



User Guide

CANopen

Option Module for
Unidrive

Part Number: 0460-0061
Issue Number: 1



SAFETY INFORMATION

Persons supervising and performing the electrical installation or maintenance of a Drive and/or an external Option Unit must be suitably qualified and competent in these duties. They should be given the opportunity to study and if necessary to discuss this User Guide before work is started.

The voltages present in the Drive and external Option Units are capable of inflicting a severe electric shock and may be lethal. The Stop function of the Drive does not remove dangerous voltages from the terminals of the Drive and external Option Unit. Mains supplies should be removed before any servicing work is performed.

The installation instructions should be adhered to. Any questions or doubt should be referred to the supplier of the equipment. It is the responsibility of the owner or user to ensure that the installation of the Drive and external Option Unit, and the way in which they are operated and maintained complies with the requirements of the Health and Safety at Work Act in the United Kingdom and applicable legislation and regulations and codes of practice in the UK or elsewhere.

The Drive software may incorporate an optional Auto-start facility. In order to prevent the risk of injury to personnel working on or near the motor or its driven equipment and to prevent potential damage to equipment, users and operators, all necessary precautions must be taken if operating the Drive in this mode.

The Stop and Start inputs of the Drive should not be relied upon to ensure safety of personnel. If a safety hazard could exist from unexpected starting of the Drive, an interlock should be installed to prevent the motor being inadvertently started.

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.

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1 Introduction

NOTE

Drive 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 Unidrive and Mentor II manuals for parameter definitions.

1.1 Unidrive CANopen Interface

The Unidrive CANopen interface for Unidrive is supplied in a large option module package. The CANopen interface uses the UD70 Applications card as a host.

The UD70 retains full functionality, allowing the user to download normal DPL application programs. No program modifications are required to allow existing DPL programs to run. A different UD70 operating system file (“.DNET.SYS”) is used, and the UD70 has this system file pre-loaded.

NOTE

System file must be V2.08.00 or later to support the CANopen interface.

1.2 Product Conformance Certification

The Unidrive CANopen interface has been fully tested by CiA (CAN In Automation) and has been certified as 100% conformant to the CANopen Specification.

Certificate Number is CIA199912-301V30/11-010

1.3 Overview Specification

- Following data rates (in bits/sec) are all supported, specified by Drive parameter: 1M, 800K, 500K, 250K, 125K, 50K, 20K, 10K
- 2 Receive and 2 Transmit (RX) Parameter Data Objects.
- RxPDO1 and TxPDO1 provide three 16-bit words, all mapped using #20.PP parameters.
- RxPDO2 and TxPDO2 provide two 32-bit words, mapping is fixed to _R and _S registers.
- Node/Life guarding and SYNC guarding both supported.
- Auto-start facility allows one node to act as a "virtual master", and initialise the network. Allows a CANopen network consisting only of UniDrives to be implemented.

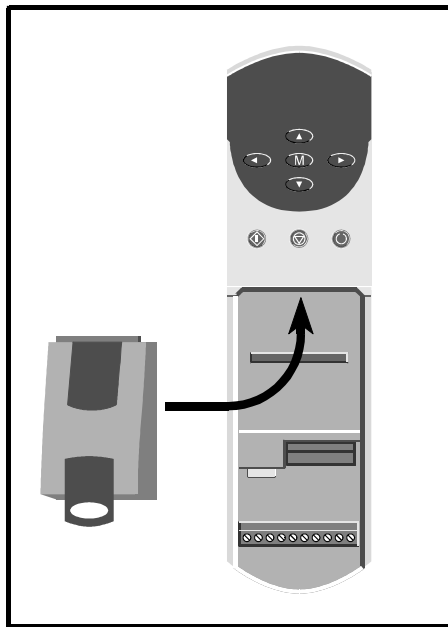
2 Mechanical Installation

NOTE

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

2.1 Unidrive

- Isolate the Drive from the main supply and allow 5 minutes for the DC Bus capacitors to discharge.
- Insert the Unidrive CANopen interface module as shown below. Ensure that it is correctly inserted. The module will click firmly into place.
- To remove the module, pull on the black tab, and the module will disengage from the connector and pull out of the Drive.

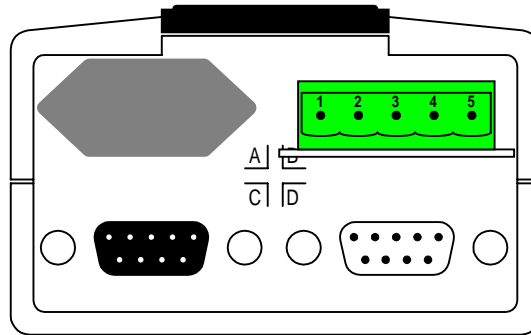


3 Electrical Installation

3.1 CANopen Connector

The Unidrive CANopen Interface provides a standard 9-way D-type male connector (B) for the CANopen network. A small converter board is also provided that converts the D-type connector to screw terminals.

