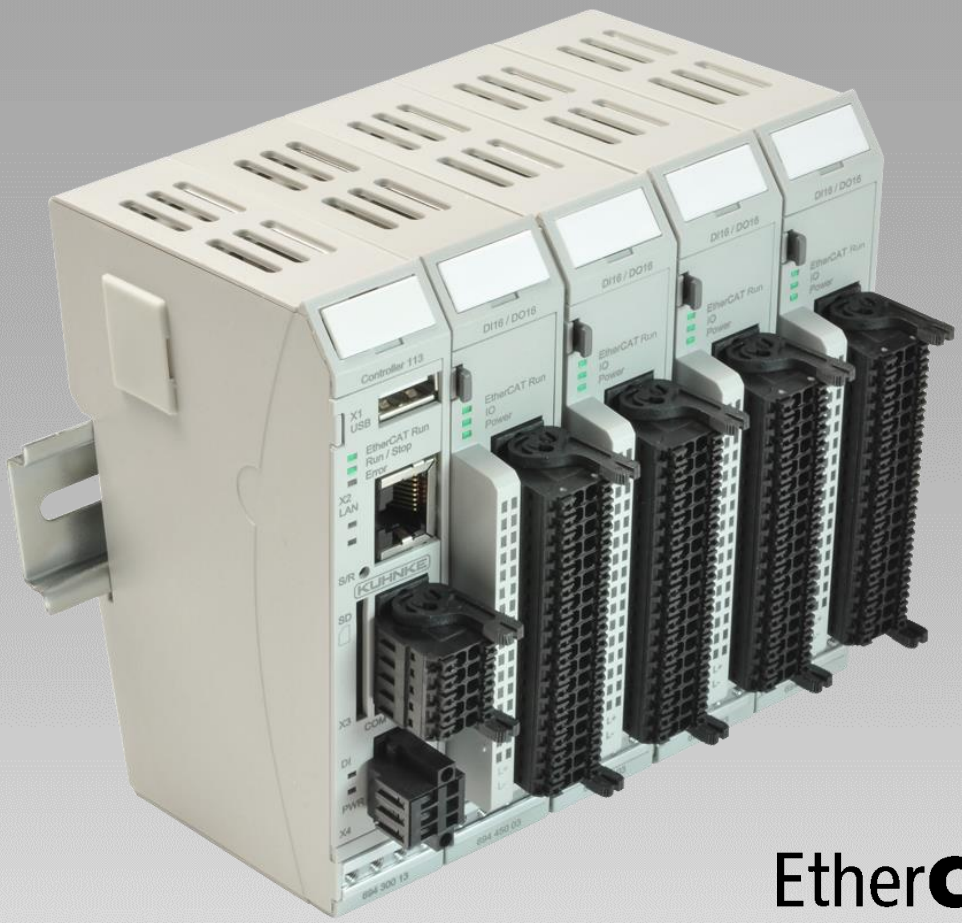
KENDRION



EtherCAT®

CANopen®

Instruction Manual

Kuhnke FIO – Counter - Mixed Modules

IP20 EtherCAT I/O Modules

E 747GB-V2

17 May 2021

PRECISION. SAFETY. MOTION.

1 Preface 7
1.1 Imprint 7
Contact Details 7
1.2 About this Manual 7
Limitation of Liability 7
Terms of Delivery 7
Copyright 7
Warranty 7
Manual Objective and Organisation 8
2 Reliability, Safety 9
2.1 Intended Use 9
2.2 Target Group of the Instruction Manual 9
2.3 Intended Use 9
2.4 Transport and Storage 9
2.5 Reliability 10
2.6 Hazard and other Warnings 11
2.7 Safety 12
Project Planning 12
Maintenance and Servicing 12
Disposal 13
2.8 Electromagnetic Compatibility 13
Definition 13
Interference Emission 13
General Notes on Installation 13
Electrical Immission Safeguard 13
Cable Routing and Wiring 13
Location of Installation 14
Temperature 14
Contamination 14
Impact and Vibration 14
Electromagnetic Interference 14
Particular Sources of Interference 14
Inductive Actuators 14
3 Introduction 15
3.1 EtherCAT® — Ethernet Control Automation Technology 15
3.2 Kuhnke FIO (Fast Input / Output) 15
3.3 Kuhnke FIO — Ventura FIO 16
4 System Description 17
4.1 General Service Conditions 17
4.2 Mechanical Design 17
Installation 18
Position 18
Order of Modules in Multi-FIO Systems 18
To Snap on a Single Module 19
To Interconnect Two Modules 19
To Disconnect Two Modules 19
To Take Down a Single Module 19
4.3 System Power Supply 20

General Instructions 20
System Power Supply 21
Earth 21
Bus Coupler 22
I/O Modules 22
4.4 Status LEDs 24
LED "EtherCAT Run" 24
LED "In L/A", LED "Out L/A" 24
LED "IO" 24
LED "Power" 24
5 Kuhnke FIO Modules 25
5.1 Counter / Posi / Drive / CAM Modules 25
5.1.1 Counter/Posi2 5V, Counter2 5V 25
Terminals 25
Status LEDs 26
Function 27
Examples 35
Technical Data 39
5.1.2 Counter / Encoder 40
Front view and I/O connection 40
Status LEDs 41
Function 43
Module configuration 43
Configuration - Overview of pluggable modules 43
Encoder interface 44
Encoder interface configuration – Incremental encoder 44
Encoder interface configuration – SSI Encoder 45
Encoder interface configuration – ENDAT Encoder 46
Encoder interface configuration – Event counter 47
Encoder interface configuration – User-defined units 48
Object dictionary 49
Technical Data 102
5.1.3 Kuhnke FIO Drive Control 103
Technical Data 103
5.1.4 Kuhnke FIO CAM Control 104
Technical Data 104
5.2 Mixed Modules 105
5.2.1 MIX 02 105
Terminals 105
Status LEDs 106
Function (CoE Variant) 106
Technical Data 114
5.2.2 MIX 04 115
Front view and I/O connection 115
Status LEDs 116
Function 117
Module configuration 118
Configuration - Overview of pluggable modules 119
Encoder interface 120

Encoder interface configuration – Incremental encoder 120
Encoder interface configuration – SSI Encoder 121
Encoder interface configuration – ENDAT Encoder 122
Encoder interface configuration – Event counter 123
Encoder interface configuration – User-defined units 124
Analogue interface configuration – Analogue inputs 125
Analogue interface configuration – Analogue outputs 126
Object dictionary 127
Technical Data 214
6 Accessories 215
6.1 Power Distributor 2 x 16 215
Terminals 215
Status LEDs 215
Function 215
Mounting 216
Technical Data 216
Power Distributor 2 x 16 216
6.2 Shield Terminal 217
Terminals 217
Function 217
Technical Data 218
Shield Terminal 2x8mm 218
Shield Terminal 14mm 218
7 Configuration 219
7.1 CODESYS V3 (CODESYS Configurator) 219
Offline Configuration 219
Online Configuration 222
8 Appendix 225
8.1 Technical Data (Summarised) 225
System Properties of Kuhnke FIO 225
Bus Coupler 225
Kuhnke FIO bus coupler 225
Kuhnke FIO Bus Coupler DI16/DO16 225
Kuhnke FIO Bus Coupler DI8 DO8 226
Kuhnke FIO Bus Coupler DI8 DO4 226
Kuhnke FIO I/O Modules (General) 226
Extender 227
Kuhnke FIO Extender 2 Port 227
Controller 227
Kuhnke FIO Controller 113 227
Kuhnke FIO Controller 116 227
Digital FIO Modules 227
Kuhnke FIO DI16/DO16 1ms/0.5A 227
Kuhnke FIO DI16/DO16 5ms/0.5A 227
Kuhnke FIO DI16/DO16 1ms/0.5A LS 227
Kuhnke FIO DI16/DO8 1ms/1A 227
Kuhnke FIO DI8/DO8 1ms/0.5A 227
Kuhnke FIO DI8/DO8 5ms/0.5A 227

Kuhnke FIO DI16 1ms 228
Kuhnke FIO DI16 2-wire 228
Kuhnke FIO DI32 1ms 228
Kuhnke FIO DO8 1A 228
Kuhnke FIO DO8 2A 228
Kuhnke FIO DO16 0.5A 228
Kuhnke FIO DO16 2-wire 228
Kuhnke FIO DO8 NO Relay 24V 228
Kuhnke FIO DO8 NO Relay 230 VAC 228
Analogue FIO Modules 228
Kuhnke FIO AI4, 12 Bit / AO4, 16Bit 228
Kuhnke FIO AO4, 16-Bit 229
Kuhnke FIO AO4, 12-Bit 229
Kuhnke FIO AI4/8-U 13-Bit 229
Kuhnke FIO AI8/16-U 13-Bit 229
Kuhnke FIO AI4-I 12-Bit 229
Kuhnke FIO AI8-I 12-Bit 229
Kuhnke FIO AI4-Pt/Ni/TC 16-Bit 230
Kuhnke FIO AI8-Pt/Ni/TC 16-Bit 230
Mixed I/O Modules 230
Kuhnke FIO MIX 02 230
Counter / Posi / Drive / CAM Modules 230
Counter2 5V 230
Kuhnke FIO CounterPosi2 5V 230
Kuhnke FIO Drive Control 231
Kuhnke FIO CAM Control 231
Interface and Communication Modules 231
Kuhnke FIO RS485 1 Port 231
Kuhnke FIO RS232 2 Port 231
Kuhnke FIO CAN Master/Slave 231
FIO Safety Modules 231
Kuhnke FIO Safety PLC 231
Kuhnke FIO Safety SDI4/SDO2 231
8.2 Order Specifications 232
Kuhnke FIO Modules 232
Kuhnke FIO Accessories 233
9 Sales & Service 235

Modification history

Date	Comments / modifications
25 Aug 2017	Source version after separation of the instructions into categories and translation
14 Jan 2019	Mounting instructions for the potential distributor added
28 Jan 2020	Design change
04 Feb 2021	Minor corrections in the document

1 Preface

1.1 Imprint

Contact Details

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1.2 About this Manual

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

Limitation of Liability

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

Terms of Delivery

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

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

Warranty

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

Manual Objective and Organisation

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

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

This manual aims to introduce you to using the modules.

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

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

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

2 Reliability, Safety

2.1 Intended Use

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

2.2 Target Group of the Instruction Manual

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

2.3 Intended Use

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

2.4 Transport and Storage

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

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

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

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

2.5 Reliability

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

These include:

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

2.6 Hazard and other Warnings

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

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

Every alert and hazard warning is made up as follows:

Type and source of risk

Potential consequences of non-observance

⇨ Preventive measures

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

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

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

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

Other Notices

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

2.7 Safety

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



DANGER

Non-observance of the instruction manual

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

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



Information

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

Project Planning

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

Maintenance and Servicing

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

Disposal

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

2.8 Electromagnetic Compatibility

Definition

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

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

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

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

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

Interference Emission

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

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

General Notes on Installation

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

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

Electrical Immission Safeguard

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

Cable Routing and Wiring

Keep power circuits separate from control circuits:

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

Joint laying of control circuits is allowed for:

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

Location of Installation

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

Temperature

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

Contamination

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

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

Impact and Vibration

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

Electromagnetic Interference

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

Particular Sources of Interference

Inductive Actuators

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

3 Introduction

3.1 EtherCAT®[1] — Ethernet Control Automation Technology

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

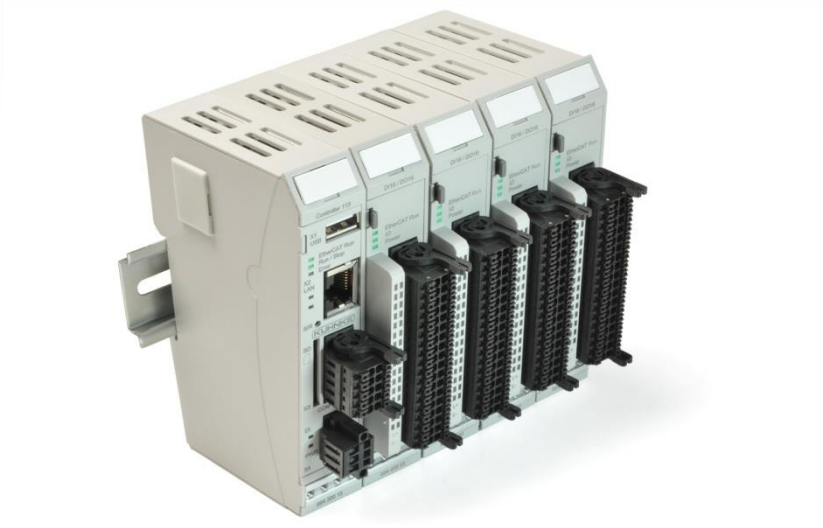
Because of its high performance, the simple wiring and its open protocol support, EtherCAT is often used as a fast motion control and I/O bus driven by an industrial PC or in conjunction with control technology on a smaller scale. EtherCAT moves beyond the limits of conventional fieldbus systems. Its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

3.2 Kuhnke FIO (Fast Input / Output)

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

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

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



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

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

3.3 Kuhnke FIO — Ventura FIO

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

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

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

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

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

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

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

4 System Description

4.1 General Service Conditions

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

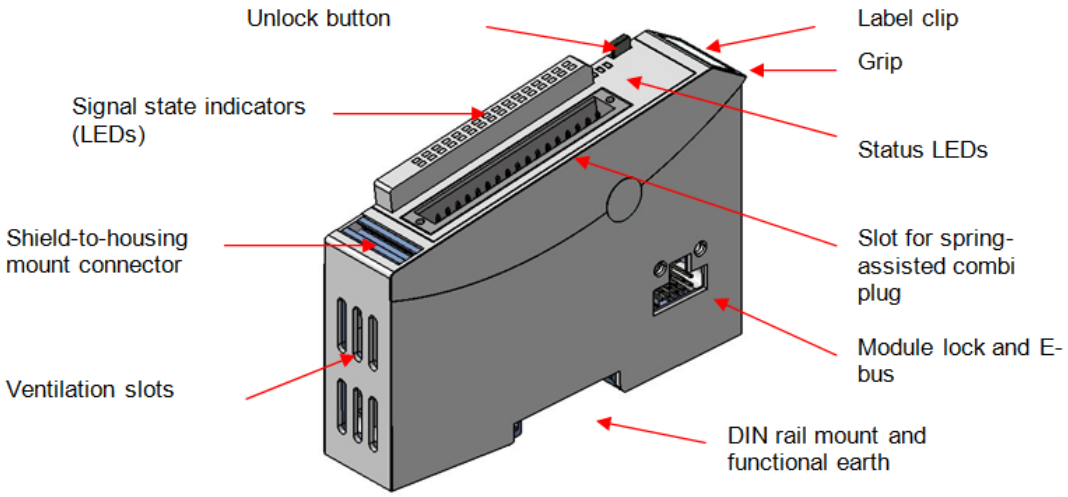
For a list of System Properties of Kuhnke FIO refer to chapter 0, page 225.

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

4.2 Mechanical Design

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

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



Mechanical Design

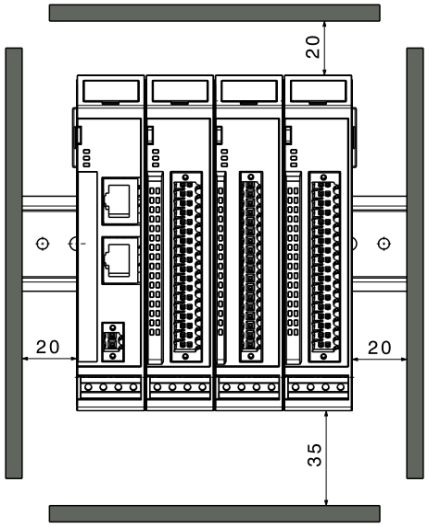
The housing mount consists of an aluminium profile with an integral snap-on device used to snap the module to a 35mm DIN rail. The housing trough including the optical fibres for the status indicators, the side face and the front is made of plastic and contains the module. The optical fibres for the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

Installation

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

Position

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



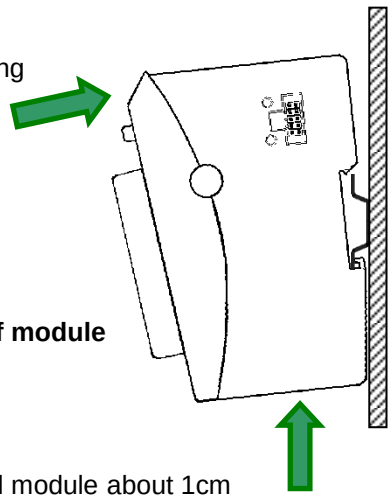
Order of Modules in Multi-FIO Systems

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

To Snap on a Single Module

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

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



Rail mounting of module

To Interconnect Two Modules

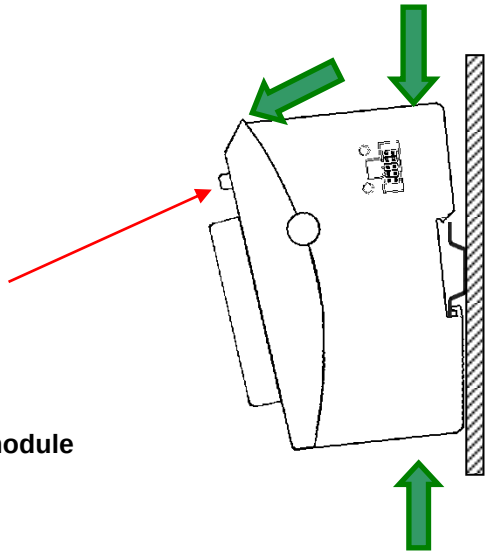
- After snapping on the first module to the rail, snap on the second module about 1cm away towards the right of the first module.
- Push the second module along the rail towards the first module until you hear the locking device snap in.

To Disconnect Two Modules

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

To Take Down a Single Module

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



Uninstalling a module

4.3 System Power Supply

General Instructions

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

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

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

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

Single row

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

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

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

Supported wires with connector sleeves:

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

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

Two rows:

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

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

Supported wires with connector sleeves:

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

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

System Power Supply

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

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

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

Earth

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

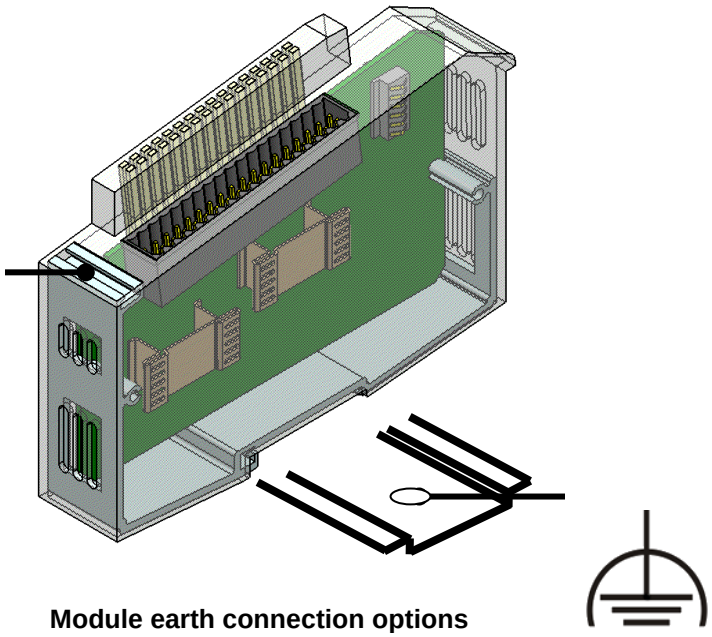
Since the functional earth connector dissipates HF currents, it is of utmost importance for the module's noise immunity.

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

You will normally have to ensure that

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

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



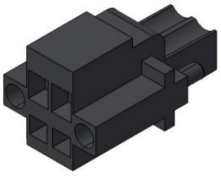
Module earth connection options

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

Bus Coupler

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

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

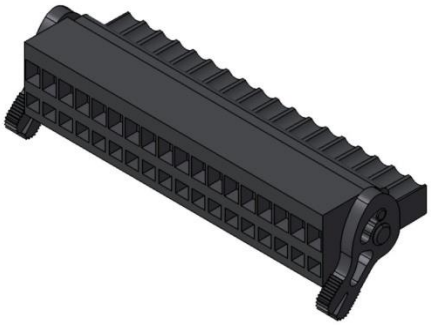


Spring-assisted plug with bolt flange for bus coupler connection

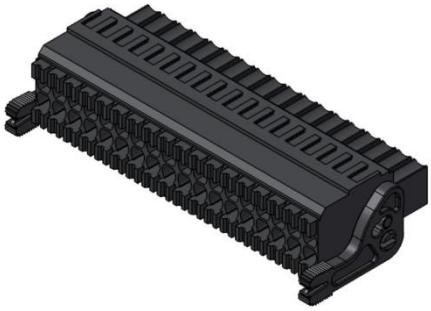
I/O Modules

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

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



Spring-assisted connector with I/O module unlock button



Two-row push-In connector with unlock button

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

Remember the following if you choose to do so:

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

This applies if the system is still supplied with power.

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

4.4 Status LEDs

LED "EtherCAT Run"

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

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

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

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

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

LED "IO"

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

LED "Power"

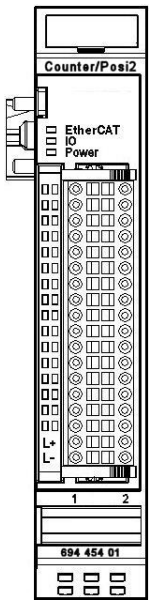
An LED labelled "Power" is located on every module that has a power supply connector (e.g. for digital outputs). It indicates the state of the I/O module's I/O power supply.

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

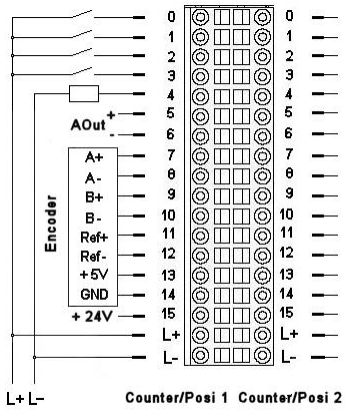
5 Kuhnke FIO Modules

5.1 Counter / Posi / Drive / CAM Modules

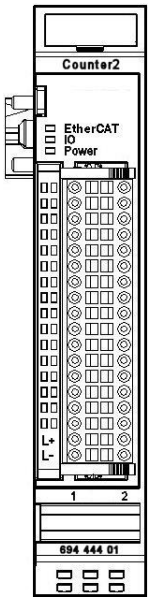
5.1.1 Counter/Posi2 5V, Counter2 5V



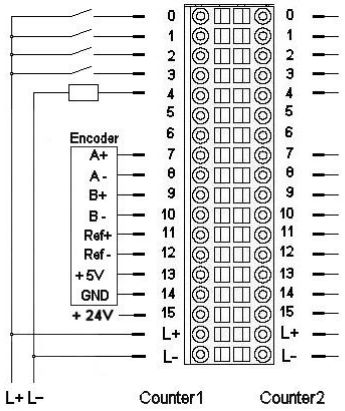
Front view of I/O module Counter/Posi2



Pin wiring of Counter/Posi2



Front view of I/O module Counter2



Pin wiring of Counter2

Terminals

Trm.	Signal	Explanation
0..3	In_0..3	Digital inputs
4	Out_0	Digital output
5..6	A_Out	Analogue output (Counter/Posi2 only)
7..12	A, B, Ref	Incremental encoder signals*
13..14	5 V	5V encoder supply (0.2A fuse)
15	+24 V	+24V encoder supply (0.2A fuse)
16..17	24V	Module power supply

*connect unused encoder signals to +5V

Operative earth / shield → section 0

Status LEDs

"EtherCAT" LED

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On
		Inoperative if E-bus LED = Off
	Red, 2x	Low voltage
	Red, 3x	Internal watchdog
	Red, 4x	EtherCAT watchdog control
	Red, 7x	Configuration error (E-bus pre-operational), no. of process data differs from that in the module
Defective	Red, on	Module defective

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

Status LEDs of IOs

The status LEDs of the IOs are indicative of the state of each of the digital I/Os.

Trm.	Voltage	LED	Explanation
0..3	24V	Green	Digital inputs
4	24V	Green	Digital output
7, 9, 11	5 V	Green	Incremental encoder signals A, B, Ref

Function

Module Counter2 features 2 identical channels.

Every channel features ports for 1 incremental encoder, 4 digital inputs and 1 digital output.

Module Counter/Posi2 also has an extra analogue output.



The variables are put into groups.

1. To control and monitor the entire module:
   - Module Control/Module State
2. To control and monitor counter 1 or 2:
   - Options/Control/State/Error
3. Readings of counter 1 or 2:
   - Set-points/Actual Values
4. State of the digital IOs of counter 1 or 2:
   - Digital Outputs/Digital Inputs/Time Stamp of Input Edge/Output Delay
5. State of the analogue outputs of counter 1 or 2:
   - Optional Analogue Outputs (function provided by module Counter/Posi2 only)

Control and State principle:

When a control bit turns (=TRUE), the rising edge makes the module run the associated function.
To indicate that the function is running, the module changes the associated status bit (=TRUE). When the control bit becomes (=FALSE) again, the module also resets the status bit to (=FALSE).

	Information
	The text below describes the function of Counter/Posi 1. The information applies to Counter/Posi 2 also.

Operation Synchronised with Frames or DC

The module runs in the appropriate mode, depending on whether Distributed Clocks (DC) is used or not.

By default, the module synchronises with frames. When the first DC frame is received, the module synchronises with DC mode and stays in this mode until it is switched off the next time.

Synchronised with Frames

The EtherCAT master sends EtherCAT frames containing the output data for the module. The module imports and processes the output data whenever it receives any of these frames. In return, the module exports its input data to the EtherCAT frame and sends the frame to the master.

Synchronised with DC

A module synchronised with DC will automatically generate DC interrupts according to the Distributed Clocks rules.

