



Option Modules

EtherCAT Option

HA501938U001 Issue 1
Technical Manual

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
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AC30 EtherCAT Option

Technical Manual HA501938U001 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
---	--	--	--

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 ETHERCAT OPTION

Introduction

Features

- CANopen over EtherCAT (CoE)
- DS301 compliant
- Galvanically isolated 2-port Ethernet interface
- 100Mbit/s
- Run and Error LEDs
- Up to 256 bytes of cyclic I/O in each direction
- EMCY support
- EtherCAT Slave Interface (ESI) files provided

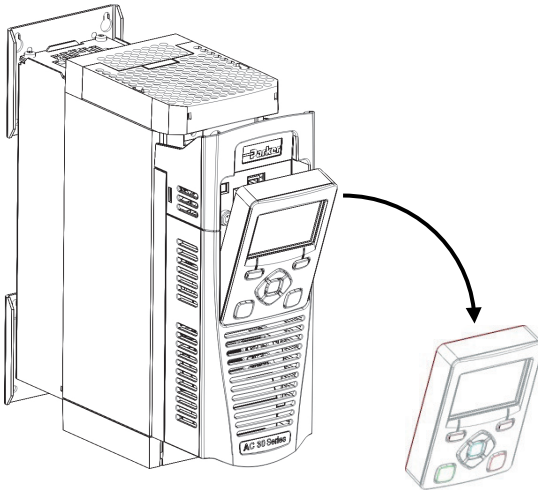
The Product Code

The product code for the EtherCAT Option is:

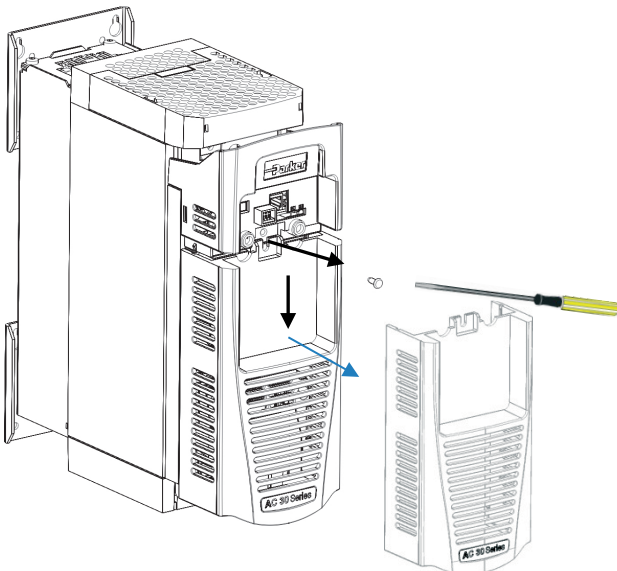
7003-EC-00

Installation

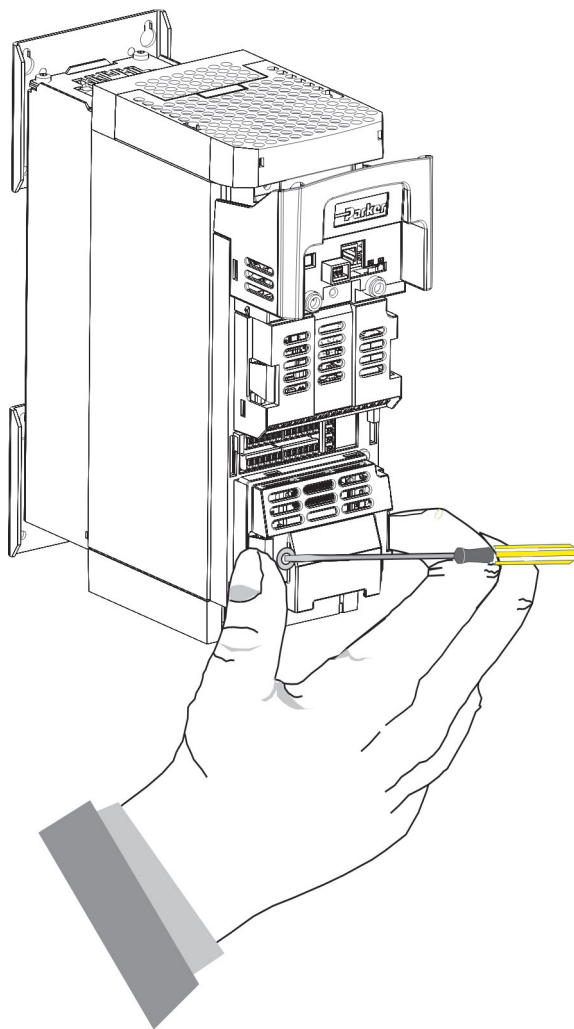
1. Remove the Graphical Keypad (GKP) by pulling from the top down, and remove.



