KENDRION



EtherCAT®

CANopen®

Instruction Manual

Kuhnke FIO - buscoupler- extender- Communication- modules

IP20 EtherCAT I/O Modules

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PRECISION. SAFETY. MOTION.

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Modification history

Date	Comments / modifications
25 Aug 2017	Source version after separation of the instructions into categories and translation
02 Mar 2018	Renaming in chapter Bus Coupler DI16 / DO16 - U24_Load to undervoltage_load and U24_Logic to undervoltage_logic
14 Jan 2019	Mounting instructions for the potential distributor added
02 Oct 2019	Chapter Bus Coupler DI8/DO8 added
28 Jan 2020	Design change
04 Feb 2021	Minor corrections in the document

1 Preface

1.1 Imprint

Contact Details

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1.2 About this Manual

This technical information is primarily directed to system designers, project engineers and device developers. It does not contain any availability information. We reserve the rights for errors, omissions and modifications. Pictures are similar.

Limitation of Liability

Specifications are for description only and are not to be understood as guaranteed product properties in a legal sense. Exact properties and characteristics shall be agreed in the specific contract. Claims for damages against us - on whatever grounds - are excluded, except in instances of deliberate intent or gross negligence on our part.

Terms of Delivery

The general conditions of sales and service of Kendrion Kuhnke Automation GmbH shall apply.

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CODESYS V3© is a product of 3S-Smart Software GmbH.

Warranty

Warranty is subject to the provisions of the conditions of sale of Kendrion Kuhnke Automation GmbH or any contractual agreements between the parties.

Manual Objective and Organisation

This manual describes the EtherCAT slave IO modules of Kuhnke FIO. These modules provide the EtherCAT master with the sensor details and operate the actuators. Other modules control the communication with other systems.

The EtherCAT master control unit decides how to configure the network and create the control program.

This manual aims to introduce you to using the modules.

The examples are preferably based on CODESYS version 3 which has an EtherCAT master and an EtherCAT configuration utility. The procedures may change if you are using other tools.

For in-depth knowledge of IEC 611131-3 programming, please refer to the CODESYS online help engine and the references listed below.

CODESYS beginners may benefit from the comprehensive training offerings of 3S-Smart Software Solutions GmbH.

2 Reliability, Safety

2.1 Intended Use

For reasons of personal safety and to avoid material damages when working with or handling this Kuhnke product, you are advised to take heed of the notes and information contained in this instruction manual.

2.2 Target Group of the Instruction Manual

This instruction manual contains all information necessary for the use of the described product (control device, control terminal, software, etc.) according to instructions. It is written for qualified design, project planning, servicing and commissioning experts. For proper understanding and error-free application of technical descriptions, instructions for use and particularly of notes of danger and warning, extensive knowledge of automation technology is compulsory.

2.3 Intended Use

Kuhnke's products are designed, developed and manufactured for standard industrial use. They must not be used for any other purposes than the ones specified in the catalogue or the associated technical documentation. Proper and safe operation depends on the products being transported, stored, lined up, mounted, installed, put into service, operated, and serviced correctly. Ambient conditions must be within the admissible limits. Notes and information in the associated documentation apply at all times.

2.4 Transport and Storage

At times of transport and storage, protect Kuhnke FIO Module against inadmissible exposure such as mechanical stress, temperature, humidity and/or aggressive atmospheres. Transport and store Kuhnke FIO Modules only in its original packaging if possible.

Verify that the contacts are neither soiled nor damaged when consigning the unit to stock or re-packaging it. Keep and transport Kuhnke FIO Modules in a container/packaging ensuring electrostatic discharge (ESD) compliance. Some parts of the units are sensitive to ESD and may be damaged if handled inappropriately. Thus, best transport practice is to place open assemblies in statically shielded transport bags with a metal coating which avoid contamination by amines, amides or silicone. When putting Kuhnke FIO Modules into service and performing any maintenance, you should also take the appropriate precautions against electrostatic discharge.

	***CAUTION***
	Electrostatic discharge *Destruction of or damage to the unit.* ⇨ Transport and store FIO Safety I/O in its original packaging. ⇨ Ensure that the ambient conditions are as specified at all times during transport and storage. ⇨ Handle FIO Safety I/O in a well-earthed environment (persons, place of work, packaging). ⇨ Do not touch electrically conductive parts such as data contacts. Some of the electronic components may be destroyed if exposed to electrostatic discharge.

	***DANGER***
	Only use devices that are in perfect condition, ie that they do not show any transport damage, fluid effects or other damage

2.5 Reliability

Reliability of Kuhnke products is brought to the highest possible standards by extensive and cost-effective means in their design and manufacture.

These include:

- selecting high-quality components,
- quality agreements with our suppliers,
- actions to avoid static charges when handling MOS circuits,
- worst case planning and design of all circuits,
- visual inspections at various stages of fabrication,
- computer-aided tests of all assemblies and their interaction in the circuit,
- statistical assessment of the quality of fabrication and of all returned goods for the immediate taking of appropriate corrective actions.

2.6 Hazard and other Warnings

Despite the actions described in section 2.4, the occurrence of faults or errors in electronic control units - even if most highly improbable - must be taken into consideration.

Please pay particular attention to the additional notices which we have marked by symbols throughout this instruction manual. While some of these notices make you aware of possible dangers, others are intended as a means of orientation. They are described further down below in descending order of importance.

Every alert and hazard warning is made up as follows:

Type and source of risk

Potential consequences of non-observance

⇨ Preventive measures

	***DANGER***
	A DANGER warning makes you aware of an immediately hazardous situation which WILL cause a serious or fatal accident if not observed.

	***WARNING***
	A WARNING makes you aware of a potentially hazardous situation which MAY cause a serious or fatal accident or damage to this or other devices if not observed.

	***CAUTION***
	A CAUTION alert makes you aware of a potentially hazardous situation which MAY cause an accident or damage to this or other devices if not observed.

	***NOTE***
	A NOTE makes you aware of a potentially hazardous situation which MAY cause damage to this or other devices if not observed.

Other Notices

	***Information***
	This symbol draws your attention to additional information concerning the use of the described product. This may include cross references to information found elsewhere (e.g. in other manuals).

2.7 Safety

Our products normally become part of larger systems or installations. The information below is intended to help you integrate the product into its environment without dangers to humans or material/equipment.



DANGER

Non-observance of the instruction manual

Measures for the prevention of dangerous faults or errors may be rendered ineffective or new hazard sources created.

- Thoroughly read the instruction manual
- Take particular heed of the hazard warnings



Information

To achieve a high degree of conceptual safety in planning and installing an electronic controller, it is essential to exactly follow the instructions given in the manual because wrong handling could lead to rendering measures against dangers ineffective or to creating additional dangers.

Project Planning

- Recommendation for 24V DC supply: Generate as electrically safely separated low voltage. Suitable devices include split-winding transformers built in compliance with European Standard EN 60742 (corresponds to VDE 0551).
- Power breakdowns or power fades: the program structure is to ensure that a defined state at restart excludes all dangerous states.
- Emergency-off installations must comply with EN 60204/IEC 204 (VDE 0113). They must be operative at any time.
- Safety and precautions regulations for qualified applications have to be complied with.
- Please pay particular attention to the notices of warning which, at relevant places, will make you aware of possible sources of dangerous mistakes or faults.
- Relevant standards and VDE regulations are to be complied with in every case.
- Control elements are to be installed in such a way as to exclude unintended operation.
- Lay control cables such that interference (inductive or capacitive) is excluded if this interference could influence controller operation or its functionality.

Maintenance and Servicing

- Precautions regulation VBG 4.0 to be observed when measuring or checking a controller after power-up. This applies to section 8 (Admissible deviations when working on parts) in particular.
- Repairs must be carried out by specially trained Kuhnke staff only (usually in the main factory in Malente). Warranty expires in every other case.
- Only use parts approved of by Kuhnke. Only genuine Kuhnke modules must be used in modular controllers.
- Modular systems: always plug or unplug modules in a power-down state. You may otherwise damage the modules or (possibly not immediately recognisably!) inhibit their functionality.
- Always dispose of (rechargeable) batteries as hazardous waste.

Disposal

- When disposing of the FIO modules, ensure that the modules are disposed of in accordance with the applicable environmental regulations.
- Treat the packaging as recyclable paper and cardboard.

2.8 Electromagnetic Compatibility

Definition

Electromagnetic compatibility is the ability of a device to function satisfactorily in its electromagnetic environment without itself causing any electromagnetic interference that would be intolerable to other devices in this environment.

Of all known phenomena of electromagnetic noise, only a certain range occurs at the location of a given device. These kinds of noise are specified in the applicable product standards.

The design and immunity to interference of programmable logic controllers are internationally governed by standard

IEC 61131-2 which, in Europe, has been the basis for European Standard
EN 61131-2.

	Information
	Refer to IEC 61131-4, User's Guideline, for general installation instructions to be complied with to ensure that hardware interface factors and the ensuing noise voltages are limited to tolerable levels.

Interference Emission

Interfering emission of electromagnetic fields, HF compliant to EN 55011, limiting value class A, Group 1

	Information
	If the controller is designed for use in residential areas, high-frequency emissions must comply with limiting value class B as described in EN 55011.Fitting the controller into earthed metal cabinets and installing filters in the supply lines may produce a shielding compliant to the above standard.

General Notes on Installation

As component parts of machines, facilities and systems, electronic control systems must comply with valid rules and regulations, depending on their field of application.

General requirements concerning the electrical equipment of machines and aiming at the safety of these machines are contained in Part 1 of European Standard EN 60204 (corresponds to VDE 0113).

Electrical Immission Safeguard

To eliminate electromagnetic interference, connect the control system to the protective earth conductor. Practice best cable routing.

Cable Routing and Wiring

Keep power circuits separate from control circuits:

- DC voltages 60 V ... 400 V
- AC voltages 25 V ... 400 V

Joint laying of control circuits is allowed for:

- shielded data signals
- shielded analogue signals
- unshielded digital I/O lines
- unshielded DC voltages < 60 V
- unshielded AC voltages < 25 V

Location of Installation

Ensure that temperatures, contaminations, impact, vibration or electromagnetic interference are no impediment to the installation.

Temperature

Consider heat sources such as general heating of rooms, sunlight, heat accumulation in assembly rooms or control cabinets.

Contamination

Use appropriate enclosures / cabinets to ensure operation of the FIO modules in a suitable environment. It is designed to prevent possible adverse effects of moisture, corrosive gases, liquids and conductive dust.

Operation of an impermissibly dirty module is not permitted. Cleaning the device is also prohibited.

Impact and Vibration

Consider possible influences caused by motors, compressors, transfer lines, presses, ramming machines and vehicles.

Electromagnetic Interference

Consider electromagnetic interference from various local sources: motors, switching devices, switching thyristors, radio-controlled devices, welding equipment, arcing, switched-mode power supplies, converters / inverters.

Particular Sources of Interference

Inductive Actuators

Switching off inductances (such as from relays, contactors, solenoids or switching magnets) produces surge voltages. It is necessary to reduce these extra voltages to a minimum.
Throttling elements could be diodes, Z-diodes, varistors or RC elements. Their rating should conform to the specifications provided by the manufacturer or supplier of the actuators.

3 Introduction

3.1 EtherCAT®[1] — Ethernet Control Automation Technology

EtherCAT is the most powerful Ethernet-based fieldbus system currently available on the market. EtherCAT puts up the top speed mark, and its flexible topology and simple configuration make it the perfect means of controlling extremely fast processes. To give you a clue: 1000 I/Os can be addressed in 30 µs.

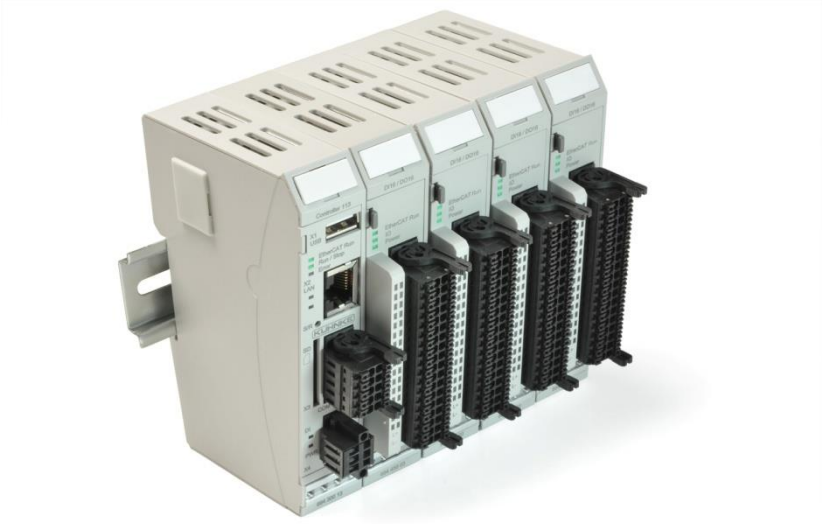
Because of its high performance, the simple wiring and its open protocol support, EtherCAT is often used as a fast motion control and I/O bus driven by an industrial PC or in conjunction with control technology on a smaller scale. EtherCAT moves beyond the limits of conventional fieldbus systems. Its interconnections between the controller at one end and both the I/O modules and drives at the other are as fast as those of a backplane bus. EtherCAT controllers thus nearly act like centralised control systems, overcoming the issue of bus transfer times that conventional fieldbus systems are burdened with.

3.2 Kuhnke FIO (Fast Input / Output)

Kuhnke FIO is a system of modules interconnecting via the backplane bus to make up a so-called EtherCAT network able to transfer process signals. For example, a Kuhnke FIO system may comprise a Kuhnke FIO controller or bus coupler plus any number of Kuhnke FIO I/O modules.

The head module (controller or bus coupler) converts the physical transfer technology (twisted pair) to LVDS (E-bus) and generates the system voltages required by the LVDS modules. The standard 100 Base Tx lines used for office network communications connect to the one side, the Kuhnke FIO I/O modules for the process signals connect to the other. This is how the Ethernet EtherCAT protocol is retained right through to the last I/O module. At the end of the modular device, the connection between the forward and return lines is automatically closed, the effect being that another 100 Base Tx line can be plugged in to connect the next EtherCAT unit to the second bus coupler port.

If the bus coupler is the last EtherCAT network station, i.e. if its RJ45 "Out" socket remains unplugged, the connection between the forward and return lines is automatically closed.



Kuhnke FIO Controller 113 and several Kuhnke FIO I/O modules

[1] EtherCAT® is a registered trademark and patented technology, licenced by Beckhoff Automation GmbH, Germany.

3.3 Kuhnke FIO — Ventura FIO

Regular product update cycles include successive revisions of the Ventura FIO modules since 2014. Revisions focused on improving the ESD properties and ensuring conformity with the guidelines of ETG (power engineering association of VDE). The revised modules are therefore referred to Kuhnke FIO or FIO V2.

Kuhnke FIO and Ventura FIO are compatible if they share the same order number. If so they are interchangeable without having to modify the control programs.

Ventura FIO modules are controlled by a wide process model map.

Kuhnke FIO modules equipped with a controller such as the analogue modules are available as variants compatible with the process map control methodology of the Ventura FIO modules or as object-controlled variants (CoE - CAN over EtherCAT).

The module descriptions in this manual will make readers aware of exceptions such as the signal range of the AO4 module.

The table below lists the visible differences between Ventura FIO and Kuhnke FIO.

Feature	Ventura FIO	Kuhnke FIO
Production date		2014, successively
Design	green dot	no dot
Module lock	green	grey
Unlock button (connector)	green	black
LED label	EtherCAT	EtherCAT Run
EtherCAT LED	green/red	green/off
LED label (RJ45)	In, Out	In L/A, Out L/A
Module control	process image	process image
		CoE
Process signal plug	extra	included
	green unlock button (including 2-pole)	black unlock button (2-pole: screw-type)
	Spring return (36-pole)	Push-in (36-pole)

4 System Description

4.1 General Service Conditions

This section describes the general requirements of installing, wiring and troubleshooting the Kuhnke FIO modules.

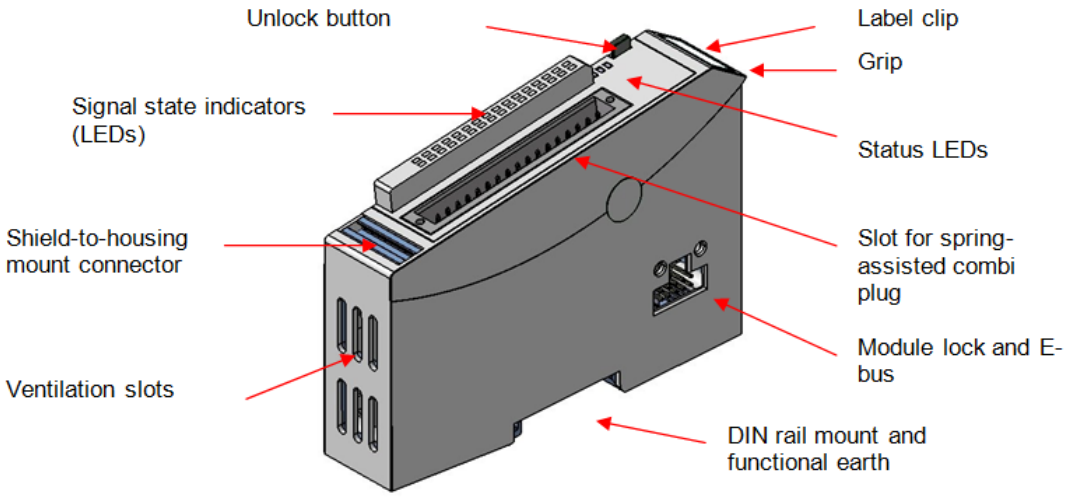
For a list of System Properties of Kuhnke FIO refer to chapter 0, page 90.

Subsequent chapters explain the specific properties of each of the modules.

4.2 Mechanical Design

The picture below shows the basic layout of the Kuhnke FIO modules.

The bus coupler and the I/O modules differ in their connectors and indicators, however.



Mechanical Design

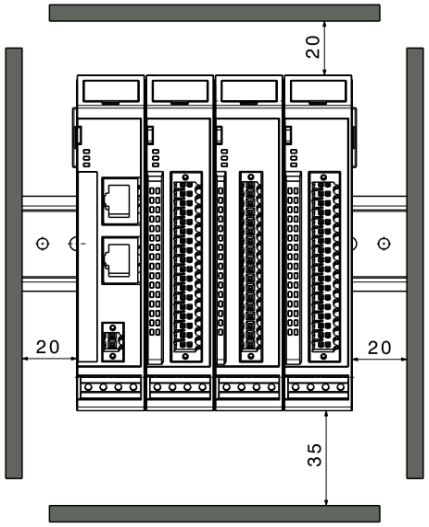
The housing mount consists of an aluminium profile with an integral snap-on device used to snap the module to a 35mm DIN rail. The housing trough including the optical fibres for the status indicators, the side face and the front is made of plastic and contains the module. The optical fibres for the signal state indicators (LEDs) are located next to the spring-assisted combi plug. They slightly protrude from the housing and allow a clear diagnosis at a glance.

Installation

Kuhnke FIO I/Os mount on 35 mm x 7.5 mm rails to DIN EN 50022.

Position

Mount with rail horizontally with the modules' multiple socket connectors pointing away from the wall. To ensure that enough air gets in through the ventilation slots, leave at least 20 mm to the top and 35 mm to adjacent devices or cabinet surfaces. Leave at least 20 mm of lateral distance to third-party units and cabinet surfaces.



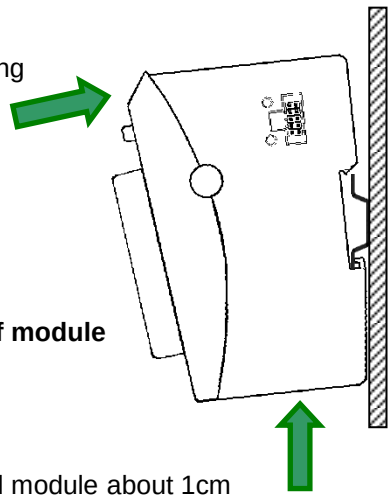
Order of Modules in Multi-FIO Systems

	NOTE
	In order to ensure that the entire FIO system works properly, arrange the FIO modules by their specific E-bus load, placing the modules with the highest E-bus load immediately next to the head module (bus coupler or controller). Take account of the head module's maximum bus load. *If possible, place the Kuhnke FIO Safety I/O modules immediately next to the head module.*

To Snap on a Single Module

- Push up the module against the mounting rail from below, allowing the metal spring to snap in between mounting rail and mounting area as illustrated.

Push the top of the module against the mounting wall until it snaps in.



Rail mounting of module

To Interconnect Two Modules

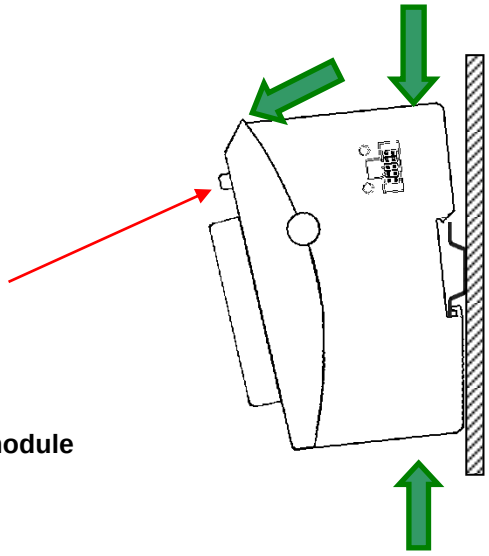
- After snapping on the first module to the rail, snap on the second module about 1cm away towards the right of the first module.
- Push the second module along the rail towards the first module until you hear the locking device snap in.

To Disconnect Two Modules

- Push down the unlock button of the module that you wish to disconnect from the module to the left of it.
- With the button still pressed, push both modules away from one another until they are about 1 cm apart.

To Take Down a Single Module

- Push the module up and against the metal spring located on the underside of the rail guide.
- Tip the module away from the rail
- as shown in the illustration.
- Pull the module down and out of the mounting rail.



Uninstalling a module

4.3 System Power Supply

General Instructions

Multi-connector plugs provide many connections in a tight space.

- Unlock buttons make it easier to unplug larger connectors where there is little space.
- Screw fittings reliably hold small connectors in place.

	Note
	The connectors must not be subjected to any inadmissible tension / pressure in order to avoid excessive force transmission to the board or contact problems. *Avoid e.g. too strong pull due to too short wiring.*

Spring-assisted multiple socket connectors support quick and easy wiring.

Single row

Tool: Screwdriver, 0.4 x 2.5 x 75 [mm] blade (DIN 5264-A)

Wires: 320 V / 10 A / 0.2 - 1.5 mm² (IEC)

Nominal current: 300 V / 10 A / 28 - 14 AWG (UL)

Supported wires with connector sleeves:

	Wire cross section [mm²]						
Connector sleeve type	0.13	0.25	0.34	0.50	0.75	1	1.5
Connector sleeve w/ collar to DIN 46 228/4	8 / 10	8 / 10	8 / 10	8 / 10	10 / 12	10 / 12	
Connector sleeve w/o collar to DIN 46 228/1	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10
	Stripped end [mm] / sleeve length [mm]						

The spring-assisted PUSH-IN connector allows you to quickly attach the wires by direct insertion without any tools. Just insert the connector sleeve end of the stripped solid or fine wire in the correct opening.

Two rows:

Wires: 320V / 13.4 A / 0.14 - 1.5 mm² (IEC)

Nominal current: 300 V / 9.5 A / 26 - 16 AWG (UL)

Supported wires with connector sleeves:

	Wire cross section [mm²]						
Connector sleeve type	0.14	0.25	0.34	0.50	0.75	1	1.5
Connector sleeve w/ collar to DIN 46 228/4	8 / 10	8 / 10	8 / 10	10 / 12	12 / 14	12 / 15	
Connector sleeve w/o collar to DIN 46 228/1	10 / 10	10 / 10	10 / 10	10 / 10	10 / 10	10 / 10	10 / 10
	Stripped end [mm] / sleeve length [mm]						

	NOTE
	Do not connect the power supply lines through from one Kuhnke FIO to the next. To ensure that there is as little interference as possible, install a central power supply point and establish a star topology of as short wires as possible between the central point and Kuhnke FIO.

System Power Supply

A system connector supplies the Kuhnke FIO Safety I/O system with system power from an upstream bus coupler or a compact controller. This system power supply is used for the analysis circuitry and for bus communication only.

