



Option Modules

DeviceNet Option

HA501840U001 Issue 2
Technical Manual

aerospace
climate control
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filtration
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AC30 DeviceNet Option

Technical Manual HA501840U001 Issue 2

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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
---	---	---	--------------------------------	---	--	---	--

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 DEVICENET OPTION

Introduction

Features

- DeviceNet
- Up to 500 Kbits/s baud rate and automatic baud rate detection
- Galvanically isolated bus via a 5-way terminal block
- Network and Module status LEDs
- Up to 256 bytes of consumed data and 256 bytes of produced data
- CIP Parameter Object support
- Explicit messaging
- Bit-strobed I/O
- Change-of-state / Cyclic I/O
- Polled I/O
- EDS file provided

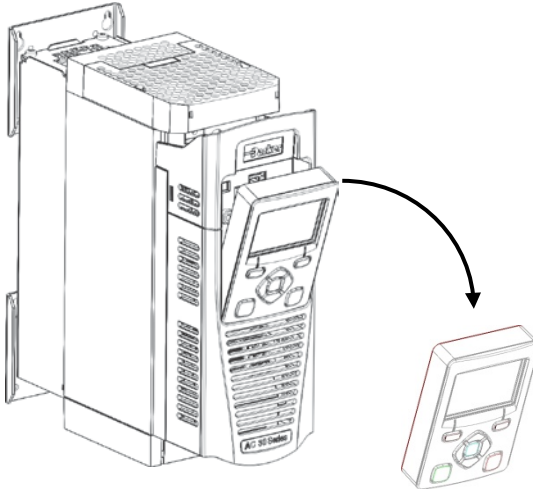
Product Code

The product code for the DeviceNet Option is:

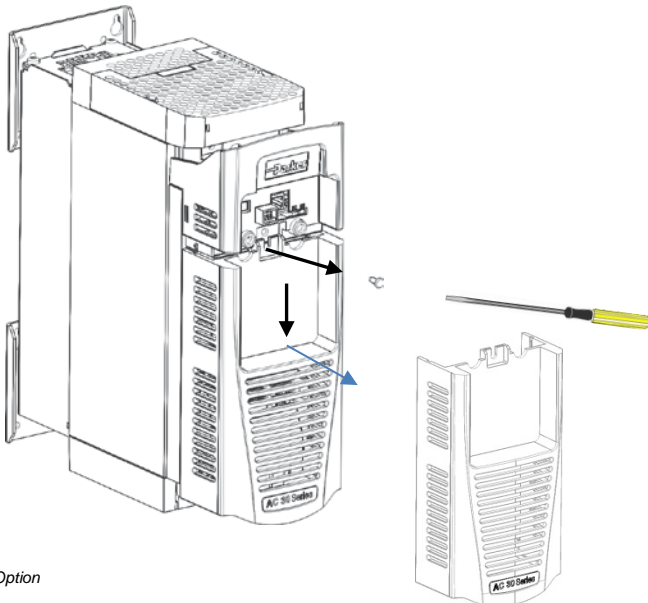
7003-DN-00

Installation

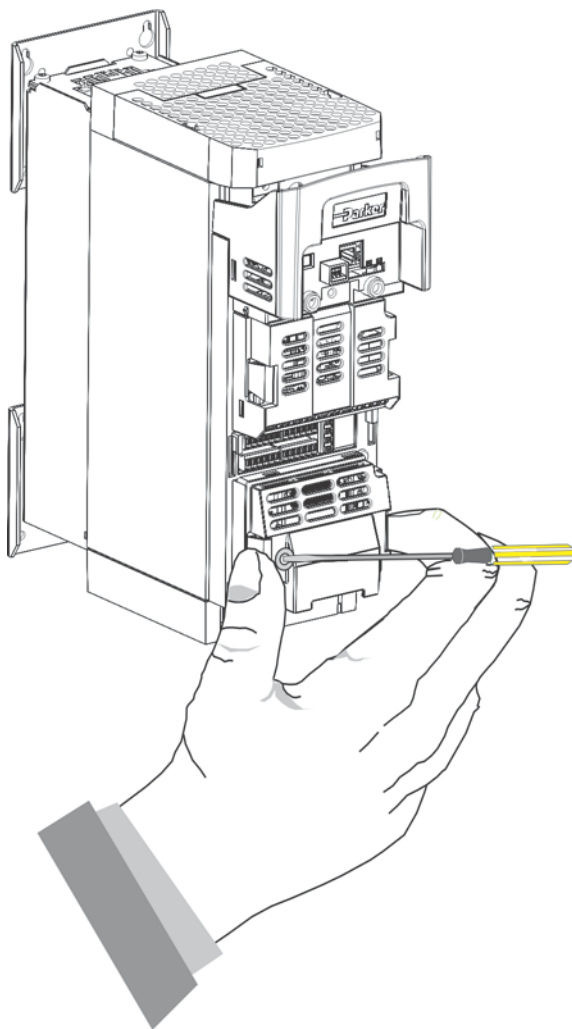
1. Remove the Graphical Keypad (GKP) by pulling from the top down, and remove.