The EtherCAT master again sends EtherCAT frames containing the output data for the module. Whereas the module will again import the output data contained in that frame, it will not process the data until it encounters a DC interrupt. The module uses the DC interrupt to export its input data to a buffer from where it is picked up by the next EtherCAT frame sent to the master.

This method allows you to synchronise the times of the digital inputs and digital outputs of several modules in the same EtherCAT network.

Refer to page 32 and following, Counter 1 - Time Stamp of Input Edge and Output delay (underway).

To Control and Monitor the Entire Module

The module is controlled by the variables of group "Module Control“. The state of the settings is contained in the variables of group "Module State".

Module Control

For the time being, this module has no global module options.

The module uses various "module state" bits to indicate errors. The states of these error bits are retained. They cannot be cleared until the error has been removed. To reset the error bits set control bit "ResetError" to a rising edge.

Variable	Data type	Explanation
ResetError	BOOL	Rising edge → acknowledges error

Module State

The following module states are indicated:

Variable	Data type	Explanation
LowSupplyVoltage	BOOL	Low voltage
Watchdog	BOOL	Internal watchdog of module
EtherCAT_Error	BOOL	Configuration error or watchdog control

Acknowledgement: see Module Control

Control/Monitoring of Counter 1

The counter properties are set by the variables of group "Counter 1 Options".

The module is controlled by the variables of group "Counter 1 Control“.

The state of the settings is contained in the variables of group "Counter 1 State".

	***Information***
	The variables of groups Counter 1 Options / Control / Status let you use the counter module for almost any kind of task.

Counter 1 Options

The module provides you with various options of how to operate Counter 1. The module uses control bit "SetOptions_1" (refer to Counter 1 Control) to set the options which are retained until the settings are changed the next time.

- To set up the module choose the options as appropriate and accept by setting control bit "SetOptions_1" to a rising edge. The module will confirm by returning "OptionsSet_1=TRUE". When "SetOptions_1" becomes FALSE, the module responds by sending "OptionsSet_1=FALSE" to indicate that it is ready for the next setup cycle.

Variable	Data type	Value	Explanation	
Enable_Compare_1	BOOL	0	Disables the reference value function	
		1	Enables the reference value function	
SelectEncoder_1	BOOL	0	A, B, Ref and detection of direction	
		1	Event counter at A	B=0 down
				B=1 up
SetResolution_1	BOOL		If SelectEncoder=1 only (event counter)	
		0	Rising and falling edges	
		1	Rising edges only	
ControlOutput_1	BOOL	0	Output_0_0 is a digital output	
		1	Reference value function controls Output_0_0.	
OnErrorForceOutputsOff_1 (Release 3 or higher)	BOOL	0	All digital and analogue outputs keep refreshing after a module error.	
		1	All digital and analogue outputs turn 0 after a module error.	

Counter 1 Control

The state of the control variables controls when and how counters and references are enabled or disabled.

Set the appropriate variable to start the set and reset functions.

The associated status variable indicates that a function is running.

After a reset of the control variable, the counter module also resets the associated status variable.

Variable	Data type	Value	Explanation
SetOptions_1	BOOL	0/1	Accepts Counter 1 Options
ResetReferenced_1	BOOL	0/1	Resets status bit "Referenced_1"
ResetCompared_1	BOOL	0/1	Resets status bit "Compared_1"
ResetCaptured_1	BOOL	0/1	Resets status bit "Captured_1"
EnableCounter_1	BOOL	0	Counter disabled
		1	Counter enabled
EnableReferencing_1	BOOL	0	Referencing disabled
		1	Referencing enabled
SetCounter_1	BOOL	0/1	Sets the counter to the preset value
SetCompare_1	BOOL	0/1	Sets the reference value
SetPreset_1	BOOL	0/1	Sets the preset value
SetMax_1	BOOL	0/1	Sets the final counter value

Counter 1 State

The status variables indicate the state of the counter. This applies to

- events and
- notifications that settings are being applied.

Variable	Data type	Explanation
Counting_1	BOOL	Counter enabled
Referenced_1	BOOL	Reference function has been run. Use ResetReferenced_1 to reset
Clockwise_1	BOOL	Up-counting
Compared_1	BOOL	Reference value function has been run. Use ResetCompared_1 to reset
Captured_1	BOOL	Capture function has been run. Use ResetCaptured_1 to reset
CounterSet_1	BOOL	Counter set to preset value
CompareSet_1	BOOL	Reference value has been set
PresetSet_1	BOOL	Preset value has been set
MaxSet_1	BOOL	Final counter value has been set
OptionsSet_1	BOOL	Counter 1 options accepted
OutputsOnErrorOff_1	BOOL	Error switches off the outputs (release 3 or higher)

Counter 1 Error

Use these variables to indicate error states.

Variable	Data type	Explanation
OutputsForcedOff_1	BOOL	Outputs set to 0 after a module error auf 0 (release 3 or higher)
Err_Reserved_1_x	BOOL	Reserved error bits

Readings of Counter 1

Counter 1 Set-points

The counter can be preset to various set-points. Use variable "SetValue_1" and the following control bits of group "Counter 1 Control" to transfer the value of the variable to the relevant registers.

Variable	Explanation
SetCounter_1	Accepts value as actual counter reading
SetCompare_1	Accepts value as the reference value
SetPreset_1	Accepts value as the preset value
SetMax_1	Accepts value as the final counter value

- Check variable "SelectedValue" to find the actual counter readings currently used as presets.
- Use variable "Select_1" to choose the value you wish to see in variable "SelectedValue".

Variable	Data type	Explanation	
Select_1	USINT	Selects the value of Counter1 to be shown in variable "SelectedValue".	
		0	None
		1	Reference value (Compare)
		2	Preset value (Preset)
		3	Final value (Max) (default: 2.147.483.647)
		4	Captured value (Capture)
		5	Counting pulses per second
		6	Revolutions per minute
		128	Version info
SetValue_1	UDINT	Set-point of Counter1 to be transferred by a control bit	

Counter 1 Actual Values

These variables indicate the actual counter value and the current presets. Variable "SelectedValue" multiplexes (use Select_1 to select) and shows the presets.

Variable	Data type	Explanation	
Counter_1	UDINT	Actual value of Counter1	
Selected_1	USINT	Selects the value of Counter1 to be shown in variable SelectedValue. (Value retrieved from Select_1)	
		0	None
		1	Reference value (Compare)
		2	Preset value (Preset)
		3	Final value (Max)
		4	Captured value (Capture)
		5	Counting pulses per second
		6	Revolutions per minute
		128	Version info
SelectedValue	UDINT	Counter1 value currently selected	

Version info:

Byte	3	2	1	0
Explanation	Version #	Release	Level	Type code
Example	0x2	0x00	0x00	0x53
	2	0	0	S

Digital I/Os

Counter 1 - Digital Inputs

These variables indicate the state of the digital inputs.

Variable	Data type	Explanation
Input_0_0	BOOL	Digital input 0
Input_0_1	BOOL	Digital input 1
Input_0_2	BOOL	Digital input 2
Input_0_3	BOOL	Digital input 3
In_Output_0_0	BOOL	Digital output 0 value retrieved

Counter 1 - Time Stamp of Input Edge

These variables indicate the time at which the state of the digital inputs changed. The current mode defines the point at which measuring the time starts.

(Refer to section Operation Synchronised with Frames or DC on page 27)

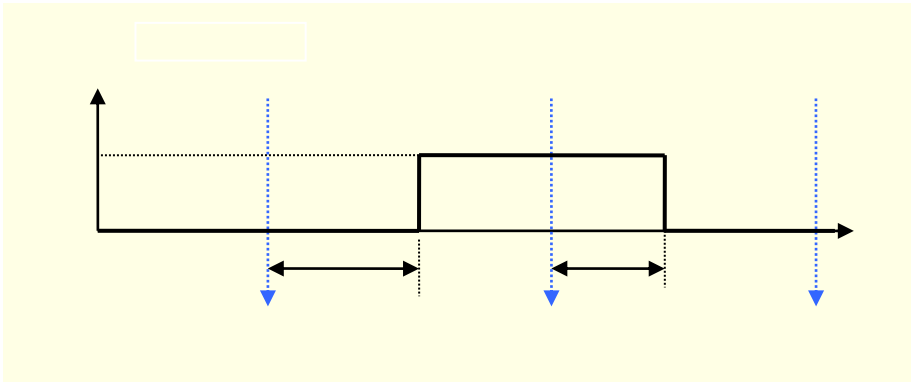
Variable	Data type	Explanation
Input_0_0_TS	UINT	Time stamp of digital input 0 (hardware trigger)
Input_0_1_TS	UINT	Time stamp of digital input 1 (software polling)
Input_0_2_TS	UINT	Time stamp of digital input 2 (software polling)
Input_0_3_TS	UINT	Time stamp of digital input 3 (software polling)

Information

The time stamp is measured in µs between the frame or DC interrupt and the change of input signal. The time stamp value turns 0xFFFF if the signal does not change between two frame or DC interrupts.

If synchronised with frames:

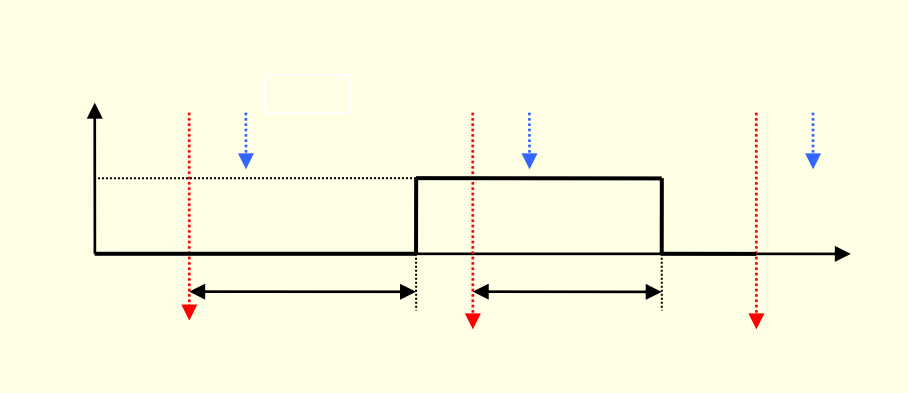
The time stamp saves the time between the last frame interrupt and the change of input state and sends that time to the EtherCAT master with the next frame.



Frame	Digital Input	
	Variable	Time stamp
n+1	TRUE	Time stamp (n)
n+2	FALSE	Time stamp (n+1)

If synchronised with DC:

The time stamp saves the time between the last DC interrupt and the change of input state and sends that time to the EtherCAT master with the next frame.



Frame	Digital Input	
	Variable	Time stamp
n+1	TRUE	Time stamp (n)
n+2	FALSE	Time stamp (n+1)

Digital Outputs

The variables define the state of the digital outputs.

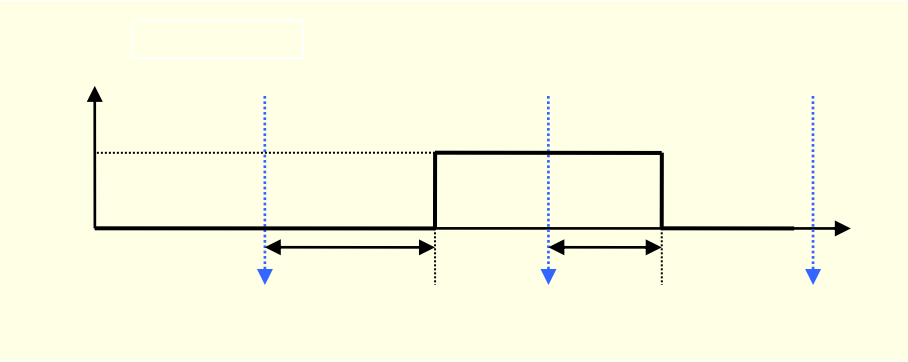
Variable	Data type	Explanation
Output_0_0	BOOL	Digital output 0

Output delay (underway)

This variable defines the time at which the output is set.

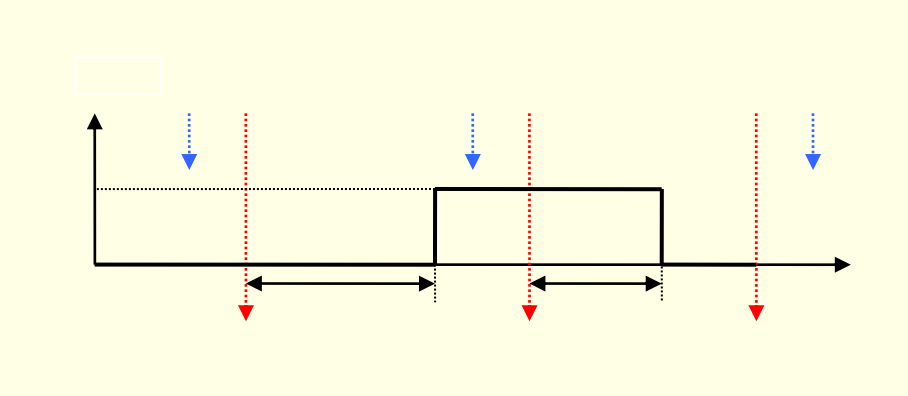
Variable	Data type	Explanation
Output_0_0_Del	UINT	Output delay, in µs

If synchronised with frames:



Frame	Digital Output	
	Variable	Output delay
n	TRUE	Output delay (n)
n+1	FALSE	Output delay (n+1)

If synchronised with DC:



Frame	Digital Output	
	Variable	Output delay
n	TRUE	Output delay (n)
n+1	FALSE	Output delay (n+1)

Analogue Outputs (Counter/Posi2.5V only)

These variables define the voltage reading of the analogue outputs.

Variable	Data type	Explanation
AnalogOutput_1	UINT	Analogue output 1

Table "Voltage output values"

Voltage [V]	Hex value	Decimal value
-10	0x8000	-32768
-5	0xC000	-16384
0	0x0	0
5	0x3FFF	16384
10	0x7FFF	32767

Examples

Enable Counter

The counter remains enabled for as long as variable "EnableCounter_1" is TRUE.

```
Term2_EnableCounter_1:=TRUE;    (*Enables the counter*)
Term2_Counting_1;               (*TRUE if the counter is enabled*)
Term2_Clockwise_1;              (*TRUE if counting up*)
```

Set / Clear Counter

A rising edge of "SetCounter_1" accepts the value of "SetValue_1" as the actual counter value.
"CounterSet_1=TRUE" indicates that the function is running.

Returning "SetCounter_1" to FALSE also returns "CounterSet_1" to FALSE.

```
Term2_SetValue_1:=diCounterValue ;  (*Write value to register*)
                                    (* 0 = clear*)
Term2_SetCounter_1:=TRUE;           (*and accept as actual counter value*)
Term2_CounterSet_1;                 (*TRUE when accepted*)
```

Set Reference Value

A rising edge of control bit "SetOptions_1" accepts the configuration settings set in "Counter 1 Options".
Status bit "OptionsSet_1" confirms that the settings have been accepted.
Example: set up the reference value function.

```
PROGRAM Initialise
VAR
    bInit: BOOL := TRUE ;
    Step: USINT;
END_VAR
-------------------------------------------------------------------------------
IF bInit THEN
    CASE Step OF
(*Choose options and accept with rising edge of "Set_Options"*)
    0:  Term2_EnableCounter_1:=TRUE;      (*Enable counter*)
        Term2_EnableCompare_1:=TRUE;      (*Enable reference function*)
        Term2_ControlOutput_1:=TRUE;      (*Reference function sets output*)
        Term2_SetValue_1:=10000;          (*Value set = 10000..*)
        Term2_SetCompare_1:=TRUE;         (*..is used as reference value*)
        Term2_SetOptions_1:=TRUE;         (*Accept*)
        Step:= 1;
(*Wait until accepting "OptionsSet" and "CompareSet" has been confirmed*)
    1:  IF Term2_OptionsSet_1 AND Term2_CompareSet_1 THEN
            Step:= 2;
        END_IF
(*Reset "Set_Options" and " SetCompare" to default*)
    2:  Term2_SetOptions_1:=FALSE;
        Term2_SetCompare_1:=FALSE;
        Step:=0;
        bInit:=FALSE;
    END_CASE
END_IF
```

Set Preset Value

A rising edge of "SetPreset_1" accepts the value of "SetValue_1" as the preset value. "PresetSet_1=TRUE" indicates that the function is running.

Returning "SetPreset_1" to FALSE also returns "PresetSet_1" to FALSE.

```
Term2_SetValue_1:=diPresetValue ;    (*Write value to register*)
Term2_SetPreset_1:=TRUE;             (*and accept as preset value*)
Term2_PresetSet_1;                   (*TRUE when accepted*)
```

Set Maximum Value

A rising edge of "SetMax_1" accepts the value of "SetValue_1" as the final counter value. "MaxSet_1=TRUE" indicates that the function is running.

Returning "SetMax_1" to FALSE also returns "MaxSet_1" to FALSE.

```
Term2_SetValue_1:=diMaxValue ;    (*Write value to register*)
Term2_SetMax_1:=TRUE;             (*and accept as final counter value*)
Term2_MaxSet_1;                   (*TRUE when accepted*)
```

Digital Output

Refer to page 29: Counter 1 Options.

The output can be optionally controlled by variable "Output_0_0" or the reference value function. Use variable "ControlOutput_1" to decide.

(Refer to page 35 to know how to set options)

The state of the output is retrieved from the module and shown in "In_Output_0_0".

```
Term2_ControlOutput_1:=FALSE;    (*Term2_Output_0_0 sets output*)
Term2_ControlOutput_1:=TRUE;     (*Reference function sets output*)
Term2_In_Output_0_0;             (*State of output*)
```

A-B-Ref or Event Counter

(Refer to page 29: Counter 1 Options)

You may use the counter as A, B, Ref counter with detection of direction or as event counter. Use variable "ControlOutput_1" to decide.

(Refer to page 35 to know how to set options)

```
Term2_SelectEncoder_1:=FALSE;    (*A, B, Ref and detection of direction*)
Term2_SelectEncoder_1:=TRUE;     (*Event counter at A*)
                                 (*B=FALSE:down, B=TRUE:up*)
```

Single and Multi-counting

The option applies to event counter mode only

(Refer to page 29: Counter 1 Options)

You can set the counter to count (all rising and falling) edges or (rising edges only) pulses. Use variable "SetResolution_1" to decide.

(Refer to page 35 to know how to set options)

```
Term2_SetResolution_1:=FALSE;    (*All edges*)
Term2_SetResolution_1:=TRUE;     (*Pulses*)
```

Referencing

You can set the counter to a preset value when a pulse occurs at the Ref input. The preset value can be 0 or any other 32-bit value.

Task:

A 500-pulse rotary encoder running in 4-fold mode outputs 2000 increments per revolution.

Every Ref signal is to set the counter to the preset value (2000). The counter is to count down to 0 within one encoder revolution.
(The incremental encoder's sense of rotation sets the counting direction.)

```
PROGRAM Referencing
VAR
	bInit: BOOL := TRUE ;
	StepInit: USINT;
	bInitReady: BOOL;
	Step: USINT;
END_VAR
-------------------------------------------------------------------------------
(*1. Initialising: enable counter and set preset value*)
IF bInit THEN
	CASE StepInit OF
(*Choose options and accept with rising edge of "Set_Options"*)
	0:	Term2_EnableCounter_1:=TRUE;
		Term2_SetValue_1:=2000;
		Term2_SetPreset_1:=TRUE;
		Term2_SetOptions_1:=TRUE;
		StepInit:=1;
(*Wait until accepting "OptionsSet" and "PresetSet" has been confirmed*)
	1:	IF Term2_OptionsSet_1 AND Term2_PresetSet_1 THEN
			StepInit:=2;
		END_IF
(*Reset "Set_Options" and " Set_Preset" to default*)
	2:	Term2_SetOptions_1:=FALSE;
		Term2_SetPreset_1:=FALSE;
		StepInit:=0;
		bInit:=FALSE;
		bInitReady:=TRUE;
	END_CASE
END_IF

(*2. Control referencing*)
IF bInitReady THEN
	CASE Step OF
	(*Enable referencing*)
	0:	Term2_EnableReferencing_1:=TRUE;
		Step:=1;
	(*Wait for Referencing*)
	1:	IF Term2_Referenced_1 THEN
			Step:=2;
		END_IF
	(*Reset referencing message*)
	2:	Term2_ResetReferenced_1:=TRUE;
		Step:=3;
	3:	IF NOT Term2_Referenced_1 THEN
	(*Terminate reset of referencing message*)
		Term2_ResetReferenced_1:=FALSE;
	(*Disable referencing*)
```

```
            Term2_EnableReferencing_1:=FALSE;
            Step:=0;        (*Restart referencing at next revolution.*)
            END_IF
        END_CASE
END_IF
```

Capture Mode (Capture)

A falling edge of digital input 1 can be used to trigger writing the current counter reading.
Status bit "Captured_1" indicates the capture event. Use "ResetCaptured_1" to reset and enable "Captured_1" to indicate the next capture event.

```
Term2_Input_0_1;            (*State of input 1*)
Term2_Select_1:=4;          (*Show captured value in Term2_SelectedValue_1*)
Term2_Selected_1;           (* =4 when captured value is in Term2_SelectedValue_1*)
Term2_SelectedValue_1;      (*Use to read the captured value*)
Term2_Captured_1;           (*A capture event has occurred*)
Term2_ResetCaptured_1;      (*Reset Term2_Captured_1*)
```

Digital Inputs (Input_0_x)

Use variable "Input_0_x" to poll the state of the digital inputs.

Permanent extra function:

Upon a falling edge of input one the current counter reading is written to the capture register.

```
Term2_Input_0_0;            (*State of input 0*)
Term2_Input_0_1;            (*State of input 1*)
Term2_Input_0_2;            (*State of input 2*)
Term2_Input_0_3;            (*State of input 3*)
```

Analogue Outputs (Counter/Posi2.5V only)

Variables "AnalogOutput _x" contain the output values of the analogue outputs.

```
Term2_ AnalogOutput_1:= 16#7FFF;    (*Output +10V to analogue output 1*)
Term2_ AnalogOutput_2:= 16#8000;    (*Output -10V to analogue output 2*)
```

Output values: See section Analogue Outputs (Counter/Posi2.5V only)

Technical Data

Counter2 5V

Encoder*	2 A, B, Ref	
*Connect unused encoder signals to +5V		
Encoder type	RS422, 5V, 24VDC	
Counting frequency	RS422:	200 kHz.
	24V:	200 kHz
Digital inputs	8	
Rising delay	1 ms	
Signal level	Off:	-3 … 5 V.
	On:	15V … 30V (EN 61131-3, type1)
Digital outputs	2	
Max. current	2 A each	
Fieldbus	EtherCAT 100 Mbit/s	
EtherCAT file	KuhnkeEtherCATModulesAll.xml	
WxHxD	25x120x90 [mm]	
Installation	35 mm DIN rail	
Controller	ASIC ET1200	
E-bus connector	10-pole system plug in side wall	
Terminating module	not required	
E-bus load	300 mA	
Power supply:		
Logic circuit	From EtherCAT coupler through E-bus connector	
IO/power connector	Male 36-pole connector (not included in module package)	
Power24V DC -20% +25%		
Electrical insulation	Module/module and modules/bus	
Storage temperature	-25 …+70 [°C]	
Working temperature	0…+55 [°C]	
Relative humidity	5...95 [%], non-condensing	
Protection	IP20	
Immunity	zone B	
Part no.	694.444.01	

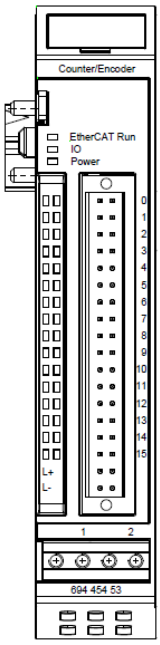
Counter/Posi2 5V

Extra		
Analogue outputs	2	
Voltage	-10V ...+10V	
Resolution	12 bit	
Part no.	694.454.01	

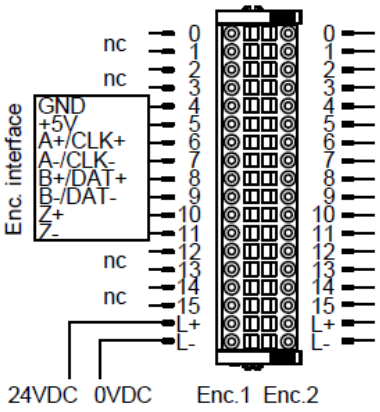
Approval:

5.1.2 Counter / Encoder

Front view and I/O connection



Front view I/O-Modul Counter / Encoder



I/O connection

Status LEDs

"EtherCAT" LED

The LED labelled "EtherCAT" 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,	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if bootstrap mode is supported

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On
		Inoperative if E-bus LED = Off
	Red, 2x	Low voltage
	Red, 3x	Internal watchdog
	Red, 4x	EtherCAT watchdog control
	Red, 7x	Configuration error (E-bus pre-operational), no. of process data differs from that in the module
Defective	Red, on	Module defective

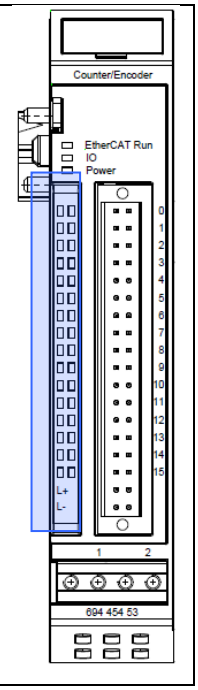
LED "Power"

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

Status LEDs of IOs

The status LEDs of the IOs are indicative of the state of each of the digital I/Os.