	***Information***
	Please also note the connection printing on the device before the electrical installation.

	***WARNING***
	Potentially hazardous failures due to wrong voltages supplied *Supplying the wrong voltages may damage or destroy the unit and may provoke potentially hazardous failures.* *Preventive measures:* ⇨ We recommend to use PELV/SELV-ready power supply units to EN50178 or EN60950-1 to supply 24 VDC to bus couplers or compact PLCs. ⇨ Only use the GND terminal to connect the power supply unit to earth (PELV system). Do not use earthing variants that connect earth to +24V. ⇨ Remember that, even in case of a fault, a maximum voltage of U max. < 33 V maybe supplied to these assemblies. If you cannot rule out this risk, external protection of the power supply is mandatory. ⇨ To ensure that there is as little interference as possible, install a central power supply point and establish a star topology of as short wires as possible between the central point and the block of FIO modules.

Earth

Connect the Kuhnke FIO modules to earth by attaching the metal housing to functional earth.

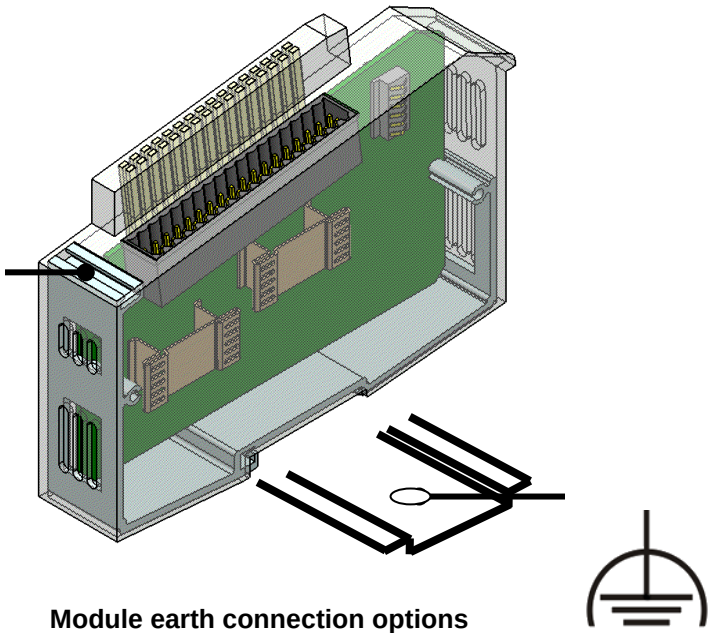
Since the functional earth connector dissipates HF currents, it is of utmost importance for the module's noise immunity.

HF interference is dissipated from the electronics board to the metal housing. The metal housing therefore needs to be suitably connected to a functional earth connector.

You will normally have to ensure that

- the connection between module housing and DIN rail conducts well,
- the connection between DIN rail and switching cabinet conducts well,
- the switching cabinet is safely connected to earth.

In special cases you may attach the earth wire straight to the module.



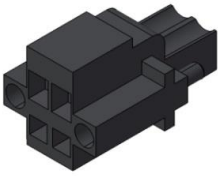
Module earth connection options

	Information
	Earth wires should be short and have a large surface (copper mesh). Refer to http://de.wikipedia.org/wiki/ground_(electronics) for further details

Bus Coupler

The system power supply connects to the bus coupler through a 2-pole plug-type terminal block with a bolt flange. Since the bus coupler supplies power to both the E-bus and the logic circuits of the I/O modules, its power consumption depends on the number of I/O modules connected.

Power to the I/O module outputs is supplied separately.

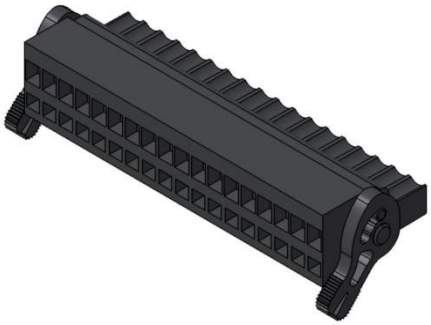


Spring-assisted plug with bolt flange for bus coupler connection

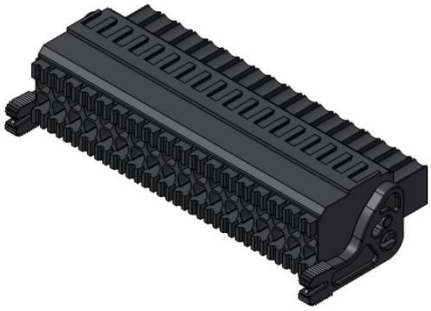
I/O Modules

The I/O supply connects to the I/O module using plug-type terminal blocks with different numbers of poles.

The bus coupler supplies power to the logic circuits of I/O modules without their own micro-controller. Modules equipped with a micro-controller may feature a power supply unit that power is supplied to through the IO connector.



Spring-assisted connector with I/O module unlock button



Two-row push-In connector with unlock button

	NOTE
	Externally turning off the I/O power supply (L+) can be used to trip all outputs. *In that case, LED Power indicates that no voltage is being supplied.* *Mind, though, that not all modules have a voltage watchdog to indicate the state to the control unit.* *To have your control program check whether power is supplied to the IOs, connect L+ to a digital input and poll that input as an indirect indicator of the IO power supply.*

Remember the following if you choose to do so:

	NOTE
	Avoid any reverse feeding of outputs while the power supply to the outputs is turned off.

This applies if the system is still supplied with power.

Outputs enabled by the user program may be supplied power via the protective diode of a reversely fed output, thus overriding the switch-off function of these outputs. Moreover, the protective diode of the feeding outputs may yield under high loads and be destroyed.

4.4 Status LEDs

LED "EtherCAT Run"

An LED labelled "EtherCAT Run" is located on both the bus coupler and the I/O modules. It indicates the state of the EtherCAT ASIC.

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange

LED "In L/A", LED "Out L/A"

The "In L/A" and "Out L/A" LEDs are located on the bus coupler. They indicate the physical state of the Ethernet.

State	LED flash code	Explanation
Not connected	Off	No Ethernet connection
Connected	Green, on	Connected to Ethernet
Traffic	Green, flashing	Exchanging telegrams

LED "IO"

Every I/O module has an LED labelled "IO". It indicates the state of the module's I/Os. Refer to the I/O module sections in this manual to know which states of a module are monitored and indicated.

LED "Power"

An LED labelled "Power" is located on every module that has a power supply connector (e.g. for digital outputs). It indicates the state of the I/O module's I/O power supply.

State	LED flash code	Explanation
On	Green, on	24 VDC supply ok
Off	Off	24 VDC supply not ok

5 Kuhnke FIO Modules

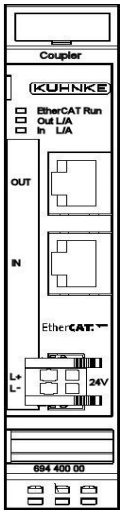
5.1 Bus Coupler and Extender

EtherCAT is an industrial real-time Ethernet and is suitable for hard and soft real-time requirements in automation technology. Please observe the following notes for the safe operation of an EtherCAT fieldbus system.

- Only use Ethernet cables that are at least Category 5 (CAt5) according to EN 50173 or ISO / IEC 11801 for connecting EtherCAT devices.
- Auto-crossing allows you to use both balanced (1: 1) and cross-over cables between EtherCAT devices.
- The permissible cable length between two EtherCAT devices may not exceed 100 meters.

	***Information***
	Twist and permanent tensile load close to the connector of the Ethernet cable strain the connections. If the Ethernet plug is seated with a lot of play and not sufficiently guided in the socket, tilting effects occur at the plug connections. This often leads to contact interruptions and thus to field bus interruptions. ***Vibration test show, the deeper the plug sits in the socket, the more robust the connection. In the industrial sector, the mechanical requirements with regard to vibration and impact resistance are known to be higher than in the IT sector.*** ***Depending on the manufacturer and system, the plug-in depths available on the connectors available on the market vary from approximately 8 mm to almost 12 mm. Standard plugs are around 9 mm insertion depth. Connectors designed for the industrial sector reach according to the manufacturer up to 11.8 mm.***

5.1.1 Bus Coupler



Bus coupler front view

The Kuhnke FIO bus coupler converts the physical transfer technology (twisted pair) to LVDS (E-bus) and generates the system voltages required by the LVDS modules. The standard 100 Base Tx lines used for office network communications connect to the one side, the Ventura FIO I/O modules for the process signals connect to the other. This is how the EtherCAT protocol is retained right through to the last single I/O module. At the end of the modular device, the connection between the forward and return lines is automatically closed, the effect being that another 100 Base Tx line can be plugged in to connect the next EtherCAT unit to the second bus coupler port.

	Information
	Best noise emission results are obtained by connecting the shield of the EtherCAT cable to operative earth. *Use the* ***Shield Terminal**, for example (see section **6.2**)*

Connectors

Module power supply

L+	24 VDC
L-	0 V

EtherCAT

Female IN RJ45	input (from previous EtherCAT station)
Female OUT RJ45	output (to next EtherCAT station)

Status LEDs

LED "EtherCAT Run"

The LED labelled "EtherCAT Run" indicates the state of the EtherCAT ASIC.

5.1.1.1.1 State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange

LED "In L/A", LED "Out L/A"

LEDs "In L/A" and "Out L/A" indicate the physical state of the Ethernet port they are allocated to (L/A: Link/Activity).

State	LED flash code	Explanation
Not connected	Off	No Ethernet connection
Connected	Green, on	Connected to Ethernet
Traffic	Green, flashing	Exchanging telegrams

Function

See page 26:

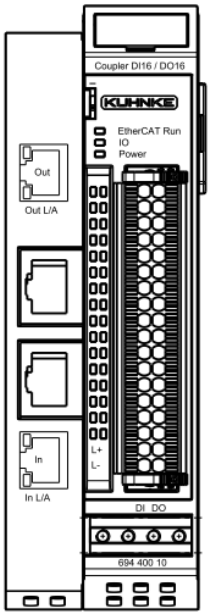
Module State

Variable	Data type	Explanation
Undervoltage	BOOL	Low voltage (supplied power < 19.2V)

Technical Data

Function ..... Connects a 100 Base-TX EtherCAT with the Kuhnke FIO I/O modules. Generates the LVDS system voltages (E-bus)
Controller ..... ASIC ET1100
Baud rate ..... 100 Mbit/s
Cable type CAT5
Cable length ..... max. 100 m between 2 bus couplers
EtherCAT port 2x RJ45
Power supply ..... 24 VDC -15% +20%
Power connector ..... male 2-pole connector (included in module package)
Input current ..... 50 mA & E-bus plus
E-bus power ..... max. 3 A (approx. 20 modules)
E-bus load ..... 195 mA
Part no. 694.400.00
Approval: .....

5.1.2 Bus Coupler DI16/DO16



Front view of bus coupler DI16/DO16

The Kuhnke FIO bus coupler DI16/DO16 is an EtherCAT IO module providing the functions of the Kuhnke FIO bus coupler and Kuhnke FIO DI16/DO16 modules in a single unit. Its E-bus power has been reduced to 2 A to make it particularly fit for use in smaller blocks of modules. The module's bus coupler element converts the physical transfer technology (twisted pair) to LVDS (E-bus) and generates the voltages required by the LVDS modules. The module features 16 digital inputs and 16 digital outputs. The E-bus port on the side allows a flexible extension of the bus coupler DI16/DO16 by Kuhnke FIO-series EtherCAT I/O modules.

	Information
	Best noise emission results are obtained by connecting the shield of the EtherCAT cable to operative earth. *Use the* ***Shield Terminal**, for example (see section **6.2**)*

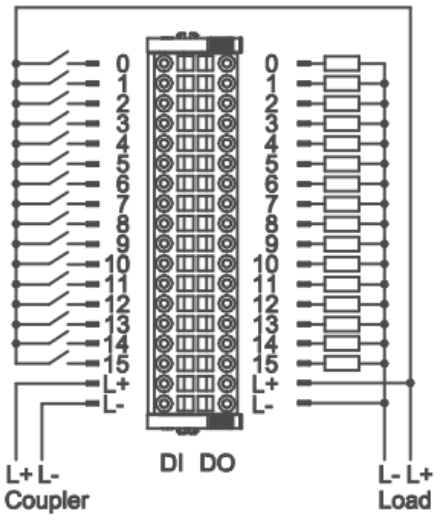
Terminals

Module and I/O port power supply:

L+	24 VDC
L-	0 V

EtherCAT

Female IN RJ45	input (from previous EtherCAT station)
Female OUT RJ45	output (to next EtherCAT station)



I/O connection

	NOTE
	For the bus coupler with digital inputs and outputs, both 24V connections must be used for complete functionality. *The logic (coupler) is supplied with voltage on the left and the IOs (load) on the right.*

Status LEDs

LED "EtherCAT Run"

The LED labelled "EtherCAT Run" indicates the state of the EtherCAT ASIC.

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange

LED "IO"

The LED labelled "IO" indicates the state of the module's I/Os.

State	LED flash code	Explanation
Ok	Off	No error
SC	Red, flashing	Short-circuited digital output

NOTE

The output drivers have a thermal fuse to automatically turn off any short-circuited outputs. In case the short circuit prevails, the outputs are allowed to cool down to be turned back on until the thermal fuse blows again.

LED "Power"

The LED labelled "Power" indicates the state of the I/O module's I/O power supply.

State	LED flash code	Explanation
On	Green, on	24 VDC for the IO's (Load) supply ok
Off	Off	24 VDC supply not ok

State	LED flash code	Explanation
On	Green, on	24 VDC supply ok
Off	Off	24 VDC supply not ok

NOTE

The module features a low voltage watchdog for the logic and load circuits.

LED "In L/A", LED "Out L/A"

LEDs "In L/A" and "Out L/A" indicate the physical state of the Ethernet port they are allocated to (L/A: Link/Activity).

State	LED flash code	Explanation
Not connected	Off	No Ethernet connection
Connected	Green, on	Connected to Ethernet
Traffic	Green, flashing	Exchanging telegrams

LEDs "Channel"

State	LED	Explanation
On	Green, on	Input signal TRUE / output enabled
Off	Off	Input signal FALSE / output disabled

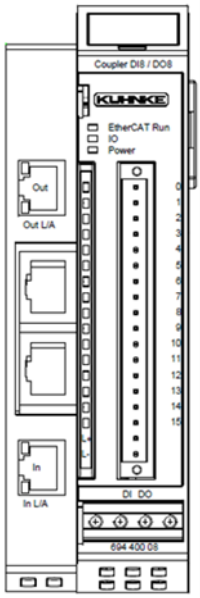
Module State

Variable	Data type	Explanation
undervoltage_load	BOOL	U24_Load undervoltage (supplied power < 19.2V)
undervoltage_logic	BOOL	U24_Logic undervoltage (supplied power < 19.2V)
ShortcutOutput	BOOL	Short-circuited digital output

Technical Data

Function	Connects a 100 Base-TX EtherCAT with the Kuhnke FIO I/O modules. Generates the LVDS system voltages (E-bus)
	IO module
Controller	ASIC ET1100
Baud rate	100 Mbit/s
Cable type	CAT5
Cable length	max. 100 m between 2 bus couplers
EtherCAT port	2x RJ45
Module power supply	24 VDC -15% +20%
IO/power connector	male 36-pole connector (included in module package)
Input current	40 mA & E-bus plus
E-bus power	max. 2 A (approx. 11 modules)
E-bus connector	10-pole system plug in side wall
Terminating module	not required
Digital inputs	16
Rising delay	3 ms (typically)
Signal level	Off: -3V … 5V (EN 61131-3, type 1) On: 15V … 30V
Digital outputs	16
Max. current	0.5 A each
Max. total current	8 A
Part no.	694.400.10
Approval:	c UL us LISTED 59DM E202287 EtherCAT Conformance tested

5.1.3 Bus Coupler DI8 DO8



The Kuhnke FIO bus coupler DI8/DO8 is an EtherCAT IO module providing the functions of the Kuhnke FIO bus coupler and Kuhnke FIO DI8/DO8 modules in a single unit. Its E-bus power has been reduced to 2 A to make it particularly fit for use in smaller blocks of modules. The module's bus coupler element converts the physical transfer technology (twisted pair) to LVDS (E-bus) and generates the voltages required by the LVDS modules. The module features 8 digital inputs and 8 digital outputs. The E-bus port on the side allows a flexible extension of the bus coupler DI8/DO8 by Kuhnke FIO-series EtherCAT I/O modules.

Front view of bus coupler DI8 DO8

	Information
	Best noise emission results are obtained by connecting the shield of the EtherCAT cable to operative earth. *Use the* ***Shield Terminal**, for example (see section **6.2**)*

Terminals

Module and I/O port power supply:

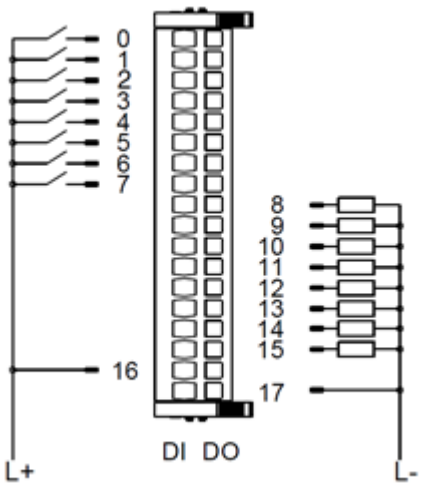
L+ 24 VDC

L- 0 V

EtherCAT

Female IN RJ45 input (from previous EtherCAT station)

Female OUT RJ45 output (to next EtherCAT station)



I/O connection

Status LEDs

LED "EtherCAT Run"

The LED labelled "EtherCAT Run" indicates the state of the EtherCAT ASIC.

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange

Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange

LED "IO"

The LED labelled "IO" indicates the state of the module's I/Os.

State	LED flash code	Explanation
Ok	Off	No error
SC	Red, flashing	Short-circuited digital output

NOTE

The output drivers have a thermal fuse to automatically turn off any short-circuited outputs. In case the short circuit prevails, the outputs are allowed to cool down to be turned back on until the thermal fuse blows again.

LED "Power"

The LED labelled "Power" indicates the state of the I/O module's I/O power supply.

State	LED flash code	Explanation
On	Green, on	24 VDC supply ok
Off	Off	24 VDC supply not ok

NOTE

The module features a low voltage watchdog for the logic and load circuits.

LED "In L/A", LED "Out L/A"

LEDs "In L/A" and "Out L/A" indicate the physical state of the Ethernet port they are allocated to (L/A: Link/Activity).

State	LED flash code	Explanation
Not connected	Off	No Ethernet connection
Connected	Green, on	Connected to Ethernet
Traffic	Green, flashing	Exchanging telegrams

LEDs "Channel"

State	LED	Explanation
On	Green, on	Input signal TRUE / output enabled
Off	Off	Input signal FALSE / output disabled

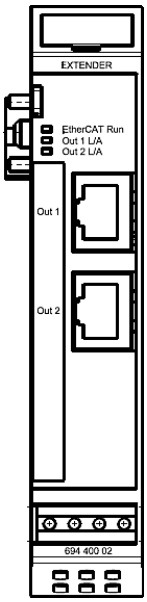
Module State

Variable	Data type	Explanation
undervoltage_load	BOOL	U24_Load undervoltage (supplied power < 19.2V)
undervoltage_logic	BOOL	U24_Logic undervoltage (supplied power < 19.2V)
ShortcutOutput	BOOL	Short-circuited digital output

Technical Data

Function	Connects a 100 Base-TX EtherCAT with the Kuhnke FIO I/O modules. Generates the LVDS system voltages (E-bus)
	IO module
Controller	ASIC ET1100
Baud rate	100 Mbit/s
Cable type	CAT5
Cable length	max. 100 m between 2 bus couplers
EtherCAT port	2x RJ45
Module power supply	24 VDC -15% +20%
IO/power connector	male 18-pole connector (included in module package)
Input current	40 mA & E-bus plus
E-bus power	max. 2 A (approx. 11 modules)
E-bus connector	10-pole system plug in side wall
Terminating module	not required
Digital inputs	8
Rising delay	3 ms (typically)
Signal level	Off: -3V … 5V (EN 61131-3, type 1) On: 15V … 30V
Digital outputs	8
Max. current	0.5 A each
Max. total current	4 A
Part no.	694.400.08
Approval:	c UL us LISTED 59DM E202287

5.1.4 Extender 2 Port



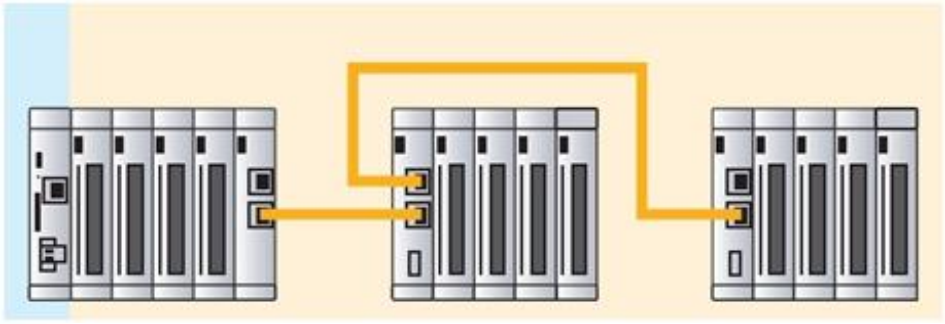
Kuhnke's FIO Extender lets you extend a Kuhnke FIO block or a Kuhnke FIO Control (Embedded PC) by EtherCAT slaves equipped with a standard 100 Base Tx connection.

The extender converts the physical transfer technology from LVDS (E-bus) to twisted pair.

The module is normally located at the end of the block.
You may also place the extender at any point after the bus coupler or the FIO Control module, though,

to design a star topology of EtherCAT slaves, for example.

Front view of two-port extender



Kuhnke FIO Control plus extender with Kuhnke FIO blocks

Terminals

Module power supply via the E-bus

EtherCAT:

OUT1 Female RJ45 output (to next EtherCAT station)

OUT2 Female RJ45 output (to next EtherCAT station)

Status LEDs

LED "EtherCAT Run"

The LED labelled "EtherCAT Run" indicates the state of the EtherCAT ASIC.

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange

5.1.4.1.1 LED "Out2", LED "Out1"

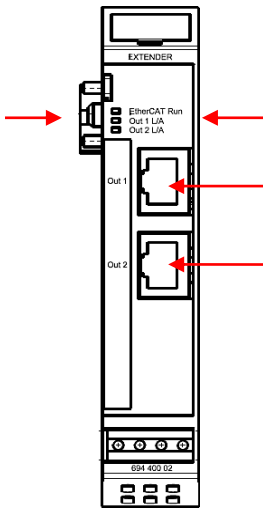
The "Out2" and "Out1" LEDs indicate the physical state of the Ethernet port they are allocated to.

State	LED flash code	Explanation
Not connected	Off	No Ethernet connection
Connected	Green, on	Connected to Ethernet
Traffic	Green, flashing	Exchanging telegrams

Function

The 2-port extender module actually has 4 ports. Calling it a 2-port module is due to its 2 standard RJ45 100 Base-Tx ports (OUT1, OUT2). The other 2 ports are used by the E-bus.

Your configuration should take account of the order in which the ports are addressed, i.e. of the transfer path of the EtherCAT frame.



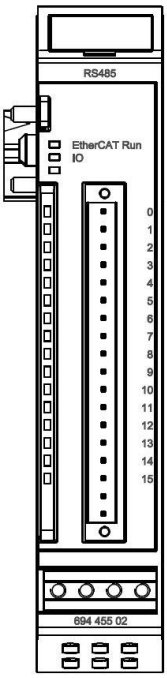
Port	Connector	Order
Port A	E-bus in	1
Port B	Out 2	3
Port C	E-bus out	4
Port D	Out 1	2

Technical Data

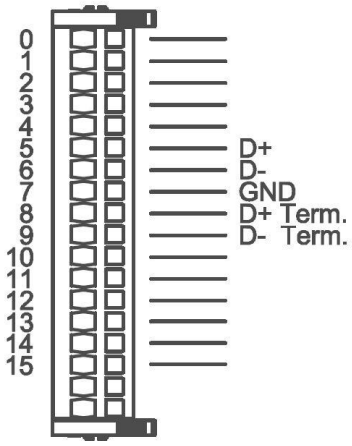
Function	Extends a Kuhnke FIO block or a Kuhnke FIO Control (embedded PC). Converts the physical transfer technology from LVDS (E-bus) to 100 Base-Tx.
Controller	ASIC ET1100
Baud rate	100 Mbit/s
Cable type	CAT5
Cable length	max. 100 m
EtherCAT port	2x RJ45
Power supply	Via E-bus
E-bus load	160 mA from Out1 / 210 mA from Out1+Out2
Part no.	694.400.02
Approval:	c UL us LISTED 59DM E202287 EtherCAT Conformance tested

5.2 Interface and Communication Modules

5.2.1 RS485 1 Port



Front view of the RS485 module



Pin wiring

The module provides a RS485 interface accessible by EtherCAT.

