



ECX-Master-Selector

Dual EtherCAT Master Selector
for two Redundant Masters



Hardware Manual

to Product E.3021.01

NOTE

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Document History

The changes in the document listed below affect changes in the hardware as well as changes in the description of the facts, only.

Revision	Chapter	Changes versus previous version	Date
1.0	-	First Version of English ECX-Master-Selector Hardware-Manual	2013-11-13
1.1	-	Safety instructions and warning messages revised, classification added	2018-12-05
	2.2	New chapter contains figure 2	
	2.3	New chapter: "Switching Signal"	
	2.4	Position of LEDs in Figure 4 corrected	
	4.1.2	Input switching threshold changed ($U_{ON} = 11\text{ V} \dots 30\text{V}$)	
1.2	8.	New declaration of conformity	2019-11-12
	3.	Safety information inserted	
	5.1.1	"Conductor Connection/Conductor Cross Sections" moved to this subchapter	
	6.	New chapter: "Notes on switching"	
	9.	Declaration of Conformity new	

Technical details are subject to change without further notice.

Classification of Warning Messages and Safety Instructions

This manual contains noticeable descriptions, warning messages and safety instructions, which you must follow to avoid personal injuries or death and property damage.



This is the safety alert symbol.

It is used to alert you to potential personal injury hazards. Obey all safety messages and instructions that follow this symbol to avoid possible injury or death.

DANGER, WARNING, CAUTION

Depending on the hazard level the signal words DANGER, WARNING or CAUTION are used to highlight safety instructions and warning messages. These messages may also include a warning relating to property damage.



DANGER

Danger statements indicate a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

Warning statements indicate a hazardous situation that, if not avoided, could result in death or serious injury.



CAUTION

Caution statements indicate a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Notice statements are used to notify people on hazards that could result in things other than personal injury, like property damage.



NOTICE

This NOTICE statement indicates that the device contains components sensitive to electrostatic discharge.



NOTICE

This NOTICE statement contains the general mandatory sign and gives information that must be heeded and complied with for a safe use.

INFORMATION



INFORMATION

Notes to point out something important or useful.



Safety Instructions

- When working with the ECX-Master-Selector follow the instructions below and read the manual carefully to protect yourself from injury and the ECX-Master-Selector from damage.
- Do not use damaged or defective cables to connect the ECX-Master-Selector.
- In case of damages to the device, which might affect safety, appropriate and immediate measures must be taken, that exclude an endangerment of persons and domestic animals and property.
- Current circuits which are connected to the device have to be sufficiently protected against hazardous voltage (SELV according to EN 60950-1).
- The ECX-Master-Selector may only be driven by power supply current circuits, that are contact protected. A power supply, that provides a safety extra-low voltage (SELV) according to EN 60950-1, complies with this conditions.

- Do not open the housing of the ECX-Master-Selector.
- The ECX-Master-Selector has to be securely installed before commissioning.
- The permitted operating position is specified as shown (Figure: 8). Other operating positions are not allowed.
- Never let liquids get inside the ECX-Master-Selector. Otherwise, electric shocks or short circuits may result.
- Protect the ECX-Master-Selector from dust, moisture and steam.
- Protect the ECX-Master-Selector from shocks and vibrations.
- The ECX-Master-Selector may become warm during normal use. Always allow adequate ventilation around the ECX-Master-Selector and use care when handling.
- Do not operate the ECX-Master-Selector adjacent to heat sources and do not expose it to unnecessary thermal radiation. Ensure an ambient temperature as specified in the technical data.

Qualified Personnel

This documentation is directed exclusively towards personnel qualified in control and automation engineering.

The installation and commissioning of the product may only be carried out by qualified personnel, which is authorized to put devices, systems and electric circuits into operation according to the applicable national standards of safety engineering.

Conformity

The ECX-Master-Selector meets the demands of the EU regulations and EMC standards printed in the conformity declaration at the end of this manual.

Intended Use

The intended use of the ECX-Master-Selector is the operation as Dual EtherCAT Master Selector for two Redundant Masters.

The guarantee given by esd does not cover damages which result from improper use, usage not in accordance with regulations or disregard of safety instructions and warnings.

- The ECX-Master-Selector is intended for indoor installation only.
- The operation of the ECX-Master-Selector in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the ECX-Master-Selector for medical purposes is prohibited.

Data Safety

This device is equipped with an Ethernet or other interface which is suitable to establish a connection to data networks. Depending on the software used on the device, these interfaces may allow attackers to compromise normal function, get illegal access or cause damage.

esd does not take responsibility for any damage caused by the device if operated at any networks. It is the responsibility of the device's user to take care that necessary safety precautions for the device's network interface are in place.

Service Note

The ECX-Master-Selector does not contain any parts that require maintenance by the user. The ECX-Master-Selector does not require any manual configuration of the hardware. Unauthorized intervention in the device voids warranty claims.

Disposal

Devices which have become defective in the long run have to be disposed in an appropriate way or have to be returned to the manufacturer for proper disposal. Please, make a contribution to environmental protection.