Kanal			**Kanal**	**Beschreibung**	
A+/CLK+			A+/CLK+	Incremental encoder: The LEDs indicate the signal status of the incremental encoder track. Endat / SSI: The LEDs light up in time with the clock or data signal Event counter: The LEDs indicate the signal status of the event counter input	
A-/CLK-			A-/CLK-		
B+/DAT+			B+/DAT+		
B-/DAT-			B-/DAT-		
Z+			Z+		
Z-			Z-		

Function

The Kuhnke FIO MIX 04 module has 4 analogue inputs for recording current or voltage values and 4 analogue outputs for outputting analogue current or voltage values.

Furthermore the Kuhnke FIO Mix 04 module has 2 counter / encoder interfaces for the connection of incremental encoders or absolute value position encoders with SSI or EnDat interface. The interface can also be configured as event counter, so that 6 independent event counters are available.

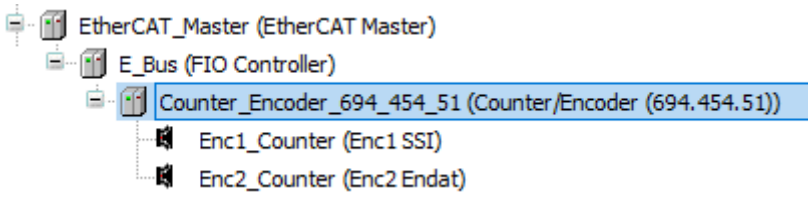
All channels can be parameterized almost independently of each other, which gives the module a high degree of flexibility.

Module configuration

The configuration of the counter/encoder interfaces is done via pluggable modules that are inserted into the corresponding slots. One slot corresponds to one counter/encoder interface. Only suitable modules can be plugged into the selected slot. This procedure is based on the "EtherCAT Modular Device Profile".

	Information
	All slots must be equipped with a module.

View CODESYS- device tree



Configuration - Overview of pluggable modules

Slot	Slot name	Function	Module code	Module function
1	Enc1	Encoder 1	192361013	Enc1 Counter
			192361014	Enc1 SSI
			192361015	Enc1 EnDat
			192361016	Enc event counter
2	Enc2	Encoder 2	192361017	Enc2 Counter
			192361018	Enc2 SSI
			192361019	Enc2 EnDat
			192361020	Enc event counter

Encoder interface

The universal encoder interface offers a wide range of possibilities for the acquisition of angles, positions and pulses to be counted.

The following encoders can be connected:

- Inkremental encoder with RS422 interface (RS422)
- Inkremental encoder with 5V single ended interface (TTL)
- Inkremental encoder with 24V single ended interface (HTL)
- SSI- Encoder
- EnDat 2.1 single turn encoder
- EnDat 2.1 multi turn encoder

These encoders can be mixed as required. The module also provides the supply voltage for 5V encoders with a maximum of 150mA per encoder. This is monitored and an error is signalled if it is exceeded.

The encoder interface can also be used as an event counter and record 6 fast signals. In this case no encoder can be connected.

In the following chapters you will find an overview of the configuration options with the associated objects. These are linked to the object directory.

Encoder interface configuration – Incremental encoder

Object overview

Slot	Object	Explanation
Enc1	0x2100 Enc1 Digital Interface Type	64 Encoder (is assigned automatically via the module)
Enc2	0x2900 Enc2 Digital Interface Type	
Enc1	0x2103 Enc1 Digital Interface Config	Sub 01 (Level): 0=HTL, 1=TTL or 2=RS422 Sub 02 (Mode): 0=Multiturn or 1=Single Turn Sub 03 (Index Level): 0=Reference on rising edge 1=Reference on falling edge Sub 04 (SSI): 0=Straight binary 1=Grey coded binary Sub 05 (event counter): 0=Count rising edges 1=Count falling edges 3=Count both edges
Enc2	0x2903 Enc2 Digital Interface Config	
Enc1	0x2110 Enc1 Digital Interface Bit Size	Encoder resolution according to data sheet
Enc2	0x2910 Enc2 Digital Interface Bit Size	
Enc1	0x2111 Enc1 Digital Interface Baud Rate	Clock frequency according to data sheet [kHz]
Enc2	0x2911 Enc2 Digital Interface Baud Rate	
Enc1	0x6002 Enc1 Total Measuring Range	With setting "Single Turn" relevant for the overflow
Enc2	0x6802 Enc2 Total Measuring Range	

Encoder interface configuration – SSI Encoder

Object overview

Slot	Object	Explanation
Enc1	0x2100 Enc1 Digital Interface Type	65 SSI (Is assigned automatically via the module)
Enc2	0x2900 Enc2 Digital Interface Type	
Enc1	0x2103 Enc1 Digital Interface Config	Sub 01 (Level): 0=HTL, 1=TTL or 2=RS422 Sub 02 (Mode): 0=Multiturn or 1=Single Turn Sub 03 (Index Level): 0=Reference on rising edge 1=Reference on falling edge Sub 04 (SSI): 0=Straight binary 1=Grey coded binary Sub 05 (event counter): 0=Count rising edges 1=Count falling edges 3=Count both edges
Enc2	0x2903 Enc2 Digital Interface Config	
Enc1	0x2110 Enc1 Digital Interface Bit Size	Encoder resolution according to data sheet
Enc2	0x2910 Enc2 Digital Interface Bit Size	
Enc1	0x2111 Enc1 Digital Interface Baud Rate	Clock frequency according to data sheet [kHz]
Enc2	0x2911 Enc2 Digital Interface Baud Rate	
Enc1	0x6002 Enc1 Total Measuring Range	With setting "Single Turn" relevant for the overflow
Enc2	0x6802 Enc2 Total Measuring Range	

Encoder interface configuration – ENDAT Encoder

Object overview

Slot	Object	Explanation
Enc1	0x2100 Enc1 Digital Interface Type	69 EnDat (Is assigned automatically via the module)
Enc2	0x2900 Enc2 Digital Interface Type	
Enc1	0x2103 Enc1 Digital Interface Config	Sub 01 (Level): 0=HTL, 1=TTL or 2=RS422 Sub 02 (Mode): 0=Multiturn or 1=Single Turn Sub 03 (Index Level): 0=Reference on rising edge 1=Reference on falling edge Sub 04 (SSI): 0=Straight binary 1=Grey coded binary Sub 05 (event counter): 0=Count rising edges 1=Count falling edges 3=Count both edges
Enc2	0x2903 Enc2 Digital Interface Config	
Enc1	0x2110 Enc1 Digital Interface Bit Size	Encoder resolution according to data sheet
Enc2	0x2910 Enc2 Digital Interface Bit Size	
Enc1	0x2111 Enc1 Digital Interface Baud Rate	Clock frequency according to data sheet [kHz]
Enc2	0x2911 Enc2 Digital Interface Baud Rate	
Enc1	0x6002 Enc1 Total Measuring Range	With setting "Single Turn" relevant for the overflow
Enc2	0x6802 Enc2 Total Measuring Range	

Encoder interface configuration – Event counter

Object overview

Slot	Object	Explanation
Enc1	0x2100 Enc1 Digital Interface Type	80 event counter (Is assigned automatically via the module)
Enc2	n/a	n/a
Enc1	0x2103 Enc1 Digital Interface Config	Sub 01 (Level): 0=HTL, 1=TTL or 2=RS422 Sub 02 (Mode): 0=Multi turn or 1=Single turn Sub 03 (Index Level): 0=Reference on rising edge 1=Reference on falling edge Sub 04 (SSI): 0=Straight binary 1=Grey coded binary Sub 05 (event counter): 0=Count rising edges 1=Count falling edges 3=Count both edges
Enc2	0x2903 Enc2 Digital Interface Config	
Enc1	0x2110 Enc1 Digital Interface Bit Size	Encoder resolution according to data sheet
Enc2	0x2910 Enc2 Digital Interface Bit Size	
Enc1	0x2111 Enc1 Digital Interface Baud Rate	Clock frequency according to data sheet [kHz]
Enc2	0x2911 Enc2 Digital Interface Baud Rate	
Enc1	0x6002 Enc1 Total Measuring Range	With setting "Single Turn" relevant for the overflow
Enc2	0x6802 Enc2 Total Measuring Range	

	Information
	The inputs of the event counter are not debounced or filtered and therefore not suitable for mechanical switches.

Encoder interface configuration – User-defined units

Besides the output of the position value in increments, the position value can also be output in user-defined units in REAL format. This applies to the use of incremental, SSI and ENDAT encoders.

The following objects are available for the output of the position value in user-defined units:

- 0x2014 Enc1 Linear Position Value
- 0x2814 Enc2 Linear Position Value

Add these objects to the PDO mapping if required.

The position value is calculated as follows:

$$Linear\ Position\ Value = High\ Resolution\ Raw\ Value * \frac{Encoder\ Increments}{Motor\ Revolutions} * \frac{Motor\ Shaft\ Revolutions}{Driving\ Shaft\ Revolutions} * \frac{Feed}{Shaft\ Revolutions}$$

Object overview

Slot	Object	Explanation
Enc1	0x208f Enc1 Position Encoder Resolution	$\frac{Encoder\ Increments}{Motor\ Revolutions}$
Enc2	0x288f Enc2 Position Encoder Resolution	
Enc1	0x2091 Enc1 Gear Ratio	$\frac{Motor\ Shaft\ Revolutions}{Driving\ Shaft\ Revolutions}$
Enc2	0x2891 Enc2 Gear Ratio	
Enc1	0x2092 Enc1 Feed Constant	$\frac{Feed}{Shaft\ Revolutions}$
Enc2	0x2892 Enc2 Feed Constant	

Object dictionary

The Kuhnke FIO MIX 04 is divided into 3 virtual devices. The objects are structured as follows

0x1000 … 0x1FFF	Device specific
0x2000 … 0x23FF	Manufacture specific: Counter / Encoder 1
0x2800 … 0x2FFF	Manufacture specific: Counter / Encoder 2
0x3000 … 0x37FF	Manufacture specific: Analogue Input / Output
0x6000 … 0x67FF	Virtual Device: Counter / Encoder 1
0x6800 … 0x6FFF	Virtual Device: Counter / Encoder 2
0x7000 … 0x7FFF	Virtual Device: Analogue Input / Output

0x1000 Device type

Object Code	Variable

Sub	**0x00**
Name	Device type
Data Type	UNSIGNED32
Access	ro
Defaultvalue	5001 (0x1389)
PDO Mapping	No

5001 = Modular Device Profile

0x1001 Error register

Object Code	Variable

Sub	**0x00**
Name	Error register
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	no

In the case of an error, the corresponding error bit is set. If the error no longer exists, it is automatically deleted.

In this object, the following objects are ORed together:

- 0x2001 Enc1 Error Register
- 0x2801 Enc2 Error Register

7	6	5	4	3	2	1	0
MAN	RES	PROF	COM	TEMP	VOL	CUR	GEN

GEN: General error
CUR: Current
VOL: Voltage
TEMP: Temperature
COM: Communication
PROF: Device profile
RES: reserved, always „0“
MAN: Manufacturer specific

0x1003 Pre-defined error field

Object Code	Array

Sub	**0x00**
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	rw
Defaultvalue	8
Low Limit	0
High Limit	0
PDO Mapping	no

Sub	**0x01**
Name	Standard error field 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[0]

Sub	**0x02**
Name	Standard error field 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[1]

Sub	**0x03**
Name	Standard error field 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[2]

Sub	**0x04**
Name	Standard error field 4
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[3]

Sub	**0x05**
Name	Standard error field 5
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[4]

Sub	**0x06**
Name	Standard error field 6
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[5]

Sub	**0x07**
Name	Standard error field 7
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[6]

Sub	**0x08**
Name	Standard error field 8
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[7]

If a new error occurs, it is entered in subindex 1. The existing entries in sub-indexes 1 to 7 are moved one place back. The error on subindex 7 is removed.

The number of errors which have already occurred can be read from the object with subindex 0. If a "0" is written into this object, counting starts again.

Bit															
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Error Register								Error Origin				Sub-Number			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Error Code															

Error Register [31 … 24]

Copy of object 0x1001 after triggering the error

Error Origin [23 … 20]

Error source in the device

0xF Module / Logical Device overlapping

0x1 Encoder 1

0x2 Encoder 2

Sub-Number [19 … 16]

See table Error Code

Error Code [15 … 0]

Errorcode	Sub	Device	Channel	Reaction	Explanation
0x2110	0x0	Enc1/Enc2		No	Overcurrent supply encoder
0x3100	0x0	Modul		No	Undervoltage module
0x3110	0x1	Enc1/Enc2		No	Signal integrity error
0x6100	0x0	Modul		Device no longer in Operational	Watchdog
0x7000	0x0	Enc1/Enc2		No	CRC-error EnDat
0x7000	0x1	Enc1/Enc2		No	Encoder error EnDat
0x7000	0x2	Enc1/Enc2		No	Timeout/Answer Format EnDat
0x8100	0x0	Modul		Device no longer in Operational	Communication error

0x1008 Manufacturer device name

Object Code	Variable

Sub	**0x00**
Name	Manufacturer device name
Data Type	VISIBLE_STRING
Access	ro
Defaultvalue	Counter/Encoder (694.454.53)
PDO Mapping	no

0x1009 Manufacturer hardware version

Object Code	Variable

Sub	**0x00**
Name	Manufacturer hardware version
Data Type	VISIBLE_STRING
Access	ro
Defaultvalue	1.00
PDO Mapping	no

0x100a Manufacturer software version

Object Code	Variable

Sub	**0x00**
Name	Manufacturer software version
Data Type	VISIBLE_STRING
Access	ro
Defaultvalue	C017
PDO Mapping	no

0x1018 Identity object

Object Code	Record

Sub	**0x00**
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0x04
PDO Mapping	no

Sub	**0x01**
Name	Vendor-ID
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x48554B
PDO Mapping	no

Sub	**0x02**
Name	Product code
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x2F144
PDO Mapping	no

Sub	**0x03**
Name	Revision number
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x00000001
PDO Mapping	no

Sub	**0x04**
Name	Serial number
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x00000000
PDO Mapping	no

0x10f1 Error Settings

Object Code	Record

Sub	**0x00**
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	**0x01**
Name	Local Error Reaction
Data Type	UNSIGNED32
Access	rw
Defaultvalue	1
PDO Mapping	no

Sub	**0x02**
Name	Sync Error Counter Limit
Data Type	UNSIGNED16
Access	rw
Defaultvalue	4
PDO Mapping	no

0x10f8 Timestamp Object

Object Code	Variable

Sub	**0x00**
Name	Timestamp Object
Data Type	UNSIGNED64
Access	rw
Defaultvalue	
PDO Mapping	optional, TPDO only

0x1601 Digital Interface Control Encoder 1

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x21010010
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1602 Digital Interface Control Encoder 2

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x29010010
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a05 Rotary Encoder SD Encoder 1

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	3
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x60040020
PDO Mapping	no

Sub	0x02
Name	Mapping Entry 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20300020
PDO Mapping	no

Sub	0x03
Name	Mapping Entry 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20010008
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a06 Event Counter

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	7
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080120
PDO Mapping	no

Sub	0x02
Name	Mapping Entry 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080220
PDO Mapping	no

Sub	0x03
Name	Mapping Entry 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080320
PDO Mapping	no

Sub	0x04
Name	Mapping Entry 4
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080420
PDO Mapping	no

Sub	0x05
Name	Mapping Entry 5
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080520

PDO Mapping	no

Sub	0x06
Name	Mapping Entry 6
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080620
PDO Mapping	no

Sub	0x07
Name	Mapping Entry 7
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20010008
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a07 Rotary Encoder SD Encoder 2

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	3
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x68040020
PDO Mapping	no

Sub	0x02
Name	Mapping Entry 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x28300020

PDO Mapping	no

Sub	0x03
Name	Mapping Entry 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x28010008
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1c00 Sync Manager Communication Type

Object Code	Array

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
Low Limit	0
High Limit	8
PDO Mapping	no

Sub	0x01
Name	Subindex 1
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
PDO Mapping	no

Sub	0x02
Name	Subindex 2
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x03
Name	Subindex 3
Data Type	UNSIGNED8
Access	ro

Defaultvalue	3
PDO Mapping	no

Sub	0x04
Name	Subindex 4
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

0x1c12 Sync Manager 2 PDO Assignment

Object Code	Array

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
Low Limit	0
High Limit	2
PDO Mapping	no

Sub	0x01
Name	Subindex
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x1600
PDO Mapping	no

Sub	0x02
Name	Subindex 2
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x1601
PDO Mapping	no

0x1c13 Sync Manager 3 PDO Assignment

Object Code	Array

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
Low Limit	0
High Limit	4
PDO Mapping	no

Sub	0x01
Name	Subindex
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x1a00
PDO Mapping	no

Sub	0x02
Name	Subindex 2
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x1a05
PDO Mapping	no

0x1c32 Sync Manager 2 Synchronization

Object Code	Record

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	32
Low Limit	0
High Limit	8
PDO Mapping	no

Sub	0x01
Name	Synchronization Type
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x02
Name	Cycle Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x04
Name	Synchronization Types supported
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x05
Name	Minimum Cycle Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x06
Name	Calc and Copy Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x08
Name	Get Cycle Time
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x10
PDO Mapping	no

Sub	0x09
Name	Delay Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x0a
Name	Sync0 Cycle Time
Data Type	UNSIGNED32

Access	rw
Defaultvalue	0x20
PDO Mapping	no

Sub	0x0b
Name	SM-Event missed
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x0c
Name	Cycle time too small
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x20
Name	Sync Error
Data Type	BOOLEAN
Access	ro
Defaultvalue	0x01
PDO Mapping	no

0x1c33 Sync Manager 3 Synchronization

Object Code	Record

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	32
Low Limit	0
High Limit	8
PDO Mapping	no

Sub	0x01
Name	Synchronization Type
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x02

Name	Cycle Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x04
Name	Synchronization Types supported
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x05
Name	Minimum Cycle Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x06
Name	Calc and Copy Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x08
Name	Get Cycle Time
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x20
PDO Mapping	no

Sub	0x09
Name	Delay Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x0a
Name	Sync0 Cycle Time
Data Type	UNSIGNED32
Access	rw

Defaultvalue	0x20
PDO Mapping	no

Sub	0x0b
Name	SM-Event missed
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x0c
Name	Cycle time too small
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x20
Name	Sync Error
Data Type	BOOLEAN
Access	ro
Defaultvalue	0x01
PDO Mapping	no

0x2001 Enc1 Error Register

Object Code	Variable

Sub	0x00
Name	Enc1 Error Register
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1ErrorRegister

0x2003 Enc1 Preset Value Signed

Object Code	Variable

Sub	0x00
Name	Enc1 Preset Value Signed
Data Type	INTEGER32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1PresetValueSigned

Offset value

0x2004 Enc1 Position Value Signed

Object Code	Variable

Sub	0x00
Name	Enc1 Position Value Signed
Data Type	INTEGER32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1PositionValueSigned

0x2008 Enc1 High Resolution Position Value Signed

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Position Value Signed
Data Type	INTEGER64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1HighResolutionPositionValueSigned

0x2009 Enc1 High Resolution Preset Value Signed

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Preset Value Signed
Data Type	INTEGER64
Access	rw
Defaultvalue	

PDO Mapping	no
Accessname	Enc1HighResolutionPresetValueSigned

High Resolution Offset Wert

0x2014 Enc1 Linear Position Value

Object Code	Variable

Sub	0x00
Name	Enc1 Linear Position Value
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1LinearPositionValue

Position value in user units

0x2015 Enc1 Linear Position Preset Value

Object Code	Variable

Sub	0x00
Name	Enc1 Linear Position Preset Value
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1LinearPositionPresetValue

Position offset in user units

0x2030 Enc1 High Resolution Speed Value

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Speed Value
Data Type	INTEGER32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1HighResolutionSpeedValue

Speed Value

0x2031 Enc1 Linear Speed Value

Object Code	Variable

Sub	0x00
Name	Enc1 Linear Speed Value
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1LinearSpeedValue

Speed value in user units

0x2032 Enc1 Speed Value Filter Select

Object Code	Variable

Sub	0x00
Name	Enc1 Speed Value Filter Select
Data Type	UNSIGNED8
Access	ro
Defaultvalue	11
PDO Mapping	no
Accessname	Enc1SpeedValueFilterSelect

Configuration object for speed calculation

0 no filter

10 PT1-filter

11 Integration (Default)

0x208f Enc1 Position Encoder Resolution

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Encoder Increments
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x000003E8
PDO Mapping	no

Accessname	Enc1PositionEncoderResolution.EncoderIncrements

Sub	0x02
Name	Motor Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc1PositionEncoderResolution.MotorRevolutions

Unit Conversion:

$$\frac{Encoder\ Increments\ 208f:01}{Motor\ Revolution\ 208f:02}$$

0x2091 Enc1 Gear Ratio

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Motor Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc1GearRatio.MotorShaftRevolutions

Sub	0x02
Name	Driving Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc1GearRatio.DrivingShaftRevolutions

Unit Conversion:

$$\frac{Motor\ Shaft\ Revolutions\ 2091{:}01}{Driving\ Shaft\ Revolutions\ 2091{:}02}$$

0x2092 Enc1 Feed Constant

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Feed
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000064
PDO Mapping	no
Accessname	Enc1FeedConstant.Feed

Sub	0x02
Name	Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc1FeedConstant.ShaftRevolutions

Unit Conversion:

$$\frac{Feed\ 2092{:}01}{Shaft\ Revolutions\ 2092{:}02}$$

0x2100 Enc1 Digital Interface Type

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Type
Data Type	UNSIGNED8
Access	rw
Defaultvalue	64
PDO Mapping	no
Accessname	Enc1DigitalInterfaceType

Settings of the connected encoder:

64 Encoder (default)

65 SSI

69 EnDat

80 Event counter

0x2101 Enc1 Digital Interface Control

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Control
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0
PDO Mapping	optional, RPDO only
Accessname	Enc1DigitalInterfaceControl

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RC6	RC5	RC4	RC3	RC2	RC1										REF

REF

A rising edge starts the referencing

RC1…6 (Reset Event Counter 1...6

A rising edge resets the corresponding event counter

0x2102 Enc1 Digital Interface Status

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Status
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1DigitalInterfaceStatus

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
													Dir	Ref	

Ref:

0 = Encoder is not referenced

1 = Encoder is referenced

Dir:

0 = Clockwise

1 = Counter clockwise

0x2103 Enc1 Digital Interface Config

Object Code	Record

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	5
PDO Mapping	no

Sub	0x01
Name	Enc1 Encoder: Level
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc1DigitalInterfaceConfig.Enc1Encoder: Level

Sub	0x02
Name	Enc1 Encoder: Mode
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no

Accessname	Enc1DigitalInterfaceConfig.Enc1Encoder: Mode

Sub	0x03
Name	Enc1 Encoder: Index level
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc1DigitalInterfaceConfig.Enc1Encoder:Indexlevel

Sub	0x04
Name	Enc1 SSI: Use grey code
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc1DigitalInterfaceConfig.Enc1SSI:Usegreycode

Sub	0x05
Name	Enc1 Event Counter: Sensitivity
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc1DigitalInterfaceConfig.Enc1EventCounter:Sensitivity

Object for configuration of the counter/ encoder interface

Subindex 01 (Encoder: Level)

0 HTL (default)

1 TTL

2 RS422

Subindex 02 (Encoder: Mode)

0 Multiturn Encoder, no Index (default)

1 Single Turn Encoder

Subindex 03 (Encoder: Index level)

0 Reference on rising edge (default)

1 Reference on falling edge

3 Reference on both edges

Subindex 04 (SSI: Use grey code)

0 Straight binary (default)

1 Grey coded binary

Subindex 05 (Event Counter: Sensitivity)

0 Count rising edges (default)

1 Count falling edges
3 Count both edges

0x2110 Enc1 Digital Interface Bit Size

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Bit Size
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc1DigitalInterfaceBitSize

SSI / ENDAT: Resolution of the encoder according to data sheet

0x2111 Enc1 Digital Interface Baud Rate

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Baud Rate
Data Type	UNSIGNED16
Access	rw
Defaultvalue	1000 (0x03E8)
PDO Mapping	No
Accessname	Enc1DigitalInterfaceBaudRate

SSI / ENDAT: Clock frequency in kHz according to data sheet of the encoder

0x2120 Enc1 Index Capture Value

Object Code	Variable

Sub	0x00
Name	Enc1 Index Capture Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1IndexCaptureValue

0x2122 Enc1 Encoder Track ABRef

Object Code	Variable

Sub	0x00
Name	Enc1 Encoder Track ABRef
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1EncoderTrackABRef

7	6	5	4	3	2	1	0
					Ref	B	A

Signal level at the corresponding encoder track

0x213f Enc1 ErrorCode

Object Code	Variable

Sub	0x00
Name	Enc1 ErrorCode
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc1ErrorCode

See table Object 0x1003 Pre-defined error field

0x2408 Event Counter Count

Object Code	Record

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	6
PDO Mapping	no

Sub	0x01
Name	Event Counter Channel 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel1

Sub	0x02
Name	Event Counter Channel 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel2

Sub	0x03
Name	Event Counter Channel 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel3

Sub	0x04
Name	Event Counter Channel 4
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel4

Sub	0x05
Name	Event Counter Channel 5
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel5

Sub	0x06
Name	Event Counter Channel 6
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel6

0x2801 Enc2 Error Register

Object Code	Variable

Sub	0x00
Name	Enc2 Error Register
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2ErrorRegister

0x2803 Enc2 Preset Value Signed

Object Code	Variable

Sub	0x00
Name	Enc2 Preset Value Signed
Data Type	INTEGER32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2PresetValueSigned

0x2804 Enc2 Position Value Signed

Object Code	Variable

Sub	0x00
Name	Enc2 Position Value Signed
Data Type	INTEGER32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2PositionValueSigned

0x2808 Enc2 High Resolution Position Value Signed

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Position Value Signed
Data Type	INTEGER64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2HighResolutionPositionValueSigned

0x2809 Enc2 High Resolution Preset Value Signed

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Preset Value Signed
Data Type	INTEGER64
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2HighResolutionPresetValueSigned

0x2814 Enc2 Linear Position Value

Object Code	Variable

Sub	0x00
Name	Enc2 Linear Position Value
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2LinearPositionValue

