



EtherCAT®

CANopen®

Instruction Manual

Kuhnke FIO
IP20 EtherCAT I/O Modules

E 747GB-V2

17 May 2021

1 Preface	6
1.1 Imprint	6
1.2 About this Manual	6
Limitation of Liability	6
Terms of Delivery	6
Copyright	6
Warranty	6
Manual Objective and Organisation	7
2 Reliability, Safety	8
2.1 Intended Use	8
2.2 Target Group of the Instruction Manual	8
2.3 Intended Use	8
2.4 Transport and Storage	8
2.5 Reliability	9
2.6 Hazard and other Warnings	10
2.7 Safety	11
Project Planning	11
Maintenance and Servicing	11
Disposal	12
2.8 Electromagnetic Compatibility	12
Definition	12
Interference Emission	12
General Notes on Installation	12
Electrical Immission Safeguard	12
Cable Routing and Wiring	12
Location of Installation	13
Particular Sources of Interference	13
3 Introduction	14
3.1 EtherCAT® — Ethernet Control Automation Technology	14
3.2 Kuhnke FIO (Fast Input / Output)	14
3.3 Kuhnke FIO — Ventura FIO	15
4 System Description	16
4.1 General Service Conditions	16
4.2 Mechanical Design	16
Installation	17
4.3 System Power Supply	19
General Instructions	19
System Power Supply	20
Earth	20
Bus Coupler	21
I/O Modules	21
4.4 Status LEDs	23
LED "EtherCAT Run"	23
LED "In L/A", LED "Out L/A"	23
LED "IO"	23
LED "Power"	23
5 Kuhnke FIO Modules	24
5.1 Controller	24

5.1.1 Controller 113.....	24
5.1.2 Controller 116.....	25
5.2 Bus Coupler and Extender	26
5.2.1 Bus Coupler.....	27
5.2.2 Bus Coupler DI16/DO16	29
5.2.3 Bus Coupler DI8 DO8.....	33
5.2.4 Extender 2 Port	36
5.3 Digital FIO Modules.....	38
5.3.1 DI16/DO16	38
5.3.2 DI16/DO16 LS (Low Side).....	40
5.3.3 DI16/DO8	42
5.3.4 DI8/DO8	44
5.3.5 DI16.....	46
5.3.6 DI16 2-Wire	48
5.3.7 DI32.....	51
5.3.8 DO8	53
5.3.9 DO16.....	55
5.3.10 DO16 2-Wire	57
5.3.11 DO8 Relay NO 24V	59
5.3.12 DO8 Relay NO 230VAC	61
5.4 Analogue FIO Modules	63
5.4.1 AI4 12Bit / AO4 16Bit CoE	63
5.4.2 AO4-U/I - 12-Bit.....	144
5.4.3 AO4-U/I - 16-Bit CoE.....	149
5.4.4 AI4/8-U	157
5.4.5 AI8/16-U	165
5.4.6 AI4-I.....	174
5.4.7 AI8-I.....	181
5.4.8 AI4-Pt/Ni/TC	189
5.4.9 AI8-Pt/Ni/TC	198
5.5 Counter / Posi / Drive / CAM Modules.....	210
5.5.1 Counter/Posi2 5V, Counter2 5V.....	210
5.5.2 Counter / Encoder	225
5.5.3 Kuhnke FIO Drive Control	288
5.5.4 Kuhnke FIO CAM Control	289
5.6 Mixed Modules	290
5.6.1 MIX 02.....	290
5.6.2 MIX 04.....	300
5.7 Interface and Communication Modules.....	399
5.7.1 RS485 1 Port.....	399
5.7.2 RS232 2 Port.....	413
5.7.3 CAN Master/Slave.....	427
5.8 Safety Modules.....	442
5.8.1 Kuhnke FIO Safety PLC.....	442
5.8.2 Kuhnke FIO Safety SDI4 SDO2	443
5.8.3 Kuhnke FIO Safety SDI8 SDO2	444
5.8.4 Kuhnke FIO Safety SDI16 SDO4	445
5.8.5 Kuhnke FIO Safety SDI16.....	446
6 Accessories	447