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1. Overview

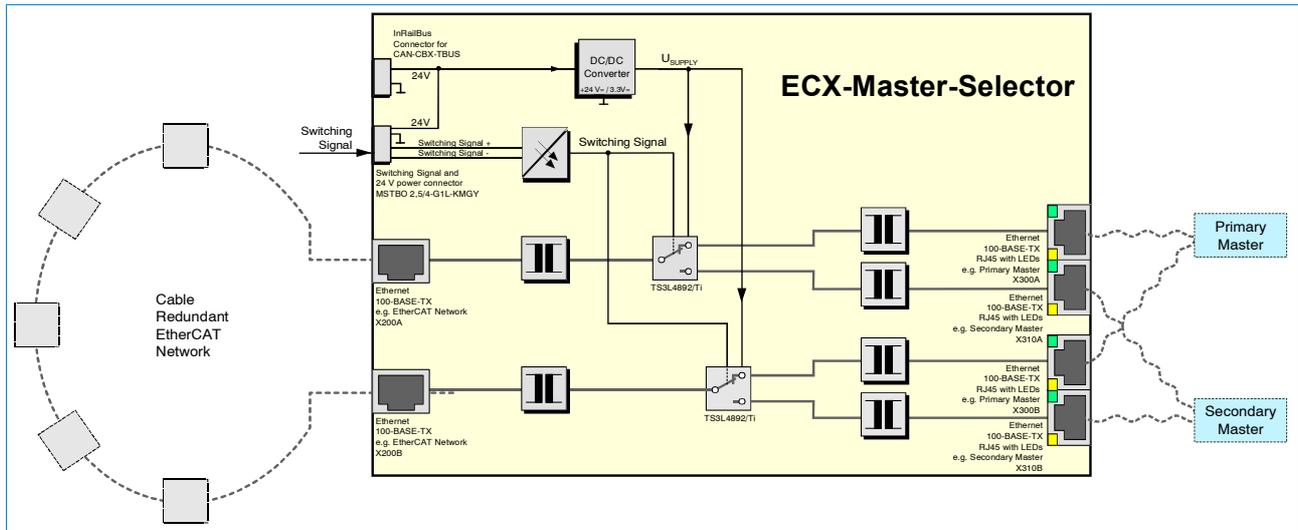


Fig. 1: Block circuit diagram

The ECX-Master-Selector is designed to build redundant EtherCAT Master Systems like EtherCAT, Sercos III, PROFINET,

The Ethernet physics are designed according to IEEE 802.3.

Controlled by a simple switching input signal via a LAN selector switch, the ECX-Master-Selector can connect an EtherCAT network to one of two different EtherCAT masters with cable redundancy. The control signal is optically isolated.

The ECX-Master-Selector is ideal to build up a redundancy at the EtherCAT Master side as extension to EtherCAT Technology Group Standard (ETG).

The ECX-Master-Selector is designed for DIN-EN carrier rail mounting. The module provides service-friendly 'wiring' of the supply voltage. The power supply can be applied via the InRailBus connector (TBUS-connector) integrated in the mounting rail or separately via the clamp-connection.

