User Guide

SE77-CANopen

Commander SE

Part Number: 0452-0051
Issue Number: 2

www.controltechniques.com

Safety Information

The option card 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 this Installation Guide carefully.

Careful consideration must be given to the functions of the drive and option card 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 a communications link.

In any application where a malfunction of the drive or option card could lead to damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk. To ensure mechanical safety, additional safety devices such as electro-mechanical interlocks may be required. The Drive must not be used in a safety-critical application without additional 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 Drive with the motor.

The contents of this User 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 the User Guide, without notice.

Drive software version

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

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

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Firmware:	V1.00.00

Contents

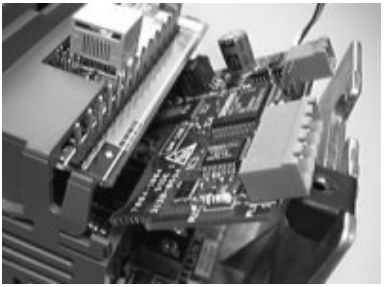
1 Mechanical Installation

Care should be taken when handling the SE77-CANopen module as it may be damaged by electrostatic discharge. To prevent inadvertent damage, touch an earthed bare metal surface to discharge yourself before removing the interface card from the anti-static bag.

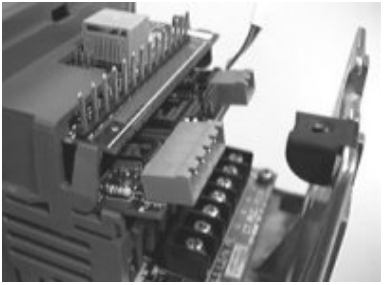
NOTE The Commander SE must be disconnected from the mains supply before installing or removing an option module.

1.1 Commander SE Size 1

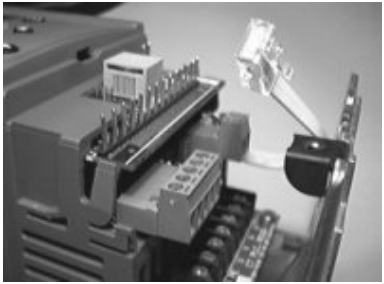
1. Remove the two terminal blocks from the option card. Slide the SE77-CANopen card diagonally into the Commander SE.



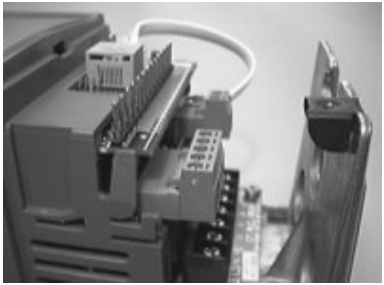
2. Ensure that the SE77-CANopen card is aligned between the runners moulded into the plastic casing, and slide into the Commander SE.



3. Push the SE77-CANopen module firmly into the Commander SE until the plastic spring clips latch it securely in place.



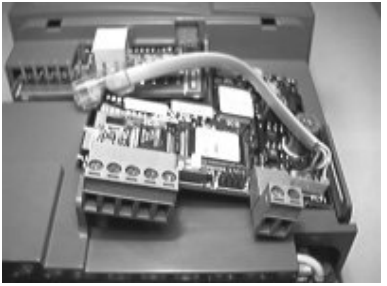
4. Plug the flylead into the RJ45 socket on the Commander SE.



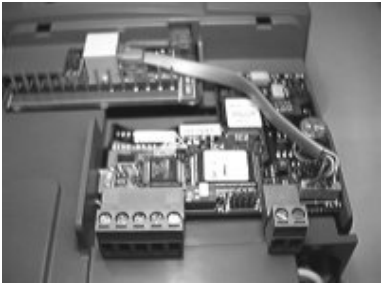
1.2 Commander SE Sizes 2, 3, 4 and 5

The following instructions apply to Commander SE drives in the size 2, 3, 4 and 5 frames. (1.1kW and above.)

1. Locate the right hand side of the SE77-CANopen card under the flange.



2. Push the left hand side of the SE77-CANopen board down to clip into place. Connect the fly-lead to the RJ-45 connector on the Commander SE.