6.1	Power Distributor 2 x 16.....	447
	Terminals.....	447
	Status LEDs	447
	Function.....	447
	Mounting.....	448
6.2	Shield Terminal	449
	Terminals.....	449
	Function.....	449
	Technical Data	450
7	Configuration	451
7.1	CODESYS V3 (CODESYS Configurator)	451
	Offline Configuration.....	451
	Online Configuration.....	454
8	Appendix.....	457
8.1	Technical Data (Summarised)	457
	System Properties of Kuhnke FIO.....	457
	Kuhnke FIO I/O Modules (General)	458
8.2	Order Specifications.....	464
	Kuhnke FIO Modules.....	464
	Kuhnke FIO Accessories.....	465
9	Sales & Service	467

Modification history	
Date	Comments / modifications
29 May 2015	Original version
31 Aug 2015	Plus chapters on AO, AI-U, AI-I
11 Nov 2015	Plus chapter on DI16/DO16 bus coupler
01 Mar 2016	Plus chapter on Counter/Posi2, new UL logo
07 Mar 2016	Analogue modules corrected
26 Apr 2016	Addition to 2-row digital terminals: L+ and L- are both internally jumpered (5.3.1) Note on installation position added (Position) Note added on order of modules in multi-FIO systems (Order of Modules in Multi-FIO Systems) Connector sleeves for Weidmüller connector (General Instructions)
06 June 2016	Chapter Relay Modules added – (5.3.9 / 5.3.12)
10 July 2016	Tables of sensor values revised (5.4)
10 Nov 2016	Chapter Thermal Modules revised (5.4.8 / 5.4.9)
25 Nov 2016	Data types modified in chapter Counter2 CounterPosi2 (5.5.1)
17 Jan 2017	Chapter Analogue Output Modules revised (5.4.2 / 5.4.3)
20 Jan 2017	Chapter General Instructions revised under connector sleeves
23 Feb 2017	Note on unused encoder signals in chapter Counter2 CounterPosi2 (5.5.1)
03 Feb 2017	Table of sensor values revised in chapter 5.4.2 / 5.4.3, UL logo added for 16/16 bus coupler added to chapter 5.2.2
08 Mar 2017	New thermo module sub-chapters on cold point compensation and calibration (5.4.8 / 5.4.9)
21 Mar 2017	Chapter 5.4.2 AO4-U/I - 12-Bit" revised with regard to compatibility with the module's predecessor
25 Aug 2017	Formatting of entire Instruction Manual revised. New FIO modules added – communication modules, chapter 5.7 Technical data of complex FIO modules added (Controller/Safety/Drive/CAM) Old modules removed from manual (separate Instruction Manual on FIO V1 modules) Translation
31 Aug 2017	Inserting a note for the AI-U modules
01 Dez 2017	Device "Kuhnke FIO DO8 2A" Order number 694.452.06 ID: 190485 added
02 Mar 2018	Revision of the complete manual with regard to the Low Voltage Directive. Renaming in chapter Bus Coupler DI16 / DO16 - U24_Load to undervoltage_load and U24_Logic to undervoltage_logic
14 Jan 2019	Mounting instructions for the potential distributor added. Added information for recommended Ethernet cable.
03 Jul 2019	FIO Bus Coupler DI8 DO8 and DI8 DO4 added. Info about the new Safety Modules added.
28 Jan 2020	Design change and analog module Kuhnke AI4 12Bit / AO4 16Bit CoE added
29 Jan 2021	Minor corrections in the document
30 Mar 2021	Modules DI16 2-wire and DO16 2-wire added

1 Preface

1.1 Imprint

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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 61131-3 programming, please refer to the CODESYS online help engine and the references listed below.

