User Guide

UD77

DeviceNet

Option Module
For Unidrive

Part Number: 0460-0077
Issue Number: 2

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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Contents

1 Introduction

NOTE

Unidrive 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 Advanced User Guide for a full list of parameter definitions.

1.1 DeviceNet Interface for Unidrive

The Unidrive DeviceNet interface is supplied as an option module, with the DeviceNet using a UD70 as the host. The UD70 does not lose any functionality when the DeviceNet interface is fitted. The fastest data rate currently supported is 500 Kbits/sec.

The Unidrive supplies all power requirements for the Unidrive DeviceNet interface. A DeviceNet network power supply must also be connected, but this power supply does NOT keep the UD70 powered up when the Unidrive is switched off.

1.2 Product Conformance Certification

The Unidrive DeviceNet interface was submitted to the Open DeviceNet Vendors Association for conformance testing. All tests were successful, and the Unidrive DeviceNet interface was awarded full DeviceNet Conformance Certification. Refer to the ODVA Web Site at "www.odva.org"for further details.

1.3 Overview Specification

- Supported data rates (bits/sec): 500k, 250k, 125k
- Three polled 16 bit input/output words, all can be mapped to and from Unidrive parameters
- Explicit data allows access to all Unidrive parameters
- 6 DeviceNet Drive Profiles supported

2 Mechanical Installation

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

2.1 Unidrive

1. Slide the option module into the Unidrive.

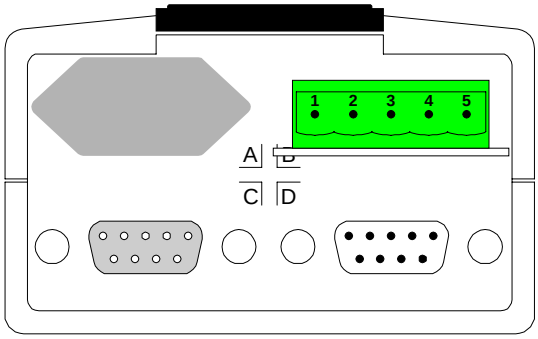
2. Push the option module into the Unidrive until it clicks into place.

3 Electrical Installation

3.1 DeviceNet Connectors

The Unidrive DeviceNet Interface provides a standard 5-way screw terminal socket (A) to connect to the DeviceNet network. A small converter board in provided to convert from the 9-way D-type connector

Connectors C and D on the Unidrive DeviceNet interface are the RS232 (C) and RS485 (D) ports of the UD70.

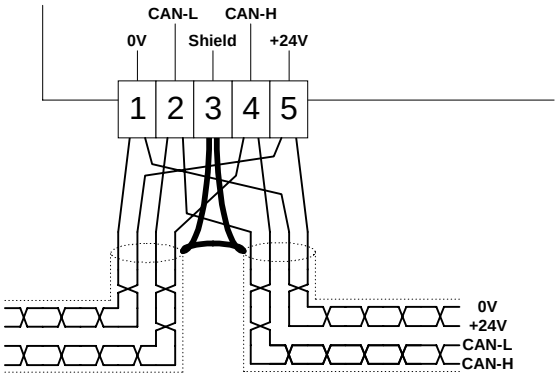


The pin connections for the DeviceNet connector are given in the table below. (Pins are numbered 1 to 5 from left to right on the above diagrams.)

Terminal	Signal	Function
1	0v	0V Isolated
2	CAN_L	Negative data line
3	SHIELD	Cable braided shield connection
4	CAN_H	Positive data line
5	V_{DC}	+24V DeviceNet power supply

3.2 DeviceNet Connections

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



3.3 DeviceNet Cable

DeviceNet 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 Open DeviceNet Vendors Association web site at “www.odva.org”.

NOTE

The Open DeviceNet Vendors Association and Control Techniques can only guarantee correct and reliable operation of a DeviceNet network if all components (including the network cable) installed have full Product Conformance Certification from the ODVA.

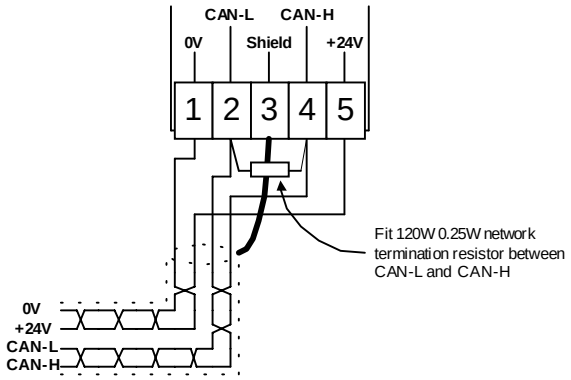
3.4 DeviceNet Cable Screen Connections

The Unidrive DeviceNet interface should be wired with the cable shields isolated from earth at each Drive. The cable shields should be linked together at the point where they emerge from the cable, and formed into a short pigtail to be connected to pin 3 on the DeviceNet connector. (See section 3.2)

3.5 DeviceNet Network Termination

There is no termination resistor supplied on the Unidrive DeviceNet 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 DeviceNet 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.

3.6 Maximum Network Length

The data rate that can be used depends mainly on the length of cable that is being used in the network, so the physical layout of the network must be considered during the network design stage of a project.

Data Rate (bits/sec)	125K	250K	500K
Max Trunk Distance	500m	250m	100m
Max Drop Length	6m	6m	6m
Cumulative Drop Length	156m	78m	39m
Number of Nodes	64	64	64

DeviceNet networks usually consist of a main terminated trunk cable length, with a series of drop cable lengths (without termination) running off the main trunk cable.

For a detailed description about the limitations and requirements for installing a DeviceNet network, refer to Allen Bradley Publication Number DN-6.7.2. (This document is available from the Allen Bradley web site at “www.ab.com”.)

3.7 External Power Supply

An external isolated +24V power supply is required to power the transceiver circuits in the DeviceNet nodes. The physical location of the external +24V power supply can be very important, particularly if the network has several nodes that draw significant power from the supply.

The Unidrive DeviceNet interface is powered by the Unidrive internal power supply. However, the external +24V power supply must be connected to meet ODVA specifications. Each Unidrive DeviceNet interface draws 5mA max from the external supply.

For detailed instructions on designing the layout of the network and determining power supply requirements, Allen Bradley Publication Number DN-6.7.2. (This document is available from the Allen Bradley web site at “www.ab.com”.)

4 Getting Started

The Quick Start section shows the basic parameter configurations required for the DeviceNet interfaces to establish communications. Polled and Explicit data explanations are given in chapters 5 and 6.

NOTE

Parameters #20.01 to #20.20 and #20.50 are reserved for configuring the DeviceNet interface, and should not be used in DPL programs.

4.1 Basic Communications Quick Start

DeviceNet communications can be established with the Unidrive DeviceNet interface simply by configuring the node address and data rate.

- Plug the DeviceNet module into the Unidrive.
- Power up the Unidrive.
- Set the MAC-ID (node address) in #20.05 as required.
- Set the Data Rate in #20.08 as required.
- Ensure Product Code Elaboration (#20.12) is set to 0.
- Set #17.19 to 1 to store and reset the UD70.

The DeviceNet interface will re-initialise, and configure itself with the new node address and data rate.

Function	Unidrive	Recommended Setting
Node Address	#20.05	1 to 62
Data Rate	#20.08	0 to 2
Network Loss Trip	#20.11	48
Product Code Elaboration	#20.12	0

4.2 DeviceNet 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 DeviceNet network, the node will not join the network. The valid range of addresses is from 1 and 255.

4.3 DeviceNet Data Rate

Unidrive: #20.08

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

#20.08	Data Rate (bits/sec)
0	125K
1	250K
2	500K

4.4 Product Code Elaboration

Unidrive: #20.12

Ensure that this parameter is set to 0. For details on using this parameter, refer to section 7.4.

