

EtherCAT®

CANopen®

## Instruction Manual

### Kuhnke FIO - digital IO modules

IP20 EtherCAT I/O Modules

E 747GB-V2

17 May 2021

1 Preface .....	8
1.1 Imprint .....	8
Contact Details .....	8
1.2 About this Manual .....	8
Limitation of Liability .....	8
Terms of Delivery .....	8
Copyright .....	8
Warranty .....	8
Manual Objective and Organisation .....	9
2 Reliability, Safety .....	10
2.1 Intended Use .....	10
2.2 Target Group of the Instruction Manual .....	10
2.3 Intended Use .....	10
2.4 Transport and Storage .....	10
2.5 Reliability .....	11
2.6 Hazard and other Warnings .....	12
2.7 Safety .....	13
Project Planning .....	13
Maintenance and Servicing .....	13
Disposal .....	14
2.8 Electromagnetic Compatibility .....	14
Definition .....	14
Interference Emission .....	14
General Notes on Installation .....	14
Electrical Immission Safeguard .....	14
Cable Routing and Wiring .....	14
Location of Installation .....	15
Temperature .....	15
Contamination .....	15
Impact and Vibration .....	15
Electromagnetic Interference .....	15
Particular Sources of Interference .....	15
Inductive Actuators .....	15
3 Introduction .....	16
3.1 EtherCAT® — Ethernet Control Automation Technology .....	16
3.2 Kuhnke FIO (Fast Input / Output) .....	16
3.3 Kuhnke FIO — Ventura FIO .....	17
4 System Description .....	18
4.1 General Service Conditions .....	18
4.2 Mechanical Design .....	18
Installation .....	19
Position .....	19
Order of Modules in Multi-FIO Systems .....	19
To Snap on a Single Module .....	20
To Interconnect Two Modules .....	20
To Disconnect Two Modules .....	20
To Take Down a Single Module .....	20
4.3 System Power Supply .....	21

General Instructions .....	21
System Power Supply .....	22
Earth .....	22
Bus Coupler .....	23
I/O Modules .....	23
4.4 Status LEDs .....	25
LED "EtherCAT Run" .....	25
LED "In L/A", LED "Out L/A" .....	25
LED "IO" .....	25
LED "Power" .....	25
5 Kuhnke FIO Modules .....	26
<b>5.1 Digital FIO Modules</b> .....	26
5.1.1 DI16/DO16 .....	26
Terminals .....	26
Status LEDs .....	26
Function .....	27
Technical Data .....	27
5.1.2 DI16/DO16 LS (Low Side) .....	29
Terminals .....	29
Status LEDs .....	29
Function .....	30
Technical Data .....	30
5.1.3 DI16/DO8 .....	31
Terminals .....	31
Status LEDs .....	31
Function .....	32
Technical Data .....	32
5.1.4 DI8/DO8 .....	33
Terminals .....	33
Status LEDs .....	33
Function .....	34
Technical Data .....	34
5.1.5 DI16 .....	35
Terminals .....	35
Status LEDs .....	35
Function .....	35
Technical Data .....	36
5.1.6 DI16 2-Wire .....	37
Terminals .....	37
Status LEDs .....	37
Function .....	38
Technical Data .....	39
5.1.7 DI32 .....	40
Terminals .....	40
Status LEDs .....	40
Function .....	40
Technical Data .....	41
5.1.8 DO8 .....	42
Terminals .....	42

Status LEDs .....	42
Function .....	43
Technical Data .....	43
5.1.9 DO16 .....	44
Terminals .....	44
Status LEDs .....	44
Function .....	45
Technical Data .....	45
5.1.10 DO16 2-Wire .....	46
Terminals .....	46
Status LEDs .....	46
Function .....	47
Technical Data .....	47
5.1.11 DO8 Relay NO 24V .....	48
Terminals .....	48
Status LEDs .....	48
Function .....	49
Technical Data .....	49
5.1.12 DO8 Relay NO 230VAC .....	50
Terminals .....	50
Status LEDs .....	50
Function .....	51
Technical Data .....	51
6 Accessories .....	52
6.1 Power Distributor 2 x 16 .....	52
Terminals .....	52
Status LEDs .....	52
Function .....	52
Mounting .....	53
Technical Data .....	53
Power Distributor 2 x 16 .....	53
6.2 Shield Terminal .....	54
Terminals .....	54
Function .....	54
Technical Data .....	55
Shield Terminal 2x8mm .....	55
Shield Terminal 14mm .....	55
7 Configuration .....	56
7.1 CODESYS V3 (CODESYS Configurator) .....	56
Offline Configuration .....	56
Online Configuration .....	59
8 Appendix .....	62
8.1 Technical Data (Summarised) .....	62
System Properties of Kuhnke FIO .....	62
<b>Bus Coupler</b> .....	62
Kuhnke FIO bus coupler .....	62
Kuhnke FIO Bus Coupler DI16/DO16 .....	62
Kuhnke FIO Bus Coupler DI8 DO8 .....	63

Kuhnke FIO Bus Coupler DI8 DO4.....	63
Kuhnke FIO I/O Modules (General) .....	63
<b>Extender</b> .....	64
Kuhnke FIO Extender 2 Port .....	64
<b>Controller</b> .....	64
Kuhnke FIO Controller 113.....	64
Kuhnke FIO Controller 116.....	64
<b>Digital FIO Modules</b> .....	64
Kuhnke FIO DI16/DO16 1ms/0.5A .....	64
Kuhnke FIO DI16/DO16 5ms/0.5A .....	64
Kuhnke FIO DI16/DO16 1ms/0.5A LS.....	64
Kuhnke FIO DI16/DO8 1ms/1A .....	64
Kuhnke FIO DI8/DO8 1ms/0.5A .....	64
Kuhnke FIO DI8/DO8 5ms/0.5A .....	64
Kuhnke FIO DI16 1ms .....	65
Kuhnke FIO DI16 2-wire .....	65
Kuhnke FIO DI32 1ms .....	65
Kuhnke FIO DO8 1A.....	65
Kuhnke FIO DO8 2A.....	65
Kuhnke FIO DO16 0.5A.....	65
Kuhnke FIO DO16 2-wire .....	65
Kuhnke FIO DO8 NO Relay 24V .....	65
Kuhnke FIO DO8 NO Relay 230 VAC .....	65
<b>Analogue FIO Modules</b> .....	65
Kuhnke FIO AI4, 12 Bit / AO4, 16Bit .....	65
Kuhnke FIO AO4, 16-Bit.....	66
Kuhnke FIO AO4, 12-Bit.....	66
Kuhnke FIO AI4/8-U 13-Bit.....	66
Kuhnke FIO AI8/16-U 13-Bit.....	66
Kuhnke FIO AI4-I 12-Bit.....	66
Kuhnke FIO AI8-I 12-Bit.....	66
Kuhnke FIO AI4-Pt/Ni/TC 16-Bit.....	67
Kuhnke FIO AI8-Pt/Ni/TC 16-Bit.....	67
<b>Mixed I/O Modules</b> .....	67
Kuhnke FIO MIX 02 .....	67
<b>Counter / Posi / Drive / CAM Modules</b> .....	67
Counter2 5V.....	67
Kuhnke FIO CounterPosi2 5V .....	67
Kuhnke FIO Drive Control.....	68
Kuhnke FIO CAM Control.....	68
<b>Interface and Communication Modules</b> .....	68
Kuhnke FIO RS485 1 Port.....	68
Kuhnke FIO RS232 2 Port.....	68
Kuhnke FIO CAN Master/Slave.....	68
<b>FIO Safety Modules</b> .....	68
Kuhnke FIO Safety PLC .....	68
Kuhnke FIO Safety SDI4/SDO2 .....	68
8.2 Order Specifications.....	69
Kuhnke FIO Modules.....	69

Kuhnke FIO Accessories.....70  
9 Sales & Service .....72

<b>Modification history</b>	
<b>Date</b>	<b>Comments / modifications</b>
<b>25 Aug 2017</b>	Source version after separation of the instructions into categories and translation
<b>01 Dec 2017</b>	Device "Kuhnke FIO DO8 2A" Order number 694.452.06 ID: 190485 added
<b>07 Nov 2018</b>	Image of the front view of the FIO relay module 230V renewed
<b>14 Jan 2019</b>	Mounting instructions for the potential distributor added
<b>28 Jan 2020</b>	Design change
<b>04 Feb 2021</b>	Minor corrections in the document
<b>30 Mar 2021</b>	Modules DI16 2-wire and DO16 2-wire added

# 1 Preface

## 1.1 Imprint

### Contact Details

Kendrion Kuhnke Automation GmbH  
Industrial Control Systems  
Lütjenburger Straße 101  
D-23714 Malente, Deutschland

Phone: +49 4523 402-0

Fax: +49 4523 402-201

Email: [sales-ics@kendrion.com](mailto:sales-ics@kendrion.com)

Web: <http://kuhnke.kendrion.com>

## 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.

### Copyright

© Kendrion Kuhnke Automation GmbH

This instruction manual is proprietary and protected by copyright.

No part of this document may be reproduced or copied in any way or by any means except expressly permitted in writing by Kendrion Kuhnke Automation GmbH.

