8903/CT EtherCAT Communications Option

Technical Manual

HA501144U001 Issue 2

WARRANTY

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Cont.2

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 *(see product label)*	
Where installed *(for your own information)*	
Unit used as a: *(refer to Certification for the Inverter)*	☐ Component ☐ Relevant Apparatus
Unit fitted:	☐ Wall-mounted ☐ Enclosure

Application Area

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

Personnel

Installation, operation and maintenance of the equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent 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

 **Caution** Risk of electric shock	 **Caution** Refer to documentation	 **Earth/Ground** Protective Conductor Terminal

Cont.3

Safety Information

Hazards

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 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.

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 can not 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

Cont.4

Contents

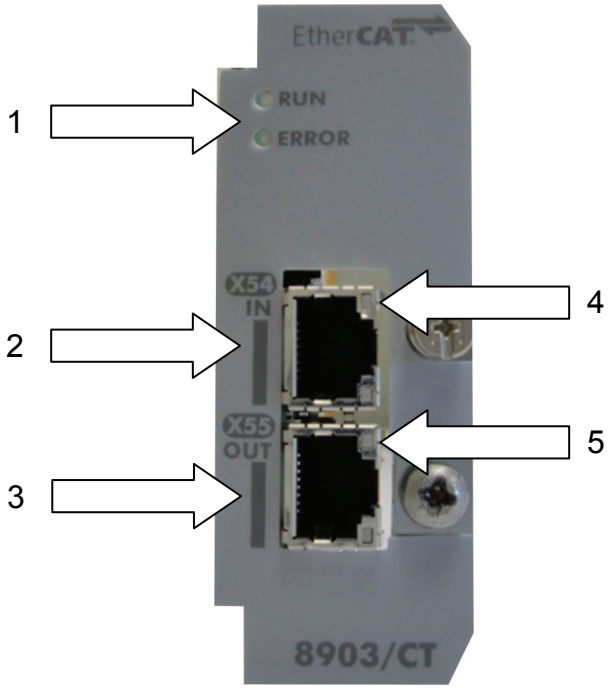
ETHERCAT COMMUNICATIONS OPTION

Introduction

This manual describes the Parker SSD Drives' EtherCAT Communications Interface Option.

Product Features

- Suitable for use with 890CD Common Bus Drive, 890SD Standalone Drive and 890PX Drive
- Galvanically isolated bus electronics
- 100Mbit/s
- LEDs to indicate network and module status
- Software configurable
- Up to 256 bytes of fast cyclic I/O in each direction
- Up to 128 DSE input registers and 128 DSE output registers
- CANopen over EtherCAT (CoE)
- DS301 compliant
- EMCY support
- EtherCAT Slave Interface file available



1	RUN and ERROR status LEDs	4	LINK / ACTIVITY LED (IN port)
2	RJ45 EtherCAT Interface (IN port)	5	LINK / ACTIVITY LED (OUT port)
3	RJ45 EtherCAT Interface (OUT port)		

Figure 1. EtherCAT Option

Product Order Codes

	Not fitted order code:	Factory fitted order code:
EtherCAT Option	8903-CT-00	not available

Compatible Firmware

This 8903/CT option will work with the following versions of 890 firmware:

Version 3.7 onwards

Restrictions

Option must be fitted in Slot A (top).

This EtherCAT option does not allow direct connection to the DSE programming application.

Installation

WARNING!

Before installing, ensure that the drive wiring is electrically isolated and cannot be made "live" unintentionally by other personnel. Wait 5 minutes after disconnecting power before working on any part of the system or removing the covers from the drives.

To Remove the Control Board

1. Remove the blanking plates, each secured by a single screw, that fits over the option slots (1).
2. Loosen the top and bottom screws from the handles of the Control Board (2).
3. Pull gently on the handles and slide the Control Board (2) out of the drive.

Note: Save the blanking plate and screw for future use. The drive should not be operated without either an Option or blanking plate fitted. When fitted, these maintain the drive's IP20 rating.

Caution

This Option contains ESD (Electrostatic Discharge) sensitive parts. Observe static control precautions when handling, installing and servicing this Option.