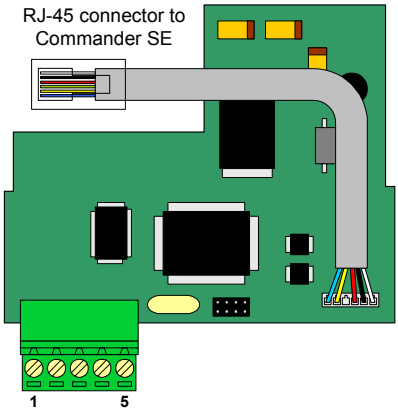


2 Electrical Installation

2.1 SE77-CANopen Module

The SE77-CANopen module has a 5-way screw terminal block connector for the CANopen data and back-up power supply connections.

Figure 2-1 SE77-CANopen Module



The terminal connections are shown in Table 2.1.

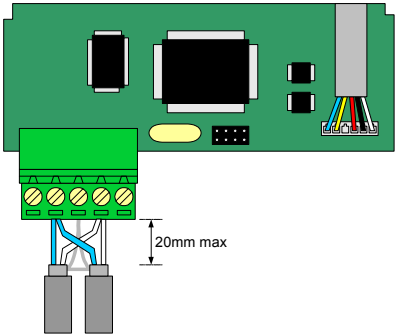
Table 2.1 SE77-CANopen Module Connections

Terminal	Function	Description
1	0V BACKUP	0V backup power supply (optional)
2	CAN-L	Negative CAN data line
3	Screen	Cable screen
4	CAN-H	Positive CAN data line
5	+24V BACKUP	+24V backup power supply (optional)

2.2 SE77-CANopen Data Connections

To connect the SE73-PROFIBUS-DP module to the PROFIBUS-DP network, make the connections as shown in the diagram below. The length of the "pigtail" screen connection should not be longer than 20mm.

Figure 2-2 SE77-CANopen Connections



2.3 CANopen Cable

CANopen cable requires a single twisted pair with overall screening for the data wires. A second twisted pair may be used for a network power supply if required. The data wires are usually white and blue in cable designed for use in CAN networks.

Table 2.2 CANopen Cable Colour Codes

Cable	Data Signal	Terminal	Description
Blue	CAN-L	2	Negative data line
Braided Shield	Screen	3	Cable screen
White	CAN-H	4	Positive data line

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. Further details are available on the CAN In Automation (CiA) web site as www.can-cia.de.

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

2.4 CANopen Cable Screen Connections

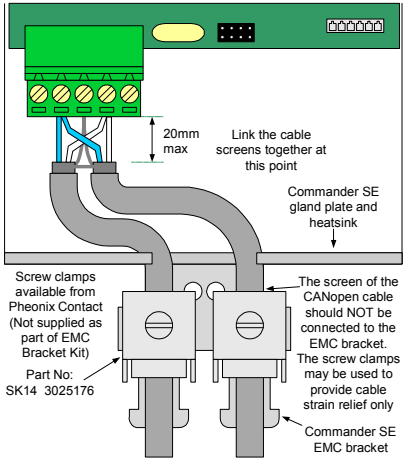
An EMC Bracket Kit is available for each size of Commander SE. This plate can be attached to the Commander SE gland plate, and provides a suitable point to clamp the motor cable screen to earth.

Table 2.3 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			

The SE77-CANopen module should be wired with the cable shields isolated from earth at each Commander SE. The cable shields should be linked together at the point where they emerge from the cable, and formed into a short pigtail to be connected to pin 3 on the SE77-CANopen connector.

Figure 2-3 SE77-CANopen Screen Connections

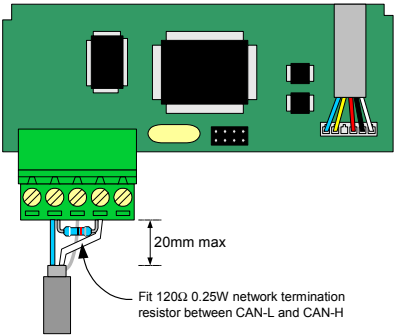


NOTE The CANopen cable shield should be grounded at one place ONLY in the network. This is to prevent it from becoming live in the unlikely event of a fault in one of the interfaces.

2.5 CANopen Network Termination

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

Figure 2-4 CANopen Network Termination



NOTE Failure to terminate a network correctly can seriously affect the operation of the network. If termination is not fitted, the noise immunity of the network is greatly reduced, while if too many nodes have their internal termination resistor networks enabled, the network will be over-loaded and may not operate at all.