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

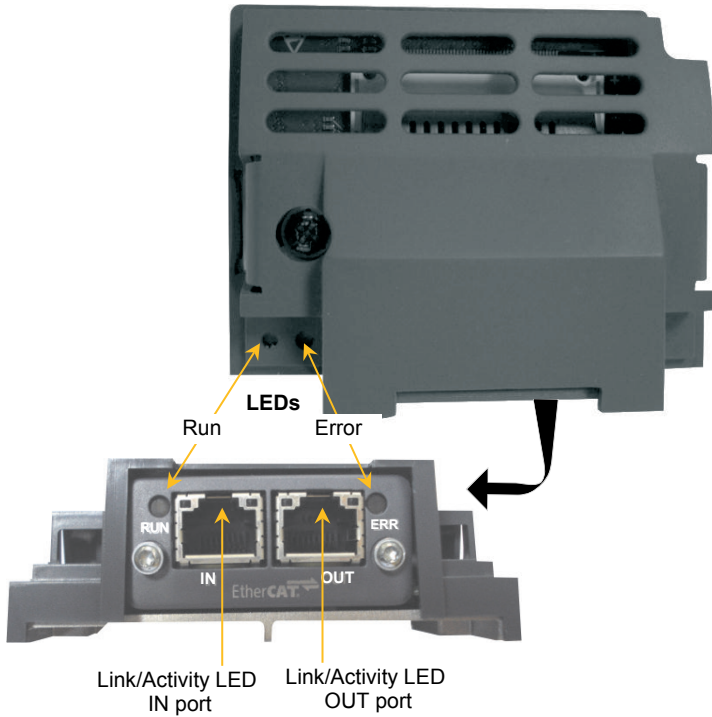


3. Click the Option into place and tighten the retaining screw, as shown.



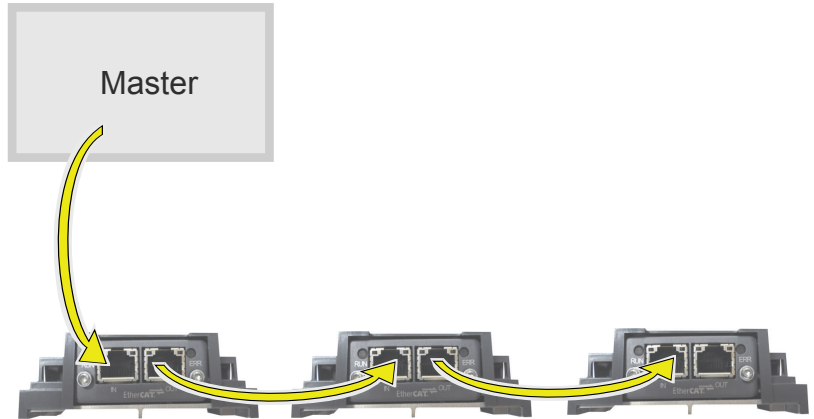
4. Slide and click back the control module lower cover, tighten the retaining screw and slot back the GKP.

Connecting to the EtherCAT Network



Wiring Example

Two RJ45 Ethernet sockets are provided. The IN socket is connected to the Master or the preceding slave coming from the direction of the Master. The OUT socket is connected to the IN socket of the next Slave, if there is one. The last OUT socket is not connected.



