



Option Modules

CANopen Communications Option

HA501841U001 Issue 1
Technical Manual

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



AC30 CANopen Option

Technical Manual HA501841U001 Issue 1

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Safety Information



Requirements

IMPORTANT: Please read this information *BEFORE* installing the equipment.

Intended Users

This manual is to be made available to all persons who are required to install, configure or service equipment described herein, or any other associated operation.

The information given is intended to highlight safety issues, EMC considerations, and to enable the user to obtain maximum benefit from the equipment.

Complete the following table for future reference detailing how the unit is to be installed and used.

INSTALLATION DETAILS	
Model Number <i>(see product label)</i>	
Where installed <i>(for your own information)</i>	

Application Area

The equipment described is intended for industrial motor speed control utilising AC induction or AC synchronous machines.

Personnel

Installation, operation and maintenance of the equipment should be carried out by competent personnel. A competent person is someone who is technically qualified and familiar with all safety information and established safety practices; with the installation process, operation and maintenance of this equipment; and with all the hazards involved.

Product Warnings

 DANGER Risk of electric shock	 WARNING Hot surfaces	 Caution Refer to documentation	 Earth/Ground Protective Conductor Terminal
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CAUTION!

APPLICATION RISK

- The specifications, processes and circuitry described herein are for guidance only and may need to be adapted to the user's specific application. We cannot guarantee the suitability of the equipment described in this Manual for individual applications.

RISK ASSESSMENT

Under fault conditions, power loss or unintended operating conditions, the drive may not operate as intended. In particular:

- Stored energy might not discharge to safe levels as quickly as suggested, and can still be present even though the drive appears to be switched off
- The motor's direction of rotation might not be controlled
- The motor speed might not be controlled
- The motor might be energised

A drive is a component within a drive system that may influence its operation or effects under a fault condition. Consideration must be given to:

- Stored energy
- Supply disconnects
- Sequencing logic
- Unintended operation

Safety Information



DANGER! - Ignoring the following may result in injury

1. This equipment can endanger life by exposure to rotating machinery and high voltages.
2. The equipment must be permanently earthed due to the high earth leakage current, and the drive motor must be connected to an appropriate safety earth.
3. Ensure all incoming supplies are isolated before working on the equipment. Be aware that there may be more than one supply connection to the drive.
4. There may still be dangerous voltages present at power terminals (motor output, supply input phases, DC bus and the brake, where fitted) when the motor is at standstill or is stopped.
5. For measurements use only a meter to IEC 61010 (CAT III or higher). Always begin using the highest range. CAT I and CAT II meters must not be used on this product.
6. Allow at least 5 minutes for the drive's capacitors to discharge to safe voltage levels (<50V). Use the specified meter capable of measuring up to 1000V dc & ac rms to confirm that less than 50V is present between all power terminals and between power terminals and earth.
7. Unless otherwise stated, this product must NOT be dismantled. In the event of a fault the drive must be returned. Refer to "Routine Maintenance and Repair".

WARNING! - Ignoring the following may result in injury or damage to equipment

SAFETY

Where there is conflict between EMC and Safety requirements, personnel safety shall always take precedence.

- Never perform high voltage resistance checks on the wiring without first disconnecting the drive from the circuit being tested.
- Whilst ensuring ventilation is sufficient, provide guarding and /or additional safety systems to prevent injury or damage to equipment.
- When replacing a drive in an application and before returning to use, it is essential that all user defined parameters for the product's operation are correctly installed.
- All control and signal terminals are SELV, i.e. protected by double insulation. Ensure all external wiring is rated for the highest system voltage.
- Thermal sensors contained within the motor must have at least basic insulation.
- All exposed metalwork in the Inverter is protected by basic insulation and bonded to a safety earth.
- RCDs are not recommended for use with this product but, where their use is mandatory, only Type B RCDs should be used.

EMC

- In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.
- This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product.
- This is a product of the restricted sales distribution class according to IEC 61800-3. It is designated as "professional equipment" as defined in EN61000-3-2. Permission of the supply authority shall be obtained before connection to the low voltage supply.

Disposal

Waste Electrical and Electronic Equipment (WEEE)



Waste Electrical and Electronic Equipment - must not be disposed of with domestic waste.

It must be separately collected according to local legislation and applicable laws.

Parker Hannifin Company, together with local distributors and in accordance with EU directive 2002/96/EC, undertakes to withdraw and dispose of its products, fully respecting environmental considerations.

For more information about how to recycle your Parker supplied waste equipment, please contact your local Parker Service Centre.

Packaging

During transport our products are protected by suitable packaging. This is entirely environmentally compatible and should be taken for central disposal as secondary raw material

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AC30 CANOPEN OPTION

Introduction

Features

- CANopen DS301 v4.02 compliant
- Supports all standard baud rates
- Galvanically isolated bus via DB9M male connector
- Run and Error LEDs
- Up to 32 transmit PDOs and 32 receive PDOs (256 bytes of cyclic I/O data in each direction)
- EDS Files (*see page 13*)

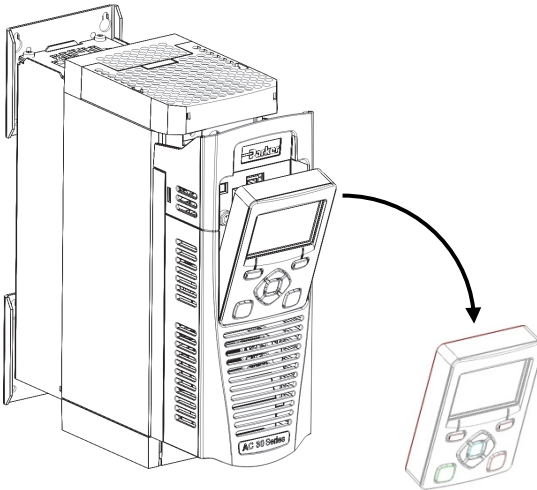
The Product Code

The product code for the CANopen Option is:

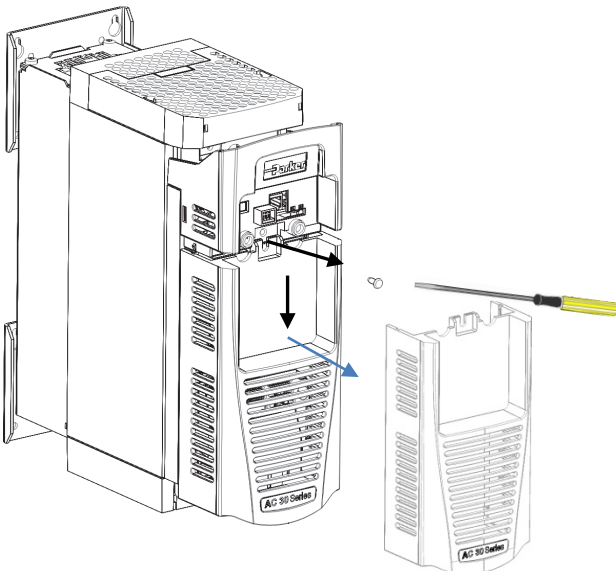
7003-CB-00

Installation

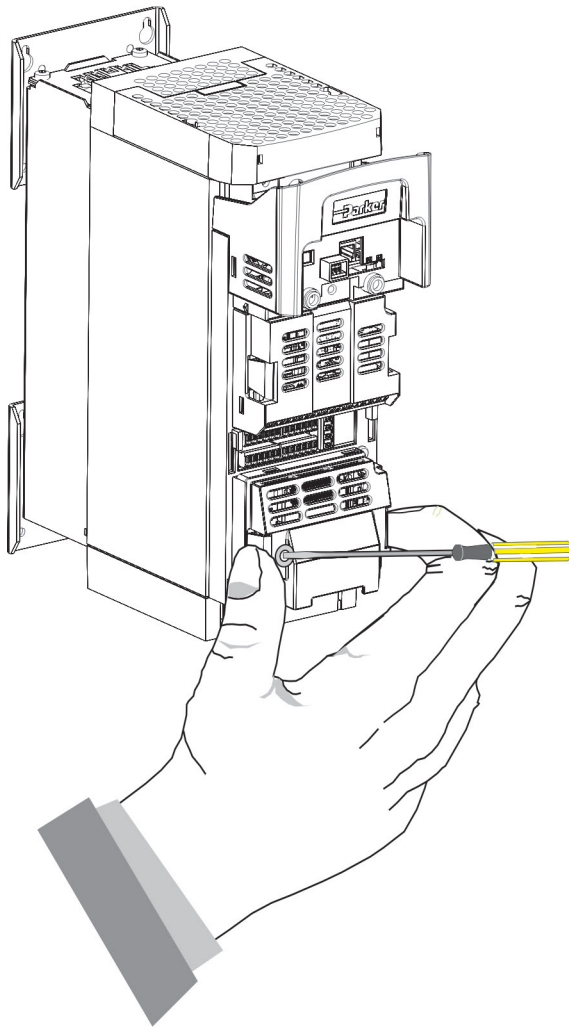
1. Remove the Graphical Keypad (GKP) by pulling from the top down, and remove.



2. After removing the screw slide the control module lower cover down slightly and then remove.

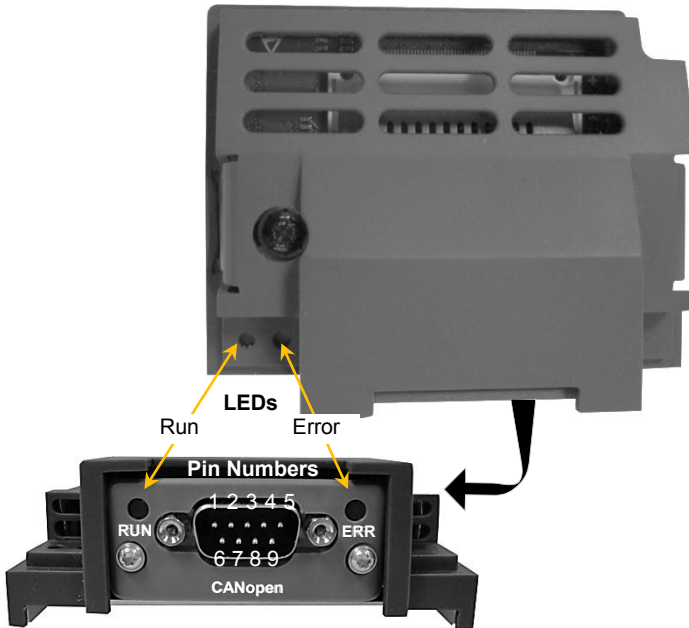


3. Click the Option into place and tighten the retaining screw, as shown.



4. Slide and click back the control module lower cover, tighten the retaining screw and slot back the GKP.

Connecting to the CANopen Network



Pin	Signal
1	-
2	CAN_L
3	CAN_GND
4	-
5	CAN_SHLD
6	-
7	CAN_H
8	-
9	-
Housing	CAN_SHLD Connected to protective earth via a filter

Note: It is possible to make serial communications operate without adhering to the following recommendations; however, the recommendations will promote greater reliability.

Cable Specification

For CANopen is shielded copper cable consisting of one twisted pair and two optional cables for an extra power supply. As standard, the CANopen option does not use the external power supply. The use of CAN_GND is recommended throughout the network. The user organization (CiA) has specified ISO/DIS 11898 as the standard bus cable.

Maximum Cable Lengths

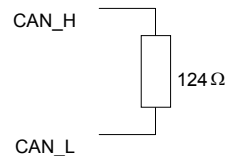
The maximum cable length depends on the baud rate selected:

Data Rate	Maximum Distance
125 kBit/s	500 metres
250 kBit/s	250 metres
500 kBit/s	100 metres
1 Mbit/s	25 metres

Terminators

- If the drive is at the end of the chain it must have a terminating resistor.
- All other drives in the system should not have a terminator.