Microsoft®, Windows® and the Windows® logo are registered trademarks of Microsoft Corp. in the USA and other countries. EtherCAT® is a registered trademark and patented technology, licenced by Beckhoff Automation GmbH, Germany. Further information about the PLCopen organisation is available at [www.plcopen.org](http://www.plcopen.org). CiA® and CANopen® are registered joint brands of CAN in Automation e.V. Title to all companies and company names mentioned heron as well as to products and product names is held by the respective enterprises.

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 61131-3 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.

	<b>CAUTION</b>
	<p><b><i>Electrostatic discharge</i></b>  <i>Destruction of or damage to the unit.</i></p> <ul style="list-style-type: none"> <li>⇒ Transport and store FIO Safety I/O in its original packaging.</li> <li>⇒ Ensure that the ambient conditions are as specified at all times during transport and storage.</li> <li>⇒ Handle FIO Safety I/O in a well-earthed environment (persons, place of work, packaging).</li> <li>⇒ Do not touch electrically conductive parts such as data contacts. Some of the electronic components may be destroyed if exposed to electrostatic discharge.</li> </ul>

	<b>DANGER</b>
	<p><b><i>Only use devices that are in perfect condition, ie that they do not show any transport damage, fluid effects or other damage</i></b></p>

## 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


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

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

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


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


### Other Notices

	<b>Information</b>
	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.

	<b>DANGER</b>
	<p><b><i>Non-observance of the instruction manual</i></b></p> <p><i>Measures for the prevention of dangerous faults or errors may be rendered ineffective or new hazard sources created.</i></p> <ul style="list-style-type: none"> <li>▪ Thoroughly read the instruction manual</li> <li>▪ Take particular heed of the hazard warnings</li> </ul>

	<b>Information</b>
	<p><i>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.</i></p>

## 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.

	<b>Information</b>
	<i>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.</i>

### Interference Emission

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

	<b>Information</b>
	<i>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.</i>

### 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®<sup>1</sup> — 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  $\mu$ s.

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**

---

<sup>1</sup>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.

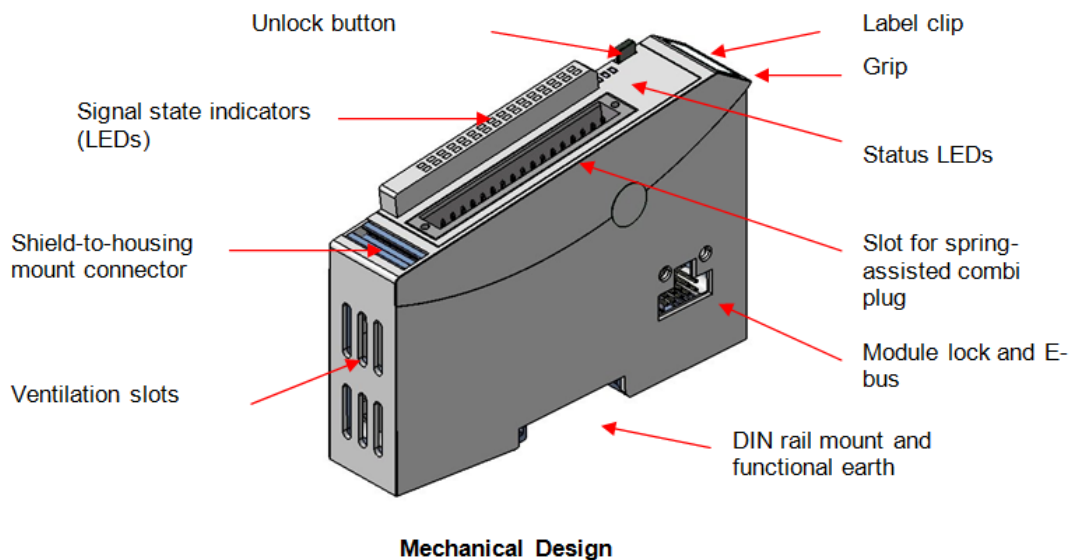
For a list of System Properties of Kuhnke FIO refer to chapter 0, page 62.

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.



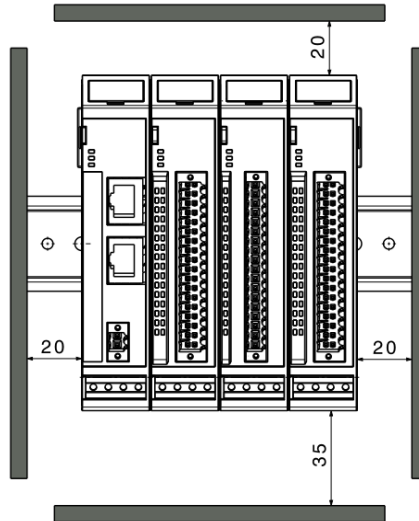
The housing mount consists of an aluminium profile with an integral snap-on device used to snap the module to a 35mm DIN rail. The housing trough including the optical fibres for the status indicators, the side face and the front is made of plastic and contains the module. The optical fibres for the 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

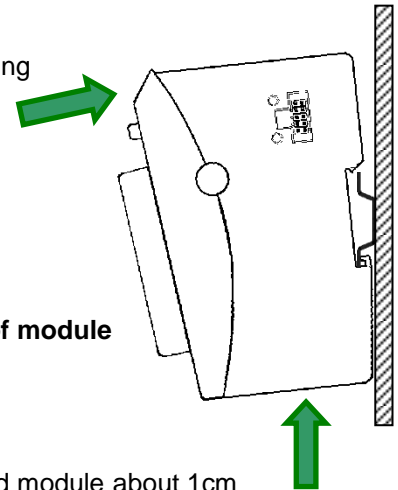
	<b>NOTE</b>
<p><i>In order to ensure that the entire FIO system works properly, arrange the FIO modules by their specific E-bus load, placing the modules with the highest E-bus load immediately next to the head module (bus coupler or controller). Take account of the head module's maximum bus load.</i>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

### 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.

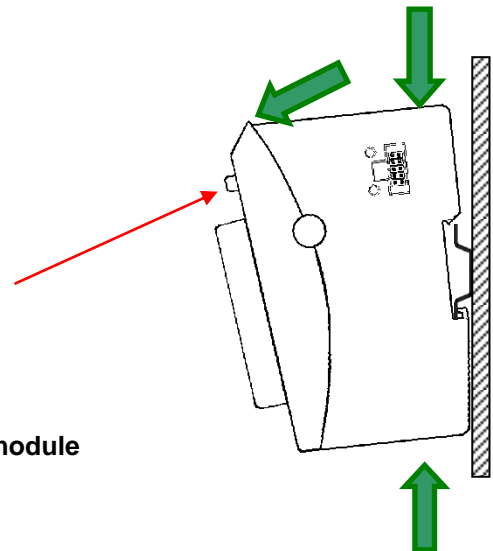
### To Disconnect Two Modules

- 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.

	<b>Note</b>
	<i>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.</i>

**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 mm<sup>2</sup> (IEC)

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

Supported wires with connector sleeves:

Connector sleeve type	Wire cross section [mm <sup>2</sup> ]						
	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 mm<sup>2</sup> (IEC)

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

Supported wires with connector sleeves:

Connector sleeve type	Wire cross section [mm <sup>2</sup> ]						
	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]							

	<b>NOTE</b>
	<i>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.</i>

## 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.

	<b>Information</b>
	<i>Please also note the connection printing on the device before the electrical installation.</i>
	<p><b>WARNING</b></p> <p><b>Potentially hazardous failures due to wrong voltages supplied</b></p> <p><i>Supplying the wrong voltages may damage or destroy the unit and may provoke potentially hazardous failures.</i></p> <p><i>Preventive measures:</i></p> <ul style="list-style-type: none"> <li>⇒ 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.</li> <li>⇒ 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.</li> <li>⇒ Remember that, even in case of a fault, a maximum voltage of <math>U_{max.} &lt; 33 \text{ V}</math> maybe supplied to these assemblies. If you cannot rule out this risk, external protection of the power supply is mandatory.</li> <li>⇒ 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.</li> </ul>

## Earth

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

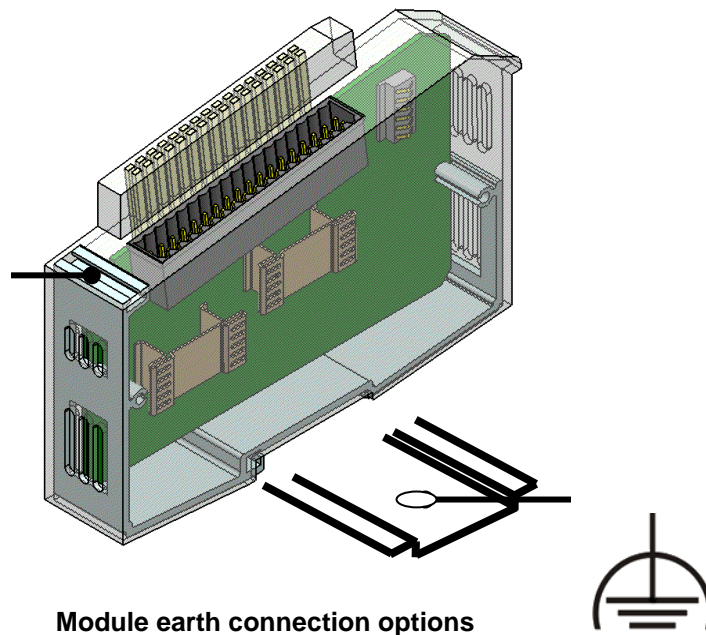
Since the functional earth connector dissipates HF currents, it is of utmost importance for the module's noise immunity.