2.6 Back-up Power Supply

The SE77-CANopen module will usually draw power via the RJ-45 communications lead from the unregulated +28V rail of the Commander SE. If the SE77-CANopen module is disconnected to check and update the configuration of the Commander SE using SESoft, it will power down, causing the master controller to indicate a network error.

By connecting a +24V back-up power supply to the SE77-CANopen module, the node will continue to communicate with the master controller, and no network errors will be detected. The SE77-CANopen module will indicate (using the status word) to the master controller that it is not current communicating with the Commander SE. When the SE77-CANopen module is re-connected to the Commander SE, communications will be re-established automatically.

The back-up power supply should be +24V ±20%, and should have sufficient current capability to supply all SE77-CANopen modules connected to it. This condition will occur if the main power supply to the Commander SE is lost. The consumption of the SE77-CANopen module is dependent on the supply voltage, with typical and maximum currents listed in the table below.

Table 2.4 SE77-CANopen Power Consumption

Back-up Supply Voltage	Nominal Current (Commander SE is off)	Typical Current (Commander SE is on)
19.2V (24V -20%)		
21.6V (24V -10%)		
24V nominal		
26.4V (24V +10%)		
28.8V (24V+20%)		

Under normal operating conditions, the Commander SE and the back-up power supply share the power supply requirements of the SE77-CANopen module. An in-rush current of 2.0 * nominal current should be allowed for at power-up, although this factor will typically be nearer 1.7.

2.7 Maximum Network Length

The maximum number of nodes that can be connected to a single CANopen network segment is 32 nodes. Repeaters may be used to increase the number of nodes on a network to a maximum of 127.

The maximum network length depends on the data rate required. The maximum number of nodes on a network without a repeater is 32.

Table 2.5

Data Rate (bits/sec)	Maximum Bus Length (m)
10K	5000
20K	2500
50K	1000
125K	500
250K	250
500K	100
800K	50
1.0M	30

3 Getting Started

NOTE The Commander SE must be fitted with firmware V1.08.00 or later. SESoft V1.04.00 or later provides support for all Commander SE fieldbus modules.

3.1 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 “CANopen”.
- Specify the Node Address for the Commander SE.
- Specify the Data Rate to be used.

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 CANopen interface into the Commander SE.
- Power up the Commander SE.

The Commander SE CANopen interface is now ready to communicate with the CANopen master controller.

3.2 Basic Communications Quick Start

The SE77-CANopen module can also be configured to establish basic CANopen communications from the Commander SE keypad and display.

- Connect the SE77-CANopen module to the Commander SE.
- Power up the Commander SE, and ensure that #0.10 is set to "L2".
- Set the communications mode (#0.41) to "FbuS".
- Set the node address (#0.45) as required and press the M key.
- Set the data rate (#0.46) as required and press the M key.
- Power down the Commander SE.

When the SE77-CANopen module next powers up, it will read the configuration parameters from the Commander SE, and configure itself accordingly.

Table 3.1 Basic Quick Start Parameters

Function	Parameter	Recommended Setting
Communications Mode	#0.41	“Fbus”
Node Address	#0.45	1 to 127
Data Rate	#0.46	0 to 7
Network Status	#0.47 (RO)	Indicates the current status of the SE77-CANopen module

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

3.3 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 CANopen interface card 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.

3.4 SE77-CANopen Node Address

Name	SE77-CANopen Node Address		
Param	#0.45	Default	0
Access	RW	Range	0 to 127

Every node on a CANopen network must be given a unique network address. If 2 or more nodes are assigned the same address, they may cause CAN framing errors, and prevent the network from operating correctly. The valid range of addresses is from 1 to 127, with a default address of 0.

If an invalid node address is set in #0.45, the CANopen interface will reject the configured address, reset to 127, and update #0.45 with the address that is actually being used.

NOTE Changes to #0.45 will be stored automatically when the MODE button is pressed after the value has been set.

3.5 SE77-CANopen Data Rate

Name	Commander SE Communications Mode		
Param	#0.46	Default	0
Access	RW	Range	0 to 7

Every node on a CANopen network must be configured to run at the same data rate. If a node is configured with the wrong data rate, it may cause errors on the CAN network, and eventually trip on “t60”, Bus Off Error. This parameter should be set to the same value on all nodes on the network. The SE77-CANopen module has a default data rate setting of 1.0 Mbits/sec.