0x2815 Enc2 Linear Position Preset Value

Object Code	Variable

Sub	0x00
Name	Enc2 Linear Position Preset Value
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2LinearPositionPresetValue

0x2830 Enc2 High Resolution Speed Value

Object Code	Variable

Sub	0x00
Name	Enc2 Linear Position Preset Value
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2LinearPositionPresetValue

0x2831 Enc2 Linear Speed Value

Object Code	Variable

Sub	0x00
Name	Enc2 Linear Speed Value
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2LinearSpeedValue

0x2832 Enc2 Speed Value Filter Select

Object Code	Variable

Sub	0x00
Name	Enc2 Speed Value Filter Select
Data Type	UNSIGNED8
Access	ro
Defaultvalue	11
PDO Mapping	no
Accessname	Enc2SpeedValueFilterSelect

0x288f Enc2 Position Encoder Resolution

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Encoder Increments
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x000003E8
PDO Mapping	no
Accessname	Enc2PositionEncoderResolution.EncoderIncrements

Sub	0x02
Name	Motor Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc2PositionEncoderResolution.MotorRevolutions

0x2891 Enc2 Gear Ratio

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Motor Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc2GearRatio.MotorShaftRevolutions

Sub	0x02
Name	Driving Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc2GearRatio.DrivingShaftRevolutions

0x2892 Enc2 Feed Constant

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Feed
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc2FeedConstant.Feed

Sub	0x02
Name	Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000064
PDO Mapping	no
Accessname	Enc2FeedConstant.ShaftRevolutions

0x2900 Enc2 Digital Interface Type

Object Code	Variable

Sub	0x00
Name	Enc2 Digital Interface Type
Data Type	UNSIGNED8
Access	rw
Defaultvalue	64
PDO Mapping	no
Accessname	Enc2DigitalInterfaceType

Settings of the connected encoder:

64 Encoder
65 SSI
69 EnDat
80 Event counter

0x2901 Enc2 Digital Interface Control

Object Code	Variable

Sub	0x00
Name	Enc2 Digital Interface Control
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	Enc2DigitalInterfaceControl

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RC6	RC5	RC4	RC3	RC2	RC1										REF

REF

A rising edge starts the referencing

RC1…6 (Reset Event Counter 1...6

A rising edge resets the corresponding event counter

0x2902 Enc2 Digital Interface Status

Object Code	Variable

Sub	0x00
Name	Enc2 Digital Interface Status
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2DigitalInterfaceStatus

Ref:

0 = Encoder is not referenced

1 = Encoder is referenced

Dir:

0 = Clockwise

1 = Counter clockwise

0x2903 Enc2 Digital Interface Config

Object Code	Record

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	5
PDO Mapping	no

Sub	0x01
Name	Enc2 Encoder: Level
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc2DigitalInterfaceConfig.Enc2Encoder:Level

Sub	0x02
Name	Enc2 Encoder: Mode
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no

Accessname	Enc2DigitalInterfaceConfig.Enc2Encoder:Mode

Sub	0x03
Name	Enc2 Encoder: Index level
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc2DigitalInterfaceConfig.Enc2Encoder:Indexlevel

Sub	0x04
Name	Enc2 SSI: Use grey code
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc2DigitalInterfaceConfig.Enc2SSI:Usegreycode

Sub	0x05
Name	Enc2 Event Counter: Sensitivity
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc2DigitalInterfaceConfig.Enc2EventCounter:Sensitivity

Object for configuration of the counter/ encoder interface

Subindex 01 (Encoder: Level)

0 HTL (default)

1 TTL

2 RS422

Subindex 02 (Encoder: Mode)

0 Multiturn Encoder, no Index (default)

1 Single Turn Encoder

Subindex 03 (Encoder: Index level)

0 Reference on rising edge (default)

1 Reference on falling edge

3 Reference on both edges

Subindex 04 (SSI: Use grey code)

0 Straight binary (default)

1 Grey coded binary

Subindex 05 (Event Counter: Sensitivity)

0 Count rising edges (default)

1 Count falling edges

3 Count both edges

0x2910 Enc2 Digital Interface Bit Size

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Bit Size
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc2DigitalInterfaceBitSize

SSI / EnDat: Resolution of the encoder according to data sheet

0x2911 Enc2 Digital Interface Baud Rate

Object Code	Variable

Sub	0x00
Name	Enc2 Digital Interface Baud Rate
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x03E8
PDO Mapping	no
Accessname	Enc2DigitalInterfaceBaudRate

SSI / EnDat: Clock frequency in kHz according to data sheet of the encoder

0x2920 Enc2 Index Capture Value

Object Code	Variable

Sub	0x00
Name	Enc2 Index Capture Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2IndexCaptureValue

0x2921 Enc2 Capture Input Value

Object Code	Variable

Sub	0x00
Name	Enc2 Capture Input Value
Data Type	INTEGER64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2CaptureInputValue

0x2922 Enc2 Encoder Track ABRef

Object Code	Variable

Sub	0x00
Name	Enc2 Encoder Track ABRef
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2EncoderTrackABRef

7	6	5	4	3	2	1	0
					Ref	B	A

Signal level at the corresponding encoder track

0x293f Enc2 ErrorCode

Object Code	Variable

Sub	0x00
Name	Enc2 ErrorCode
Data Type	UNSIGNED16
Access	ro

Defaultvalue	
PDO Mapping	no
Accessname	Enc2ErrorCode

See table object 0x1003 Pre-defined error field

0x6000 Enc1 Operating Parameters

Object Code	Variable

Sub	0x00
Name	Enc1 Operating Parameters
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1OperatingParameters

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												DIR			

Bit 3 DIR

0 = Clockwise

1 = Counter clockwise

0x6002 Enc1 Total Measuring Range

Object Code	Variable

Sub	0x00
Name	Enc1 Total Measuring Range
Data Type	UNSIGNED32
Access	rw
Defaultvalue	4000
PDO Mapping	no
Accessname	Enc1TotalMeasuringRange

Encoder resolution. With setting "Single Turn" relevant for the overflow

0x6003 Enc1 Preset Value

Object Code	Variable

Sub	0x00
Name	Enc1 Preset Value
Data Type	UNSIGNED32
Access	rw
Defaultvalue	

PDO Mapping	no
Accessname	Enc1PresetValue

Offset values

0x6004 Enc1 Position Value

Object Code	Variable

Sub	0x00
Name	Enc1 Position Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1PositionValue

0x6008 Enc1 High Resolution Position Value

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Position Value
Data Type	UNSIGNED64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1HighResolutionPositionValue

0x6009 Enc1 High Resolution Preset Value

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Preset Value
Data Type	UNSIGNED64
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1HighResolutionPresetValue

0x600b Enc1 High Resolution Raw Value

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Raw Value
Data Type	UNSIGNED64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1HighResolutionRawValue

64- Bit raw encoder value without offsets and homing and index

0x600c Enc1 Position Raw Value

Object Code	Variable

Sub	0x00
Name	Enc1 Position Raw Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1PositionRawValue

32- Bit raw encoder value without offsets and homing and index

0x6030 Enc1 Speed Value

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
PDO Mapping	no

Sub	0x01
Name	Enc1 Speed Value Channel 1
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1SpeedValue.Enc1SpeedValueChannel1

0x6031 Enc1 Speed Parameters

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	Enc1 Speed Source Selector
Data Type	UNSIGNED16
Access	rw
Defaultvalue	4
PDO Mapping	no
Accessname	Enc1SpeedParameters.Enc1SpeedSourceSelector

Sub	0x02
Name	Enc1 Speed Integration Time
Data Type	UNSIGNED16
Access	ro
Defaultvalue	100
PDO Mapping	no
Accessname	Enc1SpeedParameters.Enc1SpeedIntegrationTime

Sub	0x03
Name	Enc1 Multiplier value
Data Type	UNSIGNED16
Access	ro
Defaultvalue	1
Low Limit	1
High Limit	65535
PDO Mapping	no
Accessname	Enc1SpeedParameters.Enc1Multipliervalue

Sub	0x04
Name	Enc1 Divider value
Data Type	UNSIGNED16
Access	rw
Defaultvalue	1
Low Limit	1
High Limit	65535
PDO Mapping	no

Accessname	Enc1SpeedParameters.Enc1Dividervalue

Sub 01:

4= Use Object 0x600B

Sub 02:

Integration time in [ms]

Sub 03:

Conversion factor for velocity calculation, result in 0x6030

Sub 04:

Conversion devider for velocity calculation, result in 0x6030

0x6500 Enc1 Operating Status

Object Code	Variable

Sub	0x00
Name	Enc1 Operating Status
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc1OperatingStatus

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												DIR			

Bit 3 DIR

0 = Clockwise

1 = Counter clockwise

0x6800 Enc2 Operating Parameters

Object Code	Variable

Sub	0x00
Name	Enc2 Operating Parameters
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2OperatingParameters

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												DIR			

Bit 3 DIR

0 = Clockwise

1 = Counter clockwise

0x6802 Enc2 Total Measuring Range

Object Code	Variable

Sub	0x00
Name	Enc2 Total Measuring Range
Data Type	UNSIGNED32
Access	rw
Defaultvalue	4000
PDO Mapping	no
Accessname	Enc2TotalMeasuringRange

Encoder resolution. With setting "Single Turn" relevant for the overflow

0x6803 Enc2 Preset Value

Object Code	Variable

Sub	0x00
Name	Enc2 Preset Value
Data Type	UNSIGNED32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2PresetValue

Offset value

0x6804 Enc2 Position Value

Object Code	Variable

Sub	0x00
Name	Enc2 Position Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2PositionValue

0x6808 Enc2 High Resolution Position Value

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Position Value
Data Type	UNSIGNED64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2HighResolutionPositionValue

5.1.2.1.1 0x6809 Enc2 High Resolution Preset Value

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Preset Value
Data Type	UNSIGNED64
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2HighResolutionPresetValue

5.1.2.1.2 0x680b Enc2 High Resolution Raw Value

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Raw Value
Data Type	UNSIGNED64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2HighResolutionRawValue

64- Bit raw encoder value without offsets and homing and index

0x680c Enc2 Position Raw Value

Object Code	Variable

Sub	0x00
Name	Enc2 Position Raw Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2PositionRawValue

32- Bit raw encoder value without offsets and homing and index

0x6830 Enc2 Speed Value

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
PDO Mapping	no

Sub	0x01
Name	Enc2 Speed Value Channel 1
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2SpeedValue.Enc2SpeedValueChannel1

0x6831 Enc2 Speed Parameters

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	Enc2 Speed Source Selector
Data Type	UNSIGNED16
Access	rw
Defaultvalue	4
PDO Mapping	no
Accessname	Enc2SpeedParameters.Enc2SpeedSourceSelector

Sub	0x02
Name	Enc2 Speed Integration Time
Data Type	UNSIGNED16
Access	ro
Defaultvalue	100
PDO Mapping	no
Accessname	Enc2SpeedParameters.Enc2SpeedIntegrationTime

Sub	0x03
Name	Enc2 Multiplier Value
Data Type	UNSIGNED16
Access	ro
Defaultvalue	1
Low Limit	1
High Limit	65535
PDO Mapping	no
Accessname	Enc2SpeedParameters.Enc2MultiplierValue

Sub	0x04
Name	Enc2 Divider value
Data Type	UNSIGNED16
Access	ro
Defaultvalue	1
Low Limit	1

High Limit	65535
PDO Mapping	no
Accessname	Enc2SpeedParameters.Enc2Dividervalue

Sub 01:

4= Use Object 0x680B

Sub 02:

Integration time in [ms]

Sub 03:

Conversion factor for velocity calculation, result in 0x6830

Sub 04:

Conversion devider for velocity calculation, result in 0x6830

0x6d00 Enc2 Operating Status

Object Code	Variable

Sub	0x00
Name	Enc2 Operating Status
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc2OperatingStatus

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												DIR			

Bit 3 DIR

0 = Clockwise

1 = Counter clockwise

Technical Data

General

Order no.	694.454.53
I/O Supply	24 VDC (-20% / +25%)
Dimensions WxHxD	25 x 120 x 90 mm
Mounting	35 mm DIN-top hat rail
Storage temperature	-25°C … +70°C
Operating temperature	0°C … +55°C
Relative humidity	5% … 95% without dewing
Protection	IP20
Interference immunity	Zone B (DIN EN 61131-2)

Fieldbus (System)

Type	EtherCAT* 100 Mbit/s
Connection	10-pole system plug at the side
Logic supply	from EtherCAT-Coupler via E-Bus-plug
E-Bus-Last	<100mA
Galvanic separation	Separated from one another and versus the bus

Counter/Encoder

RS422	32Bit, 5 MHz
5/24V Single Ended	32Bit, 1,6 MHz
SSI	18-32 Bit, 80-1000 Kbit/s
EnDAT 2.1	100 kHz – 2 MHz
Event counter (CNT0-5)	6 x HTL/TTL 32Bit, 1 kHz

Encoder supply:	5V/150mA / encoder
Wire length:	<30m shielded cable

5.1.3 Kuhnke FIO Drive Control

There is a separate instruction manual available for Kuhnke FIO Drive Control from the FIO range. For further information, please click the link below.

Link to the documentation: http://productfinder.kuhnke.kendrion.com/de

Technical Data

Type	Kuhnke FIO Drive Control
Motor connection	2-phase stepper motor or brushless DC motor
Power supply	electronics 24 VDC, motor 12..72 VDC (cULus 12..48 VDC)
Nominal current	5 A, max 55°C, 5A @ 12..24 VDC / 4A @ 48 VDC)
Peak current	stepper motor: 10 A / brushless DC motor: 15 A
Incremental encoder	5V / 24V (A, /A, B, /B, Z, /Z)
Hall generator	24 V (H1, H2, H3) or 3 extra low side switching digital inputs
Digital inputs	5x 1 ms (configurable, reference switch, limit switch, enable)
Digital outputs	1x 0.5 A (brake output or standard output)
Fieldbus port	EtherCAT® 100 Mbps LVDS: E-bus
Installation	35 mm DIN rail
Signal indication	LED located next to the terminal
Shield	provided directly by the module
Terminals	spring-assisted combi plug w/ mechanical ejector
Ambient conditions	0 °C…+55 °C, IP 20, immunity to noise: Zone B to EN61131-2
Housing (W x H x D)	aluminium frame, plastic 25 x 120 x 90 [mm]
Approval	CE, cULus

5.1.4 Kuhnke FIO CAM Control

There is a separate instruction manual available for Kuhnke FIO CAM Control from the FIO range.
For further information, please click the link below.

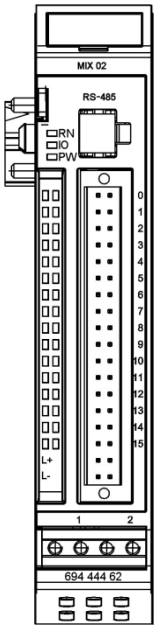
Link to the documentation: http://productfinder.kuhnke.kendrion.com/de

Technical Data

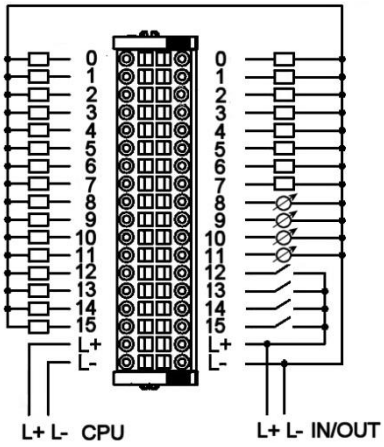
Type	Kuhnke FIO CAM Control
Cam tracks (outputs)	24 x 0.5 A (dead time compensation 1 to 5000 ms) & 8 software tracks, 8 cams per track
Total output current I_{tot}	4.5 A
Inputs	1x 24 VDC, 1 ms, 4x 24 VDC or 0...10 V (configurable)
Encoder interface	incremental 24 VDC, A, B, Ref., absolute via CAN or EtherCAT
Cam programs	32
Cycle Time	20 µs
Max. speed	1000 rpm (@ 1° resolution)
Fieldbus port	EtherCAT® 100 Mbps LVDS: E-bus
Installation	35 mm DIN rail
Signal indication	LED located next to the terminal
Shield	Provided directly by the module
Terminals	Spring-assisted combi plug w/ mechanical ejector
Ambient conditions	0 °C…+55 °C, IP 20, immunity to noise: Zone B to EN61131-2
Housing (W x H x D)	aluminium frame, plastic 25 x 120 x 90 [mm]
Approval	CE, cULus

5.2 Mixed Modules

5.2.1 MIX 02



Front view of I/O module MIX 02



I/O connection

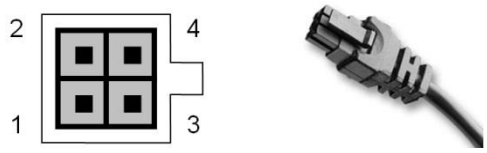
Terminals

IO connection, male 36-pin

Side	Trm.	Signal		Explanation		
left	0..15	DO8..DO23		digital outputs 8..23		
	16, 17	+24VDC, 0V		module power supply to CPU		
right	0..7	DO0..DO7		digital outputs 1..7		
	8..11	AI0..AI3, DI0..DI3		analogue inputs (optionally used as DI)		
	12	DI4		digital input DI		
	13	DI5	C_cycle	DI	counting cycle input (rising edge)	
	14	DI6	C_Dir	DI	counting direction	FALSE: up
						TRUE: down
	15	DI7	C_Clear	DI	clear counter (rising edge)	
	16, 17	+24VDC, 0V		IO power supply		

Operative earth / shield of analogue and counter lines → section Earth

RS484 Port



Female 4-pin Molex Micro Fit

Pin	Signal	Explanation
1	DGND	data earth potential (reference potential of TxD/RxD)
2	GND	earth potential
3	RxD/TxD-P	Data +
4	RxD/TxD-N	Data -

Status LEDs

LED "RN"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Red, flashing	1x short circuit 2x low voltage
Start, defective	Red	Module not initialised

LED "PW"

The LED labelled "PW" 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"

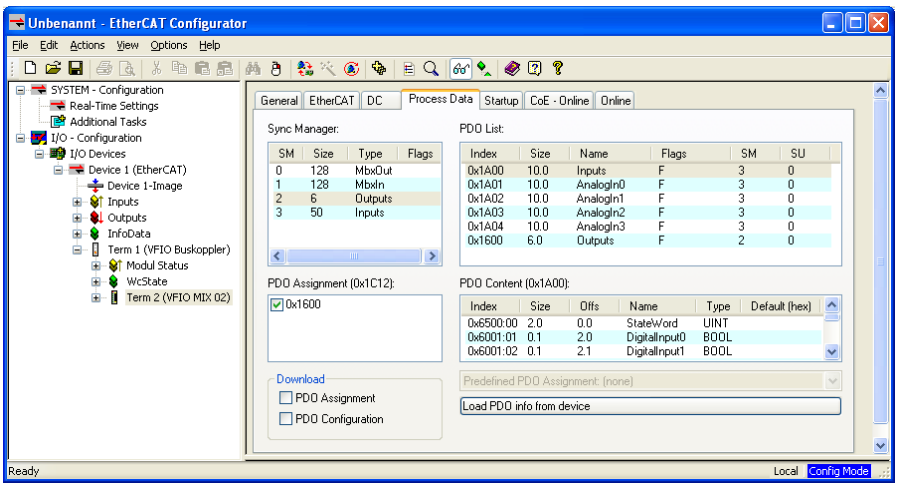
The LEDs labelled "Channel" indicate the state of the associate input/output signal.

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

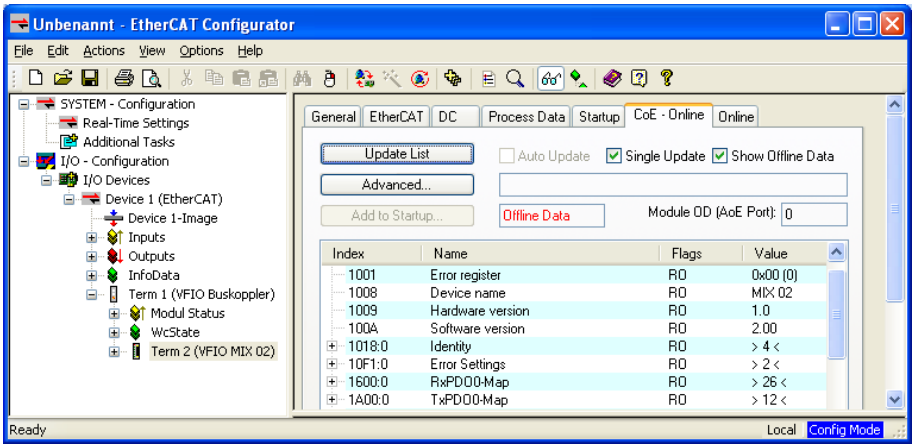
Function (CoE Variant)

Module MIX 02 features 4 interrupt-enabled digital inputs (configurable as counters), 4 analogue inputs (configurable as digital inputs) and 24 digital outputs.

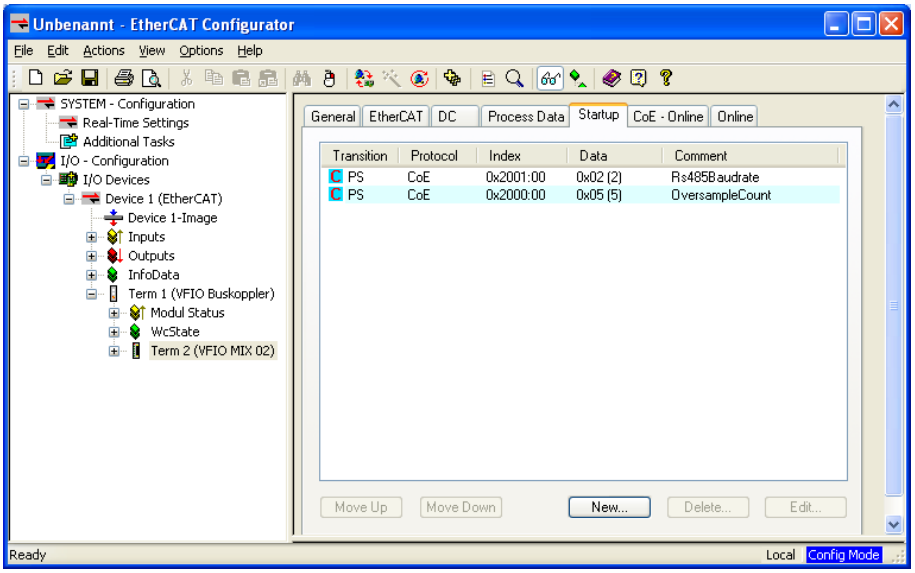
The process data objects stored as variables in the EtherCAT master's control program are used to access the IOs and the module state.



Service data objects (SDO) are available for details and settings.



You may run the configuration tool offline to change some settings of module MIX 02 (such as the RS485 baud rate). The EtherCAT master will apply the settings when starting up the module.



You can also use the SDO transfer components available for the EtherCAT master to change settings at runtime and to handle RS485 data transfer.