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



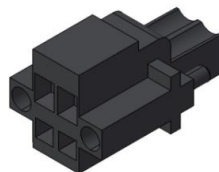
### Information

Earth wires should be short and have a large surface (copper mesh). Refer to [http://de.wikipedia.org/wiki/ground\\_\(electronics\)](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.

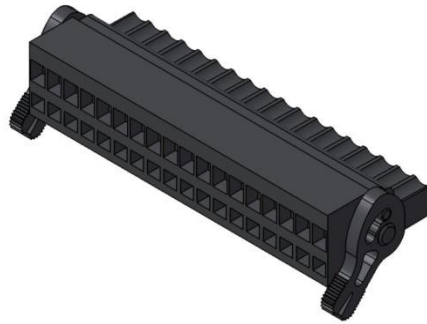


Spring-assisted plug with bolt flange for bus coupler connection

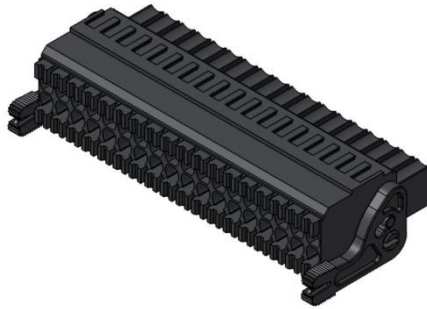
## I/O Modules

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"

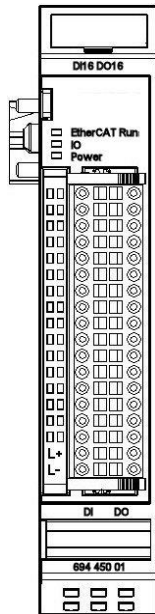
An LED labelled "Power" is located on every module that has a power supply connector (e.g. for digital outputs). It indicates the state of the I/O module's I/O power supply.

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

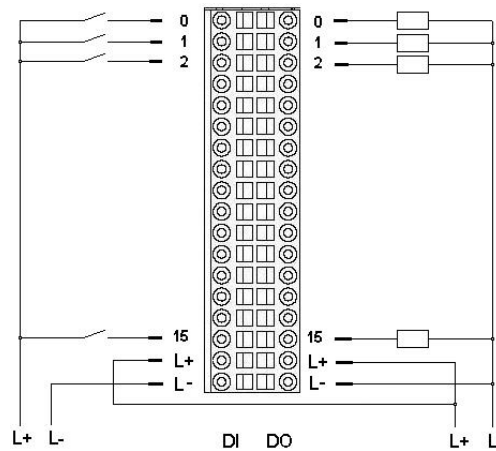
# 5 Kuhnke FIO Modules

## 5.1 Digital FIO Modules

### 5.1.1 DI16/DO16



Front view of DI16/DO16 I/O module



I/O connection

#### Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

#### 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, on	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*

	<i>thermal fuse blows again.</i>
--	----------------------------------

### 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



### Information

*The module is not monitored for low voltage states.*

### LEDs "Channel"

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

### Function

The DI16/DO16 module features 16 digital inputs and 16 digital outputs.

### Variable

Variable	Data type	Explanation
DigitalInputn	BOOL	Digital input (n=0...15)
DigitalOutputn	BOOL	Digital output (n=0...15)

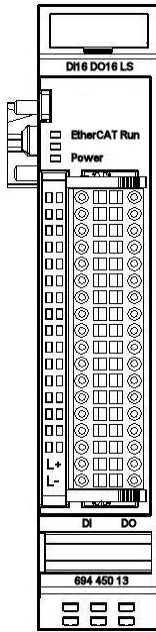
### Technical Data

Digital inputs .....	16
Rising delay .....	1 ms / 5 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
IO/power connection.....	36-pin plug
Controller .....	ASIC ET1200
Baud rate .....	100 Mbit/s
E-bus connector .....	10-pole system plug in side wall
Terminating module.....	not required
Power supply .....	24 VDC -20% +25%
E-bus load.....	135 mA
Part no.	
Kuhnke FIO DI16/DO16 5ms/0.5A .....	694.450.01
Kuhnke FIO DI16/DO16 1ms/0.5A .....	694.450.03

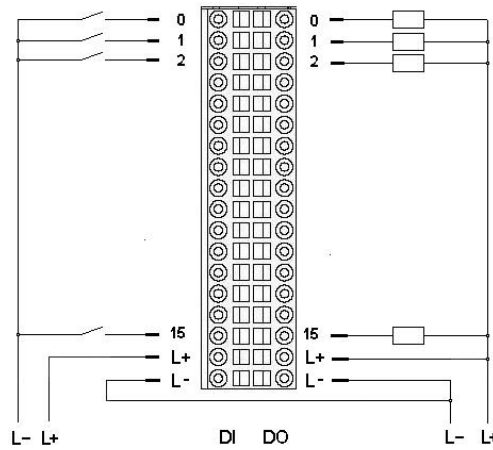


Approval:.....

### 5.1.2 DI16/DO16 LS (Low Side)



Front view of DI16/DO16 LS I/O module



I/O connection

#### Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

#### 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"

There is no LED labelled "IO".

##### 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


#### LEDs "Channel"

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

Function

The DI16/DO16 LS module features 16 digital low-side inputs and 16 digital low-side outputs.

	<b>NOTE</b>
	<p><i>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.</i></p>

	<b>Information</b>
	<p><i>The module is not monitored for low voltage states.</i></p>

Variable

Variable	Data type	Explanation
DigitalInputn	BOOL	Digital input (n=0...15)
DigitalOutputn	BOOL	Digital output (n=0...15)

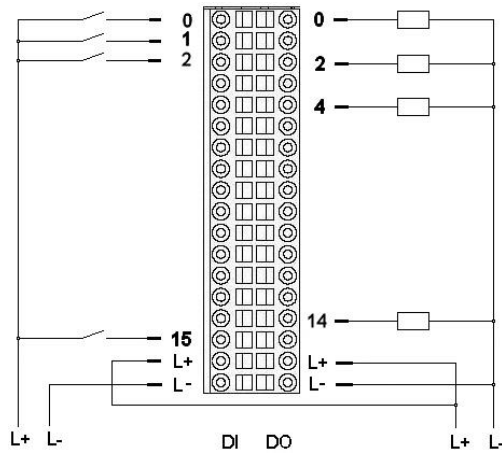
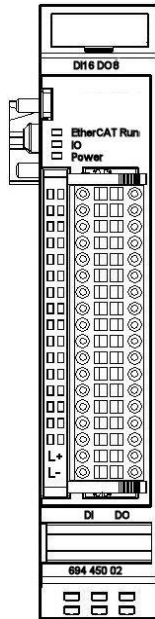
Technical Data

Digital inputs .....	16
Rising delay .....	1 ms (typically)
Logic level.....	On:       -3 ... 5 V. Off:       15V ... 30V
Input current .....	2mA (typically)
Digital outputs.....	16
Max. current.....	0.5 A each
Max. total current.....	8 A
IO/power connection.....	36-pin plug
Controller .....	ASIC ET1200
Baud rate .....	100 Mbit/s
E-bus connector .....	10-pole system plug in side wall
Terminating module.....	not required
Power supply .....	24 VDC -20% +25%
E-bus load.....	135 mA
Part no. ....	694.450.13

Approval:.....



### 5.1.3 DI16/DO8



Out	Pin
0	0
1	2
2	4
3	6
4	8
5	10
6	12
7	14

I/O connection

Front view of DI16/DO8 I/O module

#### Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

#### 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, on	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

	<b>Information</b>
	<i>The module is not monitored for low voltage states.</i>

**LEDs "Channel"**

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

**Function**

The DI16/DO8 module features 16 digital inputs and 8 digital outputs.

**Variable**

Variable	Data type	Explanation
DigitalInputn	BOOL	Digital input (n=0...15)
DigitalOutputn	BOOL	Digital output (n=0...7)
Reserved	BOOL	Unused output addresses

**Technical Data**

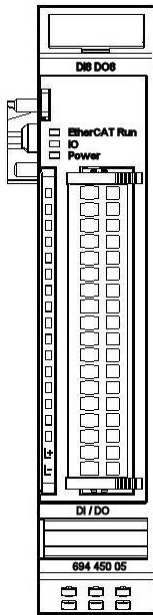
- Digital inputs ..... 16
- Rising delay ..... 1 ms (typically)
- Signal level ..... Off: -3V ... 5V (EN 61131-3, type 1)  
On: 15V ... 30V
- Digital outputs ..... 8
- Max. current ..... 1.0 A each
- Max. total current ..... 8 A
- IO/power connection ..... 36-pin plug
- Controller ..... ASIC ET1200
- Baud rate ..... 100 Mbit/s
- E-bus connector ..... 10-pole system plug in side wall
- Terminating module ..... not required
- Power supply ..... 24 VDC -20% +25%
- E-bus load ..... 135 mA
- Part no. .... 694.450.02



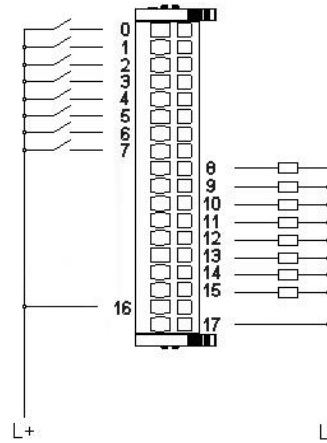
Approval:.....