2. Hardware

2.1 Connecting Diagram

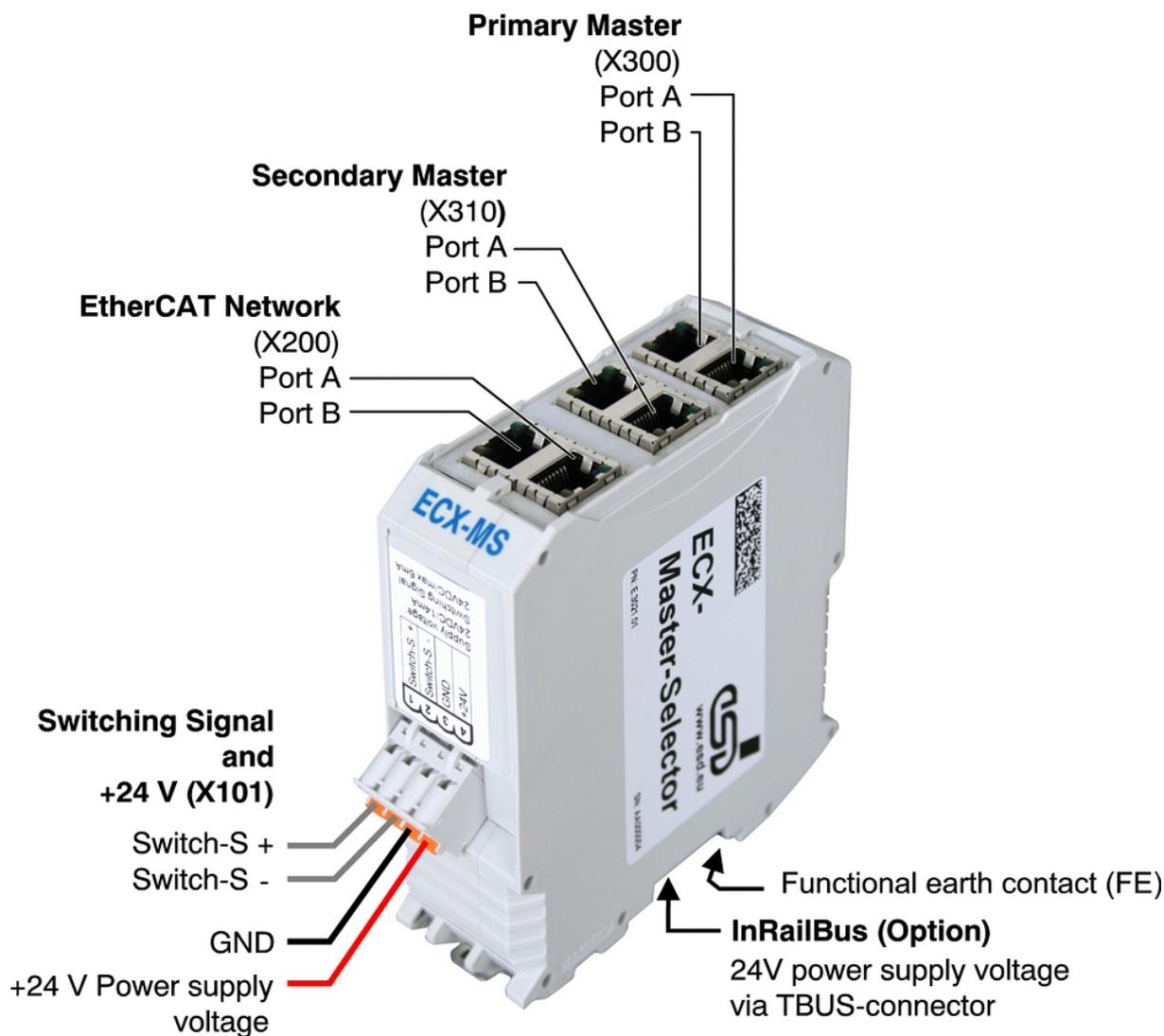


Fig. 2: Connecting diagram of ECX-Master-Selector



NOTICE

The pins 1,2 and 3 of the mounting rail bus connector are reserved and must not be connected!

The signal assignment of the connectors is described from page 15 on.

2.2 Back Label with EtherCAT Ports

The label on the back of the ECX-Master-Selector shows the EtherCAT ports:

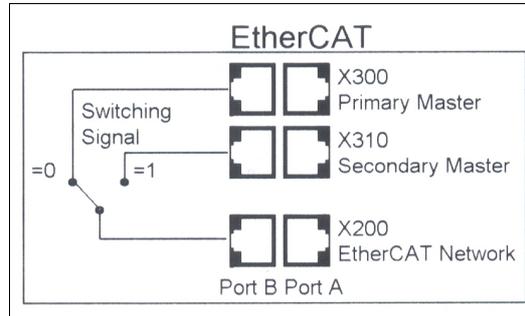


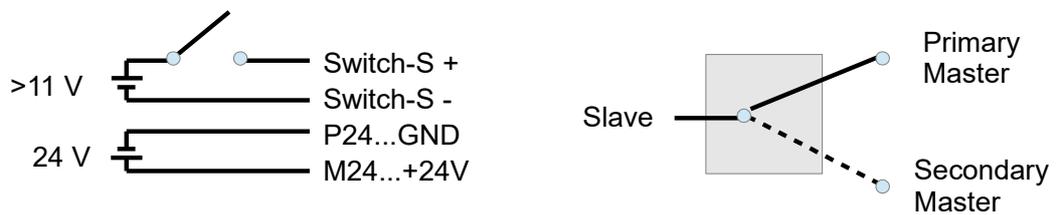
Fig. 3: Back label of the ECX-Master-Selector

2.3 Switching Signal

The switching signals (Switch-S + and Switch-S -) and the +24V power supply voltage are connected to connector X101 (see Figure 2, page 9).

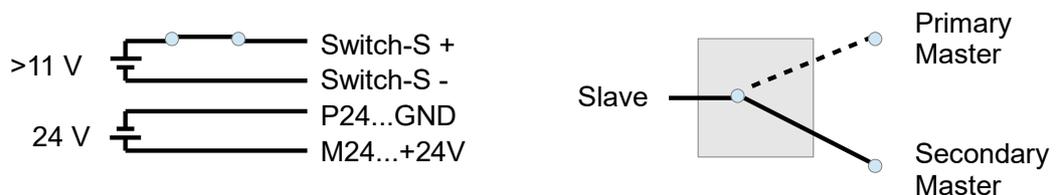
Case 1: Switching Signal = 0

Switching signal < input switching threshold (11V) → The ECX-Master-Selector connects the EtherCAT Network (Slave) with the **Primary Master** via connector X300.



Case 2: Switching Signal = 1

Switching signal > input switching threshold (11V) → The ECX-Master-Selector connects the EtherCAT Network (Slave) with the **Secondary Master** via connector X310.



For a description of connector X300 see chapter “24 V-Power Supply Voltage and Switching Signal” page 15