4.5 Data Format

The Unidrive DeviceNet interface has a data format of 3 Polled Words, as used on Mentor II and Commander SE. Each polled data word is mapped to a Unidrive parameter with default mappings as shown in the table below.

Cyclic Channel	Default Mapping Status
IN Word 0	Status word
IN Word 1	Post-ramp speed reference
IN Word 2	Motor active current
OUT Word 0	Control word
OUT Word 1	Digital speed reference 1
OUT Word 2	Torque reference

4.6 Node Status

Unidrive: **#20.09**

When the Unidrive is powered up, the DeviceNet interface will initialise the internal hardware, and go into the standby mode. The node will switch to “Operational” mode when the master controller starts communicating with the node.

#20.09	Status	Description
1	Operational	The node is configured, and is communicating with a master controller
2	Standby mode	The node is configured and on-line, but has not been initialised by a master controller
5	No =+24V external power supply	The external +24V power supply is not connected. This power supply MUST be connected for the Unidrive DeviceNet interface to operate
10	Hardware fault	Internal hardware error, the DeviceNet interface could not be initialised

4.7 Network Status

Unidrive: **#20.10**

When the Unidrive is powered up, and the DeviceNet interface has initialised, the node will attempt to join the network. If another node is detected with the same MAC-ID, it will not join the network.

#20.10	Status	Description
1	Offline	The node is offline. Check the wiring, and that there is no node with the same MAC-ID
2	Online, not connected	The node is on-line, but has not been initialised by a master controller
3	Online, connected	The node is on-line and connected to a master controller
4	Online, connection time-out	The polled connection is in the timed-out state, or a Bus Off error has occurred, The node should have tripped either tr62)if enabled) of tr60
10	Critical link failure	Internal hardware failure

4.8 Network Loss Trip

Unidrive: #17.14

If the DeviceNet network stops operating, the interface will trip the Unidrive on "tr60". The default time delay between network loss and Unidrive trip is 48ms, so the actual delay to trip will be between 48ms and 96ms. (See section 9.1 for more details.) The master controller will automatically detect that the slave node has gone missing from the network, and will update relevant status registers.

NOTE

Changes to #17.PP parameters in the Unidrive do not take effect until the UD70 has been reset. See section 4.9.

4.9 Initialising Set-up Changes

UD70 (#17.PP) and DeviceNet (#20.PP) configuration parameters are only read during the initialisation sequence of the UD70. This prevents corruption of the configuration while parameters are being edited. When parameters have been configured, the UD70 must be reset to implement any changes made to the configuration parameters.

To reset from the UD70, set #MM.00 to 1070, and press the red RESET button on the Unidrive. Any changes made to the DeviceNet configuration will now take effect.

NOTE

Resetting the UD70 does not store the #20.PP configuration parameters, so these changes will be lost when the Unidrive is powered down. See section 5.5.2 for details on how to store UD70 parameters.

5 Polled Data

The default DeviceNet configuration contains three 16-bit IN data words and three 16-bit OUT data words. These data words are classed as “polled data channels”.

NOTE

“OUT data” and “IN data” describe the direction of data transfer as seen by the PLC scanner.

5.1 What is Polled Data??

Polled 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 a 16-bit data value for each polled channel over the DeviceNet network, and relying on local mapping information within the Unidrive 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 Unidrive itself.

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

NOTE

The mapping configuration cannot be changed dynamically, as the UD70 must be reset before changes to the mapping become active.

5.2 DeviceNet Data Format

The Unidrive DeviceNet interface has a data format of 3 polled data words. Explicit data must be used for non-cyclic communications.

Non-cyclic mode	Polled words	Comments
Explicit	3	This is the same data format as Mentor II, and Format 0.03 on Commander SE

5.3 Mapping Parameters on Unidrive

The mapping for the cyclic data channels on the Unidrive DeviceNet interface can be set from the Unidrive keypad using #20.PP parameters.

The mapping method is similar to the method used 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

#20.01 to #20.20, and #20.50 are all reserved for DeviceNet set-up and configuration, and should not be used in DPL programs.

The default mapping values are shown in the table below.

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

NOTE

If a mapping parameter is set to an invalid value, e.g. destination parameter is read only, or parameter does not exist, the Unidrive will reset the mapping parameter (#20.PP) to its default value.

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 Unidrive parameter.

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.

5.4 Internal 32-Bit Parameters on UD70

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

A 32-bit cyclic channel can be created forIN data, OUT data or both, by combining polled channels 1 and 2,or channels 2 and 3. This allows full 32-bit values to be directly transferred between the UD70 and the controlling PC or PLC. (See the “User’s Guide” for the UD70 for more information.)

The 32-bit cyclic channel is configured by mapping IN or OUT polled data channel 1 (#20.06 or #20.07) to a 32 bit register. Channel 2 will contain the data high word (upper 16 bits of the 32-bit register), irrespective of the mapping value set for channel 2. If channel 2 is mapped to a 32-bit register, channel 2 will contain the data low word (lower 16 bits of the 32-bit register) and channel 3 will automatically contain the data high word.

The 32-bit registers are addressed as parameters in menu 70 to menu 73. (See table below.) To map a cyclic channel to one of these registers, the parameter reference must be entered in the appropriate mapping parameter.

Registers	Parameter Reference
_P00% - _P99%	#70.00 to #70.99
_Q00% - _Q99%	#71.00 to #71.99
_R00% - _R99%	#72.00 to #72.99
_S00% - _S99%	#73.00 to #73.99

NOTE

If all polled channels are mapped to 32 bit registers, polled channels 1 and 2 will be combined to a 32-bit channel and written to or read from the mapped parameter for channel 1. (The mapping for channel 2 will be ignored.) Channel 3 will be read from or written to the low 16-bits of the mapped parameter.

5.5 Storing Parameters

Although any changes to the mapping will take effect after a UD70 reset sequence, the new values must be stored in non-volatile memory if they are to be restored automatically when the Interface is next powered up.

5.5.1 Saving Unidrive Parameters (Menu 1 to 19)

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

All parameters in these menus are saved in the EEPROM in the Unidrive. If the Unidrive DeviceNet interface is replaced, the Unidrive will retain all values in menu 1 through menu 19 when the Unidrive is next powered up.

5.5.2 Saving UD70 Parameters (Menu 20 and Internal)

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.

All menu 20 parameters and internal 32-bit parameters (_Pxx% and _Qxx%) are stored in the FLASH memory of the UD70. If the Unidrive DeviceNet interface is replaced, the menu 20 parameters may need to be re-configured. If the replacement module has been used before, the stored values may be different from the normal default settings.

The UD70 can also be configured to store these parameters automatically when the Unidrive powers down. The store routine is

triggered when an under-voltage (UU) trip occurs. Set #17.20 to 1, store the Unidrive parameters and reset the UD70 to enable this feature.

5.6 Mapping Conflicts

When the mapping parameters for the DeviceNet 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 Unidrive. The Unidrive DeviceNet interface will not indicate any conflict of mapping parameters. This only applies to analogue and digital inputs, and OUT data on the DeviceNet 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 DeviceNet 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 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	#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		Reference Input	#13.06
Digital I/P 4	#8.19		PID O/P	#14.16
Digital I/P 5	#8.21		Cyclic OUT Word 1	#20.06
Digital I/P 6	#8.23		Cyclic OUT Word 2	#20.01
Logic O/P 1	#9.10		Cyclic OUT Word 3	#20.02

Ensure that each Unidrive parameter in the table above has a different value programmed. A value of 0 will disable analogue and digital inputs, and -1 will disable the cyclic data channels.

5.6.1 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 Unidrive must not be controlled by any digital inputs.