Connectors C and D on the Unidrive CANopen interface are the RS232 programming port (C) and RS485 general purpose communications port (D) of the UD70.



The pin connections for the D-type connector and the 5-way terminal block connector are given in the table below.

Signal	Terminal Block	D-type Terminal	Function
0v	1	3	Power supply 0V (Black)
CAN-L	2	2	Data signal low (Blue)
SHIELD	3	5	Shield
CAN-H	4	7	Data signal high (White)
V _{DC}	5	9	Power Supply +24V (Red)

The external power supply is optional, and is only used to supply the CAN transceivers and line drivers. The Unidrive CANopen interface hardware does not require this supply to operate to the full CAN network specification.

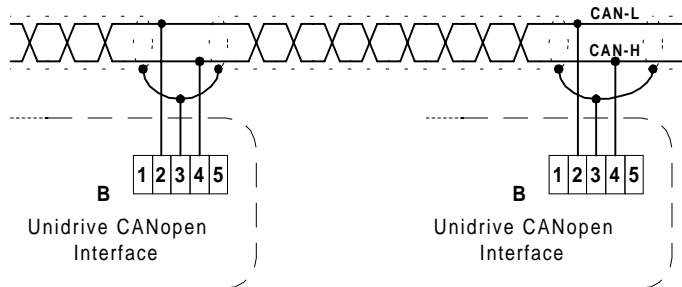
If an external power supply is used, it must be +24V \pm 20%. A Unidrive CANopen interface will draw a maximum of 5mA.

NOTE

All diagrams in this manual illustrate connections using the 5-way screw terminal connector block.

3.2 CANopen Connections

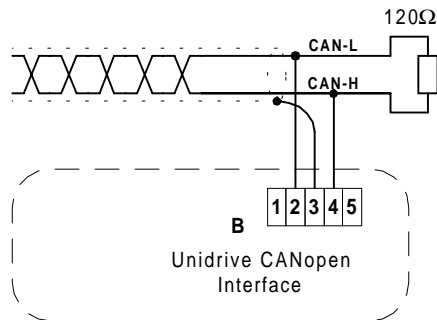
To connect a node to the CANopen network, make the connections as shown in the diagram below. The cable screen must be connected to the middle pin of the CANopen connector.



3.3 CANopen Network Termination

There is no termination resistor supplied on the Unidrive CANopen Interface. It is the user's responsibility to ensure that both ends of each section of network cable are correctly terminated.

A 120Ω 0.25W resistor should be connected between the CAN-H and CAN-L lines at each end of the main trunk cable, as shown in the diagram below.



NOTE

The above method of connecting the termination resistor ensures that the network remains terminated when the CANopen connector is disconnected from the node.

It is very important in high-speed communications networks that the network communications cable is correctly terminated. Failure to terminate the network properly may mean that the network operates with substantially reduced noise immunity, or in the worst case, the network doesn't work at all.

3.4 CANopen Cable

CANopen networks (like most fieldbus systems) run at high data rates, and consequently require cable specifically designed to carry high frequency signals. Low quality cable may attenuate the signals, and thus render the signal unreadable for the other nodes on the network.

Details of approved cables types and their manufacturers can be found on the CiA web site at "www.can-cia.de".

NOTE

Control Techniques can only guarantee correct and reliable operation of the Unidrive CANopen interface if all installed network components (including the network cable) have full Product Conformance Certification from the CiA.

3.5 Maximum Network Length

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

Data Rate (bits/sec)	Maximum Bus Length
10k	5000
20k	2500
50k	1000
125k	500
250k	250
500k	100
800k	50
1M	30

4 Getting Started

4.1 Quick Start

The Unidrive CANopen interface can be configured using parameters in the Unidrive. The parameters listed in the table below should be configured on each node BEFORE connecting the node to the CANopen network.

Function	Unidrive	Recommended Setting
Node Address	#20.05	0 to 127
Network Data Rate	#20.08	0 to 7
Network Loss Trip Time	#20.11	0 to 2000
Diagnostic	#20.50	

All parameters must be stored, and the CANopen interface reset before any changes in configuration will take effect. Refer to section 4.5 on page 10 for details.

4.2 CANopen Node Address

Unidrive: #20.05

Every node must be given a unique network address. If a node is assigned an address, and that address already exists on the CANopen network, the nodes may interfere with each other.

The valid range of addresses is from 1 and 127, while setting the node address to 0 will disable the CANopen interface.

4.3 CANopen Data Rate

Unidrive: #20.08

All nodes on CANopen must be configured to run at the same data rate. The range of data rates available is shown in the table below.

Data Rate (bits/sec)	Unidrive (#20.08)	Data Rate (bits/sec)	Unidrive (#20.08)
10K	0	250K	4
20K	1	500K	5
50K	2	800K	6
125K	3	1M	7

4.4 Network Loss Trip Time

Unidrive: #20.11

The CANopen interface can be configured to trip the Unidrive on "tr62" if a SYNC message is not received within the time period specified (in ms) in #20.11. Setting #20.11 to 0 will disable the trip.