Inputs

The following input values apply to group Inputs:

Variable	Data type	Explanation	
StateWord	UINT	State word	
		Bit0	Data ready for RS485 reception
		Bit1	RS485 in-buffer overflow
		Bit2	Short circuit (overload) of outputs
		Bit3	Low CPU voltage
		Bit4	Low In/Out (load) voltage
		Bit5	EtherCAT watchdog error
		Bit6..15	Not used
DigitalInput0	BOOL	Digital input 0	
DigitalInput1	BOOL	Digital input 1	
DigitalInput2	BOOL	Digital input 2	
DigitalInput3	BOOL	Digital input 3	
DigitalInput4	BOOL	Digital input 4	
DigitalInput5	BOOL	Digital input 5	
DigitalInput6	BOOL	Digital input 6	
DigitalInput7	BOOL	Digital input 7	
Counter	UDINT	Reading of event counter at DI5	
SampleCycleCounter	UINT	Increments when new analogue values are available	

AnalogIn0

The following input values apply to group AnalogIn0:

Variable	Data type	Explanation
AnalogIn0_Sample0	UINT	Analogue input 0, sample n
AnalogIn0_Sample1	UINT	Analogue input 0, sample n+1
AnalogIn0_Sample2	UINT	Analogue input 0, sample n+2
AnalogIn0_Sample3	UINT	Analogue input 0, sample n+3
AnalogIn0_Sample4	UINT	Analogue input 0, sample n+4

AnalogIn1

The following input values apply to group AnalogIn1:

Variable	Data type	Explanation
AnalogIn1_Sample0	UINT	Analogue input 1, sample n
AnalogIn1_Sample1	UINT	Analogue input 1, sample n+1
AnalogIn1_Sample2	UINT	Analogue input 1, sample n+2
AnalogIn1_Sample3	UINT	Analogue input 1, sample n+3
AnalogIn1_Sample4	UINT	Analogue input 1, sample n+4

AnalogIn2

The following input values apply to group AnalogIn2:

Variable	Data type	Explanation

AnalogIn2_Sample0	UINT	Analogue input 2, sample n
AnalogIn2_Sample1	UINT	Analogue input 2, sample n+1
AnalogIn2_Sample2	UINT	Analogue input 2, sample n+2
AnalogIn2_Sample3	UINT	Analogue input 2, sample n+3
AnalogIn2_Sample4	UINT	Analogue input 2, sample n+4

AnalogIn3

The following input values apply to group AnalogIn3:

Variable	Data type	Explanation
AnalogIn3_Sample0	UINT	Analogue input 3, sample n
AnalogIn3_Sample1	UINT	Analogue input 3, sample n+1
AnalogIn3_Sample2	UINT	Analogue input 3, sample n+2
AnalogIn3_Sample3	UINT	Analogue input 3, sample n+3
AnalogIn3_Sample4	UINT	Analogue input 3, sample n+4

Outputs

The following input values apply to group Outputs:

Variable	Data type	Explanation	
ControlWord	UINT	Bit 0	Reset error message
		Bit 1	Reset counter (started by edge 0->1)
		Bits 2..15	Not used
DigitalOutput0	BOOL	Digital output 0	
DigitalOutput1	BOOL	Digital output 1	
DigitalOutput2	BOOL	Digital output 2	
DigitalOutput3	BOOL	Digital output 3	
DigitalOutput4	BOOL	Digital output 4	
DigitalOutput5	BOOL	Digital output 5	
DigitalOutput6	BOOL	Digital output 6	
DigitalOutput7	BOOL	Digital output 7	
DigitalOutput8	BOOL	Digital output 8	
DigitalOutput9	BOOL	Digital output 9	
DigitalOutput10	BOOL	Digital output 10	
DigitalOutput11	BOOL	Digital output 11	
DigitalOutput12	BOOL	Digital output 12	
DigitalOutput13	BOOL	Digital output 13	
DigitalOutput14	BOOL	Digital output 14	
DigitalOutput15	BOOL	Digital output 15	
DigitalOutput16	BOOL	Digital output 16	
DigitalOutput17	BOOL	Digital output 17	
DigitalOutput18	BOOL	Digital output 18	
DigitalOutput19	BOOL	Digital output 19	
DigitalOutput20	BOOL	Digital output 20	
DigitalOutput21	BOOL	Digital output 21	
DigitalOutput22	BOOL	Digital output 22	
DigitalOutput23	BOOL	Digital output 23	

Variable	Data type	Explanation
DigitalOutput24	BOOL	Digital output 24

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0xF0191		RO
1008	Device Name	String	MIX 02		RO
1009	Hardware Version	String	1.0		RO
100A	Software Version	String	2.00		RO
1018	Identity Object	Array			
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	177173		RO
1018, 3	Revision Number	UINT32	2		RO
1018, 4	Serial Number	UINT32	0		RO
2000	OversamplingCount	UINT8	5	1,5	RW
2001	Rs485Baudrate	UINT8	2	0,9	RW
2002	Rs485Data	Octet String 10			RW
6000	counter	UINT32			RO P
6001	Digital Inputs	Array			
6001, 1..8	DigitalIn0..7	BOOL			RO P
6010	SampleCycleCounter	UINT16			RO P
6401	AnalogIn0	Array			
6401, 1..5	Sample0..4	UINT16			RO P
6402	AnalogIn1	Array			
6402, 1	Sample0	UINT16			RO P
6402, 2	Sample1	UINT16			RO P
6402, 3	Sample2	UINT16			RO P
6402, 4	Sample3	UINT16			RO P
6402, 5	Sample4	UINT16			RO P
6403	AnalogIn2	Array			
6403, 1..5	Sample0..5	UINT16			RO P
6404	AnalogIn3	Array			
6404, 1..5	Sample0..5	UINT16			RO P
6500	StateWord	UINT16			RO P
7000	DigitalOutputs	Array			
7000, 1..24	DigitalOut0..23	BOOL			RW P
7001	ControlWord	UINT16			RW P

RO=read-only, RW= read/write, P=process image

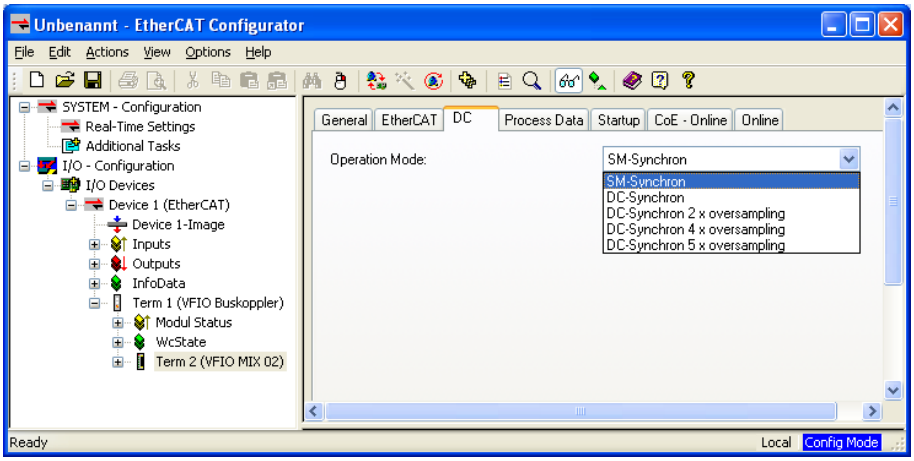
Analogue Inputs / Oversampling

The module cyclically gets the sensor values of the analogue inputs and assigns them to variables available for download by the EtherCAT master. Analysing the progression of analogue values must take account of both the cycle time of analogue conversions and the EtherCAT cycle.

Oversampling and its configurable parameters is provided by the module for detailed analysis. There are 2 control methods you can choose from in the configuration tool:

synchronised with SM (SM=Sync Master)

synchronised with DC (DC=Distributed Clocks)



Analogue Inputs / Oversampling Synchronised with SM

The module measures 4 analogue values per millisecond and adds or does not add them to the process image, depending on what the Oversampling parameter (Object Index 0x2000) is set to. The default is 5.

This setting refreshes the analogue process image every 5 ms (check how counter input *SampleCycleCounter* increments). The readings taken every millisecond are entered in *Sample0..4* of variable *AnalogIn0.. AnalogIn4*.

Lower parameter settings refresh the process image more often and the unused sample values are left blank.

Example:

Oversampling parameter = 1 refreshes the process image after 1 millisecond already.
Values will be entered in *Sample0* only. *Sample 1..4* are left blank.

Oversampling Synchronised with DC

Interrupt SYNC0 is used for analogue sampling whereas interrupt SYNC1 is used to transfer the data to the process image.

SYNC0 can be 1 to 5 times faster than SYNC1.

Example 1:

Bus cycle = 5 ms. Setting to use: "DC-synchronised 5x oversampling".

This is running Sync1 every 5 ms and SYNC0 every 1 ms.

Thus, analogue samples are read every millisecond and added to *Sample 0 to 4* of the process image after 5 ms. The *SampleCycleCounter* increments after 5 ms.

Example 2:

Bus cycle = 2 ms. Setting to use: "DC-synchronised 4x oversampling".

This is running Sync1 every 2 ms and SYNC0 every 0.5 ms.

Thus, analogue samples are read every half millisecond and added to Sample 0 to 3 of the process image after 2 ms. Sample4 stays 0. The SampleCycleCounter increments after 2 ms.

Example 3:

Bus cycle = 1 ms. Setting to use: "DC-synchronised".

This is running Sync0 every 1 ms.

Thus, analogue samples are read and added to Sample 0 of the process image every millisecond. Sample1 to 4 stay 0.
The *SampleCycleCounter* increments after 1 ms.

RS485

Object 0x2001 sets the RS485 baud rate.

Value	Baud Rate
0	2400
1	4800
2 (default)	9600
3	19200
4	38400
5	57600
6	115200
7	230400
8	460800
9	921600

Object 0x2002 is used to send and receive data.

Byte	Explanation
0	Volume of data
1	-
2	Data byte 0
…	…
9	Data byte 7

Writing the object sends the [volume of data] of data bytes 0..7.

Reading the object retrieves not more than 8 data bytes from the in-queue.

[Volume of data] = 0 means that no data has been received.

Every SDO transfer to and from the object contain 10 bytes.

Bit0 of the StateWord indicates that there is data in the in-queue.

The data-in buffer contains not more than 1024 bytes. Bit1 of the *StateWord* indicates a buffer overflow.

Counter

Inputs DI5..7 are not only used as digital inputs but also as an event counter.

Counter reading *Inputs, Counter* is a 32-bit value.

- The counting cycle connects to DI5.
- DI6 sets the counting direction.
  If DI6=FALSE, every rising edge of DI5 increments *Inputs, Counter*.
  If DI6=TRUE , every rising edge of DI5 decrements *Input Data, PositionCounter*.

A rising edge of DI7 sets *Input, Counter* to 0

The count can also be reset by the software (rising edge of *Outputs, ControlWord Bit1*).

Analogue Inputs / Oversampling

Analogue values are converted cyclically every 1 ms but not synchronised with the receipt of EtherCAT frames. The module provides oversampling.

Reading are or are not added to the process image, depending on what the oversampling parameter is set to. The default is 5.

This setting refreshes the entire set of analogue values in the process images after 5 ms (check how the counter in the StateWord increments). The readings taken every 1 ms are entered in variables AnalogInx_Sample0..4 (x=0..3).

Lower oversampling parameter settings refresh the process image more often and the unused sample values are left blank.

Oversampling parameter = 1 refreshes the process image after 1 millisecond already.
Values will be entered in Sample0 only. Samples 1..4 are left blank.

	***Information***
	Refreshing of the EtherCAT master's analogue values: *Take account of the EtherCAT cycle to assess whether the EtherCAT master's values are up-to-date. Ideal EtherCAT cycles for this module are 1 ms to 5 ms long.*

	***Information***
	Consistent analogue values: *The module provide consistent sets of analogue values. Note that analysing the master's sample values must also be consistent.*

	***Information***
	Quality of analogue values: *Best results are obtained by connecting the shield of the signal cables to operative earth.*

Low Voltage

Low CPU or load voltage turns off the outputs, sets bits 3 or 4 of Inputs, StateWord and makes LED IO of the module flash (2x).

Use Outputs, ControlWord bit0 to reset the error when the voltage has returned to the admissible range (24V -20%..+25%). This also re-enables the outputs.

Short Circuit

A thermal fuse at the output driver protects the outputs. When the current exceeds the admissible range, the associated output turns off, bits 3 of Inputs, StateWord are set and LED IO of the module flashes (1x).

Use Outputs, ControlWord bit0 to reset the error after removing the short circuit.

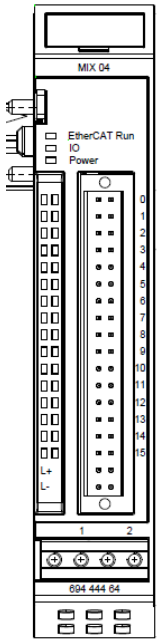
Technical Data

Digital inputs	4 (8) DI0..3 1ms DI4 0.1ms DI5..7 0.001ms
Counter (DI5)	500kHz (up to 1 MHz)2
Digital outputs	24 DO0..7: 0.5A DO8..23: 0.1A
Analogue inputs	4 x 0..10V
Resolution	12 bit
Sampling rate	1ms
RS485	Electrically insulated
Baud rate	2.4…921.6 kBit/s
Connection	e.g. 4 x KDT 621 (9.6 or 19.2 kBit/s)
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	90 mA
Part no.	694 444 62 (CoE variant)
Approval:	c UL us LISTED 59DM E202287 EtherCAT Conformance tested

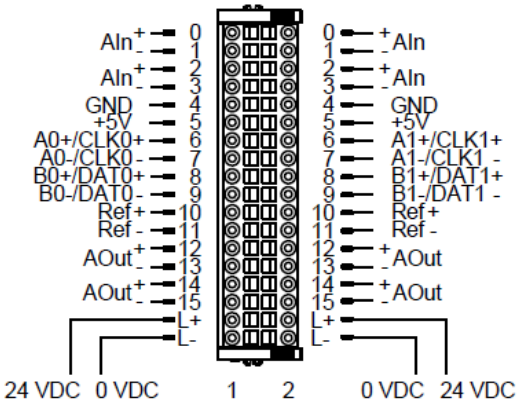
[2] Value between brackets applies to ideal clock signal and ground.

5.2.2 MIX 04

Front view and I/O connection



Front view I/O-Module MIX 04



I/O connection

Status LEDs

LED "EtherCAT Run"

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

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	green,	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if bootstrap mode is supported

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No Error
Error	Off	Malfunction of module if E-bus LED = On
		Inoperative if E-bus LED = Off
	Red, 2 x	Undervoltage
	Red, 3 x	Watchdog internal
	Red, 4 x	EtherCAT watchdog control
	Red, 6 x	Module- specific error, please see details in Predefined Error Field 0x1003:01 … 08
	Red, 7 x	Configuration error (E-bus pre-operational), no. of process data differs from that in the module
Start, defective	Red, on	Module defektiv

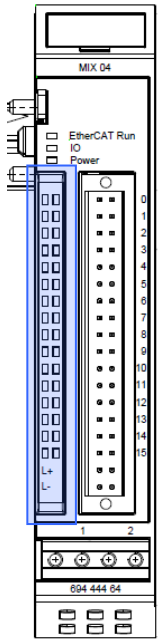
LED "Power"

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

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

LEDs "Channel"

The channel LEDs indicates the state of the In-/Output-Signals.

Channel			Channel	Explanation	
AI0+	■	■	AI2+	2-color LED: Analogue input activated, Error	
AI0-			AI2-		
AI1+	■	■	AI3+	2- color LED: Analogue input activated, Error	
AI1-			AI3-		
GND			GND		
5V			5V		
A+/CLK+			A+/CLK+	Inkremental encoder: The LEDs indicate the signal status of the incremental encoder track. EnDat / SSI: The LEDs light up in time with the clock or data signal Event counter: The LEDs indicate the signal state of the event counter input	
A-/CLK-			A-/CLK-		
B+/DAT+			B+/DAT+		
B-/DAT-			B-/DAT-		
Z+			Z+		
Z-			Z-		
AO0+			AO2+	Analogue output activated and without error	
AO0-			AO2-		
AO1+			AO3+	Analogue output activated and without error	
AO1-			AO3-		

Function

The Kuhnke FIO MIX 04 module has 4 analogue inputs for recording current or voltage values and 4 analogue outputs for outputting analogue current or voltage values.

Furthermore the Kuhnke FIO Mix 04 module has 2 counter / encoder interfaces for the connection of incremental encoders or absolute value position encoders with SSI or EnDat interface. The interface can also be configured as event counter, so that 6 independent event counters are available.

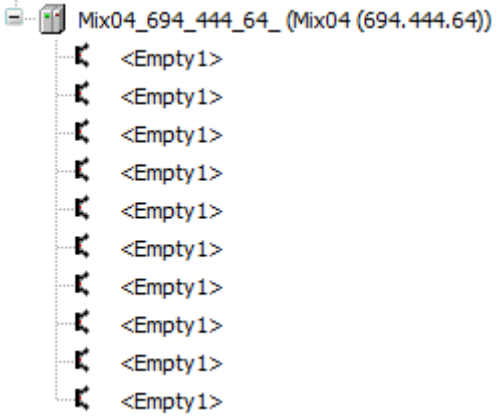
All channels can be parameterized almost independently of each other, which gives the module a high degree of flexibility.

Module configuration

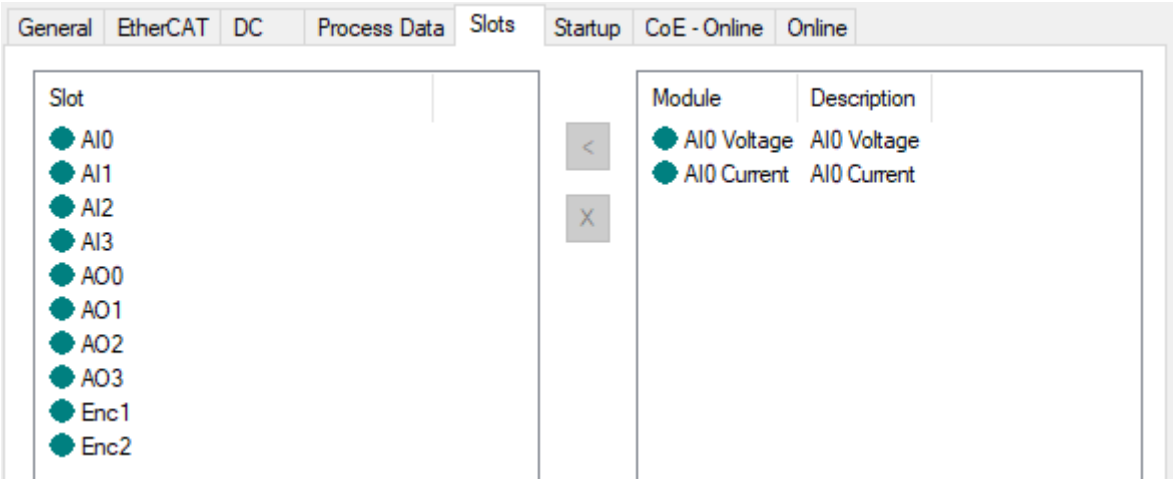
The configuration of the analogue inputs and outputs as well as the counter/encoder interfaces is done via pluggable modules that are inserted into the corresponding slots. One slot corresponds to one analogue channel or one counter/encoder interface. Only suitable modules can be plugged into the selected slot. This procedure is based on the "EtherCAT Modular Device Profile".

	Information
	All slots must be equipped with a module.

View CODESYS- device tree



TwinCAT2 Slot- configuration



Configuration - Overview of pluggable modules

Slot	Slot name	Function	Module code	Module function
1	AI0	Analogue Input AI0	192361001	AI0 Voltage
			192361002	AI0 Current 0..20mA
			192361003	AI0 Current 4..20mA
2	AI1	Analogue Input AI1	192361004	AI1 Voltage
			192361005	AI1 Current 0..20mA
			192361006	AI1 Current 4..20mA
3	AI2	Analogue Input AI2	192361007	AI2 Voltage
			192361008	AI2 Current 0..20mA
			192361009	AI2 Current 4..20mA
4	AI3	Analogue Input AI3	192361010	AI3 Voltage
			192361011	AI3 Current 0..20mA
			192361012	AI3 Current 4..20mA
5	Enc1	Encoder 1	192361013	Enc1 Counter
			192361014	Enc1 SSI
			192361015	Enc1 EnDat
			192361016	Enc event counter
6	Enc2	Encoder 2	192361017	Enc2 Counter
			192361018	Enc2 SSI
			192361019	Enc2 EnDat
			192361020	Enc event counter
7	AO0	Analogue Output AO0	192361021	AO0 0..10V
			192361022	AO0 -10..10V
			192361023	AO0 0..20mA
			192361024	AO0 4..20mA
			192361025	AO0 off
8	AO1	Analogue Output AO1	192361026	AO1 0..10V
			192361027	AO1 -10..10V
			192361028	AO1 0..20mA
			192361029	AO1 4..20mA
			192361030	AO1 off
9	AO2	Analogue Output AO2	192361031	AO2 0..10V
			192361032	AO2 -10..10V
			192361033	AO2 0..20mA
			192361034	AO2 4..20mA
			192361035	AO2 off
10	AO3	Analogue Output AO3	192361036	AO3 0..10V
			192361037	AO3 -10..10V
			192361038	AO3 0..20mA
			192361039	AO3 4..20mA
			192361040	AO3 off

Encoder interface

The universal encoder interface offers a wide range of possibilities for the acquisition of angles, positions and pulses to be counted.

The following encoders can be connected:

- Inkremental encoder with RS422 interface (RS422)
- Inkremental encoder with 5V single ended interface (TTL)
- Inkremental encoder with 24V single ended interface (HTL)
- SSI- Encoder
- EnDat 2.1 single turn encoder
- EnDat 2.1 multi turn encoder

These encoders can be mixed as required. The module also provides the supply voltage for 5V encoders with a maximum of 150mA per encoder. This is monitored and an error is signalled if it is exceeded.

The encoder interface can also be used as an event counter and record 6 fast signals. In this case no encoder can be connected.

In the following chapters you will find an overview of the configuration options with the associated objects. These are linked to the object directory.

Encoder interface configuration – Incremental encoder

Object overview

Slot	Object	Explanation
Enc1	0x2100 Enc1 Digital Interface Type	64 Encoder (is assigned automatically via the module)
Enc2	0x2900 Enc2 Digital Interface Type	
Enc1	0x2103 Enc1 Digital Interface Config	Sub 01 (Level): 0=HTL, 1=TTL or 2=RS422 Sub 02 (Mode): 0=Multiturn or 1=Single Turn Sub 03 (Index Level): 0=Reference on rising edge 1=Reference on falling edge Sub 04 (SSI): 0=Straight binary 1=Grey coded binary Sub 05 (event counter): 0=Count rising edges 1=Count falling edges 3=Count both edges
Enc2	0x2903 Enc2 Digital Interface Config	
Enc1	0x2110 Enc1 Digital Interface Bit Size	Encoder resolution according to data sheet
Enc2	0x2910 Enc2 Digital Interface Bit Size	
Enc1	0x2111 Enc1 Digital Interface Baud Rate	Clock frequency according to data sheet [kHz]
Enc2	0x2911 Enc2 Digital Interface Baud Rate	
Enc1	0x6002 Enc1 Total Measuring Range	With setting "Single Turn" relevant for the overflow
Enc2	0x6802 Enc2 Total Measuring Range	

Encoder interface configuration – SSI Encoder

Object overview

Slot	Object	Explanation
Enc1	0x2100 Enc1 Digital Interface Type	65 SSI (Is assigned automatically via the module)
Enc2	0x2900 Enc2 Digital Interface Type	
Enc1	0x2103 Enc1 Digital Interface Config	Sub 01 (Level): 0=HTL, 1=TTL or 2=RS422 Sub 02 (Mode): 0=Multiturn or 1=Single Turn Sub 03 (Index Level): 0=Reference on rising edge 1=Reference on falling edge Sub 04 (SSI): 0=Straight binary 1=Grey coded binary Sub 05 (event counter): 0=Count rising edges 1=Count falling edges 3=Count both edges
Enc2	0x2903 Enc2 Digital Interface Config	
Enc1	0x2110 Enc1 Digital Interface Bit Size	Encoder resolution according to data sheet
Enc2	0x2910 Enc2 Digital Interface Bit Size	
Enc1	0x2111 Enc1 Digital Interface Baud Rate	Clock frequency according to data sheet [kHz]
Enc2	0x2911 Enc2 Digital Interface Baud Rate	
Enc1	0x6002 Enc1 Total Measuring Range	Encoder resolution according to data sheet
Enc2	0x6802 Enc2 Total Measuring Range	

Encoder interface configuration – ENDAT Encoder

Object overview

Slot	Object	Explanation
Enc1	0x2100 Enc1 Digital Interface Type	69 EnDat (Is assigned automatically via the module)
Enc2	0x2900 Enc2 Digital Interface Type	
Enc1	0x2103 Enc1 Digital Interface Config	Sub 01 (Level): 0=HTL, 1=TTL or 2=RS422 Sub 02 (Mode): 0=Multiturn or 1=Single Turn Sub 03 (Index Level): 0=Reference on rising edge 1=Reference on falling edge Sub 04 (SSI): 0=Straight binary 1=Grey coded binary Sub 05 (event counter): 0=Count rising edges 1=Count falling edges 3=Count both edges
Enc2	0x2903 Enc2 Digital Interface Config	
Enc1	0x2110 Enc1 Digital Interface Bit Size	Encoder resolution according to data sheet
Enc2	0x2910 Enc2 Digital Interface Bit Size	
Enc1	0x2111 Enc1 Digital Interface Baud Rate	Clock frequency according to data sheet [kHz]
Enc2	0x2911 Enc2 Digital Interface Baud Rate	
Enc1	0x6002 Enc1 Total Measuring Range	Encoder resolution according to data sheet
Enc2	0x6802 Enc2 Total Measuring Range	

Encoder interface configuration – Event counter

Object overview

Slot	Object	Explanation
Enc1	0x2100 Enc1 Digital Interface Type	80 event counter (Is assigned automatically via the module)
Enc2	0x2900 Enc2 Digital Interface Type	
Enc1	0x2103 Enc1 Digital Interface Config	Sub 01 (Level): 0=HTL, 1=TTL or 2=RS422 Sub 02 (Mode): 0=Multi turn or 1=Single turn Sub 03 (Index Level): 0=Reference on rising edge 1=Reference on falling edge Sub 04 (SSI): 0=Straight binary 1=Grey coded binary Sub 05 (event counter): 0=Count rising edges 1=Count falling edges 3=Count both edges
Enc2	0x2903 Enc2 Digital Interface Config	
Enc1	0x2110 Enc1 Digital Interface Bit Size	Encoder resolution according to data sheet
Enc2	0x2910 Enc2 Digital Interface Bit Size	
Enc1	0x2111 Enc1 Digital Interface Baud Rate	Clock frequency according to data sheet [kHz]
Enc2	0x2911 Enc2 Digital Interface Baud Rate	
Enc1	0x6002 Enc1 Total Measuring Range	Encoder resolution according to data sheet
Enc2	0x6802 Enc2 Total Measuring Range	

Information

The inputs of the event counter are not debounced or filtered and therefore not suitable for mechanical switches.

Encoder interface configuration – User-defined units

Besides the output of the position value in increments, the position value can also be output in user-defined units in REAL format. This applies to the use of incremental, SSI and ENDAT encoders.

The following objects are available for the output of the position value in user-defined units:

- 0x2014 Enc1 Linear Position Value
- 0x2814 Enc2 Linear Position Value

Add these objects to the PDO mapping if required.