Function	Param		Function	Param
Enable	#6.15		Preset ref select bit 1	#1.46
Run Forwards	#6.30		Application bit	#18.31
Jog	#6.31		Application bit	#18.32
Run Reverse	#6.32		Application bit	#18.33
Preset ref select bit 0	#1.45			

5.7 Fieldbus Control Word for Unidrive

NOTE

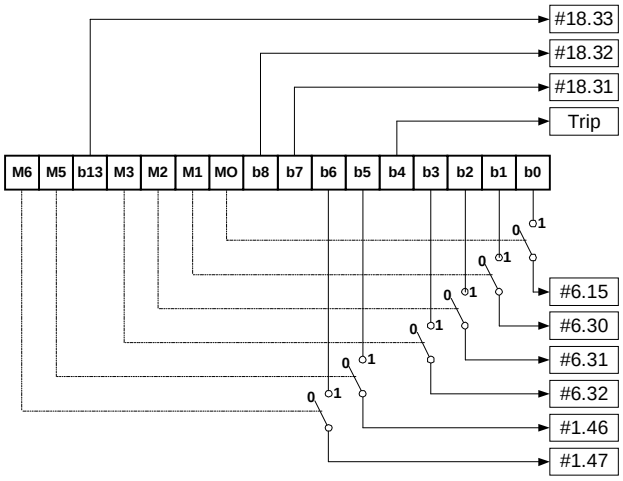
This section assumes that the Unidrive is configured to use the default Wire Proof PLC sequencing mode (#6.04 = 4). If PLC mode is selected (#6.04 = 3), the control word mapping is slightly different. Refer to section 9.2 for details.

The Control Word is an efficient way of remotely controlling the motion of a Unidrive. Each bit in the control word has a particular function, and provides a method of controlling the function of the Unidrive (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	RUN REV	JOG	RUN FWD	ENABLE

The bits shown as “Mx” are individual mask bits that allow the corresponding "bx" to be masked, i.e. the MASK bits determine whether or not the data bit is written through to the corresponding parameter.



If mask bits M0 and M1 are set to 1, ENABLE and RUN FWD are updated with the values of b0 and b1 (either 0 or 1) every time the control word value is received. JOG and RUN REV will not be updated, even if the values of b2 and b3 change, because their mask bits (M2 and M3) are not set to 1. If M0 and M1 are reset to 0, the values in b0 and b1 will NOT be written to ENABLE and RUN FWD, and these parameters will remain set to their current state.

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

Bit	Function	Description
0	ENABLE	Set to 1 to put the Unidrive in READY mode. (The hardware ENABLE must also be present.) The RUN FWD, JOG and RUN REV bits will have no effect unless the ENABLE bit is set to 1. The Unidrive outputs are disabled immediately when the ENABLE bit is reset to 0, and the motor will coast to stop
1	RUN FWD	Set to 1 to run the motor in the forwards direction. Reset to 0 to decelerate the motor to a controlled stop before the Unidrive output stage is disabled
2	JOG	Set to 1 with RUN FWD or RUN REV bit also set to jog the motor in the appropriate direction. The Unidrive will ramp the motor to the normal speed or stop when the JOG bit is reset to 0, depending on the status of the RUN FWD and RUN REV bits.
3	RUN REV	Set to 1 to run the motor in the reverse direction. When reset to 0, the Unidrive will decelerate the motor to stop before the outputs are disabled
4	TRIP	Set to 1 to trip the Unidrive on “tr52”. The TRIP bit must be reset to 0 before the Unidrive can be reset.
5	#1.45	Preset Reference Select. These bits are used to select the digital speed references used. Refer to the Unidrive User Guide for more information.
6	#1.46	
7	#18.31	User application bit
8	#18.32	User application bit
9	M0	ENABLE mask bit
10	M1	RUN FWD mask bit
11	M2	JOG mask bit
12	M3	RUN REV mask bit
13	#18.33	User application bit
14	M5	Mask bits for the Preset Reference Select bits
15	M6	

Some example control words for Wire-Proof PLC mode are given in the table below.

b15-b12	b11-b8	b7-b4	b3-b0	Value	Action
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

5.8 Fieldbus Status Word for Unidrive

The status word is an efficient way of remotely monitoring and diagnosing the status of the Unidrive. Each bit in the status word indicates the status of a function of the Unidrive, e.g. At Speed, Drive Healthy, etc. The status word is addressed in the UD70 by reading from #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

The table below shows the particular status of the Unidrive indicated by each bit when set to 1.

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		Not used

5.9 Disabling Cyclic Data Channels

Set the appropriate channel mapping parameter to -1, and reset the Unidrive DeviceNet Interface.

If an application only requires 2 cyclic data channels, the remaining channel can be disabled. This means that the data received from that channel will not be written to any Unidrive parameter. It does not actually remove the channel from the DeviceNet network.

6 Explicit Data

"Explicit data" is the non-cyclic data channel on DeviceNet that provides allows access to any parameter within the Unidrive. Non-cyclic data access to drive parameters is controlled entirely by the PLC program, and is not configured in any way when the DeviceNet network map is defined.

The method of using non-cyclic data will depend entirely on the type of scanner used to control the DeviceNet network. For this reason, Control Techniques is unable to offer any specific technical support with implementing non-cyclic data transfer on any particular DeviceNet scanner and PLC combination..

6.1 Explicit Parameter Access

The Control Techniques object (Class 100 or 0x64) provides access to all Unidrive parameters, using the parameters as shown:

Class Code: 100 (0x64)

Instance: Menu

Attribute: Parameter

All supported pre-defined DeviceNet objects can also be accessed using explicit messaging. See sections9.8 to 9.14 for full details.

NOTE

Multiple parameter access is not supported by the Unidrive DeviceNet interface.

Refer to the Scanner documentation for full details about explicit messaging, and how to implement explicit messaging using the scanner and PLC.

7 Support Files

7.1 What are EDS Files?

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

EDS files are not downloaded to the PLC or scanner, and are only used during network configuration. It is actually possible to configure a network without the EDS files, but they do help to provide a good picture of the network within the network configuration software.

7.2 Generic EDS Files

Generic EDS files are available that support Unidrive fitted with Version 2 and Version 3 software, and configured in open loop, closed loop and servo mode. Generic EDS files for Mentor II and Commander SE are also supplied. These files are available from your local Control Techniques Drive Centre.

These files contain a basic common selection of the drive parameters, allowing configuration of speed or torque references, acceleration and deceleration ramps, motor data set-up, digital and analogue I/O configuration parameters, and DeviceNet configuration parameters.

Unidrive Open Loop	G3_OPEN.EDS	G2_OPEN.EDS
Unidrive Closed Loop	G3_CLSD.EDS	G2_CLSD.EDS
Unidrive Servo	G3_SERVO.EDS	G2_SERVO.EDS
Mentor II	G410_M4Q.EDS	G501_M4Q.EDS
Mentor II	G502_M4Q.EDS	G504_M4Q.EDS
Mentor II	G505_M4Q.EDS	
Commander SE	G1_CSE.EDS	

Drive icon files are also supplied for use with the DeviceNet configuration software being used. EDS files must usually be installed into the software package being used to configure a DeviceNet network. 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.

7.3 EDS File Revisions

The EDS files from Control Techniques have undergone several revisions as specifications have been changed or tightened up. The table below shows the compatibility with the most common DeviceNet configuration tools.

EDS Revision	DeviceNet Manager	RSNetworx
1.x	OK	Not compatible
2.x	OK	V2.xx.xx and earlier
3.x	OK	V3.xx.xx

7.4 Advanced EDS Files

Advanced EDS files provide access to the complete drive parameter set for a specific version of software. This also includes parameters for any small option module that may be fitted to the drive. Advanced EDS files must be created using the Advanced EDS File Compiler, available from your local Control Techniques Drive Centre.

