

# Installation Manual

## KSM 45

## EtherCAT



Installation manual for extension modules KSM 45 in use with one device series KSM11/KSM12.

**Note:** The German version is the original version of the installation manual.

Status: 06/2013

### **Subject to change without prior notification**

The contents of this documentation has been collated with greatest care and corresponds with our present status of information. However, we would like to point out, that this document cannot always be updated at the same time as the technical development of the product progresses. Information and specifications can be changed at any time. Please keep yourself informed about the current version under [www.kollmorgen.com](http://www.kollmorgen.com).

Devices of the

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**Contents**

- 1 IMPORTANT NOTES ..... 4**
- 1.1 Definitions ..... 4
- 1.2 Co-valid Documents..... 5
- 1.3 Abbreviations Used ..... 5
- 2 SAFETY REGULATIONS..... 7**
- 2.1 Intended Use ..... 7
- 2.2 General Safety Regulations..... 7
- 2.3 Operation and Service ..... 8
- 2.4 Transport/Storage ..... 8
- 2.5 Scope of delivery ..... 8
- 3 DEVICE DESCRIPTION ..... 9**
- 4 SAFETY RELATED CHARACTERISTICS..... 10**
- 5 CONNECTION AND INSTALLATION ..... 10**
- 5.1 General Notes on Installation ..... 10
- 5.2 Installation KSM-Module ..... 11
- 5.3 Assembly on Backplane Bus..... 11
- 5.4 Terminal Assignment ..... 11
- 6 START UP ..... 12**
- 6.1 Configuraqtion SafePLC ..... 12
- 6.1.1 Basic Settings ..... 12
- 6.1.2 Source and Target Mapping Logic Data..... 13
- 6.1.3 Validation of FSoE Profile..... 14
- 6.2 Configuration and Commissioning of the FSoE Master ..... 15
- 6.2.1 Installation ESI-File..... 15
- 6.2.2 Integration KSM55 into TwinCAT ..... 16
- 7 DIAGNOSTIC LED ..... 21**
- 8 MODIFICATION /HANDLING CHANGES TO THE DEVICE..... 22**
- 9 MAINTENANCE ..... 22**
- 9.1 Exchanging a Module..... 22
- 10 TECHNICAL DATA ..... 23**
- 10.1 Enviromental Conditions ..... 23
- 10.2 Characteristic Data ..... 23

## 1 Important Notes

Definition of individual target groups

Project engineers for safe drive systems:  
Engineers and technicians

Assembly, electric installation, maintenance and replacement of devices:  
Maintenance electricians and service technicians

Commissioning, operation and configuration:  
Technicians and engineers

### 1.1 Definitions

The designation KSM is used as generic term for all derivatives from the KSM product range. Wherever this description refers to a certain derivative, the complete designation is used.

KSM45 is the short form of the communication device FSOE over EtherCAT.

The term "safe" used in the following text in any case refers to the classification as a safe function for application up to PL e acc. to EN ISO 13849-1 or SIL3 acc. to EN 61508.

The system software "SafePLC" serves the purpose of configuring and programming KSM modules.

The designation process image reflect the view of the KSM device.

PAE refers to process image input, i.e digital inputs of the device and the received data from fieldbus of master device.

PAA refers to process image output, i.e. digital outputs of the device and the transmitted data fieldbus of master device.

## 1.2 Co-valid Documents

Description	Reference
General information about KSM devices and their usage.	KSM Installation manual KSM Programming manual
Description CAN data format.	TD-37350-810-51-xxF-EN Status message data
Creating and configuring TwinSAFE projects.	Beckhoff TwinCAT documentation

### Note:

- Thoroughly read the manuals before you start the installation and the commissioning of the KSM module.
- Paying attention to the documentation is a prerequisite for trouble-free operation and fulfilment of possible warranty claims.

## 1.3 Abbreviations Used

Abbreviation	Meaning
AC	Alternating voltage
IL	Instruction list
ELIA	Employer's liability insurance association
CLK	Clock (cycle)
CPU	Central Processing Unit
DC	Direct voltage
DI1..DI14	Digital Input
DIN	Deutsches Institut für Normung (German Institute for Standardization)
DO	Digital Output
EMU	Emergency Monitoring Unit
EMC	Electromagnetic compatibility
ELC	Emergency Limit Control
EN	European Standard
HISIDE	Output with 24VDC nominal level switching to plus
IP20	Degree of protection for housing
ISO	International Organisation for Standardisation
LED	Light Emitting Diode

<b>Abbreviation</b>	<b>Meaning</b>
LOSIDE	Output switching to reference potential
OLC	Operational Limit Control
PIA	Process image of outputs
PII	Process image of inputs
PESSRAL	Programmable electronic system in safety related applications for elevators
P1,P2	Pulse outputs
PLC	Programmable Logic Controller
POR	Power on Reset
PSC	Position Supervision Control
SELV	Safety Extra Low Voltage
SSI	Synchronous Serial Interface
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik e. V. (association for el. engineering, electronics and information technology)
PAA	Process image outputs
PAE	Process image inputs
FSOE	Safe fieldbus protocol from Beckhoff for transmitting safe process data.
ETHERCAT	Fieldbus protocol from Beckhoff with Ethernet as transmission medium.

## 2 Safety Regulations

### 2.1 Intended Use

The communication device KSM45 is an extension for the modules KSM11, KSM12 and their variants for safety data transmission with FSoE protocol in use with EtherCAT.