2.4 Front Panel View with Position of LEDS and Connectors

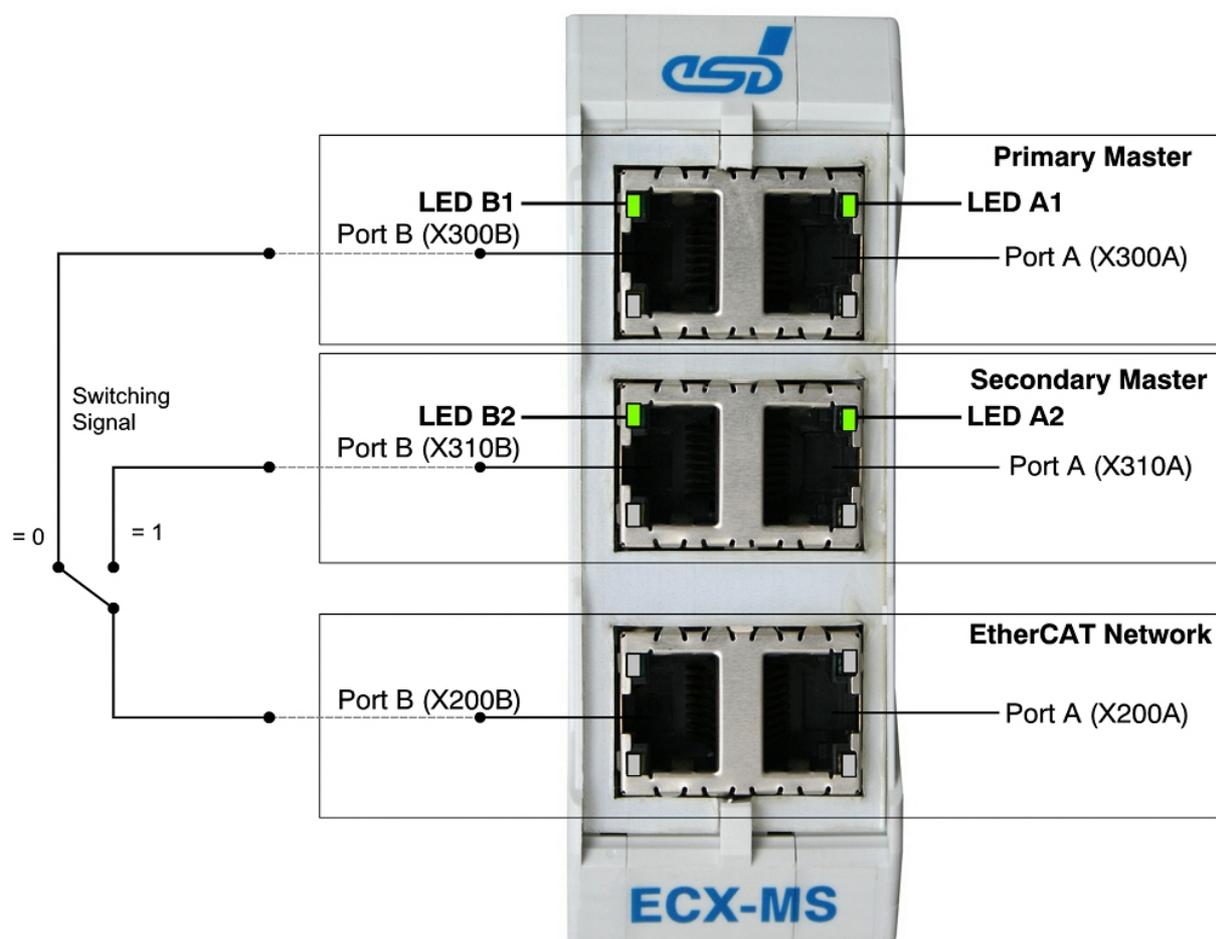


Fig. 4: Connectors and LEDS

2.5 LED Indication

The ECX-Master-Selector is equipped with six RJ45 sockets with integrated LEDs in the front panel. Only the four green LEDs of the Primary and Secondary Master are used:

- LED B1, LED A1
- LED B2, LED A2 .

Connector	Port	LED	Colour	Indication when LED on
Primary Master (X300)	B	LED B1	green	Primary Master is selected
	A	LED A1	green	
Secondary Master (X310)	B	LED B2	green	Secondary Master is selected
	A	LED A2	green	

Table 1: Description of the green master LEDs

The other LEDs have no functionality.

3. Hardware Installation

To put the ECX-Master-Selector into operation, please follow the installation notes.

Step	Procedure	see page
	<p>NOTICE Read the safety instructions at the beginning of this document carefully, before you start with the hardware installation!</p>	4
	<p>WARNING Hazardous voltage - Risk of electric shock Ensure the absence of voltage before starting any electrical work. All current circuits which are connected to the device have to be sufficiently protected against hazardous voltage (SELV according to EN 60950-1) before you start with the installation.</p>	
1.	Mount the ECX-Master-Selector module and connect the interfaces (EtherCAT, power supply voltage, switching signal).	9
2.	If you use the InRailBus, please make sure to have read the chapter: "Appendix InRailBus (Option)".	19
3.	Apply the 24 V-power supply voltage.	-

4. Technical Data

4.1 General Technical Data

Power supply voltage	nominal voltage: 24 VDC ± 20% current consumption (24 V, 20°C): 14 mA
Control voltage (off/on)	-5 ...8 VDC / 11 ... 32 VDC; max.6 mA according to DIN EN 61131-2, Type 3
Connectors	EtherCAT Network Dual port RJ45 socket - Ethernet-A/EtherCAT-Slave-A (X200A) - Ethernet-B/EtherCAT-Slave-B (X200B)
	Primary Master Dual port RJ45 socket, - Ethernet-A.1/EtherCAT-Master_A.1 (X300A) - Ethernet-B.1/EtherCAT-Master_B.1 (X300B)
	Secondary Master Dual port RJ45 socket, - Ethernet-A.2/EtherCAT-Master_A.2 (X310A) - Ethernet-B.2/EtherCAT-Master_B.2 (X310B)
	Control signal and 24 V power supply voltage 4-pin Phoenix Contact PCB plug connector with spring-cage connection (X101) - Control signal and +24V power supply voltage
	InRailBus 5-pin TBUS connector (X100) - Power supply voltage via InRailBus (Option)
Temperature range	0...70 °C ambient temperature
Humidity	max. 90%, non-condensing
Protection class	IP20
Pollution degree	maximum 2 (according to DIN EN 61131-2)
Housing	Plastic housing for carrier rail mounting NS35/7,5 DIN EN 60715
Dimensions	Width: 35 mm x height: 99 mm x depth: 114.5 (dimensions without mating connectors)
Mounting	DIN-EN carrier rail mounting (TS35)
Weight	150 g