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

2 Reliability, Safety

2.1 Intended Use

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

2.2 Target Group of the Instruction Manual

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


2.3 Intended Use

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

2.4 Transport and Storage

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

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

	CAUTION
	<p><i>Electrostatic discharge</i> <i>Destruction of or damage to the unit.</i></p> <ul style="list-style-type: none"> ⇒ 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
	<p><i>Only use devices that are in perfect condition, ie that they do not show any transport damage, fluid effects or other damage</i></p>

2.5 Reliability

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

These include:

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

2.6 Hazard and other Warnings

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


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

Every alert and hazard warning is made up as follows:


Type and source of risk


Potential consequences of non-observance

⇒ Preventive measures


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

	WARNING
<i>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.</i>	

	CAUTION
<i>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.</i>	


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


Other Notices

	Information
<i>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).</i>	

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

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

Project Planning

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

Maintenance and Servicing

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

Disposal

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

2.8 Electromagnetic Compatibility


Definition

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

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


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

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

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

Interference Emission

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

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

General Notes on Installation

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

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

Electrical Immission Safeguard

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

Cable Routing and Wiring

Keep power circuits separate from control circuits:

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

Joint laying of control circuits is allowed for:

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

Location of Installation

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

Temperature

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

Contamination

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

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

Impact and Vibration

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

Electromagnetic Interference

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

Particular Sources of Interference

Inductive Actuators

Switching off inductances (such as from relays, contactors, solenoids or switching magnets) produces surge voltages. It is necessary to reduce these extra voltages to a minimum.

Throttling elements could be diodes, Z-diodes, varistors or RC elements. Their rating should conform to the specifications provided by the manufacturer or supplier of the actuators.

3 Introduction

3.1 EtherCAT®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 μ s.

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

3.2 Kuhnke FIO (Fast Input / Output)

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

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

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



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

¹EtherCAT® 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.

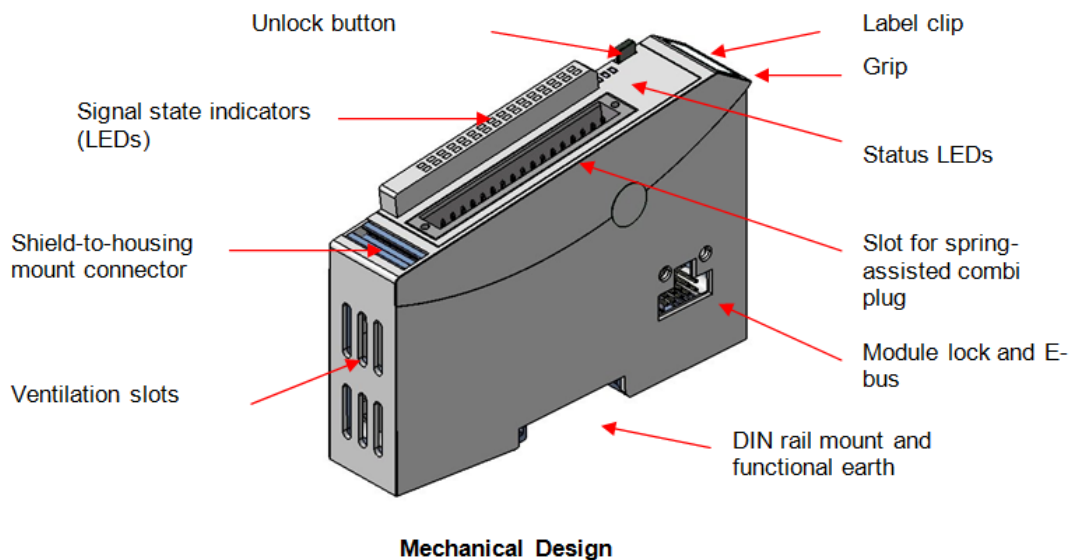
For a list of System Properties of Kuhnke FIO refer to chapter 0, page 457.