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

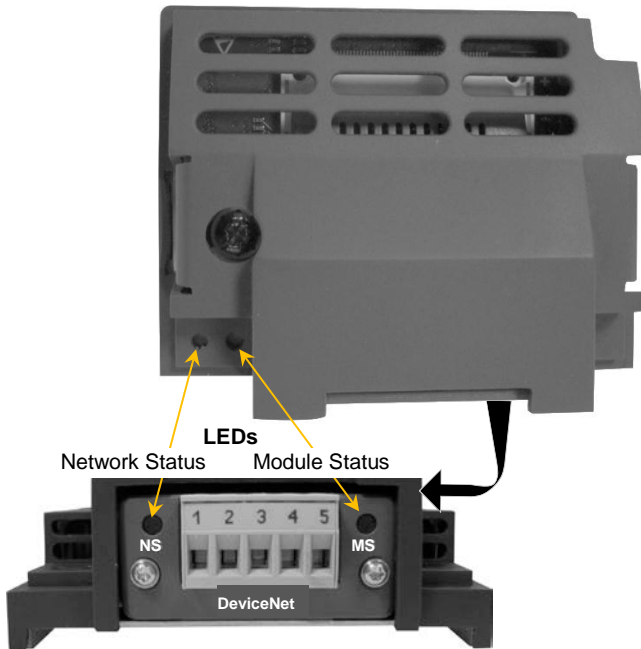


3. Click the Option into place and tighten the retaining screw, as shown.



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

Connecting to the DeviceNet Network



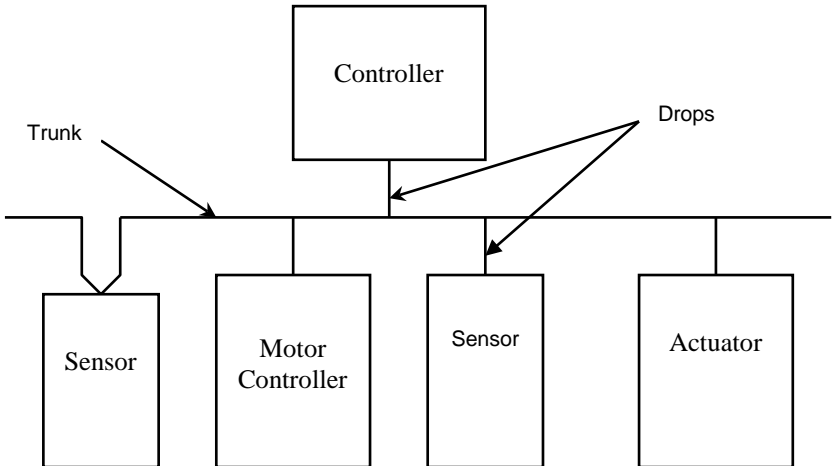
Note: DeviceNet with optional connector attached

Pin	Signal	Description	Wire Colour
1	V-	Negative bus supply voltage	Black
2	CAN_L	CAN low bus line	Blue
3	SHIELD	Cable shield. Connected to protective earth via a filter	
4	CAN_H	CAN high bus line	White
5	V+	Positive bus supply voltage	Red

DeviceNet is a 4-wire system. Two wires convey the DeviceNet data and the remaining two wires convey power if the product is remotely powered. Remote powering is recommended and is necessary if the network is to remain operational between other devices when the drive is powered down.