Run CoE (CODESYS configuration tool) to set the parameters. The process image is the medium of data interchange. A library can be downloaded *(RS485 is there COM2)* for this module.

Terminals

IO Connection, Male 18-pin

Trm.	Signal	Explanation
0..4	-	Not used
5	D+	Data +
6	D-	Data -
7	GND	earth potential
8	D+ Term.	Bus termination, Data+
9	D- Term.	Bus termination, Data-
10..15	-	Not used

Status LEDs

LED "EtherCAT Run"

The LED labelled "RN" indicates the state of the EtherCAT ASIC.

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange

LED "IO"

The LED labelled "IO" indicates the state of the module's I/Os.

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Red, 4x	EtherCAT watchdog
	Red, 5x	Transmit queue overflow
	Red, 6x	Receive queue overflow
	Red, 7x	No Tx counter
Start, defective	Red	Module not initialised

LED "Power"

Not used

LEDs "Channel [COM State]"

The "Channel" LEDs indicate the state of every channel.

State	LED	Explanation
On	Green, flashing	Communication
Off	Off	No communication
Error	Red/green, flashing	Controller communication error
	Red, flashing	Controller error

Process Image

There are 20 PDOs containing 8 bytes of data each for every direction. Use PDO Assignment (objects 1C12 and 1C13) to vary the volume of data. Taken together with the mailboxes (32 bytes each), this is the maximum configuration of ET1200.

Output Data (PLC -> IO, 0-160 Bytes)

Name	Size	Source
ControlData	8 bytes	PLC
TxData1[0..7]	8 bytes	PLC
…	…	…
TxData19[0..7]	8 bytes	PLC

The process image holds max. 152 bytes of payload data per direction.

ControlData:

Name	Format	Source
TxCounter	Word	Incrementing the TxCounter tells the gateway that the process image contains new data to be sent.
RxCounterCon	Word	If synchronised data (RxSync) is used, this object is used to acknowledge that the data received has been processed. Only then will the gateway send the next data.
TxNrOfMsg	Word	Number of bytes to be sent from the process image. Range: 0..152. Starting point of the data section is TxData1[0].
ResetError	Bit (1)	Bit 0 ->1: Resets errors that have been removed.
Unused 0..14	Bit (15)	

Input Data (IO -> PLC, 0..160 Bytes)

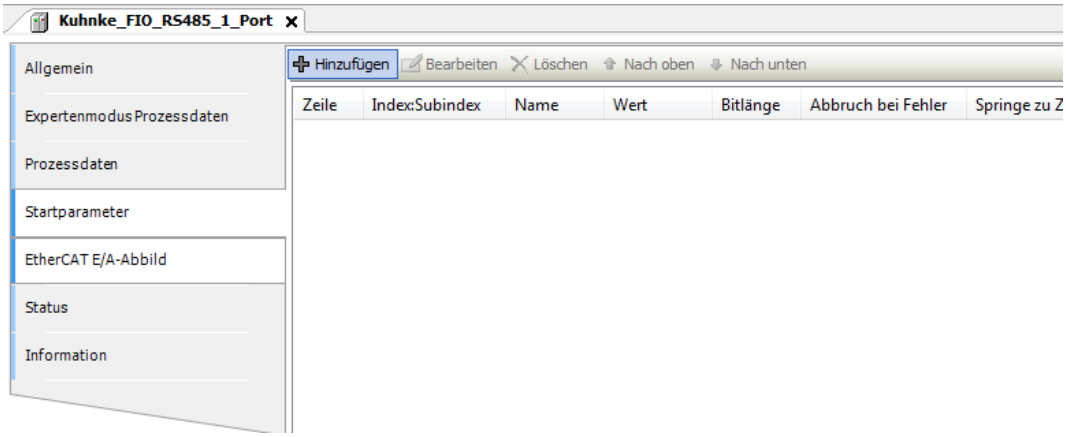
Name	Size	Source
StateData	8 bytes	IO
RxData1[0..7]	8 bytes	IO
…	…	…
RxData19[0..7]	8 bytes	IO

StateData:

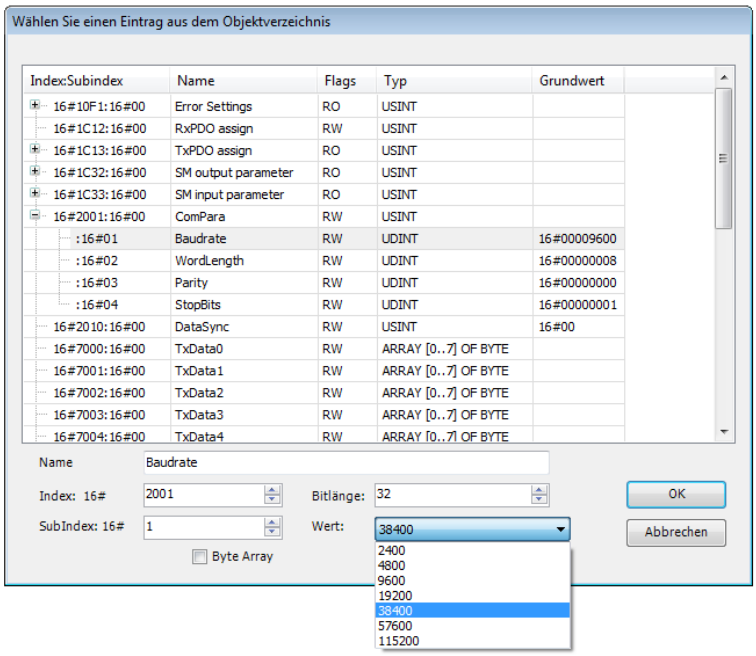
Name	Format	Source
TxCounterCon	Word	The gateway shows the TxCounter again to confirm the new out-queue data.
RxCounter	Word	Incrementing the RxCounter indicates that the process image contains new in-queue data.
RxNrOfMsg	Word	Number of bytes received by the process image. Range: 0..152. Starting point of the data section is RxData1[0].
ResetErrorAck	Bit (1)	Acknowledges the state of the Reset Error signal.
EtherCATError	Bit (1)	If 1: Sync Manager watchdog triggered (watchdog control)
Unused 0	Bit (1)	
Unused 1	Bit (1)	
TxCounterMiss	Bit(1)	The gateway checks the TxCounter for steady increments. This error indicates a skipped increment. Best use TxCounterCon to send new data.
Unused 2	Bit (1)	
COM_TxQueueOvr	Bit (1)	Overflow of the gateway's out-buffer. Too much data is being sent or the baud rate is too low.
COM_RxQueueOvr	Bit (1)	In-buffer overflow. Data is being accepted too slowly. Either speed up the EtherCAT task or reduce the volume of data (lower baud rate).
Unused 3	Bit (1)	
COM_CtrlErr	Bit (1)	RS485 controller error (bit error or overrun)
Unused 4..7	Bit (4)	
COM_TxBusy	Bit (1)	The interface is transmitting data
Unused 8	Bit (1)	

Configuration

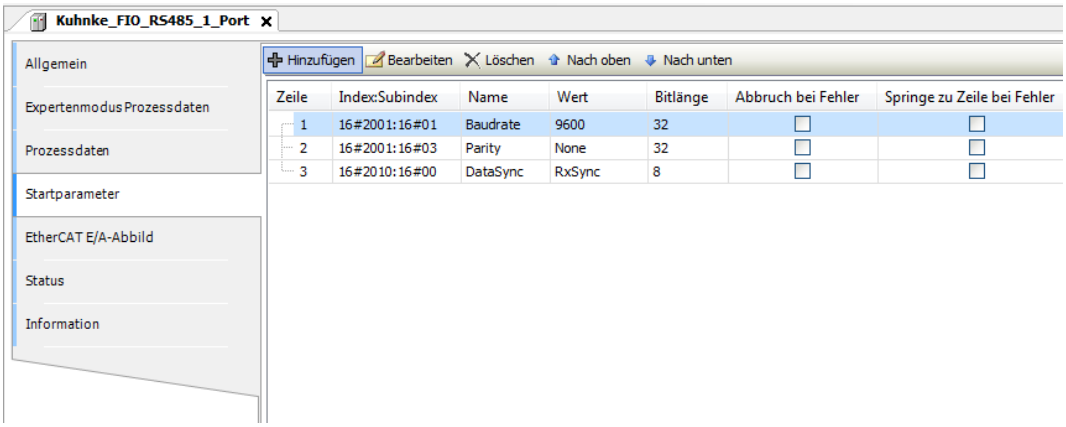
Run CoE to configure the RS485 module. You can directly set the startup parameters.
Select the module and go to "Startparameter" (startup parameters) and "Hinzufügen" (add).



Now go to ComParameter and change the Baud Rate or other settings as appropriate or enable/disable data synchronisation.



Your settings are then displayed on tab "Startparameter" (startup parameters).



Sample Program

The example below illustrates how a program works. It does not use library available for the communication module.

Visit Kendrion Kuhnke's Product Finder to download a sample project and the library.

Link: http://productfinder.kuhnke.kendrion.com

Run your development environment (e.g. CODESYS) to set the interface parameters, including the baud rate, parity, stop bits, etc.

Refer to section Object Dictionary. The settings are applied when PreOp turns into SafeOp.

Running SDO components to make changes in state Operational will therefore have no effect.

Transfer Data:

Initial state:

TxCounter = 0 TxCounterCon = 0

TxNrOfMsg := 6;

TxData1[0] = `H`

TxData1[1] = `e`

TxData1[2] = `l`

TxData1[3] = `l`

TxData1[4] = `o`

TxData1[5] = ` `

Increment TxCounter by 1:

TxCounter = 1 TxCounterCon = 0

Slave module accepts data (into a an out-data queue). TxCounterCon = TxCounter acknowledges. (Data has not necessarily been transferred yet, though. Use COM_TxBusy to check the data transfer.)

TxCounter = 1 TxCounterCon = 1

TxNrOfMsg := 4;

TxData1[0] = `W`

TxData1[1] = `o`

TxData1[2] = `r`

TxData1[3] = `l

TxData1[4] = 'd'`

Increment TxCounter by 1:

TxCounter = 2 TxCounterCon = 1

Slave module accepts data. TxCounterCon = TxCounter acknowledges.

TxCounter = 2 TxCounterCon = 2

Receive Data

Initial state:

RxCounter = 0 RxCounterCon = 0

The module increments RxCounter by 1:

RxCounter = 1 TxCounterCon = 0

RxNrOfMsg := 4;

RxData1[0] = `T`

RxData1[1] = `e`

RxData1[2] = `s`

RxData1[3] = `t`

If RxSync is enabled (object 2010 DataSync = RxSync), the module will not be allowed to send the next set of data until you set RxCounterCon = RxCounter. If RxSync is disabled, the module will send data without checking RxCounterCon.

RxCounter = 1 RxCounterCon = 1

Response to Errors

- EtherCAT error.
  Sync Manager watchdog.
  LED "Error" flashes 4x.
  Unit changes from Op to Safe-Op.
  Use "Reset Error" to acknowledge the error.

- Out-queue overflow (COM_TxQueueOvr).
  Failure to send the data fast enough.
  LED "Error" flashes 5x.
  Use "Reset Error" to acknowledge the error.

- In-queue overflow (COM_RxQueueOvr).
  Too much data is being received and cannot be transferred to the control unit fast enough.
  LED "Error" flashes 6x.
  Use "Reset Error" to acknowledge the error.

- TxCount error (TxCounterMiss).
  The TxCounter received is not "last TxCounter + 1".
  The gateway probably missed an EtherCAT frame. The EtherCAT master is sending the data too quickly (< 1ms for 9 messages).
  LED "Error" flashes 7x.
  Use "Reset Error" to acknowledge the error.

- Com controller wrror (COM_CtrlErr).
  Indicates bit errors or overruns of the control unit concerned.
  The applicable LED "COM State" is red and flashes rapidly or alternates green/red while communicating.
  Use "Reset Error" to acknowledge the error.

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	FIO RS485 1 Port		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	187270		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32	0		RO
10F1,0	Number of Entries	UINT8	2		RO
10F1,0	Local Error Reaction	UINT32	1		RW
10F1,1	Sync Error Counter Limit	UINT32	4		RW
1600	Receive PDO0 Mapping Parameter	Array			
1600, 0	Number of Entries	UINT8	5		RO
1600, 1	Subindex 001h	UINT32	0x71000010		RO
1600, 2	Subindex 002h	UINT32	0x71010010		RO
1600, 3	Subindex 003h	UINT32	0x71020010		RO

Index	Name	Type	Default	Min Max	Access
1600, 4	Subindex 004h	UINT32	0x71100101		RO
1600, 5	Subindex 005h	UINT32	0x0000000F		RO
1601	ReceivePDO1 Mapping Parameter	Array			
1601, 0	Number of Entries	UINT8	1		RO
1601, 1	Subindex 001h	UINT32	0x70010040		RO
1602	ReceivePDO2 Mapping Parameter	Array			
1602, 0	Number of Entries	UINT8	1		RO
1602, 1	Subindex 001h	UINT32	0x70020040		RO
1603	ReceivePDO3 Mapping Parameter	Array			
1603, 0	Number of Entries	UINT8	1		RO
1603, 1	Subindex 001h	UINT32	0x70030040		RO
1604	ReceivePDO4 Mapping Parameter	Array			
1604, 0	Number of Entries	UINT8	1		RO
1604, 1	Subindex 001h	UINT32	0x70040040		RO
1605	ReceivePDO5 Mapping Parameter	Array			
1605, 0	Number of Entries	UINT8	1		RO
1605, 1	Subindex 001h	UINT32	0x70050040		RO
1606	ReceivePDO6 Mapping Parameter	Array			
1606, 0	Number of Entries	UINT8	1		RO
1606, 1	Subindex 001h	UINT32	0x70060040		RO
1607	ReceivePDO7 Mapping Parameter	Array			
1607, 0	Number of Entries	UINT8	1		RO
1607, 1	Subindex 001h	UINT32	0x70070040		RO
1608	ReceivePDO8 Mapping Parameter	Array			
1608, 0	Number of Entries	UINT8	1		RO
1608, 1	Subindex 001h	UINT32	0x70080040		RO
1609	ReceivePDO9 Mapping Parameter	Array			
1609, 0	Number of Entries	UINT8	1		RO
1609, 1	Subindex 001h	UINT32	0x70090040		RO
160A	ReceivePDO10 Mapping Parameter	Array			
A to 1600A	Number of Entries	UINT8	1		RO
A to 160A	Subindex 001h	UINT32	0x700A0040		RO
160B	ReceivePDO11 Mapping Parameter	Array			
160B0	Number of Entries	UINT8	1		RO
160B0	Subindex 001h	UINT32	0x700B0040		RO
[160C]	ReceivePDO12 Mapping Parameter	Array			
160C, 0	Number of Entries	UINT8	1		RO
160C, 1	Subindex 001h	UINT32	0x700C0040		RO

Index	Name	Type	Default	Min Max	Access
[160D]	ReceivePDO13 Mapping Parameter	Array			
160, 0	Number of Entries	UINT8	1		RO
160, 1	Subindex 001h	UINT32	0x700D0040		RO
160E	ReceivePDO14 Mapping Parameter	Array			
160 * E 0	Number of Entries	UINT8	1		RO
160 * E 1	Subindex 001h	UINT32	0x700E0040		RO
F) 160.	ReceivePDO15 Mapping Parameter	Array			
160, 0	Number of Entries	UINT8	1		RO
160, 1	Subindex 001h	UINT32	0x700F0040		RO
1610	ReceivePDO16 Mapping Parameter	Array			
1610, 0	Number of Entries	UINT8	1		RO
1610, 1	Subindex 001h	UINT32	0x70100040		RO
1611	ReceivePDO17 Mapping Parameter	Array			
1611, 0	Number of Entries	UINT8	1		RO
1611, 1	Subindex 001h	UINT32	0x70110040		RO
1612	ReceivePDO18 Mapping Parameter	Array			
1612, 0	Number of Entries	UINT8	1		RO
1612, 1	Subindex 001h	UINT32	0x70120040		RO
1613	ReceivePDO19 Mapping Parameter	Array			
1613, 0	Number of Entries	UINT8	1		RO
1613, 1	Subindex 001h	UINT32	0x70130040		RO
1A00	Receive PDO0 Mapping Parameter	Array			
1A00, 0	Number of Entries	UINT8	17		RO
1A00, 1	Subindex 001h	UINT32	0x66000010		RO
1A00, 2	Subindex 002h	UINT32	0x66010010		RO
1A00, 3	Subindex 003h	UINT32	0x66020010		RO
1A00, 4	Subindex 004h	UINT32	0x65000101		RO
1A00, 5	Subindex 005h	UINT32	0x65000201		RO
1A00, 6	Subindex 006h	UINT32	0x65000301		RO
1A00, 7	Subindex 007h	UINT32	0x65000401		RO
1A00, 8	SubIndex 008	UINT32	0x65000501		RO
1A00, 9	SubIndex 009	UINT32	0x00000001		RO
1A00, 10	SubIndex 010	UINT32	0x65000701		RO
1A00, 11	SubIndex 011	UINT32	0x65000801		RO
1A00, 12	SubIndex 012	UINT32	0x65000901		RO
1A00, 13	SubIndex 013	UINT32	0x65000A01		RO
1A00, 14	SubIndex 014	UINT32	0x00000003		RO
1A00, 15	SubIndex 015	UINT32	0x65000E01		RO
1A00, 16	SubIndex 016	UINT32	0x65000F01		RO
1A00, 17	SubIndex 017	UINT32	0x65001001		RO
1A01	Receive PDO1 Mapping	Array			

Index	Name	Type	Default	Min Max	Access
	Parameter				
1A01, 0	Number of Entries	UINT8	1		RO
1A01, 1	Subindex 001h	UINT32	0x75010040		RO
1A02	Receive PDO2 Mapping Parameter	Array			
1A02, 0	Number of Entries	UINT8	1		RO
1A02, 0	Subindex 001h	UINT32	0x75020040		RO
1A03	Receive PDO3 Mapping Parameter	Array			
1A03, 0	Number of Entries	UINT8	1		RO
1A03, 1	Subindex 001h	UINT32	0x75030040		RO
1A04	Receive PDO4 Mapping Parameter	Array			
1A04, 0	Number of Entries	UINT8	1		RO
1A04, 1	Subindex 001h	UINT32	0x75040040		RO
1A05	Receive PDO5 Mapping Parameter	Array			
1A05, 0	Number of Entries	UINT8	1		RO
1A05, 1	Subindex 001h	UINT32	0x75050040		RO
1A06	Receive PDO6 Mapping Parameter	Array			
1A06, 0	Number of Entries	UINT8	1		RO
1A06, 1	Subindex 001h	UINT32	0x75060040		RO
1A07	Receive PDO7 Mapping Parameter	Array			
1A07, 0	Number of Entries	UINT8	1		RO
1A07, 1	Subindex 001h	UINT32	0x75070040		RO
1A08	Receive PDO8 Mapping Parameter	Array			
1A08, 0	Number of Entries	UINT8	1		RO
1A08, 1	Subindex 001h	UINT32	0x75080040		RO
1A09	Receive PDO9 Mapping Parameter	Array			
1A09, 0	Number of Entries	UINT8	1		RO
1A09, 1	Subindex 001h	UINT32	0x75090040		RO
1A0A	Receive PDO10 Mapping Parameter	Array			
1A0A, 0	Number of Entries	UINT8	1		RO
1A0A, 1	Subindex 001h	UINT32	0x750A0040		RO
1A0B	Receive PDO11 Mapping Parameter	Array			
1A0B, 0	Number of Entries	UINT8	1		RO
1A0B, 1	Subindex 001h	UINT32	0x750B0040		RO
1A0C	Receive PDO12 Mapping Parameter	Array			
1A0C, 0	Number of Entries	UINT8	1		RO
1A0C, 1	Subindex 001h	UINT32	0x750C0040		RO
1A0D	Receive PDO13 Mapping Parameter	Array			
1A0D, 0	Number of Entries	UINT8	1		RO

Index	Name	Type	Default	Min Max	Access
1A0D, 1	Subindex 001h	UINT32	0x750D0040		RO
1A0E	Receive PDO14 Mapping Parameter	Array			
1A0E, 0	Number of Entries	UINT8	1		RO
1A0E, 1	Subindex 001h	UINT32	0x750E0040		RO
1A0F	Receive PDO15 Mapping Parameter	Array			
1A0F, 0	Number of Entries	UINT8	1		RO
1A0F, 1	Subindex 001h	UINT32	0x750F0040		RO
1A10	Receive PDO16 Mapping Parameter	Array			
1A10, 0	Number of Entries	UINT8	1		RO
1A10, 1	Subindex 001h	UINT32	0x75100040		RO
1A11	Receive PDO17 Mapping Parameter	Array			
1A11, 0	Number of Entries	UINT8	1		RO
1A11, 1	Subindex 001h	UINT32	0x75110040		RO
1A12	Receive PDO18 Mapping Parameter	Array			
1A12, 0	Number of Entries	UINT8	1		RO
1A12, 1	Subindex 001h	UINT32	0x75120040		RO
1A13	Receive PDO19 Mapping Parameter	Array			
1A13, 0	Number of Entries	UINT8	1		RO
1A13, 1	Subindex 001h	UINT32	0x75130040		RO
1C00	Sync Manager Type	Array			
1C00, 0	Number of Entries	UINT8	4		RO
1C00, 1	Subindex 001h	UINT8	1		RO
1C00, 2	Subindex 002h	UINT8	2		RO
1C00, 3	Subindex 003h	UINT8	3		RO
1C00, 4	Subindex 004h	UINT8	4		RO
1C12	RxPDO assign	Array			
1C12, 0	Number of Entries	UINT8	20		RW
1C12, 1	Subindex 001h	UINT16	0x1600		RW
1C12, 2	Subindex 002h	UINT16	0x1601		RW
1C12, 3	Subindex 003h	UINT16	0x1602		RW
1C12, 4	Subindex 004h	UINT16	0x1603		RW
1C12, 5	Subindex 005h	UINT16	0x1604		RW
1C12, 6	Subindex 006h	UINT16	0x1605		RW
1C12, 7	Subindex 007h	UINT16	0x1606		RW
1C12, 8	SubIndex 008	UINT16	0x1607		RW
1C12, 9	SubIndex 009	UINT16	0x1608		RW
1C12, 10	SubIndex 010	UINT16	0x1609		RW
1C12, 11	SubIndex 011	UINT16	0x160A		RW
1C12, 12	SubIndex 012	UINT16	0x160B		RW
1C12, 13	SubIndex 013	UINT16	0x160C		RW
1C12, 14	SubIndex 014	UINT16	0x160D		RW
1C12, 15	SubIndex 015	UINT16	0x160E		RW