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

4.2 Mechanical Design

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

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



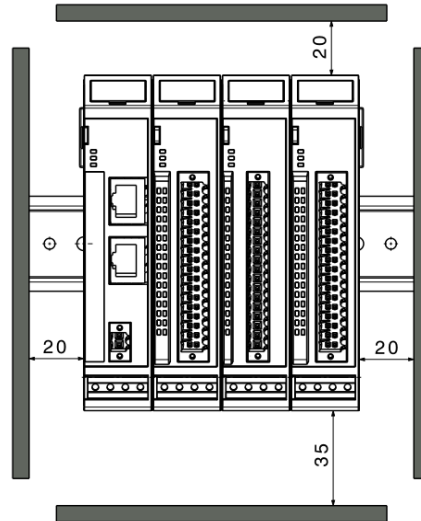
The housing mount consists of an aluminium profile with an integral snap-on device used to snap the module to a 35mm DIN rail. The housing trough including the optical fibres for the status indicators, the side face and the front is made of plastic and contains the module. The optical fibres for the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

Installation


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

Position

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



Order of Modules in Multi-FIO Systems

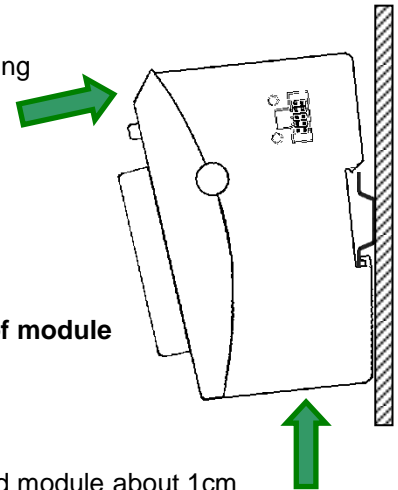
	NOTE
<p><i>In order to ensure that the entire FIO system works properly, arrange the FIO modules by their specific E-bus load, placing the modules with the highest E-bus load immediately next to the head module (bus coupler or controller). Take account of the head module's maximum bus load.</i></p> 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

To Snap on a Single Module

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

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

Rail mounting of module



To Interconnect Two Modules

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

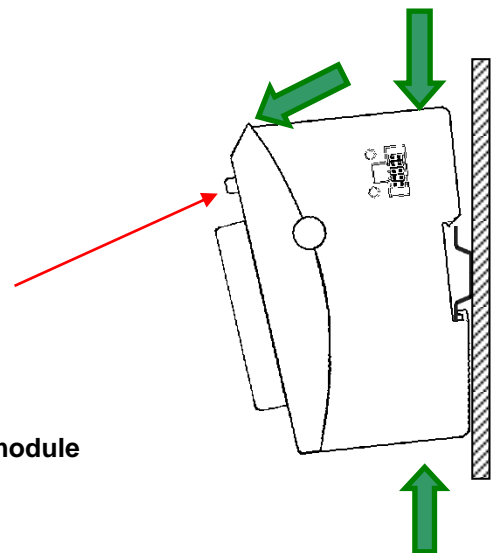
To Disconnect Two Modules

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

To Take Down a Single Module

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

Uninstalling a module




4.3 System Power Supply

General Instructions

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

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

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

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

Single row

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

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

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

Supported wires with connector sleeves:

Connector sleeve type	Wire cross section [mm ²]						
	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:

Connector sleeve type	Wire cross section [mm ²]						
	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
	<i>Do not connect the power supply lines through from one Kuhnke FIO to the next. To ensure that there is as little interference as possible, install a central power supply point and establish a star topology of as short wires as possible between the central point and Kuhnke FIO.</i>

System Power Supply

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

	<p>Information</p> <p>Please also note the connection printing on the device before the electrical installation.</p>
	<p>WARNING</p> <p>Potentially hazardous failures due to wrong voltages supplied</p> <p>Supplying the wrong voltages may damage or destroy the unit and may provoke potentially hazardous failures.</p> <p>Preventive measures:</p> <ul style="list-style-type: none"> ⇒ 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 $U_{max.} < 33 \text{ V}$ 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.