The KSM 45 extension device may only be used in an EtherCAT environment according to the IEC 61158 standard as a "slave" device.

### 2.2 General Safety Regulations

#### Safety Note:

- In order to avoid damage to persons and property only qualified personnel is entitled to work on the device. The term qualified personnel refers to persons who have successfully completed electrotechnical training and are fully familiar with the applicable rules and standards of electrical engineering.  
The qualified person must become familiar with the operating instructions (see IEC364, DIN VDE0100).
- The qualified must have profound knowledge of the national accident prevention regulations
- The use of the device must be strictly limited to the intended use as specified in the following list. The values of data listed under section "3.2 Characteristic device data" must also be observed.
- The contents of this installation manual is restricted to the basic function of the device or its installation. The "Programming instructions KSM11/12" contains a more detailed description of the programming and re-parameterization of the devices. Exact knowledge and understanding of these instructions is mandatory for a new installation or modification of device functions or device parameters.
- Commissioning (i.e. starting up the intended operation) is only permitted in strict compliance with the EMC-directive. The EMC-testing regulations EN55011:2007 + A2:2007 and EN 61000-6-2:2005 are used as basis.
- Compliance with the conditions acc. to EN 60068-2-6 related to the values specified under "Technical characteristics" is mandatory for storage and transport.
- The wiring and connecting instructions in chapter "Installation" must be strictly followed.
- The applicable VDE-regulations and other special safety regulations of relevance for the application must be strictly followed.
- Evidence of the configured monitoring functions as well as their parameters and links must be issued by means of a validation report.
- The implementation of the module must be coordinated with the demands of the responsible acceptance testing authority (e.g. TÜV or ELIA).

- Do not install or operate damaged products. Report damages immediately to the responsible forwarding agent.
- Never open the housing and/or make unauthorized conversions.

Inputs and outputs for standard functions or digital and analog data transmitted via communication modules must not be used for safety relevant applications.

**⚠ WARNING:**

**Using our devices contrary to the rules and conditions specified hereunder can lead to injuries or fatalities as well as damage to connected devices and machines! This will also cause the loss of all warranty and compensation claims against Kollmorgen.**

## 2.3 Operation and Service

The module must always be de-energized before installation and removal, or before disconnecting signal lines. For this purpose all live supply lines to the device must be checked for safe isolation from supply

When installing or removing the module appropriate measures must be applied to prevent electrostatic discharge to the externally arranged terminal and plug connections. Contact with such terminals should be reduced to a minimum and earthing should by means of e.g. an earthing strap should take place before and during these procedures.

## 2.4 Transport/Storage

Information concerning transport, storage and proper handling must be strictly followed. The climate related specifications in chapter "Technical data" must be complied with.

## 2.5 Scope of delivery

### The scope of delivery contains

- Extension device EtherCAT KSM55
- ESI-file
- Installation manual



## 3 Device Description

The KSM45 allows the user a safety communication link using FSoE protocol to a FSoE master module, typically the Beckhoff series EL6xxx.

The KSM45 is always delivered with a basic device series KSM11/KSM12 as a fixed configured system.

In each case, 12 bytes of FSoE user data are transmitted in both directions. The data consists of logic and process data.

Furthermore, 16 bytes of non-safe diagnostic data can be sent from a basic device series KSM11/KSM12 via EtherCAT. It is also possible to send 4 bytes functional inputs (without header information) via EtherCAT to a basic device series KSM11/KSM12.

The device has to be parameterized as an EtherCAT device (slave). A corresponding ESI-file is included with the device.

EtherCAT data rate is 100Mbit/s in full-duplex mode..

The EtherCAT connector is to conform with the provision of the EtherCAT user organization. Die EtherCAT-Steckverbindung ist nach der Montagevorschrift der EtherCAT.


Example: KSM12 with KSM45:



## 4 Safety Related Characteristics

The KSM45 provide a safety communication over FSoE protocol with a FSoE master device

The profile of the transmitted binary and process data is within predefined limits configurable. The correct source and target mapping of this data has to be ensured by appropriate validation measures.

 **Safety Note:** The safety regulations and EMC guidelines for FSoE protocol and the KSM devices has to be considered.

## 5 Connection and Installation

### 5.1 General Notes on Installation

Strictly follow the safety regulations when installing!

Degree of protection IP20

Route all signal lines for the interfacing of digital inputs and contact monitoring separately. You should in any case disconnect 230VAC voltages from low voltage power lines, if these voltages are used in connection with the application.

The cable lengths for digital inputs and outputs must normally not exceed **30 m**. If the cable lengths exceeds 30 m you must apply appropriate measures for fault exclusion concerning impermissible overvoltage. Appropriate measures include e.g. lightning protection for outdoor lines, overvoltage protection of the indoor system, protected routing of cables.

Measures concerning the electromagnetic compatibility (EMC)

The KSM module is intended for use in the drive environment and meets the EMC-requirements mentioned above. It is also assumed that the electromagnetic compatibility of the overall system is ensured by application of appropriate measures.

#### **Safety Notes:**

Electric power supply lines of the KSM and "discontinuous-action lines" of the power converter must be isolated from each other.

Signal lines and power lines of the power converter must be routed through separate cable ducts. The distance between the cable ducts should be minimum 10 mm.