The "SYNC Guard" mechanism is used to generate the trip. This mechanism resets a timer to 0 when a SYNC message is received, and a "tr62" is generated if the timer reaches the specified network loss trip time, also known as the "SYNC Guard Time". This value is specified in milliseconds in #20.11.

The "Node/Life Guarding" mechanism is also supported, but the configuration registers are not available through parameters. The master controller must configure this mechanism during initialisation. (See section 9.3 for more details.)

4.5 Initialising Set-up Changes

CANopen configuration parameters are only read during the initialisation sequence of the CANopen interface, thus preventing unpredictable network behaviour while parameters are being edited. When parameters have been configured, the Unidrive CANopen interface must be reset to implement the changes in network set-up.

The UD70 can be reset from the Unidrive keypad in 2 ways.

- Set #MM.00 to 1070 and press the red RESET button. This will implement any changes made to the CANopen configuration, but the changes will NOT be stored. If power is lost to the Drive, the changes made will be lost, and the UD70 will revert to the stored configuration.
- Set #17.19 to 1. This causes a full reset of the UD70, and implements any changes made to the CANopen configuration. It will also force the UD70 to store the #20.PP parameters in FLASH memory, thus ensuring that the changes will not be lost when power is removed from the Drive. The UD70 will reset #17.19 to 0, when the reset sequence is complete.

NOTE

CANopen configuration parameters are stored in the FLASH memory inside the UD70. This means that if a module is moved to a different node on the network, the previous settings will be retained.

4.6 Network Status

Unidrive: #20.50

The status of the CANopen network is displayed in #20.50, and can be viewed on the display on the Unidrive.

#20.50	Operating State	Description
>0	OPERATIONAL	Indicates that the slave is communicating with the master controller. Displays the number of TxPDO, RxPDO and SDO messages per second.
0	STOPPED	The master has put the slave node into the STOPPED state. No data transfer (except SDO messages) will occur in this state.
-1	PRE-OPERATIONAL	Indicates that the CANopen interface has initialised correctly, and is waiting for a master controller to start communications.
-2	INITIALISATION	Indicates that the CANopen interface has not initialised correctly. Likely causes are hardware faults, and you should contact your local Drive centre.

5 Cyclic Data

NOTE

“RxPDO” and “TxPDO” describe the direction of data transfer with respect to the Unidrive CANopen interface.

5.1 What is Cyclic Data?

Cyclic data is a method 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 the data values for each cyclic channel over the CANopen network, and relying on local mapping information within the Drive to ensure the correct data is sent to the correct locations. This method relies on the PLC 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 Drive itself.

The flexibility of the Control Techniques Unidrive CANopen interface means that each cyclic data IN channel can be directed to any read-write Drive parameter. Similarly, each cyclic data OUT channel can use any Drive parameter as a source of data.

NOTE

The mapping configuration cannot be changed dynamically, as a full RESET of the Unidrive CANopen Interface must be performed before the any mapping changes become active.

5.2 Process Data Objects (PDO)

CANopen uses Process Data Objects (PDOs) to implement automatic data transfer. PDO details are stored in the CANopen "Object Dictionary", which stores data values about all aspects of the CANopen interface. (See section 9.5) A full listing of the Object Dictionary entries available within the Unidrive CANopen interface can be found in the advanced detail section.

For TxPDO1 and RxPDO1, these details are read from Drive parameters, and automatically written into the Object Dictionary. This simplifies the cyclic data transfer set-up for the Unidrive CANopen interface.

TxPDO2 and RxPDO2 are also provided, and are designed to transfer signed 32-bit data. The data mapping for these objects is fixed, but the COB-ID data is defined using Drive parameters.

5.2.1 Receive Process Data Object 1 (RxPDO1)

Receive PDO 1 consists of three 16-bit parameter values, and can be referred to as the IN cyclic data channels. The data transferred over the 3 cyclic data channels can be mapped to any read/write destination parameter in the Unidrive.

The COB-ID is automatically assigned for RxPDO1 using the node address, and may need to be entered manually when configuring the CANopen master controller.

COB-ID = 512 + #20.05

5.2.2 Transmit Process Data Object 1 (TxPDO1)

Transmit PDO 1 also consists of three 16-bit parameter values, and can be referred to as the OUT cyclic data channels. Any read/write or read only parameter in the Unidrive can be selected as the data source parameter for any cyclic data channel.

The COB-ID is automatically assigned for TxPDO1 using the node address, and may need to be entered manually when configuring the CANopen master controller. The decimal COB-ID can be calculated as:

COB-ID = 384 + #20.05

5.3 Mapping Parameters on Unidrive

The mapping for the cyclic data channels (RxPDO1 and TxPDO1) on the Unidrive CANopen Interface can be configured from the Drive keypad using menu 20 parameters.

The mapping method is similar to the method used in Unidrive 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.

RxPDO1 and TxPDO1 parameters cannot be mapped to the internal 32-bit registers in the UD70. RxPDO2 and TxPDO2 provide the capability, if required, to map to 32-bit registers. (See section 5.4)

The default mapping values are shown in the table below.