The position value is calculated as follows:

$$Linear\ Position\ Value = High\ Resolution\ Raw\ Value * \frac{Encoder\ Increments}{Motor\ Revolutions} * \frac{Motor\ Shaft\ Revolutions}{Driving\ Shaft\ Revolutions} * \frac{Feed}{Shaft\ Revolutions}$$

Object overview

Slot	Object	Explanation
Enc1	0x208f Enc1 Position Encoder Resolution	$\frac{Encoder\ Increments}{Motor\ Revolutions}$
Enc2	0x288f Enc2 Position Encoder Resolution	
Enc1	0x2091 Enc1 Gear Ratio	$\frac{Motor\ Shaft\ Revolutions}{Driving\ Shaft\ Revolutions}$
Enc2	0x2891 Enc2 Gear Ratio	
Enc1	0x2092 Enc1 Feed Constant	$\frac{Feed}{Shaft\ Revolutions}$
Enc2	0x2892 Enc2 Feed Constant	

Analogue interface configuration – Analogue inputs

Object overview

Slot	Object	Subindex	Explanation
AI0	0x7110 AISensorType	01	Is assigned automatically via the module
AI1		02	
AI2		03	
AI3		04	
AI0	0x7120 AIInputScaling1FV 0x7122 AIInputScaling2FV 0x7121 AIInputScaling1PV 0x7123 AIInputScaling2PV	01	Scaling of the analogue input values by specifying interpolation points. To output the scaled values, add object 0x7130 AIInputPV the object to the mapping
AI1		02	
AI2		03	
AI3		04	
AI0	0x7126 AIScalingFactor 0x7127 AIScalingOffset	01	Scaling of the analogue input values by setting the scaling factor and offset. To output the scaled values, add object 0x7130 AIInputPV the object to the mapping
AI1		02	
AI2		03	
AI3		04	
AI0	0x7130 AIInputPV	01	Object for output of the scaled analogue values
AI1		02	
AI2		03	
AI3		04	
AI0	0x71a0 AIFilterType	01, 05	Object for filtering the analogue input values Subindex 01…04 Low pass filter Subindex 05…08 Notch Filter
AI1		02, 06	
AI2		03, 07	
AI3		04, 08	
AI0	0x71a1 AIFilterConstant	01	Object for setting the PT1 filter time in [ms]
AI1		02	
AI2		03	
AI3		04	
AI0	0x3011 AIChannelControl	01	Object for
AI1		02	
AI2		03	
AI3		04	

Analogue interface configuration – Analogue outputs

Object overview

Slot	Object	Subindex	Explanation
AO0	0x7300 AOOutputPV	01	Object to output the scaled analogue values as real value.
AO1		02	
AO2		03	
AO3		04	
AO0	0x7310 AOOutputType	01	Is assigned automatically via the plugged module
AO1		02	
AO2		03	
AO3		04	
AO0	0x7312 AOOperatingMode	01	Is assigned automatically via the plugged module, when using scaled output values the automatic configuration in the slot must be adjusted.
AO1		02	
AO2		03	
AO3		04	
AO0	0x7320 AOOutputScaling1FV 0x7321 AOOutputScaling1PV 0x7322 AOOutputScaling2FV 0x7323 AOOutputScaling2PV	01	Scaling of the analogue output values by specifying interpolation points. To output the scaled values, add object 0x7300 AOOutputPV the object to the mapping
AO1		02	
AO2		03	
AO3		04	
AO0	0x7330 AOOutputFV_Dec	01	Object for output of the analogue output values as real value, in V or mA, depending on the plugged module
AO1		02	
AO2		03	
AO3		04	
AO0	0x8331 AOOutputFV_Inc	01	Object for output of the analogue output values as integer value (raw value)
AO1		02	
AO2		03	
AO3		04	

Object dictionary

The Kuhnke FIO MIX 04 is divided into 3 virtual devices. The objects are structured as follows

0x1000 … 0x1FFF Device specific
0x2000 … 0x23FF Manufacture specific: Counter / Encoder 1
0x2800 … 0x2FFF Manufacture specific: Counter / Encoder 2
0x3000 … 0x37FF Manufacture specific: Analogue Input / Output
0x6000 … 0x67FF Virtual Device: Counter / Encoder 1
0x6800 … 0x6FFF Virtual Device: Counter / Encoder 2
0x7000 … 0x7FFF Virtual Device: Analogue Input / Output

0x1000 Device type

Object Code	Variable

Sub	**0x00**
Name	Device type
Data Type	UNSIGNED32
Access	ro
Defaultvalue	5001 (0x1389)
PDO Mapping	No

5001 = Modular Device Profile

0x1001 Error register

Object Code	Variable

Sub	**0x00**
Name	Error register
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	no

In the case of an error, the corresponding error bit is set. If the error no longer exists, it is automatically deleted.

In this object, the following objects are ORed together:

- 0x2001 Enc1 Error Register
- 0x2801 Enc2 Error Register
- 0x3001 AI/AO Error Register

7	6	5	4	3	2	1	0
MAN	RES	PROF	COM	TEMP	VOL	CUR	GEN

GEN: General error
CUR: Current
VOL: Voltage
TEMP: Temperature

COM: Communication
PROF: Device profile
RES: reserved, always „0“
MAN: Manufacturer specific

0x1003 Pre-defined error field

Object Code	Array

Sub	**0x00**
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	rw
Defaultvalue	8
Low Limit	0
High Limit	0
PDO Mapping	no

Sub	**0x01**
Name	Standard error field 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[0]

Sub	**0x02**
Name	Standard error field 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[1]

Sub	**0x03**
Name	Standard error field 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[2]

Sub	**0x04**
Name	Standard error field 4
Data Type	UNSIGNED32
Access	ro

Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[3]

Sub	**0x05**
Name	Standard error field 5
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[4]

Sub	**0x06**
Name	Standard error field 6
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[5]

Sub	**0x07**
Name	Standard error field 7
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[6]

Sub	**0x08**
Name	Standard error field 8
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Pre-definederrorfield[7]

If a new error occurs, it is entered in subindex 1. The existing entries in sub-indexes 1 to 7 are moved one place back. The error on subindex 7 is removed.

The number of errors which have already occurred can be read from the object with subindex 0. If a "0" is written into this object, counting starts again.

Bit															
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Error Register								Error Origin				Sub-Number			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Error Code															

Error Register [31 … 24]

Copy of object 0x1001 after triggering the error

Error Origin [23 … 20]

Error source in the device

0xF Module / Logical Device overlapping

0x1 Encoder 1

0x2 Encoder 2

0x3 AI/AO

Sub-Number [19 … 16]

See table Error Code

Error Code [15 … 0]

Errorcode	Sub	Device	Channel	Reaction	Explanation
0x2110	0x0	Enc1/Enc2		No	Overcurrent supply encoder
0x2320	0x0	AI/AO	AO0	Output is set to zero	Overtemperature output driver
0x2320	0x1	AI/AO	AO1	Output is set to zero	Overtemperature output driver
0x2320	0x2	AI/AO	AO2	Output is set to zero	Overtemperature output driver
0x2320	0x3	AI/AO	AO3	Output is set to zero	Overtemperature output driver
0x2330	0x0	AI/AO	AO0	Output is set to zero	Open Circuit / Overvoltage
0x2330	0x1	AI/AO	AO1	Output is set to zero	Open Circuit / Overvoltage
0x2330	0x2	AI/AO	AO2	Output is set to zero	Open Circuit / Overvoltage
0x2330	0x3	AI/AO	AO3	Output is set to zero	Open Circuit / Overvoltage
0x3100	0x0	Modul		No	Undervoltage module
0x3110	0x1	Enc1/Enc2		No	Signal integrity error
0x5030	0x0	AI/AO	AI0	No	Current lower than 4mA
0x5030	0xA	AI/AO	AI0	No	Input outside parametrized limits
0x5030	0x1	AI/AO	AI1	No	Current lower than 4mA
0x5030	0xB	AI/AO	AI1	No	Input outside parametrized limits
0x5030	0x2	AI/AO	AI2	No	Current lower than 4mA
0x5030	0xC	AI/AO	AI2	No	Input outside parametrized limits
0x5030	0x3	AI/AO	AI3	No	Current lower than 4mA
0x5030	0xD	AI/AO	AI3	No	Input outside parametrized limits
0x6100	0x0	Modul		Device no longer in Operational	Watchdog
0x7000	0x0	Enc1/Enc2		No	CRC-error EnDat
0x7000	0x1	Enc1/Enc2		No	Encoder error EnDat
0x7000	0x2	Enc1/Enc2		No	Timeout/Answer Format EnDat
0x8100	0x0	Modul		Device no longer in Operational	Communication error

0x1008 Manufacturer device name

Object Code	Variable

Sub	**0x00**
Name	Manufacturer device name
Data Type	VISIBLE_STRING
Access	ro
Defaultvalue	Mix04 (694.444.64)
PDO Mapping	no

0x1009 Manufacturer hardware version

Object Code	Variable

Sub	**0x00**
Name	Manufacturer hardware version
Data Type	VISIBLE_STRING
Access	ro
Defaultvalue	1.00
PDO Mapping	no

0x100a Manufacturer software version

Object Code	Variable

Sub	**0x00**
Name	Manufacturer software version
Data Type	VISIBLE_STRING
Access	ro
Defaultvalue	C017
PDO Mapping	no

0x1018 Identity object

Object Code	Record

Sub	**0x00**
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0x04
PDO Mapping	no

Sub	**0x01**
Name	Vendor-ID
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x48554B
PDO Mapping	no

Sub	**0x02**
Name	Product code
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x2F144
PDO Mapping	no

Sub	**0x03**
Name	Revision number
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x00000001
PDO Mapping	no

Sub	**0x04**
Name	Serial number
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x00000000
PDO Mapping	no

0x10f1 Error Settings

Object Code	Record

Sub	**0x00**
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	**0x01**
Name	Local Error Reaction
Data Type	UNSIGNED32
Access	rw
Defaultvalue	1
PDO Mapping	no

Sub	**0x02**
Name	Sync Error Counter Limit
Data Type	UNSIGNED16
Access	rw
Defaultvalue	4
PDO Mapping	no

0x10f8 Timestamp Object

Object Code	Variable

Sub	**0x00**
Name	Timestamp Object
Data Type	UNSIGNED64
Access	rw
Defaultvalue	
PDO Mapping	optional, TPDO only

0x1600 Analogue Interface Control

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x32010010
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1601 Digital Interface Control Encoder 1

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x21010010
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1602 Digital Interface Control Encoder 2

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x29010010
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1603 AO0 Output Value

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x73300108
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1604 AO1 Output Value

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro

Defaultvalue	0x73300208
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1605 AO2 Output Value

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x73300308
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1606 AO3 Output Value

Object Code	Record

Sub	**0x00**
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	**0x01**
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x73300408
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a00 Analogue Interface Status

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x30010008
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a01 AI0 Input Value

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1

Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x71000108
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a02 AI1 Input Value

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x71000208
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a03 AI2 Input Value

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x71000308
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a04 AI3 Input Value

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x71000408
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a05 Rotary Encoder SD Encoder 1

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	3
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x60040020
PDO Mapping	no

Sub	0x02
Name	Mapping Entry 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20300020
PDO Mapping	no

Sub	0x03
Name	Mapping Entry 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20010008
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a06 Event Counter

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	7
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080120
PDO Mapping	no

Sub	0x02
Name	Mapping Entry 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080220
PDO Mapping	no

Sub	0x03
Name	Mapping Entry 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080320
PDO Mapping	no

Sub	0x04
Name	Mapping Entry 4
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080420
PDO Mapping	no

Sub	0x05
Name	Mapping Entry 5
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080520

PDO Mapping	no

Sub	0x06
Name	Mapping Entry 6
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x24080620
PDO Mapping	no

Sub	0x07
Name	Mapping Entry 7
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20010008
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1a07 Rotary Encoder SD Encoder 2

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	3
Low Limit	0
High Limit	64
PDO Mapping	no

Sub	0x01
Name	Mapping Entry 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x68040020
PDO Mapping	no

Sub	0x02
Name	Mapping Entry 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x28300020
PDO Mapping	no

Sub	0x03
Name	Mapping Entry 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x28010008
PDO Mapping	no

Each subindex (1-8) describes one mapped object. A mapping entry consists of four bytes which are composed as follows:

Index[16]	Bit 31..16	Index of the object to be mapped
SubIndex[8]	Bit 15..8	Subindex of the object to be mapped
Length[8]	Bit 7..0	Length of the object to be mapped

0x1c00 Sync Manager Communication Type

Object Code	Array

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
Low Limit	0
High Limit	8
PDO Mapping	no

Sub	0x01
Name	Subindex 1
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
PDO Mapping	no

Sub	0x02
Name	Subindex 2
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x03
Name	Subindex 3
Data Type	UNSIGNED8
Access	ro
Defaultvalue	3
PDO Mapping	no

Sub	0x04
Name	Subindex 4
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

0x1c12 Sync Manager 2 PDO Assignment

Object Code	Array

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
Low Limit	0
High Limit	2
PDO Mapping	no

Sub	0x01
Name	Subindex
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x1600
PDO Mapping	no

Sub	0x02
Name	Subindex 2
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x1601
PDO Mapping	no

0x1c13 Sync Manager 3 PDO Assignment

Object Code	Array

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
Low Limit	0
High Limit	4
PDO Mapping	no

Sub	0x01
Name	Subindex
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x1a00
PDO Mapping	no

Sub	0x02
Name	Subindex 2
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x1a05
PDO Mapping	no

0x1c32 Sync Manager 2 Synchronization

Object Code	Record

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	32
Low Limit	0
High Limit	8
PDO Mapping	no

Sub	0x01
Name	Synchronization Type
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x02
Name	Cycle Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x04
Name	Synchronization Types supported
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x05
Name	Minimum Cycle Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x06
Name	Calc and Copy Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20

PDO Mapping	no

Sub	0x08
Name	Get Cycle Time
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x10
PDO Mapping	no

Sub	0x09
Name	Delay Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x0a
Name	Sync0 Cycle Time
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x20
PDO Mapping	no

Sub	0x0b
Name	SM-Event missed
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x0c
Name	Cycle time too small
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x20
Name	Sync Error
Data Type	BOOLEAN
Access	ro
Defaultvalue	0x01
PDO Mapping	no

0x1c33 Sync Manager 3 Synchronization

Object Code	Record

Sub	0x00
Name	Highest subindex supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	32
Low Limit	0
High Limit	8
PDO Mapping	no

Sub	0x01
Name	Synchronization Type
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x02
Name	Cycle Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x04
Name	Synchronization Types supported
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x05
Name	Minimum Cycle Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x06
Name	Calc and Copy Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x20

PDO Mapping	no

Sub	0x08
Name	Get Cycle Time
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x20
PDO Mapping	no

Sub	0x09
Name	Delay Time
Data Type	UNSIGNED32
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x0a
Name	Sync0 Cycle Time
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x20
PDO Mapping	no

Sub	0x0b
Name	SM-Event missed
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x20
PDO Mapping	no

Sub	0x0c
Name	Cycle time too small
Data Type	UNSIGNED16
Access	ro
Defaultvalue	0x10
PDO Mapping	no

Sub	0x20
Name	Sync Error
Data Type	BOOLEAN
Access	ro
Defaultvalue	0x01
PDO Mapping	no

0x2001 Enc1 Error Register

Object Code	Variable

Sub	0x00
Name	Enc1 Error Register
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1ErrorRegister

0x2003 Enc1 Preset Value Signed

Object Code	Variable

Sub	0x00
Name	Enc1 Preset Value Signed
Data Type	INTEGER32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1PresetValueSigned

Offset value

0x2004 Enc1 Position Value Signed

Object Code	Variable

Sub	0x00
Name	Enc1 Position Value Signed
Data Type	INTEGER32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1PositionValueSigned

0x2008 Enc1 High Resolution Position Value Signed

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Position Value Signed
Data Type	INTEGER64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1HighResolutionPositionValueSigned

0x2009 Enc1 High Resolution Preset Value Signed

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Preset Value Signed
Data Type	INTEGER64
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1HighResolutionPresetValueSigned

High Resolution Offset Wert

0x2014 Enc1 Linear Position Value

Object Code	Variable

Sub	0x00
Name	Enc1 Linear Position Value
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1LinearPositionValue

Position value in user units

0x2015 Enc1 Linear Position Preset Value

Object Code	Variable

Sub	0x00
Name	Enc1 Linear Position Preset Value
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1LinearPositionPresetValue

Position offset in user units

0x2030 Enc1 High Resolution Speed Value

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Speed Value
Data Type	INTEGER32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1HighResolutionSpeedValue

Speed Value

0x2031 Enc1 Linear Speed Value

Object Code	Variable

Sub	0x00
Name	Enc1 Linear Speed Value
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1LinearSpeedValue

Speed value in user units

0x2032 Enc1 Speed Value Filter Select

Object Code	Variable

Sub	0x00
Name	Enc1 Speed Value Filter Select
Data Type	UNSIGNED8
Access	ro
Defaultvalue	11
PDO Mapping	no

Accessname	Enc1SpeedValueFilterSelect

Configuration object for speed calculation

0 no filter

10 PT1-filter

11 Integration (Default)

0x208f Enc1 Position Encoder Resolution

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Encoder Increments
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x000003E8
PDO Mapping	no
Accessname	Enc1PositionEncoderResolution.EncoderIncrements

Sub	0x02
Name	Motor Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc1PositionEncoderResolution.MotorRevolutions

Unit Conversion:

$$\frac{Encoder\ Increments\ 208f:01}{Motor\ Revolution\ 208f:02}$$

0x2091 Enc1 Gear Ratio

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Motor Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc1GearRatio.MotorShaftRevolutions

Sub	0x02
Name	Driving Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc1GearRatio.DrivingShaftRevolutions

Unit Conversion:

$$\frac{Motor\ Shaft\ Revolutions\ 2091{:}01}{Driving\ Shaft\ Revolutions\ 2091{:}02}$$

0x2092 Enc1 Feed Constant

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Feed
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000064
PDO Mapping	no
Accessname	Enc1FeedConstant.Feed

Sub	0x02
Name	Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc1FeedConstant.ShaftRevolutions

Unit Conversion:

$$\frac{Feed\ 2092{:}01}{Shaft\ Revolutions\ 2092{:}02}$$

0x2100 Enc1 Digital Interface Type

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Type
Data Type	UNSIGNED8
Access	rw
Defaultvalue	64
PDO Mapping	no
Accessname	Enc1DigitalInterfaceType

Settings of the connected encoder:

64 Encoder (default)

65 SSI

69 EnDat

80 Event counter

0x2101 Enc1 Digital Interface Control

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Control
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0
PDO Mapping	optional, RPDO only
Accessname	Enc1DigitalInterfaceControl

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RC6	RC5	RC4	RC3	RC2	RC1										REF

REF

A rising edge starts the referencing

RC1…6 (Reset Event Counter 1...6

A rising edge resets the corresponding event counter

0x2102 Enc1 Digital Interface Status

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Status
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only

Accessname	Enc1DigitalInterfaceStatus

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
													Dir	Ref	

Ref:

0 = Encoder is not referenced

1 = Encoder is referenced

Dir:

0 = Clockwise

1 = Counter clockwise

0x2103 Enc1 Digital Interface Config

Object Code	Record

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	5
PDO Mapping	no

Sub	0x01
Name	Enc1 Encoder: Level
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc1DigitalInterfaceConfig.Enc1Encoder: Level

Sub	0x02
Name	Enc1 Encoder: Mode
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc1DigitalInterfaceConfig.Enc1Encoder: Mode

Sub	0x03
Name	Enc1 Encoder: Index level
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no

Accessname	Enc1DigitalInterfaceConfig.Enc1Encoder:Indexlevel

Sub	0x04
Name	Enc1 SSI: Use grey code
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc1DigitalInterfaceConfig.Enc1SSI:Usegreycode

Sub	0x05
Name	Enc1 Event Counter: Sensitivity
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc1DigitalInterfaceConfig.Enc1EventCounter:Sensitivity

Object for configuration of the counter/ encoder interface

Subindex 01 (Encoder: Level)

0 HTL (default)

1 TTL

2 RS422

Subindex 02 (Encoder: Mode)

0 Multiturn Encoder, no Index (default)

1 Single Turn Encoder

Subindex 03 (Encoder: Index level)

0 Reference on rising edge (default)

1 Reference on falling edge

3 Reference on both edges

Subindex 04 (SSI: Use grey code)

0 Straight binary (default)

1 Grey coded binary

Subindex 05 (Event Counter: Sensitivity)

0 Count rising edges (default)

1 Count falling edges

3 Count both edges

0x2110 Enc1 Digital Interface Bit Size

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Bit Size
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc1DigitalInterfaceBitSize

SSI / ENDAT: Resolution of the encoder according to data sheet

0x2111 Enc1 Digital Interface Baud Rate

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Baud Rate
Data Type	UNSIGNED16
Access	rw
Defaultvalue	1000 (0x03E8)
PDO Mapping	No
Accessname	Enc1DigitalInterfaceBaudRate

SSI / ENDAT: Clock frequency in kHz according to data sheet of the encoder

0x2120 Enc1 Index Capture Value

Object Code	Variable

Sub	0x00
Name	Enc1 Index Capture Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1IndexCaptureValue

0x2122 Enc1 Encoder Track ABRef

Object Code	Variable

Sub	0x00
Name	Enc1 Encoder Track ABRef
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1EncoderTrackABRef

7	6	5	4	3	2	1	0
					Ref	B	A

Signal level at the corresponding encoder track

0x213f Enc1 ErrorCode

Object Code	Variable

Sub	0x00
Name	Enc1 ErrorCode
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc1ErrorCode

See table Object 0x1003 Pre-defined error field

0x2408 Event Counter Count

Object Code	Record

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	6
PDO Mapping	no

Sub	0x01
Name	Event Counter Channel 1
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel1

Sub	0x02
Name	Event Counter Channel 2
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel2

Sub	0x03
Name	Event Counter Channel 3
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel3

Sub	0x04
Name	Event Counter Channel 4
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel4

Sub	0x05
Name	Event Counter Channel 5
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel5

Sub	0x06
Name	Event Counter Channel 6
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	EventCounterCount.EventCounterChannel6

0x2801 Enc2 Error Register

Object Code	Variable

Sub	0x00
Name	Enc2 Error Register
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2ErrorRegister

0x2803 Enc2 Preset Value Signed

Object Code	Variable

Sub	0x00
Name	Enc2 Preset Value Signed
Data Type	INTEGER32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2PresetValueSigned

0x2804 Enc2 Position Value Signed

Object Code	Variable

Sub	0x00
Name	Enc2 Position Value Signed
Data Type	INTEGER32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2PositionValueSigned

0x2808 Enc2 High Resolution Position Value Signed

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Position Value Signed
Data Type	INTEGER64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2HighResolutionPositionValueSigned

0x2809 Enc2 High Resolution Preset Value Signed

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Preset Value Signed
Data Type	INTEGER64
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2HighResolutionPresetValueSigned

0x2814 Enc2 Linear Position Value

Object Code	Variable

Sub	0x00
Name	Enc2 Linear Position Value
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2LinearPositionValue

0x2815 Enc2 Linear Position Preset Value

Object Code	Variable

Sub	0x00
Name	Enc2 Linear Position Preset Value
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2LinearPositionPresetValue

0x2830 Enc2 High Resolution Speed Value

Object Code	Variable

Sub	0x00
Name	Enc2 Linear Position Preset Value
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2LinearPositionPresetValue

0x2831 Enc2 Linear Speed Value

Object Code	Variable

Sub	0x00
Name	Enc2 Linear Speed Value
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2LinearSpeedValue

0x2832 Enc2 Speed Value Filter Select

Object Code	Variable

Sub	0x00
Name	Enc2 Speed Value Filter Select
Data Type	UNSIGNED8
Access	ro
Defaultvalue	11
PDO Mapping	no
Accessname	Enc2SpeedValueFilterSelect

0x288f Enc2 Position Encoder Resolution

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Encoder Increments
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x000003E8
PDO Mapping	no
Accessname	Enc2PositionEncoderResolution.EncoderIncrements

Sub	0x02
Name	Motor Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc2PositionEncoderResolution.MotorRevolutions

0x2891 Enc2 Gear Ratio

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Motor Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc2GearRatio.MotorShaftRevolutions

Sub	0x02
Name	Driving Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc2GearRatio.DrivingShaftRevolutions

0x2892 Enc2 Feed Constant

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	2
PDO Mapping	no

Sub	0x01
Name	Feed
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000001
PDO Mapping	no
Accessname	Enc2FeedConstant.Feed

Sub	0x02
Name	Shaft Revolutions
Data Type	UNSIGNED32
Access	rw
Defaultvalue	0x00000064
PDO Mapping	no
Accessname	Enc2FeedConstant.ShaftRevolutions

0x2900 Enc2 Digital Interface Type

Object Code	Variable

Sub	0x00
Name	Enc2 Digital Interface Type
Data Type	UNSIGNED8
Access	rw
Defaultvalue	64
PDO Mapping	no
Accessname	Enc2DigitalInterfaceType

Settings of the connected encoder:

64 Encoder
65 SSI
69 EnDat
80 Event counter

0x2901 Enc2 Digital Interface Control

Object Code	Variable

Sub	0x00
Name	Enc2 Digital Interface Control
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	Enc2DigitalInterfaceControl

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RC6	RC5	RC4	RC3	RC2	RC1										REF

REF

A rising edge starts the referencing

RC1…6 (Reset Event Counter 1...6

A rising edge resets the corresponding event counter

0x2902 Enc2 Digital Interface Status

Object Code	Variable

Sub	0x00
Name	Enc2 Digital Interface Status
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2DigitalInterfaceStatus

Ref:

0 = Encoder is not referenced

1 = Encoder is referenced

Dir:

0 = Clockwise

1 = Counter clockwise

0x2903 Enc2 Digital Interface Config

Object Code	Record

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	5
PDO Mapping	no

Sub	0x01
Name	Enc2 Encoder: Level
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc2DigitalInterfaceConfig.Enc2Encoder:Level

Sub	0x02
Name	Enc2 Encoder: Mode
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no

Accessname	Enc2DigitalInterfaceConfig.Enc2Encoder:Mode

Sub	0x03
Name	Enc2 Encoder: Index level
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc2DigitalInterfaceConfig.Enc2Encoder:Indexlevel

Sub	0x04
Name	Enc2 SSI: Use grey code
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc2DigitalInterfaceConfig.Enc2SSI:Usegreycode

Sub	0x05
Name	Enc2 Event Counter: Sensitivity
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	Enc2DigitalInterfaceConfig.Enc2EventCounter:Sensitivity

Object for configuration of the counter/ encoder interface

Subindex 01 (Encoder: Level)

0 HTL (default)

1 TTL

2 RS422

Subindex 02 (Encoder: Mode)

0 Multiturn Encoder, no Index (default)

1 Single Turn Encoder

Subindex 03 (Encoder: Index level)

0 Reference on rising edge (default)

1 Reference on falling edge

3 Reference on both edges

Subindex 04 (SSI: Use grey code)