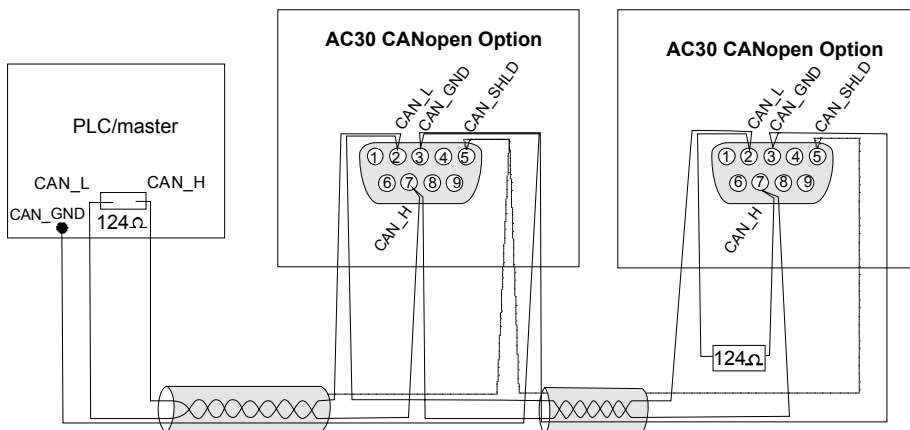
Connect terminating resistors to the last drive as shown opposite (resistor is $\pm 1\%$, minimum $\frac{1}{4}$ Watt).



The CANopen specification recommends 124Ω , but it should be chosen to equal as closely as possible the characteristic impedance of the cable.

IMPORTANT: *Failing to fit terminating resistors correctly may result in unreliable operation.*

Wiring Diagram Example



LEDs

Run (RUN) LED

State	Indication
Off	-
Green	OPERATIONAL
Green, blinking	PRE-OPERATIONAL
Green, single flash	STOPPED
Green, flickering	Autobaud – baud detection in progress
Red**	EXCEPTION

Error (ERR) LED

State	Indication
Off	No power or device is in working condition
Red, single flash	A bus error counter reached or exceeded its warning level
Red, flickering	LSS services – <i>not supported</i>
Red, double flash	A guard (NMT-slave or NMT-master) or heartbeat event has occurred
Red**	Bus off

** If both LEDs turn red, this indicates a fatal event; the bus interface is shifted into a physically passive state.

Configuration

The option requires configuration of the node address, the baud rate and mapping of the process data to the master. Note that some communication parameters only become active after the AC30 leaves the configuration state.

The **0044 Comms Required** parameter must be set to **CANOPEN**.

Device Address

The **0212 CANopen Node Address** parameter must be set to the required address for the slave. The range is the 1 - 127.

Baud Rate

The **0213 CANopen Baud Rate** parameter must be set to the required baud rate for the network. A baud rate of up to 1000 Kbits/s may be chosen. Alternatively, AUTO may be selected so that the option automatically detects the baud rate.

Process Data

Parameters mapped as Process Data can be exchanged cyclically as Process Data Objects (PDOs) on the bus. The option supports up to 32 RPDOs (receive PDOs) and 32 TPDOs (transmit PDOs) each capable of carrying up to 8 bytes of data.

The cyclic I/O data is configured by using the read and write process data mapping tables in the AC30. These tables are two parameter arrays in which AC30 parameter numbers may be added. AC30 parameters mapped to process data become 'candidates' for PDO transfer.

String-type parameters may not be mapped.

The CANopen manufacturer specific range (index 2001h to 5FFFh) of object entries corresponds directly to the AC30 parameter numbers.

Read Mapping

The read process data represents cyclic data sent from the master to the AC30. Only writable AC30 parameters, that are not configuration parameters, may be added to the read process data.

When the CANopen option first becomes operational, the read process data area will be pre-loaded once with data by reading the associated mapped AC30 parameters values.

Note that AC30 parameters that are mapped to the read process data may be written by the option even if they are not configured by the master for PDO transfer. The value written would be the original pre-loaded value.

Write Mapping

The write process data represents cyclic data sent from the AC30 to the PLC.

Mapping Arrays

Parameter arrays may be added into the process data, however this could lead to large amounts of data being passed across the communications. An alternative is to only reference the element(s) of the array required. This is possible as each element of a parameter array has its own parameter number. See the [Appendix A – Array Parameter Numbers](#).

If an array is added to the process data mapping, the master may choose to use only one or more elements of the array referenced by the associated object's sub-index. If the array is part of the read process data, any elements not configured by the master may still be written by the option. The value written would be the original pre-loaded value.

Default Mapping

The process data mapping will contain a factory default mapping. The default mapping may be overwritten if required.

Cyclic Data Exchange

Cyclic data exchange will occur when the option is in the OPERATIONAL (PROCESS ACTIVE) or STOP (IDLE) state.

However, the read process data will only update the mapped parameters when in the PROCESS ACTIVE state.

On a transition into the PROCESS ACTIVE state all read process mapped parameters will be updated.

When in the PROCESS ACTIVE state the read process mapped parameters will all update only when a change in the read process data occurs.

CANopen PDO Triggering Modes

The option supports two triggering modes.

Event Driven

Message transmission is triggered by:

Transmission Type	Description
254/255 COS	When process data have been changed.
1...240 Cyclic Synchronous	This is the expiration of the specified transmission period, synchronised by the reception of the SYNC object.
0 Acyclic Synchronous	The message shall be transmitted synchronously with the SYNC but not periodically, only when COS is fulfilled (SYNC and COS).

Timer Driven

Transmission Type	Description
254/255 COS/Timer	Message transmission is either triggered by the occurrence of a device-specific event (COS) or if specified has elapsed without the occurrence of the event.