Cyclic Channel	Mapping Parameter	Value	Default Mapping Status
IN Word 1	#20.07	9011	#90.11, Drive status word
IN Word 2	#20.03	201	#2.01, post-ramp speed reference
IN Word 3	#20.04	402	#4.02, torque-producing current
OUT Word 1	#20.06	9011	#90.11, Drive control word
OUT Word 2	#20.01	121	#1.21, digital speed reference 1
OUT Word 3	#20.02	408	#4.08, torque reference

NOTE

#20.01 to #20.20, and #20.50, are all reserved for CANopen set-up and configuration. Mapping to these parameters should be avoided as they may be used to configure new features in future versions of the CANopen interface.

If a mapping parameter is set to an invalid value (target parameter does not exist) the mapping will revert back to the default value when the UD70 is reset.

If a cyclic channel is not required, setting the mapping value to -1 will disable it. The data word will still be transmitted over the network, but the data value will not be written to any Drive parameter.

5.4 Internal 32-Bit Parameters in UD70

The Unidrive CANopen Interface has a set of internal 32-bit registers, which are addressed as `_Pxx%`, `_Qxx%`, `_Rxx%` or `_Sxx%` from the DPL program. The `_Qxx%` registers are used with the internal position controller in the UD70.

The Process Data Objects RxPDO2 and TxPDO2 allow the transfer of two 32-bit data values. The mapping for the PDOs is fixed as shown in the table below.

Process Data Object	32-bit Cyclic Channel	Source/Destination Register
RxPDO2	IN Double Word 1	<code>_S00%</code>
RxPDO2	IN Double Word 2	<code>_S01%</code>
TxPDO2	OUT Double Word 1	<code>_R00%</code>
TxPDO2	OUT Double Word 2	<code>_R01%</code>

5.4.1 Receive Process Data Object 2 (RxPDO2)

RxPDO2 consists of two 32-bit parameter values, and can be referred to as 32-bit IN cyclic data channels. The mapping for the data received by RxPDO2 is fixed, with RxPDO2 always writing the data received to registers `_S00%` and `_S01%`.

The COB-ID is for RxPDO2 taken directly from #20.16, and is unrelated to the node address. If RxPDO2 is being used to communicate with a CANopen master controller, the recommended COB-ID is:

Recommended COB-ID = 768 + Node Address

RxPDO2 can also be used to receive data from another Unidrive over a CANopen network with no CANopen master controller. (See section 9 for more details.)

5.4.2 Transmit Process Data Object 2 (TxPDO2)

TxPDO2 also consists of two 32-bit parameter values, and can be referred to as 32-bit OUT cyclic data channels. The mapping for the data transferred by TxPDO2 is fixed, with TxPDO2 always reading data from registers `_R00%` and `_R01%`.

The COB-ID is for TxPDO2 taken directly from #20.17, and is unrelated to the node address. Although any COB-ID can be entered, the recommended method of assigning the decimal COB-ID for TxPDO2 is:

Recommended COB-ID = 640 + Node Address

TxPDO2 can also be used to send data to another Unidrive over a CANopen network with no CANopen master controller. (See section 9 for more details.)

5.5 Changing The Cyclic Data Mappings

The Unidrive CANopen interface must be reset before the changes will take effect. This prevents any corruption of the Drive parameters as a mapping parameter is changed to its new value at the keypad. To reset the UD70 from the Unidrive keypad, set #MM.00 to 1070 and press the red RESET button on the keypad.

5.6 Storing Parameters

Although any changes to the mapping will take effect after a reset sequence, the new values must be stored in non-volatile memory if they are to be restored automatically next time the Drive is powered up.

5.6.1 Saving Unidrive Parameters (Menu 1 to 19)

All parameters in these menus are saved in the EEPROM in the Unidrive. If the Unidrive CANopen interface is replaced in the Drive, these values will still be available when the Drive is next powered up.

To initiate the Unidrive parameter save sequence, set #MM.00 to 1000 and press the red RESET button on the keypad.

5.6.2 Saving Unidrive Parameters (Menu 20 and Internal)

All menu 20 parameters and internal 32-bit parameters (`_Pxx%` and `_Qxx%`) are stored in the FLASH memory of the UD70. If a module has been used before, the stored values may be very different from the normal default settings.

To initiate the non-volatile save sequence for these parameters, set #17.19 to 1. The UD70 will then store menu 20 and the internal 32-bit parameters, clear #17.19 back to zero and completely reset itself.

The UD70 can also be configured to store these parameters automatically when the Drive powers down. The store routine is triggered when an under-voltage (UU) trip occurs. Setting #17.20 to 1 enables this feature.

5.7 Mapping Conflicts

When the mapping parameters for the CANopen 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 Drive. The Unidrive CANopen interface will not indicate any conflict of mapping parameters. Possible conflicts can occur with analogue and digital inputs, IN data from the CANopen network, and internal Drive function reference, e.g. motorised pot and PID output.