Figure 2. 890 showing Control Board withdrawn, with Options fitted

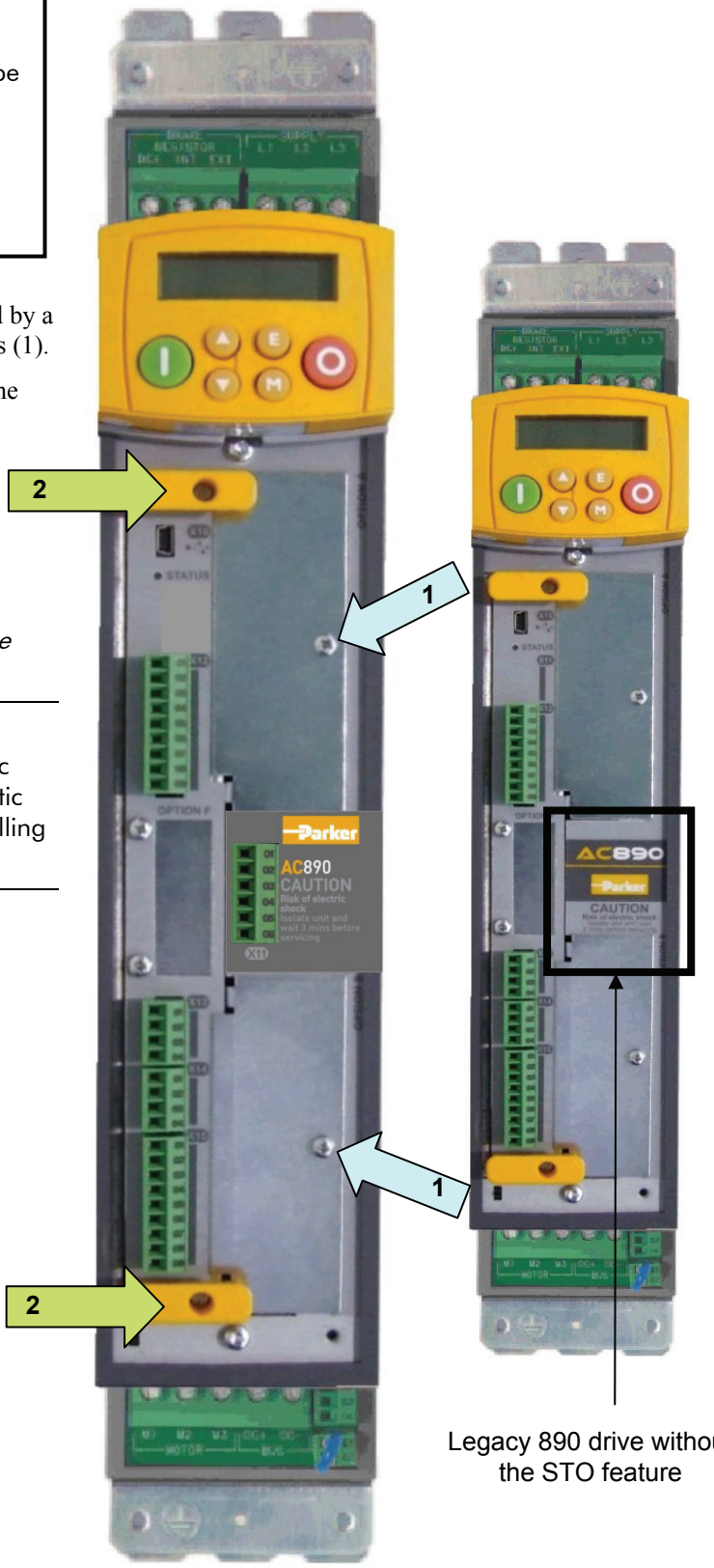


Figure 3. Front of 890 drive showing Control Board fitted

Fitting the Option

The Option fits onto the Control Board.

1. Insert the connector into the Option as shown. The legs of the connector will protrude through into the connector on the other side of the Option.
2. Press the assembly into the **TOP** connector (adjacent to terminals X10, X11 and X12) on the Control Board. Ensure that the front panel of the Option overlaps the front of the Control Board.

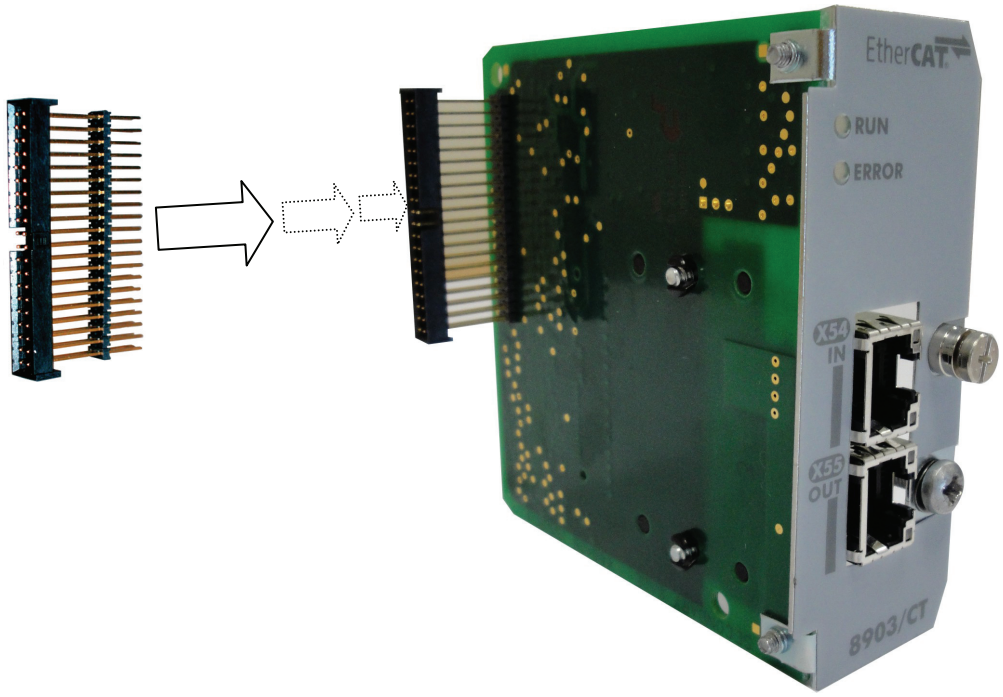


Figure 4. Fitting the connector to the Option

Re-fitting the Control Board

1. Slide the board into the drive, engaging the edges of the boards into the slots. Push until the back edge of the Control Board PCB locates with the connectors in the drive.
2. Tighten in position using the top and bottom screws in the handles of the Control Board.
3. Screw the Option in position using the captive screw (*) on the front of the Option.
4. Replace lower blanking plate, if no Slot B Option fitted.

Figure 5. 890 Control Board with Option fitted

Wiring the System

Each EtherCAT Slave has 2 RJ45 sockets. The IN socket is connected to the Master or coming from the direction of the Master if there are other Slaves in between. The OUT socket is connected to the IN socket of the next Slave, if there is one, away from the Master. The OUT socket on the Slave "furthest" from the Master will not be connected.

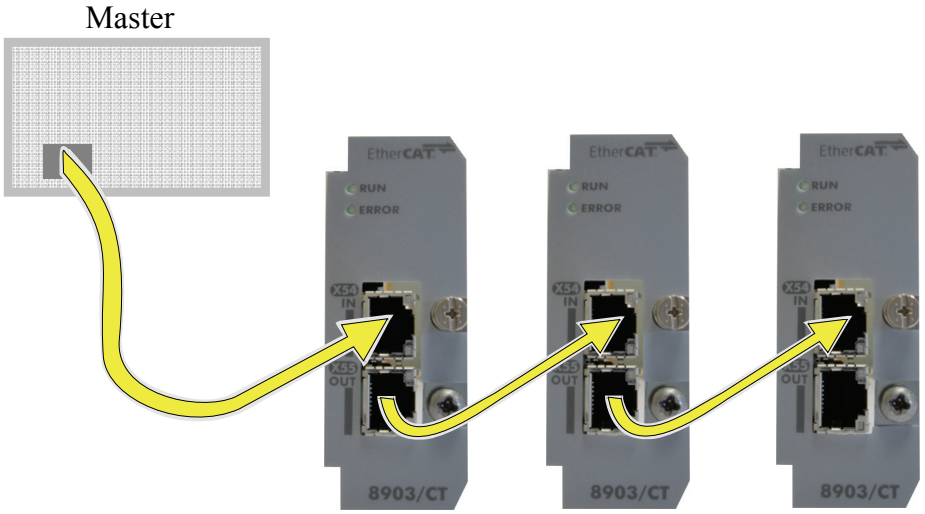
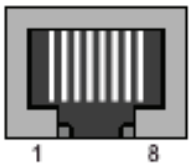


Figure 6. Connections between Master and Slave devices

RJ45 (Standard) Pin Details

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



Cable Specifications

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

Use a direct cable (without "crossover").

Avoid running close to power cables. Always cross at right angle.