Cable Type

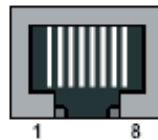
Cable Type	Shielded	Maximum Node-to-Node Distance (m)
CAT5/5E	Yes	100
*CAT5/5E	No	3

*For cable lengths <3m and not being trunked with power cables.

- Use a direct cable (without “crossover”).
- Avoid running communication cables close to power cables and always cross at right angles.

RJ45 (standard) Pin Details

Pin	Signal
1	TD+
2	TD-
3	RD+
4	Termination
5	Termination
6	RD-
7	Termination
8	Termination



LEDs

Run (RUN) LED

State	Indication
Off	INIT state (or no power)
Green	OPERATIONAL state
Green, blinking	PRE-OPERATIONAL state
Green, single flash	SAFE-OPERATIONAL state
Red	Fatal event

Error (ERR) LED

State	Indication
Off	No error (or no power)
Red, blinking	Invalid configuration
Red, double flash	Application (sync manager) watchdog timeout
Red	Application controller failure (EXCEPTION)

Link/Activity LED

State	Indication
Off	No link (or no power)
Green	Link sensed, no traffic detected
Green, flickering	Link sensed, traffic detected

Configuration

The option requires configuration of the mapping of the process data to the master.

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

Process Data

Parameters mapped as Process Data can be exchanged cyclically as Process Data Objects (PDOs) on the bus. The option supports one RPDO (receive PDO) and one TPDO (transmit PDO) each capable of carrying 256 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 must match, and be in the same order as, those of the master.

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

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 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 the option is in the OPERATIONAL (PROCESS ACTIVE) or SAFE OPERATIONAL (IDLE) state.

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

On 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 over EtherCAT Object Dictionary

Standard Objects

Index	Object Name	Sub-Index	Description	Type/Access
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
1008h	Manufacturer device name	00h	Manufacturer device name	Visible string RO
1009h	Manufacturer hardware version	00h	Manufacturer hardware version	Visible string RO
1011h	Restore parameters	00h	Largest sub index supported (01h)	U8 RO
		01h	Restore all default parameters	U32 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
1600h	Receive PDO mapping	00h	No. of mapped application objects in PDO (0..254)	U8 RW
		01h	Mapped object #1	U32 RW
		02h	Mapped object #2	U32 RW
	
		NNh	Mapped object #NN	U32 RW

Index	Object Name	Sub-Index	Description	Type/ Access
1A00h ... 1A1Fh	Transmit PDO mapping	00h	No. of mapped application objects in PDO (0..254)	U8 RW
		01h	Mapped object #1	U32 RW
		02h	Mapped object #2	U32 RW
	
		NNh	Mapped object #NN	U32 RW
1C00h	Sync Manager Comm Type	00h	Number of entries (4)	U8 RO
		01h	Mailbox wr (1)	U8 RO
		02h	Mailbox rd (2)	U8 RO
		03h	Process Data out (3)	U8 RO
		04h	Process Data in (4)	U8 RO
1C12h	Sync Manager Rx PDO Assign	00h	No. of assigned PDOs (1)	U8 RO
		01h	Assigned PDO (1600h)	U16 RO
1C13h	Sync Manager Tx PDO Assign	00h	No. of assigned PDOs (1)	U8 RO
		01h	Assigned PDO (1A00h)	U16 RO
1C32h	SM output parameter	00h	Number of entries (1)	U8 RO
		01h	Sync mode (0 - FREE RUN)	U16 RO
1C33h	SM input parameter	00h	Number of entries (1)	U8 RO
		01h	Sync mode (0 - FREE RUN)	U16 RO

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.

For multiple element parameters (parameter arrays), sub-index 00h represents the number of parameter elements and sub-indices 01h-FEh represents the value of each of the parameter elements.

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
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	

EtherCAT ESI Files

ESI files for the AC30 EtherCAT option may be downloaded from www.parker.com/ssd. Two types of ESI files are available: one without any pre-mapped process data and one with the default process data mapping. These files may be edited to match the required process data mapping.