Index	Name	Type	Default	Min Max	Access
1C12, 16	SubIndex 016	UINT16	0x160F		RW
1C12, 17	SubIndex 017	UINT16	0x1610		RW
1C12, 18	SubIndex 018	UINT16	0x1611		RW
1C12, 19	SubIndex 019	UINT16	0x1612		RW
1C12, 20	SubIndex 020	UINT16	0x1613		RW
1C13	TxPDO assign	Array			
1C13, 0	Number of Entries	UINT8	20		RO
1C13, 1	Subindex 001h	UINT16	0x1A00		RO
1C13, 2	Subindex 002h	UINT16	0x1A01		RO
1C13, 3	Subindex 003h	UINT16	0x1A02		RO
1C13, 4	Subindex 004h	UINT16	0x1A03		RO
1C13, 5	Subindex 005h	UINT16	0x1A04		RO
1C13, 6	Subindex 006h	UINT16	0x1A05		RO
1C13, 7	Subindex 007h	UINT16	0x1A06		RO
1C13, 8	SubIndex 008	UINT16	0x1A07		RO
1C13, 9	SubIndex 009	UINT16	0x1A08		RO
1C13, 10	SubIndex 010	UINT16	0x1A09		RO
1C13, 11	SubIndex 011	UINT16	0x1A0A		RO
1C13, 12	SubIndex 012	UINT16	0x1A0B		RO
1C13, 13	SubIndex 013	UINT16	0x1A0C		RO
1C13, 14	SubIndex 014	UINT16	0x1A0D		RO
1C13, 15	SubIndex 015	UINT16	0x1A0E		RO
1C13, 16	SubIndex 016	UINT16	0x1A0F		RO
1C13, 17	SubIndex 017	UINT16	0x1A10		RO
1C13, 18	SubIndex 018	UINT16	0x1A11		RO
1C13, 19	SubIndex 019	UINT16	0x1A12		RO
1C13, 20	SubIndex 020	UINT16	0x1A13		RO
1C32	SM Output Parameter	RECORD			
1C32, 0	Number of Entries	UINT8	32		RO
1C32, 1	Synchronisation Type	UINT16	0x0001		RW
1C32, 2	Cycle Time	UINT32			RO
1C32, 4	Synchronisation Types supported	UINT16	0x8007		RO
1C32, 5	Cycle Time	UINT32			RO
1C32, 6	Calc and Copy Time	UINT32			RO
1C32, 8	Cycle Time	UINT16			RW
1C32, 9	Delay Time	UINT32			RO
1C32, 10	Sync0 Cycle Time	UINT32			RW
1C32, 11	SM-Event Missed	UINT16			RO
1C32, 12	Cycle Time too small	UINT16			RO
1C32, 32	Sync Error	BOOL			RO
1C33	SM Input Parameter	RECORD			
1C33, 0	Number of Entries	UINT8	32		RO
1C33, 1	Synchronisation Type	UINT16	0x0022		RW
1C33, 2	Cycle Time	UINT32			RO
1C33, 4	Synchronisation Types supported	UINT16	0x8007		RO
1C33, 5	Cycle Time	UINT32			RO

Index	Name	Type	Default	Min Max	Access
1C33, 6	Calc and Copy Time	UINT32			RO
1C33, 8	Cycle Time	UINT16			RW
1C33, 9	Delay Time	UINT32			RO
1C33, 10	Sync0 Cycle Time	UINT32			RW
1C33, 11	SM-Event Missed	UINT16			RO
1C33, 12	Cycle Time too small	UINT16			RO
1C33, 32	Sync Error	BOOL			RO
2001	ComPara	Array			
2001, 0	Number of Entries	UINT8	4		RO
2001, 1	Baud Rate	UINT32	38400	2400 4800 9600 19200 38400 57600 115200	RW
2001, 2	WordLength	UINT32	8 Bits 8..	8 bit	
2001, 3	including the baud rate, parity, stop bits, etc.	UINT32	None (0)	None (0) Odd (1) Even (2)	
2001, 4	StopBits	UINT32	1..1	1..1 2 stop bits (2)	
2010	DataSync	UINT8	NoSync	NoSync (0) RxSync (1)	RW
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	EtherCAT Error	BOOL			RO P
6500, 3	unused0	BOOL			RO P
6500, 4	unused1	BOOL			RO P
6500, 5	TxCounterMiss	BOOL			RO P
6500, 6	unused2	BOOL			RO P
6500, 7	COM_TxQueueOvr	BOOL			RO P
6500, 8	COM_RxQueueOvr	BOOL			RO P
6500, 9	unused3	BOOL			RO P
6500, 10	COM2_ CtrlErr	BOOL			RO P
6500, 11	unused4	BOOL			RO P
6500, 12	unused5	BOOL			RO P
6500, 13	unused6	BOOL			RO P
6500, 14	unused7	BOOL			RO P
6500, 15	COM_TxBusy	BOOL			RO P
6500, 16	Unused8	BOOL			RO P
6600	TxCounterCon	UINT16		0..65535	RO P
6601	RxCounter	UINT16		0..65535	RO P
6602	RxNrOfMsg	UINT16		0..152	RO P
7000	TxData0	UINT64	0		RW P
7001	TxData1	UINT64	0		RW P

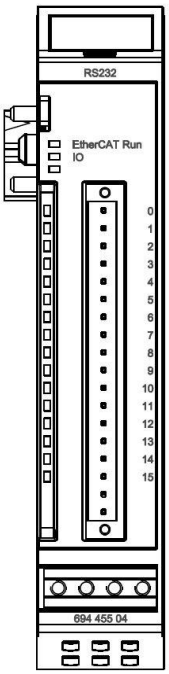
Index	Name	Type	Default	Min Max	Access
7002	TxData2	UINT64	0		RW P
7003	TxData3	UINT64	0		RW P
7004	TxData4	UINT64	0		RW P
7005	TxData5	UINT64	0		RW P
7006	TxData6	UINT64	0		RW P
7007	TxData7	UINT64	0		RW P
7008	TxData8	UINT64	0		RW P
7009	TxData9	UINT64	0		RW P
700A	TxData10	UINT64	0		RW P
700B	TxData11	UINT64	0		RW P
[700C]	TxData12	UINT64	0		RW P
[700D]	TxData13	UINT64	0		RW P
700E	TxData14	UINT64	0		RW P
F) 700.	TxData15	UINT64	0		RW P
7010	TxData16	UINT64	0		RW P
7011	TxData17	UINT64	0		RW P
7012	TxData18	UINT64	0		RW P
7013	TxData19	UINT64	0		RW P
7100	TxCounter	UINT16		0..65535	RW P
7101	RxCounterCon	UINT16		0..65535	RW P
7102	TxNrOfMsg	UINT16		0..152	RW P
7110	ControlWord	Array			
7110, 0	Number of Entries	UINT8	16		RO
7110, 1	ResetError	BOOL			RW P
7110, 2	unused0	BOOL			RW P
7110, 3	unused1	BOOL			RW P
7110, 4	unused2	BOOL			RW P
7110, 5	unused3	BOOL			RW P
7110, 6	unused4	BOOL			RW P
7110, 7	unused5	BOOL			RW P
7110, 8	unused6	BOOL			RW P
7110, 9	unused7	BOOL			RW P
7110, 10	unused8	BOOL			RW P
7110, 11	unused9	BOOL			RW P
7110, 12	unused10	BOOL			RW P
7110, 13	unused11	BOOL			RW P
7110, 14	unused12	BOOL			RW P
7110, 15	unused13	BOOL			RW P
7110, 16	unused14	BOOL			RW P
7500	RxData0	UINT64			RO P
7501	RxData1	UINT64			RO P
7502	RxData2	UINT64			RO P
7503	RxData3	UINT64			RO P
7504	RxData4	UINT64			RO P
7505	RxData5	UINT64			RO P
7506	RxData6	UINT64			RO P
7507	RxData7	UINT64			RO P

Index	Name	Type	Default	Min Max	Access
7508	RxData8	UINT64			RO P
7509	RxData9	UINT64			RO P
750A	RxData10	UINT64			RO P
750B	RxData11	UINT64			RO P
[750C]	RxData12	UINT64			RO P
[750D]	RxData13	UINT64			RO P
750E	RxData14	UINT64			RO P
F) 750.	RxData15	UINT64			RO P
7510	RxData16	UINT64			RO P
7511	RxData17	UINT64			RO P
7512	RxData18	UINT64			RO P
7513	RxData19	UINT64			RO P

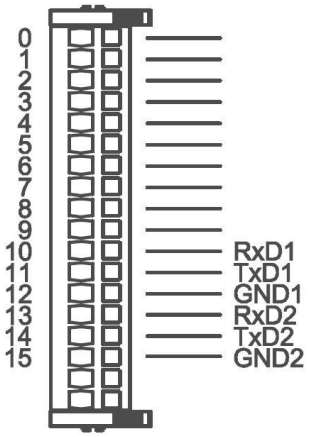
Technical Data

RS485 ..... Electrically insulated
Baud rate ..... 2400…115200 kBit/s
Payload data ..... Max. 152 bytes In/Out
IO connection 18-pin
Controller ..... ASIC ET1200
E-bus connector ..... 10-pole system plug in side wall
Terminating module ..... not required
Power supply ..... Via E-bus
E-bus load ..... Max. 330 mA
Part no. 694 455 02
Approval .....

5.2.2 RS232 2 Port



Front view of the RS232 module



Pin wiring

The module provides 2 RS232 interfaces accessible by EtherCAT.

Run CoE (CODESYS configuration tool) to set the parameters. The process image is the medium of data interchange. A library can be downloaded for this module.

Terminals

IO Connection, Male 18-pin

Trm.	Signal	Explanation
0..9	-	Not used
10	RxD1	Channel 1 Rx data
11	TxD1	Channel 1 Tx data
12	GND1	Channel 1 earth potential
13	RxD2	Channel 2 Rx data
14	TxD2	Channel 2 Tx data
15	GND2	Channel 2 earth potential

Status LEDs

LED "EtherCAT Run"

The LED labelled "RN" indicates the state of the EtherCAT ASIC.

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange

LED "IO"

The LED labelled "IO" indicates the state of the module's I/Os.

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Red, 4x	EtherCAT watchdog
	Red, 5x	Transmit queue overflow
	Red, 6x	Receive queue overflow
	Red, 7x	No Tx counter
Start, defective	Red	Module not initialised

LED "Power"

Not used

LEDs "Channel [COM State]"

The "Channel" LEDs indicate the state of every channel.

State	LED	Explanation
On	Green, flashing	Communication
Off	Off	No communication
Error	Red/green, flashing	Controller communication error
	Red, flashing	Controller error

process image

There are 20 PDOs containing 8 bytes of data each for every direction. Use PDO Assignment (objects 1C12 and 1C13) to vary the volume of data. Taken together with the mailboxes (32 bytes each), this is the maximum configuration of ET1200.

Output Data (PLC -> IO, 0-160 Bytes)

Name	Size	Source
ControlData	8 bytes	PLC
TxData1[0..7]	8 bytes	PLC
…	…	…
TxData19[0..7]	8 bytes	PLC

The process image holds max. 152 bytes of payload data per direction.

ControlData:

Name	Format	Source
TxCounter	Word	Incrementing the TxCounter tells the gateway that the process image contains new data to be sent.
RxCounterCon	Word	If synchronised data (RxSync) is used, this object is used to acknowledge that the data received has been processed. Only then will the gateway send the next data.
TxNrOfMsg	Word	Number of bytes to be sent from the process image. Range: 0..152. Starting point of the data section is TxData1[0].
ResetError	Bit (1)	Bit 0 ->1: Resets errors that have been removed.
unused 0..13	Bit (14)	
TxComSwitch	Bit (1)	0 -> COM1; 1-> COM2

Input Data (IO -> PLC, 0..160 Bytes)

Name	Size	Source
StateData	8 bytes	IO
RxData1[0..7]	8 bytes	IO
…	…	…
RxData19[0..7]	8 bytes	IO

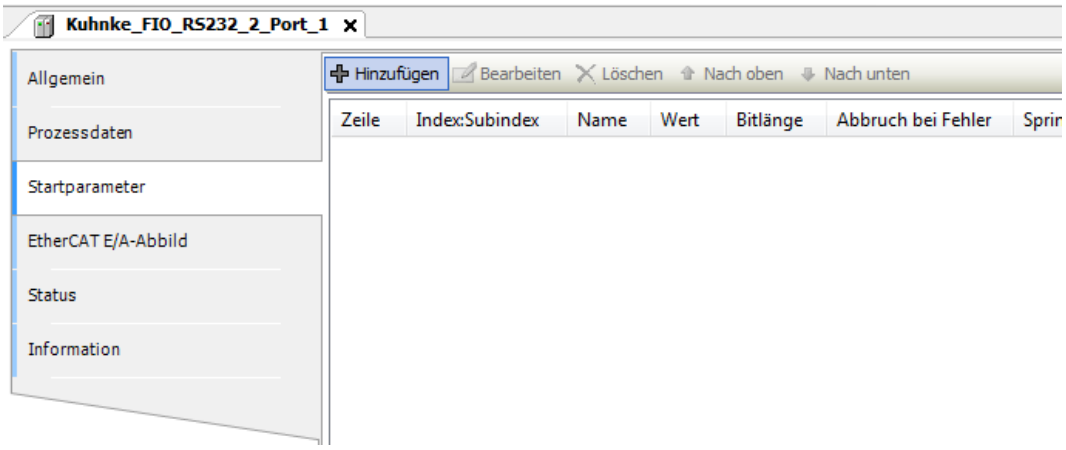
StateData:

Name	Format	Source
TxCounterCon	Word	The gateway shows the TxCounter again to confirm the new out-queue data.
RxCounter	Word	Incrementing the RxCounter indicates that the process image contains new in-queue data.
RxNrOfMsg	Word	Number of bytes received by the process image. Range: 0..152. Starting point of the data section is RxData1[0].
ResetErrorAck	Bit (1)	Acknowledges the state of the Reset Error signal.
EtherCATError	Bit (1)	If 1: Sync Manager watchdog triggered (watchdog control)
COM1_TxQueueOvr	Bit (1)	Overflow of the gateway's out-buffer (Com1). Too much data is being sent or the baud rate is too low.
COM1_RxQueueOvr	Bit (1)	In-buffer overflow (Com1). Data is being accepted too slowly. Either speed up the EtherCAT task or reduce the volume of data (lower baud rate).
TxCounterMiss	Bit(1)	The gateway checks the TxCounter for steady increments. This error indicates a skipped increment. Best use TxCounterCon to send new data.
unused 0	Bit (1)	
COM2_TxQueueOvr	Bit (1)	Overflow of the gateway's out-buffer (Com2). Too much data is being sent or the baud rate is too low.
COM2_RxQueueOvr	Bit (1)	In-buffer overflow (Com2). Data is being accepted too slowly. Either speed up the EtherCAT task or reduce the volume of data (lower baud rate).
COM1_CtrlErr	Bit (1)	RS232 controller error (Com1) (bit error or overrun)
COM2_CtrlErr	Bit (1)	RS232 controller error (Com2) (bit error or overrun)
unused 1..3	Bit (3)	
COM1_TxBusy	Bit (1)	Com1 is transferring data
COM2_TxBusy	Bit (1)	Com2 is transferring data
RxComSwitch	Bit (1)	0 -> data received from Com1 1 -> data received from Com2

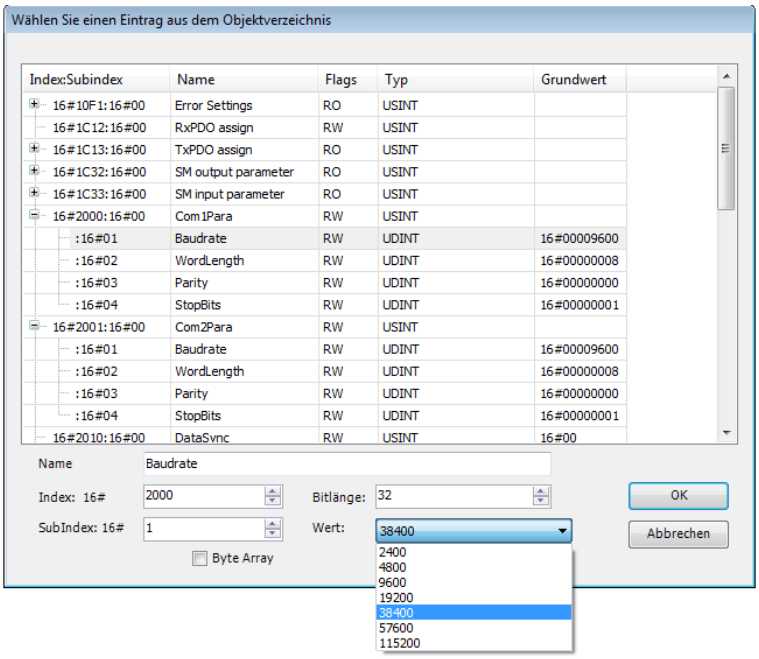
Configuration

Run CoE to configure the RS232 module. You can directly set the startup parameters.

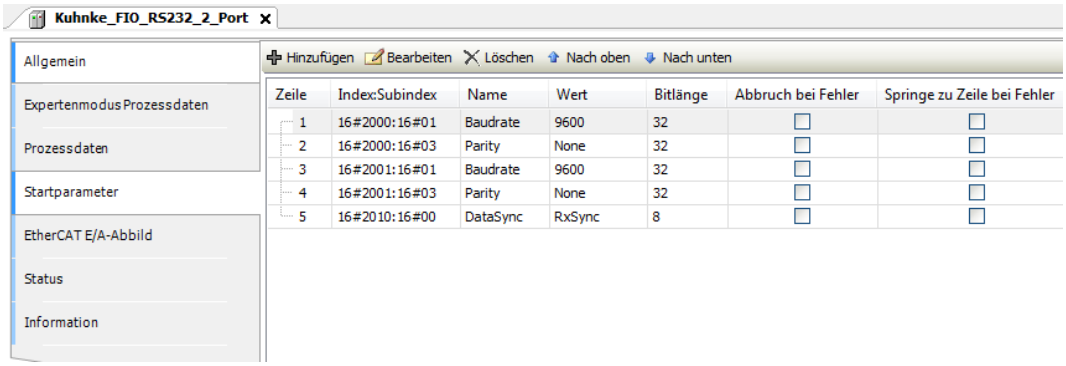
Select the module and go to "Startparameter" (startup parameters) and "Hinzufügen" (add).



Now go to ComParameter and change the Baud Rate or other settings as appropriate or enable/disable data synchronisation.



Your settings are then displayed on tab "Startparameter" (startup parameters).



Sample Program

The example below illustrates how a program works. It does not use library available for the communication module.

Visit Kendrion Kuhnke's Product Finder to download a sample project and the library.

Link: http://productfinder.kuhnke.kendrion.com

Run your development environment (e.g. CODESYS) to set the interface parameters, including the baud rate, parity, stop bits, etc.

Refer to section Object Dictionary. The settings are applied when PreOp turns into SafeOp.

Running SDO components to make changes in state Operational will therefore have no effect.

Transfer Data:

Initial state:TxCounter = 0 TxCounterCon = 0

TxComSwitch = 0 -> COM1, TxComSwitch = 1 -> COM2

TxNrOfMsg := 6;

TxData1[0] = `H`

TxData1[1] = `e`

TxData1[2] = `l`

TxData1[3] = `l`

TxData1[4] = `o`

TxData1[5] = ` `

Increment TxCounter by 1:

TxCounter = 1 TxCounterCon = 0

Slave module accepts data (into a an out-data queue). TxCounterCon = TxCounter acknowledges. (Data has not necessarily been transferred yet, though. Use COM_TxBusy to check the data transfer.)

TxCounter = 1 TxCounterCon = 1

TxNrOfMsg := 4;

TxData1[0] = `W`

TxData1[1] = `o`

TxData1[2] = `r`

TxData1[3] = `l

TxData1[4] = 'd'`

Increment TxCounter by 1:

TxCounter = 2 TxCounterCon = 1

Slave module accepts data. TxCounterCon = TxCounter acknowledges.

TxCounter = 2 TxCounterCon = 2

Receive Data:

Initial state:RxCounter = 0 RxCounterCon = 0

The module increments RxCounter by 1:

RxCounter = 1 TxCounterCon = 0

RxComSwitch = 0 -> COM1, RxComSwitch = 1 -> COM2

RxNrOfMsg := 4;

RxData1[0] = `T`

RxData1[1] = `e`

RxData1[2] = `s`

RxData1[3] = `t`

If RxSync is enabled (object 2010 DataSync = RxSync), the module will not be allowed to send the next set of data until you set RxCounterCon = RxCounter. If RxSync is disabled, the module will send data without checking RxCounterCon.

RxCounter = 1 RxCounterCon = 1

Response to Errors

- EtherCAT error.
  Sync Manager watchdog.
  LED "Error" flashes 4x.
  Unit changes from Op to Safe-Op.
  Use "Reset Error" to acknowledge the error.

- Out-queue overflow (COM1_TxQueueOvr, COM2_TxQueueOvr).
  Failure to send the data fast enough.
  LED "Error" flashes 5x.
  Use "Reset Error" to acknowledge the error.

- In-queue overflow (COM1_RxQueueOvr, COM2_RxQueueOvr).
  Too much data is being received and cannot be transferred to the control unit fast enough.
  LED "Error" flashes 6x.
  Use "Reset Error" to acknowledge the error.

- TxCount error (TxCounterMiss).
  The TxCounter received is not "last TxCounter + 1".
  The gateway probably missed an EtherCAT frame. The EtherCAT master is sending the data too quickly (< 1ms for 9 messages).
  LED "Error" flashes 7x.
  Use "Reset Error" to acknowledge the error.

- Com controller error (COM1_CtrlErr, COM2_CtrlErr).
  Indicates bit errors or overruns of the control unit concerned.
  The applicable LED "COM State" is red and flashes rapidly or alternates green/red while communicating.
  Use "Reset Error" to acknowledge the error.

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	FIO RS232 2 Port		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	167351		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32	0		RO
10F1	Error Settings	Array			
10F1, 0	Number of Entries	UINT8	2		RO
10F1, 1	Local Error Reaction	UINT32	1		RW
10F1,2	Sync Error Counter Limit	UINT32	4		RW
1600	Receive PDO0 Mapping Parameter	Array			
1600, 0	Number of Entries	UINT8	6		RO
1600, 1	Subindex 001h	UINT32	0x71000010		RO
1600, 2	Subindex 002h	UINT32	0x71010010		RO

Index	Name	Type	Default	Min Max	Access
1600, 3	Subindex 003h	UINT32	0x71020010		RO
1600, 4	Subindex 004h	UINT32	0x71100101		RO
1600, 5	Subindex 005h	UINT32	0x0000000E		RO
1600, 6	Subindex 006h	UINT32	0x71101001		RO
1601	ReceivePDO1 Mapping Parameter	Array			
1601, 0	Number of Entries	UINT8	1		RO
1601, 1	Subindex 001h	UINT32	0x70010040		RO
1602	ReceivePDO2 Mapping Parameter	Array			
1602, 0	Number of Entries	UINT8	1		RO
1602, 1	Subindex 001h	UINT32	0x70020040		RO
1603	ReceivePDO3 Mapping Parameter	Array			
1603, 0	Number of Entries	UINT8	1		RO
1603, 1	Subindex 001h	UINT32	0x70030040		RO
1604	ReceivePDO4 Mapping Parameter	Array			
1604, 0	Number of Entries	UINT8	1		RO
1604, 1	Subindex 001h	UINT32	0x70040040		RO
1605	ReceivePDO5 Mapping Parameter	Array			
1605, 0	Number of Entries	UINT8	1		RO
1605, 1	Subindex 001h	UINT32	0x70050040		RO
1606	ReceivePDO6 Mapping Parameter	Array			
1606, 0	Number of Entries	UINT8	1		RO
1606, 1	Subindex 001h	UINT32	0x70060040		RO
1607	ReceivePDO7 Mapping Parameter	Array			
1607, 0	Number of Entries	UINT8	1		RO
1607, 1	Subindex 001h	UINT32	0x70070040		RO
1608	ReceivePDO8 Mapping Parameter	Array			
1608, 0	Number of Entries	UINT8	1		RO
1608, 1	Subindex 001h	UINT32	0x70080040		RO
1609	ReceivePDO9 Mapping Parameter	Array			
1609, 0	Number of Entries	UINT8	1		RO
1609, 1	Subindex 001h	UINT32	0x70090040		RO
160A	ReceivePDO10 Mapping Parameter	Array			
A to 1600A	Number of Entries	UINT8	1		RO
A to 160A	Subindex 001h	UINT32	0x700A0040		RO
160B	ReceivePDO11 Mapping Parameter	Array			
160B0	Number of Entries	UINT8	1		RO
160B0	Subindex 001h	UINT32	0x700B0040		RO
[160C]	ReceivePDO12 Mapping Parameter	Array			