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

LED Indications

RUN Status and MODULE Status LEDs

RUN Status LED

This LED reflects the status of the CoE (CANopen over EtherCAT) communication.

Colour	LED Indication	Description
 OFF	OFF	INIT state (or no power)
 GREEN	ON	OPERATIONAL state
 GREEN	BLINKING	PRE-OPERATIONAL state
 GREEN	SINGLE FLASH	SAFE-OPERATIONAL state
 RED	ON	Fatal Event

Figure 7. RUN Status LED

ERROR LED

This LED indicates EtherCAT communication errors etc.

Colour	LED Indication	Description
 OFF	OFF	No error (or no power)
 RED	BLINKING	Invalid configuration. State change request received from master is not possible.
 RED	DOUBLE FLASH	Application (Sync manager) watchdog timeout
 RED	ON	Application controller failure

Figure 8. Error Status LED

Note – If RUN and ERROR LEDs both turn RED, this indicates a fatal event, forcing the bus interface to a physically passive state. Contact PARKER SSD Support.

LINK/Activity LEDs

These LEDs indicate the EtherCAT link status and activity.

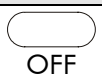
Colour	LED Indication	Description
 OFF	OFF	No link. Link not sensed (or no power)
 GREEN	ON	Link sensed, no traffic detected.
 GREEN	Flickering	Link sensed, traffic detected.

Figure 9. LINK/Activity LED

8

Drive Diagnostics

The Ethernet MMI View

Diagnostic information is available through the MMI.

MMI Menu Map

1 SETUP
2 COMMUNICATIONS
3 ETHERNET
- NETWORK TYPE
- RTNX IP ADDRESS
- 890 IP ADDRESS
- 890 SUBNET MASK
- 890 GATEWAY
- FTP ENABLED
- ADMIN ENABLED
- MAC ADDRESS
- STATE

Parameter Descriptions

NETWORK TYPE *Read Only* *Range: Enumerated - see below*

Network type of the Ethernet option.

Enumerated Value: NETWORK TYPE

0: NONE
1: UNKNOWN
2: ETHERNET IP
3: MODBUS TCP
4: PROFINET IO
5: ETHERCAT

RTNX IP ADDRESS *Read Only* *"NOT SUPPORTED"*

DSE connection not supported

890 IP ADDRESS *Read Only* *"NOT SUPPORTED"*

TCP/IP connection not supported

890 SUBNET MASK *Read Only* *"NOT SUPPORTED"*

TCP/IP connection not supported

890 GATEWAY *Read Only* *"NOT SUPPORTED"*

TCP/IP connection not supported

FTP ENABLED *Read Only* *FALSE*

FTP Server not supported

ADMIN ENABLED *Read Only* *FALSE*

FTP Server not supported

MAC ADDRESS *Read Only* *NOT SUPPORTED*

MAC address not supported

STATE *Read Only* *Range: Enumerated - see below*

Operating state of the EtherCAT option.

Enumerated Value : STATE

6: ERROR	Requested state change not possible
7: EXCEPTION	Fatal Error
15: INIT OR PREOP	Initialising or pre-operational, accepts SDO parameterisation.
16: OPERATIONAL	Normal operation, PDO and SDO data exchange
17: SAFE-OP	Safe operation, Master reads actual values using PDO and SDO but cannot write values.
14: NOT SUPPORTED	Wrong firmware installed

Configuring the EtherCAT System

To configure the EtherCAT system, complete the steps below.

Step 1: Configuring the EtherCAT Option using DSE

Step 1.1: Inserting an Ethernet Function Block

Display your configuration page. Click on the Block menu at the top of the screen.

1. Move the cursor down to select "890 Comms" and select "Ethernet".
2. Click to attach the block icon to the cursor. Move the icon to where you want on the screen. Click again to release the icon.

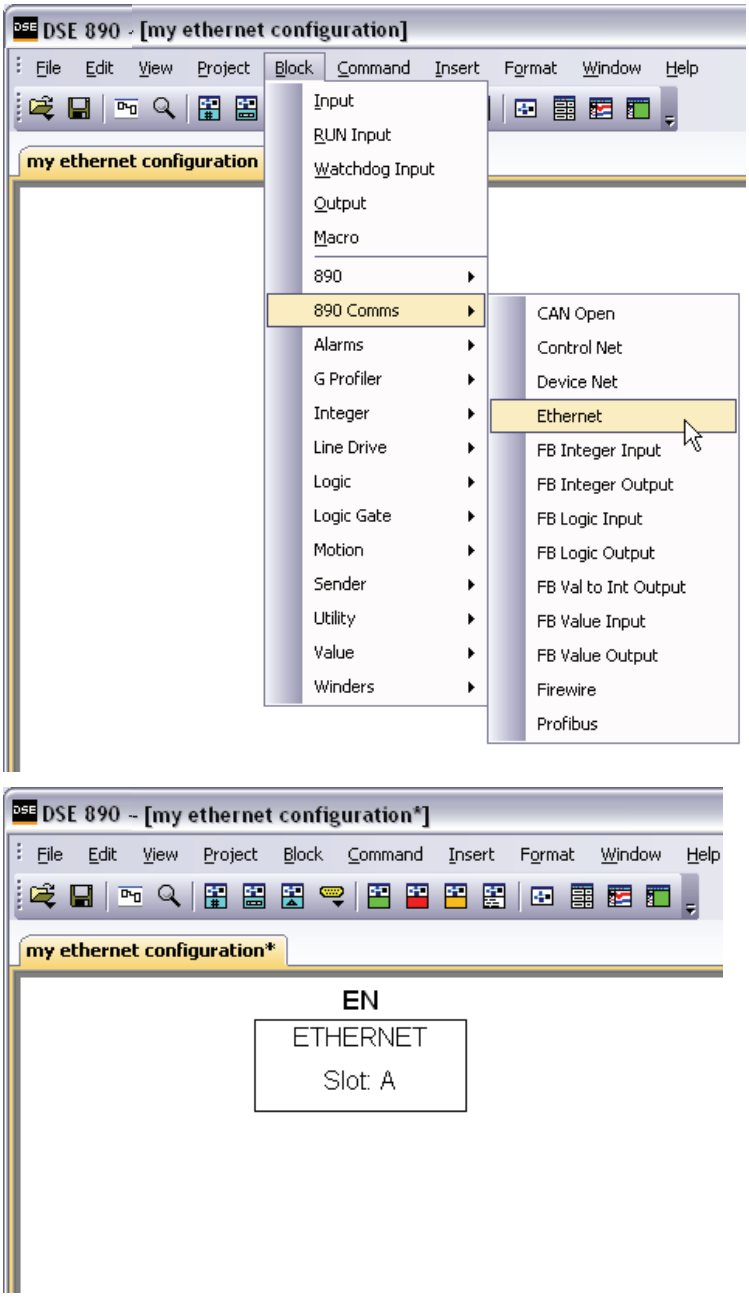


Figure 10. Configuration showing EN Function Block

Step 1.2: Attaching Fieldbus Connectors

Seven fieldbus connector types are available:

FB Logic Input	FB Integer Input	FB Value Input	
FB Logic Output	FB Integer Output	FB Value Output	FB Val to Int Output

Input connector: the data is sent from PLC to 890

Output connector: the data is sent from 890 to PLC

The fieldbus connectors must be added before they will appear in the EtherNet function block.