To use an advanced EDS file:

1. Specify the Unidrive mode to be used.
2. Specify the type of small option module fitted
3. Specify the nearest matching software version
4. Make a note of the “Product Code Elaboration” value specified for #20.12.
5. Build the EDS file.
6. Install the EDS file into the DeviceNet configuration software.
7. Set #20.12 as specified for the Unidrive
8. Set #17.19 to 1 to store and reset the UD70. (See section 4.9)

When the network is re-scanned, the product code of the Unidrive will have changed, and this should be matched to the EDS file that has just been created.

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 DeviceNet interface. 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 on the Unidrive display. This number is shown in the form XYZ, where X is the fieldbus type, Y is the fieldbus flavour, and Z is the hardware revision level.

Code	Fieldbus Type	Fieldbus Flavour	Hardware Revision	
500	5 (CAN)	0 (DeviceNet)	0 (UD77A Issue 2 and UD77B Issue 1)	DeviceNet

NOTE

System file V2.07.03 or later must be installed in the UD70 to indicate the full fieldbus code.

8.2 Firmware Version

Unidrive: #20.15

The version of firmware fitted to the DeviceNet interface can be read from #20.15. The Hardware Revision column shows the hardware levels that can accept each version of firmware.

#20.15	Firmware Version	Hardware Revision
200	V2.00.00	0

8.3 System File Version

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 DeviceNet interface is “DNET.SYS”.

The system file that must be installed can depend on the level of hardware and firmware in the module. In general, new system files are backward compatible with older versions of firmware and hardware, but there may be some limitations when upgrading older modules. (See sections 8.1 and 8.2.)

The system file version can be read from parameter #17.02 on the Unidrive.

Firmware	Hardware Revision	System File	Comments
V2.00.00	0	V2.07.03	DeviceNet

NOTE

System files can be downloaded using the WINFLASHER utility, which can be obtained from you local Drive Centre.

8.4 Node Address

Unidrive: #20.05

Every DeviceNet 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.

8.5 Network Data Rate

Unidrive: #20.08

Every node must be configured to run at the same data rate. To change the data rate, set the appropriate value in #20.08, and reset the DeviceNet interface to make the change take effect.

8.6 Number of Network Messages

Unidrive #20.50

#20.50 is incremented by 1 each time a message is received from the DeviceNet network. This parameter can be used to monitor the network activity within a DPL program.

This provides an alternative to using the network connection loss trip, enabled using #20.11. #20.11 trips the drive instantly, but a DPL program could monitor the state of the network, and bring the drive to a controlled stop before tripping the drive.

8.7 Node Status

Unidrive #20.09

The Node Status is indicated in #20.09.

Status	Node Status	Description
Device Operational	1	Device is operating correctly.
Device In Standby Mode	2	On Mentor II, the speed feedback scaling parameter (#3.16) is set 0. This must be set to positive value to allow speed feedback to be scaled correctly.
No +24V Power Supply	5	Device is operating in a normal condition, but no +24V supply has been detected.
Hardware Fault	10	Initialisation routine failed. The device has an unrecoverable fault.

8.8 Network Status

Unidrive #20.10

The Network Status is indicated in #20.10.

Status	Network Status	Description
Not On-line	1	Device not on-line, or not powered up.
On-line, Not Connected	2	Device on-line, but no connections have been established. The device is not allocated to a master.
On-line, Connected	3	Device on-line and a connection has been established. Device is allocated to a master
Connection Time-out	4	One or more of the I/O connections are in the timed-out state, or a Bus Off error has occurred. No response from the network.
Critical Link Failure	10	Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network.

8.9 No Data Transfer

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

- The mapping parameters have been programmed correctly. If an invalid 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 channels.
- OUT data has been enabled in the DeviceNet scanner. (Refer to Scanner documentation.)

8.10 Unidrive Trip Codes

The trip codes listed below may be caused by the Unidrive DeviceNet interface. Other trips may occur if a DPL program is loaded. For a full list of UD70 trips, refer to the UD70 User Guide

Trip Code	Error
tr52	This code indicates that the trip originated from the setting of bit 4 in the control Word
tr56	The UD70 does not contain the correct operating system for the detected hardware. Download the system file "IBSPROFI.SYS". If the trip persists, ensure that the UD73A and UD70 boards inside the module are properly clipped together. (This should only be attempted by suitably qualified personnel!!)
tr57	An illegal operating system call has been made, e.g. WRNET. CTNet commands cannot be used with DeviceNet
tr60	Bus Off. This is a low-level CAN trip condition, and prevents the node from communicating with the network. A manual reset is required to clear the Bus Off condition
tr62	This trip indicates that loss of the DeviceNet network has been detected. This can be caused by disconnecting the node form the network, a bad cable connection, or by resetting or stopping the network master controller

See section 9.3 for details on how to reset the Unidrive using the DeviceNet network.

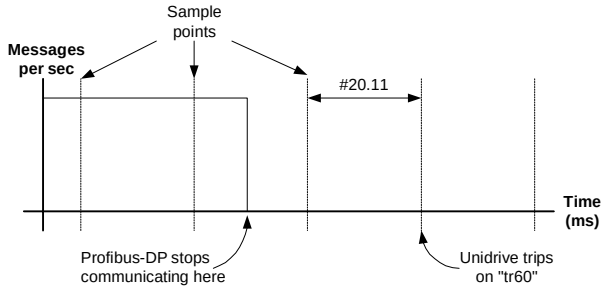
9 Advanced Features

9.1 Network Loss Trip

Unidrive: **#20.11**

0 = trip disabled 16 to 992 = trip delay time (in ms)

The DeviceNet interface counts the number of valid network cycles received in a time period specified by #20.11. The trip 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 #20.11 is 48ms. The UD70 Global Run-Time Trips also have to be enabled by setting #17.14 to 1.



As can be seen from the diagram, the actual time from network loss to Unidrive trip will range from #20.11 ms to 2 * #20.11 ms. If the trip time is set too low, spurious network loss trips may be seen.

The actual network loss trip time depends entirely on the number of messages per second being received under normal operation. As a rough guide, the network loss trip time (#20.11) should be set such that a minimum of 5 messages will be received in any given sample period under normal operating conditions.

NOTE

The network loss trip delay is specified in ms, but the time set will be rounded up to the nearest multiple of 16ms. Hence, if the time delay is set to 100ms, this will be rounded up to 112ms.

9.2 Unidrive Sequencing Mode 3

The default sequencing mode for Unidrive is the Wire-Proof PLC Mode. If PLC Mode is selected (#6.04 = 3), the sequencing bits (#6.30 - #6.32) have slightly different functions.

Control Word	Parameter	Sequencing Bit	PLC Mode (#6.04 = 3)
b0	#6.15	Enable	Enable
b1	#6.30	0	Run
b2	#6.31	1	Jog
b3	#6.32	2	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 Unidrive. The motor will coast to rest if it is running when the Unidrive is disabled.

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

To reset the Unidrive using the DeviceNet network, use the non-cyclic channel to set #10.38 to 100. The Unidrive will clear #10.38 back to 0 and reset. (See Unidrive manual 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 (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

9.3 Drive Reset Using The DeviceNet Network

The Unidrive control word does not provide a RESET bit to clear a trip condition in the Unidrive. There are three methods of resetting the Unidrive from the master controller via the DeviceNet network.

9.3.1 Reset Without DPL Code

To implement a RESET function without using DPL code, one of the application bits in the control word (see section 5.7) must be used. The application bits directly control #18.31, #18.32 and #18.33, so one of these parameters must be used to control the RESET function (#10.33) of the Unidrive. A 0-1 transition of the application bit will reset the Unidrive.

Assuming #18.31 is to be used as the RESET bit, one of the programmable logic functions in menu 9 can be used to link #18.31 to #10.33, and control resetting of the Unidrive. The table below shows the Unidrive parameter settings required. An alternative configuration using logic function 2 can be implemented by using the parameters in brackets instead.