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 CANopen 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 occasionally glitch in the value will be seen. In reality, this value may be changing continuously, leading to erratic Drive behaviour.

Function	Mapping Parameter	Function	Mapping Parameter
Analogue I/P 1	#7.10	Logic O/P 2	#9.20
Analogue I/P 2	#7.14	Motorised Pot O/P	#9.25
Analogue I/P 3	#7.18	Binary Summer O/P	#9.33
Digital I/P 1	#8.10	Comparator 1 O/P	#12.07
Digital I/P 2	#8.13	Comparator 2 O/P	#12.17
Digital I/P 3	#8.16	Digital Lock Ref	#13.06
Digital I/P 4	#8.19	PID O/P	#14.16
Digital I/P 5	#8.21	RxPDO1 Channel 1	#20.10
Digital I/P 6	#8.23	RxPDO1 Channel 2	#20.11
Logic O/P 1	#9.10	RxPDO1 Channel 3	#20.12

To ensure that there are no mapping conflicts, check that each Unidrive mapping destination parameter has a different value programmed. Analogue and digital inputs can be de-programmed by setting the value to 0. Setting the mapping value to -1 will disable any channel on RxPDO1.

5.7.1 Control Word Mapping Conflicts

The control word provides a method of writing to multiple bit parameters using one data word. If one of the cyclic data channels is writing to the control word, the following bit parameters for each Drive must not be controlled by any digital inputs.

Unidrive		
#6.15	#6.32	#18.31
#6.30	#1.45	#18.32
#6.31	#1.46	#18.33

5.8 Control Word for Unidrive

The Control Word is an efficient way of remotely controlling the motion of a Drive. Each bit in the control word has a particular function, and provides a method of controlling the function of the Drive (RUN, JOG, etc.) with a single data word. The control word is addressed in the UD70 by writing to #90.11.

b15	b14	b13	b12	b11	b10	b9	b8
M6	M5	#18.33	M3	M2	M1	M0	#18.32

b7	b6	b5	b4	b3	b2	b1	b0
#18.31	#1.46	#1.45	TRIP	#6.32	#6.31	#6.30	#6.15

The bits shown as "Mx" are individual mask bits that allow the corresponding "bx" bit to be masked.

For example, if a control word is received where mask bit "M0" (b9) is set to 0, the value in b0 will NOT be written to #6.15. #6.15 will remain at its last value. If bit "M0" (b9) is set to 1, the value of b0 (0 or 1) will be written to #6.15. The same principle applies to all other "Mx" bits.

The "TRIP" bit will cause a "tr52" trip when set to 1, but the trip cannot be cleared until b4 has been reset to 0. Parameters #18.31 to #18.33 are general user parameters and do not have mask bits.

Unidrive CANopen Interface		
Bit	Parameter	Description
0	#6.15	Drive enable
1	#6.30	Sequencing bit 0
2	#6.31	Sequencing bit 1
3	#6.32	Sequencing bit 2
4	TRIP	Drive Trip (tr52)
5	#1.45	Pre-set select 0
6	#1.46	Pre-set select 1
7	#18.31	Application bit 1
8	#18.32	Application bit 2
9	M0	Mask bit for b0
10	M1	Mask bit for b1
11	M2	Mask bit for b2
12	M3	Mask bit for b3
13	#18.33	Application bit 3
14	M5	Mask bit for b5
15	M6	Mask bit for b6

NOTE

If an "Mx" bit is reset to 0, the bit parameter that it masks will remain at it's previous value.

All direct control of the sequencing bits (#6.30 - #6.32) from digital inputs must be disabled before the control word will can be used. (Set #8.16, #8.19 and #8.21 to another value or 0.) The sequencing bits have the following functions when set to 1.

Parameter	Sequencing bit	Wire-proof PLC Mode (#6.04 = 4)	PLC Mode (#6.04 = 3)
#6.15	Enable	Enable	Enable
#6.30	0	Run Forward	Run
#6.31	1	Jog	Jog
#6.32	2	Run Reverse	Reverse

ENABLE The display will show "Inh" when set at 0, and depends on #6.30 and #6.32 when set to 1. Setting #6.15 to 0 overrides #6.30 and #6.32, and immediately disables the Drive. The motor will coast to rest if it is running when the Drive is disabled.

JOG The jog bit must be set, along with the appropriate run and direction signals.

To reset the Drive using the CANopen network, use the non-cyclic channel to set #10.38 to 100. The Drive will immediately clear #10.38 back to 0 and reset. (See *Unidrive Advanced User Guide* for more information.)