Note: *The function block and connectors can be renamed by using the right mouse button and selecting* ***Rename Block****.*

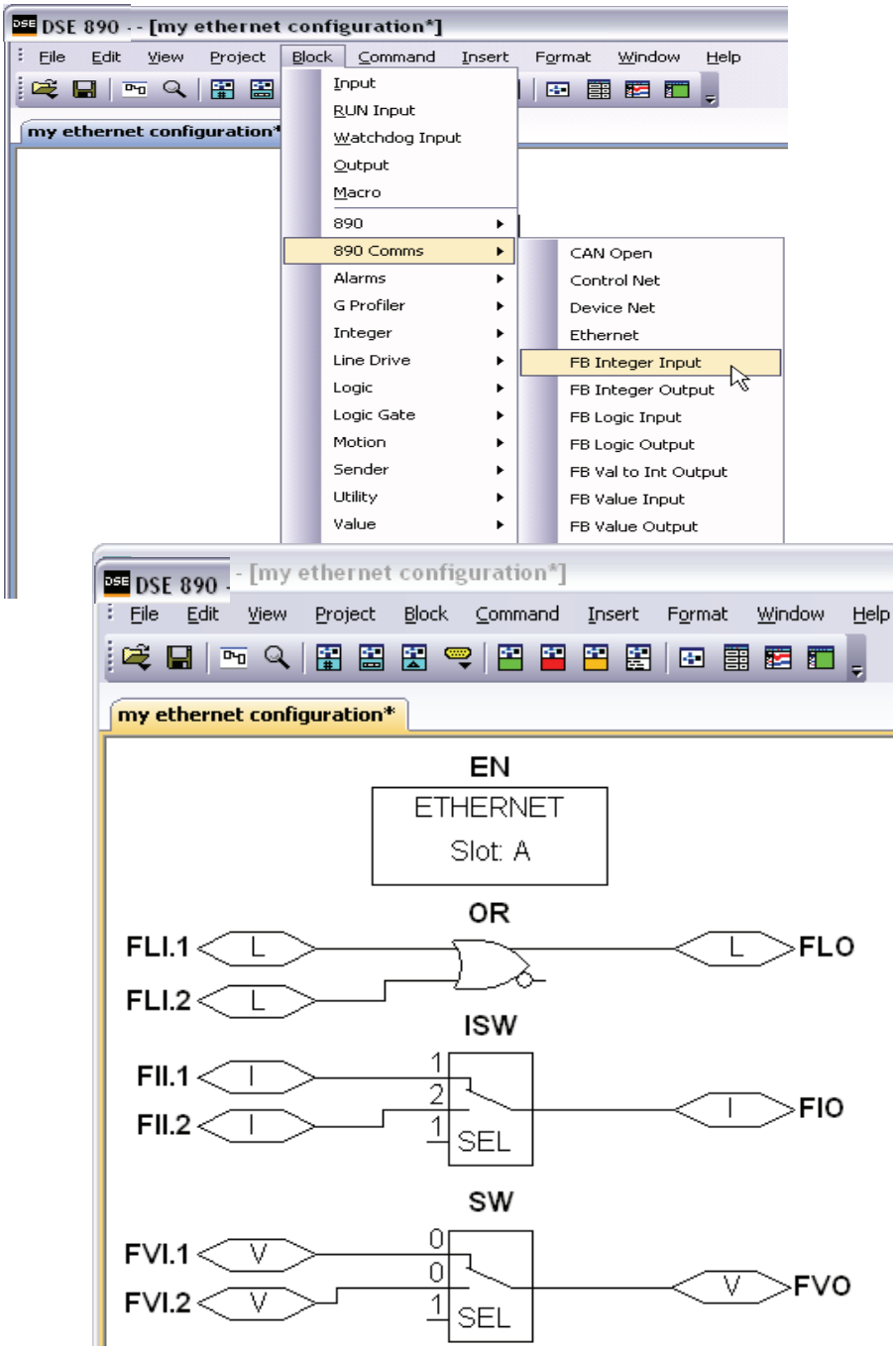
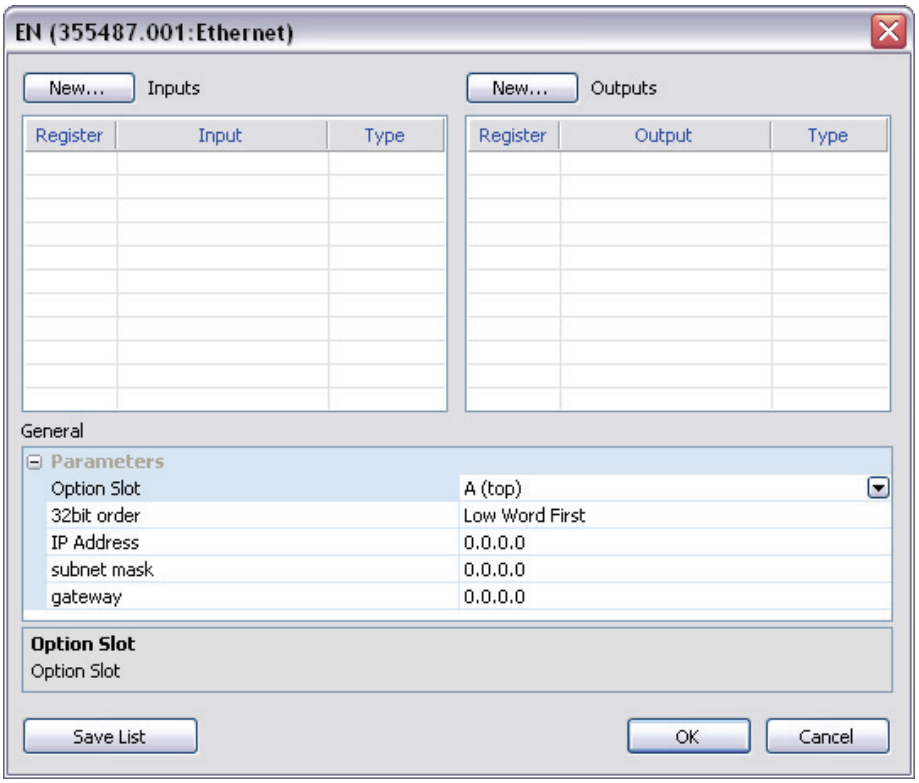