Parameter	Value		Parameter	Value
#9.04 (#9.14)	18.31		#9.08 (#9.18)	0
#9.05 (#9.15)	0		#9.09 (#9.19)	0.0
#9.06 (#9.16)	0.00		#9.10 (#9.20)	10.33

By default, #10.33 is directly controlled by digital input 2. This must be disabled by setting the mapping parameter for digital input 2 (#8.13) to another value.

If the terminal reset function is required in addition to a fieldbus reset function, logic function 1 or 2 can be configured as an OR function of the fieldbus and terminal reset signals. The parameter settings for menu 9 to implement this are shown below.

Parameter	Value		Parameter	Value
#8.13	<> 10.33		#9.07 (#9.17)	1
#9.04 (#9.14)	18.31		#9.08 (#9.18)	1
#9.05 (#9.15)	1		#9.09 (#9.19)	0.0
#9.06 (#9.16)	8.02		#9.10 (#9.20)	10.33

NOTE

The Unidrive may need to be reset several times if multiple trips have occurred. As the reset will only occur on a 0 -1 transition of #10.33, the master controller should toggle the RESET bit until Drive Healthy (bit 0 of the status word) goes to 1.

9.3.2 Reset Using Explicit Communications

The Unidrive can be reset by writing a value of 100 to #10.38 using Explicit communications. The Unidrive may require several reset attempts if multiple trips have occurred. Use bit 0 of the status word (Drive Healthy) to check that the Unidrive has been successfully reset.

9.3.3 Reset Using DPL Code

If both of the menu 9 logic functions within the Unidrive are being used, some DPL code can be used to monitor the control word, and reset the Unidrive. The code should be placed in the SPEED, ENCODER or CLOCK task to ensure frequent scanning of the RESET bit.

```
ENCODER   {
reset% = #18.31      ; new state of RESET signal

; check for 0 to 1 transition of RESET bit
IF reset% = 1 AND old_reset% = 0 THEN

    ; set #10.38 to 100 until Drive Healthy bit is set
    DO
            #10.38 = 100
    LOOP WHILE #10.01 = 0
ENDIF

old_reset% = reset%  ; store current state of RESET signal
}
```

If another trip condition occurs while the Unidrive is tripped, the Unidrive must be reset twice before all trips are cleared. This is achieved by using the **DO...WHILE** loop until the Drive Healthy bit (#10.01) is set. The DPL program will also be reset, and the INITIAL task will run when the reset sequence ins complete.

NOTE

If a run-time (program) error occurs in the UD70, the DPL program will stop, and the master controller will not be able to reset the Unidrive using the DeviceNet network. In this case, the Unidrive node can only be reset using non-cyclic data to access #10.38.

9.4 Non-Cyclic Parameter Store

Unidrive: **#17.19**

0 = no action 1 = store DeviceNet configuration

Setting #17.19 to 1 will store all #20.PP parameters, and all internal 32-bit _Pxx% and _Qxx% registers. The DeviceNet interface will also be reset, and may cause the DeviceNet master to indicate a network error. Any changes made to the configuration via the non-cyclic communications channel will take effect when the reset sequence has been completed.

NOTE

The Unidrive DeviceNet interface will take approximately 700ms to complete the reset sequence, after which the network can be re-started.

9.5 EVENT Task Trigger on UD70

The EVENT task is a high priority task in the UD70 that can be triggered either by the timer/counter unit, or by the DeviceNet network.

When the fieldbus network is selected as the trigger source, the EVENT task is triggered in every DeviceNet network cycle.

#17.23	EVENT Task Trigger Source	Comments
0	Timer/Counter	Refer to UD70 Manual for more information.
1	DeviceNet	The EVENT task is triggered every time polled data arrives from the DeviceNet network, and is passed to the UD70.

Care must be taken not to put too much code in the EVENT task. It has a higher priority than all other UD70 tasks except the INITIAL task, so an extended EVENT task could easily prevent the SPEED task from running, and cause the UD70 to trip on “tr54”.

NOTE

This feature is only available with system file V2.07.06 or later.

9.6 Multi-Master Networks

DeviceNet networks can operate with more than one master device connected to the same lines. Commander SE, Unidrive and Mentor II DeviceNet interfaces can all operate on multi-master networks, but each device can only be assigned to one of the master devices.

Consult the supplier of your master controller for more details about implementing multi-master DeviceNet networks.

9.7 Supported Drive Profiles

Class: 41 (0x29) Instance: 1 (0x1) Attribute: 100(0x64)

Class: 41 (0x29) Instance: 1 (0x1) Attribute: 101(0x65)

The input (attribute 101) and output (attribute 100) assembly objects are set in the Control Supervisor. The default assembly objects are the Control Techniques Input (106) and Output (107) objects, which allow each data word to be mapped using #20.PP parameters. Refer to section 5 for more details.

The DeviceNet specification includes a series of set profiles for different devices, including Drives, and the Unidrive DeviceNet interface supports several of these pre-defined assembly objects. The format of the DeviceNet pre-defined assembly objects is fixed.

There are 3 ways to select a pre-defined Input or Output assembly object:

1. Use the PLC Explicit communications to write directly to the Control Supervisor. (See page 43 in DeviceNet User Guide Issue 1.) The relevant attributes are 100 (Output) and 101 (Input).
2. Use the Class Instance Editor within RSNetworx to modify the Control Supervisor directly yourself. Refer to page 43 to check the supported services for Unidrive DeviceNet interface.
3. Double-click on a node to go on-line to it, and look under the group "DeviceNet Config". In this group, you will find the attributes "Polled Input Assembly" and "Polled Output Assembly". Update with the appropriate value.

NOTE

The parameter mapping of the pre-defined DeviceNet objects CANNOT be changed.

9.7.1 Basic Speed Control

Output Assembly Object 20

The scanner must be configured for 4 Tx bytes (or 2 Tx words) if this output assembly object is selected.

Word	Function
Word 0	Basic Control Word (See section 9.11)
Word 1	Speed Reference (See section 9.11.13)

The Basic Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 9.11 for mapping details of each function.

b15	b14	b13	B12	b11	B10	b9	b8

b7	b6	b5	b4	b3	B2	b1	b0
					FaultRst		RunFwd

9.7.2 Extended Speed Control

Output Assembly Object 21

The scanner must be configured for 4 Tx bytes (or 2 Tx words) if this output assembly object is selected.

Word	Function
Word 0	Extended Control Word (See section 9.11)
Word 1	Speed Reference (See section 9.11.13)

The Extended Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 9.11 for mapping details of each function.

b15	b14	b13	B12	b11	b10	b9	b8

b7	b6	b5	B4	b3	b2	b1	b0
	NetRef	NetCtrl			FaultRst	RunRev	RunFwd

9.7.3 Basic Speed and Torque Control

Output Assembly Object 22

The scanner must be configured for 6 Tx bytes (or 3 Tx words) if this output assembly object is selected.

Word	Function
Word 0	Basic Control Word (See section 9.11)
Word 1	Speed Reference (See section 9.11.13)
Word 2	Torque Reference (See section 9.11.13)

The Basic Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 9.11 for mapping details of each function.

b15	b14	b13	b12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					FaultRst		RunFwd

9.7.4 Extended Speed and Torque Control

Output Assembly Object 23

The scanner must be configured for 6 Tx bytes (or 3 Tx words) if this output assembly object is selected.

Word	Function
Word 0	Basic Control Word (See section 9.11)
Word 1	Speed Reference (See section 9.11.13)
Word 2	Torque Reference (See section 9.11.13)

The Extended Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 9.11 for mapping details of each function.

b15	b14	b13	B12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
	NetRef	NetCtrl			FaultRst	RunRev	RunFwd

9.7.5 Basic Speed Control

Input Assembly Object 70

The scanner must be configured for 4 Rx bytes (or 2 Rx words) if this input assembly object is selected.

Word	Function
Word 0	Basic Status Word (See below)
Word 1	SpeedActual (See section 9.12.4)

The Basic Status Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 9.11 for mapping details of each function.

b15	b14	b13	B12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					Running Fwd		Faulted

9.7.6 Basic Speed and Torque Control

Input Assembly Object 72

The scanner must be configured for 6 Rx bytes (or 3 Rx words) if this input assembly object is selected.