The version of the ESI file should match that of the module version of the EtherCAT option. The version of the module may be found from the parameter **0049 Comms Module Version**. This is given in hexadecimal. The most significant byte is the major version number and the next significant byte is the minor version number. For example the version number 0105001 refers to version V1.05

Some masters do not require an ESI file and can automatically extract the configuration description from the slave.

Example Configuration

Configuration Summary

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

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

Example using CoDeSys Soft PLC as an EtherCAT Master

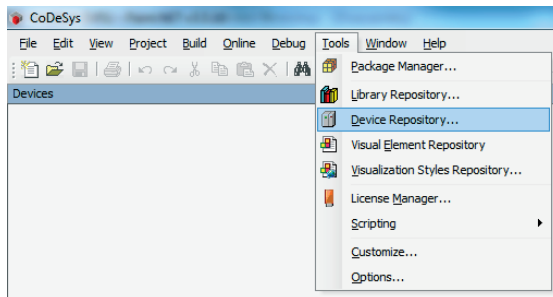
The example uses CoDeSys V3.5 running on a PC as a soft PLC. A trial version of CoDeSys is available from www.codesys.com

1. Start CoDeSys and install the ESI file.

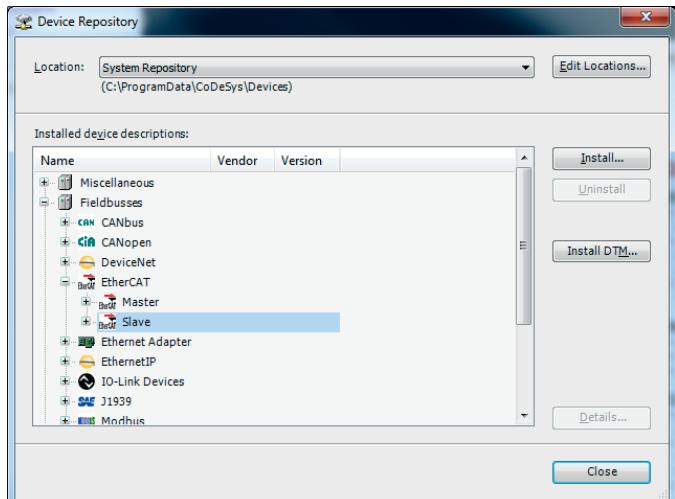
Download the AC30 EtherCAT option ESI file

ESI_AC30_DEFAULT_V1_05.XML from www.parker.com/ssd

Start CoDeSys V3.5 and from the menu select **Tools** and **Device Repository...**

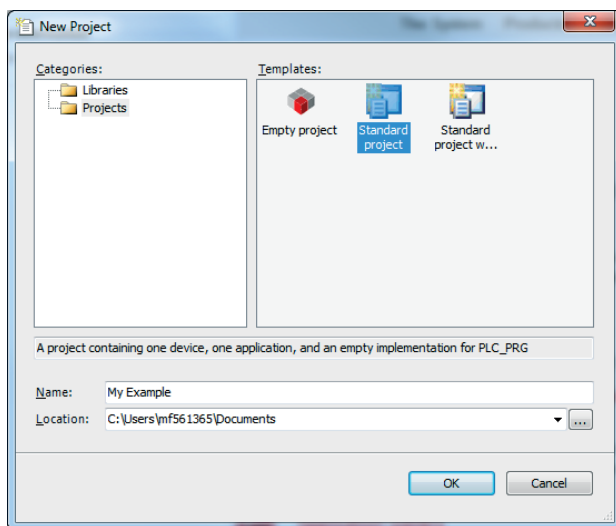


Click on **Install...** With the file type selected as **EtherCAT XMI Device description Configuration Files** browse to the ESI file required and click on **Open**.