Table 2: General data

4.1.1 Ethernet Interface

Number	Cable redundant primary and secondary Master, 1x EtherCAT network
Connection	Twisted Pair (compatible to IEEE 802.3), 100BASE-TX
Bit rate	10/100 Mbit/s
Electrical isolation	via transformer
Connector	RJ45 socket with integrated LEDs in the front panel

Table 3: Data of the Ethernet interface

4.1.2 Digital Inputs

Number	1
Connection technology	2-wire technology
Specification	EN 61131-2, Type 3
Nominal voltage	18 V ... 30 V DC
Input switching threshold	$U_{ON} = 11 \text{ V} \dots 30\text{V}$ $U_{OFF} = 5 \text{ V} \dots -3\text{V}$
Input current	3 mA typical
Input low-pass filter	$F_G = 2.8 \text{ kHz}$
Electrical isolation	yes
Protective circuit	Overvoltage protection up to 40 V, reverse voltage protection
Connector	4-pin Phoenix Contact PCB plug connector with spring-cage connection (X101)

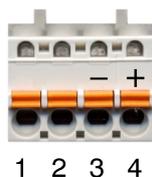
Table 4: Digital Inputs

5. Connector Assignments

5.1 24 V-Power Supply Voltage and Switching Signal

Device socket: Phoenix Contact MSTBO 2,5/4-G1L-KMGY
Line connector: Phoenix Contact FKCT 2,5/4-ST, 5.0 mm pitch, spring cage connection, Phoenix Contact order No.: 19 21 90 0 (included in the scope of delivery)
 For conductor connection and conductor cross section see page 16.

Pin Position:



Pin Assignment:

Labelling of the ECX-Master-Selector				
	Switch-S +	Switch-S -	GND	+24V
Connector	(free)	(free)	-	+
Pin No.	1	2	3	4
Signal	Switch-S +	Switch-S -	M24 (GND)	P24 (+ 24 V)

Please refer to the connecting diagram page 9.

Signal Description:

Switch-S +,
 Switch-S - ... Switching Signal lines, 24 VDC / max. 6 mA
 P24... Power supply voltage +24 V DC \pm 20% / 14 mA
 M24... Reference potential

5.1.1 Conductor Connection/Conductor Cross Sections

The following table contains an extract of the technical data of the line connector.

Interface	24 V Power Supply Voltage ^[1]
Connector type plug component (Range of articles)	FKCT 2,5/...-ST KMGY
Connection method	spring-cage connection
Stripping length	10 mm
Conductor cross section solid min.	0.2 mm ²
Conductor cross section solid max.	2.5 mm ²
Conductor cross section stranded min.	0.2 mm ²
Conductor cross section stranded max.	2.5 mm ²
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm ²
Conductor cross section stranded, with ferrule without plastic sleeve max.	2.5 mm ²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm ²
Conductor cross section stranded, with ferrule with plastic sleeve max.	2.5 mm ²
Conductor cross section AWG/kcmil min.	24
Conductor cross section AWG/kcmil max	12
2 conductors with same cross section, solid min.	not allowed
2 conductors with same cross section, solid max.	not allowed
2 conductors with same cross section, stranded min.	not allowed
2 conductors with same cross section, stranded max.	not allowed
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	not allowed
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	not allowed
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm ²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	1.0 mm ²
Minimum AWG according to UL/CUL	26
Maximum AWG according to UL/CUL	12

6. Notes on Switching

The switching delay time results, among other things, from the time caused by switching the ECX-Master-Selector and the time that is needed to establish a link between e.g. the PC on the EtherCAT Master side and the first EtherCAT Slave on the EtherCAT Network side.

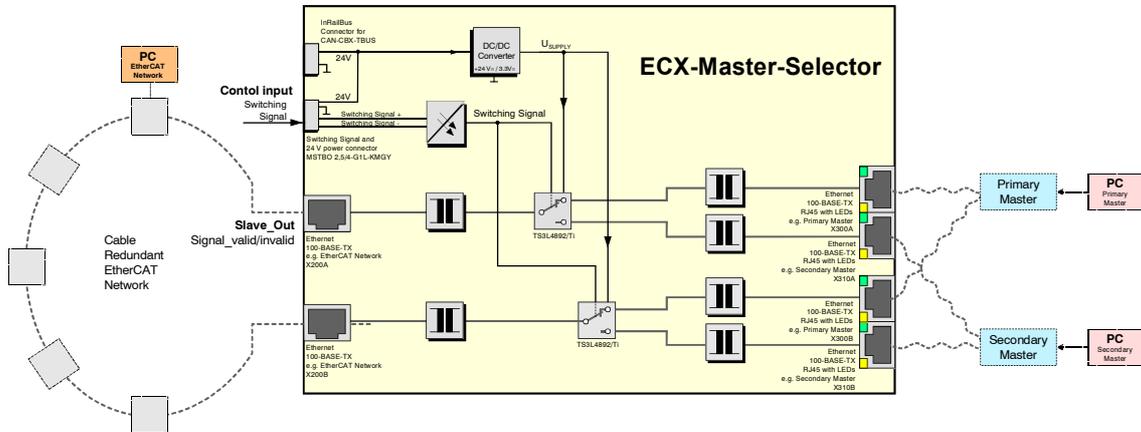


Fig. 5: ECX-Master-Selector and connection

Delay caused by ECX-Master-Selector (Switching time)