### 5.1.4 DI8/DO8



Front view of DI8/DO8 I/O module



I/O connection

#### Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

#### 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, on	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

	<b>Information</b>
	<i>The module is not monitored for low voltage states.</i>

LEDs "Channel"

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

Function

The DI8/DO8 module features 8 digital inputs and 8 digital outputs.

Variable

Variable	Data type	Explanation
DigitalInputn	BOOL	Digital input (n=0...7)
DigitalOutputn	BOOL	Digital output (n=0...7)

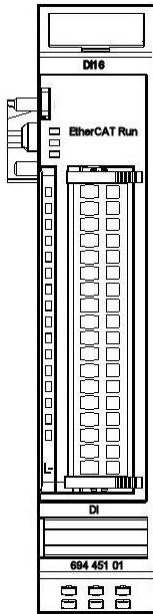
Technical Data

- Digital inputs ..... 8
- Rising delay ..... 1 ms / 5 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 ..... 8 A
- IO/power connection ..... 18-pin plug
- Controller ..... ASIC ET1200
- Baud rate ..... 100 Mbit/s
- E-bus connector ..... 10-pole system plug in side wall
- Terminating module ..... not required
- Power supply ..... 24 VDC -20% +25%
- E-bus load ..... 135 mA
- Part no.
- Kuhnke FIO DI8/DO8 5ms/0.5A ..... 694.450.04
- Kuhnke FIO DI8/DO8 1ms/0.5A ..... 694.450.05

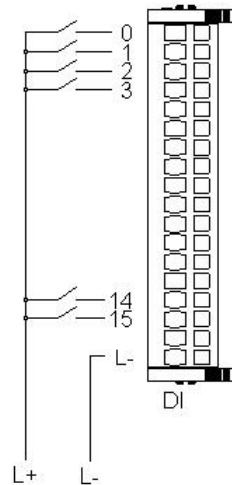


Approval:.....

### 5.1.5 DI16



Front view of DI16 I/O module



I/O connection

#### Terminals

Power supply to module I/Os

L- 0 V

#### 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"

There is no LED labelled "IO".

##### LED "Power"

There is no LED labelled "Power" because a separate power feed is not required.

##### LEDs "Channel"

State	LED	Explanation
On	Green, on	Input signal = TRUE
Off	Off	Input signal = FALSE

#### Function

The DI16 module has 16 digital inputs.

#### Variable

Variable	Data type	Explanation
DigitalInputn	BOOL	Digital input (n=0...15)

## Technical Data

Digital inputs .....	16
Rising delay .....	1 ms (typically)
Signal level .....	Off: -3V ... 5V (EN 61131-3, type 1) On: 15V ... 30V
IO/power connection.....	18-pin plug
Controller .....	ASIC ET1200
Baud rate .....	100 Mbit/s
E-bus connector .....	10-pole system plug in side wall
Terminating module.....	not required
Power supply .....	24 VDC -20% +25%
E-bus load.....	100 mA
Part no.	
Kuhnke FIO DI16, 1ms.....	694.451.03

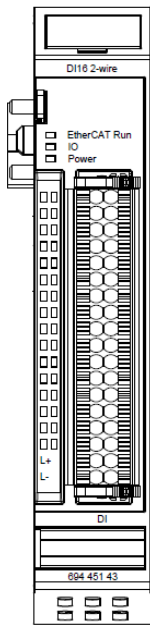


LISTED  
59DM  
E202287

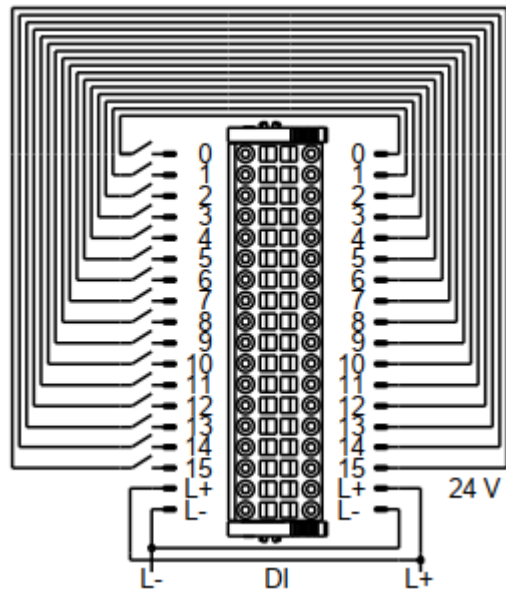
EtherCAT<sup>®</sup>  
Conformance tested

Approval:.....

### 5.1.6 DI16 2-Wire



Front view of DI16 I/O module



I/O connection

#### Terminals

Power supply to module I/Os

L+ 24 V DC

L- 0 V

#### 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"

There is no LED labelled "IO".

##### 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

	Information
	<i>The module is not monitored for low voltage states.</i>

## LEDs "Channel"

State	LED	Explanation
On	Green, on	Input signal = TRUE
Off	Off	Input signal = FALSE

## Function

The DI16 module has 16 digital inputs and 16 24V outputs for decentralized supply of the two-wire connection without additional distribution terminal.

**CAUTION**

*The 24V outputs are only intended for use with the inputs of the module.*

**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.*

## Variable

Variable	Data type	Explanation
DigitalInputn	BOOL	Digital input (n=0...15)

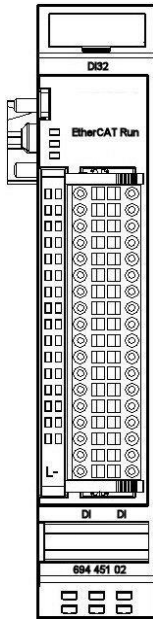
## Technical Data

Digital inputs .....	16	(+16 x 24VDC each max. 1A)
Rising delay .....	1 ms	(typically)
Signal level .....	Off:	-3V ... 5V (EN 61131-3, type 1)
	On:	15V ... 30V
IO/power connection.....	36-pin plug	
Controller .....	ASIC ET1200	
Baud rate .....	100 Mbit/s	
E-bus connector .....	10-pole system plug in side wall	
Terminating module .....	not required	
Power supply .....	24 VDC	-20% +25%
E-bus load.....	110 mA	
Part no.		
Kuhnke FIO DI16, 1ms .....	694.451.43	

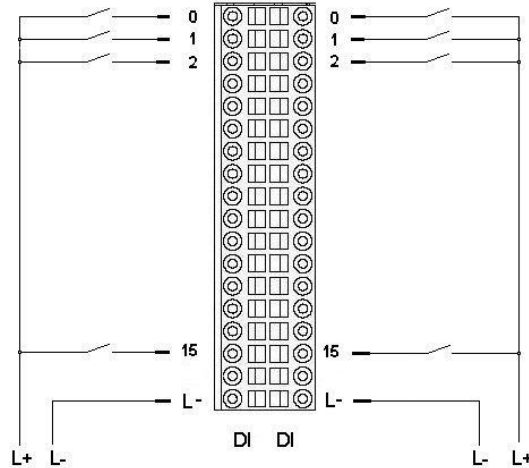


Approval:.....

### 5.1.7 DI32



Front view of DI32 I/O module



I/O connection

#### Terminals

Power supply to module I/Os

L- 0 V

#### 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"

There is no LED labelled "IO".

##### LED "Power"

There is no LED labelled "Power" because a separate power feed is not required.

##### LEDs "Channel"

State	LED	Explanation
On	Green, on	Input signal = TRUE
Off	Off	Input signal = FALSE

#### Function

The DI32 module has 32 digital inputs.

#### Variable

Variable	Data type	Explanation
DigitalInputn	BOOL	Digital input (n=0...31)



## Technical Data

Digital inputs .....	32
Rising delay .....	1 ms (typically)
Signal level .....	Off: -3V ... 5V (EN 61131-3, type 1) On: 15V ... 30V
IO/power connection.....	36-pin plug
Controller .....	ASIC ET1100
Baud rate .....	100 Mbit/s
E-bus connector .....	10-pole system plug in side wall
Terminating module.....	not required
Power supply .....	24 VDC -20% +25%
E-bus load.....	85 mA
Part no.	
Kuhnke FIO DI32, 1ms.....	694.451.02

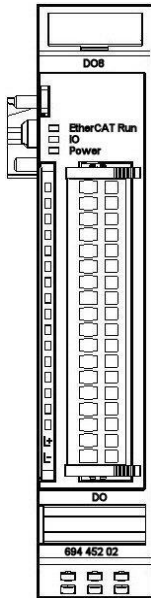


LISTED  
59DM  
E202287

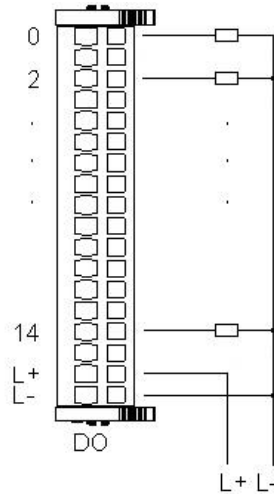
EtherCAT  
Conformance tested

Approval:.....