Cable Specification

The DeviceNet specification makes recommendations for cable type depending on whether the cable is to serve in a trunk or a drop.



Full cable specifications are provided in the ODVA DeviceNet specification, Volume1 appendix B.

A summary is given here.

	Trunk cable	Drop cable
Signal wires	Twisted pair, #18. Blue / white	Twisted pair, #24. Blue / white
Power wires	Twisted pair, #15. Black / red	Twisted pair, #22. Black / red
Shield	Foil / braid with drain wire (#18); bare. Each pair shielded separately in aluminized mylar. Combined pair shielded	Foil / braid with drain wire (#22); bare. Signal pair shielded in foil. Overall braid shield
Internal insulation	PVC insulation on power pair	PVC insulation on power pair
Electrical	High speed (VP ≥ 0.75), low loss, low distortion data pair.	High speed (VP ≥ 0.75), low loss, low distortion data pair.
Characteristic impedance of data pair	120 Ω ± 10%	120 Ω ± 10%

Maximum Cable Lengths

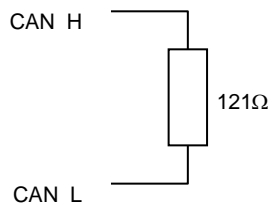
The maximum cable length depends on the baud rate selected:

Data Rate	Trunk Distance	Drop Length	
		Maximum	Cumulative
125kbaud	500 metres (1600 ft.)	3 metres (10ft)	156 metres (512 ft.)
250kbaud	200 metres (600 ft.)		78 metres (256 ft.)
500kbaud	100 metres (300 ft.)		39 metres (128 ft.)

Bus Termination

If the drive is at the end of the trunk it must have a terminating resistor. Connect a terminating resistor to the last drive between Pin 2 and Pin 4 as shown. (The resistor is $\pm 1\%$, minimum $\frac{1}{4}$ Watt).

The DeviceNet specification recommends 121Ω , but it should be chosen to equal as closely as possible the characteristic impedance of the cable.

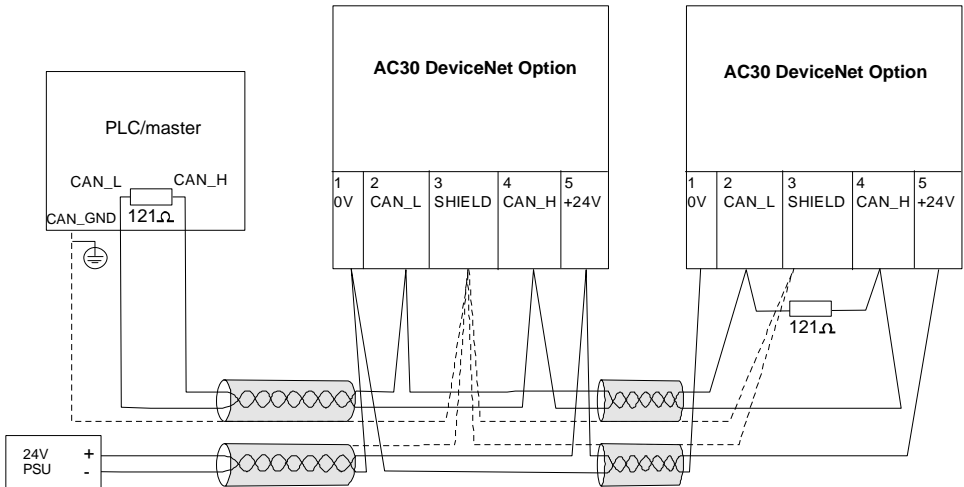


Important: Failing to fit terminating resistors correctly may result in unreliable operation.

For more information about cabling and terminators, refer to www.ODVA.org

NOTE The connector conforms to the DeviceNet recommended terminal assignment.

Wiring Diagram Example



LEDs

Network Status (NS) LED

State	Indication
Off	Not online / No power
Green	On-line, one or more connections are established
Flashing Green (1Hz)	On-line, no connections established
Red	Critical link failure
Flashing Red (1Hz)	One or more connections timed-out
Alternating Red/Green	Self test

Module Status (MS) LED

State	Indication
Off	No power
Green	Operating in normal condition
Flashing Green (1Hz)	Missing or incomplete configuration
Red	Unrecoverable Fault(s)
Flashing Red (1Hz)	Recoverable Fault(s)
Alternating Red/Green	Self test

Configuration

The option requires configuration of the MAC ID, baud rate and mapping of the process data to the master. The Producer Assembly instance number and Consumer Assembly instance number may be changed from the defaults if required. Note that some communication parameters only become active after the AC30 leaves the configuration state.