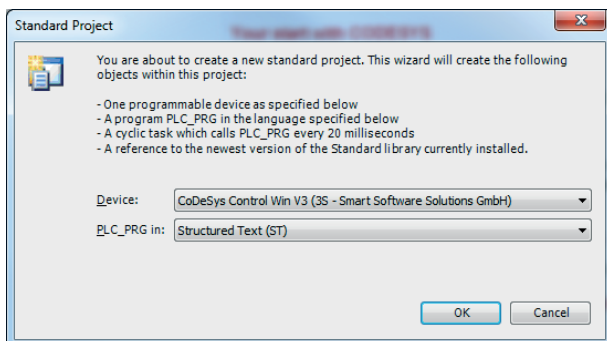


2. Create a new project.

From the CoDeSys menu select **File** and **New Project...** Enter the name of the project and select **Standard Project**



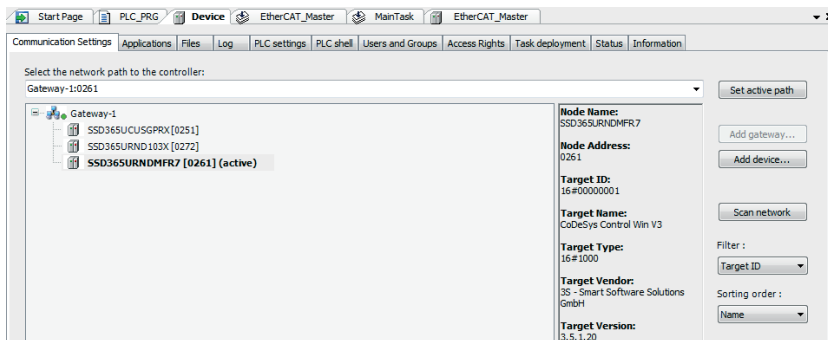
Select **CoDeSys Control Win V3** as the device and select the programming language, then press OK.



3. Set the gateway.

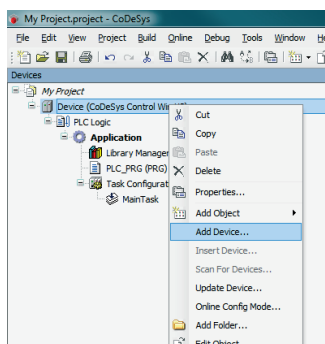
Double-click on the **Device (CoDeSys Control Win V3)**. On the right-hand pane select the **Device** tab and the **Communication Settings** tab underneath.

Next select **Add gateway....** and select OK. Click on **Scan network** to find the required node. Double-click the required node to make it the active path.

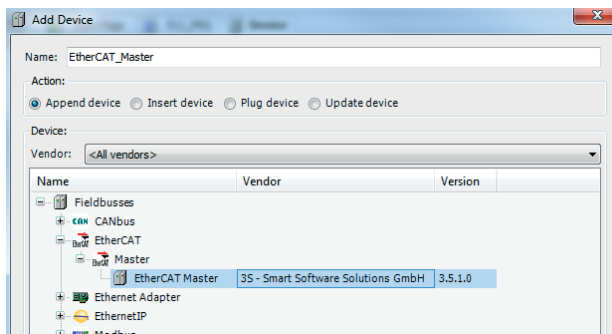


4. Add EtherCAT master.

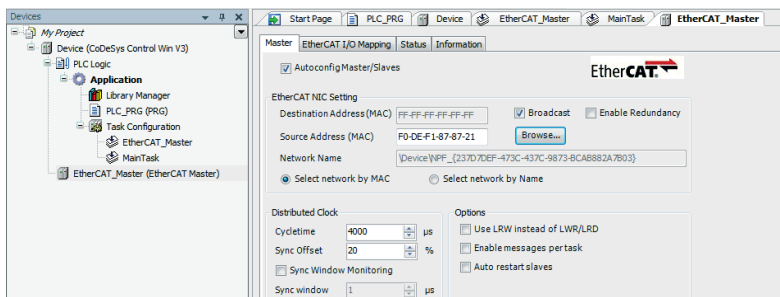
Right-click on **Device (CoDeSys Control Win V3)** and select **Add Device...**



Select the **EtherCAT Master** and click on **Add Device** and then **Close**.