Figure 11. Configuration showing EN Function Block and Fieldbus Connectors

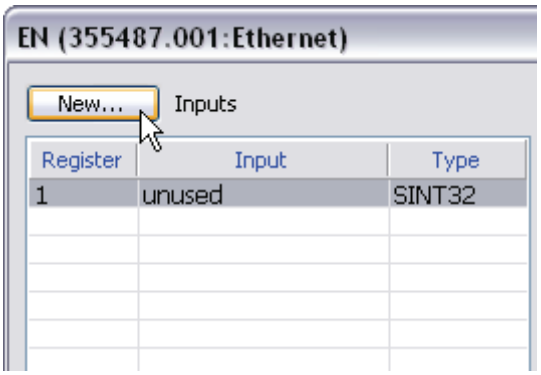
Step 1.3 : Configuring the Fieldbus Connectors

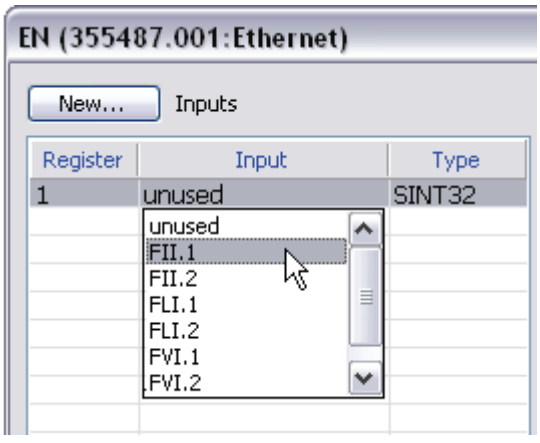
Double-click on the function block to display the dialog below. The fieldbus connectors (inputs and outputs) are assignable in the function block along with their data type to/from the PLC. The Option Slot, 32-bit Order, IP Address, Subnet Mask and Gateway Address can also be selected.



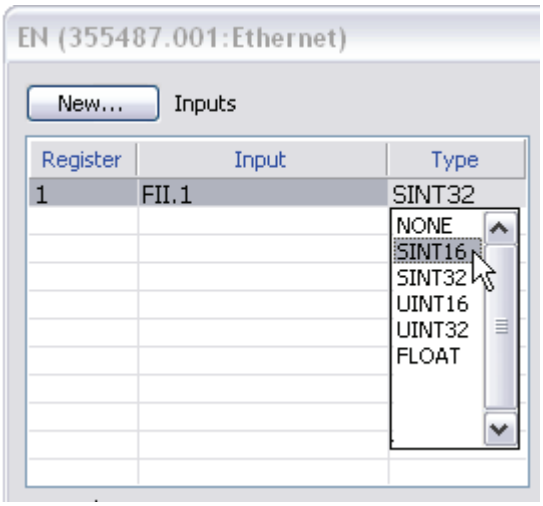
To configure the input and output connectors you have placed in the configuration:

1. Click on **New…** to add Inputs or Outputs to table.
2. Select the drop-down menu below **Input** to choose the required input connector to be mapped to the Register. For example below, Register 1 "Input" is shown with the possible fieldbus selections that have been placed in the configuration: FII.1 (**F**ieldbus **I**nteger **I**nput 1), FLI.1 (**F**ieldbus **L**ogic **I**nput **1**), FVI.1 (**F**ieldbus **V**alue **I**nput **1**) etc.





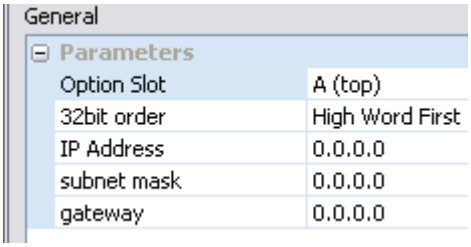
3. Select the drop down menu in the **Type** column to choose the required PLC type on Register 1, for example.



4. Set up all the input/output registers in a similar way.

> **Remember**:
> - The order and size of the *inputs* in the DSE Ethernet configuration MUST match the order and size of the *outputs* from the PLC configuration.
> - The order and size of the *outputs* in the DSE Ethernet configuration MUST match the order and size of the *inputs* to the PLC configuration.

Set up the option parameters:



"Option Slot" = A (top). The EtherCAT Option can only be fitted in the OPTION A slot of the drive. This is the default setting for "Option Slot".

“32bit order”, “IP Address”, “subnet mask” and “gateway” parameters are ignored by the EtherCAT option.

DSE Data Types

Data Type	Description	Range
LOGIC	Logic	False (F) and True (T)
INTEGER	32-bit signed integer	-2,147,483,648 to 2,147,483,647
VALUE	32-bit fixed point value	-32768.0 to 32767.9999

Ethernet Data Types

Data Type	Description	Range	Bytes Used
SINT16	16-bit signed integer	-32,768 to 32,767	2
SINT32	32-bit signed integer	-2,147,438,648 to 2,147,483,647	4
UINT16	16-bit unsigned integer	0 to 65,535	2
USINT32	32-bit unsigned integer	0 to 4,294,967,295	4
FLOAT	32-bit IEEE-754 floating-point value	1.19209290e-38 to 3.4028235e+38	4

Conversion of DSE Type < > Ethernet Type

The DSE fieldbus connectors are each assigned an Ethernet "Type" as described in "Step 1.3 : Configuring the Fieldbus Connectors" on page 12.

The conversion between the DSE type and the PLC type is performed automatically (refer to Appendix A : DSE/EtherCAT Conversion Rules, page 20).

Any PLC type can be assigned to a fieldbus connector.

DSE Input and Output

To prevent persistent data within the 890 User Application from being overwritten before it can be used, both the **Inputs** and **Outputs** have a special *Initial Value*. This allows a change-in-value event to be detected.

The *Initial Values* are 8000h for 16-bit data types and 80000000h for 32-bit data types.

Outputs will have this value until a block diagram event causes them to update.

Inputs will only be updated in the block diagram when the incoming value (from PLC) is different from the *Initial Value*.

Step 2: Configuring the PLC

Example Set-up of Beckhoff TwinCAT® System Manager

Step 2.1: EtherCAT Slave Interface File

Each device on EtherCAT is associated with an EtherCAT Slave Interface (ESI) file in XML format, which holds a description of the device and its functions.