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

MAC ID

The **0219 DeviceNet MAC ID** parameter must be set. The range is 0 - 63.

Baud Rate

The **0220 DeviceNet Baud Rate** parameter must be set. If AUTO is chosen then the baud rate will be automatically detected.

Producing / Consuming Instance Numbers

The Producing Instance Number may be changed from its default of 0064h if required using the parameter **0222 DNET Producing Inst**

The Consuming Instance Number may be changed from its default of 0096h if required using the parameter **0223 DNET Consuming Inst**

Process 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.

At least one AC30 parameter must be mapped to the process data. String-type parameters may not be mapped.

Read Mapping

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

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](#).

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 a Class 0 connection is established (active or idle). 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.

DeviceNet Supported CIP Objects

The following CIP objects are supported:

- Identity Object (01h)
- Message Router (02h)
- DeviceNet Object (03h)
- Assembly Object (04h)
- Connection Object (05h)
- Parameter Object (0Fh)
- Acknowledge Handler Object (2Bh)
- Vendor Specific Object (A2h)

Example Configuration

Configuration Summary

Communications Settings	
MAC ID	5
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 RSNetWorx for DeviceNet

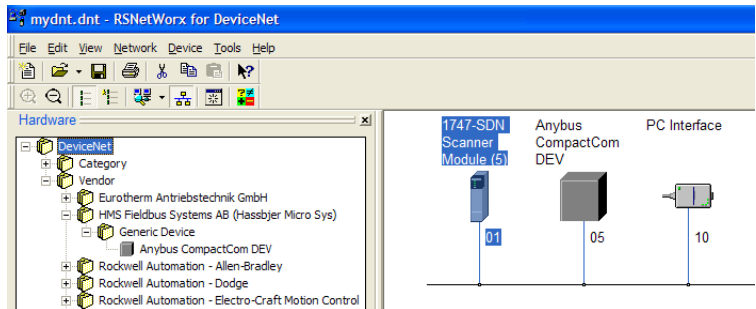
Prior knowledge of the Allen Bradley RSNetWorx for DeviceNet software is assumed. The following is an example of configuring the PLC.

1. Create a new configuration file and install EDS file

Start RSNetwork for DeviceNet. From the menu, click on **File** and **New** to create a new DeviceNet configuration.

From the menu, click on **Tools** and **EDS Wizard** to install the EDS file. When prompted select **Register a single file**. The EDS file can be downloaded from www.parker.com/ssd

2. Add the devices to the network.



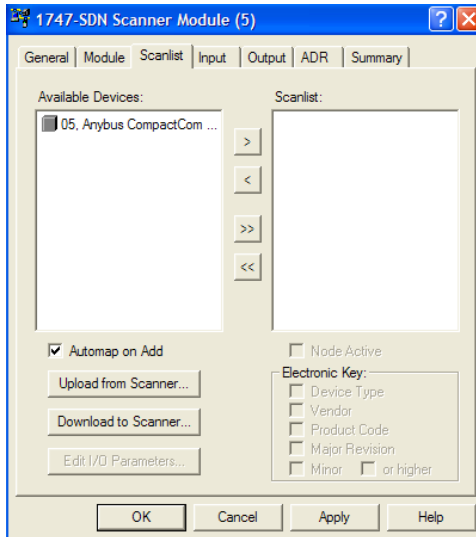
The PLC DeviceNet Scanner, any DeviceNet PC interface and DeviceNet devices may be added to the network by selecting from the Hardware list and dragging onto the network.


The AC30 DeviceNet option is found under **Vendor::HMS Fieldbus Systems AB::Generic Device::Anybus CompactCOM DEV**

Alternatively, any DeviceNet devices that are configured and powered-up on the network can be automatically browsed for by clicking on the menu **Network** and **Single Pass Browse**.