### 5.1.8 DO8



Front view of DO8 I/O module



I/O connection

Out	Pin
0	0
1	2
2	4
3	6
4	8
5	10
6	12
7	14

#### Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

#### 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, on	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

	<b>Information</b>
	<i>The module is not monitored for low voltage states.</i>

## LEDs "Channel"

State	LED	Explanation
On	Green, on	Output enabled
Off	Off	Output disabled

## Function

The DO8 module has 8 digital outputs.

## Variable

Variable	Data type	Explanation
DigitalOutputn	BOOL	Digital output (n=0...7)
Reserved	BOOL	Unused output addresses

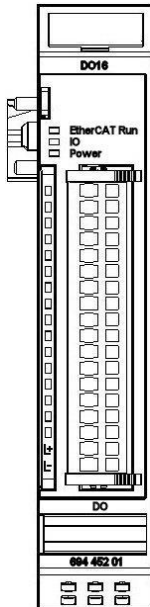
## Technical Data

Digital outputs.....	8
Max. current.....	1.0A each (694.452.02) 2.0A each (694.452.06)
Max. total current.....	∑ max. 10A
IO/power connection.....	18-pin plug
Controller .....	ASIC ET1200
Baud rate .....	100 Mbit/s
E-bus connector .....	10-pole system plug in side wall
Terminating module.....	not required
Power supply .....	24 VDC -20% +25%
E-bus load.....	130 mA
Part no. ....	694.452.02

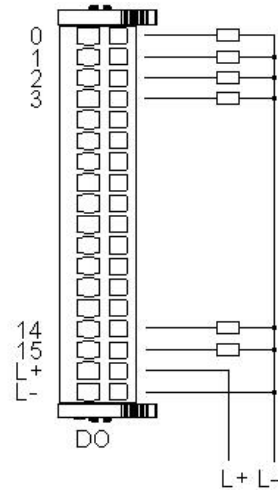


Approval:.....

## 5.1.9 DO16



Front view of DO16 I/O module



I/O connection

## Terminals

Power supply to module I/Os

L+ 24 VDC

L- 0 V

## 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, on	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

	<b>Information</b>
	<i>The module is not monitored for low voltage states.</i>

LEDs "Channel"

State	LED	Explanation
On	Green, on	Output enabled
Off	Off	Output disabled

Function

The DO16 module has 16 digital outputs.

Variable

Variable	Data type	Explanation
DigitalOutputn	BOOL	Digital output (n=0...15)

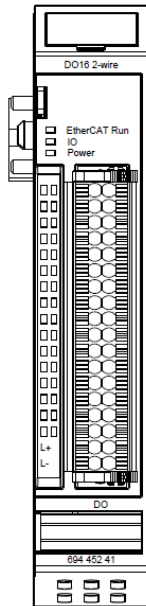
Technical Data

- Digital outputs ..... 16
- Max. current ..... 0.5 A each
- Max. total current ..... 8 A
- IO/power connection ..... 18-pin plug
- Controller ..... ASIC ET1200
- Baud rate ..... 100 Mbit/s
- E-bus connector ..... 10-pole system plug in side wall
- Terminating module ..... not required
- Power supply ..... 24 VDC -20% +25%
- E-bus load ..... 130 mA
- Part no. .... 694.452.01

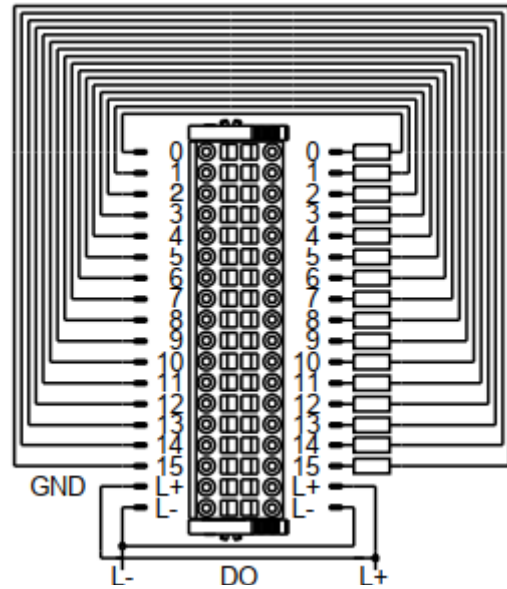
Approval:.....



### 5.1.10 DO16 2-Wire



Front view of DO16 I/O module



I/O connection

#### Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

#### 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, on	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

	<b>Information</b>
	<i>The module is not monitored for low voltage states.</i>

LEDs "Channel"

State	LED	Explanation
On	Green, on	Output enabled
Off	Off	Output disabled

Function

The DO16 module has 16 digital outputs and 16 ground connections without an additional distribution terminal.

Variable

Variable	Data type	Explanation
DigitalOutputn	BOOL	Digital output (n=0...15)

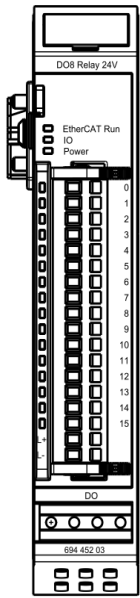
Technical Data

- Digital outputs..... 16 (+16 x Ground)
- Max. current..... 1A each
- Max. total current..... 10 A
- IO/power connection..... 36-pin plug
- Controller ..... ASIC ET1200
- Baud rate ..... 100 Mbit/s
- E-bus connector ..... 10-pole system plug in side wall
- Terminating module..... not required
- Power supply ..... 24 VDC -20% +25%
- E-bus load..... 100 mA
- Part no. .... 694.452.41

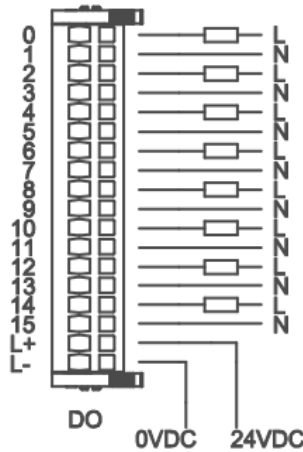


Approval:.....

### 5.1.11 DO8 Relay NO 24V



Front view of DO8 Relay NO 24V module



I/O connection

Out	Pin
0-a	0
0-b	1
1-a	2
1-b	3
2-a	4
2-b	5
3-a	6
3-b	7
4-a	8
4-b	9
5-a	10
5-b	11
6-a	12
6-b	13
7-a	14
7-b	15
24V	16
0V	17

#### Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

#### 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"

LED "IO" has no function.

##### 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

##### LEDs "Channel"

State	LED	Explanation
On	Green, on	Output enabled
Off	Off	Output disabled



Function


The DO8 Relay NO 24 VDC module features 8 relay outputs.


Variable

Variable	Data type	Explanation
DigitalOutputn	BOOL	Digital output (n=0...7)
Reserved	BOOL	Unused output addresses

Module State

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

	<b>NOTE</b>
	<i>In case of undervoltage the switching of the relays is prevented and already energized relays fall off.</i>

	<b>NOTE</b>
	<i>Operation of the module in the limit range (temperature / total current) reduces the lifetime of the module. Pay attention to a good allocation of the switching currents to the individual outputs insert e.g. two outputs loaded with 5A if possible not directly next to each other.</i>

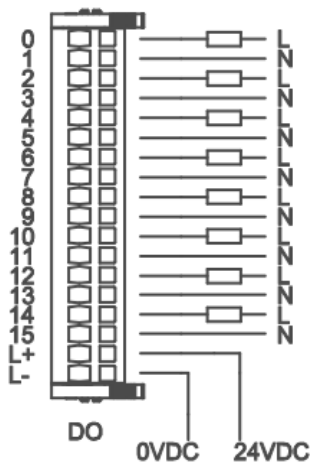
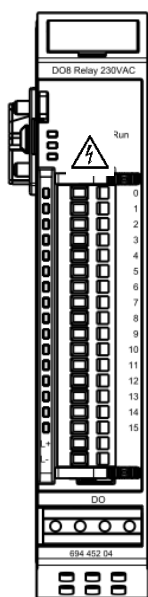
Technical Data

- Digital outputs ..... 8 normally open relays
- Max. switching current (resistive) ..... 5.0 A each
- Max. switching current (inductive) ..... 2.0 A each
- Min. admissible load ..... 10 mA @ 5 VDC
- Min. mech. switching cycles ..... 2 x 10<sup>7</sup>
- Min. electr. switching cycles ..... 3 x 10<sup>5</sup> (2A/30 VDC)
- Switching voltage..... max. 24 VDC/VAC
- IO/power connection..... 18-pin plug
- Controller ..... ASIC ET1200
- Baud rate ..... 100 Mbit/s
- E-bus connector ..... 10-pole system plug in side wall
- Terminating module ..... not required
- Power supply ..... 24 VDC -20% +25%
- E-bus load..... 130 mA
- Part no. .... 694.452.03

Approval:.....



### 5.1.12 DO8 Relay NO 230VAC



I/O connection

Front view of DO8 Relay NO 230V module

Out	Pin
0-a	0
0-b	1
1-a	2
1-b	3
2-a	4
2-b	5
3-a	6
3-b	7
4-a	8
4-b	9
5-a	10
5-b	11
6-a	12
6-b	13
7-a	14
7-b	15
24V	16
0V	17

#### Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

#### 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"

LED "IO" has no function.