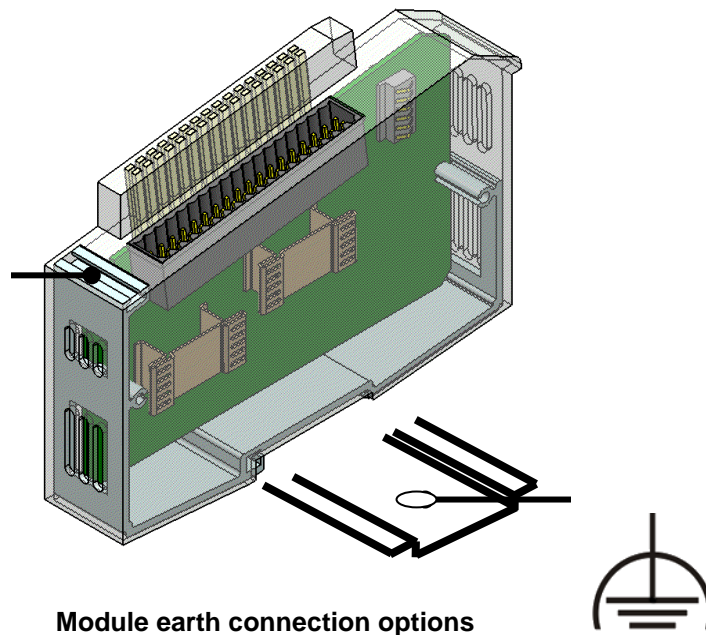
Since the functional earth connector dissipates HF currents, it is of utmost importance for the module's noise immunity.

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.



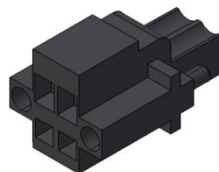
Information

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

Bus Coupler

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

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

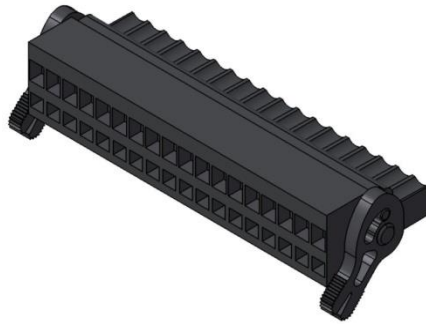


Spring-assisted plug with bolt flange for bus coupler connection

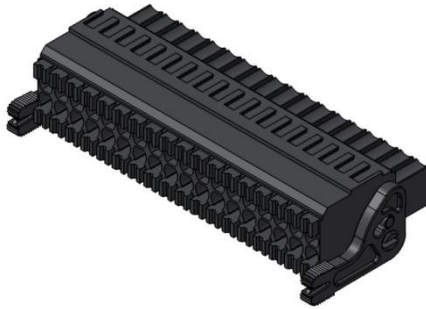
I/O Modules

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

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



Spring-assisted connector with I/O module unlock button



Two-row push-In connector with unlock button

**NOTE**

Externally turning off the I/O power supply (L+) can be used to trip all outputs.

In that case, LED Power indicates that no voltage is being supplied.

Mind, though, that not all modules have a voltage watchdog to indicate the state to the control unit.

To have your control program check whether power is supplied to the IOs, connect L+ to a digital input and poll that input as an indirect indicator of the IO power supply.

Remember the following if you choose to do so:

**NOTE**

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

This applies if the system is still supplied with power.

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

4.4 Status LEDs

LED "EtherCAT Run"

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

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

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

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

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

LED "IO"

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

LED "Power"

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

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

5 Kuhnke FIO Modules

5.1 Controller

5.1.1 Controller 113

Separate instruction manuals describe the FIO-series mini-IPC control units. For further information, please click the link below.