Only shielded cables must be used to connect the position and speed sensors. The signal transmission cable must be RS-485-standard compliant (lines twisted in pairs).

Care must be taken to ensure that the shielding is correctly connected in the 9-pin SUB-D plugs of the position and speed sensors. Only metal or metal coated plugs are permitted.

The shielding on the sensor side must comply with appropriate methods.

EMC-compliant installation of the power converter technology in the environment of the KSM module must be assured. Special attention must be paid to the routing of cables, the shielding of motor cables and the connection of the braking resistor. Strict compliance with the installation instructions of the power converter manufacturer is mandatory.

All contactors in the environment of the power converter must be equipped with appropriate suppressor circuits.

Suitable measures to protect against overvoltages must be applied.

## 5.2 Installation KSM-Module

The module is solely to be installed in control cabinets with a degree of protection of at least IP54.

The modules must be vertically fastened on a top hat rail.

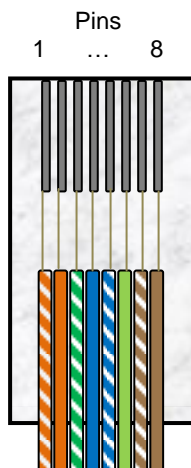
The ventilation slots must be kept unobstructed, to ensure adequate air circulation inside the module.

## 5.3 Assembly on Backplane Bus



For more information see “Installation Manual KSM”.

## 5.4 Terminal Assignment



### RJ45

Pin	Name	Description	Colour
1	TX+	Tranceive Data +	White/Orange
2	TX-	Tranceive Data -	Orange
3	RX+	Receive Data +	White/Green
4	nc.	Not used	Blue
5	nc.	Not used	White/Blue
6	RX-	Receive Data -	Green
7	nc.	Not used	White/Brown
8	nc.	Not used	Brown

## 6 Start Up

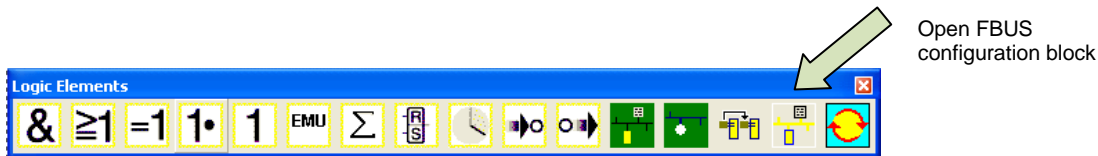
Start-up must only be performed by qualified personnel!  
Strictly follow the safety regulations when commissioning!

The commissioning of the module is illustrated by an FMX45 FSoE system.

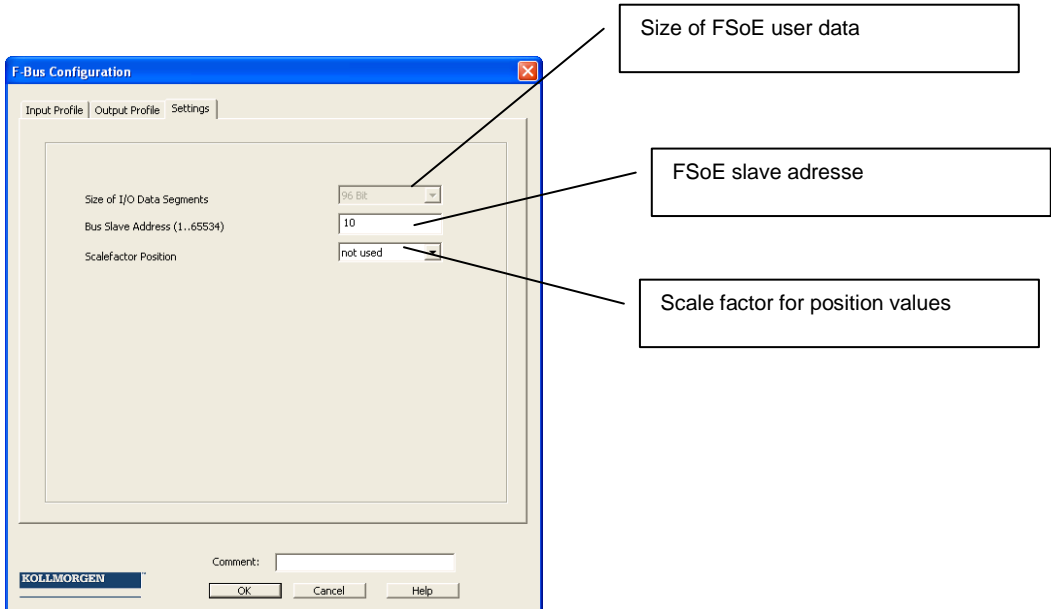
### 6.1 Configuraqtion SafePLC

#### 6.1.1 Basic Settings

The configuration of FSoE profile is done by calling “FBus configuration block”.



Settings:



## Output Profile:

The screenshot shows the 'F-Bus Configuration' dialog box with the 'Output Profile' tab selected. The 'Number of Logic Bits Output' is set to 40. The 'Bit Pos.' column shows bit positions 0, 24, and others. The 'Source' column lists 'Actual Position', 'Actual Speed', and 'SLP Stop-Position'. The 'Resolution' column shows 24 Bit and 16 Bit. The 'Already Used Bit Positions' is 40/56.