Some example control word values for the Unidrive are given in the tables below.

b15-b12	b11-b8	b7-b4	b3-b0	Value	Action (Wire-proof PLC mode)
0000	0010	0000	0000	0x0200	Drive disable
0001	1110	0000	0001	0x1E01	Enabled + stopped
0001	1110	0000	0011	0x1E03	Enabled + run fwd
0001	1110	0000	1001	0x1E09	Enabled + run rev
0001	1110	0000	1101	0x1E0C	Enabled + jog rev

b15-b12	b11-b8	b7-b4	b3-b0	Value	Action (PLC mode)
0000	0010	0000	0000	0x0200	Drive disable
0001	1110	0000	0001	0x1E01	Enabled + stopped
0001	1110	0000	0011	0x1E03	Enabled + run fwd
0001	1110	0000	1011	0x1E0B	Enabled + run rev
0001	1110	0000	1111	0x1E07	Enabled + jog rev

5.9 Status Word for Unidrive

The status word is an efficient way of remotely monitoring and diagnosing the status of the Drive. Each bit in the status word indicates the status of a particular function of the Drive, e.g. at speed, zero speed, Drive healthy, etc., and provides a quick method of checking the current status of the Drive. The status word is addressed in the UD70 by writing to #90.11.

b15	b14	b13	b12	b11	b10	b9	b8
X	#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

Unidrive CANopen Interface		
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 min 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	X	Not used

5.10 Disabling Cyclic Data Channels

If an application only requires two of the three cyclic data channels on RxPDO1 or TxPDO1, the remaining channel can be disabled. For RxPDO1, this means that the data value received is discarded, while for TxPDO1, the data value sent via the network will always be zero.

On Unidrive and Unidrive CANopen interface, set the appropriate channel mapping parameter to -1, and reset the UD70.

6 Non-Cyclic Data

The Service Data Object provides access to all entries in the Object Dictionary within the Unidrive CANopen Interface, and hence access to all Drive parameters. This form of non-cyclic data access to Drive parameters is controlled entirely by the master controller

For this reason, Control Techniques is unable to offer any specific technical support with implementing SDO communications on any particular CANopen master controller.

6.1 Service Data Objects Supported

The Unidrive CANopen interface provides one SDO server. The following services are supported:

- Initiate SDO Download
- Download SDO Segment
- Initiate SDO Upload
- Upload SDO Segment
- Abort SDO Transfer

6.2 Accessing Drive Parameters

All Drive parameters have been mapped to the CANopen object dictionary, allowing full access using SDO communications.

The parameter mapping is calculated as shown below.

Index	Value
Object Index:	0x2000 + menu number (in hex)
Sub Index:	0x01 + parameter number (in hex)

For example, to access #14.12, the CANopen Object Dictionary location would be:

Object Index: 0x200E

Sub-Index: 0x0D

7 EDS Files

7.1 What are EDS Files?

EDS (Electronic Data Sheets) files are text files that are used by CANopen network configuration software tools. They contain a listing of the functions supported by the device. EDS files are not downloaded to the PLC or scanner, and are only used during network configuration.

7.2 Generic EDS Files

A GSD file is available for the Commander SE CANopen interface, and can be obtained from your local Control Techniques Drive Centre. This file contains a full description of the performance capabilities of the Commander SE CANopen interface.

Drive	Filename
Unidrive	UNI_BETA.EDS

Unidrive bitmaps and icons are supplied for use with the CANopen master controller configuration software being used.

Refer to the software documentation for instructions on how to install EDS files. Control Techniques cannot provide specific technical support for any of these software packages.

8 Diagnostics

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

8.1 Fieldbus Code

Unidrive: #20.14

The fieldbus code identifies the hardware level in the option module. This information is vital when trying to determine what upgrades can be performed on older modules.

The identification of the high-speed communications option module can be read from #20.14. There is no fieldbus code available with the Mentor II DeviceNet interface, as it does not have the MD29 programmability.

#20.14	Fieldbus Type	Fieldbus Flavour	Hardware Revision
510	5 (CAN)	1 (CANopen)	0 (UD77A Issue 1 and UD77B Issue 04.00)

8.2 Firmware Version

Unidrive: #20.15

The version of firmware fitted to the CANopen interface can be read from #20.15 on Unidrive.

	Code	Firmware Version	Hardware Revision
Unidrive	110	V1.01.00	0

8.3 System File

Unidrive: #17.02

The system file installed in the UD70 must be the correct file for the communications option installed. The system file for the Unidrive CANopen interface is "DNET.SYS". The system file version can be read from parameter #17.02 on the Unidrive.

Firmware	Hardware Revision	System File	Comments
V1.01.00	0	V2.08.00 and later	First released versions of firmware and system file for CANopen interface

8.4 Node Address

Unidrive: #20.05

Every node must be given a unique network address. If a node is assigned an address, and that address already exists on the CANopen network, the nodes may interfere with other.

The valid range of addresses is from 1 and 127, while setting the node address to 0 will disable the CANopen interface.

8.5 Network Data Rate

Unidrive: #20.08

Ensure that every node on the CANopen network has been configured to run at the same data rate. A node with the wrong data rate may corrupt data from other nodes, and prevent the network from starting.

To change the data rate, set the appropriate value in #20.08, and reset the CANopen interface to make the change take effect.