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

Technical Data

Type	Kuhnke FIO Controller 113
Processor	454 MHz i.MX28 Freescale
RAM / remanent memory	128 MB / flash storage
Drives	On-board flash memory, SD(HC) card slot
Software	Operating system: Windows® Embedded CE 6.0 Application: CODESYS V3 Soft PLC plus WebVisu...
Ports	1x RS232, 1x USB 2.0
Networks	1x Ethernet 10/100 Mbps – RJ45
Fieldbus interfaces	1x CAN, electrically isolated EtherCAT®, internal through the E-Bus interface, external through an extender module
Integral I/Os	1x DI, interrupt-enabled
Housing (W x H x D)	Aluminium base, plastic, 25 x 120 x 90 [mm]
Installation	35 mm DIN rail
Power supply	24 VDC / (19.2 ... 28.8)
Output	Approx. 3 W (@ 24 VDC)
Operating temperature	0 °C...+55 °C

5.1.2 Controller 116

Separate instruction manuals describe the FIO-series mini-IPC control units. For further information, please click the link below.

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

Technical Data

Type	Kuhnke FIO Controller 116
Processor	i.MX6 SoloX Freescale 800 MHz
RAM / remanent memory	256 MB / flash storage
Drives	On-board flash memory, SD(HC) card slot
Software	Operating system: Windows® Embedded Compact 2013 Application: CODESYS V3 Soft PLC plus optional WebVisu...
Ports	1x RS232, 1x USB 2.0
Networks	1x Ethernet 10/100 Mbps – RJ45
Fieldbus interfaces	1x CAN, electrically isolated EtherCAT®, internal through the E-Bus interface, external through an extender module
Integral I/Os	1x DI, interrupt-enabled
Housing (W x H x D)	Aluminium base, plastic, 25 x 120 x 90 [mm]
Installation	35 mm DIN rail
Power supply	24 VDC / (19.2 ... 28.8)
Output	Approx. 3.5 W (@ 24 VDC)
Operating temperature	0 °C...+55 °C

5.2 Bus Coupler and Extender

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

- Only use Ethernet cables that are at least Category 5 (CAT5) according to EN 50173 or ISO / IEC 11801 for connecting EtherCAT devices.
- Auto-crossing allows you to use both balanced (1: 1) and cross-over cables between EtherCAT devices.
- The permissible cable length between two EtherCAT devices may not exceed 100 meters.



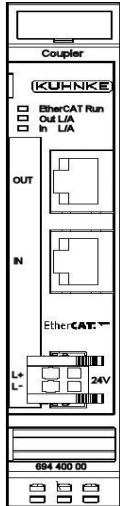
Information

Twist and permanent tensile load close to the connector of the Ethernet cable strain the connections. If the Ethernet plug is seated with a lot of play and not sufficiently guided in the socket, tilting effects occur at the plug connections. This often leads to contact interruptions and thus to field bus interruptions.

Vibration test show, the deeper the plug sits in the socket, the more robust the connection. In the industrial sector, the mechanical requirements with regard to vibration and impact resistance are known to be higher than in the IT sector.


Depending on the manufacturer and system, the plug-in depths available on the connectors available on the market vary from approximately 8 mm to almost 12 mm. Standard plugs are around 9 mm insertion depth. Connectors designed for the industrial sector reach according to the manufacturer up to 11.8 mm.

5.2.1 Bus Coupler



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

Bus coupler front view

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

Connectors

Module power supply

- L+ 24 VDC
- L- 0 V

EtherCAT

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

Status LEDs

LED "EtherCAT Run"

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

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

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

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

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

Function

See page 27:

Module State

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

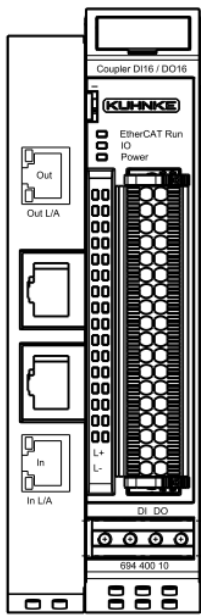
Technical Data

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



Approval:.....