Index	Name	Type	Default	Min Max	Access
160C, 0	Number of Entries	UINT8	1		RO
160C, 1	Subindex 001h	UINT32	0x700C0040		RO
[160D]	ReceivePDO13 Mapping Parameter	Array			
160, 0	Number of Entries	UINT8	1		RO
160, 1	Subindex 001h	UINT32	0x700D0040		RO
160E	ReceivePDO14 Mapping Parameter	Array			
160 * E 0	Number of Entries	UINT8	1		RO
160 * E 1	Subindex 001h	UINT32	0x700E0040		RO
F) 160.	ReceivePDO15 Mapping Parameter	Array			
160, 0	Number of Entries	UINT8	1		RO
160, 1	Subindex 001h	UINT32	0x700F0040		RO
1610	ReceivePDO16 Mapping Parameter	Array			
1610, 0	Number of Entries	UINT8	1		RO
1610, 1	Subindex 001h	UINT32	0x70100040		RO
1611	ReceivePDO17 Mapping Parameter	Array			
1611, 0	Number of Entries	UINT8	1		RO
1611, 1	Subindex 001h	UINT32	0x70110040		RO
1612	ReceivePDO18 Mapping Parameter	Array			
1612, 0	Number of Entries	UINT8	1		RO
1612, 1	Subindex 001h	UINT32	0x70120040		RO
1613	ReceivePDO19 Mapping Parameter	Array			
1613, 0	Number of Entries	UINT8	1		RO
1613, 1	Subindex 001h	UINT32	0x70130040		RO
1A00	Receive PDO0 Mapping Parameter	Array			
1A00, 0	Number of Entries	UINT8	17		RO
1A00, 1	Subindex 001h	UINT32	0x66000010		RO
1A00, 2	Subindex 002h	UINT32	0x66010010		RO
1A00, 3	Subindex 003h	UINT32	0x66020010		RO
1A00, 4	Subindex 004h	UINT32	0x65000101		RO
1A00, 5	Subindex 005h	UINT32	0x65000201		RO
1A00, 6	Subindex 006h	UINT32	0x65000301		RO
1A00, 7	Subindex 007h	UINT32	0x65000401		RO
1A00, 8	SubIndex 008	UINT32	0x65000501		RO
1A00, 9	SubIndex 009	UINT32	0x00000001		RO
1A00, 10	SubIndex 010	UINT32	0x65000701		RO
1A00, 11	SubIndex 011	UINT32	0x65000801		RO
1A00, 12	SubIndex 012	UINT32	0x65000901		RO
1A00, 13	SubIndex 013	UINT32	0x65000A01		RO
1A00, 14	SubIndex 014	UINT32	0x00000003		RO
1A00, 15	SubIndex 015	UINT32	0x65000E01		RO
1A00, 16	SubIndex 016	UINT32	0x65000F01		RO

Index	Name	Type	Default	Min Max	Access
1A00, 17	SubIndex 017	UINT32	0x65001001		RO
1A01	Receive PDO1 Mapping Parameter	Array			
1A01, 0	Number of Entries	UINT8	1		RO
1A01, 1	Subindex 001h	UINT32	0x75010040		RO
1A02	Receive PDO2 Mapping Parameter	Array			
1A02, 0	Number of Entries	UINT8	1		RO
1A02, 1	Subindex 001h	UINT32	0x75020040		RO
1A03	Receive PDO3 Mapping Parameter	Array			
1A03, 0	Number of Entries	UINT8	1		RO
1A03, 1	Subindex 001h	UINT32	0x75030040		RO
1A04	Receive PDO4 Mapping Parameter	Array			
1A04, 0	Number of Entries	UINT8	1		RO
1A04, 1	Subindex 001h	UINT32	0x75040040		RO
1A05	Receive PDO5 Mapping Parameter	Array			
1A05, 0	Number of Entries	UINT8	1		RO
1A05, 1	Subindex 001h	UINT32	0x75050040		RO
1A06	Receive PDO6 Mapping Parameter	Array			
1A06, 0	Number of Entries	UINT8	1		RO
1A06, 1	SubIndex 001	UINT32	0x75060040		RO
1A07	Receive PDO7 Mapping Parameter	Array			
1A07, 0	Number of Entries	UINT8	1		RO
1A07, 1	SubIndex 001	UINT32	0x75070040		RO
1A08	Receive PDO8 Mapping Parameter	Array			
1A08, 0	Number of Entries	UINT8	1		RO
1A08, 1	SubIndex 001	UINT32	0x75080040		RO
1A09	Receive PDO9 Mapping Parameter	Array			
1A09, 0	Number of Entries	UINT8	1		RO
1A09, 1	SubIndex 001	UINT32	0x75090040		RO
1A0A	Receive PDO10 Mapping Parameter	Array			
1A0A, 0	Number of Entries	UINT8	1		RO
1A0A, 1	SubIndex 001	UINT32	0x750A0040		RO
1A0B	Receive PDO11 Mapping Parameter	Array			
1A0B, 0	Number of Entries	UINT8	1		RO
1A0B, 1	SubIndex 001	UINT32	0x750B0040		RO
1A0C	Receive PDO12 Mapping Parameter	Array			
1A0C, 0	Number of Entries	UINT8	1		RO
1A0C, 1	SubIndex 001	UINT32	0x750C0040		RO
1A0D	Receive PDO13 Mapping	Array			

Index	Name	Type	Default	Min Max	Access
	Parameter				
1A0D, 0	Number of Entries	UINT8	1		RO
1A0D, 1	SubIndex 001	UINT32	0x750D0040		RO
1A0E	Receive PDO14 Mapping Parameter	Array			
1A0E, 0	Number of Entries	UINT8	1		RO
1A0E, 1	SubIndex 001	UINT32	0x750E0040		RO
1A0F	Receive PDO15 Mapping Parameter	Array			
1A0F, 0	Number of Entries	UINT8	1		RO
1A0F, 1	SubIndex 001	UINT32	0x750F0040		RO
1A10	Receive PDO16 Mapping Parameter	Array			
1A10, 0	Number of Entries	UINT8	1		RO
1A10, 1	SubIndex 001	UINT32	0x75100040		RO
1A11	Receive PDO17 Mapping Parameter	Array			
1A11, 0	Number of Entries	UINT8	1		RO
1A11, 1	SubIndex 001	UINT32	0x75110040		RO
1A12	Receive PDO18 Mapping Parameter	Array			
1A12, 0	Number of Entries	UINT8	1		RO
1A12, 1	SubIndex 001	UINT32	0x75120040		RO
1A13	Receive PDO19 Mapping Parameter	Array			
1A13, 0	Number of Entries	UINT8	1		RO
1A13, 1	SubIndex 001	UINT32	0x75130040		RO
1C00	Sync Manager Type	Array			
1C00, 0	Number of Entries	UINT8	4		RO
1C00, 1	SubIndex 001	UINT8	1		RO
1C00, 2	Subindex 002h	UINT8	2		RO
1C00, 3	Subindex 003h	UINT8	3		RO
1C00, 4	Subindex 004h	UINT8	4		RO
1C12	RxPDO assign	Array			
1C12, 0	Number of Entries	UINT8	20		RW
1C12, 1	SubIndex 001	UINT16	0x1600		RW
1C12, 2	Subindex 002h	UINT16	0x1601		RW
1C12, 3	Subindex 003h	UINT16	0x1602		RW
1C12, 4	Subindex 004h	UINT16	0x1603		RW
1C12, 5	Subindex 005h	UINT16	0x1604		RW
1C12, 6	Subindex 006h	UINT16	0x1605		RW
1C12, 7	Subindex 007h	UINT16	0x1606		RW
1C12, 8	SubIndex 008	UINT16	0x1607		RW
1C12, 9	SubIndex 009	UINT16	0x1608		RW
1C12, 10	SubIndex 010	UINT16	0x1609		RW
1C12, 11	SubIndex 011	UINT16	0x160A		RW
1C12, 12	SubIndex 012	UINT16	0x160B		RW
1C12, 13	SubIndex 013	UINT16	0x160C		RW

Index	Name	Type	Default	Min Max	Access
1C12, 14	SubIndex 014	UINT16	0x160D		RW
1C12, 15	SubIndex 015	UINT16	0x160E		RW
1C12, 16	SubIndex 016	UINT16	0x160F		RW
1C12, 17	SubIndex 017	UINT16	0x1610		RW
1C12, 18	SubIndex 018	UINT16	0x1611		RW
1C12, 19	SubIndex 019	UINT16	0x1612		RW
1C12, 20	SubIndex 020	UINT16	0x1613		RW
1C13	TxPDO assign	Array			
1C13, 0	Number of Entries	UINT8	20		RO
1C13, 1	SubIndex 001	UINT16	0x1A00		RO
1C13, 2	Subindex 002h	UINT16	0x1A01		RO
1C13, 3	Subindex 003h	UINT16	0x1A02		RO
1C13, 4	Subindex 004h	UINT16	0x1A03		RO
1C13, 5	Subindex 005h	UINT16	0x1A04		RO
1C13, 6	Subindex 006h	UINT16	0x1A05		RO
1C13, 7	Subindex 007h	UINT16	0x1A06		RO
1C13, 8	SubIndex 008	UINT16	0x1A07		RO
1C13, 9	SubIndex 009	UINT16	0x1A08		RO
1C13, 10	SubIndex 010	UINT16	0x1A09		RO
1C13, 11	SubIndex 011	UINT16	0x1A0A		RO
1C13, 12	SubIndex 012	UINT16	0x1A0B		RO
1C13, 13	SubIndex 013	UINT16	0x1A0C		RO
1C13, 14	SubIndex 014	UINT16	0x1A0D		RO
1C13, 15	SubIndex 015	UINT16	0x1A0E		RO
1C13, 16	SubIndex 016	UINT16	0x1A0F		RO
1C13, 17	SubIndex 017	UINT16	0x1A10		RO
1C13, 18	SubIndex 018	UINT16	0x1A11		RO
1C13, 19	SubIndex 019	UINT16	0x1A12		RO
1C13, 20	SubIndex 020	UINT16	0x1A13		RO
1C32	SM Output Parameter	RECORD			
1C32, 0	Number of Entries	UINT8	32		RO
1C32, 1	Synchronisation Type	UINT16	0x0001		RW
1C32, 2	Cycle Time	UINT32			RO
1C32, 4	Synchronisation Types supported	UINT16	0x8007		RO
1C32, 5	Cycle Time	UINT32			RO
1C32, 6	Calc and Copy Time	UINT32			RO
1C32, 8	Cycle Time	UINT16			RW
1C32, 9	Delay Time	UINT32			RO
1C32, 10	Sync0 Cycle Time	UINT32			RW
1C32, 11	SM-Event Missed	UINT16			RO
1C32, 12	Cycle Time too small	UINT16			RO
1C32, 32	Sync Error	BOOL			RO
1C33	SM Input Parameter	RECORD			
1C33, 0	Number of Entries	UINT8	32		RO
1C33, 1	Synchronisation Type	UINT16	0x0022		RW
1C33, 2	Cycle Time	UINT32			RO

Index	Name	Type	Default	Min Max	Access
1C33, 4	Synchronisation Types supported	UINT16	0x8007		RO
1C33, 5	Cycle Time	UINT32			RO
1C33, 6	Calc and Copy Time	UINT32			RO
1C33, 8	Cycle Time	UINT16			RW
1C33, 9	Delay Time	UINT32			RO
1C33, 10	Sync0 Cycle Time	UINT32			RW
1C33, 11	SM-Event Missed	UINT16			RO
1C33, 12	Cycle Time too small	UINT16			RO
1C33, 32	Sync Error	BOOL			RO
2000	Com1Para	Array			
2000, 0	Number of Entries	UINT8	4		RO
2000, 1	Baud Rate	UINT32	38400	2400 4800 9600 19200 38400 57600 115200	RW
2000, 2	WordLength	UINT32	8 Bits 8..	8 bit	
2000, 3	including the baud rate, parity, stop bits, etc.	UINT32	None (0)	None (0) Odd (1) Even (2)	
2000, 4	StopBits	UINT32	1..1	1..1 2 stop bits (2)	
2001	Com2Para	Array			
2001, 0	Number of Entries	UINT8	4		RO
2001, 1	Baud Rate	UINT32	38400	2400 4800 9600 19200 38400 57600 115200	RW
2001, 2	WordLength	UINT32	8 Bits 8..	8 bit	
2001, 3	including the baud rate, parity, stop bits, etc.	UINT32	None (0)	None (0) Odd (1) Even (2)	
2001, 4	StopBits	UINT32	1..1	1..1 2 stop bits (2)	
2010	DataSync	UINT8	NoSync	NoSync (0) RxSync (1)	RW
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	EtherCAT Error	BOOL			RO P
6500, 3	COM1_TxQueueOvr	BOOL			RO P
6500, 4	COM1_RxQueueOvr	BOOL			RO P

Index	Name	Type	Default	Min Max	Access
6500, 5	TxCounterMiss	BOOL			RO P
6500, 6	unused0	BOOL			RO P
6500, 7	COM2_TxQueueOvr	BOOL			RO P
6500, 8	COM2_RxQueueOvr	BOOL			RO P
6500, 9	COM1_CtrlErr	BOOL			RO P
6500, 10	COM2_ CtrlErr	BOOL			RO P
6500, 11	unused1	BOOL			RO P
6500, 12	unused2	BOOL			RO P
6500, 13	Unused3	BOOL			RO P
6500, 14	COM1_TxBusy	BOOL			RO P
6500, 15	COM2_TxBusy	BOOL			RO P
6500, 16	RxComSwitch	BOOL			RO P
6600	TxCounterCon	UINT16		0..65535	RO P
6601	RxCounter	UINT16		0..65535	RO P
6602	RxNrOfMsg	UINT16		0..152	RO P
7000	TxData0	UINT64	0		RW P
7001	TxData1	UINT64	0		RW P
7002	TxData2	UINT64	0		RW P
7003	TxData3	UINT64	0		RW P
7004	TxData4	UINT64	0		RW P
7005	TxData5	UINT64	0		RW P
7006	TxData6	UINT64	0		RW P
7007	TxData7	UINT64	0		RW P
7008	TxData8	UINT64	0		RW P
7009	TxData9	UINT64	0		RW P
700A	TxData10	UINT64	0		RW P
700B	TxData11	UINT64	0		RW P
[700C]	TxData12	UINT64	0		RW P
[700D]	TxData13	UINT64	0		RW P
700E	TxData14	UINT64	0		RW P
F) 700.	TxData15	UINT64	0		RW P
7010	TxData16	UINT64	0		RW P
7011	TxData17	UINT64	0		RW P
7012	TxData18	UINT64	0		RW P
7013	TxData19	UINT64	0		RW P
7100	TxCounter	UINT16		0..65535	RW P
7101	RxCounterCon	UINT16		0..65535	RW P
7102	TxNrOfMsg	UINT16		0..152	RW P
7110	ControlWord	Array			
7110, 0	Number of Entries	UINT8	16		RO
7110, 1	ResetError	BOOL			RW P
7110, 2	unused0	BOOL			RW P
7110, 3	unused1	BOOL			RW P
7110, 4	unused2	BOOL			RW P
7110, 5	unused3	BOOL			RW P
7110, 6	unused4	BOOL			RW P
7110, 7	unused5	BOOL			RW P

Index	Name	Type	Default	Min Max	Access
7110, 8	unused6	BOOL			RW P
7110, 9	unused7	BOOL			RW P
7110, 10	unused8	BOOL			RW P
7110, 11	unused9	BOOL			RW P
7110, 12	unused10	BOOL			RW P
7110, 13	unused11	BOOL			RW P
7110, 14	unused12	BOOL			RW P
7110, 15	unused13	BOOL			RW P
7110, 16	TxComSwitch	BOOL			RW P
7500	RxData0	UINT64			RO P
7501	RxData1	UINT64			RO P
7502	RxData2	UINT64			RO P
7503	RxData3	UINT64			RO P
7504	RxData4	UINT64			RO P
7505	RxData5	UINT64			RO P
7506	RxData6	UINT64			RO P
7507	RxData7	UINT64			RO P
7508	RxData8	UINT64			RO P
7509	RxData9	UINT64			RO P
750A	RxData10	UINT64			RO P
750B	RxData11	UINT64			RO P
[750C]	RxData12	UINT64			RO P
[750D]	RxData13	UINT64			RO P
750E	RxData14	UINT64			RO P
F) 750.	RxData15	UINT64			RO P
7510	RxData16	UINT64			RO P
7511	RxData17	UINT64			RO P
7512	RxData18	UINT64			RO P
7513	RxData19	UINT64			RO P

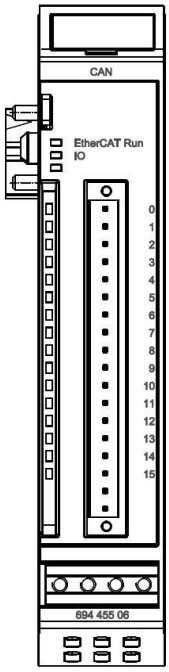
Technical Data

RS232 ..... Electrically insulated
Baud rate ..... 2400…115200 kBit/s
Payload data ..... Max. 152 bytes In/Out
IO connection ..... 18-pin, male
Controller ..... ASIC ET1200
E-bus connector ..... 10-pole system plug in side wall
Terminating module ..... not required
Power supply ..... Via E-bus
E-bus load ..... Max. 330 mA
Part no. 694 455 04

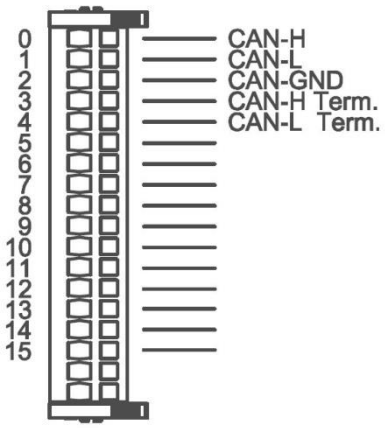
Approval .....



5.2.3 CAN Master/Slave



Front view of the CAN Master/Slave module



Pin wiring

The FIO CAN Master/Slave module is a layer 2 EtherCAT CAN gateway. CODESYS provides the higher-layer protocols (CANopen Master / Slave, etc.). The module is based on the EtherCAT slave stack version 5.11.

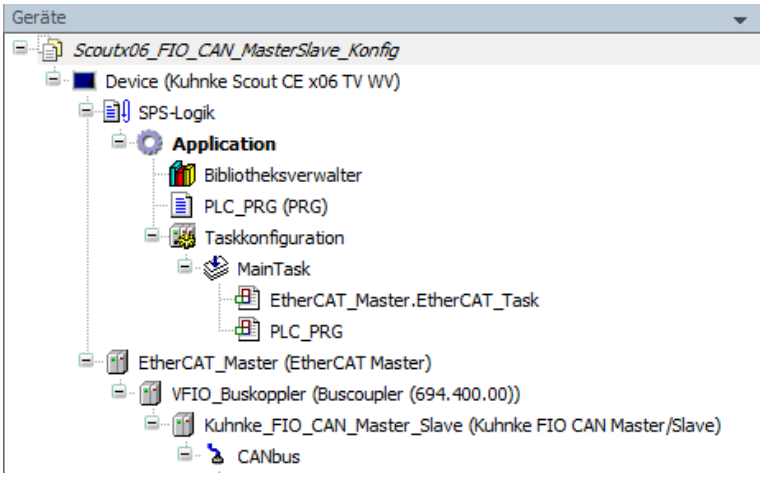
In CODESYS 3, the module provides a CANbus port that further configurations can be connected to. A device description available for CODESYS 3 contains all the required details. Mind that you also need the device driver (CAN Mini Driver).

Visit Kendrion Kuhnke's Product Finder to download the data you need. Please note the installation instructions.

FIO_CAN_MasterSlave.DevDesc.xml	29.11.2016 10:52	XML-Datei	166 KB
Installationanweisung.txt	14.06.2017 14:37	Textdokument	1 KB
KuhnkeEcatCan.xml	29.11.2016 10:52	XML-Datei	124 KB

Link: http://productfinder.kuhnke.kendrion.com

Screen if the device description has been installed properly



Terminals

IO Connection, 18-pin, Male

Trm.	Signal	Explanation
0	CAN-H	CAN-High Signal
1	CAN-L	CAN-Low Signal
2	CAN-GND	earth potential
3	CAN-H Term.	Bus termination CAN-H
4	CAN-L Term.	Bus termination CAN-L
5..15	-	Not used

Status LEDs

LED "EtherCAT Run"

The LED labelled "RN" indicates the state of the EtherCAT ASIC.

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange

LED "IO"

The LED labelled "IO" indicates the state of the module's I/Os.

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Red, 4x	EtherCAT watchdog
	Red, 5x	Transmit queue overflow
	Red, 6x	Receive queue overflow
	Red, 7x	No Tx counter

LED "Power"

Not used

LEDs "Channel [COM State]"

The "Channel" LEDs indicate the state of every channel.

LED colour, flash code	Explanation
Off	No communication
Green, flashing	Communication
Alternating red/green, flashing	CAN warning while communicating
Red, flashing	CAN warning
Red, on	CAN Bus Off

Process Image

There are 20 PDOs containing 8 bytes of data each for every direction. Use PDO Assignment (objects 1C12 and 1C13) to vary the volume of data. Taken together with the mailboxes (32 bytes each), this is the maximum configuration of ET1200.

Output Data (PLC -> IO, 0-160 Bytes)

Name	Size	Source
ControlData	8 bytes	PLC
TxData1[0..7]	8 bytes	PLC
…	…	…
TxData19[0..7]	8 bytes	PLC

The CAN data in this data range are superposed. The data range can hold up to 9 CAN messages. If so, Rx/TxData19 stays blank.

ControlData:

Name	Format	Source
TxCounter	Word	Incrementing the TxCounter tells the gateway that the process image contains new data to be sent.
RxCounterCon	Word	If synchronised data (RxSync) is used, this object is used to acknowledge that the data received has been processed. Only then will the gateway send the next data.
TxNrOfMsg	Word	Number of CAN messages in the process image. Range: 0..9.
ResetError	Bit (1)	Bit 0 ->1: Resets errors that have been removed.
Unused 0..14	Bit (15)	

TxData1,2 / 3,4 / 5,6 / 7,8 / 9,10 / 11,12 / 13,14 / 15,16 / 17,18 :

Byte	Name	Explanation
0	CanIdLowWordLowByte	CAN Identifier. ExtendedId = 0 -> 11 bit. ExtendedId = 1 -> 29 bit.
1	CanIdLowWordHighByte	
2	CanIdHighWordLowByte	
3	CanIdHighWordHighByte	
4	CanDataLength	Number of data bytes. Range: 0..8
5	RemoteFrame	RemoteFrame = 1 -> no data, just request to send the identifier
6	ExtendendId	ExtendedId = 0 -> 11 bit, ExtendedId = 1 -> 29 bit.
7	Reserved	-
8	Data[0]	Payload data. Only “CanDataLength” bytes are sent.
9	Data[1]	
10	Data[2]	
11	Data[3]	
12	Data[4]	
13	Data[5]	
14	Data[6]	
15	Data[7]	

Input Data (IO -> PLC, 0..160 Bytes)

Name	Size	Source
StateData	8 bytes	IO
RxData1[0..7]	8 bytes	IO
…	…	…
RxData19[0..7]	8 bytes	IO

StateData:

Name	Format	Source
TxCounterCon	Word	The gateway shows the TxCounter again to confirm the new out-queue data.
RxCounter	Word	Incrementing the RxCounter indicates that the process image contains new in-queue data.
RxNrOfMsg	Word	Number of CAN messages in the process image. Range: 0..9.
ResetErrorAck	Bit (1)	Acknowledges the state of the Reset Error signal.
EtherCATError	Bit (1)	If 1: Sync Manager watchdog triggered (watchdog control)
CanTxQueueOvr	Bit (1)	Overflow of the gateway's out-buffer. Too much CAN data is being sent or CAN bus the baud rate is too low.
CanRxQueueOvr	Bit (1)	In-buffer overflow. CAN data is being accepted too slowly. Either speed up the EtherCAT task or reduce the bus load.
TxCounterMiss	Bit(1)	The gateway checks the TxCounter for steady increments. This error indicates a skipped increment. Best use TxCounterCon to send new data.
CanWarning	Bit (1)	Indicates the CAN controller states "CAN Warning" and "Error Passive". These states are retained unless several frames are sent and received without errors. Reset Error is NOT required to acknowledge the bit.
CanBusOff	Bit(1)	Massive problems have changed the CAN controller's state to "bus off". The controller will quit this error state automatically.
Unused 0..5	Bit (6)	
CanTxBusy	Bit(1)	1: Data is being sent.
Unused 6..7	Bit (2)	