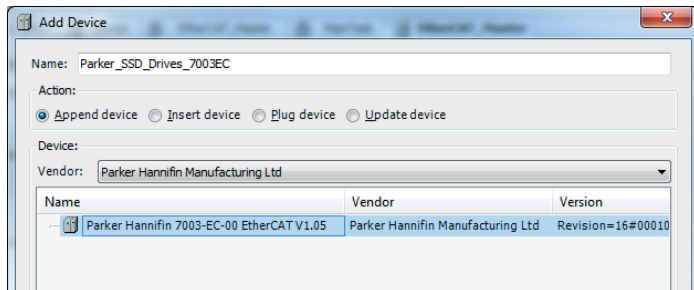


The EtherCAT Master device and an EtherCAT task will be added. Click on **Browse...** to find the target network adapter. The gateway must be active (see previous section).

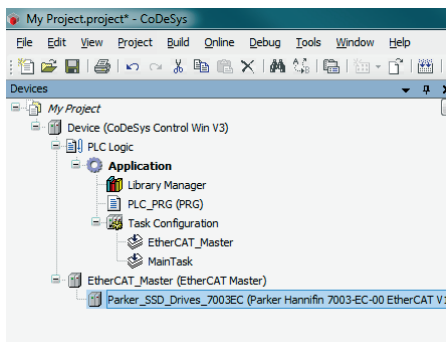


5. Add EtherCAT slave.

Right-click on **EtherCAT_Master** and select **Add Device...**
 Select the device **Parker Hannifin 7003-EC-00 EtherCAT V1.05** and click on **Add Device**.



The slave will appear under the master. Double-click on the slave to see its details including the process data mapping.



6. Build the project, download and run.

The project may be built and downloaded by selecting **Online** and **Login** from the CoDeSys menu, and then **RUN**.

Example using a TwinCAT PLC

The example set up uses Beckhoff TwinCAT[®] System Manager.

1. Install the ESI file.

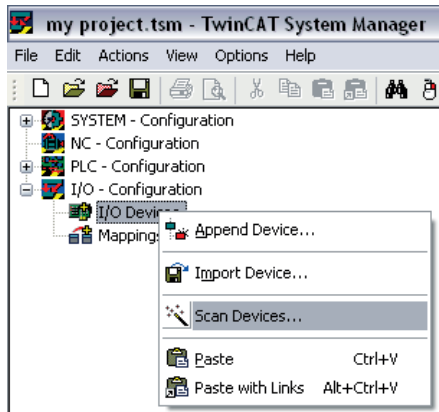
The ESI file can be downloaded from www.parker.com/ssd. The file **ESI_AC30_DEFAULT_V1_05.XML** contains the default process data mapping.

Copy the file into the folder **C:\TwinCAT\Io\EtherCAT**

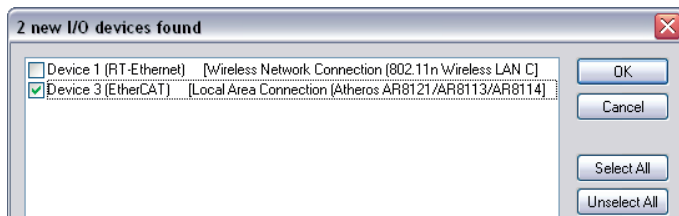
Start TwinCAT System manager.

2. ScanDevices.

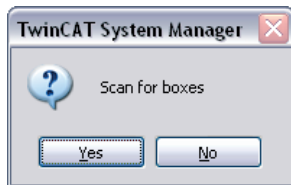
Right-click on **I/O Devices** and select Scan Devices...



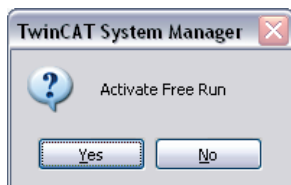
Select the EtherCAT port and deselect any other Ethernet ports.



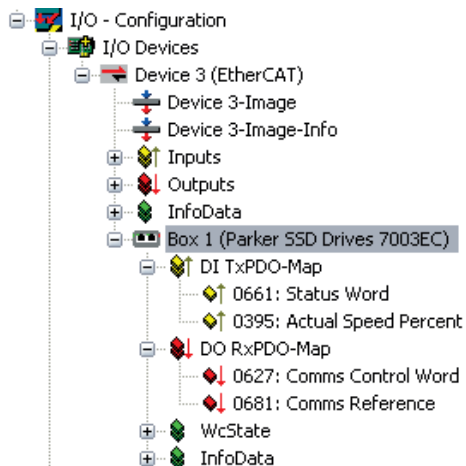
Select **YES** to scan for connected EtherCAT devices.