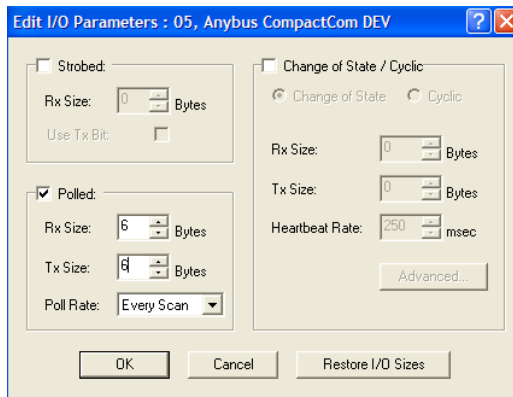
3. Connecting an AC30 option to a scanner.

To make a connection between the scanner and the option, double-click on the scanner icon, and then click on the **Scanlist** tab.



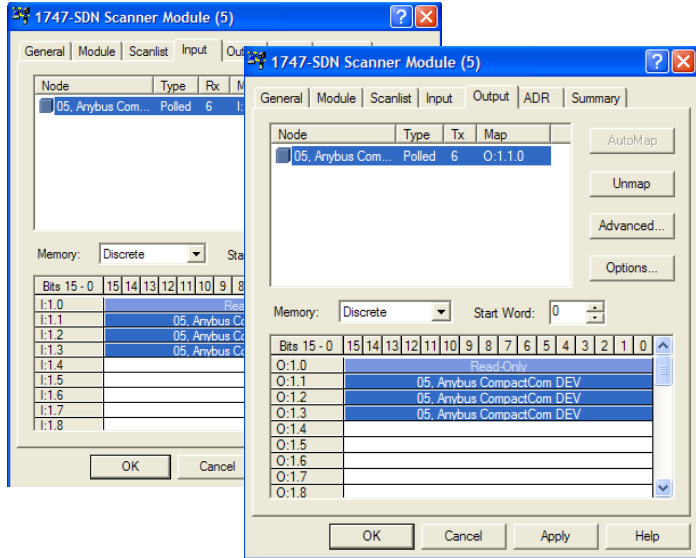
Add the device into the Scanlist by clicking on 

Next, click on Edit I/O parameters to specify the number of bytes to be transferred.



In this example polled I/O will be used with 6 bytes receive and 6 bytes transmit to match the process data configuration in the AC30. Click on OK and confirm the Automapping warning.

Click on the Input and Output tabs to view the mappings. Click OK when finished.



4. Download the configuration.

From the menu select **Network** and **Download to Network**, ensure that the PLC is in the PROG mode.

When the download is complete, switch the PLC to RUN mode to start data transfer between the PLC and AC30.

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 **DEVICENET**.

Parker Create a New Drive - Drive

Choose a Task | Drive | Application | Motor | Motor Control | Input/Output

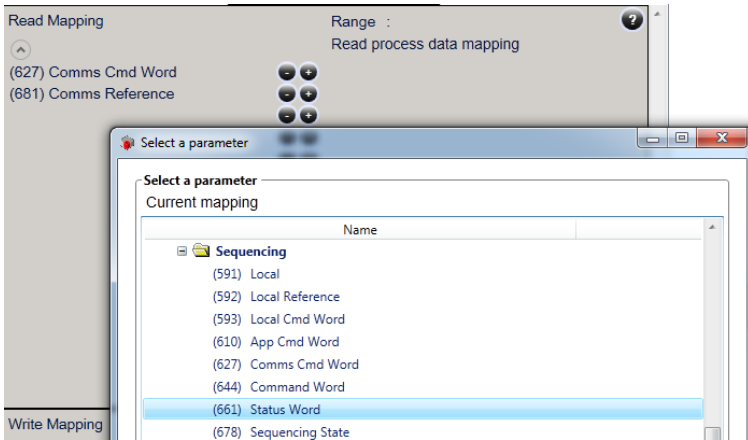
Power Stack	4.5A 400V
Comms Required	DEVICENET
Range :	
Type of communication option required by application	NONE BACNET IP BACNET MSTP CANOPEN CC LINK CONTROLNET
IO Option Type	
Drive Name	DEVICENET ETHERCAT ETHERNET IP MODBUS RTU MODBUS TCP PROFIBUS DPV1 PROFINET IO

In the Application tab, the following settings are available in the Communications block.