Callouts explain the following settings:

- Selection of process data:** Several data can be selected. The data are loaded in the profile in ascending order.
- Bit/offset order:** Points to the 'Bit Pos.' column.
- Max. size of process data:** Points to the 'Number of Logic Bits Output' dropdown.
- Resolution of process data:** Points to the 'Resolution' dropdowns.
- Max. number in bit for processdata:** Points to the 'Already Used Bit Positions' field.
- Currently used process data in bit:** Points to the 'Source' column.

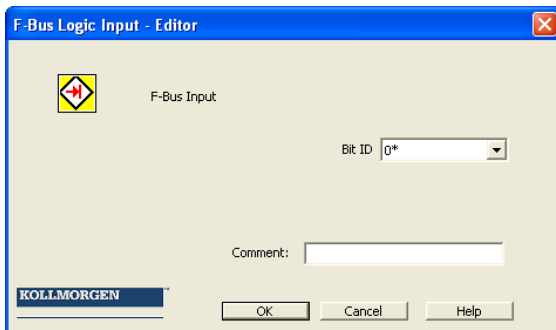
## Input Profile:

Configuration size of logic data.

### 6.1.2 Source and Target Mapping Logic Data

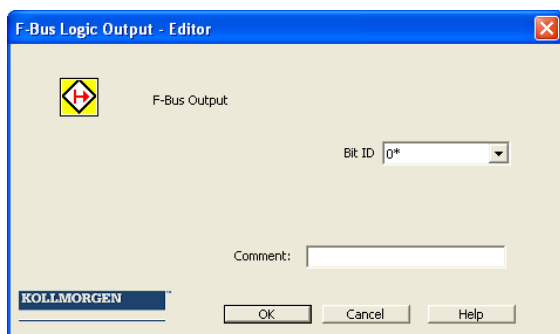
In the terminal diagram SafePLC the logic data can be inserted.

## Logical Data Input:



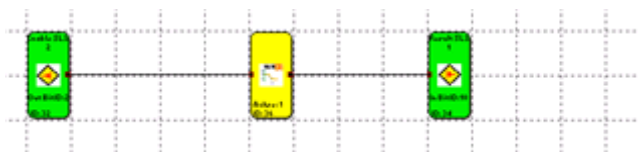
Bit ID is the bit order in the FSoE data telegram.

Logical Data Output:



Bit ID is the bit order in the FSoE data telegram.

In the CFC view of SafePLC the output and input blocks of the logical data are linked.



**Figure 9:** Function diagram with F-bus inputs and outputs

### 6.1.3 Validation of FSoE Profile

The correct source and target mapping of F-bus data (logical data and process data) according to applicative specification must be checked by validation in the whole system.

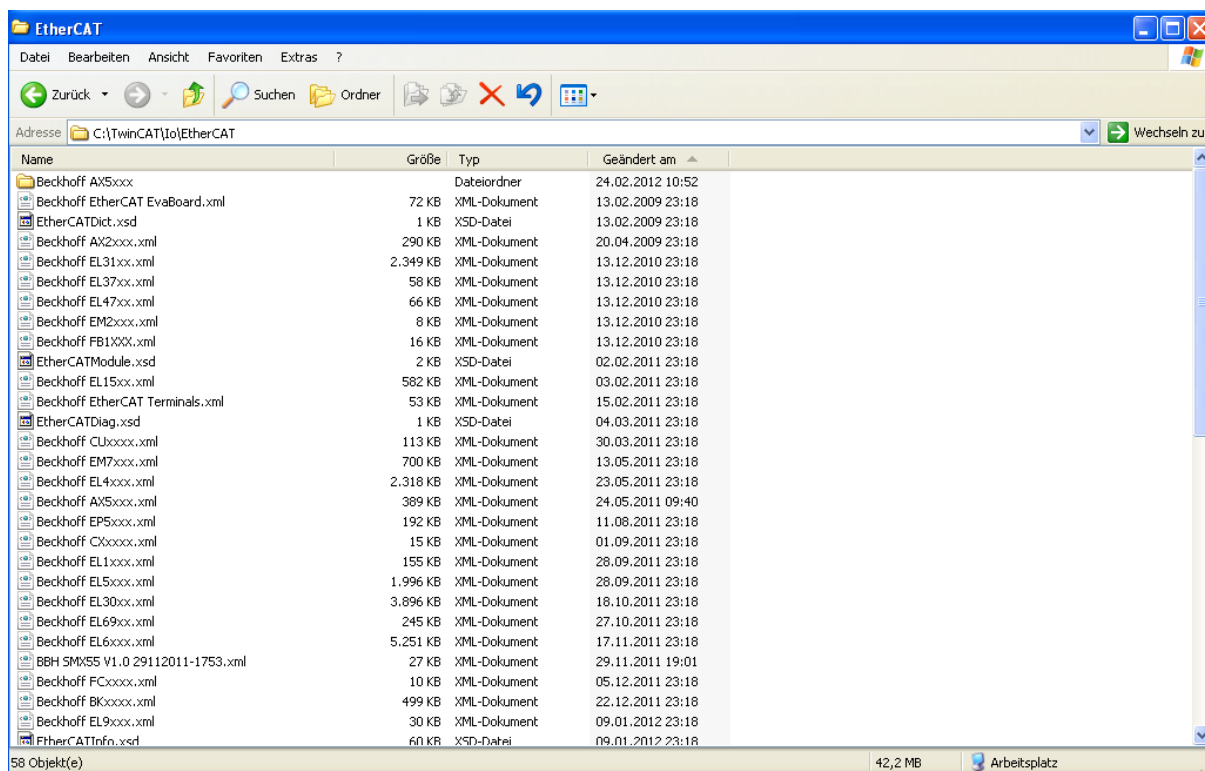
See instructions in the KSM Installation manual and instruction of manufacturer user manuals of FsoE master device.