Word	Function
Word 0	Basic Status Word (See below)
Word 1	SpeedActual (See section 9.12.4)
Word 2	TorqueActual (See section 9.12.6)

The Extended Control Word uses a full 16-bit word, with the bits having functions as shown below. Refer to section 9.11 for mapping details of each function.

b15	b14	b13	B12	b11	b10	b9	b8

b7	b6	b5	b4	b3	b2	b1	b0
					Running Fwd		Faulted

9.8 Object Model

The Object Model used to represent an AC or DC Drive has the following object classes present.

Object Class	Class Code		Effect on behaviour
Identity	1	0x01	Supports the device reset service
Message Router	2	0x02	Internally routes messages
DeviceNet	3	0x03	Configures device attributes
Assembly	4	0x04	Defines I/O data format, i.e. parameter mapping
Connection	5	0x05	Logical ports in to or out of the drive
Parameter Group	16	0x10	Provides an interface to the AC/DC Drive, Motor Data and Control Supervisor Objects
Motor Data	40	0x28	Defines the motor data
Control Supervisor	41	0x29	Manages drive functions, operational states and control
AC/DC Drive	42	0x2A	Provides drive configuration
Control Techniques	100	0x64	Provides an interface to all drive parameters

9.9 Identity Object

Class: 1 (0x1)

The identity object provides device identification information, along with general device information. All attributes are instance 1.

Attribute	Access	Name	Data Type
1	Get	Vendor ID	Word
2	Get	Device Type	Word
3	Get	Product Code	Word
4	Get	Revision	Word
5	Get	Status	Word
6	Get	Serial Number	Double Word
7	Get	Product Name	Short String

The following services are supported:

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes	Reset
16 (0x10)	No	Yes	Set_Attribute_Single
14 (0x0E)	Yes	Yes	Get_Attribute_Single

9.9.1 Vendor ID

Class: 1 (0x1) Instance: 1 (0x1) Attribute: 1 (0x1)

The Vendor ID is a unique code assigned to each manufacturer of DeviceNet-compatible equipment by the Open DeviceNetVendors Association. The code for Control Techniques is 257.

Action	Value	Comment
Read	257	257 is the Vendor ID code assigned to Control Techniques

9.9.2 Device Type

Class: 1 (0x1) Instance: 1 (0x1) Attribute: 2 (0x2)

The Device Type code indicates to which product group the Unidrive DeviceNet belongs.

Action	Value	Comment
Read	2	2 is the “AC Drives“ group of devices

9.9.3 Product Code

Class: 1 (0x1) Instance: 1 (0x1) Attribute: 4 (0x4)

The product code for Unidrive depends on the mode of the drive. A parameter for product code elaboration is also provided to allow the use of advanced EDS files if required.

Action	Value
Read	$(32 * [\#11.31 + 1]) + \#20.12$

9.9.4 Revision

Class: 1 (0x1) **Instance: 1 (0x1)** **Attribute: 4 (0x4)**

The revision code is the combination of the major and minor revision codes, where the major revision code is the low byte, and the minor revision code is the high byte.

Action	Major Revision	Minor Revision
Read	$\frac{\#11.29}{100}$	#11.29 Mod 100

9.9.5 Status

Class: 1 (0x1) **Instance: 1 (0x1)** **Attribute: 5 (0x5)**

This attribute represents the current status of the entire device. Its value changes as the state of the device changes.

b15	b14	b13	b12	b11	b10	b9	b8
				Major fault (U)	Major fault (R)	Minor fault (U)	Minor fault (R)

b7	b6	b5	b4	B3	b2	b1	b0
					Configured		Owned

R - Recoverable fault

U - Unrecoverable fault

9.9.6 Serial Number

Class: 1 (0x1) **Instance: 1 (0x1)** **Attribute: 6 (0x6)**

All Control Techniques DeviceNet interfaces have a unique serial number stored in the non-volatile memory.

9.9.7 Product Name

Class: 1 (0x1) **Instance: 1 (0x1)** **Attribute: 7 (0x7)**

The Unidrive DeviceNet interface will return the string “UD77” when this attribute is read.

9.10 DeviceNet Object

Class: 3 (0x3)

The DeviceNet Object provides the configuration and status of the Unidrive DeviceNet interface. All attributes are instance 1.

Attribute	Access	Name	Data Type
1	Get/Set	MAC-ID	Byte
2	Get/Set	Baud Rate	Byte
3	Get/Set	Bus Off Interrupt	Byte
4	Get/Set	Bus Off Counter	Byte
5	Get	Allocation Byte	Byte

The following services are supported:

Service Code	Class	Instance	Service Name
16 (0x10)	No	Yes	Set_Attribute_Single
14 (0x0E)	Yes	Yes	Get_Attribute_Single
75 (0x4B)	No	Yes	Allocate Master/Slave
76 (0x4C)	No	Yes	Release Master/Slave

9.10.1 MAC-ID

Class: 3 (0x3) **Instance: 1 (0x1)** **Attribute: 1 (0x1)**

Specifies the MAC-ID to be used by the node. Valid range is from 0 to 63. If this value is changed, the node will assume the new MAC-ID immediately.

NOTE

It is not recommended to change the MAC-ID via DeviceNet. The MAC-ID should be configured using parameter #20.05 BEFORE the node is connected to the network.

9.10.2 Data Rate

Class: 3 (0x3) **Instance: 1 (0x1)** **Attribute: 2 (0x2)**

Specifies the data rate to be used by the node. If this value is changed, the node will not be able to communicate with the scanner until the scanner's data rate has been changed.

Value	Data Rate (bits/sec)
0	125K
1	250K
2	500K

NOTE

It is not recommended to change the network data rate via DeviceNet. The data rate should be configured using parameter #20.08 BEFORE the node is connected to the network.

9.10.3 Bus Off Interrupt

Class: 3 (0x3) **Instance: 1 (0x1)** **Attribute: 3 (0x3)**

Bus Off Interrupt (BOI) determines the action if the Bus Off state is encountered. The following values are supported (default value = 0)

Value	Action
0	CAN chip is not reset. Manual reset of the device is required.
1	Device attempts to reset itself. After 10 attempts, an error is raised, and a manual reset is required.

9.10.4 Bus Off Counter

Class: 3 (0x3) **Instance: 1 (0x1)** **Attribute: 4 (0x4)**

The Bus Off counter counts the number of times the CAN chip went to the “bus off” state. The counter has values of 0 to 255 decimal. The “bus off” counter is reset to zero whenever set regardless of the data value written. The Bus–off Counter is initialised to zero at power–up or device initialisation.

The transmission of a Set_Attribute_Single request to the Bus–off Counter is all that’s required to reset the counter.

9.10.5 Allocation Byte

Class: 3 (0x3) **Instance: 1 (0x1)** **Attribute: 5 (0x5)**

b7	b6	b5	b4	b3	B2	b1	b0
	Ack Suppress					Polled	Explicit Message

Any bit set to 1 indicates that a request is being made to allocate that particular connection.

9.11 Control Supervisor Object

Class: 41 (0x29)

Manages drive functions such as start/stop and operational states. All attributes are instance 1. For each attribute, the READ and WRITE mappings are shown in the table. These are the actions that take place when each attribute is accessed.