Select YES to activate Free Run mode.



The EtherCAT slave is listed together with the Input and Outputs corresponding to the process data mapping defined in the AC30 process data mapping.



3. View online objects.

Click on **Box 1 (Parker SSD Drives 7003EC)**. In the right-hand pane click on **CoE – Online**. This will extract the objects from the slave including the manufacturer specific objects which are mapped to the AC30 parameters. Note this may take a few minutes.

The screenshot shows the 'CoE - Online' window with the 'Online' tab selected. The interface includes buttons for 'Update List', 'Advanced...', and 'Add to Startup...'. There are checkboxes for 'Auto Update', 'Single Update' (checked), and 'Show Offline Data'. A text field for 'All Objects' is empty, and a 'Module OD (AoE Port)' field contains '0'. Below these controls is a table of objects.

Index	Name	Flags	Value
1000	Device type	RO	0x00000000 (0)
1001	Error register	RO	0x00 (0)
+ 1003:0	Pre-defined error field	RW	> 0 <
1008	Device name	RO	Parker SSD Drives 7003EC
+ 1011:0	Restore default parameters	RO	> 1 <
+ 1018:0	Identity	RO	> 4 <
+ 1600:0	DO RxPDO-Map	RO	> 2 <
+ 1A00:0	DI TxPDO-Map	RO	> 2 <
+ 1C00:0	Sync manager type	RO	> 4 <
+ 1C12:0	RxPDO assign	RO	> 1 <
+ 1C13:0	TxPDO assign	RO	> 1 <
+ 1C32:0	SM output parameter	RO	> 1 <
+ 1C33:0	SM input parameter	RO	> 1 <
2001	0001: Anin 01 Type	RW	0x00 (0)
2002	0002: Anin 02 Type	RW	0x00 (0)
2003	0003: Anout 01 Type	RW	0x00 (0)
2004	0004: Anout 02 Type	RW	0x01 (1)
2005	0005: Digin Value	RO	0x0000 (0)
2016	0022: Digin Value	RW	0x0000 (0)
2027	0039: Anin 01 Value	RO	0.000000 (0.000000e+000)
2028	0040: Anin 01 Break	RO	rv01 01

Configuring the AC30

AC30 Parker Drive Quicktool (PDQ)

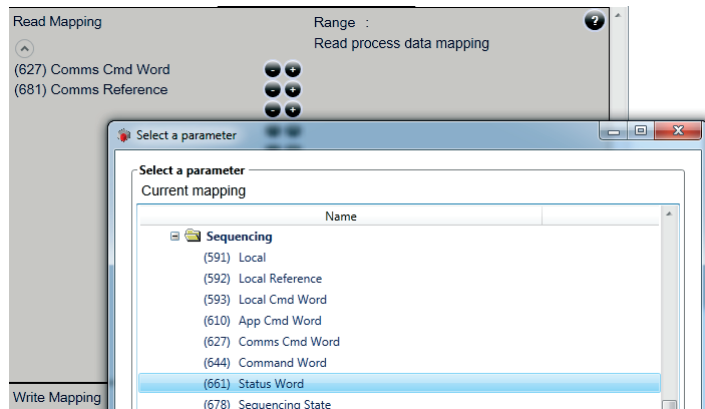
When performing an online configuration, the fitted option card will automatically be selected. In offline mode, parameter **0044 Comms Required** must be set to **ETHERCAT**.