##### 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

##### LEDs "Channel"

State	LED	Explanation
On	Green, on	Output enabled
Off	Off	Output disabled

Function


The DO8 Relay NO 230 VDC module features 8 relay outputs.


Variable

Variable	Data type	Explanation
DigitalOutputn	BOOL	Digital output (n=0...7)
Reserved	BOOL	Unused output addresses

Module State

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

	<b>NOTE</b>
	<i>In case of undervoltage the switching of the relays is prevented and already energized relays fall off.</i>

	<b>NOTE</b>
	<i>Operation of the module in the limit range (temperature / total current) reduces the lifetime of the module. Pay attention to a good allocation of the switching currents to the individual outputs insert e.g. two outputs loaded with 5A if possible not directly next to each other.</i>

Technical Data

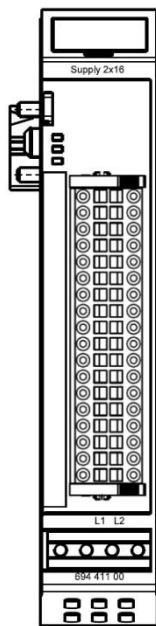
- Digital outputs ..... 8 normally open relays
- Max. switching current (resistive) ..... 5.0 A each
- Max. switching current (inductive) ..... 2.0 A each
- Min. admissible load ..... 10 mA @ 5 VDC
- Min. mech. switching cycles ..... 2 x 10<sup>7</sup>
- Min. electr. switching cycles ..... 3 x 10<sup>5</sup> (2A/30 VDC)
- Switching voltage ..... max. 24 VDC/230 VAC
- IO/power connection ..... 18-pin plug
- Controller ..... ASIC ET1200
- Baud rate ..... 100 Mbit/s
- E-bus connector ..... 10-pole system plug in side wall
- Terminating module ..... not required
- Power supply ..... 24 VDC -20% +25%
- E-bus load ..... 130 mA
- Part no. .... 694.452.04



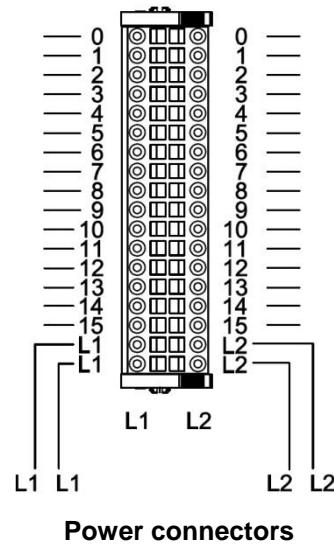
Approval:.....

## 6 Accessories

### 6.1 Power Distributor 2 x 16



Front view of power distributor



#### 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 it 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

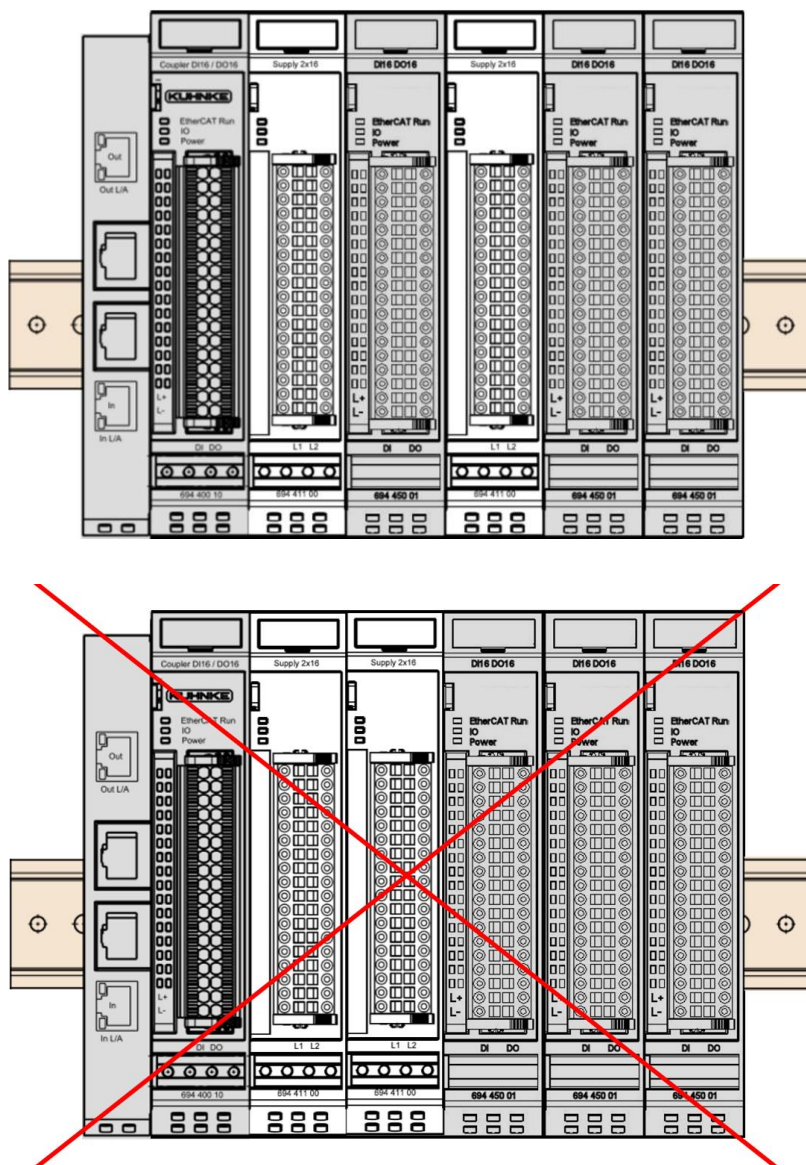
None.

#### 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

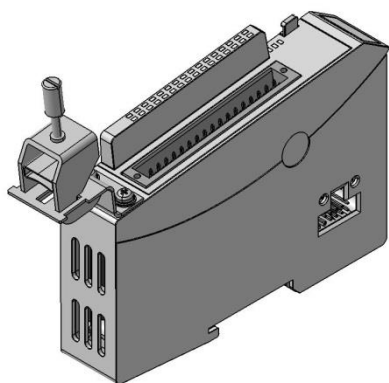
#### Power Distributor 2 x 16

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

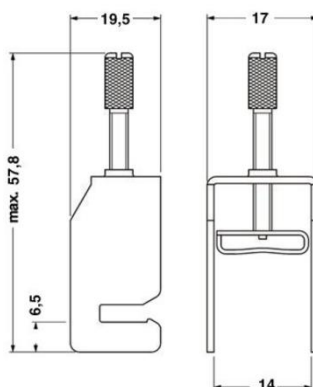


Approval:.....

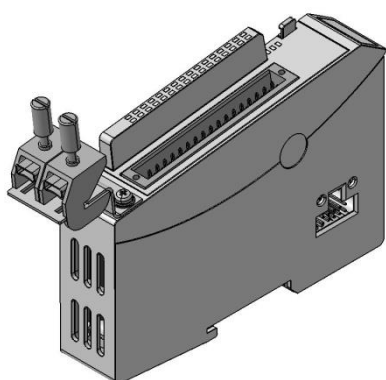
## 6.2 Shield Terminal



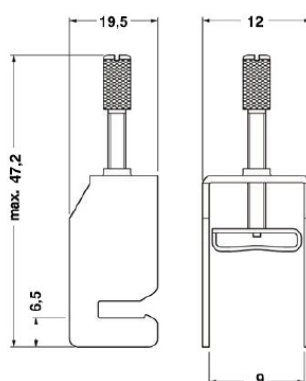
Shield terminal 1x14mm



Dimensions



Shield terminal 2x8mm



Dimensions

### Terminals



The shield terminal assembly consists of the actual shield terminal, the terminal bracket, two 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.

	<b>NOTE</b>
	<i>Verify that the DIN rail is properly earthed.</i>

	<b>NOTE</b>
	<i>Do not use the shield terminals as a strain relief.</i>

## 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.

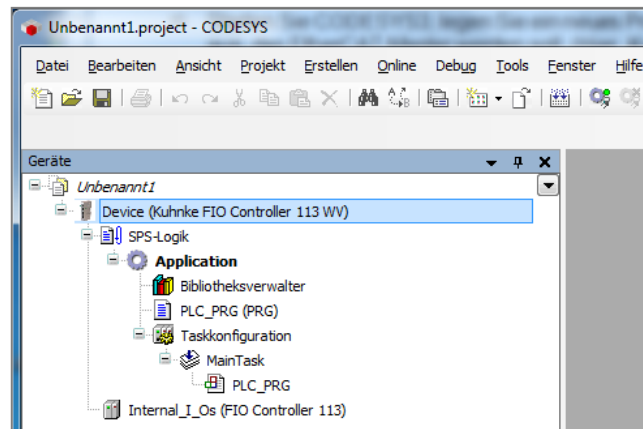
The file to use for Kuhnke FIO is called "KuhnkeEtherCATModulesAll.xml".