Attribute	Access	Name	Data Type
3	Get/Set	RunFwd	Byte
4	Get/Set	RunRev	Byte
5	Get/Set	NetCtrl	Byte
7	Get	RunningFwd	Byte
8	Get	RunningRev	Byte
9	Get	Ready	Byte
10	Get	Faulted	Byte
12	Set	FaultRst	Byte
13	Get	FaultCode	Word
100	Get/Set	OutputAssembly	Byte
101	Get/Set	InputAssembly	Byte
102	Get/Set	DriveEnable	Byte
103	Get/Set	ZeroParam	Byte

The following services are supported:

Service Code	Class	Instance	Service Name
16 (0x10)	No	Yes	Set_Attribute_Single
14 (0x0E)	Yes	Yes	Get_Attribute_Single

9.11.1 RunFwd

Class: 41 (0x29) Instance: 1 (0x1) Attribute: 3 (0x3)

Set to 1 to start the drive, and run forwards. Wire-proof PLC sequencing mode (#6.04 = 4) must be selected on the Unidrive.

Action	Mapping
Read	#6.30
Write (0)	#90.11 = 0x1C00
Write (1)	#90.11 = 0x1C02

9.11.2 RunRev

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 4 (0x4)**

Set to 1 to start the drive, and run in reverse. Wire-proof PLC sequencing mode (#6.04 = 4) must be selected on the Unidrive.

Action	Mapping
Read	#6.32
Write (0)	#90.11 = 0x1C00
Write (1)	#90.11 = 0x1C08

9.11.3 NetCtrl

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 5 (0x5)**

This attribute writes to #18.31 in the Unidrive. If the control word is being written to using a polled data connection, this parameter will be over-written by bit 7 in the control word.

Action	Mapping
Read	#18.31
Write (0)	#18.31 = 0
Write (1)	#18.31 = 1

NOTE

The user must implement DPL code in the UD70 to select between local terminal control and network control. This attribute simply writes the NetCtrl attribute to #18.31.

9.11.4 RunningFwd

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 7 (0x7)**

Read only attribute that indicates that the motor is running forwards when set to 1.

Action	Mapping
Read	(#90.11 & 0x2002) == 0x2000

9.11.5 RunningRev

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 8 (0x8)**

Read only attribute that indicates that the motor is running in reverse when set to 1.

Action	Mapping
Read	(#90.11 & 0x2002)==0x2002

9.11.6 Ready

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 9 (0x9)**

Read only attribute that indicates that the drive is enabled and ready to run.

Action	Mapping
Read	#6.15

9.11.7 Faulted

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 10 (0xA)**

Read only attribute that indicates that the drive tripped when set to 1.

Action	Mapping
Read	!#10.01

NOTE

This is the opposite polarity to #10.01 on the Unidrive.

9.11.8 FaultRst

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 12 (0xC)**

Set to 1 to reset a drive from a tripped condition. Note that with Unidrive, this will cause a complete reset of the DeviceNet interface.

Action	Mapping
Write (0)	No action
Write (1)	#10.38 = 100

9.11.9 FaultCode

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 13 (0xD)**

Returns a fault code number, indicating the reason why the drive tripped. Refer to the Unidrive or Mentor II User's Guides for a full list of fault codes.

Action	Mapping
Read	#10.20

Under normal operating conditions, the Unidrive and Mentor II will be in the "Drive Healthy" condition, indicating that the drives are operating with no problems. This condition is indicated by a value of 1 in #10.01 on Unidrive.

If a drive trips for any reason, the drive healthy bit is reset to 0, and a diagnostic code is provided to indicate the reason for the trip. This code is available from #10.20 in the Unidrive.

The table below indicates which trip codes from the drive have pre-defined DeviceNet fault codes.

Unidrive Trip Display	Unidrive Trip Code	ODVA Fault Code
OI.AC	3	0x2300
OI.br	4	0x7112
PS	5	0x5100
ENC.OVL	10	0x7305
Oh1	21	0x4300
OA	23	0x4110
OP.OVLd	26	0x5112
Ph	32	0x3120

If the drive trip code is not on the above list, the code returned will be 0x1000 + Unidrive trip code.

9.11.10 OutputAssembly

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 100 (0x64)**

The output assembly selected determines the format of the data that is transferred from the scanner to the drive. Four pre-defined DeviceNet output assemblies are supported, and a Control Techniques output assembly is also provided. (See section 9.7)

Value	Description
20	Basic Speed Control
21	Extended Speed Control
22	Basic Speed and Torque Control
23	Extended Speed and Torque Control
107	User Defined Control Techniques Object

9.11.11 InputAssembly

Class: 41 (0x29) **Instance: 1 (0x1)** **Attribute: 101 (0x65)**

The input assembly selected determines the format of the data that is transferred from the drive to the PLC. Two pre-defined DeviceNet input assemblies are supported. (See section 9.7)

Value	Description
70	Basic Speed Control
72	Basic Speed and Torque Control
106	User Defined Control Techniques Object

9.11.12 DriveEnable

Class: 41 (0x29) Instance: 1 (0x1) Attribute: 102 (0x66)

Control the software enable of the Unidrive. Both the software and hardware enable must be set before the Unidrive can run.

Action	Mapping
Read	#6.15
Write (0)	#6.15 = 0
Write (1)	#6.15 = 1

9.11.13 ZeroParam

Class: 41 (0x29) Instance: 1 (0x1) Attribute: 102 (0x66)

Provides access to the #0.00 in the Unidrive. This allows functions that use this parameter, such as Unidrive Parameter Store, Unidrive Mode Change, UD70 Reset, etc, to be controlled via the DeviceNet network.

Action	Mapping
Read	#0.00
Write	#0.00

9.12 AC/DC Drive Object

Class: 42 (0x2A)

Models the drive specific functions, e.g. ramp times, torque control. The pre-defined attributes listed in the table below are supported. All attributes are instance 1.

Attribute	Access	Name	Data Type
3	Get	AtReference	Byte
4	Get/Set	NetRef	Byte
6	Get/Set	DriveMode	Byte
7	Get	SpeedActual	Word
8	Get/Set	SpeedRef	Word
11	Get	TorqueActual	Word
12	Get/Set	TorqueRef (6)	Word

The following services are supported:

Service Code	Class	Instance	Service Name
16 (0x10)	No	Yes	Set_Attribute_Single
14 (0x0E)	Yes	Yes	Get_Attribute_Single

9.12.1 AtReference

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 3 (0x3)

When set to 1, this attribute indicates that the motor is running at the demanded speed.

Action	Mapping
Read	#10.06

9.12.2 NetRef

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 4 (0x4)

This attribute selects the source of the speed reference for the drive. The source can only be changed when the Unidrive is configured in speed control mode.

Action	Mapping	Comment
Read/Write (0)	#1.14 = 1	Local Reference from #1.36
Read/Write (1)	#1.14 = 3	Network reference from #1.21

9.12.3 DriveMode

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 6 (0x6)

The Unidrive allows speed and torque control is all modes of operation. It is not possible to dynamically switch the Unidrive to another mode of operation, so DriveMode should be considered to be read-only. If requested a 'Device state conflict' error code 10h should be issued.

DriveMode	Control Mode	Parameter settings
1	Speed (OL)	#11.31 = 0 AND #4.11 = 0
2	Speed (CL or S)	(#11.31 =1 OR 2) AND #4.11 = 0
3	Torque (All)	#4.11 = 0

9.12.4 SpeedActual

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 7 (0x7)

The attribute returns the actual speed of the motor in rpm.

Action	Mapping	Comment
Read (OL)	$rpm = \frac{\#2.01 * 6}{\#5.11 + 1}$	Converts Hz to rpm
Read (CL or S)	#3.02	

9.12.5 SpeedRef

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 8 (0x8)

This attribute provides the speed reference for the drive, when network reference is selected. ("rpm" is the value transmitted over DeviceNet.)

Action	Mapping	Comment
Read (OL)	$rpm = \frac{\#2.01 * 6}{\#5.11 + 1}$	Converts Hz to rpm
Read (CL or S)	rpm = #3.02	
Write (OL)	$\#1.21 = \frac{rpm * 6}{\#5.11 + 1}$	Converts rpm to Hz
Write (CL or S)	#1.21 = rpm	

9.12.6 TorqueActual

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 11 (0xB)

Returns the active motor current being supplied by the Unidrive.