Data Rate (bits/sec)	Unidrive (#20.08)	Data Rate (bits/sec)	Unidrive (#20.08)
10K	0	250K	4
20K	1	500K	5
50K	2	800K	6
125K	3	1M	7

8.6 Network Status

Unidrive: #20.50

The status of the CANopen network is displayed in #20.50, and can be viewed on the display on the Unidrive.

#20.50	Operating State	Description
>0	OPERATIONAL	Indicates that the slave is communicating with the master controller. Displays the number of TxPDO, RxPDO and SDO messages per second.
0	STOPPED	The master has put the slave node into the STOPPED state. No data transfer (except SDO messages) will occur in this state.
-1	PRE-OPERATIONAL	Indicates that the CANopen interface has initialised correctly, and is waiting for a master controller to start communications.
-2	INITIALISATION	Indicates that the CANopen interface has not initialised correctly. Likely causes are hardware faults, and you should contact your local Drive centre.

8.7 Unidrive Trip Codes

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

Trip Code	Error
tr52	This code indicates that the trip was caused by bit 4 in the control word being set to 1. (See section 5.8)
tr56	The wrong system file has been downloaded to the UD70, or the module does not have the CANopen firmware fitted. Download system file "DNET.SYS" V2.08.00 to the UD70.
tr62	Network Loss, caused by the "SYNC Guard" mechanism. The node has not received a SYNC telegram within the time period specified in #20.11. (See section 4.4)
tr63	Network Loss, caused by the "Node/Life Guarding" mechanism. The node has not received an the guarding telegram within the time period specified. (See section 9.3)

9 Other Unidrive CANopen Features

9.1 Auto-Start

Unidrive: #20.10

The Unidrive CANopen interface offers a mechanism whereby the node can be made to automatically enter the OPERATIONAL state from the PRE-OPERATIONAL state. This allows a network of UniDrives using CANopen without the need for a master controller. One node must be configured to generate the SYNC message when boot-up is complete. (See section 9.2)

Set #20.10 to 1 to enable the auto-start mode. Auto-start **MUST** be enabled on all Drives if there is no master controller on the network. When changing automatically from the PRE-OPERATIONAL to the OPERATIONAL state, the boot-up object is not sent.

9.2 SYNC Time

Unidrive: #20.09

To run a network of UniDrives on a CANopen network without a master controller, one node must be configured to generate the CANopen SYNC message. The Unidrive CANopen interface can be configured to generate this message by entering the SYNC time period (in ms) in #20.09. The SYNC message will only be generated when the node has completed the auto-start sequence, and entered the operational state. The SYNC time should not be set faster than 10ms.

Setting #20.09 to 0 will disable the SYNC message generation.

NOTE

Only one node on a CANopen network should be configured to generate the SYNC message.

9.3 Node/Life Guarding

"Node/Life Guarding" is the specified CANopen mechanism where a master polls a remote slave node periodically. This allows the slave node to "guard" the master by timing poll messages, and tripping on "tr63" if the poll message is not received within a specified period of time. The master "guards the slave by ensuring that the slave responds to each poll message.

The time period before the network loss trip will occur is the product of the Guard Time (Object 0x100C) and Lifetime Factor (0x100D). The master controller will usually configure these objects during node initialisation. (See section 9.5.1.)

9.4 "Peer-to-Peer" Communications

With local intelligence provided by the UD70 in every Unidrive CANopen interface, the Auto-Start (#20.10) and SYNC Time (#20.09) features allow peer-to-peer communications over a CANopen network, without the need for a master controller.

To implement "peer-to-peer" communications between 2 Unidrive nodes, the COB-ID of an RxPDO on the receiving node must match the COB-ID of a TxPDO on the transmitting node. The table below shows how to configure data transfer between 2 nodes.

From TxPDO	To RxPDO	Configuration
TxPDO1	RxPDO1	Cannot be implemented as the COB-IDs for both PDOs are fixed by the node address
TxPDO1	RxPDO2	Set #20.16 in target node to 384 + source node address
TxPDO2	RxPDO1	Set #20.17 in source node to 512 + target node address
TxPDO2	RxPDO2	Ensure #20.17 on the source node and #20.16 on the target node are set to the same valid COB-ID

9.5 CANopen Object Dictionary

The table below lists all supported objects within the Object Dictionary, plus any sub-indexes relating to each object.

9.5.1 Communication Profile Objects

Object	Sub-index	Object Description	Data Type	Access
1000	0	Device type	UINT32	RO
1001	0	Error register	UINT8	RO
1003		Pre-defined error field		
1003	0	Number of sub-indexes	UINT32	RW
1003	1	Last error	UNIT32	RO
1003	2-254	Previous errors	UNIT32	RO
1004		Number of supported PDOs		
1004	0	Supported PDOs	UNIT32	RO
1004	1	Synchronous PDOs	UNIT32	RO
1004	2	Asynchronous PDOs	UNIT32	RO
1005	0	COB-ID of the SYNC message	UINT32	RW
1008	0	Manufacturer device name	STRING	CONST
1009	0	Manufacturer hardware version	STRING	CONST
100A	0	Manufacturer software version	STRING	CONST
100B	0	Node ID	UINT32	RO
100C	0	Guard time	UINT32	RW
100D	0	Lifetime factor	UINT32	RW
100E	0	COB-ID guarding protocol	UINT32	RW
100F	0	Number of SDOs supported	UINT32	RO