CANopen Object Dictionary

Standard Objects

Index	Object Name	Sub-Index	Description	Type/ Access
0005h	Dummy object	00h	Dummy Object	U8 WO
0006h	Dummy Object	00h	Dummy Object	U16 WO
0007h	Dummy Object	00h	Dummy Object	U32 WO
1000h	Device Type	00h	Device Type	U32 RO
1001h	Error Register	00h	Error Register	U8 RO
1003h	Pre-define error field	00h	Number of errors	U8 RW
		01h .. 06h	Error field	U32 RO
1005h	COB-ID Sync	00h	COB-ID Sync	U32 RW
1008h	Manufacturer device name	00h	Manufacturer device name	Visible string RO
1009h	Manufacturer hardware version	00h	Manufacturer hardware version	Visible string RO
100Ah	Manufacturer software version	00h	Manufacturer software version	Visible string RO
100Ch	Guard time	00h	Guard time	U16 RW
100Dh	Life time factor	00h	Life time factor	U8 RW
		01h	Store all parameters	U32 RW
		02h	Store communication parameters	U32 RW
1011h	Restore parameters	00h	Largest sub index supported (04h)	U8 RO
		01h	Restore all default parameters	U32 RW
		02h	Restore communication default parameters	U32 RW
		04h	Restore manufacturer parameters to default	U32 RW
1014h	COB ID EMCY	00h	COB ID EMCY	U32 RO

Index	Object Name	Sub-Index	Description	Type/ Access
1015h	Inhibit Time EMCY	00h	Inhibit Time EMCY	U16 RW
1016h	Consumer Heartbeat Time	00h	Number of entries	U8 RO
		01h	Consumer Heartbeat Time	U32 RW
1017h	Producer Heartbeat Time	00h	Producer Heartbeat Time	U16 RW
1018h	Identify object	00h	Number of entries (04h)	U16 RW
		01h	Vendor ID	U32 RO
		02h	Product Code	U32 RO
		03h	Revision Number	U32 RO
		04h	Serial Number	U32 RO
1400h ... 141Fh	Receive PDO parameter	00h	Largest sub-index supported (02h)	U8 RO
		01h	COB ID used by PDO	U32 RW
		02h	Transmission type	U8 RW
1600h ... 161Fh	Receive PDO mapping	00h	No. of mapped application objects in PDO	U8 RW
		01h	Mapped object #1	U32 RW
		02h	Mapped object #2	U32 RW
		03h	Mapped object #3	U32 RW
		04h	Mapped object #4	U32 RW
		05h	Mapped object #5	U32 RW
		06h	Mapped object #6	U32 RW
		07h	Mapped object #7	U32 RW
		08h	Mapped object #8	U32 RW
1800h ... 181Fh	Transmit PDO parameter	00h	Largest sub-index supported (05h)	U8 RO
		01h	COB ID used by PDO	U32 RW
		02h	Transmission type	U8 RW

Index	Object Name	Sub-Index	Description	Type/Access
		03h	Inhibit time	U16 RW
		05h	Event timer (ms)	U16 RW
1A00h ... 1A1Fh	Transmit PDO mapping		No. of mapped application objects in PDO	U8 RW
			Mapped object #1	U32 RW
			Mapped object #2	U32 RW
			Mapped object #3	U32 RW
			Mapped object #4	U32 RW
			Mapped object #5	U32 RW
			Mapped object #6	U32 RW
			Mapped object #7	U32 RW
			Mapped object #8	U32 RW

Manufacturer Specific Objects

Each object entry in the manufacturer specific range (2001h to 5FFFh) corresponds to an AC30 parameter number, with parameter number 1 corresponding to object index 2001h, parameter number 2 to object index 2002h, etc.

For standard parameters (of a single element), sub-index 00h of the object represents the value of the parameter. Its data type and access depends on the AC30 parameter. Sub-index FFh represents the data type according to DS302.

For multiple element parameters (parameter arrays), sub-index 00h represents the number of parameter elements, sub-indexes 01h-FEh represents the value of each of the parameter elements and sub-index FFh represents the data type according to DS302.

In the example below parameter number 1 is a single element parameter and parameter number 2 is a 4-element parameter array:

AC30 Parameter	Index	Sub-index	Description	Type/Access
1	2001h	00h	Parameter value	Depends on parameter
		FFh	DS302 data type	U32 RO
2	2002h	00h	Number of elements	U8 RO
		01h	Parameter value of element 0	Depends on parameter
		02h	Parameter value of element 1	
		03h	Parameter value of element 2	
		04h	Parameter value of element 3	
		FFh	DS302 data type	U32 RO

CANopen EDS Files

An EDS file for the AC30 CANopen option may be downloaded from www.parker.com/ssd. The **AC30Default.eds** file has one RPDO and one TPDO each pre-mapped with the default AC30 option communications process data mapping.

Alternatively, an EDS file may be generated from the PDQ (Parker Drive Quicktool). All the AC30 parameters will be mapped as Manufacturer-Specific Objects. AC30 parameters included in the option communications process data will be mapped as objects which permit PDO mapping.

Example Configuration

Configuration Summary

Communications Settings	
Device Address	3
Baud Rate	Auto

Read Process Mapping Table		Data Type	Bytes
000	0627 Comms Control Word	WORD	2
001	0681 Comms Reference	REAL	4
002	000		
003	000		

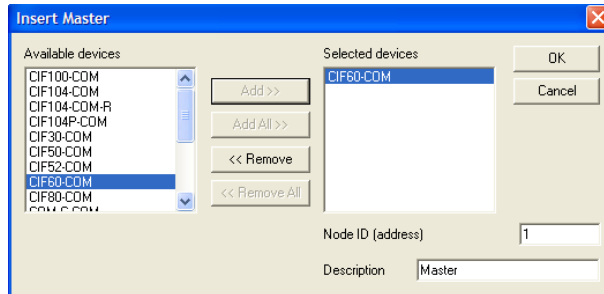
Write Process Mapping Table		Data Type	Bytes
000	0661 Status Word	WORD	2
001	0395 Actual Speed Percent	REAL	4
002	000		
003	000		

Example using a Hilscher CANopen Master

This example uses a Hilscher CIF 60-COM CANopen master.

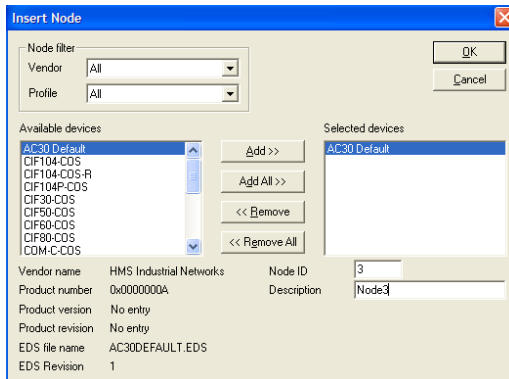
1. Create a new CANopen project.