Table 3.2

#0.46	bits/sec		#0.46	bits/sec
0	1.0M		4	125K
1	800K		5	50K
2	500K		6	20k
3	250k		7	10k

3.6 SE77-CANopen Data Format

The default data format is 3 Cyclic Words, which is the same data format as used on Unidrive CANopen interface. Each cyclic data word is mapped to a Commander SE parameter with default mappings as shown in the table below.

Table 3.3

Cyclic Word	Default Mapping Status
OUT Word 0	Control word
OUT Word 1	Digital speed reference 1
OUT Word 2	Not mapped
IN Word 0	Status word
IN Word 1	Post-ramp speed reference
IN Word 2	Motor load current as % of rated load current

3.7 CANopen Network Status

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

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

Table 3.4

#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 CANopen interface has initialised correctly, and is waiting for the master controller to initialise communications
-2	Internal failure	Indicates that part of CANopen interface initialisation test was not successful. Replace the module if this error persists.

3.8 Network Loss Trip

3.8.1 Loss of CANopen Network

If the CANopen network stops operating, the SE77-CANopen module will trip the Commander SE on “t62”. 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 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.

3.8.2 Loss of RS485 "FbuS" Link

The Commander SE has a serial communications watchdog that must be updated at least once every second. The SE77-CANopen module ensures that this 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 SE77-CANopen module remains powered up, it will continue to communicate with the 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.

3.9 Restore SE77-CANopen Defaults

Name	Restore SE77-CANopen Defaults		
Param	#15.30	**Default**	0
Access	RW	**Range**	0 or 1

Default SE77-CANopen values can be restored to the Commander SE using SESoft or the Universal Keypad. This resets ALL SE77-CANopen configuration parameters (except node address) back to the factory default values..

Table 3.5

#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 interface.)

3.9.1 SESoft

- Power down the Commander SE and disconnect the SE77-CANopen 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 SE77-CANopen module.
- Re-apply power to the Commander SE.
- The SE77-CANopen module will overwrite all #15.PP parameters with their default values. The default values will take effect immediately.

3.9.2 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 SE77-CANopen module.
- The SE77-CANopen module will overwrite all #15.PP parameters with their default values. The default values will take effect immediately.

3.10 Restore Previous SE77-CANopen Configuration

The SE77-CANopen module stores the last set of configuration parameters that were used in its own FLASH memory. These values can be restored to the Commander SE using SESoft or the Universal Keypad.

3.10.1 Commander 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 SE77-CANopen module.
- Re-apply power to the Commander SE.
- The SE77-CANopen 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.

3.10.2 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 SE77-CANopen module.
- Re-apply power to the Commander SE.
- The SE77-CANopen 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 with firmware V1.01.05 or earlier fitted, do not provide access to #15.01. It is recommended that the Universal Keypad should have firmware V1.04.00 or later fitted.

4 Control and Status Words

4.1 SE77-CANopen Control Word

Name	SE77-CANopen Control Word		
Param	#90.12	Default	0
Access	WO	Range	0 to 255

The SE77-CANopen control word allows digital control of the Commander SE to be implemented using a single data word. Each bit in the SE77-CANopen 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 SE77-CANopen 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 SE77-CANopen 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 SE77-CANopen 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 SE77-CANopen 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 SE77-CANopen 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 4.1 Control Word Bit Descriptions

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

Table 4.1 Control Word Bit Descriptions

Bit	Function	Description
3	RUN REV	Set to 1 (with ENABLE set to 1) to run the motor in the reverse direction. When reset to 0, the 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 SE77-CANopen module is not affected by a Commander SE trip. As the SE77-CANopen module will only update the Commander SE control word (#6.42) when it sees a change in the SE77-CANopen 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 SE77-CANopen 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 SE77-CANopen control word to a safe state if any Commander SE trip, SE77-CANopen fault or RS485 "FbuS" link loss error is detected. When both CANopen and "FbuS" communications links are healthy again, and it is safe to re-start the Commander SE, the appropriate SE77-CANopen control word can be set, a change of SE77-CANopen control word is detected, the SE77-CANopen module will update the Commander SE control word (#6.42) and the Commander SE will restart.

Some example SE77-CANopen control words are shown in the table below..