5.2.2 Bus Coupler DI16/DO16



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

Front view of bus coupler DI16/DO16

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

Terminals

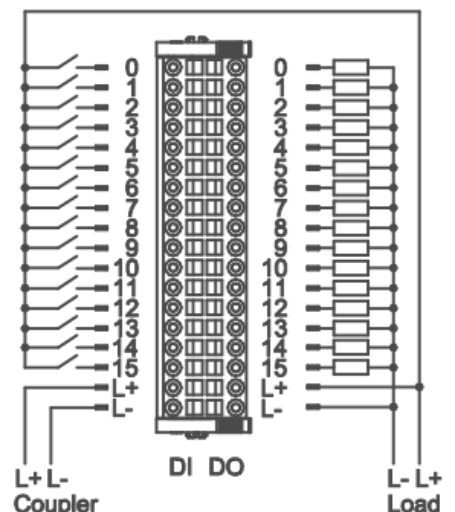
Module and I/O port power supply:

- L+ 24 VDC
- L- 0 V

EtherCAT

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

I/O connection



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

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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

**NOTE**

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

LED "Power"

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

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

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

**NOTE**

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

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

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

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

LEDs "Channel"

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

Module State

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

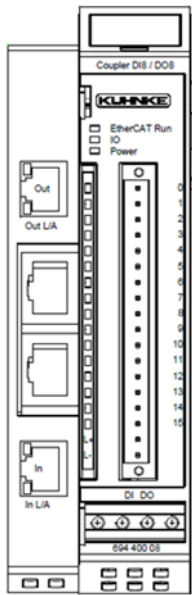
Technical Data

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

Approval:.....



5.2.3 Bus Coupler DI8 DO8



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

Front view of bus coupler DI8 DO8

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

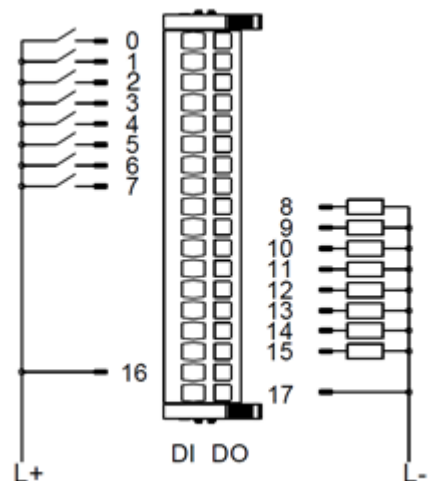
Terminals

Module and I/O port power supply:

- L+ 24 VDC
- L- 0 V

EtherCAT

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



I/O connection

Status LEDs

LED "EtherCAT Run"

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


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

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

LED "IO"

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

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




NOTE

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

LED "Power"

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

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



NOTE

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

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

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

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

LEDs "Channel"

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

Module State

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

Technical Data

Function Connects a 100 Base-TX EtherCAT with the Kuhnke FIO I/O modules.
 Generates the LVDS system voltages (E-bus)
 IO module

Controller ASIC ET1100

Baud rate 100 Mbit/s

Cable type..... CAT5

Cable length..... max. 100 m between 2 bus couplers

EtherCAT port..... 2x RJ45

Module power supply..... 24 VDC -15% +20%

IO/power connector male 18-pole connector (included in module package)

Input current..... 40 mA & E-bus plus

E-bus power..... max. 2 A (approx. 11 modules)

E-bus connector 10-pole system plug in side wall

Terminating module not required

Digital inputs 8

Rising delay 3 ms (typically)