Select **File** and **New** from the main menu. Next select **Insert** and **Master...** and choose **CIF60-COM**. The master node address may be set as required.



2. Add the AC30 slave.

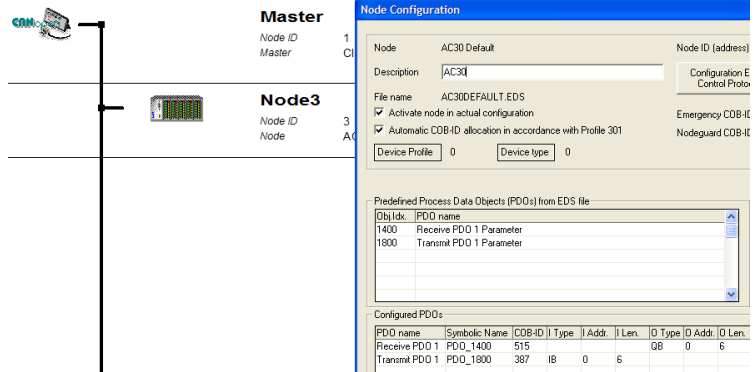
An EDS file must first be copied. In this example the 'AC30Default' EDS configuration file will be used. In this EDS file the four parameters to be mapped have been pre-defined. This can be downloaded from www.parker.com/ssd, then select **File** and **Copy EDS** from the menu.



Select **Insert** and **Node...** and click to add to bus. From the available devices choose **AC30Default**.

Change the **Node ID** to **3** and change the **Description** if required, and then click OK.

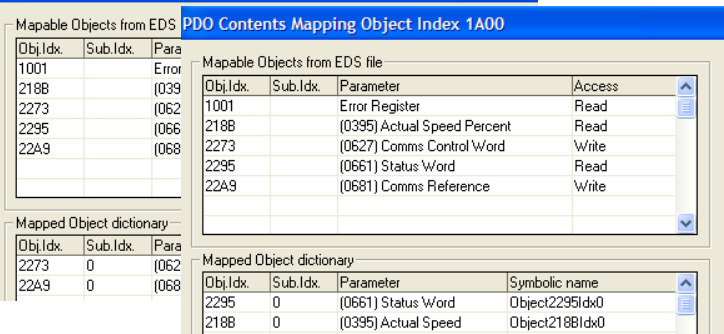
3. Configure the AC30 slave.



Double-click on the slave so that the **Node Configuration** window opens. Two PDOs will be available in the **Predefined Process Data Objects...** list. These may be added into the **Configured PDOs** list by double-clicking on each one. The opportunity will be given to modify the PDO characteristics from the defaults in the EDS file.

These PDOs have pre-defined mappings. To see these mappings, double-click on either PDO. Click OK when finished.

PDO Contents Mapping Object Index 1600



4. Download the configuration.


Click on the master and select **Settings** and **Bus Parameter** from the menu. The baud rate may be changed if required.

Next select **Online** and **Download...** from the menu.


Configuring the AC30

AC30 Parker Drive Quicktool (PDQ)


When performing an online configuration, the fitted option card will automatically be selected. In offline mode, parameter **0044 Comms required** must be set to CANOPEN:

 Create a New Drive - Drive

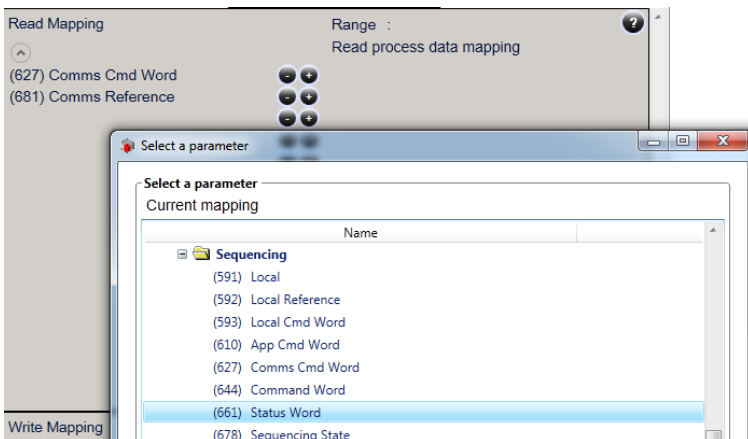
Choose a Task

Power Stack	4.5A 400V
 Comms Required	CANOPEN <input type="button" value="v"/>
Range :	NONE
Type of communication option required by application	BACNET IP
	BACNET MSTP
	CANOPEN
IO Option Type	CC LINK
	CONTROLNET
Drive Name	DEVICENET
	ETHERCAT
	ETHERNET IP
	MODBUS RTU
	MODBUS TCP
	PROFIBUS DPV1
	PROFINET IO

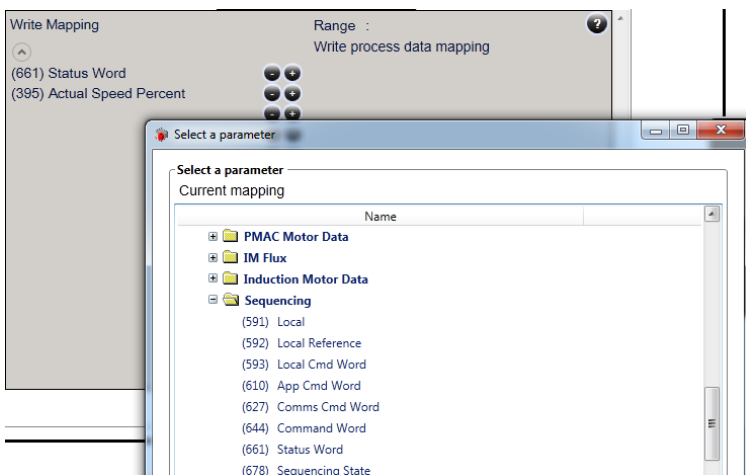
Set the **0212 CANopen Node Address** and **0213 CANopen Baud Rate** parameters to the required value:

 CANopen Node Address	<input type="text" value="1"/>
Range : 1 ---> 127	
Node address	
CANopen Baud Rate	AUTO

Add the required parameters to the Read Process Mapping table (parameter **0055 Read Mapping**) by selecting them from the popup window:



Add the required parameters to the Write Process Mapping table (parameter **0120 Write Mapping**) by selecting them from the popup window:



Note the Process Data mapping ends on the first empty entry.