The ESI file can be downloaded from www.ssddrives.com

Copy the file "**ESI_890_V1_04.XML**" into the folder **C:\TwinCAT\Io\EtherCAT** with the other XML files.

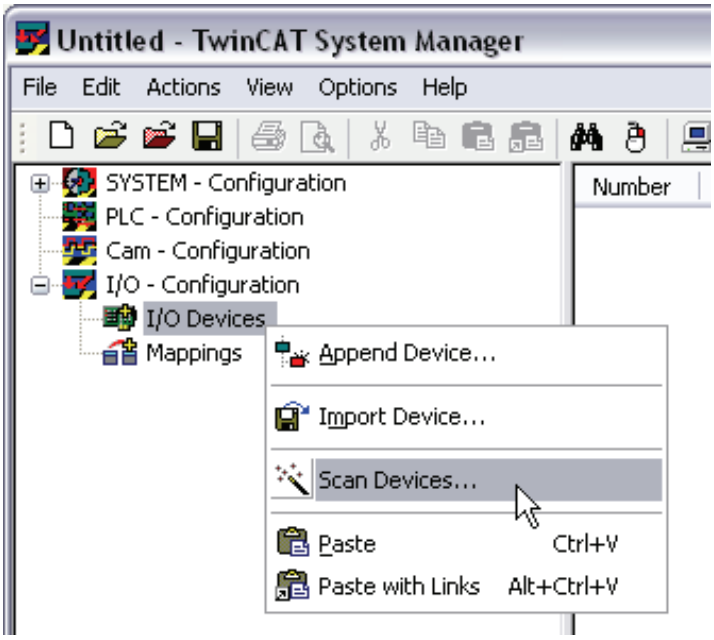
Restart TwinCAT System manager after copying the XML file.

Step 2.2: Connect EtherCAT Master

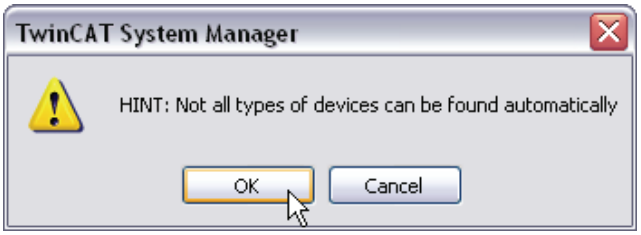
Connect the EtherCAT port on the Master to the IN port X54 of the Slave.

Run TwinCAT System Manager Application:

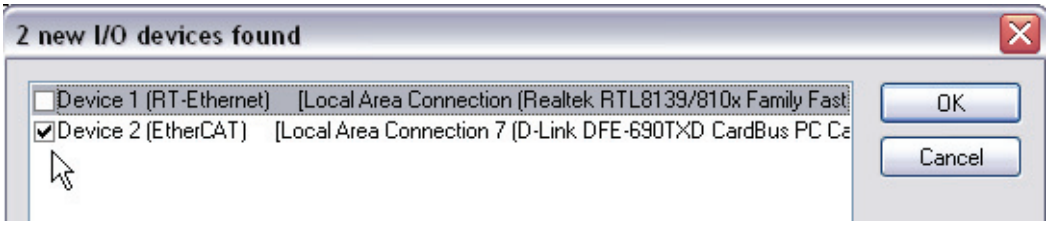
Right clink on "I/O Devices" and select "Scan Devices":



Select “OK” to skip HINT:



Deselect Ethernet ports not connected to EtherCAT Slave and then “OK”:

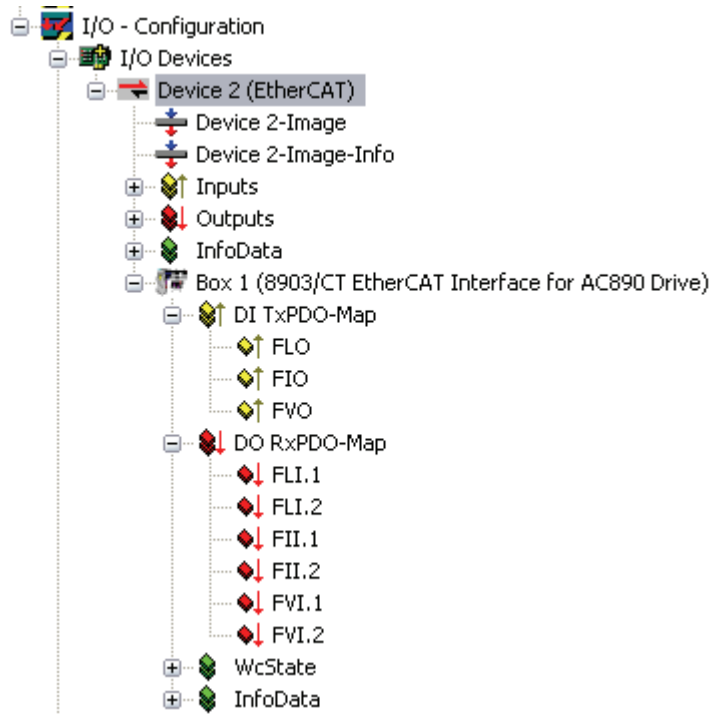


Note: this will be [EtherCAT] and **not** [RT-Ethernet] if connected to an EtherCAT device.

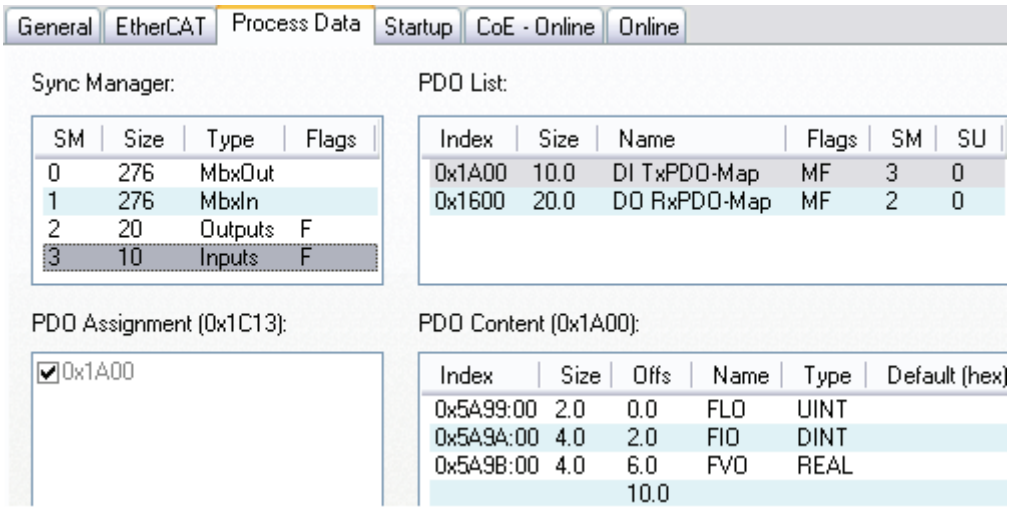
Select “Yes” to scan for connected EtherCAT devices:

Select “Yes” to activate Free Run mode:

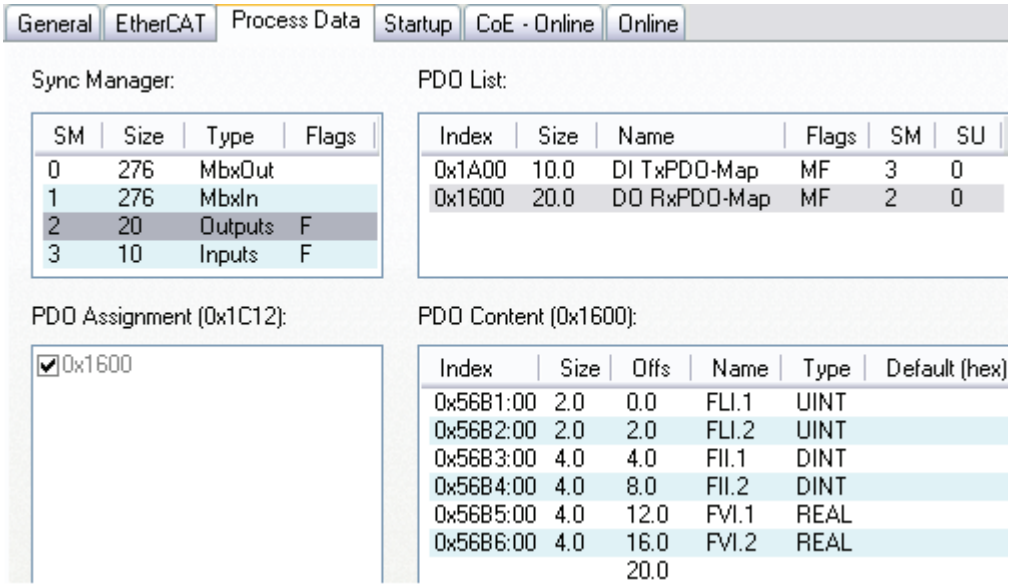
The found EtherCAT Slave (Box) is now listed together with any Inputs and Outputs that have been declared by the 890 application:



Tx Process Data (890 to Master):

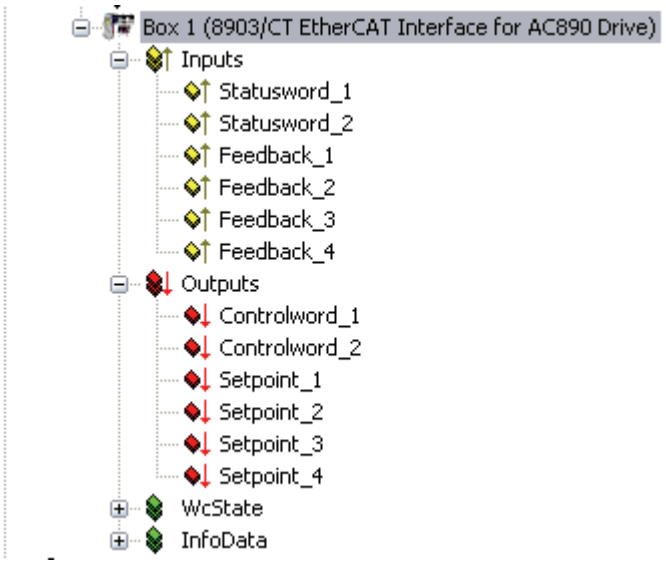


Rx Process Data (Master to 890):