Measurement	Delay time caused by ECX-Master-Selector
Delay time for RF-signal fed to Primary Master, Secondary Master remains unconnected. Delay measured from Control Input (switching signal) to Slave_Out Signal_Valid/invalid	$t_{\text{Switch_M1}} = \max 20 \mu\text{s}$
Delay time for RF-signal fed to Secondary Master, Primary Master remains unconnected. Delay measured from Control Input (switching signal) to Slave_Out Signal_Valid/invalid	$t_{\text{Switch_M2}} = \max 20 \mu\text{s}$

The maximum measured delay caused by ECX-Master-Selector is $t_{\text{Switch_M1/2}} = \max 20 \mu\text{s}$

Delay caused by Link Establishment

After the signal is switched by the ECX-Master-Selector, a link between the PHY of the new Master and the PHY of the EtherCAT Network has to be established.

Normally this takes only $t_{\text{Link}} = \max 1\text{s}$.

NOTICE

Please note that the following circumstance leads to longer times (e.g.: 7-8 s):

- Devices, which can transmit and announce 1 GBit, are connected only with 2 pairs of cables instead of 4 pairs of cables as it is done using the ECX-Master-Selector.

EtherCAT slaves usually announce only 100 MBit.

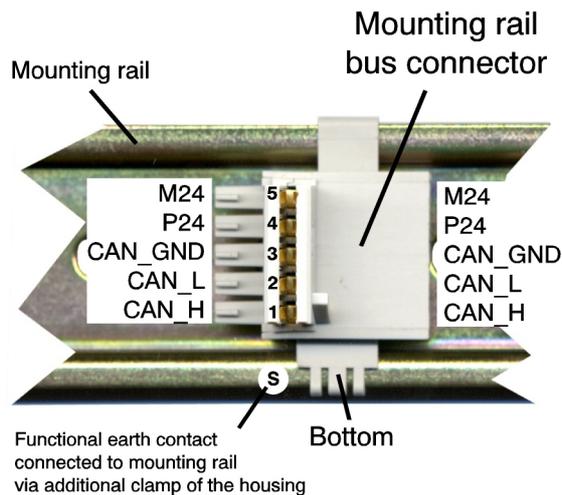
- Switch off the Gigabit support of your switch or of the Master. Now there is still the auto-negotiation but 1 GBit is excluded. Or:
- Force hard on both sides 100 MBit Full Duplex (without auto-negotiation). This is the fastest negotiation-method. Never force 100MBit on one side and leave auto-negotiation enabled on the other side!

7. Appendix InRailBus (Option)

7.1 Connector Assignment 24V via InRailBus (Option)

Connector type: Mounting-rail bus connector
 Phoenix Contact ME 17,5 TBUS 1,5/5-ST-3,81 KMGY
 The mounting-rail bus connector is not included in the scope of delivery.

Connector View:



Pin Assignment:

Pin	Signal
5	M24 (GND)
4	P24 (+24 V)
3	Do not connect!
2	Do not connect!
1	Do not connect!
S	FE (PE_GND)

Signal Description:

P24... power supply voltage +24 V
 M24... reference potential
 FE... functional earth contact (EMC) (connected to mounting rail potential)

7.2 Installation of the Module Using InRailBus Connector

7.2.1 Connection of the Power Supply Voltage

The power supply voltage can be connected via the +24V connector for the power supply voltage or via the InRailBus connector.



NOTICE

Read and observe the safety instructions to requirements on the supply current circuit (see page 4).



NOTICE

It is **not permissible** to feed through the power supply voltage through the ECX station from the InRailBus terminal plug to the 24 V power supply connector (and vice versa) to supply other ECX stations! A feed through of the +24 V power supply voltage can cause damage on the ECX modules.



NOTICE

The connections for the 24V power supply are internally connected and must not be supplied by two independent current sources at the same time!