Acyclic Data Exchange

AC30 parameters may be accessed using the SDO (Service Data Object) protocol. The parameter numbers are mapped to the manufacturer specific range as described in the Manufacturer Specific Objects section above.

Accessing Parameters

The value of a single-element AC30 parameter is accessed by via its corresponding object:

$$\text{index} = 2000h + \text{parameter number}$$

$$\text{sub-index} = 00h$$

The values of a multi-element AC30 parameter are accessed via its corresponding object:

$$\text{index} = 2000h + \text{parameter number}$$

$$\text{sub-index} = \text{element number} + 1$$

Alternatively, each element has its own parameter number and may be accessed via its corresponding object index. See [Appendix A – Array Parameter Numbers](#).

A string parameter array must be accessed via each element of the array. Each element has its own parameter number.

Status Codes

The following CANopen report codes may be reported:

CANopen Abort Code #	Description
0602 0000h	Object does not exist in the object dictionary (parameter does not exist)
0609 0011h	Sub-index does not exist
0601 0002h	Attempt to write to read-only object
0601 0001h	Attempt to read a write-only object
0607 0012h	Data type does not match. Too much data.
0607 0013h	Data type does not match. Not enough data.
0609 0030h	Out of range.

Lost Communications Trip

Supervised Parameter

The **0047 Comms Supervised** parameter indicates that the CANopen network participation is supervised by another CANopen device.

The Supervised parameter value is set to TRUE when either:

- The Heartbeat consumer *and* Heartbeat producer is enabled and error free, or
- Node guarding is enabled and error free

Comms Break Trip

The Comms Break trip will generate a trip if a break in communications is detected. A trip event will be generated when a transition from TRUE to FALSE of the parameter **0047 Comms Supervised** occurs.

To enable the Comms Break trip, the parameter **0048 Comms Trip Enable** must be set to TRUE *and* the **COMMS BREAK** bit set in the parameter **0697 Enable 1-32**.

For more information on enabling trips see Chapter 10 Trips & Fault Finding in the AC30 Product Manual HA501718U001.

Diagnostic Event

A single diagnostic event may be created. The severity is fixed as Minor Recoverable.

When a diagnostic instance is created a new entry is created in object entry 1003h sub-index 01h (UNSIGNED32) as given below.

High Byte		Low byte	
Not used	Not used	Event Code	00h

The number of entries is found in object entry 1003h sub-index 00h.

The Error Register (object 1001h) is set with the corresponding bit information.

The EMCY Object is sent to the network with the following information.

Byte			Byte 7
00h	Event Code	Error register	Not used

Four AC30 parameters are associated with the diagnostic event:

0185 Comms Event Code

This code will be entered into object 1003h sub-index 01h when the diagnostic become active.

0186 Comms Event Set

A rising edge signal from FALSE to TRUE will create a diagnostic event. The **Comms Event Clear** parameter must be set FALSE.

0187 Comms Event Clear

A rising edge signal from FALSE to TRUE will remove a diagnostic event. The **Comms Event Set** parameter must be set to FALSE.

0188 Event Active

This parameter indicates if a diagnostic event is active or not.

Note: The rising edge signals for Comms Event Set and Comms Event Clear must be held for at least 10ms in FALSE and at least 10ms in TRUE to take effect.

Parameters

Configuration Parameters

0044 Comms Required		Range	RW	Saved	Config
Type	USINT (enumerated)	(1) NONE	✓	✓	✓
Default	NOT FITTED	(2) BACNET IP			
Communications option parameter. Sets the required communications option.		(3) BACNET MSTP			
		(4) CANOPEN			
		(5) CC LINK			
		(6) CONTROLNET			
		(7) DEVICENET			
		(8) ETHERCAT			
		(9) ETHERNET IP			
		(10) MODBUS RTU			
		(11) MODBUS TCP			
		(12) PROFIBUS DPV1			
		(13) PROFINET IO			

0212 CANopen Node Address		Range	RW	Saved	Config
Type	USINT	1	✓	✓	✓
Default	0	...			
CANopen communications option parameter. Sets the required node address.		127			

0213 CANopen Baud Rate		Range	RW	Saved	Config
Type	USINT (enumerated)	(0) 10 KBPS	✓	✓	✓
Default	AUTO	(1) 20 KBPS			
		(2) 50 KBPS			
CANopen communications option parameter.		(3) 100 KBPS			
Sets the required baud rate. If set to AUTO the baud rate will be automatically detected.		(4) 125 KBPS			
		(5) 250 KBPS			
		(6) 500 KBPS			
		(7) 800 KBPS			
		(8) 1000 KBPS			
		(9) AUTO			

0055 Read Mapping		Range	RW	Saved	Config
Type	Array of UINT	0	✓	✓	✓
Default	0	...			
Communications option parameter.		Last parameter number			
Sets the required read process data mapping.					
Each entry in the table represents the required parameter number.					

0120 Write Mapping		Range	RW	Saved	Config
Type	Array of UINT	0	✓	✓	✓
Default	0	...			
Communications option parameter.		Last parameter number			
Sets the required write process data mapping.					
Each entry in the table represents the required parameter number.					

0048 Comms Trip Enable		Range	RW	Saved	Config
Type	BOOL	FALSE	✓	✓	✗
Default	FALSE	TRUE			
Communications option parameter. Enables the communications trip.					