9.5.2 Service Data Objects

Index	Sub-index	Description	Data Type	Access
1200		Server SDO Parameters		
1200	0	Number of sub-indexes	UINT8	RO
1200	1	COB-ID Client to Server (Rx)	UINT32	RO
1200	2	COB-ID Server to Client (Tx)	UINT32	RO

9.5.3 Receive Parameter Data Objects

Index	Sub-index	Description	Data Type	Access
1400		RxPDO1 Communication Parameters		
1400	0	Number of sub-indexes	UINT8	RO
1400	1	COB-ID used by RxPDO1	UINT32	RW
1400	2	Transmission type	UINT8	RW
1400	3	Inhibit time	UINT16	RW
1400	4	Compatibility entry	UINT8	RW
1401		RxPDO2 Communication Parameters		
1401	0	Number of sub-indexes	UINT8	RO
1401	1	COB-ID used by RxPDO2	UINT32	RW
1401	2	Transmission type	UINT8	RW
1401	3	Inhibit time	UINT16	RW
1401	4	Compatibility entry	UINT8	RW

Index	Sub-index	Description	Data Type	Access
1600		RxPDO1 Mapping Parameters		
1600	0	Number of mapped application objects in RxPDO1		RO
1600	1	Mapping for RxPDO1 Word 1	UINT32	RW
1600	2	Mapping for RxPDO1 Word 2	UINT32	RW
1600	3	Mapping for RxPDO1 Word 3	UINT32	RW
1601		RxPDO2 Mapping Parameters		
1601	0	Number of mapped application objects in RxPDO2		RO
1601	1	Mapping for RxPDO2 Word 1	UINT32	RW
1601	2	Mapping for RxPDO2 Word 2	UINT32	RW

9.5.4 Transmit Parameter Data Objects

Index	Sub-index	Description	Data Type	Access
1800		TxPDO1 Communication Parameters		
1800	0	Number of sub-indexes	UINT8	RO
1800	1	COB-ID used by TxPDO1	UINT32	RW
1800	2	Transmission type	UINT8	RW
1800	3	Inhibit time	UINT16	RW
1801		TxPDO2 Communication Parameters		
1801	0	Number of sub-indexes	UINT8	RO
1801	1	COB-ID used by TxPDO2	UINT32	RW
1801	2	Transmission type	UINT8	RW
1801	3	Inhibit time	UINT16	RW

Index	Sub-index	Description	Data Type	Access
1A00		TxPDO1 Mapping Parameters		
1A00	0	Number of mapped application objects in TxPDO1		
1A00	1	Mapping for TxPDO1 Word 1	UINT32	
1A00	2	Mapping for TxPDO1 Word 2	UINT32	
1A00	3	Mapping for TxPDO1 Word 3	UINT32	
1A01		TxPDO2 Mapping Parameters		
1A01	0	Number of mapped application objects in TxPDO1		
1A01	1	Mapping for TxPDO2 Word 1	UINT32	
1A01	2	Mapping for TxPDO2 Word 2	UINT32	

10 Quick Reference

10.1 Set-up and Mapping Parameters

Function	Unidrive	Default
Node Address	#20.05	0
Data Rate	#20.08	0
Network Loss Trip Time	#20.11	0
TxPDO1 Word 1 Mapping	#20.07	9011
TxPDO1 Word 2 Mapping	#20.03	201
TxPDO1 Word 3 Mapping	#20.04	402
RxPDO1 Word 1 Mapping	#20.06	9011
RxPDO1 Word 2 Mapping	#20.01	121
RxPDO1 Word 3 Mapping	#20.02	408
SYNC Generation Time	#20.09	0
Auto-Start Enable	#20.10	0
RxPDO2 COB-ID	#20.16	0
TxPDO2 COB-ID	#20.17	0
Fieldbus ID Code	#20.14	510
CANopen Firmware	#20.15	110
Reserved	#20.12	
Reserved	#20.13	
Reserved	#20.18	
Reserved	#20.19	
Reserved	#20.20	

10.2 Control Word

Unidrive CANopen Interface		
Bit	Parameter	Description
0	#6.15	Drive enable
1	#6.30	Sequencing bit 0
2	#6.31	Sequencing bit 1
3	#6.32	Sequencing bit 2
4	TRIP	Drive Trip (tr52)
5	#1.45	Pre-set select 0
6	#1.46	Pre-set select 1
7	#18.31	Application bit
8	#18.32	Application bit
9	M0	Mask bit 0
10	M1	Mask bit 1
11	M2	Mask bit 2
12	M3	Mask bit 3
13	#18.33	Application bit
14	M5	Mask bit 5
15	M6	Mask bit 6

10.3 Status Word

Unidrive CANopen Interface		
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 min 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	X	Not used