## 6.2 Configuration and Commissioning of the FSoE Master

In the following example a start-up in TwinCAT is shown.

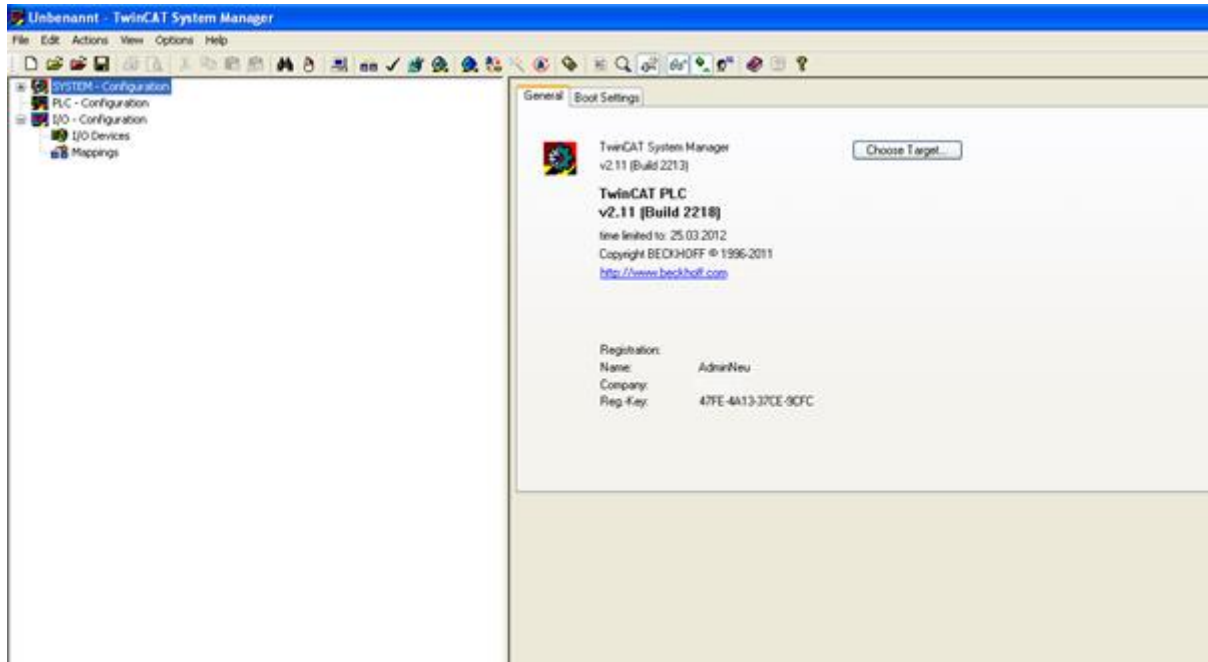
### 6.2.1 Installation ESI-File

Copy ESI-File into ESI-Folder of TwinCAT program.  
TwinCAT program has to be closed for this step.  
After starting TwinCAT the ESI cache is reinitialized.

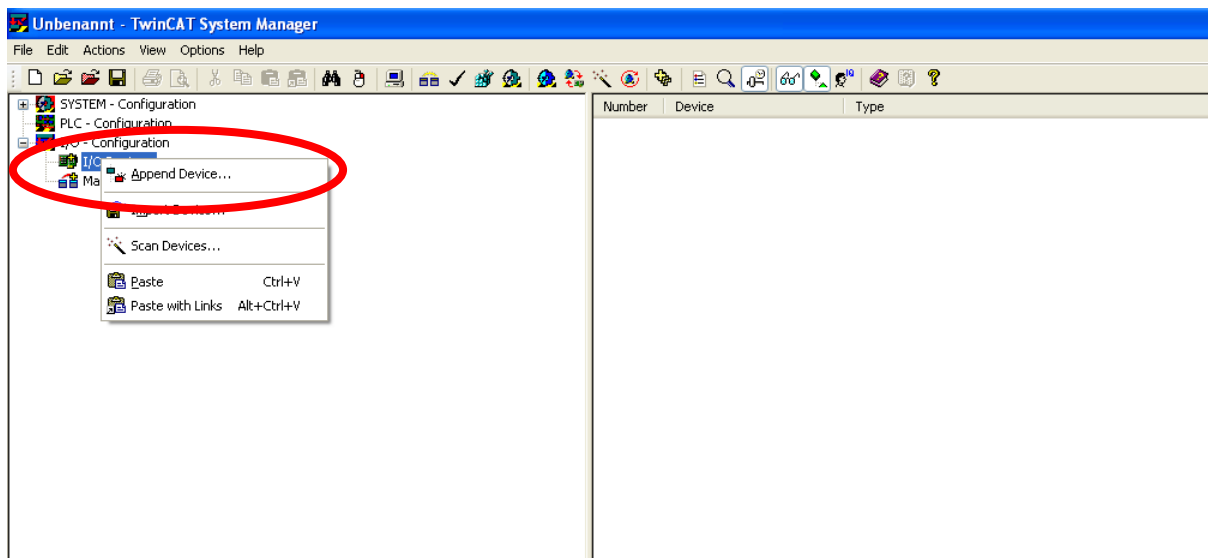


## 6.2.2 Integration KSM55 into TwinCAT

Open TwinCAT System Manager and if necessary create a new project.