Runtime Parameters

0185 Comms Event Code		Range	RW	Saved	Config
Type	BYTE	0x00	✓	✗	✗
Default	0	...			
Communications option parameter. Sets the event code to be used when a diagnostic event is created.		0xFF			

0186 Comms Event Set		Range	RW	Saved	Config
Type	BOOL	FALSE	✓	✗	✗
Default	FALSE	TRUE			
Communications option parameter. A rising edge (FALSE to TRUE) will create a diagnostic event.					

0188 Comms Event Clear		Range	RW	Saved	Config
Type	BOOL	FALSE	✓	✗	✗
Default	TRUE	TRUE			
Communications option parameter. A rising edge (FALSE to TRUE) will remove a diagnostic event.					

Diagnostic Parameters

0045 Comms Fitted		Range
Type	USINT (enumerated)	(0) UNKNOWN
		(1) NONE
Communications option parameter. Indicates the communications option fitted.		(2) BACNET IP
		(3) BACNET MSTP
		(4) CANOPEN
		(5) CC LINK
		(6) CONTROLNET
		(7) DEVICENET
		(8) ETHERCAT
		(9) ETHERNET IP
		(10) MODBUS RTU
		(11) MODBUS TCP
		(12) PROFIBUS DPV1
		(13) PROFINET IO

0046 Comms State		Range
Type	USINT (enumerated)	(0) SETUP – setup in progress
		(1) NW INIT – network-related initialisation tasks are being performed
Communications option parameter.		(0) WAIT PROCESS – PRE-OPEATIONAL state
Indicates the state of the communications option fitted.		(2) IDLE – STOP state
		(3) PROCESS ACTIVE – OPERATIONAL state
		(4) ERROR – BUS OFF state
		(5) RESERVED
		(6) EXCEPTION – unrecoverable error
		(7) NONE – option not fitted

0211 CANopen State		Range
Type	USINT (enumerated)	(0) SETUP – setup in progress
		(1) NW INIT – network-related initialisation tasks are being performed
CANopen communications option parameter.		(2) PRE-OPERATIONAL – PRE-OPEATIONAL state
Indicates the state of the communications option fitted as the parameter 0046 Comms State , but using specific enumerated strings for CANopen.		(3) STOP – STOP state
		(4) OPERATIONAL – OPERATIONAL state
		(5) BUS OFF – network error
		(6) RESERVED
		(7) EXCEPTION – unrecoverable error
		(8) NONE – option not fitted

1251 CANopen Actual Baud		Range
Type	USINT (enumerated)	(0) 10 KBPS
		(1) 20 KBPS
		(2) 50 KBPS
		(3) 100 KBPS
		(4) 125 KBPS
		(5) 250 KBPS
		(6) 500 KBPS
		(7) 800 KBPS
		(8) 1000 KBPS
		(9) AUTO
CANopen communications option parameter. The actual baud rate of the device. AUTO indicates auto-detection of the baud rate is in progress.		

0047 Comms Supervised		Range
Type	BOOL	FALSE
		TRUE
Communications option parameter. Indicates that the CANopen network participation is supervised by another CANopen device.		

0049 Comms Module Version		Range
Type	DWORD	0x00000000
		...
		0xFFFFFFFF
Communications option parameter. Firmware version of the option communications module.		The most significant byte is the major version number, followed by the minor version number. The least significant byte is the build number.

0050 Comms Module Serial		Range
Type	DWORD	0x00000000 ... 0xFFFFFFFF
Communications option parameter. Serial number of the option communications module.		

0051 Comms Diagnostic		Range
Type	USINT (enumerated)	(0) NONE (1) HARDWARE MISMATCH – required communications option does not match that fitted, or no option fitted but one is required. (2) INVALID CONFIGURATION – the configuration of the option is not valid. (3) MAPPING FAILED – the process data mapping is not permitted, e.g. adding read-only parameters to the read process data mapping. (4) EXCEPTION – configuration error (5) UNSUPPORTED OPTION – the fitted option is not currently supported
Communications option parameter. Indicates the state of the communications option fitted.		

0052 Comms Diagnostic Code		Range
Type	DWORD	0x00000000 ... 0xFFFFFFFF
Communications option parameter. Diagnostic code associated with the Diagnostic parameter.		

0053 Comms Exception		Range
Type	BYTE	0x00 ... 0xFF
Communications option parameter. Exception code associated with the Diagnostic parameter being in EXCEPTION		

0054 Comms Net Exception		Range
Type	BYTE	0x00 ... 0xFF
Communications option parameter. Network specific exception code associated with the Diagnostic parameter being in EXCEPTION		

0186 Comms Event Active		Range
Type	BOOL	FALSE TRUE
Communications option parameter. Indicates a diagnostic event is active.		

Troubleshooting

Configuration problems can often be identified by looking at the Run and Error LEDs and from the CANopen State and Diagnostic parameters. Under normal operating conditions the Diagnostic parameter should indicate *NONE*. Other values are summarized in the [Diagnostic Parameters](#) section.

Hardware Mismatch

Diagnostic = HARDWARE MISMATCH

- The required option does not match the actual fitted option.
- No option is fitted but one is required.

Invalid Configuration

Diagnostic = INVALID CONFIGURATION

- Invalid read or write process data mapping
- Invalid communication settings

Diagnostic = MAPPING FAILED

- Attempting to map a parameter that does not exist.
- Attempting to map a configuration parameter.
- Attempting to map a string parameter.
- Attempting to map a read-only parameter to the read process data.

Appendix A – Array Parameter Numbers

Some parameters have multiple elements and are classified as parameter arrays. A parameter array has a parameter number that accesses the *whole* of the array. It also has parameter numbers that represent each *element* of the array.

Array Example

A parameter array called **My Array** has 4 elements.

Parameter Number	Parameter - My Array
0152	Whole array
0153	index 0
0154	index 1
0155	index 2
0156	index 3

If the parameter number of the whole array is 0152, then the parameter number of the element index 0 of the array will be 0153, the parameter number of the element index 01 will be 0154, etc.

Note that *string* array parameters access their elements via parameter numbers that are calculated in a different way. See the AC30 Product Manual HA501718U001 for more details

Appendix B – Data Types

The AC30 parameter data type and size and corresponding CANopen data type is given in the table below.