Parker Create a New Drive - Drive

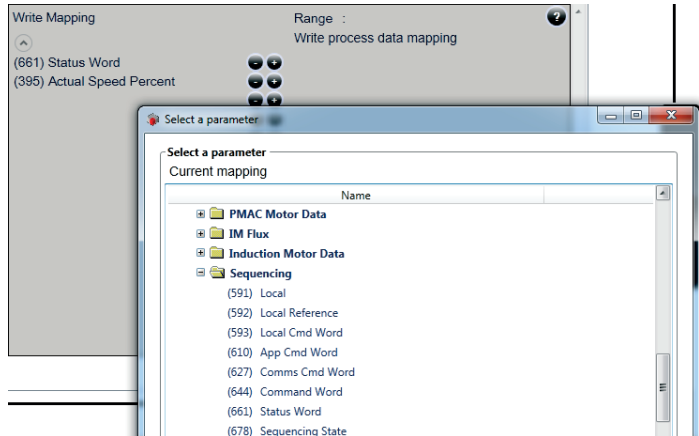
Choose a Task Drive Application Motor Motor Control Input/Output

(987) power stack	38.0A 400V
? Comms Required	ETHERCAT
Range :	
ID : 44	
The required communications option type.	
(1178) IO Option Type	NONE
(961) Drive Name	'Nicks'

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.

Accessing Parameters

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

$$\begin{aligned} \text{index} &= 2000h + \text{parameter number} \\ \text{sub-index} &= 00h \end{aligned}$$

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

$$\begin{aligned} \text{index} &= 2000h + \text{parameter number} \\ \text{sub-index} &= \text{element number} + 1 \end{aligned}$$

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 EtherCAT network participation is supervised by another EtherCAT device.

The Supervised parameter value is mapped to the Sync Manager watchdog.

- The value is set to FALSE when the Sync Manager watchdog is disabled or not running.
- The value is set to TRUE when the Sync Manager watchdog is enabled and running.

Note that the watchdog will not be available if the Read Process data size is zero, in which case the Supervised parameter will be FALSE.

To enable the sync manager watchdog by default, then within the ESI file the parameter ControlByte has the value #64 and Reg0420 has a value > 0 (given in milliseconds). Example for a watchdog with a timeout of 100 milliseconds:

```
<sm StartAddress="#x1000" ControlByte="#x64" Enable="1">Outputs</sm>
```

...

```
<Reg0420>100</Reg0420>
```

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 0			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	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			

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

0120 Write Mapping		Range	RW	Saved	Config
Type	Array of UINT	0 ... Last parameter number	✓	✓	✓
Default	-				
<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 TRUE	✓	✓	✗
Default	FALSE				
<p>Communications option parameter.</p> <p>Enables the communications trip.</p>					

Runtime Parameters

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

0186 Comms Event Set		Range	RW	Saved	Config
Type	BOOL	FALSE TRUE	✓	x	x
Default	FALSE				
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 TRUE	✓	x	x
Default	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
		(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
Communications option parameter. Indicates the communications option fitted.		

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 – Initialising or PRE-OPERATIONAL state
Indicates the state of the communications option fitted.		(3) IDLE – SAFE OPERATIONAL state
		(4) PROCESS ACTIVE – OPERATIONAL state
		(5) ERROR
		(6) RESERVED
		(7) EXCEPTION – unrecoverable error
		(8) NONE – option not fitted

0224 EtherCAT State		Range
Type	USINT (enumerated)	(0) SETUP – setup in progress
		(1) NW INIT – network-related initialisation tasks are being performed
EtherCAT communications option parameter.		(2) INIT or PREOP – Initialising or PRE-OPERATIONAL state
Indicates the state of the communications option fitted as the parameter 0046 Comms State , but using specific enumerated strings for EtherCAT.		(3) SAFE OPERATIONAL – SAFE OPERATIONAL state
		(4) OPERATIONAL – OPERATIONAL state
		(5) ERROR
		(6) RESERVED
		(7) EXCEPTION – unrecoverable error
		(8) NONE – option not fitted

0047 Comms Supervised		Range
Type	BOOL	FALSE TRUE
Communications option parameter. Indicates that the EtherCAT network participation is supervised by another EtherCAT 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
<p>Communications option parameter.</p> <p>Network specific exception code associated with the Diagnostic parameter being in EXCEPTION</p>		

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

Troubleshooting

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

Hardware Mismatch

Comms Diagnostic = HARDWARE MISMATCH

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

Invalid Configuration

Comms Diagnostic = INVALID CONFIGURATION or

EtherCAT State = ERROR

- Invalid read or write process data mapping

Comms 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

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