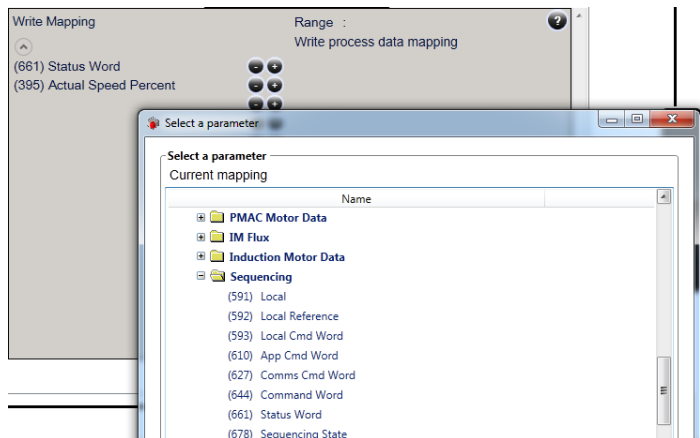
Set the **0219 DeviceNet MAC ID** and **0220 DeviceNet Baud Rate** as below:

DeviceNet MAC ID	0
Range :	0 ---> 63
MAC ID	
DeviceNet 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 acyclically using explicit messaging via vendor specific object **A2h**.

Overview

The instance number of this object corresponds directly to the AC30 parameter number. The supported services are **Get Attribute Single** and **Set Attribute Single**. The instance attributes are summarized as:

#	Attribute Name	Access / Type	Description
1	Name	Get / SHORT_STRING	Parameter name
2	Data Type**	Get / USINT	Data Type Code
3	No. of elements	Get / USINT	No. of elements of the parameter
4	Descriptor	Get / USINT	Bit 0=Get Access Bit 1= Set Access
5	Value	Get/Set / Depends on parameter	Parameter value
6	Max Value	Get / Depends on parameter	Maximum allowed parameter value
7	Min Value		Minimum allowed parameter value
8	Default Value		Not supported

** The Data Type Code can be found Appendix B – Data Types

The class attributes are summarized as:

#	Attribute Name	Access / Type	Description
1	Revision	Get / UINT	Object revision (0001h)
2	Max Instance	Get / UINT	Highest parameter number
3	No. of instances	Get / UINT	Number of instances

Arrays

Parameter arrays may be accessed either as a whole or as a single element.

Using the parameter number (instance number) that represents the whole parameter with attribute 5 will return / modify the contents of all elements. Using the parameter number that represents a single element will allow access only to that element.

See [Appendix A – Array Parameter Numbers](#).

Strings

String parameters may be accessed via its parameter number. This is in the format of a SHORT_STRING. See [Appendix B – Data Types](#).

String arrays may not be accessed as a whole array, but may be accessed via each element. Each element has its own parameter number. See the AC30 Product Manual HA501718U001 for more information.

Lost Communications Trip

Supervised Parameter

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

The Supervised parameter value is set to TRUE when the connection object has a connection.

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.

This is represented on the network through the CIP Identity Object:
Identity Object (01h)

Instance #1

Attribute #5 (Status)

Bit #8 (Minor Recoverable Faults)

Three AC30 parameters are associated with the diagnostic event:

0187 Comms Event Set

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

0188 Comms Event Clear

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

0186 Comms 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.

When a diagnostic event is active the Module Status LED will flash red.

Parameters

Configuration Parameters

0044 Comms Required		Range	RW	Saved	Config
Type	USINT (enumerated)	(1) NONE	✓	✓	✓
Default	NONE	(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			

0219 DeviceNet MAC ID		Range	RW	Saved	Config
Type	USINT	0	✓	✓	✓
Default	0	...			
DeviceNet communications option parameter. Sets the MAC ID of the device.		63			

0220 DeviceNet Baud Rate		Range	RW	Saved	Config
Type	USINT (enumerated)	(0) 125 KPS	✓	✓	✓
Default	AUTO	(1) 250 KPS			
		(2) 500 KPS			
		(3) AUTO			
<p>DeviceNet communications option parameter.</p> <p>Sets the baud rate. If AUTO is chosen then the baud rate will be automatically detected.</p>					

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

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

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

0222 DNet Producing Inst		Range	RW	Saved	Config
Type	WORD	0x0000	✓	✓	✓
Default	0064	0xFFFF			
DeviceNet communications option parameter. Sets the Producing Instance Number for DeviceNet.					