AC30 Parameter		CANopen	
Data Type	Description	Data Type	Bytes
BOOL	Boolean	UNSIGNED8	1
SINT	Short integer	INTEGER8	1
INT	Integer	INTEGER16	2
DINT	Double integer	INTEGER32	4
USINT	Unsigned short integer	UNSIGNED8	1
UINT	Unsigned integer	UNSIGNED16	2
UDINT	Unsigned double integer	UNSIGNED32	4
REAL	Floating point	REAL32	4
TIME	Duration	UNSIGNED32	4
DATE	Date	UNSIGNED32	4
TIME_OF_DAY	Time of day	UNSIGNED32	4
DATE_AND_TIME	Date and time of day	UNSIGNED32	4
STRING	String	VISIBLE STRING	n
BYTE	Bit string length 8	UNSIGNED8	1
WORD	Bit string length 16	UNSIGNED16	2
DWORD	Bit string length 32	UNSIGNED32	4

Parker Worldwide

AE – UAE, Dubai
Tel: +971 4 8127100
parker.me@parker.com

AR – Argentina, Buenos Aires
Tel: +54 3327 44 4129

AT – Austria, Wiener Neustadt
Tel: +43 (0)2622 23501-0
parker.austria@parker.com

AT – Eastern Europe, Wiener Neustadt
Tel: +43 (0)2622 23501 900
parker.easteurope@parker.com

AU – Australia, Castle Hill
Tel: +61 (0)2-9634 7777

AZ – Azerbaijan, Baku
Tel: +994 50 2233 458
parker.azerbaijan@parker.com

BE/LU – Belgium, Nivelles
Tel: +32 (0)67 280 900
parker.belgium@parker.com

BR – Brazil, Cachoeirinha RS
Tel: +55 51 3470 9144

BY – Belarus, Minsk
Tel: +375 17 209 9399
parker.belarus@parker.com

CA – Canada, Milton, Ontario
Tel: +1 905 693 3000

CH – Switzerland, Etoy
Tel: +41 (0)21 821 87 00
parker.switzerland@parker.com

CL – Chile, Santiago
Tel: +56 2 623 1216

CN – China, Shanghai
Tel: +86 21 2899 5000

CZ – Czech Republic, Klecany
Tel: +420 284 083 111
parker.czechrepublic@parker.com

DE – Germany, Kaarst
Tel: +49 (0)2131 4016 0
parker.germany@parker.com

DK – Denmark, Ballerup
Tel: +45 43 56 04 00
parker.denmark@parker.com

ES – Spain, Madrid
Tel: +34 902 330 001
parker.spain@parker.com

FI – Finland, Vantaa
Tel: +358 (0)20 753 2500
parker.finland@parker.com

FR – France, Contamine s/Arve
Tel: +33 (0)4 50 25 80 25
parker.france@parker.com

GR – Greece, Athens
Tel: +30 210 933 6450
parker.greece@parker.com

HK – Hong Kong
Tel: +852 2428 8008

HU – Hungary, Budapest
Tel: +36 1 220 4155
parker.hungary@parker.com

IE – Ireland, Dublin
Tel: +353 (0)1 466 6370
parker.ireland@parker.com

IN – India, Mumbai
Tel: +91 22 6513 7081-85

IT – Italy, Corsico (MI)
Tel: +39 02 45 19 21
parker.italy@parker.com

JP – Japan, Tokyo
Tel: +81 (0)3 6408 3901

KR – South Korea, Seoul
Tel: +82 2 559 0400

KZ – Kazakhstan, Almaty
Tel: +7 7272 505 800
parker.easteurope@parker.com

MX – Mexico, Apodaca
Tel: +52 81 8156 6000

MY – Malaysia, Shah Alam
Tel: +60 3 7849 0800

NL – The Netherlands, Oldenzaal
Tel: +31 (0)541 585 000
parker.nl@parker.com

NO – Norway, Asker
Tel: +47 66 75 34 00
parker.norway@parker.com

NZ – New Zealand, Mt Wellington
Tel: +64 9 574 1744

PL – Poland, Warsaw
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

PT – Portugal, Leca da Palmeira
Tel: +351 22 999 7360
parker.portugal@parker.com

RO – Romania, Bucharest
Tel: +40 21 252 1382
parker.romania@parker.com

RU – Russia, Moscow
Tel: +7 495 645-2156
parker.russia@parker.com

SE – Sweden, Spånga
Tel: +46 (0)8 59 79 50 00
parker.sweden@parker.com

SG – Singapore
Tel: +65 6887 6300

SK – Slovakia, Banská Bystrica
Tel: +421 484 162 252
parker.slovakia@parker.com

SL – Slovenia, Novo Mesto
Tel: +386 7 337 6650
parker.slovenia@parker.com

TH – Thailand, Bangkok
Tel: +662 717 8140

TR – Turkey, Istanbul
Tel: +90 216 4997081
parker.turkey@parker.com

TW – Taiwan, Taipei
Tel: +886 2 2298 8987

UA – Ukraine, Kiev
Tel: +380 44 494 2731
parker.ukraine@parker.com

UK – United Kingdom, Warwick
Tel: +44 (0)1926 317 878
parker.uk@parker.com

US – USA, Cleveland
Tel: +1 216 896 3000

VE – Venezuela, Caracas
Tel: +58 212 238 5422

ZA – South Africa, Kempton Park
Tel: +27 (0)11 961 0700
parker.southafrica@parker.com

European Product Information Centre

Free phone: 00 800 27 27 5374

(from AT, BE, CH, CZ, DE, EE, ES, FI, FR, IE, IL, IS, IT, LU, MT, NL, NO, PT, SE, SK, UK)

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**Parker Hannifin Manufacturing Limited,
Automation Group, SSD Drives Europe,**
New Courtwick Lane, Littlehampton,
West Sussex BN17 7RZ
United Kingdom
Tel: +44(0)1903 737000
Fax: +44(0)1903 737100
www.parker.com/ssd