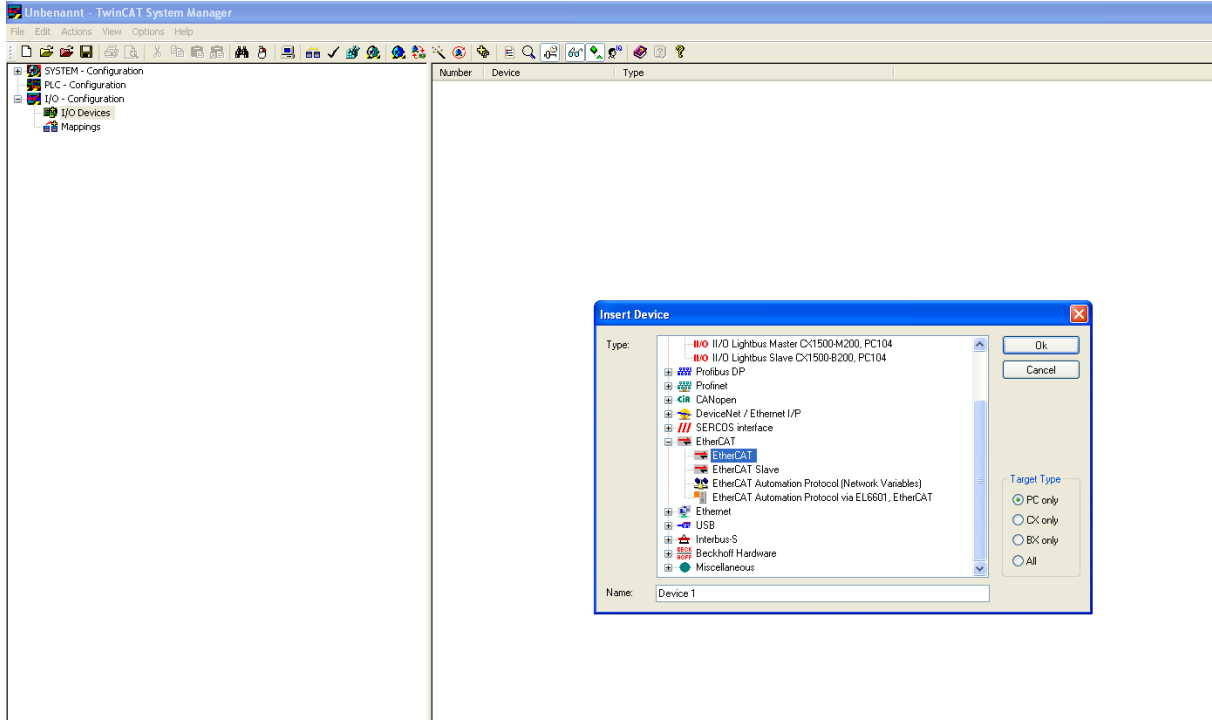


Right-click "I/O Device" -> "Append Device".