0 Straight binary (default)

1 Grey coded binary

Subindex 05 (Event Counter: Sensitivity)

0 Count rising edges (default)

1 Count falling edges

3 Count both edges

0x2910 Enc2 Digital Interface Bit Size

Object Code	Variable

Sub	0x00
Name	Enc1 Digital Interface Bit Size
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc2DigitalInterfaceBitSize

SSI / EnDat: Resolution of the encoder according to data sheet

0x2911 Enc2 Digital Interface Baud Rate

Object Code	Variable

Sub	0x00
Name	Enc2 Digital Interface Baud Rate
Data Type	UNSIGNED16
Access	rw
Defaultvalue	0x03E8
PDO Mapping	no
Accessname	Enc2DigitalInterfaceBaudRate

SSI / EnDat: Clock frequency in kHz according to data sheet of the encoder

0x2920 Enc2 Index Capture Value

Object Code	Variable

Sub	0x00
Name	Enc2 Index Capture Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2IndexCaptureValue

0x2921 Enc2 Capture Input Value

Object Code	Variable

Sub	0x00
Name	Enc2 Capture Input Value
Data Type	INTEGER64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2CaptureInputValue

0x2922 Enc2 Encoder Track ABRef

Object Code	Variable

Sub	0x00
Name	Enc2 Encoder Track ABRef
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2EncoderTrackABRef

7	6	5	4	3	2	1	0
					Ref	B	A

Signal level at the corresponding encoder track

0x293f Enc2 ErrorCode

Object Code	Variable

Sub	0x00
Name	Enc2 ErrorCode
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc2ErrorCode

See table object 0x1003 Pre-defined error field

0x3001 AI/AO Error Register

Object Code	Variable

Sub	0x00
Name	AI/AO Error Register
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AI/AOErrorRegister

See object 0x1001 Error register

0x3011 AIChannelControl

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	Channel Control AI0
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AIChannelControl.ChannelControlAI0

Sub	0x02
Name	Channel Control AI1
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AIChannelControl.ChannelControlAI1

Sub	0x03
Name	Channel Control AI2
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AIChannelControl.ChannelControlAI2

Sub	0x04
Name	Channel Control AI3
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AIChannelControl.ChannelControlAI3

7	6	5	4	3	2	1	0
					COMP	CAL	ACT

ACT:

0 = Input not active

1 = Input active

SCAL:

0 = Scale input values with faktor and offset

1 = Scale input values with interpolation pointsn

COMP:

0 = Comparator not active

1= Comparator active

0x3012 AIChannelStatus

Object Code	Array

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	Channel Status AI0
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIChannelStatus[0]

Sub	0x02
Name	Channel Status AI1
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only

Accessname	AIChannelStatus[1]

Sub	0x03
Name	Channel Status AI2
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIChannelStatus[2]

Sub	0x04
Name	Channel Status AI3
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIChannelStatus[3]

7	6	5	4	3	2	1	0
						UpLim	LoLim

LoLim (Lower Limit) bzw. UpLim (Upper Limit)

0 = Limit nicht überschritten

1 = Limit überschritten

0x3100 AI/AO SampleCount

Object Code	Variable

Sub	0x00
Name	AI/AO SampleCount
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AI/AOSampleCount

Number of samples since reset / restart

0x3125 AIInputCalibrationGain

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input calibration gain 0
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIInputCalibrationGain.AIInputcalibrationgain0

Sub	0x02
Name	AI Input calibration gain 1
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIInputCalibrationGain.AIInputcalibrationgain1

Sub	0x03
Name	AI Input calibration gain 2
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIInputCalibrationGain.AIInputcalibrationgain2

Sub	0x04
Name	AI Input calibration gain 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIInputCalibrationGain.AIInputcalibrationgain3

0x313f AI/AO Error Code

Object Code	Variable

Sub	0x00
Name	AI/AO Error Code
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AI/AOErrorCode

See table object 0x1003 Pre-defined error field

0x3201 AI/AO DeviceControl

Object Code	Variable

Sub	0x00
Name	AI/AO DeviceControl
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AI/AODeviceControl

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
															RES

RES

0 = no action

1 = Reset Device

0x3202 AI/AO DeviceState

Object Code	Variable

Sub	0x00
Name	AI/AO DeviceState
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AI/AODeviceState

Unused

0x6000 Enc1 Operating Parameters

Object Code	Variable

Sub	0x00
Name	Enc1 Operating Parameters
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1OperatingParameters

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												DIR			

Bit 3 DIR

0 = Clockwise

1 = Counter clockwise

0x6002 Enc1 Total Measuring Range

Object Code	Variable

Sub	0x00
Name	Enc1 Total Measuring Range
Data Type	UNSIGNED32
Access	rw
Defaultvalue	4000
PDO Mapping	no
Accessname	Enc1TotalMeasuringRange

Encoder resolution. With setting "Single Turn" relevant for the overflow

5.2.2.1.1 0x6003 Enc1 Preset Value

Object Code	Variable

Sub	0x00
Name	Enc1 Preset Value
Data Type	UNSIGNED32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1PresetValue

Offset values

0x6004 Enc1 Position Value

Object Code	Variable

Sub	0x00
Name	Enc1 Position Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1PositionValue

0x6008 Enc1 High Resolution Position Value

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Position Value
Data Type	UNSIGNED64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1HighResolutionPositionValue

0x6009 Enc1 High Resolution Preset Value

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Preset Value
Data Type	UNSIGNED64
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc1HighResolutionPresetValue

0x600b Enc1 High Resolution Raw Value

Object Code	Variable

Sub	0x00
Name	Enc1 High Resolution Raw Value
Data Type	UNSIGNED64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1HighResolutionRawValue

64- Bit raw encoder value without offsets and homing and index

0x600c Enc1 Position Raw Value

Object Code	Variable

Sub	0x00
Name	Enc1 Position Raw Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1PositionRawValue

32- Bit raw encoder value without offsets and homing and index

0x6030 Enc1 Speed Value

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
PDO Mapping	no

Sub	0x01
Name	Enc1 Speed Value Channel 1
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1SpeedValue.Enc1SpeedValueChannel1

0x6031 Enc1 Speed Parameters

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	Enc1 Speed Source Selector
Data Type	UNSIGNED16
Access	rw
Defaultvalue	4
PDO Mapping	no
Accessname	Enc1SpeedParameters.Enc1SpeedSourceSelector

Sub	0x02
Name	Enc1 Speed Integration Time
Data Type	UNSIGNED16
Access	ro
Defaultvalue	100
PDO Mapping	no
Accessname	Enc1SpeedParameters.Enc1SpeedIntegrationTime

Sub	0x03
Name	Enc1 Multiplier value
Data Type	UNSIGNED16
Access	ro
Defaultvalue	1
Low Limit	1
High Limit	65535
PDO Mapping	no
Accessname	Enc1SpeedParameters.Enc1Multipliervalue

Sub	0x04
Name	Enc1 Divider value
Data Type	UNSIGNED16
Access	rw
Defaultvalue	1
Low Limit	1
High Limit	65535
PDO Mapping	no

Accessname	Enc1SpeedParameters.Enc1Dividervalue

Sub 01:

4= Use Object 0x600B

Sub 02:

Integration time in [ms]

Sub 03:

Conversion factor for velocity calculation, result in 0x6030

Sub 04:

Conversion devider for velocity calculation, result in 0x6030

0x6500 Enc1 Operating Status

Object Code	Variable

Sub	0x00
Name	Enc1 Operating Status
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc1OperatingStatus

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												DIR			

Bit 3 DIR

0 = Clockwise

1 = Counter clockwise

0x6800 Enc2 Operating Parameters

Object Code	Variable

Sub	0x00
Name	Enc2 Operating Parameters
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2OperatingParameters

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												DIR			

Bit 3 DIR

0 = Clockwise

1 = Counter clockwise

0x6802 Enc2 Total Measuring Range

Object Code	Variable

Sub	0x00
Name	Enc2 Total Measuring Range
Data Type	UNSIGNED32
Access	rw
Defaultvalue	4000
PDO Mapping	no
Accessname	Enc2TotalMeasuringRange

Encoder resolution. With setting "Single Turn" relevant for the overflow

0x6803 Enc2 Preset Value

Object Code	Variable

Sub	0x00
Name	Enc2 Preset Value
Data Type	UNSIGNED32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2PresetValue

Offset value

0x6804 Enc2 Position Value

Object Code	Variable

Sub	0x00
Name	Enc2 Position Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2PositionValue

0x6808 Enc2 High Resolution Position Value

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Position Value
Data Type	UNSIGNED64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2HighResolutionPositionValue

0x6809 Enc2 High Resolution Preset Value

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Preset Value
Data Type	UNSIGNED64
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	Enc2HighResolutionPresetValue

0x680b Enc2 High Resolution Raw Value

Object Code	Variable

Sub	0x00
Name	Enc2 High Resolution Raw Value
Data Type	UNSIGNED64
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2HighResolutionRawValue

64- Bit raw encoder value without offsets and homing and index

0x680c Enc2 Position Raw Value

Object Code	Variable

Sub	0x00
Name	Enc2 Position Raw Value
Data Type	UNSIGNED32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2PositionRawValue

32- Bit raw encoder value without offsets and homing and index

0x6830 Enc2 Speed Value

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	1
PDO Mapping	no

Sub	0x01
Name	Enc2 Speed Value Channel 1
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2SpeedValue.Enc2SpeedValueChannel1

0x6831 Enc2 Speed Parameters

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	Enc2 Speed Source Selector
Data Type	UNSIGNED16
Access	rw

Defaultvalue	4
PDO Mapping	no
Accessname	Enc2SpeedParameters.Enc2SpeedSourceSelector

Sub	0x02
Name	Enc2 Speed Integration Time
Data Type	UNSIGNED16
Access	ro
Defaultvalue	100
PDO Mapping	no
Accessname	Enc2SpeedParameters.Enc2SpeedIntegrationTime

Sub	0x03
Name	Enc2 Multiplier Value
Data Type	UNSIGNED16
Access	ro
Defaultvalue	1
Low Limit	1
High Limit	65535
PDO Mapping	no
Accessname	Enc2SpeedParameters.Enc2MultiplierValue

Sub	0x04
Name	Enc2 Divider value
Data Type	UNSIGNED16
Access	ro
Defaultvalue	1
Low Limit	1
High Limit	65535
PDO Mapping	no
Accessname	Enc2SpeedParameters.Enc2Dividervalue

Sub 01:

4= Use Object 0x680B

Sub 02:

Integration time in [ms]

Sub 03:

Conversion factor for velocity calculation, result in 0x6830

Sub 04:

Conversion devider for velocity calculation, result in 0x6830

0x6d00 Enc2 Operating Status

Object Code	Variable

Sub	0x00
Name	Enc2 Operating Status
Data Type	UNSIGNED16
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	Enc2OperatingStatus

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												DIR			

Bit 3 DIR

0 = Clockwise

1 = Counter clockwise

0x7100 AIInputFV_Real

Object Code	Array

Sub	0x00
Name	unnamed subindex
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input FV 0
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputFV_Real[0]

Sub	0x02
Name	AI Input FV 1
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputFV_Real[1]

Sub	0x03
Name	AI Input FV 2
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputFV_Real[2]

Sub	0x04
Name	AI Input FV 3
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputFV_Real[3]

Analogue input values as real measured variable, with active oversampling average value of the sampled input values.

0x7110 AISensorType

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI sensor type 0
Data Type	UNSIGNED16
Access	Ro
Defaultvalue	42
PDO Mapping	No
Accessname	AISensorType.AIsensortype0

Sub	0x02
Name	AI sensor type 1
Data Type	UNSIGNED16
Access	ro
Defaultvalue	42
PDO Mapping	no
Accessname	AISensorType.AIsensortype1

Sub	0x03
Name	AI sensor type 2
Data Type	UNSIGNED16
Access	Ro
Defaultvalue	42
PDO Mapping	No
Accessname	AISensorType.AIsensortype2

Sub	0x04
Name	AI sensor type 3
Data Type	UNSIGNED16
Access	Ro
Defaultvalue	42
PDO Mapping	No
Accessname	AISensorType.AIsensortype3

Channel dependent adjustment of the connected sensor:
42 = 0…10 V (Default), 52 = 0…20 mA, 51 = 4…20 mA

0x7120 AIInputScaling1FV

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input scaling 1 FV 0
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling1FV.AIInputscaling1FV0

Sub	0x02
Name	AI Input scaling 1 FV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling1FV.AIInputscaling1FV1

Sub	0x03
Name	AI Input scaling 1 FV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling1FV.AIInputscaling1FV2

Sub	0x04
Name	AI Input scaling 1 FV 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling1FV.AIInputscaling1FV3

0x7121 AIInputScaling1PV

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input scaling 1 PV 0
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling1PV.AIInputscaling1PV0

Sub	0x02
Name	AI Input scaling 1 PV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling1PV.AIInputscaling1PV1

Sub	0x03
Name	AI Input scaling 1 PV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling1PV.AIInputscaling1PV2

Sub	0x04
Name	AI Input scaling 1 PV 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling1PV.AIInputscaling1PV3

0x7122 AIInputScaling2FV

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input scaling 2 FV 0
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling2FV.AIInputscaling2FV0

Sub	0x02
Name	AI Input scaling 2 FV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling2FV.AIInputscaling2FV1

Sub	0x03
Name	AI Input scaling 2 FV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling2FV.AIInputscaling2FV2

Sub	0x04
Name	AI Input scaling 2 FV 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling2FV.AIInputscaling2FV3

0x7123 AIInputScaling2PV

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input scaling 2 PV 0
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling2PV.AIInputscaling2PV0

Sub	0x02
Name	AI Input scaling 2 PV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling2PV.AIInputscaling2PV1

Sub	0x03
Name	AI Input scaling 2 PV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling2PV.AIInputscaling2PV2

Sub	0x04
Name	AI Input scaling 2 PV 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputScaling2PV.AIInputscaling2PV3

0x7124 AIInputOffset

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input offset 0
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputOffset.AIInputoffset0

Sub	0x02
Name	AI Input offset 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputOffset.AIInputoffset1

Sub	0x03
Name	AI Input offset 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputOffset.AIInputoffset2

Sub	0x04
Name	AI Input offset 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIInputOffset.AIInputoffset3

Channel dependent Offset in [V] or [mA]

0x7126 AIScalingFactor

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI scaling factor 0
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIScalingFactor.AIscalingfactor0

Sub	0x02
Name	AI scaling factor 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIScalingFactor.AIscalingfactor1

Sub	0x03
Name	AI scaling factor 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIScalingFactor.AIscalingfactor2

Sub	0x04
Name	AI scaling factor 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIScalingFactor.AIscalingfactor3

Scaling factor [Process value / field value]

0x7127 AIScalingOffset

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI scaling offset 0
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIScalingOffset.AIscalingoffset0

Sub	0x02
Name	AI scaling offset 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIScalingOffset.AIscalingoffset1

Sub	0x03
Name	AI scaling offset 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIScalingOffset.AIscalingoffset2

Sub	0x04
Name	AI scaling offset 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AIScalingOffset.AIscalingoffset3

Scalling offset [Process value]

0x7130 AIInputPV

Object Code	Array

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input PV 0
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputPV[0]

Sub	0x02
Name	AI Input PV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputPV[1]

Sub	0x03
Name	AI Input PV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputPV[2]

Sub	0x04
Name	AI Input PV 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputPV[3]

Analogue process input values as real measured variables, determined by the scaling values.
With active oversampling, mean value of the sampled process input values.

0x71a0 AIFilterType

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	8
PDO Mapping	no

Sub	0x01
Name	AI0 low pass filter type
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AIFilterType.AI0lowpassfiltertype

Sub	0x02
Name	AI1 low pass filter type
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AIFilterType.AI1lowpassfiltertype

Sub	0x03
Name	AI2 low pass filter type
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AIFilterType.AI2lowpassfiltertype

Sub	0x04
Name	AI3 low pass filter type
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AIFilterType.AI3lowpassfiltertype

Sub	0x05
Name	AI0 notch filter type
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AIFilterType.AI0notchfiltertype

Sub	0x06
Name	AI1 notch filter type
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AIFilterType.AI1notchfiltertype

Sub	0x07
Name	AI2 notch filter type
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AIFilterType.AI2notchfiltertype

Sub	0x08
Name	AI3 notch filter type
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AIFilterType.AI3notchfiltertype

Object to activate the input filter.
Subindex 01…04

0 = no Filter active

1 = PT1-Filter

Subindex 05…08

0 = no Filter active

101 = 50 Hz notch filter

102 = 60 Hz notch filter

0x71a1 AIFilterConstant

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI filter constant 0
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIFilterConstant.AIfilterconstant0

Sub	0x02
Name	AI filter constant 1
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIFilterConstant.AIfilterconstant1

Sub	0x03
Name	AI filter constant 2
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIFilterConstant.AIfilterconstant2

Sub	0x04
Name	AI filter constant 3
Data Type	UNSIGNED16
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AIFilterConstant.AIfilterconstant3

PT1 filter time in [ms]

0x7300 AOOutputPV

Object Code	Array

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO Output PV 0
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputPV[0]

Sub	0x02
Name	AO Output PV 1
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputPV[1]

Sub	0x03
Name	AO Output PV 2
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputPV[2]

Sub	0x04
Name	AO Output PV 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputPV[3]

0x7310 AOOutputType

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO output type 0
Data Type	UNSIGNED8
Access	ro
Defaultvalue	10
PDO Mapping	no
Accessname	AOOutputType.AOoutputtype0

Sub	0x02
Name	AO output type 1
Data Type	UNSIGNED8
Access	ro
Defaultvalue	10
PDO Mapping	no
Accessname	AOOutputType.AOoutputtype1

Sub	0x03
Name	AO output type 2
Data Type	UNSIGNED8
Access	ro
Defaultvalue	10
PDO Mapping	no
Accessname	AOOutputType.AOoutputtype2

Sub	0x04
Name	AO output type 3
Data Type	UNSIGNED8
Access	ro
Defaultvalue	10
PDO Mapping	no
Accessname	AOOutputType.AOoutputtype3

Channel dependent adjustment of the connected sensor:
10 = 0…10 V (Default), 11 = -10…10 V, 20 = 0…20 mA, 21 = 4…20 mA

0x7312 AOOperatingMode

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO operating mode 0
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AOOperatingMode.AOoperatingmode0

Sub	0x02
Name	AO operating mode 1
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AOOperatingMode.AOoperatingmode1

Sub	0x03
Name	AO operating mode 2
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AOOperatingMode.AOoperatingmode2

Sub	0x04
Name	AO operating mode 3
Data Type	UNSIGNED8
Access	ro
Defaultvalue	0
PDO Mapping	no
Accessname	AOOperatingMode.AOoperatingmode3

Selecting the output source

0 = Output not active, 1 = Output Process Value,

10 = Output Field Value Decimal, 11 = Output Field Value Increments

0x7320 AOOutputScaling1FV

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO output scaling 1 FV 0
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling1FV.AOoutputscaling1FV0

Sub	0x02
Name	AO output scaling 1 FV 1
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling1FV.AOoutputscaling1FV1

Sub	0x03
Name	AO output scaling 1 FV 2
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling1FV.AOoutputscaling1FV2

Sub	0x04
Name	AO output scaling 1 FV 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling1FV.AOoutputscaling1FV3

0x7321 AOOutputScaling1PV

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO output scaling 1 PV 0
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling1PV.AOoutputscaling1PV0

Sub	0x02
Name	AO output scaling 1 PV 1
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling1PV.AOoutputscaling1PV1

Sub	0x03
Name	AO output scaling 1 PV 2
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling1PV.AOoutputscaling1PV2

Sub	0x04
Name	AO output scaling 1 PV 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling1PV.AOoutputscaling1PV3

0x7322 AOOutputScaling2FV

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO output scaling 2 FV 0
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling2FV.AOoutputscaling2FV0

Sub	0x02
Name	AO output scaling 2 FV 1
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling2FV.AOoutputscaling2FV1

Sub	0x03
Name	AO output scaling 2 FV 2
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling2FV.AOoutputscaling2FV2

Sub	0x04
Name	AO output scaling 2 FV 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling2FV.AOoutputscaling2FV3

0x7323 AOOutputScaling2PV

Object Code	Record

Sub	0x00
Name	SubIndex 000
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO output scaling 2 PV 0
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling2PV.AOoutputscaling2PV0

Sub	0x02
Name	AO output scaling 2 PV 1
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling2PV.AOoutputscaling2PV1

Sub	0x03
Name	AO output scaling 2 PV 2
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling2PV.AOoutputscaling2PV2

Sub	0x04
Name	AO output scaling 2 PV 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AOOutputScaling2PV.AOoutputscaling2PV3

0x7330 AOOutputFV_Dec

Object Code	Array

Sub	0x00
Name	unnamed subindex
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO Output FV 0
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputFV_Dec[0]

Sub	0x02
Name	AO Output FV 1
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputFV_Dec[1]

Sub	0x03
Name	AO Output FV 2
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputFV_Dec[2]

Sub	0x04
Name	AO Output FV 3
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputFV_Dec[3]

0x8100 AIInputFV_Int

Object Code	Array

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AI Input FV 0
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputFV_Int[0]

Sub	0x02
Name	AI Input FV 1
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputFV_Int[1]

Sub	0x03
Name	AI Input FV 2
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputFV_Int[2]

Sub	0x04
Name	AI Input FV 3
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AIInputFV_Int[3]

Analogue input value as integer measured variable, with active oversampling mean value of the samples input values.

0x8331 AOOutputFV_Inc

Object Code	Array

Sub	0x00
Name	Highest sub-index supported
Data Type	UNSIGNED8
Access	ro
Defaultvalue	4
PDO Mapping	no

Sub	0x01
Name	AO Output FV 0
Data Type	INTEGER16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputFV_Inc[0]

Sub	0x02
Name	AO Output FV 1
Data Type	INTEGER16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputFV_Inc[1]

Sub	0x03
Name	AO Output FV 2
Data Type	INTEGER16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputFV_Inc[2]

Sub	0x04
Name	AO Output FV 3
Data Type	INTEGER16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOOutputFV_Inc[3]

Analogue output values as integer value

Technical Data

General

Order no.	694.444.64
I/O Supply	24 VDC (-20% / +25%)
Dimensions WxHxD	25 x 120 x 90 mm
Mounting	35 mm DIN-top hat rail
Storage temperature	-25°C … +70°C
Operating temperature	0°C … +55°C
Relative humidity	5% … 95% without dewing
Protection	IP20
Interference immunity	Zone B (DIN EN 61131-2)

Fieldbus (System)

Type	EtherCAT* 100 Mbit/s
Connection	10-pole system plug at the side
Logic supply	from EtherCAT-Coupler via E-Bus-plug
E-Bus-Last	<100mA
Galvanic separation	Separated from one another and versus the bus

Analogue inputs

Number	4
Type	0 … 10 V, 0(4) … 20 mA
Internal resistance (Voltage)	>200 kΩ
Internal resistance (Current)	120 Ω
Resolution	12 Bit
Sampling rate	<62,5 µs

Analogue outputs

Number	4
Type	0 … 10 V, -10 … +10 V, 0(4) … 20 mA
Load (Voltage)	>1000 Ω (short circuit protected)
Load (Current)	<500 Ω (short circuit protected)
Resolution	16 Bit
Sampling rate	<=250 µs

Counter/Encoder

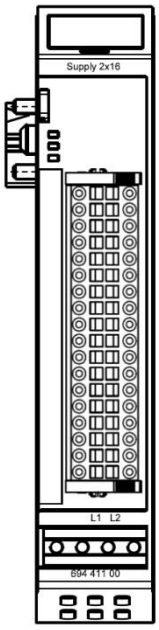
RS422	32Bit, 5 MHz
5/24V Single Ended	32Bit, 1,6 MHz
SSI	18-32 Bit, 80-1000 Kbit/s
EnDAT 2.1	100 kHz – 2 MHz
Event counter (CNT0-5)	6 x HTL/TTL 32Bit, 1 kHz

Encoder supply:	5V/150mA / encoder

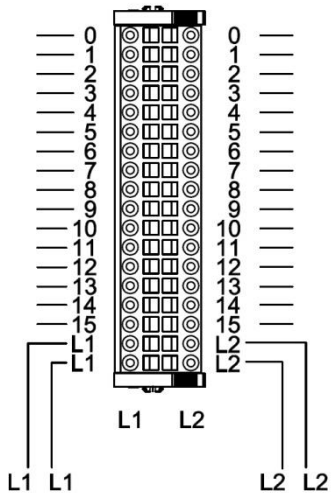
Wire length:	<30m shielded cable

6 Accessories

6.1 Power Distributor 2 x 16



Front view of power distributor



Power connectors

Terminals

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

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

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

Status LEDs

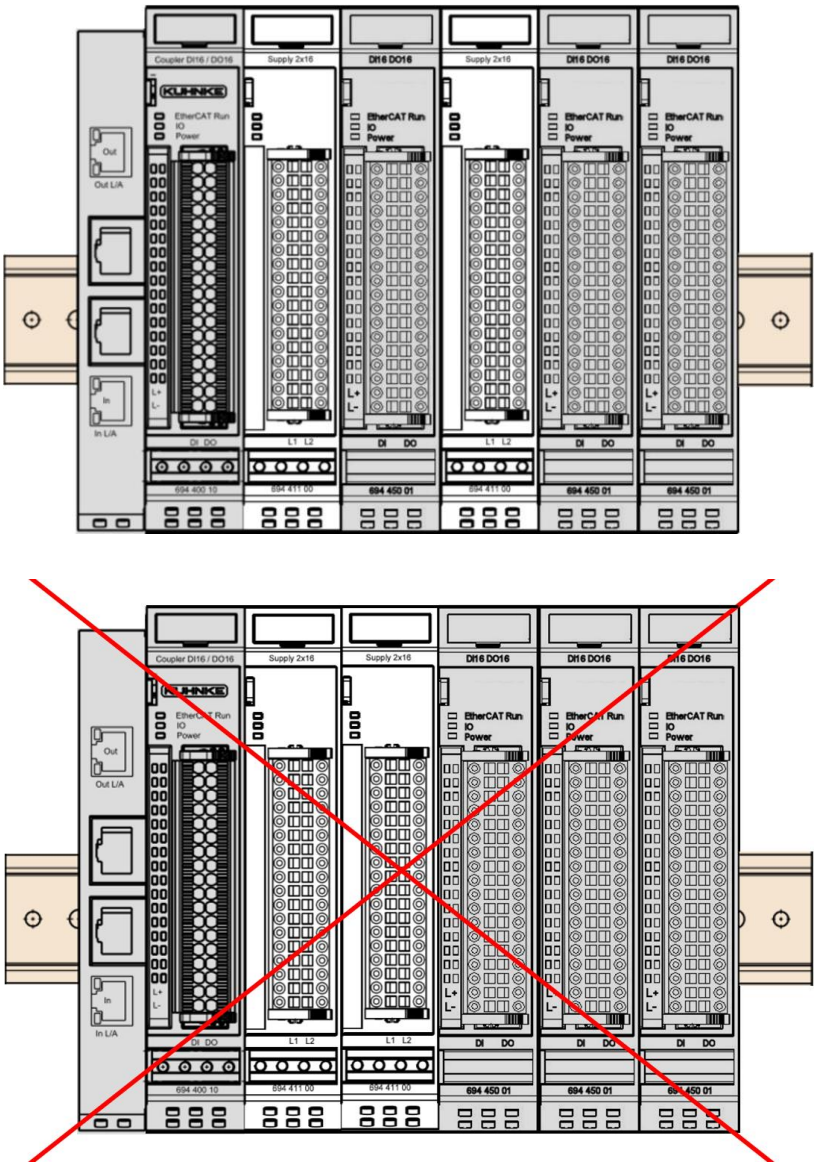
None.