Table 4.2 Example 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

Table 4.2 Example Control Words

Control Word (Hex)	Control Word (Dec)	Action
0x0080	128	Trip Commander SE
0x0070	112	Reset Commander SE into fieldbus control
0x0040	64	Reset Commander SE into terminal control

4.2 SE77-CANopen Status Word

Name	SE77-CANopen 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 SE77-CANopen 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 4.3 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 4.3 Status Word Bit Descriptions

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

Table 4.3 Status Word Bit Descriptions

Bit	Parameter	Description
13	#10.14	Direction Running
14	#10.15	Mains Loss
15	FBUS LOSS	"FbuS" Communications Link lost

4.3 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 CANopen 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.

4.3.1 FBUS CTRL

When a 0-1 transition of the FBUS CTRL bit in the CANopen control word occurs, the SE77-CANopen 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 SE77-CANopen 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 SE77-CANopen 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.

4.3.2 DIG REF

When a 0-1 transition of the DIG REF bit in the CANopen control word occurs, the SE77-CANopen 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 SE77-CANopen 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 SE77-CANopen 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.

5 Diagnostics

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

5.1 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 5.1 Commander SE Fieldbus Option 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

5.2 SE77-CANopen Firmware Version

Name	SE77-CANopen Major Firmware Version		
Param	#15.02	Default	N/A
Access	RO	Range	0 to 999

Name	SE77-CANopen Minor Firmware Version		
Param	#15.50	Default	N/A
Access	RO	Range	0 to 99

The SE77-CANopen 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 5.2 SE77-CANopen Firmware Version

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

5.3 SE77-CANopen Node Address

Name	SE77-CANopen Node Address		
Param	#15.03	Default	N/A
Access	RW	Range	0 to 125

Every CANopen node must be assigned a unique node address. If two or more nodes have the same address, this will cause a conflict when the master attempts to initialise the network.

Ideally, the node address should be configured on each node BEFORE any attempt is made to connect it to the network. #15.03 can also be accessed as #0.45, allowing the node address to be modified using the keypad on the Commander SE itself.

5.4 SE77-CANopen Data Rate

Name	SE77-CANopen Data Rate		
Param	#15.04	Default	N/A
Access	RO	Range	0 to 9

The SE77-CANopen module automatically detects the network data rate, and displays the data rate in #15.04. The data rates supported by the SE77-CANopen module are listed in the table below. #15.04 can also be accessed as #0.46, allowing the data rate to be viewed on the Commander SE itself..

Table 5.3 SE77-CANopen Data Rates

Data Rate	bits/sec		Data Rate	bits/sec
0	1.0M		4	125K
1	800K		5	50K
2	500K		6	20K
3	250K		7	10K

5.5 CANopen Network Status

Name	SE77-CANopen Network Status		
Param	#15.06	Default	N/A
Access	RO	Range	-2 to 9999

The network activity can be monitored in #0.47 on the Commander SE. When the interface is communicating with the CANopen network, the approximate number of messages per second is displayed. If polled data transfer is stopped by the master, but is not due to any network errors, #0.47 will show 0.

-1 indicates that the SE77-CANopen module has initialised correctly, but is waiting for the master to initiate communications.

- Check that the CANopen cables and screens have been wired correctly, and the physical connections are good.
- Ensure that the SE77-CANopen 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.
- Ensure that the network has been terminated.
- Check that the node address has been set correctly and only one node on the network has that particular address.
- Check that the node has been configured correctly in the master.

-2 indicates an initialisation failure. If fault persists, replace the SE77-CANopen module.

5.6 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 polled 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 3.7)

5.7 Commander SE Trip Codes

If the SE77-CANopen module detects an error, it will trip the Commander SE. The trip codes are listed in Table 5.4.

Table 5.4 SE77-CANopen 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 4.1)
t60	CANopen network failure. This trip can be caused by a network fault, e.g. broken wire, disconnected node, missing termination resistors, etc. "t60" will also occur if the master controller stops the network while it is being re-programmed or reset. (See section 3.8.1)
t62	CANopen Network Loss. This trip can be caused by a network fault, e.g. broken wire, disconnected node, missing termination resistors, etc. See Advanced User Guide for further details.
t63	CANopen Node Guarding Trip. See Advanced User Guide for further details about Node Guarding.
SCL	RS485 "FbuS" link failure. Communications between the CANopen interface card and the Commander SE (RJ45) port have been interrupted. (See section 3.8.2)