that the trip was caused by bit 7 in the control word being set to 1. The trip is initiated by a 0-1 transition of bit 7 in the control word. (See section 5.6)
t60	INTERBUS Network Loss The node has not received a cyclic data message for a time period specified in #15.07. This trip can be caused by a network fault, e.g. broken wire, disconnected node, missing termination resistors, etc. "t60" may also occur if the master controller stops the network while it is being re-programmed or reset. (See section 9.1)
SCL	RS485 "FbuS" link failure. Communications between the SE74-INTERBUS module and the Commander SE (RJ45) port have been interrupted. (See section 4.8.2)