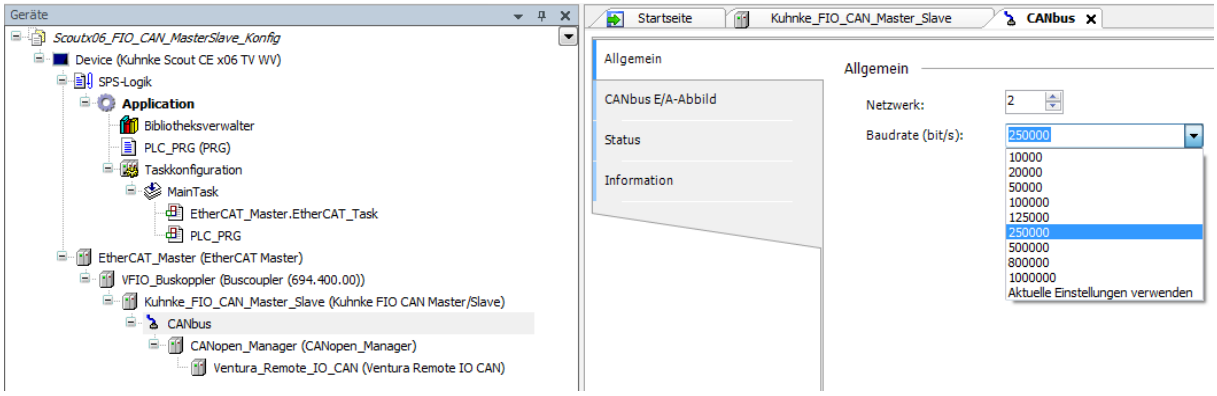
RxData1,2 / 3,4 / 5,6 / 7,8 / 9,10 / 11,12 / 13,14 / 15,16 / 17,18 :

Byte	Name	Explanation
0	CanIdLowWordLowByte	CAN Identifier. ExtendedId = 0 -> 11 bit. ExtendedId = 1 -> 29 bit.
1	CanIdLowWordHighByte	
2	CanIdHighWordLowByte	
3	CanIdHighWordHighByte	
4	CanDataLength	Number of data bytes. Range: 0..8
5	RemoteFrame	RemoteFrame = 1 -> no data, just request to send the identifier
6	ExtendendId	ExtendedId = 0 -> 11 bit, ExtendedId = 1 -> 29 bit.
7	Reserved	-
8	Data[0]	Payload data. Only the number of bytes in “CanDataLength” is accepted.
9	Data[1]	
10	Data[2]	
11	Data[3]	
12	Data[4]	

Byte	Name	Explanation
13	Data[5]	
14	Data[6]	
15	Data[7]	

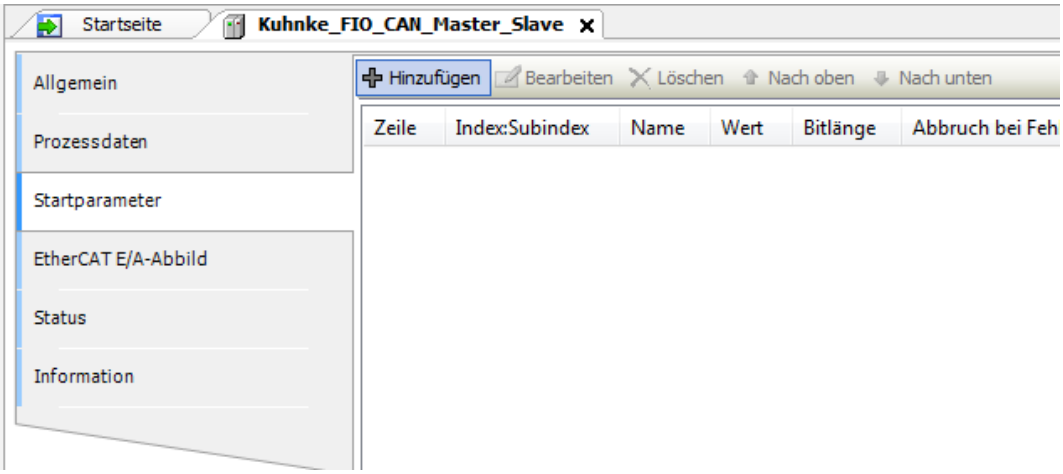
Configuration

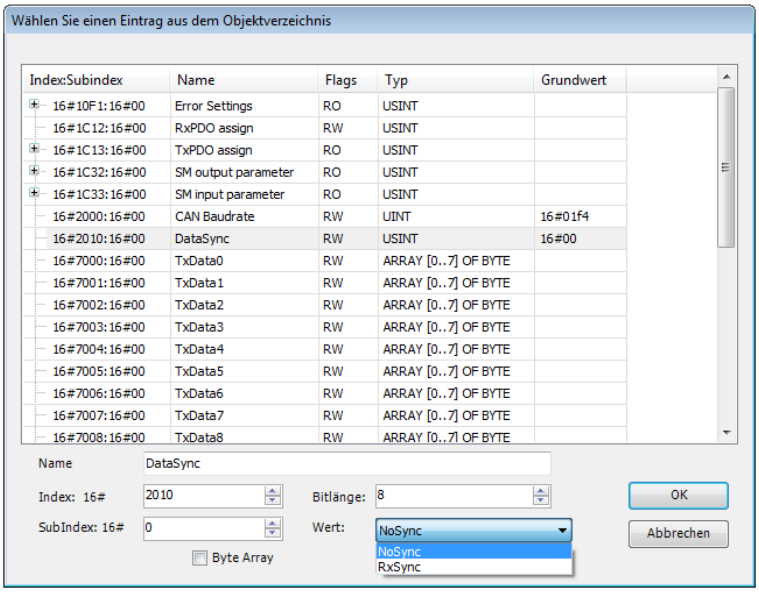
To set the baud rate, go down the device tree and find the CAN node immediately underneath the Kuhnke FIO CAN Master/Slave module.



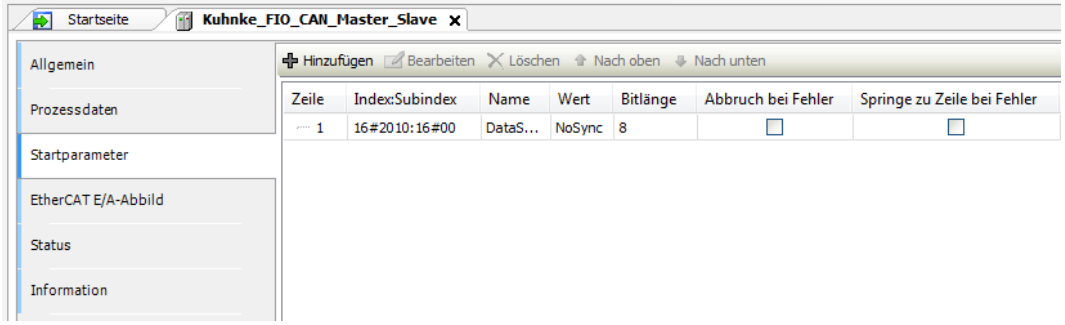
	Information
	The Kuhnke FIO CAN Master/Slave module does NOT support all CODESYS baud rates (refer to the object dictionary). *The following baud rates are supported:* ▪ 100, 125, 250, 500 and 1000 kBit/s

Go to the startup parameters of the CAN module to enable or disable data synchronisation.
Select the module and go to "Startparameter" (startup parameters) and "Hinzufügen" (add).





Your settings are then displayed on tab "Startparameter" (startup parameters).



Response to Errors

- EtherCAT error.
  Sync Manager watchdog.
  LED "Error" flashes 4x.
  Unit changes from Op to Safe-Op.
  Use "Reset Error" to acknowledge the error.

- Out-queue overflow (CanTxQueueOvr).
  Failure to send the data fast enough across the CAN bus.
  LED "Error" flashes 5x.
  Use "Reset Error" to acknowledge the error.

- In-queue overflow (CanRxQueueOvr).
  Too much data is being received via the CAN bus. and cannot be transferred to the control unit fast enough.
  LED "Error" flashes 6x.
  Use "Reset Error" to acknowledge the error.

- TxCount error (TxCounterMiss).
  The TxCounter received is not "last TxCounter + 1".
  The gateway probably missed an EtherCAT frame. The EtherCAT master is sending the data too quickly (< 1ms for 9 messages).
  LED "Error" flashes 7x.
  Use "Reset Error" to acknowledge the error.

- CAN warning.
  Indicates the CAN controller states "CAN Warning" and "Error Passive". These states are retained unless several frames are sent and received without errors.LED "CAN" is red and flashes rapidly (or alternates between green and red while communicating).
  "Reset Error" is NOT requied to acknowledge the error.
- CAN Bus Off.
  Massive problems have changed the CAN controller's state to "bus off". The controller will quit this error state automatically.LED "CAN" lights up red.
  Use "Reset Error" to acknowledge the error.

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	FIO CAN		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185580		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32	0		RO
10F1,0	Number of Entries	UINT8	2		RO
10F1,1	Local Error Reaction	UINT32	1		RW
10F1,2	Sync Error Counter Limit	UINT32	4		RW

Index	Name	Type	Default	Min Max	Access
1600	Receive PDO0 Mapping Parameter	Array			
1600, 0	Number of Entries	UINT8	5		RO
1600, 1	SubIndex 001	UINT32	0x71000010		RO
1600, 2	Subindex 002h	UINT32	0x71010010		RO
1600, 3	Subindex 003h	UINT32	0x71020010		RO
1600, 4	Subindex 004h	UINT32	0x71100101		RO
1600, 5	Subindex 005h	UINT32	0x0000000F		RO
1601	ReceivePDO1 Mapping Parameter	Array			
1601, 0	Number of Entries	UINT8	1		RO
1601, 1	SubIndex 001	UINT32	0x70010040		RO
1602	ReceivePDO2 Mapping Parameter	Array			
1602, 0	Number of Entries	UINT8	1		RO
1602, 1	SubIndex 001	UINT32	0x70020040		RO
1603	ReceivePDO3 Mapping Parameter	Array			
1603, 0	Number of Entries	UINT8	1		RO
1603, 1	SubIndex 001	UINT32	0x70030040		RO
1604	ReceivePDO4 Mapping Parameter	Array			
1604, 0	Number of Entries	UINT8	1		RO
1604, 1	SubIndex 001	UINT32	0x70040040		RO
1605	ReceivePDO5 Mapping Parameter	Array			
1605, 0	Number of Entries	UINT8	1		RO
1605, 1	SubIndex 001	UINT32	0x70050040		RO
1606	ReceivePDO6 Mapping Parameter	Array			
1606, 0	Number of Entries	UINT8	1		RO
1606, 1	SubIndex 001	UINT32	0x70060040		RO
1607	ReceivePDO7 Mapping Parameter	Array			
1607, 0	Number of Entries	UINT8	1		RO
1607, 1	SubIndex 001	UINT32	0x70070040		RO
1608	ReceivePDO8 Mapping Parameter	Array			
1608, 0	Number of Entries	UINT8	1		RO
1608, 1	SubIndex 001	UINT32	0x70080040		RO
1609	ReceivePDO9 Mapping Parameter	Array			
1609, 0	Number of Entries	UINT8	1		RO
1609, 1	SubIndex 001	UINT32	0x70090040		RO
160A	ReceivePDO10 Mapping Parameter	Array			
A to 1600A	Number of Entries	UINT8	1		RO
A to 160A	SubIndex 001	UINT32	0x700A0040		RO

Index	Name	Type	Default	Min Max	Access
160B	ReceivePDO11 Mapping Parameter	Array			
160B0	Number of Entries	UINT8	1		RO
160B0	SubIndex 001	UINT32	0x700B0040		RO
[160C]	ReceivePDO12 Mapping Parameter	Array			
160C, 0	Number of Entries	UINT8	1		RO
160C, 1	SubIndex 001	UINT32	0x700C0040		RO
[160D]	ReceivePDO13 Mapping Parameter	Array			
160, 0	Number of Entries	UINT8	1		RO
160, 1	SubIndex 001	UINT32	0x700D0040		RO
160E	ReceivePDO14 Mapping Parameter	Array			
160 * E 0	Number of Entries	UINT8	1		RO
160 * E 1	SubIndex 001	UINT32	0x700E0040		RO
160F	ReceivePDO15 Mapping Parameter	Array			
160, 0	Number of Entries	UINT8	1		RO
160F, 1	SubIndex 001	UINT32	0x700F0040		RO
1610	ReceivePDO16 Mapping Parameter	Array			
1610, 0	Number of Entries	UINT8	1		RO
1610, 1	SubIndex 001	UINT32	0x70100040		RO
1611	ReceivePDO17 Mapping Parameter	Array			
1611, 0	Number of Entries	UINT8	1		RO
1611, 1	SubIndex 001	UINT32	0x70110040		RO
1612	ReceivePDO18 Mapping Parameter	Array			
1612, 0	Number of Entries	UINT8	1		RO
1612, 1	SubIndex 001	UINT32	0x70120040		RO
1613	ReceivePDO19 Mapping Parameter	Array			
1613, 0	Number of Entries	UINT8	1		RO
1613, 1	SubIndex 001	UINT32	0x70130040		RO
1A00	Receive PDO0 Mapping Parameter	Array			
1A00, 0	Number of Entries	UINT8	13		RO
1A00, 1	SubIndex 001	UINT32	0x66000010		RO
1A00, 2	Subindex 002h	UINT32	0x66010010		RO
1A00, 3	Subindex 003h	UINT32	0x66020010		RO
1A00, 4	Subindex 004h	UINT32	0x65010101		RO
1A00, 5	Subindex 005h	UINT32	0x65010201		RO
1A00, 6	Subindex 006h	UINT32	0x65010301		RO
1A00, 7	Subindex 007h	UINT32	0x65010401		RO
1A00, 8	SubIndex 008	UINT32	0x65010501		RO
1A00, 9	SubIndex 009	UINT32	0x65010601		RO

Index	Name	Type	Default	Min Max	Access
1A00, 10	SubIndex 010	UINT32	0x65010701		RO
1A00, 11	SubIndex 011	UINT32	0x00000006		RO
1A00, 12	SubIndex 012	UINT32	0x65010E01		RO
1A00, 13	SubIndex 013	UINT32	0x00000002		RO
1A01	Receive PDO1 Mapping Parameter	Array			
1A01, 0	Number of Entries	UINT8	1		RO
1A01, 1	SubIndex 001	UINT32	0x75010040		RO
1A02	Receive PDO2 Mapping Parameter	Array			
1A02, 0	Number of Entries	UINT8	1		RO
1A02,1	SubIndex 001	UINT32	0x75020040		RO
1A03	Receive PDO3 Mapping Parameter	Array			
01A03	Number of Entries	UINT8	1		RO
1A03, 1	SubIndex 001	UINT32	0x75030040		RO
1A04	Receive PDO4 Mapping Parameter	Array			
1A04, 0	Number of Entries	UINT8	1		RO
1A04, 1	SubIndex 001	UINT32	0x75040040		RO
1A05	Receive PDO5 Mapping Parameter	Array			
1A05, 0	Number of Entries	UINT8	1		RO
1A05, 1	SubIndex 001	UINT32	0x75050040		RO
1A06	Receive PDO6 Mapping Parameter	Array			
1A06, 0	Number of Entries	UINT8	1		RO
1A06, 1	SubIndex 001	UINT32	0x75060040		RO
1A07	Receive PDO7 Mapping Parameter	Array			
1A07, 0	Number of Entries	UINT8	1		RO
1A07, 1	SubIndex 001	UINT32	0x75070040		RO
1A08	Receive PDO8 Mapping Parameter	Array			
1A08, 0	Number of Entries	UINT8	1		RO
1A08, 1	SubIndex 001	UINT32	0x75080040		RO
1A09	Receive PDO9 Mapping Parameter	Array			
1A09, 0	Number of Entries	UINT8	1		RO
1A09, 1	SubIndex 001	UINT32	0x75090040		RO
1A0A	Receive PDO10 Mapping Parameter	Array			
1A0A, 0	Number of Entries	UINT8	1		RO
1A0A, 1	SubIndex 001	UINT32	0x750A0040		RO
1A0B	Receive PDO11 Mapping Parameter	Array			
1A0B, 0	Number of Entries	UINT8	1		RO
1A0B, 1	SubIndex 001	UINT32	0x750B0040		RO

Index	Name	Type	Default	Min Max	Access
1A0C	Receive PDO12 Mapping Parameter	Array			
1A0C, 0	Number of Entries	UINT8	1		RO
1A0C, 1	SubIndex 001	UINT32	0x750C0040		RO
1A0D	Receive PDO13 Mapping Parameter	Array			
1A0D, 0	Number of Entries	UINT8	1		RO
1A0D, 1	SubIndex 001	UINT32	0x750D0040		RO
1A0E	Receive PDO14 Mapping Parameter	Array			
1A0E, 0	Number of Entries	UINT8	1		RO
1A0E, 1	SubIndex 001	UINT32	0x750E0040		RO
1A0F	Receive PDO15 Mapping Parameter	Array			
1A0F, 0	Number of Entries	UINT8	1		RO
1A0F, 1	SubIndex 001	UINT32	0x750F0040		RO
1A10	Receive PDO16 Mapping Parameter	Array			
1A10, 0	Number of Entries	UINT8	1		RO
1A10, 1	SubIndex 001	UINT32	0x75100040		RO
1A11	Receive PDO17 Mapping Parameter	Array			
1A11, 0	Number of Entries	UINT8	1		RO
1A11, 1	SubIndex 001	UINT32	0x75110040		RO
1A12	Receive PDO18 Mapping Parameter	Array			
1A12, 0	Number of Entries	UINT8	1		RO
1A12, 1	SubIndex 001	UINT32	0x75120040		RO
1A13	Receive PDO19 Mapping Parameter	Array			
1A13, 0	Number of Entries	UINT8	1		RO
1A13, 1	SubIndex 001	UINT32	0x75130040		RO
1C00	Sync Manager Type	Array			
1C00, 0	Number of Entries	UINT8	4		RO
1C00, 1	SubIndex 001	UINT8	1		RO
1C00, 2	Subindex 002h	UINT8	2		RO
1C00, 3	Subindex 003h	UINT8	3		RO
1C00, 4	Subindex 004h	UINT8	4		RO
1C12	RxPDO assign	Array			
1C12, 0	Number of Entries	UINT8	20		RW
1C12, 1	SubIndex 001	UINT16	0x1600		RW
1C12, 2	Subindex 002h	UINT16	0x1601		RW
1C12, 3	Subindex 003h	UINT16	0x1602		RW
1C12, 4	Subindex 004h	UINT16	0x1603		RW
1C12, 5	Subindex 005h	UINT16	0x1604		RW
1C12, 6	Subindex 006h	UINT16	0x1605		RW
1C12, 7	Subindex 007h	UINT16	0x1606		RW
1C12, 8	SubIndex 008	UINT16	0x1607		RW

Index	Name	Type	Default	Min Max	Access
1C12, 9	SubIndex 009	UINT16	0x1608		RW
1C12, 10	SubIndex 010	UINT16	0x1609		RW
1C12, 11	SubIndex 011	UINT16	0x160A		RW
1C12, 12	SubIndex 012	UINT16	0x160B		RW
1C12, 13	SubIndex 013	UINT16	0x160C		RW
1C12, 14	SubIndex 014	UINT16	0x160D		RW
1C12, 15	SubIndex 015	UINT16	0x160E		RW
1C12, 16	SubIndex 016	UINT16	0x160F		RW
1C12, 17	SubIndex 017	UINT16	0x1610		RW
1C12, 18	SubIndex 018	UINT16	0x1611		RW
1C12, 19	SubIndex 019	UINT16	0x1612		RW
1C12, 20	SubIndex 020	UINT16	0x1613		RW
1C13	TxPDO assign	Array			
1C13, 0	Number of Entries	UINT8	20		RO
1C13, 1	SubIndex 001	UINT16	0x1A00		RO
1C13, 2	Subindex 002h	UINT16	0x1A01		RO
1C13, 3	Subindex 003h	UINT16	0x1A02		RO
1C13, 4	Subindex 004h	UINT16	0x1A03		RO
1C13, 5	Subindex 005h	UINT16	0x1A04		RO
1C13, 6	Subindex 006h	UINT16	0x1A05		RO
1C13, 7	Subindex 007h	UINT16	0x1A06		RO
1C13, 8	SubIndex 008	UINT16	0x1A07		RO
1C13, 9	SubIndex 009	UINT16	0x1A08		RO
1C13, 10	SubIndex 010	UINT16	0x1A09		RO
1C13, 11	SubIndex 011	UINT16	0x1A0A		RO
1C13, 12	SubIndex 012	UINT16	0x1A0B		RO
1C13, 13	SubIndex 013	UINT16	0x1A0C		RO
1C13, 14	SubIndex 014	UINT16	0x1A0D		RO
1C13, 15	SubIndex 015	UINT16	0x1A0E		RO
1C13, 16	SubIndex 016	UINT16	0x1A0F		RO
1C13, 17	SubIndex 017	UINT16	0x1A10		RO
1C13, 18	SubIndex 018	UINT16	0x1A11		RO
1C13, 19	SubIndex 019	UINT16	0x1A12		RO
1C13, 20	SubIndex 020	UINT16	0x1A13		RO
1C32	SM Output Parameter	RECORD			
1C32, 0	Number of Entries	UINT8	32		RO
1C32, 1	Synchronisation Type	UINT16	0x0001		RW
1C32, 2	Cycle Time	UINT32			RO
1C32, 4	Synchronisation Types supported	UINT16	0x8007		RO
1C32, 5	Cycle Time	UINT32			RO
1C32, 6	Calc and Copy Time	UINT32			RO
1C32, 8	Cycle Time	UINT16			RW
1C32, 9	Delay Time	UINT32			RO
1C32, 10	Sync0 Cycle Time	UINT32			RW
1C32, 11	SM-Event Missed	UINT16			RO

Index	Name	Type	Default	Min Max	Access
1C32, 12	Cycle Time too small	UINT16			RO
1C32, 32	Sync Error	BOOL			RO
1C33	SM Input Parameter	RECORD			
1C33, 0	Number of Entries	UINT8	32		RO
1C33, 1	Synchronisation Type	UINT16	0x0022		RW
1C33, 2	Cycle Time	UINT32			RO
1C33, 4	Synchronisation Types supported	UINT16	0x8007		RO
1C33, 5	Cycle Time	UINT32			RO
1C33, 6	Calc and Copy Time	UINT32			RO
1C33, 8	Cycle Time	UINT16			RW
1C33, 9	Delay Time	UINT32			RO
1C33, 10	Sync0 Cycle Time	UINT32			RW
1C33, 11	SM-Event Missed	UINT16			RO
1C33, 12	Cycle Time too small	UINT16			RO
1C33, 32	Sync Error	BOOL			RO
2000	CAN Baud Rate	UINT32	500	100 125 250 500 1000	RW
2010	DataSync	UINT8	NoSync	NoSync (0) RxSync (1)	RW
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	EtherCAT Error	BOOL			RO P
6500, 3	CanTxQueueOvr	BOOL			RO P
6500, 4	CanRxQueueOvr	BOOL			RO P
6500, 5	TxCounterMiss	BOOL			RO P
6500, 6	CanWarning	BOOL			RO P
6500, 7	CanBusOff	BOOL			RO P
6500, 8	unused0	BOOL			RO P
6500, 9	unused1	BOOL			RO P
6500, 10	unused2	BOOL			RO P
6500, 11	unused3	BOOL			RO P
6500, 12	unused4	BOOL			RO P
6500, 13	unused5	BOOL			RO P
6500, 14	CanTxBusy	BOOL			RO P
6500, 15	unused6	BOOL			RO P
6500, 16	unused7	BOOL			RO P
6600	TxCounterCon	UINT16		0..65535	RO P
6601	RxCounter	UINT16		0..65535	RO P
6602	RxNrOfMsg	UINT16		0..9	RO P
7000	TxData0	UINT64	0		RW P
7001	TxData1	UINT64	0		RW P

Index	Name	Type	Default	Min Max	Access
7002	TxData2	UINT64	0		RW P
7003	TxData3	UINT64	0		RW P
7004	TxData4	UINT64	0		RW P
7005	TxData5	UINT64	0		RW P
7006	TxData6	UINT64	0		RW P
7007	TxData7	UINT64	0		RW P
7008	TxData8	UINT64	0		RW P
7009	TxData9	UINT64	0		RW P
700A	TxData10	UINT64	0		RW P
700B	TxData11	UINT64	0		RW P
700C	TxData12	UINT64	0		RW P
[700D]	TxData13	UINT64	0		RW P
700E	TxData14	UINT64	0		RW P
F) 700.	TxData15	UINT64	0		RW P
7010	TxData16	UINT64	0		RW P
7011	TxData17	UINT64	0		RW P
7012	TxData18	UINT64	0		RW P
7013	TxData19	UINT64	0		RW P
7100	TxCounter	UINT16		0..65535	RW P
7101	RxCounterCon	UINT16		0..65535	RW P
7102	TxNrOfMsg	UINT16		0..9	RW P
7110	ControlWord	Array			
7110, 0	Number of Entries	UINT8	16		RO
7110, 1	ResetError	BOOL			RW P
7110, 2	unused0	BOOL			RW P
7110, 3	unused1	BOOL			RW P
7110, 4	unused2	BOOL			RW P
7110, 5	unused3	BOOL			RW P
7110, 6	unused4	BOOL			RW P
7110, 7	unused5	BOOL			RW P
7110, 8	unused6	BOOL			RW P
7110, 9	unused7	BOOL			RW P
7110, 10	unused8	BOOL			RW P
7110, 11	unused9	BOOL			RW P
7110, 12	unused10	BOOL			RW P
7110, 13	unused11	BOOL			RW P
7110, 14	unused12	BOOL			RW P
7110, 15	unused13	BOOL			RW P
7110, 16	unused14	BOOL			RW P
7500	RxData0	UINT64			RO P
7501	RxData1	UINT64			RO P
7502	RxData2	UINT64			RO P
7503	RxData3	UINT64			RO P
7504	RxData4	UINT64			RO P
7505	RxData5	UINT64			RO P
7506	RxData6	UINT64			RO P

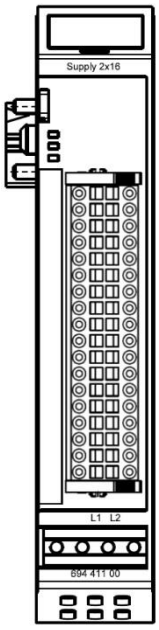
Index	Name	Type	Default	Min Max	Access
7507	RxData7	UINT64			RO P
7508	RxData8	UINT64			RO P
7509	RxData9	UINT64			RO P
750A	RxData10	UINT64			RO P
750B	RxData11	UINT64			RO P
[750C]	RxData12	UINT64			RO P
[750D]	RxData13	UINT64			RO P
750E	RxData14	UINT64			RO P
F) 750.	RxData15	UINT64			RO P
7510	RxData16	UINT64			RO P
7511	RxData17	UINT64			RO P
7512	RxData18	UINT64			RO P
7513	RxData19	UINT64			RO P

Technical Data

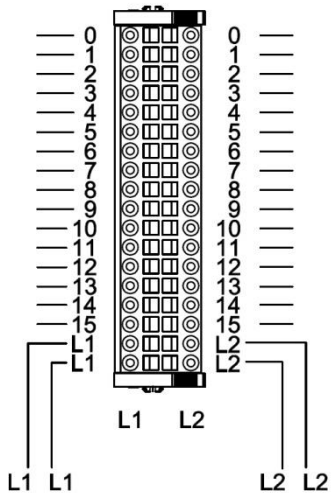
CAN Master/Slave ..... Electrically insulated
Baud rate ..... 100,125, 250, 500 and 1000 kbit/s
Payload data..... 9 frames of max. 8 bytes In/Out per EtherCAT cycle
IO connection..... 18-pin, male
Controller ..... ASIC ET1200
E-bus connector ..... 10-pole system plug in side wall
Terminating module..... not required
Power supply ..... Via E-bus
E-bus load..... Max. 330 mA
Part no. 694 455 06
Approval.....