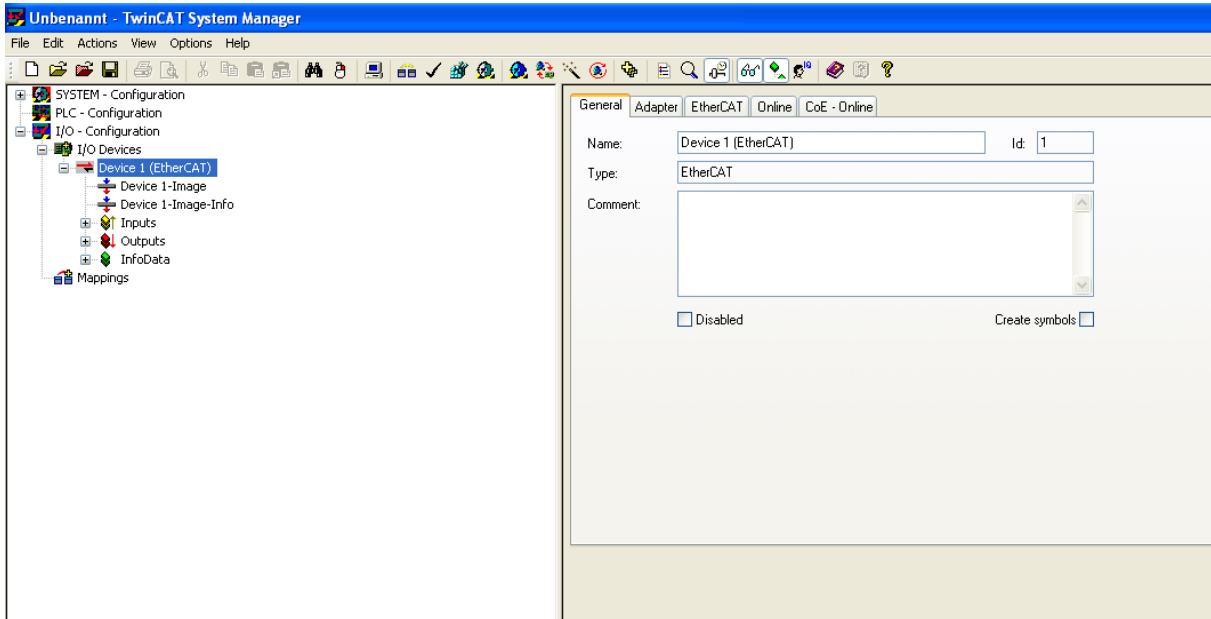




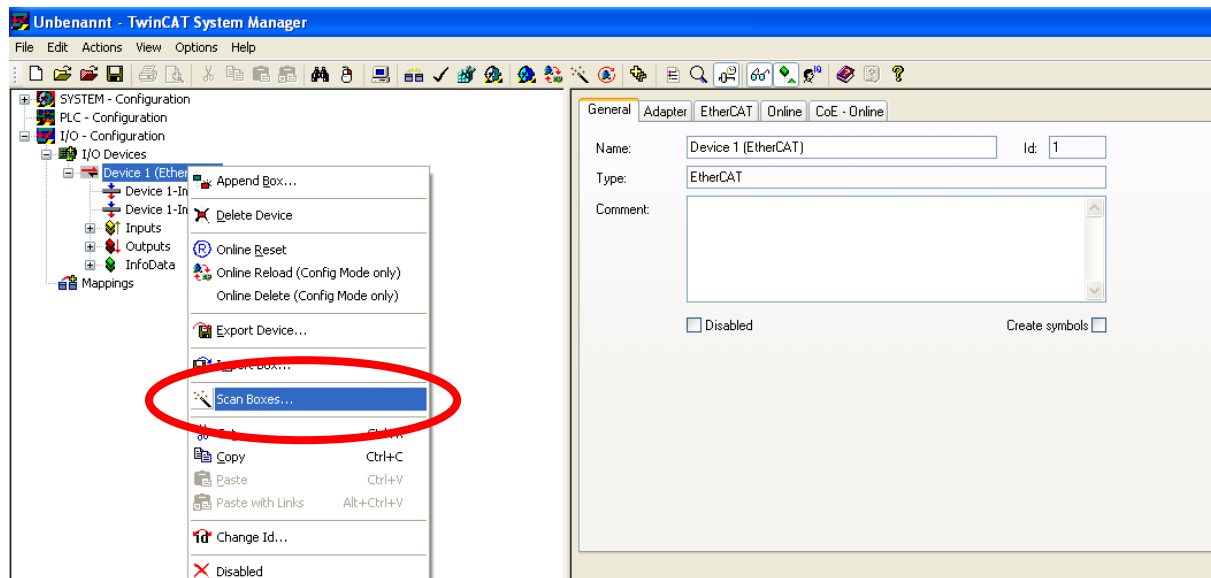
Confirm EtherCAT.



The EtherCAT master is now added into TwinCAT. You can now start searching for an EtherCAT slave. The EtherCAT –Slave should be running and connected to the PC (TwinCAT program).



Click Device 1 (EtherCAT) and then Scan boxes. Searching for slave devices starts.

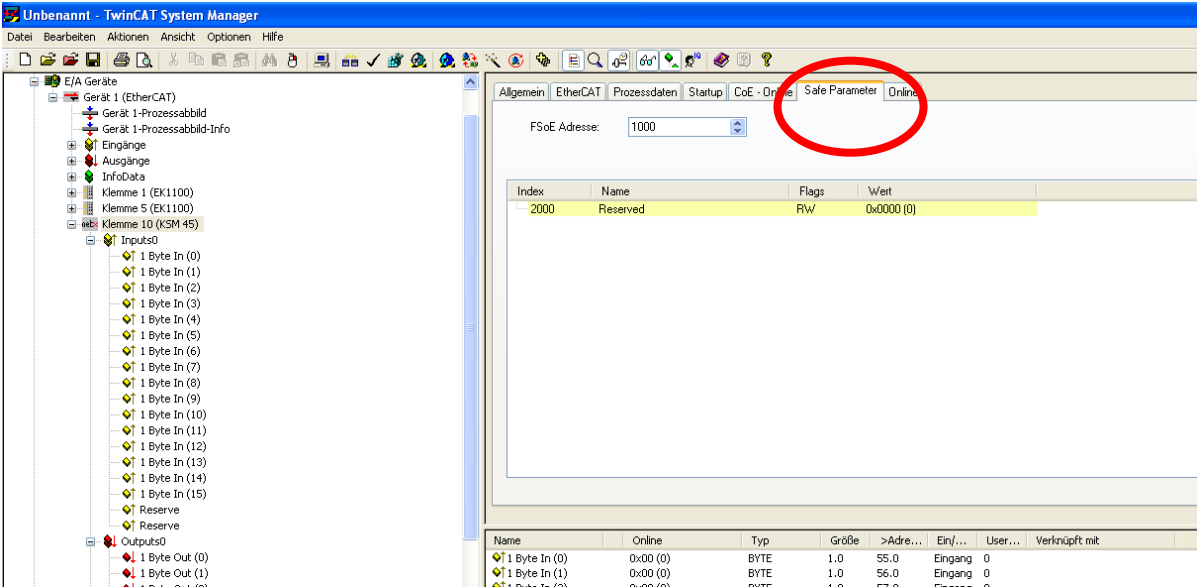


By clicking on the KSM45, the input and output bytes are displayed.