Function

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

Mounting

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



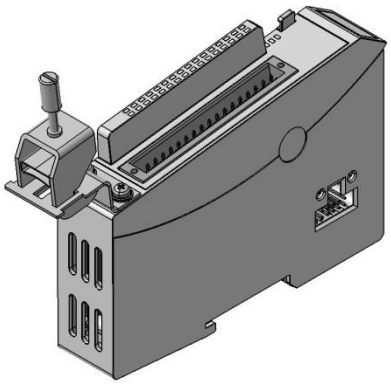
Technical Data

Power Distributor 2 x 16

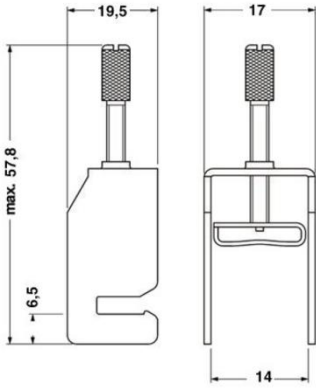
Power connection ..... 36-pin male
E-bus connector ..... 10-pole system plug in side wall
E-bus load..... none
Part no. 694.411.00

Approval:.....

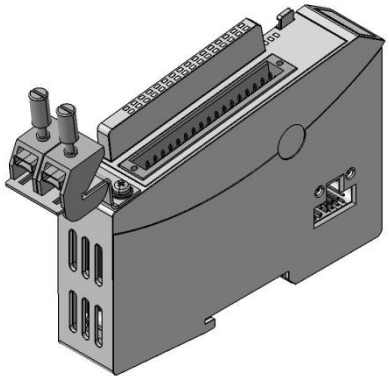
6.2 Shield Terminal



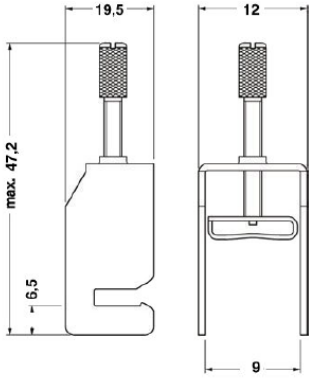
Shield terminal 1x14mm



Dimensions

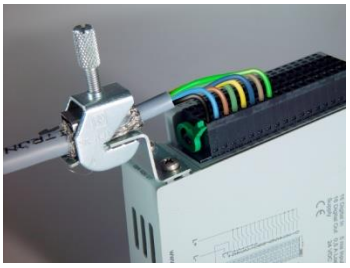


Shield terminal 2x8mm



Dimensions

Terminals



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

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

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

Function

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

	NOTE
	Verify that the DIN rail is properly earthed.

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

Technical Data

Shield Terminal 2x8mm

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

Shield Terminal 14mm

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

7 Configuration

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

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

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

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

The XML device files provide EtherCAT administrators with convenient options.

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

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

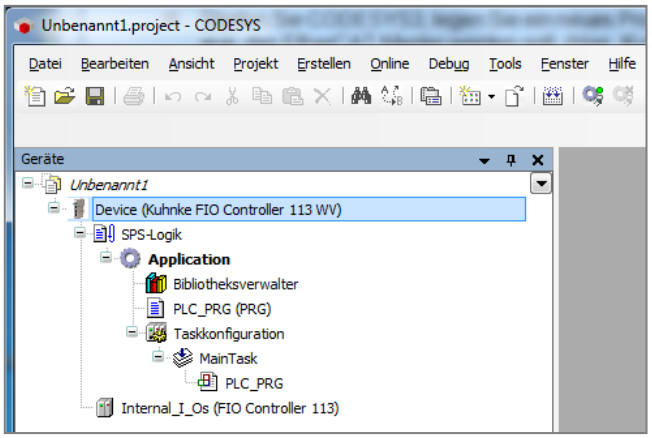
The file to use for Kuhnke FIO is called "KuhnkeEtherCATModulesAll.xml".

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

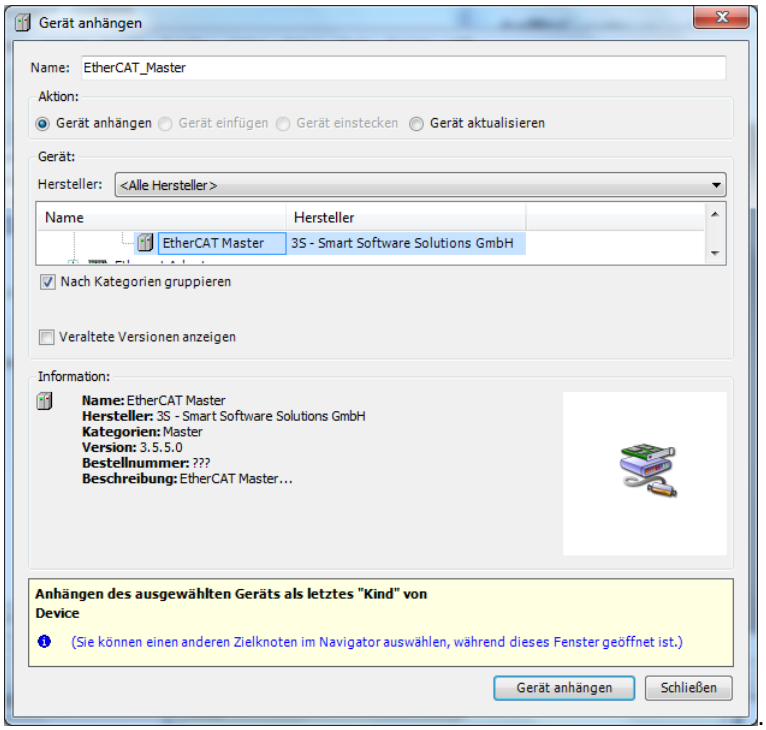
7.1 CODESYS V3 (CODESYS Configurator)

Offline Configuration

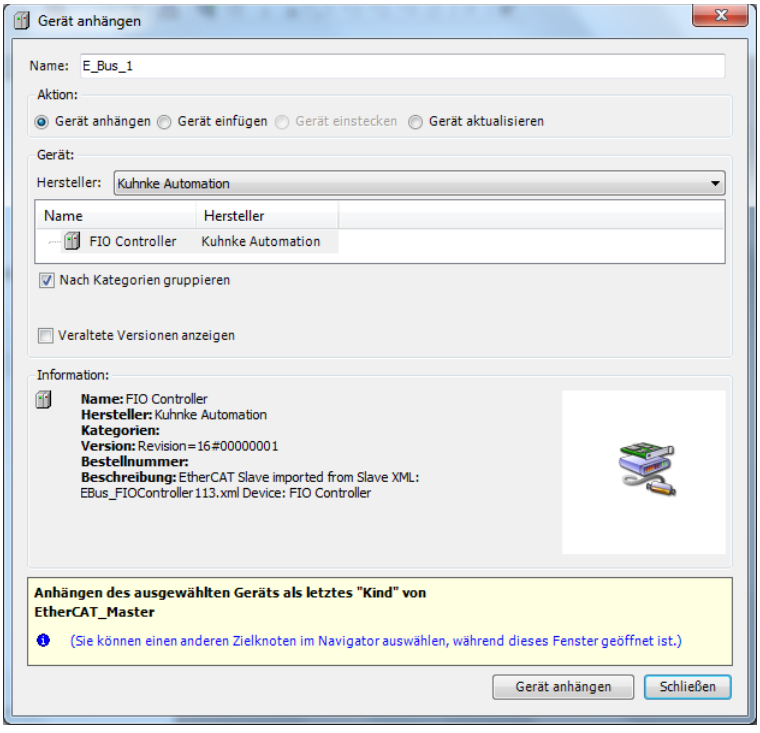
- Run CODESYS3, create a new project (default project), and select the device to become the EtherCAT master (here: "Kuhnke FIO Controller 113 WV").



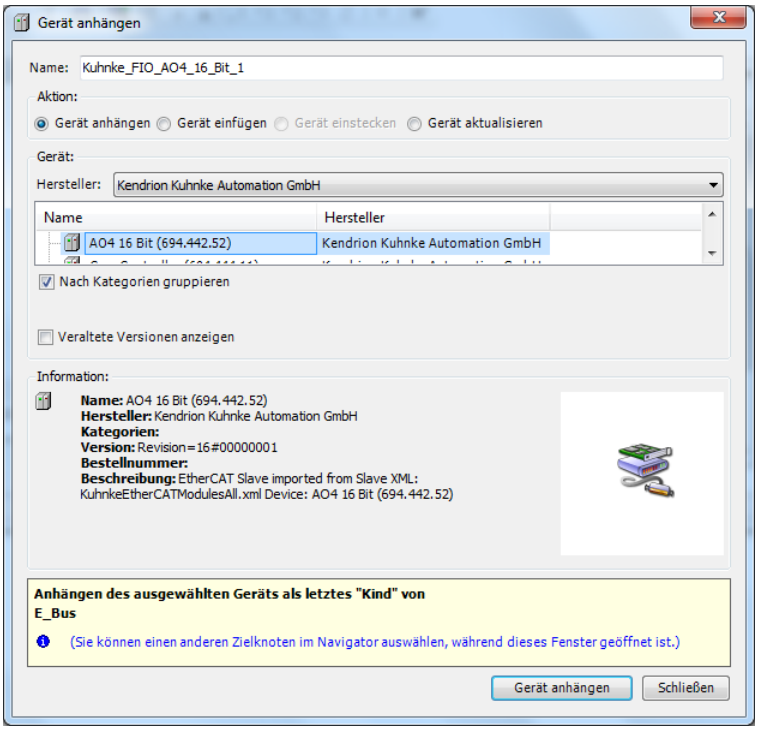
- Highlight the device and pick the 3S "EtherCAT Master" from the right-click menu.



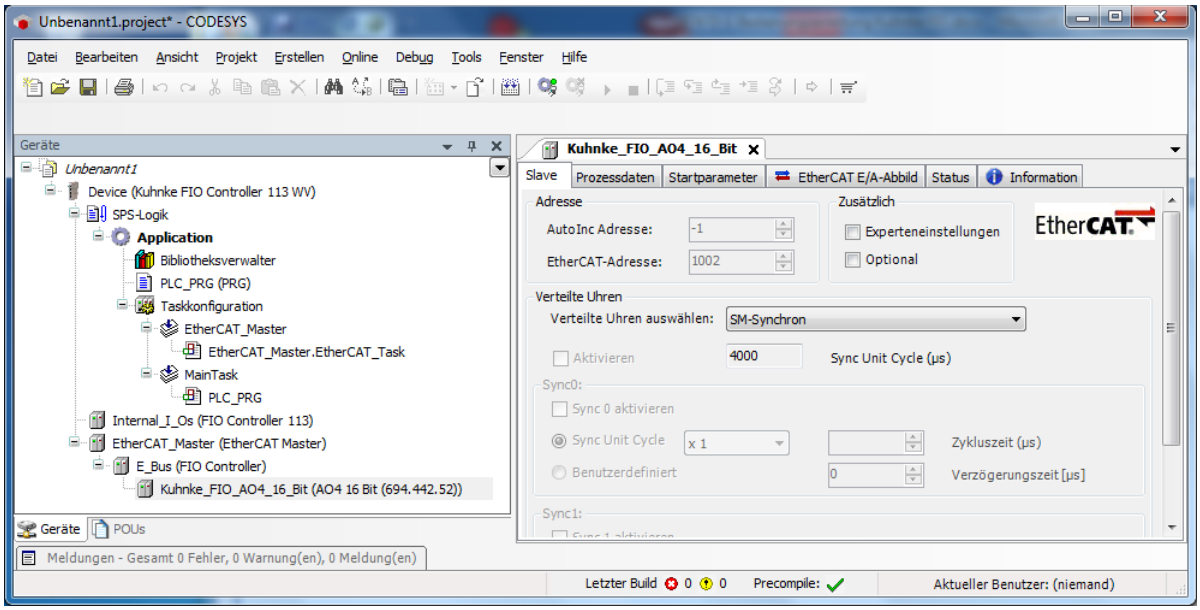
- Go down the list of devices, pick "EtherCAT_Master (EtherCAT Master)", and add Kuhnke Automation's "FIO Controller".



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



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



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

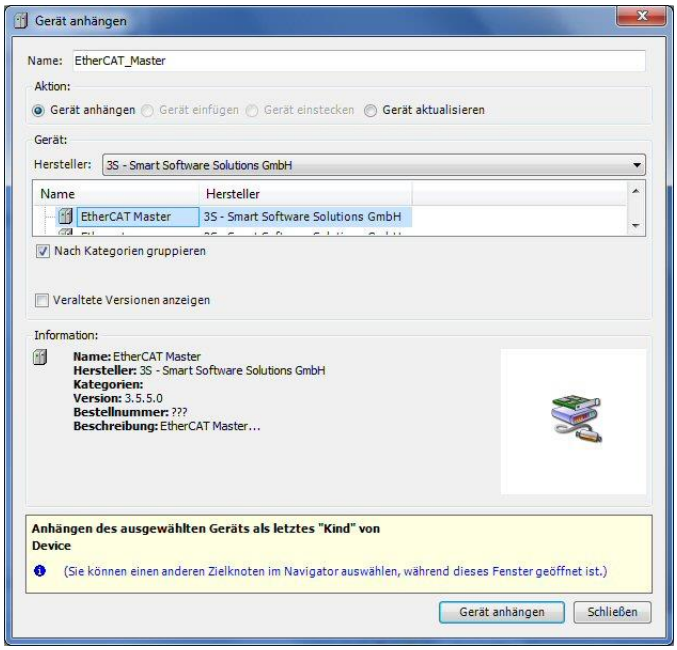
If the configuration is complete and all devices are connected to the programming PC, you can log in and run the configuration tool to test your Kuhnke FIO modules.

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

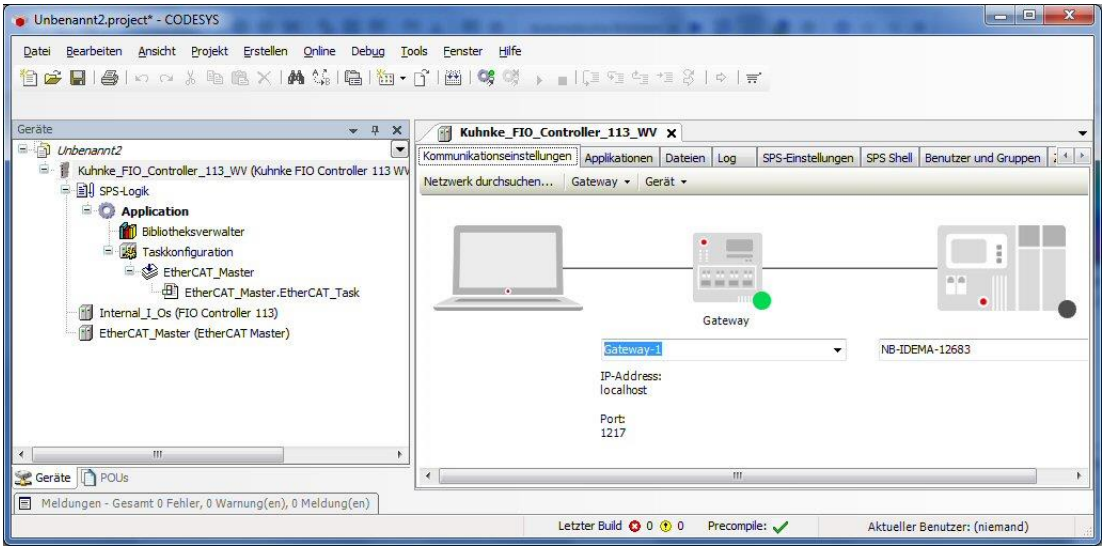
Online Configuration

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

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

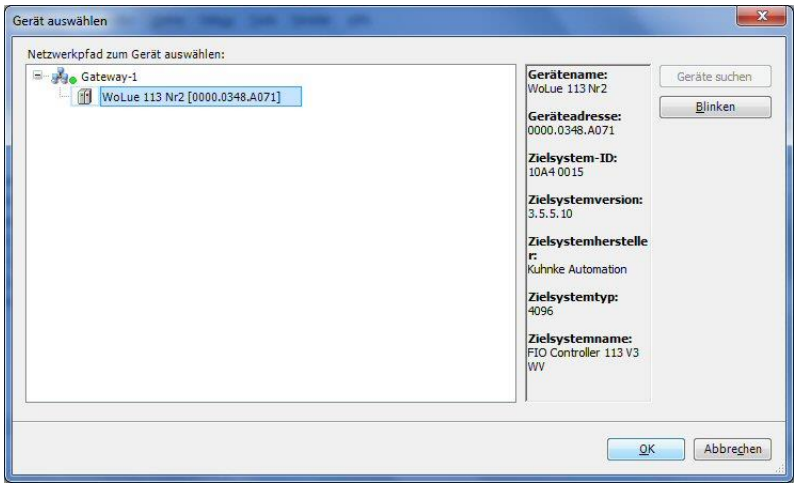


- Configure an EtherCAT master by adding an "EtherCAT Master" supplied by 3S-Smart Software Solutions GmbH to your device.

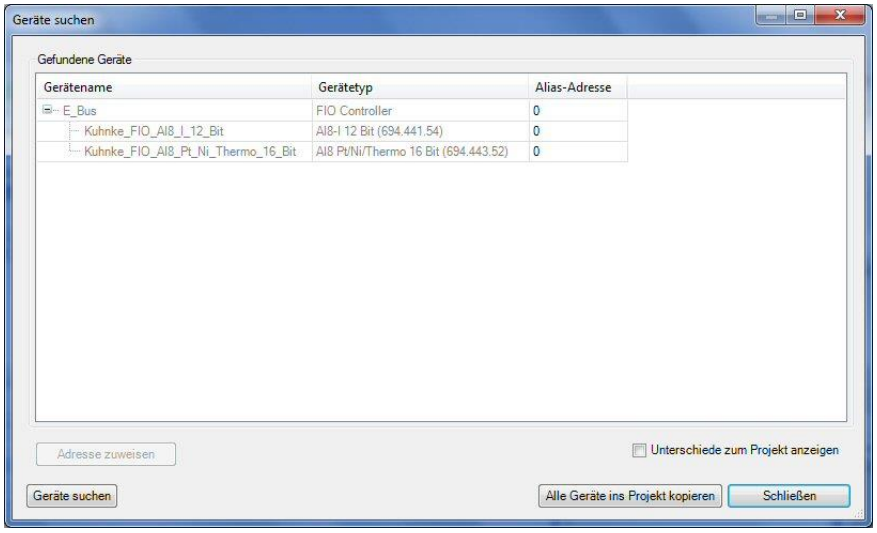


- Select "Device (…..Kuhnke FIO Controller 113)" and choose "Netzwerk durchsuchen" (search network).

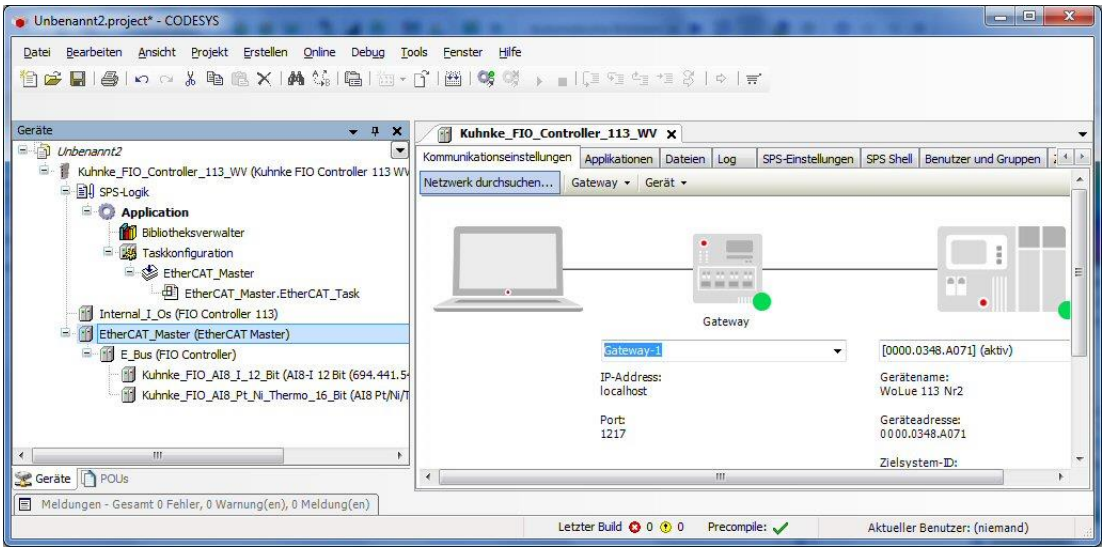
The software now scans the Ethernet network and finds the CoDeSys3 control unit connected to it.



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



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



- Test the EtherCAT IOs.

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

8 Appendix

8.1 Technical Data (Summarised)

System Properties of Kuhnke FIO

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

Bus Coupler

Kuhnke FIO bus coupler

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

Kuhnke FIO Bus Coupler DI16/DO16

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

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

Kuhnke FIO Bus Coupler DI8 DO8

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

Kuhnke FIO Bus Coupler DI8 DO4

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

Kuhnke FIO I/O Modules (General)

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

Extender

Kuhnke FIO Extender 2 Port

Part no. 694.400.02
Ports 2x RJ45

Controller

Kuhnke FIO Controller 113

http://productfinder.kuhnke.kendrion.com

Kuhnke FIO Controller 116

http://productfinder.kuhnke.kendrion.com

Digital FIO Modules

Kuhnke FIO DI16/DO16 1ms/0.5A

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

Kuhnke FIO DI16/DO16 5ms/0.5A

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

Kuhnke FIO DI16/DO16 1ms/0.5A LS

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

Kuhnke FIO DI16/DO8 1ms/1A

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

Kuhnke FIO DI8/DO8 1ms/0.5A

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

Kuhnke FIO DI8/DO8 5ms/0.5A

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

Kuhnke FIO DI16 1ms

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

Kuhnke FIO DI16 2-wire

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

Kuhnke FIO DI32 1ms

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

Kuhnke FIO DO8 1A

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

Kuhnke FIO DO8 2A

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

Kuhnke FIO DO16 0.5A

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

Kuhnke FIO DO16 2-wire

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

Kuhnke FIO DO8 NO Relay 24V

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

Kuhnke FIO DO8 NO Relay 230 VAC

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

Analogue FIO Modules

Kuhnke FIO AI4, 12 Bit / AO4, 16Bit

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

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

Kuhnke FIO AO4, 16-Bit

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

Kuhnke FIO AO4, 12-Bit

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

Kuhnke FIO AI4/8-U 13-Bit

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

Kuhnke FIO AI8/16-U 13-Bit

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

Kuhnke FIO AI4-I 12-Bit

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

Kuhnke FIO AI8-I 12-Bit

Part no. 694.441.54

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

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

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

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

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

Mixed I/O Modules

Kuhnke FIO MIX 02

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

Counter / Posi / Drive / CAM Modules

Counter2 5V

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

Kuhnke FIO CounterPosi2 5V

Part no. 694.454.01
Encoder inputs 2
Counting frequency ..... max. 200 kHz
Digital inputs ..... 8, 1 ms delay

Digital outputs ..... 2, load: 2.0 A, high-side semiconductor
Analogue outputs ..... 2, -10V..+10 V, 12 bit

Kuhnke FIO Drive Control

http://productfinder.kuhnke.kendrion.com

Kuhnke FIO CAM Control

http://productfinder.kuhnke.kendrion.com

Interface and Communication Modules

Kuhnke FIO RS485 1 Port

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

Kuhnke FIO RS232 2 Port

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

Kuhnke FIO CAN Master/Slave

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

FIO Safety Modules

Kuhnke FIO Safety PLC

http://productfinder.kuhnke.kendrion.com

Kuhnke FIO Safety SDI4/SDO2

http://productfinder.kuhnke.kendrion.com

8.2 Order Specifications

Kuhnke FIO Modules

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

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

Kuhnke FIO Accessories

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

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

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

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

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

9 Sales & Service

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



Malente Headquarters

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