6 Accessories

6.1 Power Distributor 2 x 16



Front view of power distributor



Power connectors

Terminals

The power distribution module 2 x 16 has two separate power lines.

It picks up the potential fed to connections L1 and L2 (0 VDC or 24 VDC, to the operator's discretion) and distributes its among the connections 0 to 15 along the same line.

The E-bus is fed through from the upstream to the downstream module.

Status LEDs

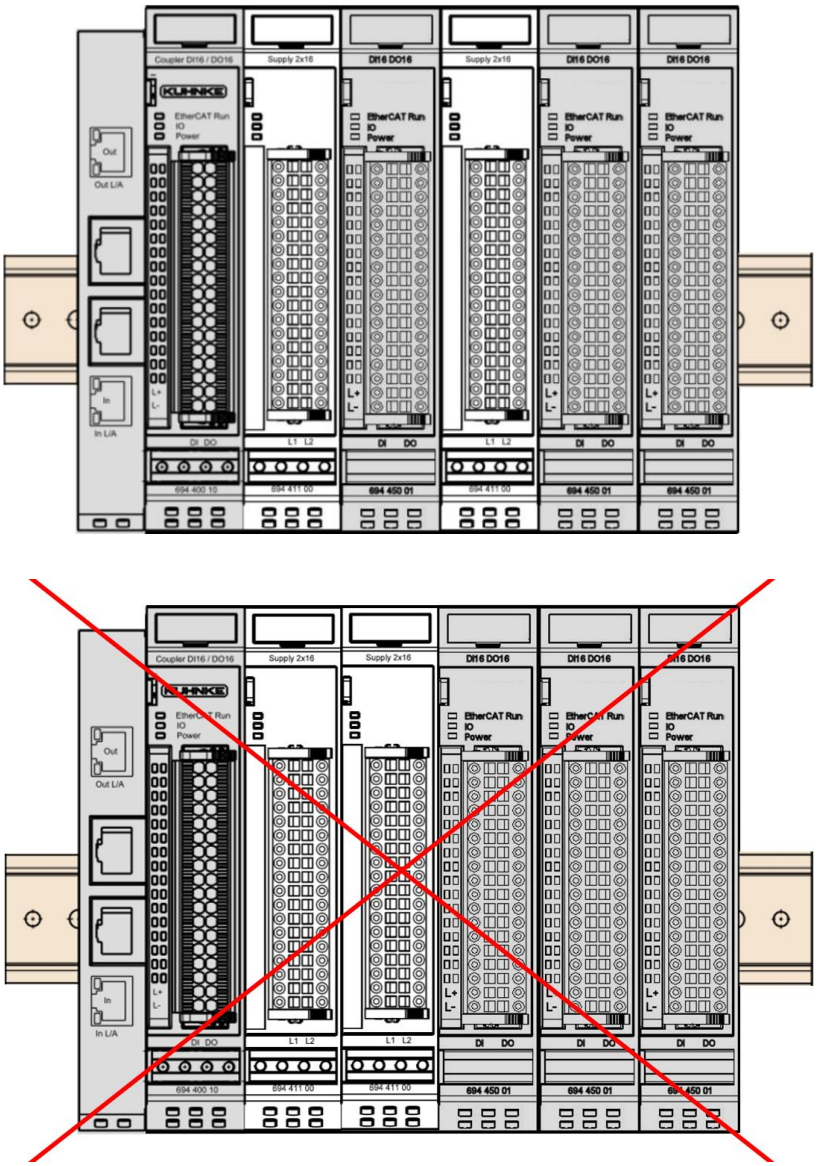
None.

Function

2-wire or 3-wire connection of digital IO modules.

Mounting

When mounting, you should make sure that you do not mount several potential distributors next to each other to prevent possible EMC problems. Please note the following connection example:



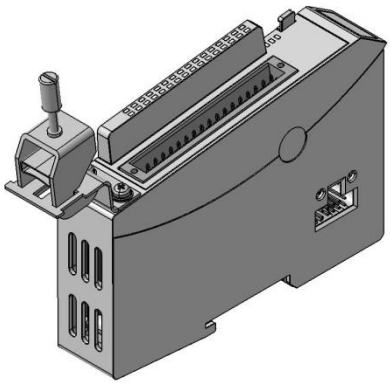
Technical Data

Power Distributor 2 x 16

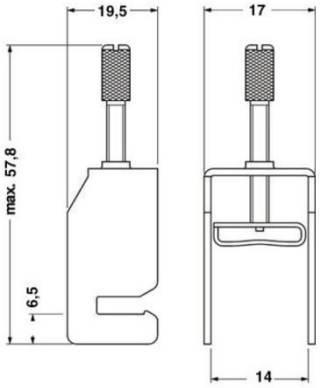
Power connection ..... 36-pin male
E-bus connector ..... 10-pole system plug in side wall
E-bus load..... none
Part no. 694.411.00

Approval:.....

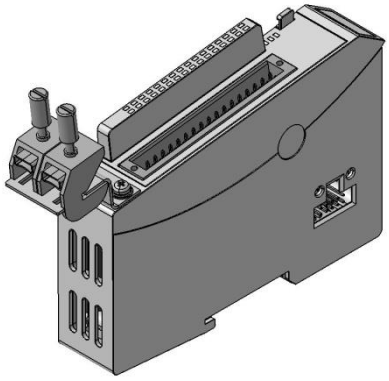
6.2 Shield Terminal



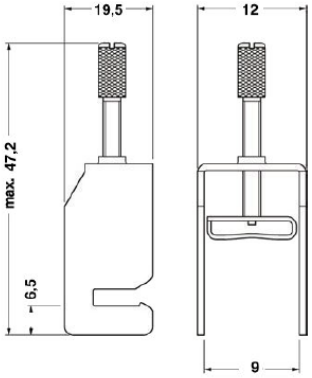
Shield terminal 1x14mm



Dimensions

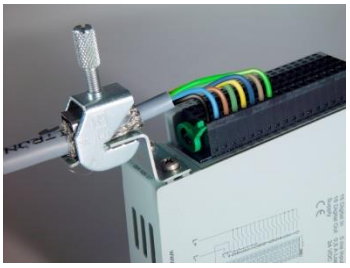


Shield terminal 2x8mm



Dimensions

Terminals



The shield terminal assembly consists of the actual shield terminal, the terminal bracket, tweo M3x5 screws, 2 washers, and 2 spring washers.

Use the 2 screws, washers and spring washers to mount the terminal bracket on the housing mount of the Kuhnke FIO module.

Screw the screws into the 2 holes tapped into the bottom of the front side.

Function

The shield terminal makes it easier for you to connect the cable shield. The terminal deflects the cable shield power to the DIN rails that the Kuhnke FIO module is snapped on to.

	NOTE
	Verify that the DIN rail is properly earthed.

	NOTE
	Do not use the shield terminals as a strain relief.

Technical Data

Shield Terminal 2x8mm

Shield terminals, 8mm. ..... 2 pcs:
Part no. 694.412.01

Shield Terminal 14mm

Shield terminals, 14mm. ..... 1 pcs:
Part no. 694.412.02

7 Configuration

The EtherCAT master needs to be configured to drive the EtherCAT network.

One major part of the configuration is to specify the EtherCAT slave stations.

There are two ways of documenting the properties of an EtherCAT slave.

1. The basic properties are stored in an EEPROM of the slave, whereas a XML device file (ESI file) describes the others.
2. All of the properties are stored in an EEPROM of the slave. (This method is not supported by every OEM supplier.)

The XML device files provide EtherCAT administrators with convenient options.

EtherCAT allows both, a configuration offline and the scanning of station data via an Ethernet line (online configuration).

The examples below are based around the standard ETG configuration tool (EtherCAT configuration tool supplied by Beckhoff Automation GmbH) which accesses the XML device files for both offline and online configuration.

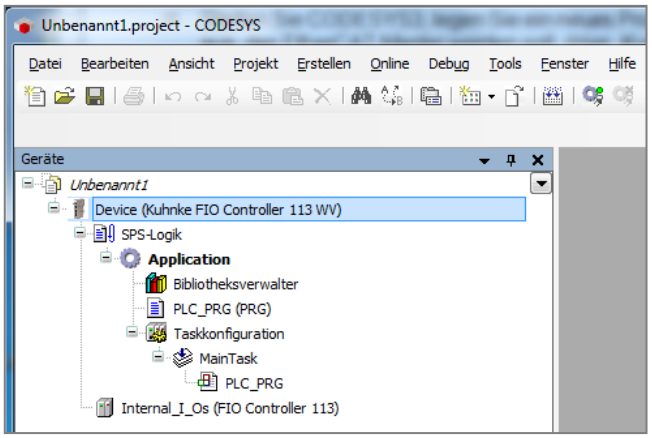
The file to use for Kuhnke FIO is called "KuhnkeEtherCATModulesAll.xml".

Copy file "KuhnkeEtherCATModulesAll.xml" to folder C:\Programs\EtherCAT Configurator\EtherCAT or, if you are using another tool, to the folder set for that tool.

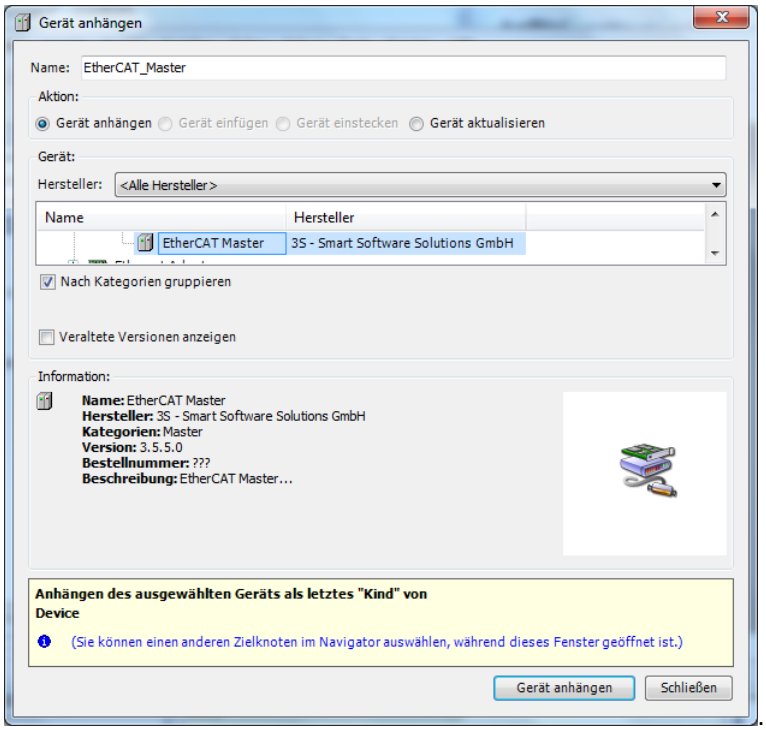
7.1 CODESYS V3 (CODESYS Configurator)

Offline Configuration

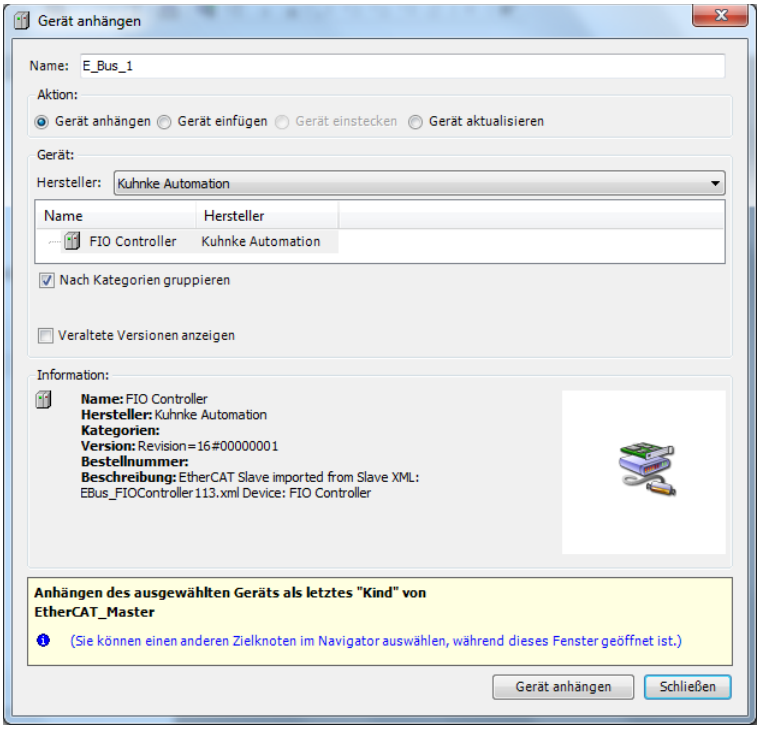
- Run CODESYS3, create a new project (default project), and select the device to become the EtherCAT master (here: "Kuhnke FIO Controller 113 WV").



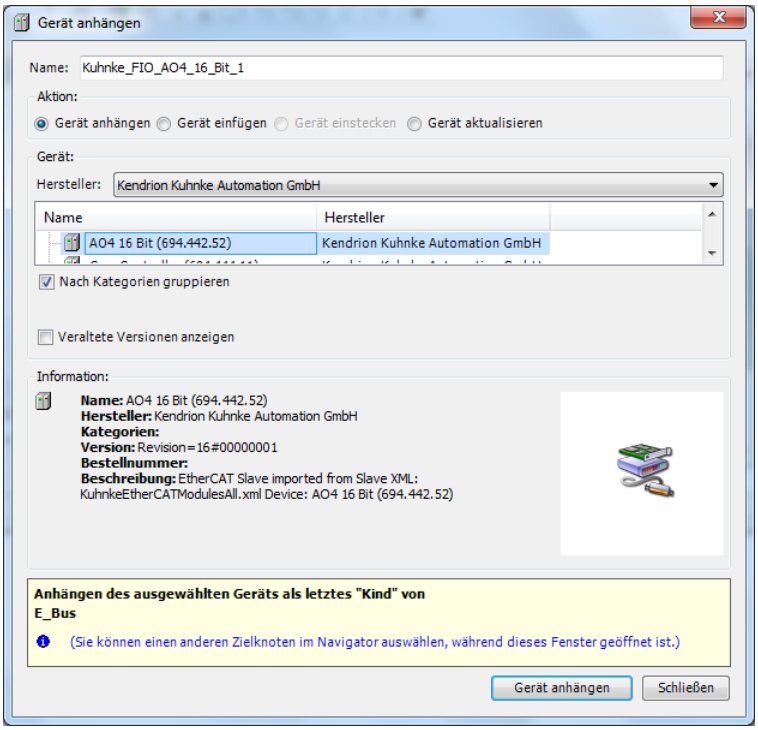
- Highlight the device and pick the 3S "EtherCAT Master" from the right-click menu.



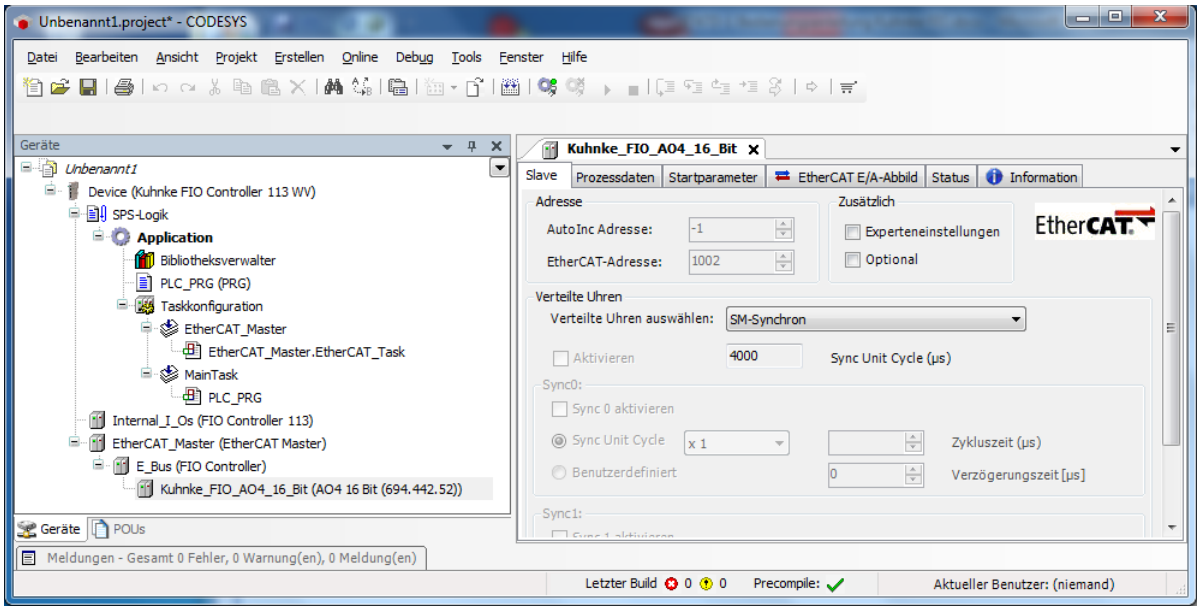
- Go down the list of devices, pick "EtherCAT_Master (EtherCAT Master)", and add Kuhnke Automation's "FIO Controller".



- Go down the list of devices, pick "E-Bus (FIO Controller)", and add Kendrion Kuhnke Automation's "AO4 16Bit".



- Now highlight "Kuhnke_FIO_AO4_16Bit" in the list of devices and make the appropriate settings on the right-hand side (see section "AO4 16Bit").



- Keep repeating the last two steps until your configuration is complete.

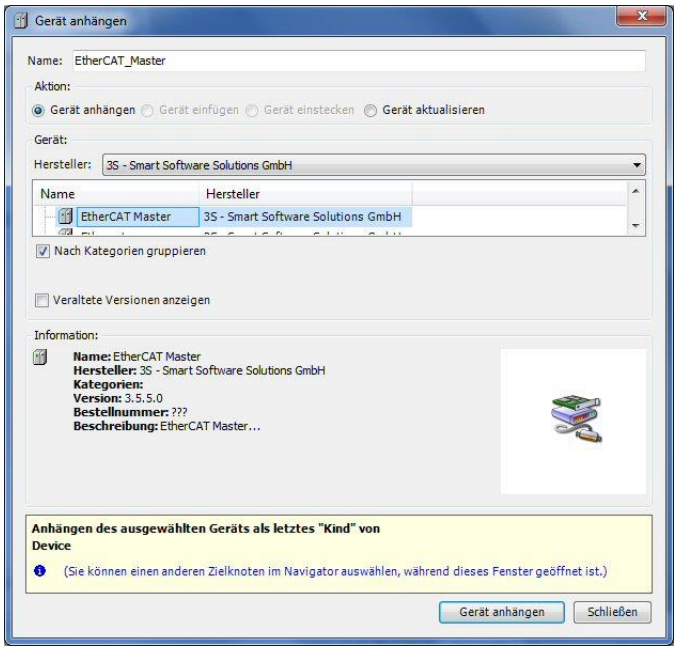
If the configuration is complete and all devices are connected to the programming PC, you can log in and run the configuration tool to test your Kuhnke FIO modules.

⚠	***DANGER***
	Set outputs only if you are sure that this will cause no harm.

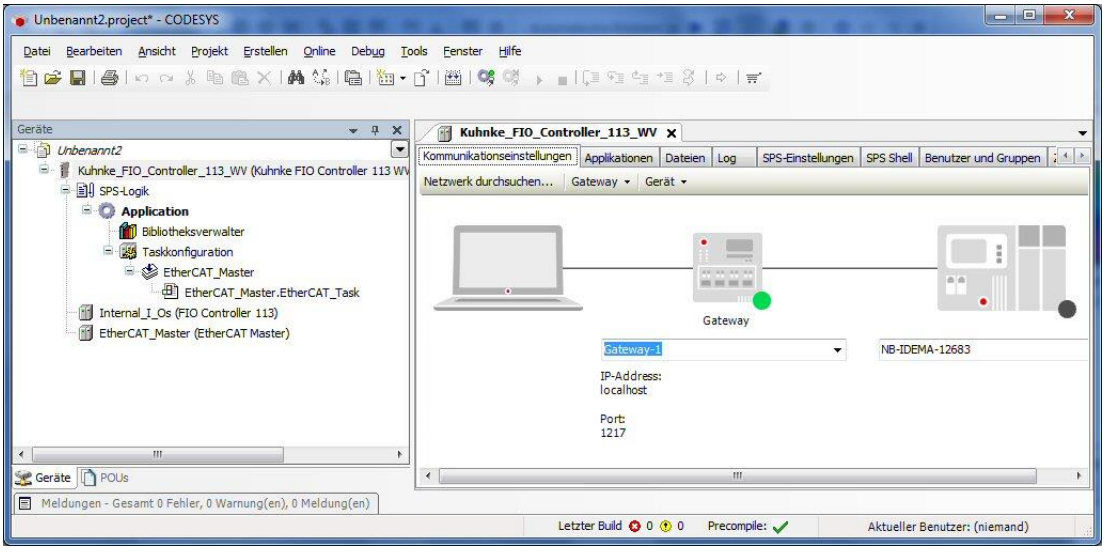
Online Configuration

EtherCAT allows you to scan the stations connected to an Ethernet line. The example below illustrates how to identify the actual configuration of an I/O unit consisting of a Kuhnke Controller 113, a Kuhnke FIO AI8-I module, and a Kuhnke FIO AI8-Pt/Ni/Tc module.