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)

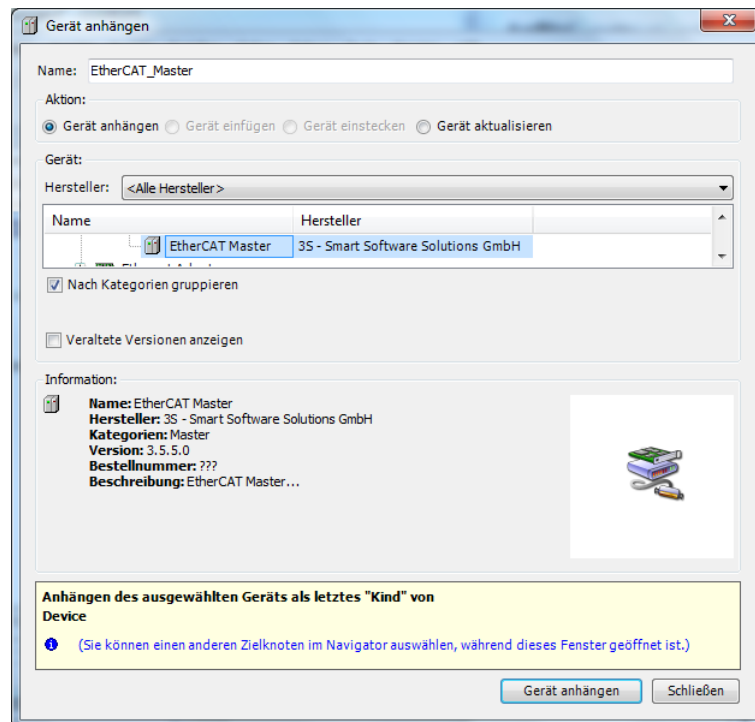
#### Offline Configuration

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

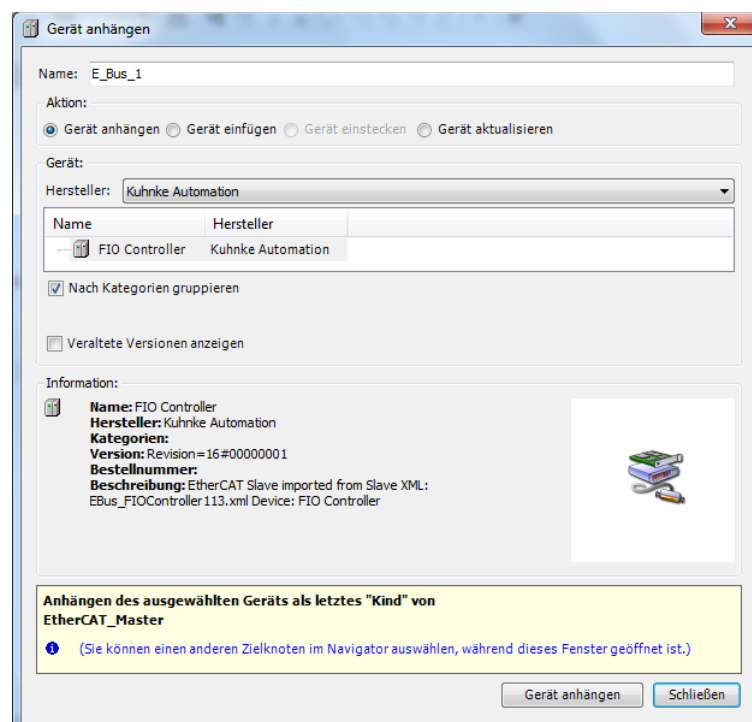


- Highlight the device and pick the 3S "EtherCAT Master" from the right-click menu.

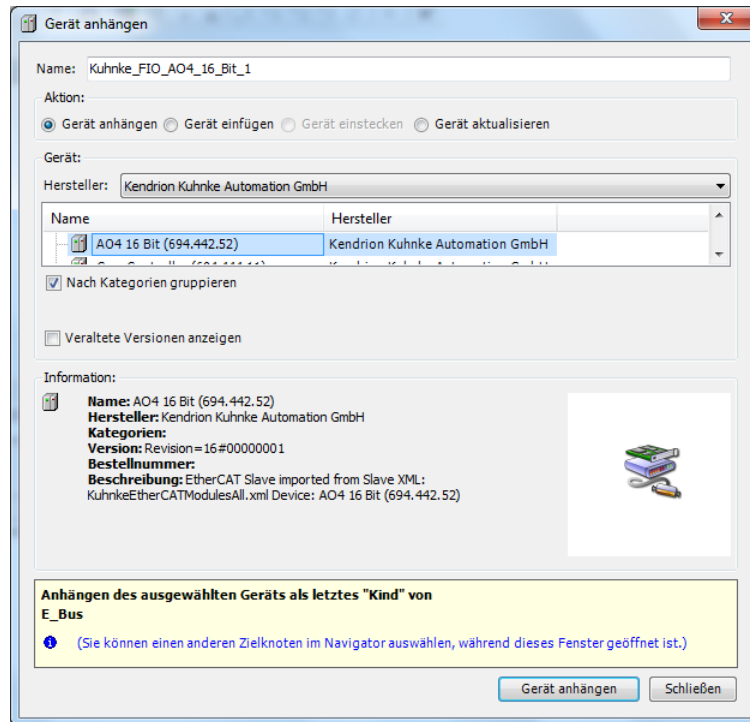




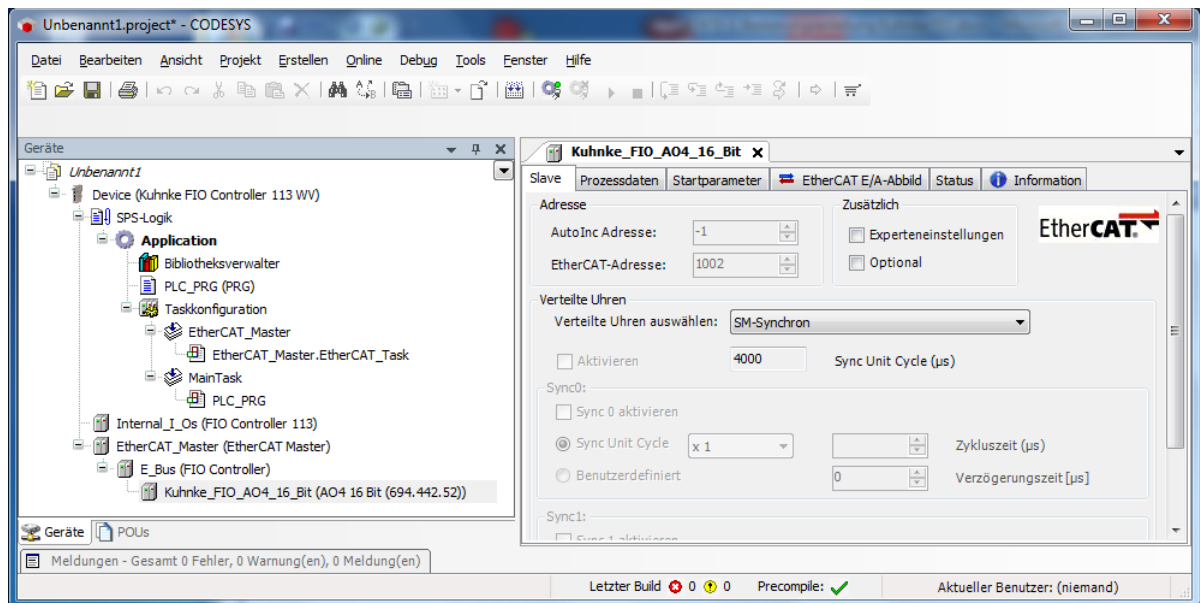
- Go down the list of devices, pick "EtherCAT\_Master (EtherCAT Master)", and add Kuhnke Automation's "FIO Controller".



- 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.

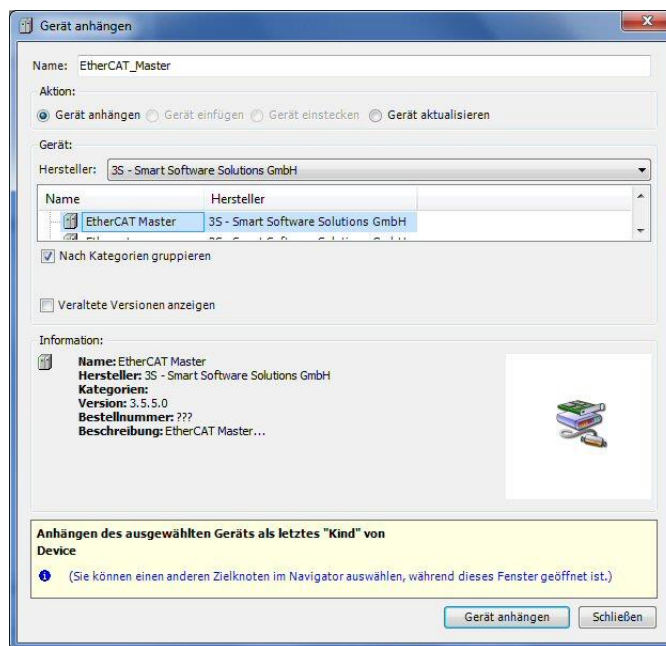
If the configuration is complete and all devices are connected to the programming PC, you can log in and run the configuration tool to test your Kuhnke FIO modules.