0223 DNet Consuming Inst		Range	RW	Saved	Config
Type	WORD	0x0000	✓	✓	✓
Default	0096	0xFFFF			
DeviceNet communications option parameter. Sets the Consuming Instance Number for DeviceNet.					

Runtime Parameters

0187 Comms Event Set		Range	RW	Saved	Config
Type	BOOL	FALSE	✓	x	x
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	✓	x	x
Default	FALSE	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.		(2) BACNET IP
Indicates the communications option fitted.		(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.		(2) WAIT PROCESS – the module will stay in this state until a Class 0 connection is opened
Indicates the state of the communications option fitted.		(3) IDLE – Class 0 connection idle
		(4) PROCESS ACTIVE – Error free Class 0 connection
		(5) ERROR – Class 0 connection error, bus off event detected or dup-MAC-fail
		(6) RESERVED
		(7) EXCEPTION – major fault
		(8) NONE – option not fitted

0218 DeviceNet State		Range
Type	USINT (enumerated)	(0) SETUP – setup in progress (1) NW INIT – network-related initialisation tasks are being performed (2) WAITING TO CONNECT – the module will stay in this state until a Class 0 connection is opened (3) CONNECTION IDLE – Class 0 connection idle (4) CONNECTION ACTIVE – Error free Class 0 connection (5) ERROR – Class 0 connection error, bus off event detected or dup-MAC-fail (6) RESERVED (7) EXCEPTION – major fault (8) NONE – option not fitted
DeviceNet communications option parameter. Indicates the state of the communications option fitted as the 0046 Comms State parameter, but using specific enumerated strings for DeviceNet.		

0221 DeviceNet Actual Baud		Range
Type	USINT (enumerated)	(0) 125 KPS (1) 250 KPS (2) 500 KPS (3) AUTO
DeviceNet 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 DeviceNet network participation is supervised by another DeviceNet device.		

0049 Comms Module Version		Range
Type	DWORD	0x00000000
Communications option parameter.		...
Firmware version of the option communications module.		0xFFFFFFFF
		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
Communications option parameter.		...
Serial number of the option communications module.		0xFFFFFFFF

0051 Comms Diagnostic		Range
Type	USINT (enumerated)	(0) NONE
Communications option parameter.		(1) HARDWARE MISMATCH – required communications option does not match that fitted, or no option fitted but one is required.
Indicates the state of the communications option fitted.		(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

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 Network Status and Module Status LEDs and from the **DeviceNet State** and **Comms 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
- No read or write process data mapped
- 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 relationship between AC30 parameter and CIP data type is given in the table below.

AC30 Parameter		CIP	
AC30 Data Type	Description	Data Type	Bytes
BOOL	Boolean	BOOL	1
SINT	Short integer	SINT	1
INT	Integer	INT	2
DINT	Double integer	DINT	4
USINT	Unsigned short integer	USINT	1
UINT	Unsigned integer	UINT	2
UDINT	Unsigned double integer	UDINT	4
REAL	Floating point	FLOAT	4
TIME	Duration	UDINT	4
DATE	Date	UDINT	4
TIME_OF_DAY	Time of day	UDINT	4
DATE_AND_TIME	Date and time of day	UDINT	4
STRING	String	SHORT_STRING**	<i>n</i>
BYTE	Bit string length 8	USINT	1
WORD	Bit string length 16	UINT	2
DWORD	Bit string length 32	UDINT	4

** SHORT_STRING consists of a single-byte length field followed by the actual character data.

The Data Type Code returned using explicit messaging via vendor specific object A2h, attribute 2 is given in the table below.

AC30 Data Type	Data Type Code
BOOL	0
SINT	1
INT	2
DINT	3
USINT	4
UINT	5
UDINT	6
REAL	18
TIME	6
DATE	6
TIME_OF_DAY	6
DATE_AND_TIME	6
STRING	7
BYTE	4
WORD	5
DWORD	6
USINT (enumerated)	8

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,
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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



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