- Connect Kuhnke Controller 113 to the Kuhnke FIO AI8-I module and the Kuhnke FIO AI8-Pt/Ni/Tc module and turn on the power supply.
- Use a CAT5 cable to connect your PC's Ethernet port to your CoDeSys3 controm unit (Kuhnke Controller 113) (both a patch cable and a crossover cable will work).
- Run CoDeSys V3.
- Open a project for your CoDeSys3 control unit (Kuhnke Controller 113).
- Select "Device (…..Kuhnke FIO Controller 113)" and pick "Gerät anhängen" (add device).

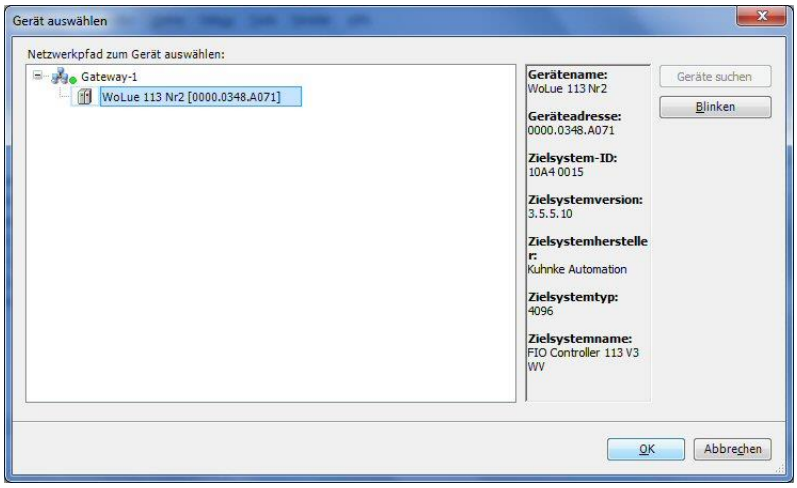


- Configure an EtherCAT master by adding an "EtherCAT Master" supplied by 3S-Smart Software Solutions GmbH to your device.

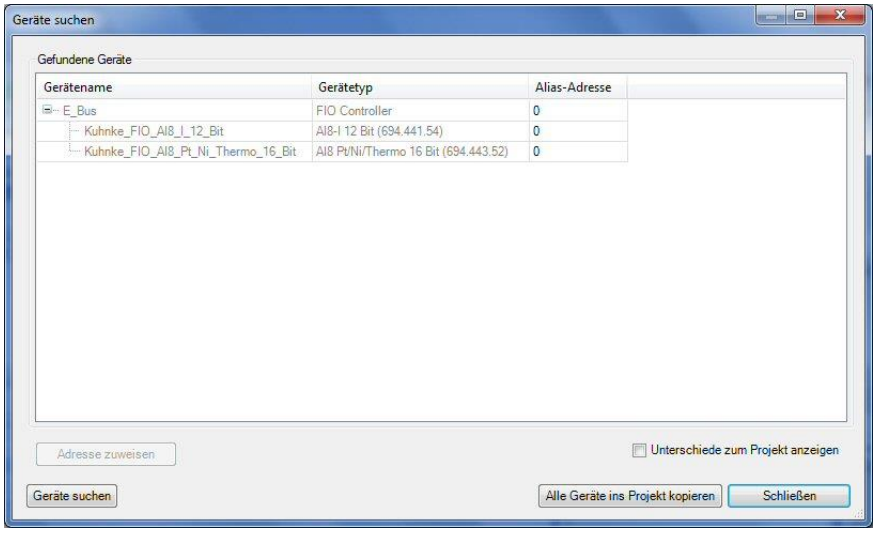


- Select "Device (…..Kuhnke FIO Controller 113)" and choose "Netzwerk durchsuchen" (search network).

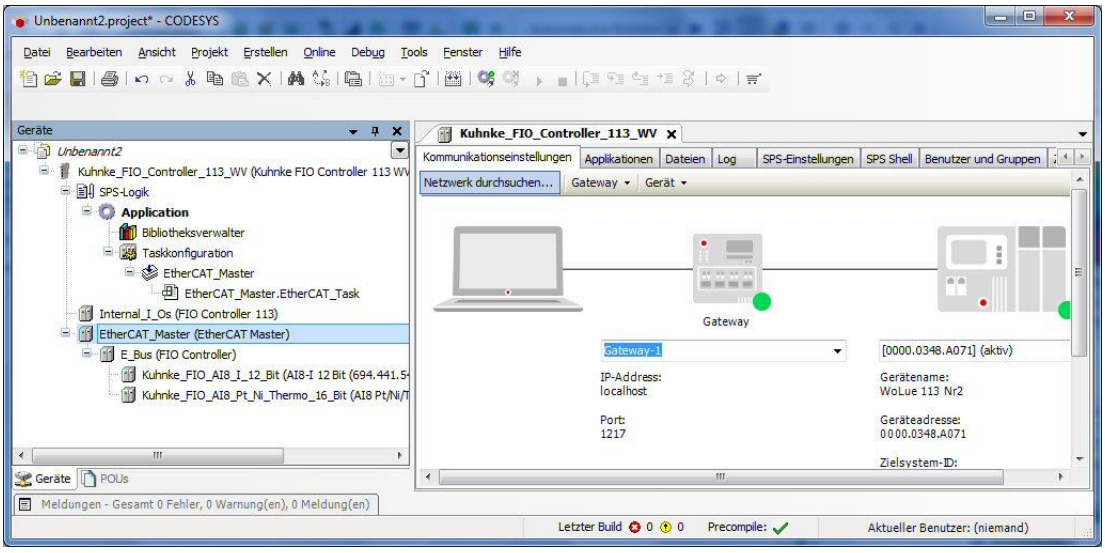
The software now scans the Ethernet network and finds the CoDeSys3 control unit connected to it.



- Now select "EtherCAT_Master" and choose "Netzwerk durchsuchen" (search network). CoDeSys scans your EtherCAT configuration.



- Click on "Alle Geräte ins Projekt kopieren" (copy all devices to the project).
  You have added your actual EtherCAT configuration to your project.



- Test the EtherCAT IOs.

⚠	***DANGER***
	Set outputs only if you are sure that this will cause no harm.

8 Appendix

8.1 Technical Data (Summarised)

System Properties of Kuhnke FIO

Fieldbus	EtherCAT 100 Mbit/s
Dimensions	25mm x 120mm x 90mm (W x H x D)
Housing mount	aluminium
Shield	connects directly to the module housing
Installation	35mm DIN rail
IO connection	spring-assisted combi plug with mechanical ejector, 4 … 36-pin
Signal indication	LED, local assignment to terminal
Diagnostics	LED: bus state, module state, broken wire/excessive current
Numer of connectors	up to 32 digital I/Os and 8 analogue channels per module
Supply voltage	24 VDC -20% / +25%
Overvoltage category	Overvoltage category 2
Numer of I/O modules	20 per bus coupler (total max. power consumption: 3A)
Electrical insulation	modules electrically insulated from one another and from the bus
Length of analogue signal lines	< 30m
Storage temperature	-25 …+ 70 [°C]
Working temperature	0…+ 55 [°C]
Rel. humidity	5...95 [%], non-condensing
Protection	IP20
Immunity to noise	Zone B to EN 61131-2, mounted on earthed DIN rail in earthed control cubicle
Permitted operating environment	Operation only permitted in an environment that at least complies with degree of protection IP54 according to IEC 60529 (eg suitable control cabinet)

Bus Coupler

Kuhnke FIO bus coupler

Part no.	694.400.00
Fieldbus	EtherCAT 100 Mbit/s 100 Base TX to IEEE802.3
Connection	2x RJ45
Controller	ASIC ET1100
Extension	connection to first Kuhnke FIO I/O module integrated in side panel of module
Diagnostics	LED: EtherCAT module state EtherCAT In/Out state

Kuhnke FIO Bus Coupler DI16/DO16

Part no.	694.400.10
Fieldbus	EtherCAT 100 Mbit/s 100 Base TX to IEEE802.3
Connection	2x RJ45
Controller	ASIC ET1100

Extension	connection to first Kuhnke FIO I/O module integrated in side panel of module
Diagnostics	LED: EtherCAT module state, EtherCAT In/Out state I/O state (summarised) state of every I/O
Digital inputs	16, 3 ms delay
Digital outputs	16, load: 0.5 A, high-side semiconductor

Kuhnke FIO Bus Coupler DI8 DO8

Part no.	694.400.08
Fieldbus	EtherCAT 100 Mbit/s 100 Base TX to IEEE802.3
Connection	2x RJ45
Controller	ASIC ET1100
Extension	connection to first Kuhnke FIO I/O module integrated in side panel of module
Diagnostics	LED: EtherCAT module state, EtherCAT In/Out state I/O state (summarised) state of every I/O
Digital inputs	8, 3 ms delay
Digital outputs	8, load: 0.5 A, high-side semiconductor

Kuhnke FIO Bus Coupler DI8 DO4

Part no.	694.400.04
Fieldbus	EtherCAT 100 Mbit/s 100 Base TX to IEEE802.3
Connection	2x RJ45
Controller	ASIC ET1100
Extension	connection to first Kuhnke FIO I/O module integrated in side panel of module
Diagnostics	LED: EtherCAT module state, EtherCAT In/Out state I/O state (summarised) state of every I/O
Digital inputs	8, 3 ms delay
Digital outputs	4, load: 0.5 A, high-side semiconductor

Kuhnke FIO I/O Modules (General)

Fieldbus	EtherCAT 100 Mbit/s LVDS: E-bus
Controller	ASIC ET1200 or ET1100
Extension	connection to adjacent Kuhnke FIO I/O modules integrated in side panels of module
Diagnostics	LED: EtherCAT state I/O states (summarised) *, IO power supply state * state of every I/O (* if available)

Extender

Kuhnke FIO Extender 2 Port

Part no. 694.400.02
Ports 2x RJ45

Controller

Kuhnke FIO Controller 113

http://productfinder.kuhnke.kendrion.com

Kuhnke FIO Controller 116

http://productfinder.kuhnke.kendrion.com

Digital FIO Modules

Kuhnke FIO DI16/DO16 1ms/0.5A

Part no. 694.450.03
Digital inputs ..... 16, 1 ms delay
Digital outputs ..... 16, load: 0.5 A, high-side semiconductor

Kuhnke FIO DI16/DO16 5ms/0.5A

Part no. 694.450.01
Digital inputs ..... 16, 5 ms delay
Digital outputs ..... 16, load: 0.5 A, high-side semiconductor

Kuhnke FIO DI16/DO16 1ms/0.5A LS

Part no. 694.450.13
Digital inputs ..... 16, 1 ms delay, low/side
Digital outputs ..... 16, load: 0.5 A, low-side semiconductor

Kuhnke FIO DI16/DO8 1ms/1A

Part no. 694.450.02
Digital inputs ..... 16, 1 ms delay
Digital outputs ..... 8, load: 1 A, high-side semiconductor

Kuhnke FIO DI8/DO8 1ms/0.5A

Part no. 694.450.05
Digital inputs ..... 8, 1 ms delay
Digital outputs ..... 8, load: 0,5 A, high-side semiconductor

Kuhnke FIO DI8/DO8 5ms/0.5A

Part no. 694.450.04
Digital inputs ..... 8, 5 ms delay
Digital outputs ..... 8, load: 0,5 A, high-side semiconductor

Kuhnke FIO DI16 1ms

Part no. 694.451.03
Digital inputs ..... 16, 1 ms delay

Kuhnke FIO DI16 2-wire

Part no. 694.451.43
Digital inputs ..... 16, 1 ms delay
+16 x 24V each max. 1A

Kuhnke FIO DI32 1ms

Part no. 694.451.02
Digital inputs ..... 32, 1 ms delay

Kuhnke FIO DO8 1A

Part no. 694.452.02
Digital outputs ..... 8, load: 1 A, high-side semiconductor

Kuhnke FIO DO8 2A

Part no. 694.452.06
Digital outputs ..... 8, load: 2 A (∑ max. 10A), high-side semiconductor,

Kuhnke FIO DO16 0.5A

Part no. 694.452.01
Digital outputs ..... 16, load: 0.5 A, high-side semiconductor

Kuhnke FIO DO16 2-wire

Part no. 694.452.41
Digital outputs ..... 16, load: 1 A, high-side semiconductor
+16 Ground connections

Kuhnke FIO DO8 NO Relay 24V

Part no. 694.452.03
Digital outputs ..... 8, load: 5A (resistive) / 2A (inductive), n.o. relay
Swiching voltage ..... max. 24 VDC / VAC

Kuhnke FIO DO8 NO Relay 230 VAC

Part no. 694.452.04
Digital outputs ..... 8, load: 5A (resistive) / 2A (inductive), n.o. relay
Swiching voltage ..... max. 24 VDC/ 230 VAC

Analogue FIO Modules

Kuhnke FIO AI4, 12 Bit / AO4, 16Bit

Part no. 694.444.65
Analogue Inputs 4
Resolution ..... 12 Bit
Output signal ..... 0..10V, (0→10V: ≤22µs at 2kΩ/<200pF)
0..20mA, 4..20mA, (0→16V: ≤25µs at 300Ω/<1mH)

Output frequency ..... DC-synchron, SM-synchron
Analogue outputs 4
Resolution ..... 16 Bit
Output signal ..... 0..10V, +/- 10V, (0→10V: ≤22µs at 2kΩ/<200pF)
0..20mA, 4..20mA, 0..24mA, (0→16V: ≤25µs at 300Ω/<1mH)
Output frequency ..... DC-synchron, SM-synchron

Kuhnke FIO AO4, 16-Bit

Part no. 694.442.52
Analogue outputs 4
Resolution ..... 16 bit
Output signal ..... 0..10V, +/- 10V, (at loads > 1kΩ, <1µF)
0..20mA, 4..20mA, 0..24mA, (at loads < 500Ω, <1mH)
(channels configure separately),
Output frequency ..... synchronised with DC / SM

Kuhnke FIO AO4, 12-Bit

Part no. 694.442.02
Analogue outputs 4
Resolution ..... 12 bit
Output signal ..... 0..10V, +/- 10V, (at loads > 1kΩ, <1µF)
0..20mA, 4..20mA, 0..24mA, (at loads < 500Ω, <1mH)
(configurable),
Output frequency ..... 220 µs (constant)

Kuhnke FIO AI4/8-U 13-Bit

Part no. 694.441.52
Analogue inputs ..... 4x differential signal or 8x single-ended
Resolution ..... 13 bit
Measuring range ..... 0...10V, +/- 10V, +/- 5V, +/- 2.5V
Conversion time ..... 464 µs (all channels)

Kuhnke FIO AI8/16-U 13-Bit

Part no. 694.441.53
Analogue inputs ..... 8x differential signal or 16x single-ended
Resolution ..... 13 bit
Measuring range ..... 0...10V, +/- 10V, +/- 5V, +/- 2.5V
Conversion time ..... 580 µs (all channels)

Kuhnke FIO AI4-I 12-Bit

Part no. 694.441.51
Analogue inputs 4
Resolution ..... 12 bit
Measuring range ..... 0 …20mA, 4…20mA
Conversion time ..... 235 µs (4 channels)

Kuhnke FIO AI8-I 12-Bit

Part no. 694.441.54

Analogue inputs 8
Resolution ..... 12 bit
Measuring range ..... 0 …20mA, 4…20mA
Conversion time ..... 290 µs (8 channels)

Kuhnke FIO AI4-Pt/Ni/TC 16-Bit

Part no. 694.443.51
Analogue inputs 4
Resolution ..... 16 bit
Measuring range ..... mV, Pt100, Pt1000, Ni100, Ni1000DIN43760, thermalcouple types K, J
Conversion time ..... 50 ms (adjustable)

Kuhnke FIO AI8-Pt/Ni/TC 16-Bit

Part no. 694.443.52
Analogue inputs 8
Resolution ..... 16 bit
Measuring range ..... mV, Pt100, Pt1000, Ni100, Ni1000DIN43760, thermalcouple types K, J
Conversion time ..... 50 ms (adjustable)

Mixed I/O Modules

Kuhnke FIO MIX 02

Part no. 694.444.62
Digital inputs ..... 4x 1ms, 1x 0.1ms, 3x 0.001 ms delay
Digital outputs 8x 0.5A, 16x 0.1A
Counters ..... 1 (clock, direction, reset)
Counting frequency ..... 500 kHz (up to 1 MHz)
Analogue inputs ..... 4x 0..+10 V, 12 bit
RS485 ..... 2.4..921.6 kBit/s, electrically insulated

Counter / Posi / Drive / CAM Modules

Counter2 5V

Part no. 694.444.01
Encoder inputs 2
Counting frequency ..... max. 200 kHz
Digital inputs ..... 8, 1 ms delay
Digital outputs ..... 2, load: 2.0 A, high-side semiconductor

Kuhnke FIO CounterPosi2 5V

Part no. 694.454.01
Encoder inputs 2
Counting frequency ..... max. 200 kHz
Digital inputs ..... 8, 1 ms delay
Digital outputs ..... 2, load: 2.0 A, high-side semiconductor

Analogue outputs..... 2, -10V..+10 V, 12 bit

Kuhnke FIO Drive Control

http://productfinder.kuhnke.kendrion.com

Kuhnke FIO CAM Control

http://productfinder.kuhnke.kendrion.com

Interface and Communication Modules

Kuhnke FIO RS485 1 Port

Part no. 694.455.02
Serial interface..... RS485, electrically insulated
Baud rate ..... 2400…115200 Bit/s
Payload data..... max. 152 bytes In/Out

Kuhnke FIO RS232 2 Port

Part no. 694.455.04
Serial interface..... 2x RS232, electrically insulated
Baud rate ..... 2400…115200 Bit/s
Payload data..... max. 152 bytes In/Out

Kuhnke FIO CAN Master/Slave

Part no. 694.455.06
Serial interface..... RS485, electrically insulated
Baud rate ..... 100,125, 250, 500 and 1000 kbit/s
Payload data..... 9 frames of max. 8 bytes In/Out per EtherCAT cycle

FIO Safety Modules

Kuhnke FIO Safety PLC

http://productfinder.kuhnke.kendrion.com

Kuhnke FIO Safety SDI4/SDO2

http://productfinder.kuhnke.kendrion.com

8.2 Order Specifications

Kuhnke FIO Modules

Link to the Product Finder	Part no.	ID no.	Power / IO connector
Controller			
Kuhnke FIO Controller 113	694.300.13	178.445	3-pin, 10-pin
Kuhnke FIO Controller 116	694.300.16	187.320	3-pin, 10-pin
Bus coupler / Extender			
Kuhnke FIO Bus Coupler	694.400.00	182.633	2-pin
Kuhnke FIO Bus Coupler DI16 DO16	694.400.10	184.111	36-pin
Kuhnke FIO Bus Coupler DI8 DO8	694.400.08	192.874	18-pin
Kuhnke FIO Bus Coupler DI8 DO4	694.400.04	193.512	18-pin
Kuhnke FIO Extender 2 Port	694.440.02	182.673	none
Digital FIO Modules			
Kuhnke FIO DI16 DO16 1ms/0.5A	694.450.03	182.642	36-pin
Kuhnke FIO DI16 DO16 5ms/0.5A	694.450.01	182.643	36-pin
Kuhnke FIO DI16 DO16 LS 1ms/0.5A	694.450.13	182.641	36-pin
Kuhnke FIO DI16 DO8 1ms/1A	694.450.02	176.617	36-pin
Kuhnke FIO DI8 DO8 5ms/0.5A	694.450.04	182.638	18-pin
Kuhnke FIO DI8 DO8 1ms/0.5A	694.450.05	182.637	18-pin
Kuhnke FIO DI16 1ms	694.451.03	182.639	18-pin
Kuhnke FIO DI16 2-wire	694.451.43	196.425	36-pin
Kuhnke FIO DI32 1ms	694.451.02	182.644	36-pin
Kuhnke FIO DO8 1A	694.452.02	176.618	18-pin
Kuhnke FIO DO8 2A	694.452.06	190.485	18-pin
Kuhnke FIO DO16 0.5A	694.452.01	182.646	18-pin
Kuhnke FIO DO16 2-wire	694.452.41	196.429	36-pin
Kuhnke FIO DO8 Relay NO 24V	694.452.03	184.720	18-pin
Kuhnke FIO DO8 Relay NO 230VAC	694.452.04	187.657	18-pin
Analogue FIO Modules			
Kuhnke FIO AI4, 12 Bit / AO4, 16Bit	694.444.65	192.357	36-pin
Kuhnke FIO AO4, 16-Bit	694.442.52	183.564	18-pin
Kuhnke FIO AO4, 12-Bit	694.442.02	182.632	18-pin
Kuhnke FIO AI4-I 12-Bit CoE	694.441.51	184.919	18-pin
Kuhnke FIO AI8-I 12-Bit CoE	694.441.54	183.279	36-pin
Kuhnke FIO AI4/8-U 13-Bit CoE	694.441.52	184.920	18-pin
Kuhnke FIO AI8/16-U 13-Bit CoE	694.441.53	184.921	36-pin
Kuhnke FIO AI4-Pt/Ni/TC	694.443.01	184.894	18-pin

Link to the Product Finder	Part no.	ID no.	Power / IO connector
Kuhnke FIO AI8-Pt/Ni/TC	694.443.02	184.895	36-pin
Counter / Posi / Drive / CAM Modules			
Counter2 5V	694.444.01	182.634	36-pin
Kuhnke FIO Counter/Posi2 5V	694.454.01	182.636	36-pin
Kuhnke FIO Drive Control Stepper / BLDC	694.454.16	178.789	36-pin
Kuhnke FIO CAM Control	694.444.11	186.682	36-pin
Mixed IO Modules			
Kuhnke FIO MIX 02 CoE	694.444.62	176.215	36-pin
Communication Modules			
Kuhnke FIO RS485 1 Port	694.455.02	187.270	18-pin
Kuhnke FIO RS232 2 Port	694.455.04	185.725	18-pin
Kuhnke FIO CAN Master/Slave	694.455.06	187.272	18-pin
Safety Modules			
Kuhnke FIO Safety PLC	694.330.00	178.779	none
Kuhnke FIO Safety SDI4 SDO2	694.430.00	186.696	18-pin
Kuhnke FIO Safety SDI8 SDO2	694.430.10	188.895	18-pin
Kuhnke FIO Safety SDI16 SDO4	694.430.20	192.405	36-pin
Kuhnke FIO Safety SDI16	694.431.00	192.406	36-pin

Kuhnke FIO Accessories

Link to the Product Finder	Part no.	ID no.	Connector
Kuhnke FIO Power Distributor			
Kuhnke FIO Power Distributor 2x16	694.411.00	155.915	36-pin
Kuhnke FIO Shield Terminal			
Kuhnke FIO Shield Terminal 2x8mm	694.412.01	154.008	-
Kuhnke FIO Shield Terminal 14mm	694.412.02	154.009	-

	Information
	The 2, 18 and 36-pin IO/Power connectors are included in the module package and part of the delivery. D-SUB connectors are not included but sold separately.

Name	Part no.	ID no.	Type
Kuhnke FIO Connector (black plug, black unlock button)			
Ventura FIO connector, 2-pin, 1x	694.102.02.01	178.638	Spring return, screw
Kuhnke FIO connector, 18-pin, 1x	694.101.18.01	178.640	Spring return, unlock button
Kuhnke FIO connector, 36-pin, 1x	694.101.36.01	178.642	Push-in, unlock button
Kuhnke FIO connector, 2-pin, 20x	694.102.02.20	178.639	Spring return, screw
Kuhnke FIO connector, 18-pin, 20x	694.101.18.20	178.641	Spring return, unlock button
Kuhnke FIO connector, 36-pin, 20x	694.101.36.20	178.643	Push-in, unlock button

Name	Part no.	ID no.	Type
Ventura FIO Connector (black plug, black unlock button)			
Ventura FIO connector, 2-pin, 1x	694.100.02.01	155.373	Spring return, unlock button
Kuhnke FIO connector, 18-pin, 1x	694.100.18.01	155.375	Spring return, unlock button
Kuhnke FIO connector, 36-pin, 1x	694.100.36.01	155.377	Spring return, unlock button
Kuhnke FIO connector, 2-pin, 20x	694.100.02.20	155.374	Spring return, unlock button
Kuhnke FIO connector, 18-pin, 20x	694.100.18.20	155.376	Spring return, unlock button
Kuhnke FIO connector, 36-pin, 20x	694.100.36.20	155.378	Spring return, unlock button

Name	Part no.	ID no.
PROFIBUS Connector		
PROFIBUS D-SUB Connector, termination resistance activates separately	645.180.00	93.288

9 Sales & Service

Please visit our Internet site to find a comprehensive overview of our sales and service network including all the relevant addresses. Feel free to also contact us at our headquarters in Malente/Germany



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