	<p><b>DANGER</b></p>
<p><i>Set outputs only if you are sure that this will cause no harm.</i></p>	

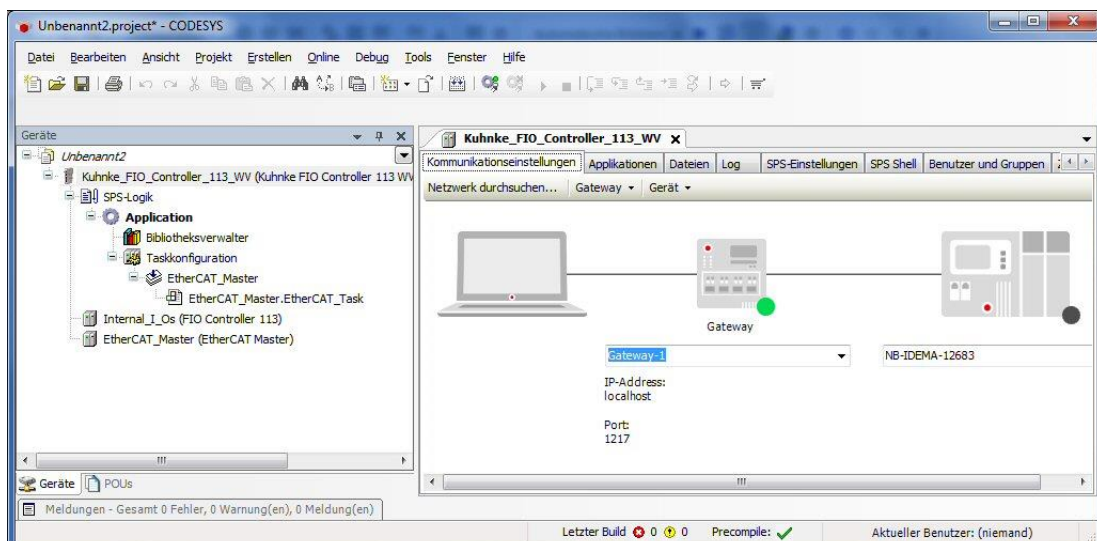
## Online Configuration

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 A18-I module, and a Kuhnke FIO A18-Pt/Ni/Tc module.

- Connect Kuhnke Controller 113 to the Kuhnke FIO A18-I module and the Kuhnke FIO A18-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).

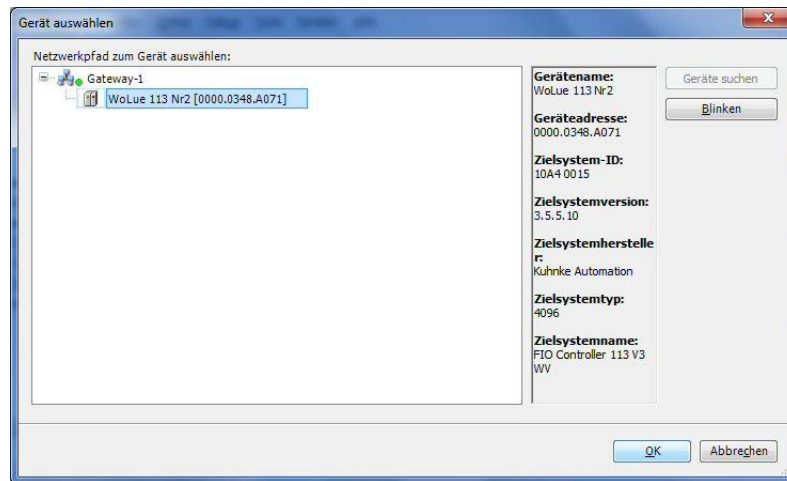


- Configure an EtherCAT master by adding an "EtherCAT Master" supplied by 3S-Smart Software Solutions GmbH to your device.

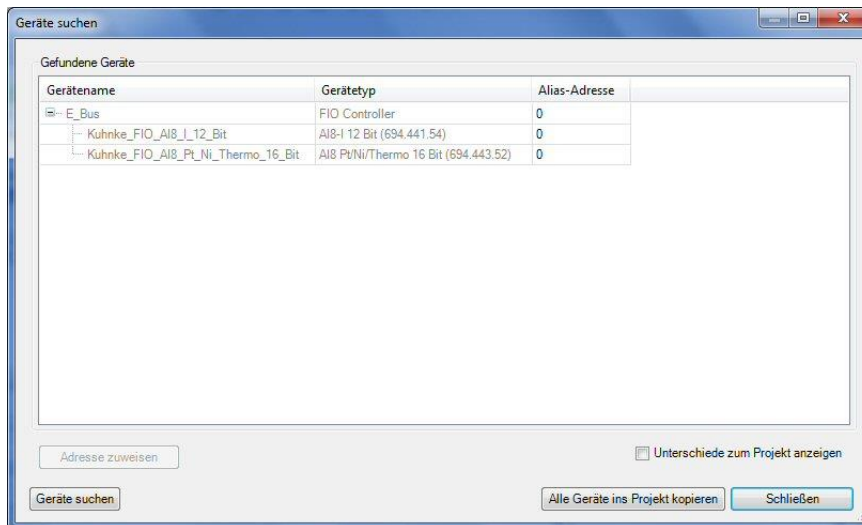


- Select "Device (.....Kuhnke FIO Controller 113)" and choose "Netzwerk durchsuchen" (search network).

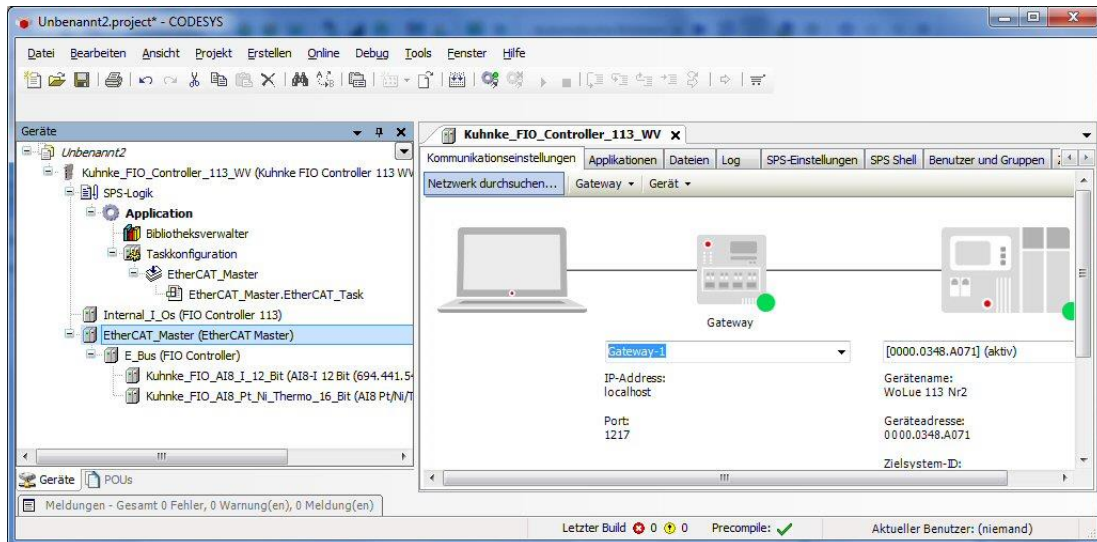
The software now scans the Ethernet network and finds the CoDeSys3 control unit connected to it.



- 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 ( $\Sigma$  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  
 Switching 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  
 Switching 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:  $\leq 22\mu\text{s}$  at  $2\text{k}\Omega / < 200\text{pF}$ )  
 0..20mA, 4..20mA, (0→16V:  $\leq 25\mu\text{s}$  at  $300\Omega / < 1\text{mH}$ )

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, thermocouple 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, thermocouple 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

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

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

## Kuhnke FIO Accessories

<a href="#">Link to the Product Finder</a>	Part no.	ID no.	Connector
Kuhnke FIO Power Distributor			
<a href="#">Kuhnke FIO Power Distributor 2x16</a>	694.411.00	155.915	36-pin
Kuhnke FIO Shield Terminal			
<a href="#">Kuhnke FIO Shield Terminal 2x8mm</a>	694.412.01	154.008	-
<a href="#">Kuhnke FIO Shield Terminal 14mm</a>	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

**KENDRION**  
WE MAGNETISE THE WORLD

INDUSTRIAL CONTROL SYSTEMS

Home | Products | Industries | Customised Solutions | About us | News | Press | Career | Contact

Herzlich Willkommen bei  
**Kendrion Kuhnke Automation  
Industrial Control Systems**

**Kuhnke Control Technology**  
To the control technology ▶

**Kuhnke Solenoid Technology**  
To the solenoid technology ▶

**Kuhnke Pneumatic and Fluid Technology**  
To the pneumatic and fluid technology ▶

**Arriva Control Technology Mobile Automation**  
To the mobile control technology ▶

### Malente Headquarters

Kendrion Kuhnke Automation GmbH  
Industrial Control Systems  
Lütjenburger Straße 101  
D-23714 Malente, Deutschland

Tel. +49 4523 402-0  
Fax +49 4523 402-201

E-Mail [sales-ics@kendrion.com](mailto:sales-ics@kendrion.com)  
Internet [kuhnke.kendrion.com](http://kuhnke.kendrion.com)