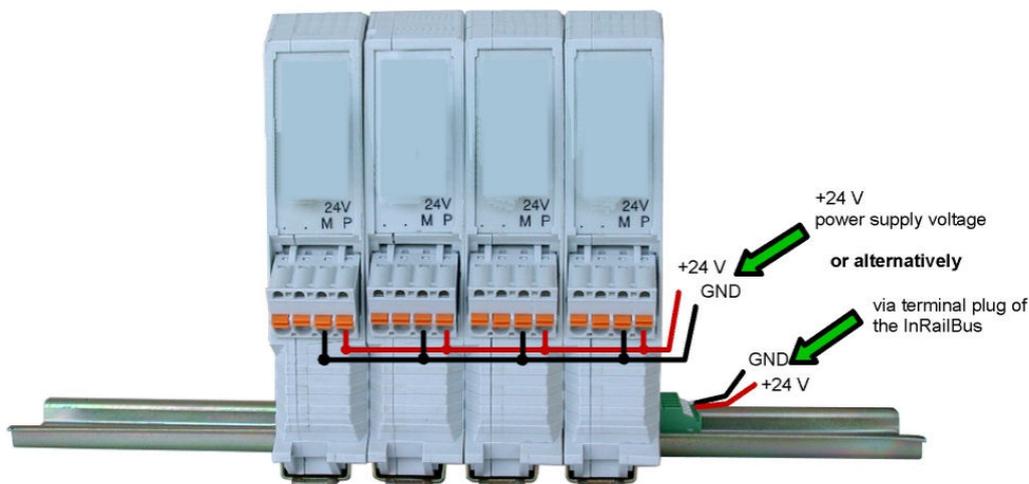


Fig. 6: ECX-Station

Earthing of the mounting rail



NOTICE

Connect the mounting rail to functional earth potential. Please note that the impedance of the connecting cable has to be kept as low as possible.

The functional earth contact is a current path of low impedance between current circuits and earth, that is not intended as protection measure, but improves the stability. It is not a protection against accidental contact for persons.



NOTICE

The EG conformity (see page 25) can only be warranted if the earthing via the mounting rail is made as described herein.

7.2.2 Installation of the Module Using the InRailBus Connector

If the power supply voltage shall be fed via the InRailBus, please proceed as follows:



NOTICE

The pins 1,2 and 3 of the mounting rail bus connector are reserved and must not be connected!

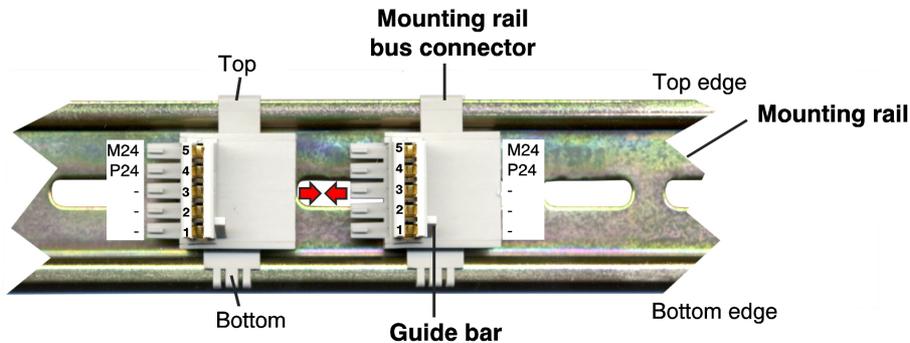


Fig. 7: Mounting rail with bus connector

1. Position the InRailBus connector on the mounting rail and snap it onto the mounting rail using slight pressure. Plug the bus connectors together to contact the power signals (in parallel with one). The bus connectors can be plugged together before or after mounting the ECX module.
2. Place the ECX module with the DIN rail guideway on the top edge of the mounting rail.

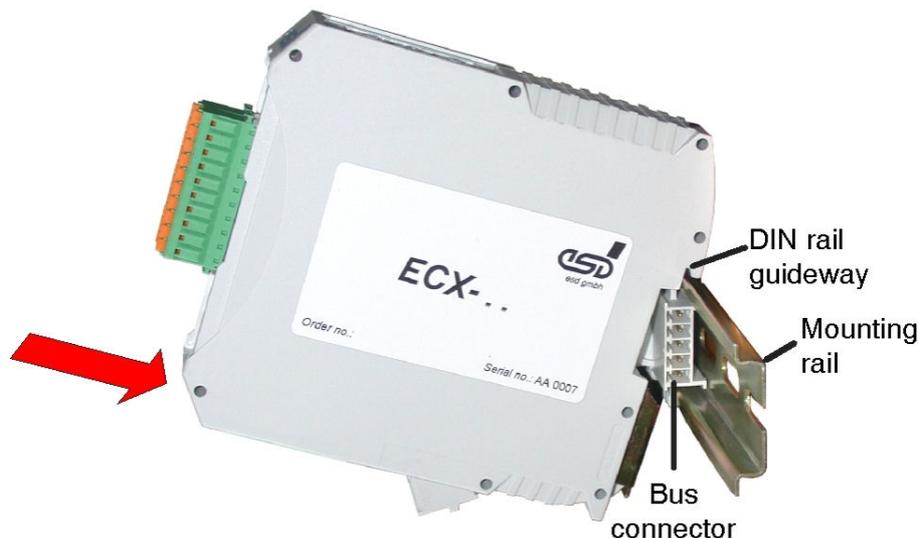


Fig. 8: Mounting ECX modules

3. Swivel the ECX module onto the mounting rail in pressing the module downwards according to the arrow as shown in Fig. 7. The housing is mechanically guided by the DIN rail bus connector.

Appendix InRailBus (Option)

- When mounting the ECX module the metal foot catch snaps on the bottom edge of the mounting rail. Now the module is mounted on the mounting rail and connected to the InRailBus via the bus connector. Connect the bus connectors and the InRailBus, if not already done.



Fig. 9: Mounted ECX-module

7.2.2.1 Connecting Power Supply to InRailBus

To connect the power supply signals via the InRailBus, a terminal plug (order no.: C.3000.02) is needed. The terminal plug is not included in delivery and must be ordered separately.