The screenshot shows the TwinCAT System Manager interface. On the left, a tree view displays the system configuration. The 'I/O Devices' folder is expanded, and 'Box 10 (KSM 45)' is selected and circled in red. The right pane shows the configuration details for this device. The 'General' tab is active, showing the name 'Box 10 (KSM 45)', type 'KSM 45', and ID '10'. Below the panes, a table lists the input and output bytes for the device.

Name	Online	Type	Size	>Addr...	In/Out	User...	Linked to
1 Byte In (0)	0xD4 (212)	BYTE	1.0	55.0	Input	0	
1 Byte In (1)	0x00 (0)	BYTE	1.0	56.0	Input	0	
1 Byte In (2)	0x00 (0)	BYTE	1.0	57.0	Input	0	
1 Byte In (3)	0x00 (0)	BYTE	1.0	58.0	Input	0	
1 Byte In (4)	0x00 (0)	BYTE	1.0	59.0	Input	0	
1 Byte In (5)	0x00 (0)	BYTE	1.0	60.0	Input	0	
1 Byte In (6)	0x00 (0)	BYTE	1.0	61.0	Input	0	
1 Byte In (7)	0x00 (0)	BYTE	1.0	62.0	Input	0	
1 Byte In (8)	0x00 (0)	BYTE	1.0	63.0	Input	0	
1 Byte In (9)	0x00 (0)	BYTE	1.0	64.0	Input	0	
1 Byte In (10)	0x00 (0)	BYTE	1.0	65.0	Input	0	
1 Byte In (11)	0x00 (0)	BYTE	1.0	66.0	Input	0	
1 Byte In (12)	0x00 (0)	BYTE	1.0	67.0	Input	0	
1 Byte In (13)	0x03 (3)	BYTE	1.0	68.0	Input	0	
1 Byte In (14)	0xD0 (208)	BYTE	1.0	69.0	Input	0	
1 Byte In (15)	0x8F (143)	BYTE	1.0	70.0	Input	0	
1 Byte In (16)	0x00 (0)	BYTE	1.0	71.0	Input	0	
1 Byte In (17)	0x00 (0)	BYTE	1.0	72.0	Input	0	
1 Byte In (18)	0x00 (0)	BYTE	1.0	73.0	Input	0	
1 Byte In (19)	0x00 (0)	BYTE	1.0	74.0	Input	0	
1 Byte In (20)	0x00 (0)	BYTE	1.0	75.0	Input	0	
1 Byte In (21)	0x00 (0)	BYTE	1.0	76.0	Input	0	
1 Byte In (22)	0x00 (0)	BYTE	1.0	77.0	Input	0	
1 Byte In (23)	0x00 (0)	BYTE	1.0	78.0	Input	0	
1 Byte In (24)	0x00 (0)	BYTE	1.0	79.0	Input	0	
1 Byte In (25)	0x00 (0)	BYTE	1.0	80.0	Input	0	
1 Byte In (26)	0x00 (0)	BYTE	1.0	81.0	Input	0	
1 Byte In (27)	0x00 (0)	BYTE	1.0	82.0	Input	0	

Next the FSoE slave address is set. For this click on “Safe Parameter”. The slave address has to match with the setting in the SafePLC program.



## 7 Diagnostic LED

LED	Farbe	Mode	Description
<b>RUN</b>	Green	Blinking	Device OK
<b>XB</b>	Green	Constant	EtherCAT connection active with data exchange
	Green	Blinking	EtherCAT connection not active, device in RUN
	Red	Blinking	EtherCAT connection not active, device not in RUN
<b>ST</b>	Green	Blinking	Data from basic device KSM 1X received
	Red	Blinking	Missing data or data not received within 9ms

## 8 Modification /Handling Changes to the Device

Maintenance work must solely be carried out by qualified personnel.  
Regular maintenance work is not required.

### Repair

The devices must always be replaced as whole units  
Repair work on the device can only be performed in the factory.

### Warranty

By opening the module without permission the warranty will become null and void.

### Note:


By modifying the module the safety approval will become null and void!

## 9 Maintenance

### 9.1 Exchanging a Module

The following should be noted when exchanging a module KSM31R:

- Disconnect the electric power converter from the main supply.
- Switch off the electric power supply for the device and disconnect.
- Take the module off the top hat rail and pack up EMC-compliant.
- Setting bus adress on the new device and mount the new module on the top hat rail
- Reconnect all connections.
- Switch on the electric power converter.
- Switch on the supply voltage.

 **Note:** Pluggable connections of the KSM module must generally not be disconnected or connected in live condition.

## 10 Technical Data

### 10.1 Environmental Conditions

<b>Class of Protection</b>	IP 20
<b>Ambient Temperature</b>	0 °C* ... 50 °C
<b>Climatic Category</b>	3k3 acc. to DIN 50 178
<b>Lifetime</b>	90000h at 50 °C ambient

### 10.2 Characteristic Data

<b>Device KSM45</b>	
System Cycle Time	8 to 9 ms
Size of FSoE User Data	12 bytes
Minimum FSoE Watchdog Timeout	70 ms

## About Kollmorgen

Kollmorgen is a leading provider of motion systems and components for machine builders. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions that are unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

For assistance with your application needs, visit [www.kollmorgen.com](http://www.kollmorgen.com) or contact us at:

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