Action	Mapping
Read	#4.02

9.12.7 TorqueRef

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 12 (0xC)

Provides the torque reference for the drive when running in torque control mode. No scaling is applied to #4.08.

Action	Mapping
Read	#4.08
Write	#4.08

9.13 Motor Data Object

Class: 40 (0x28)

Serves as a database for the motor parameters. All attributes are instance 1.

Attribute	Access	Name	Data Type
3	Set/Get	MotorType	Byte
6	Set/Get	RatedCurrent	Word
7	Set/Get	RatedVoltage	Word

The following services are supported:

Service Code	Class	Instance	Service Name
16 (0x10)	No	Yes	Set_Attribute_Single
14 (0x0E)	Yes	Yes	Get_Attribute_Single

9.13.1 MotorType

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 3 (0x3)

Defines the type of motor Unidrive supports in different modes of operation.

DriveMode	Motor Types Supported
Open Loop	6 - Wound Rotor Induction Motor 7 - Squirrel Cage Induction Motor
Closed Loop	6 - Wound Rotor Induction Motor 7 - Squirrel Cage Induction Motor
Servo	9 - Sinusoidal permanent magnet BL Motor 10 - Trapezoidal permanent magnet BL Motor

9.13.2 RatedCurrent

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 6 (0x6)

This attribute specifies or returns the rated current (in amps) for the motor, to an accuracy of 1 decimal place. On size 1 and 2 Unidrive, the second decimal place of current is not accessible via DeviceNet. On size 5 Unidrive, the decimal place is not available inside the drive, but it must be specified over DeviceNet.

Action	Mapping
Read	#5.07
Write	#5.07

9.13.3 RatedVoltage

Class: 42 (0x2A) Instance: 1 (0x1) Attribute: 7 (0x7)

This attribute specifies the rated voltage for the motor.

Action	Mapping
Read	#5.09
Write	#5.09

9.14 Control Techniques Object

Class: 100 (0x64)

This application specific object provides a means to access all parameters within a Control Techniques Drive. Each of the drive menus is modelled as an instance within this object; each parameter is an attribute of that instance.

When using an explicit connection, each drive parameter should be accessed as a 16-bit integer, except for menus 70 to 73 on Unidrive. These UD70 internal parameters are 32-bit signed parameters, and will accept or return 4 byte (32 bit) data values.

Service Code	Class	Instance	Service Name
16 (0x10)	No	Yes	Set_Attribute_Single
14 (0x0E)	Yes	Yes	Get_Attribute_Single

The table below indicates the number of instances supported and also the number of attributes within each instance.

Instance	Menu	Number of Attributes
1	Speed Reference	50
2	Speed Ramps	41
3	Speed Control	30
4	Current Control	20
5	Motor Control	33
6	Sequencing	38
7	Analogue I/O	32
8	Digital I/O	28
9	Logic	33
10	Drive Status	42
11	Drive Set-up	35
12	Programmable Thresholds	17
13	Position Control	19
14	Process PID Loop	18
16	Small Option Module	41
17	Large Option Module Set-up	28
18	User Menu 1	50
19	User Menu 2	50
20	Large Option Module	50
70	Application Menu	100
71	Application Menu	100
72	Application Menu	100
73	Application Menu	100

If an attempt to access a drive parameter using this object fails, the codes in the table below will indicate the reason for the failure.

DeviceNet Error Message	DeviceNet Error Code	Reason
Attribute not supported	0x14	Parameter does not exist.
Attribute not settable	0x0E	Parameter is read only.
Attribute not settable	0x0E	Parameter is write only.
Invalid attribute value	0x09	Parameter value out of range.

NOTE

Since V2.00.00 firmware was released, new parameters have been added to some menus in the Unidrive. It is not possible access these parameters via the DeviceNet interface.

10 Quick Reference

10.1 Complete Parameter Reference

Parameter	Default	Description
#20.01	121	OUT Channel 2 Mapping
#20.02	408	OUT Channel 3 Mapping
#20.03	201	IN Channel 2 Mapping
#20.04	402	IN Channel 3 Mapping
#20.05	0	Node Address
#20.06	9011	OUT Channel 1 Mapping
#20.07	9011	IN Channel 1 Mapping
#20.08	0	Data Rate
#20.09	0	Node Status (Read only)
#20.10	0	Network Status (Read only)
#20.11	48	Trip Delay Time (ms)
#20.12	0	Product Code Elaboration
#20.14	----	Option ID Code (Read only)
#20.15	----	Firmware Version XXYY, where the firmware version is VXX.YY.ZZ (Read only)
#20.50	----	Fieldbus Diagnostic (Read only)
#17.02	----	System File Version (Read only)
#17.14	0	Network Loss Trip Enable
#17.19	0	UD70 Store and Reset
#20.13	0	Reserved
#20.16	0	Reserved
#20.17	0	Reserved
#20.18	0	Reserved
#20.19	0	Reserved
#20.20	0	Reserved

10.2 DeviceNet Data Format

The Unidrive DeviceNet interface has a data format of 3 polled data words. Explicit data must be used for non-cyclic communications.

Non-cyclic mode	Polled words	Comments
Explicit	3	This is the same data format as Mentor II, and Format 0.03 on Commander SE

10.3 Fieldbus Control Word

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	RUN REV	JOG	RUN FWD	ENABLE

Bit	Function	Description
0	ENABLE	Set to 1 to put the Unidrive in READY mode. (The hardware ENABLE must also be present.) The RUN FWD, JOG and RUN REV bits will have no effect unless the ENABLE bit is set to 1. The Unidrive outputs are disabled immediately when the ENABLE bit is reset to 0, and the motor will coast to stop
1	RUN FWD	Set to 1 to run the motor in the forwards direction. Reset to 0 to decelerate the motor to a controlled stop before the Unidrive output stage is disabled
2	JOG	Set to 1 with RUN FWD or RUN REV bit also set to jog the motor in the appropriate direction. The Unidrive will ramp the motor to the normal speed or stop when the JOG bit is reset to 0, depending on the status of the RUN FWD and RUN REV bits.
3	RUN REV	Set to 1 to run the motor in the reverse direction. When reset to 0, the Unidrive will decelerate the motor to stop before the outputs are disabled
4	TRIP	Set to 1 to trip the Unidrive on “tr52”. The TRIP bit must be reset to 0 before the Unidrive can be reset.
5	#1.45	Preset Reference Select. These bits are used to select the digital speed references used. Refer to the Unidrive User Guide for more information.
6	#1.46	
7	#18.31	User application bit
8	#18.32	User application bit
9	M0	ENABLE mask bit
10	M1	RUN FWD mask bit
11	M2	JOG mask bit
12	M3	RUN REV mask bit
13	#18.33	User application bit
14	M5	Mask bits for the Preset Reference Select bits
15	M6	

10.4 Fieldbus Status Word

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

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

10.5 Unidrive Trip Codes

The trip codes listed below may be caused by the Unidrive DeviceNet interface. Other trips may occur if a DPL program is loaded. For a full list of UD70 trips, refer to the UD70 User Guide

Trip Code	Error
tr52	This code indicates that the trip originated from the setting of bit 4 in the control Word
tr56	The UD70 does not contain the correct operating system for the detected hardware. Download the system file "IBSPROFI.SYS". If the trip persists, ensure that the UD73A and UD70 boards inside the module are properly clipped together. (This should only be attempted by suitably qualified personnel!!)
tr57	An illegal operating system call has been made, e.g. WRNET. CTNet commands cannot be used with DeviceNet
tr60	Bus Off. This is a low-level CAN trip condition, and prevents the node from communicating with the network. A manual reset is required to clear the Bus Off condition
tr62	This trip indicates that loss of the DeviceNet network has been detected. This can be caused by disconnecting the node from the network, a bad cable connection, or by resetting or stopping the network master controller