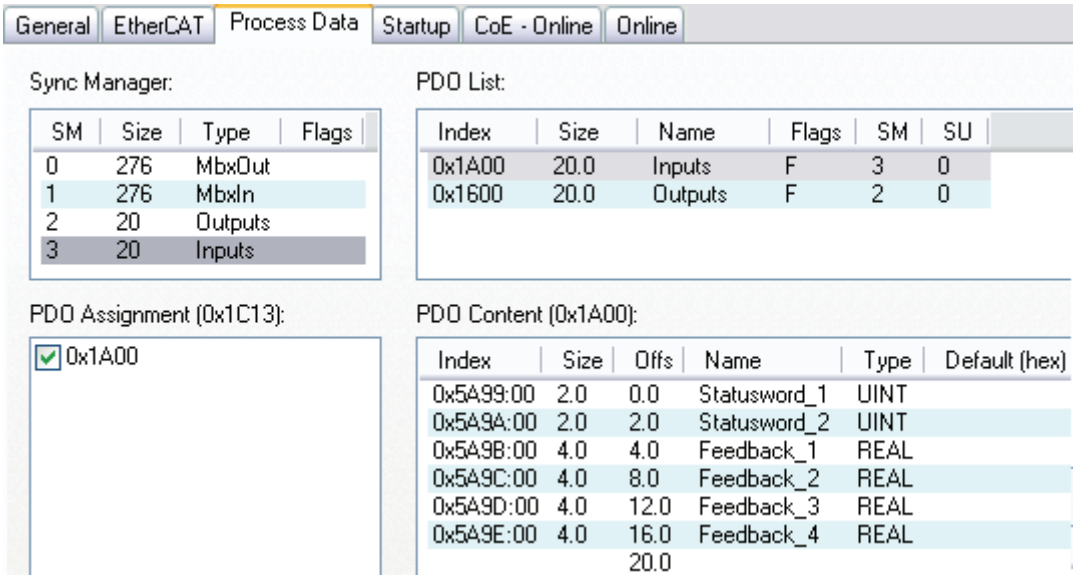


Step 2.3: Configuring EtherCAT Master Manually

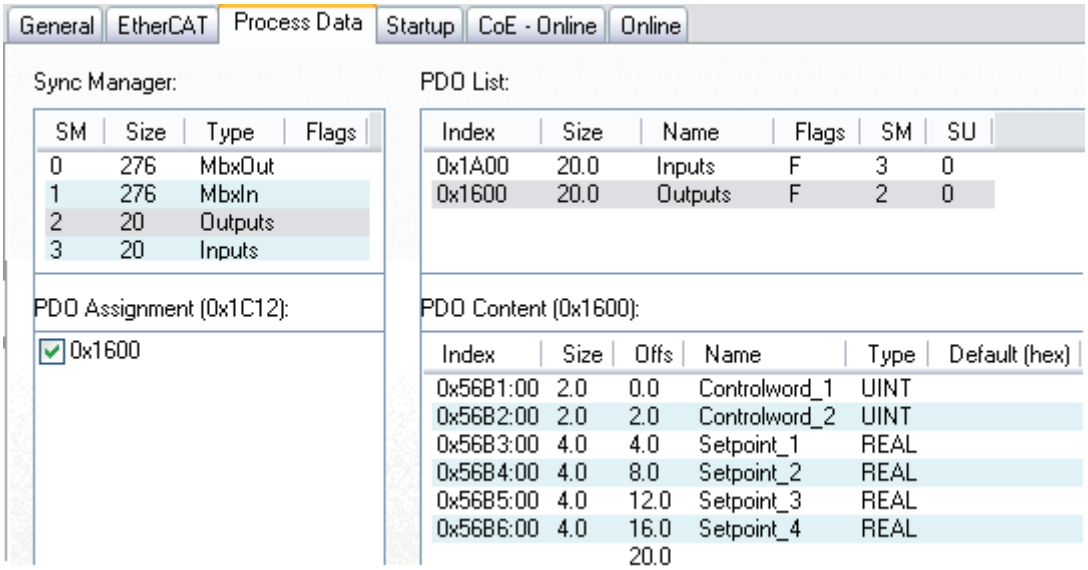
If the Master does not support extracting the EtherCAT mapping from the Drive, the provided ESI file also contains a fixed mapping as shown below:



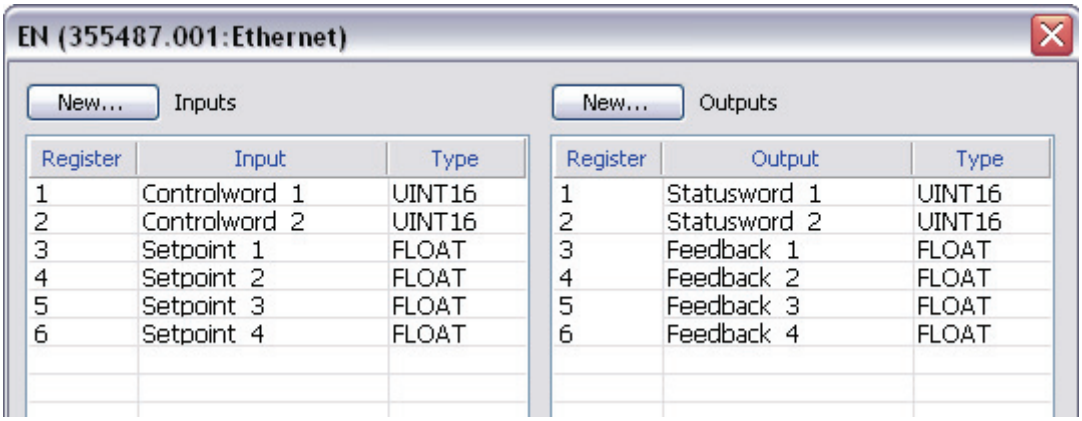
Tx Process Data (890 to Master):



Tx Process Data (Master to 890):



This works with the corresponding 890 configuration:



Appendix A : DSE/EtherCAT Conversion Rules

The rules governing the conversion between DSE data types and EtherCAT data types are given below. Note carefully that some conversions will result in rounding, limiting and truncation of the original value

LOGIC Type Connector

	Data from PLC	Data to DSE
From SINT16 to LOGIC	Zero Non-zero	False True
From SINT32 to LOGIC	Zero Non-zero	False True
From UINT16 to LOGIC	Zero Non-zero	False True
From UINT32 to LOGIC	Zero Non-zero	False True
From FLOAT to LOGIC	Zero Non-zero	False True

	Data from DSE	Data to PLC
From LOGIC to SINT16	False True	0 1
From LOGIC to SINT32	False True	0 1
From LOGIC to UINT16	False True	0 1
From LOGIC to UINT32	False True	0 1
From LOGIC to FLOAT	False True	0.0 1.0

INTEGER Type Connector

	Data from PLC	Data to DSE
From SINT16 to INTEGER	-32,768 to 32,767	-32,768 to 32,767
From SINT32 to INTEGER	-2,147,483,648 to 2,147,483,547	-2,147,483,648 to 2,147,483,547
From UINT16 to INTEGER	0 to 65,535	0 to 65,535
From UINT32 to INTEGER	0 to 4,294,967,295	0 to 2,147,483,647 limits apply
From FLOAT to INTEGER	32-bit IEEE floating-point	-2,147,483,648 to 2,147,483,547 Fractional part rounded

	Data from DSE	Data to PLC
From INTEGER to SINT16	-2,147,483,648 to 2,147,483,647	-32768 to 32767 limits apply
From INTEGER to SINT32	-2,147,483,648 to 2,147,483,647	-2,147,483,648 to 2,147,483,647
From INTEGER to UINT16	-2,147,483,648 to 2,147,483,647	0 to 65,535 limits apply
From INTEGER to UINT32	-2,147,483,648 to 2,147,483,647	0 to 2,147,483,647 limits apply
From INTEGER to FLOAT	-2,147,483,648 to 2,147,483,647	32-bit IEEE floating-point

VALUE Type Connector

	Data from PLC	Data to DSE
From SINT16 to VALUE	-32,768 to 32,767	-32,768.0 to 32,767.0
From SINT32 to VALUE	-2,147,483,648 to 2,147,483,547	-32,768.0 to 32,767.0 limits apply
From UINT16 to VALUE	0 to 65,535	0.0 to 32,767.0 limits apply
From UINT32 to VALUE	0 to 4,294,967,295	0.0 to 32,767.0 limits apply
From FLOAT to VALUE	32-bit IEEE floating-point	-32,768.0 to 32,767.9999 limits apply

	Data from DSE	Data to PLC
From VALUE to SINT16	-32,768.0 to 32,767.9999	-32,768 to 32,767 limits apply/ rounding applies
From VALUE to SINT32	-32,768.0 to 32,767.9999	-32768 to 32,767 limits apply/ rounding applies
From VALUE to UINT16	-32,768.0 to 32,767.9999	0 to 32767 limits apply/ rounding applies
From VALUE to UINT32	-32,768.0 to 32,767.9999	0 to 32767 limits apply/ rounding applies
From VALUE to REAL	-32,768.0 to 32,767.9999	32-bit IEEE floating-point