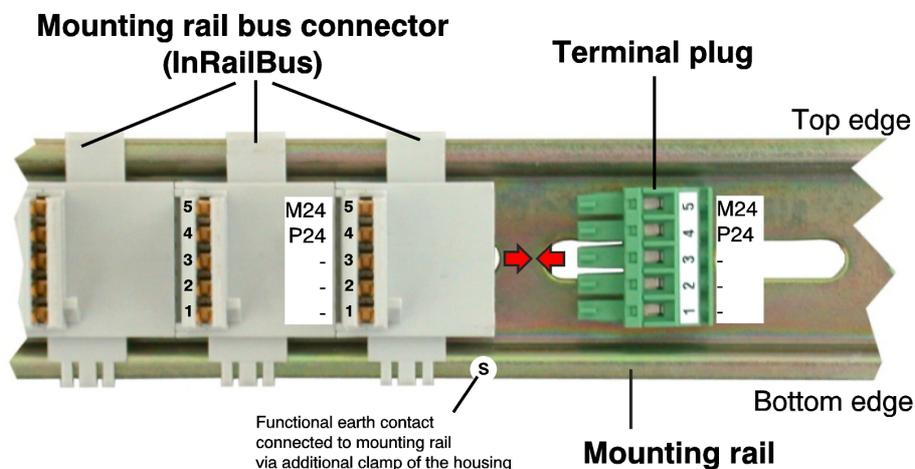


Fig. 10: Mounting rail with InRailBus and terminal plug



NOTICE

The pins 1,2 and 3 of the mounting rail bus connector are reserved. Do not connect!

Plug the terminal plug into the socket on the right of the mounting-rail bus connector of the InRailBus, as described in Fig. 8. Then connect the power supply voltage via the terminal plug. Please pay attention to the notes on the connection of the power supply voltage on page 20.

7.2.3 Remove the ECX Module from InRailBus

If the ECX-Master-Selector module is connected to the InRailBus please proceed as follows:

Release the module from the mounting rail in moving the foot catch (see Fig. 6) downwards (e.g. with a screwdriver). Now the module is detached from the bottom edge of the mounting rail and can be removed.



INFORMATION

It is possible to remove individual devices from the whole without interrupting the InRailBus connection, because the contact chain will not be interrupted.

8. References

- [1] Phoenix Contact GmbH & Co. KG, Blomberg.
Technical data taken from the Phoenix Contact website, <http://www.phoenixcontact.com>
PCB plug component - FKCT-2,5/4-ST KMGY - 1921900, download 2013-11-06

9. Declaration of Conformity

EU-KONFORMITÄTSERKLÄRUNG EU DECLARATION OF CONFORMITY



Adresse **esd electronics gmbh**
Address **Vahrenwalder Str. 207**
30165 Hannover
Germany

esd erklärt, dass das Produkt
esd declares, that the product

ECX-Master-Selector

Typ, Modell, Artikel-Nr.
Type, Model, Article No.

E.3021.01

die Anforderungen der Normen
fulfills the requirements of the standards

EN 61000-6-2:2005
EN 61000-6-3:2007+A1:2011

gemäß folgendem Prüfbericht erfüllt.
according to test certificate.

H-K00-0512-13

Das Produkt entspricht damit der EU-Richtlinie „EMV“
Therefore the product conforms to the EU Directive 'EMC'

2014/30/EU

Das Produkt entspricht den EU-Richtlinien „RoHS“
The product conforms to the EU Directives 'RoHS'

2011/65/EU, 2015/863/EU

Diese Erklärung verliert ihre Gültigkeit, wenn das Produkt nicht den Herstellerunterlagen entsprechend eingesetzt und betrieben wird, oder das Produkt abweichend modifiziert wird.
This declaration loses its validity if the product is not used or run according to the manufacturer's documentation or if non-compliant modifications are made.

Name / Name T. Bielert
Funktion / Title QM-Beauftragter / QM Representative
Datum / Date Hannover, 2019-10-29

Rechtsgültige Unterschrift / authorized signature

10. Order Information

Type	Properties	Order No.
ECX-Master-Selector	ECX-Master-Selector Dual EtherCAT Redundant Master Selector, IEEE 802.3, 24VDC, rail mounting	E.3021.02
Accessories for usage with InRailBus		
 ECX-TBUS	2x Mounting-rail bus connector for the ECX-Master-Selector module (ME MAX 35 G U-U1 KMGY): ME 17,5 TBUS 1,5/5-ST-3,81 KMGY (2 connectors per ECX-Master-Selector module needed)	E.3000.01
 CAN-CBX-TBUS-Connector	Terminal plug of the InRailBus for the connection of the +24V power supply voltage and the CAN interface, Female type	C.3000.02
 CAN-CBX-TBUS-Connection adapter	Terminal plug of the InRailBus for the connection of the +24V power supply voltage and the CAN-Interface, Male type	C.3000.03

Table 5: Order information

PDF Manuals

Manuals are available in English and usually in German as well. For availability of English manuals see table below.

Please download the manuals as PDF documents from our esd website www.esd.eu for free.

Manuals		Order No.
ECX-Master-Selector-ME	Hardware manual in English	E.3021.21

Table 6: Available manuals

Printed Manuals

If you need a printout of the manual additionally, please contact our sales team: sales@esd.eu for a quotation. Printed manuals may be ordered for a fee.