Signal level Off: -3V ... 5V (EN 61131-3, type 1)
 On: 15V ... 30V

Digital outputs 8

Max. current..... 0.5 A each

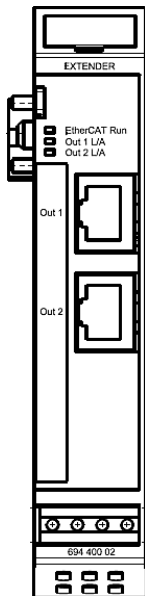
Max. total current..... 4 A

Part no. 694.400.08



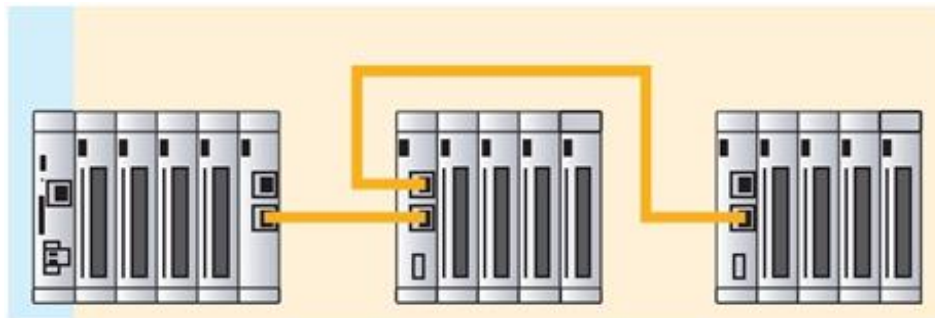
Approval:.....

5.2.4 Extender 2 Port



Kuhnke's FIO Extender lets you extend a Kuhnke FIO block or a Kuhnke FIO Control (Embedded PC) by EtherCAT slaves equipped with a standard 100 Base Tx connection. The extender converts the physical transfer technology from LVDS (E-bus) to twisted pair. The module is normally located at the end of the block. You may also place the extender at any point after the bus coupler or the FIO Control module, though, to design a star topology of EtherCAT slaves, for example.

Front view of two-port extender



Kuhnke FIO Control plus extender with Kuhnke FIO blocks

Terminals

Module power supply via the E-bus

EtherCAT:

OUT1 Female RJ45 output (to next EtherCAT station)

OUT2 Female RJ45 output (to next EtherCAT station)

Status LEDs

LED "EtherCAT Run"

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

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

5.2.4.1.1 LED "Out2", LED "Out1"

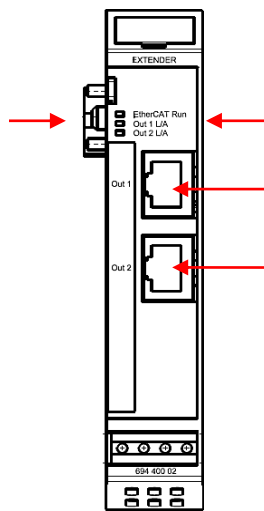
The "Out2" and "Out1" LEDs indicate the physical state of the Ethernet port they are allocated to.

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

Function

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

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



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

Technical Data

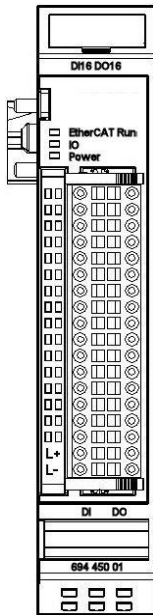
Function	Extends a Kuhnke FIO block or a Kuhnke FIO Control (embedded PC). Converts the physical transfer technology from LVDS (E-bus) to 100 Base-Tx.
Controller	ASIC ET1100
Baud rate	100 Mbit/s
Cable type.....	CAT5
Cable length.....	max. 100 m
EtherCAT port.....	2x RJ45
Power supply	Via E-bus
E-bus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



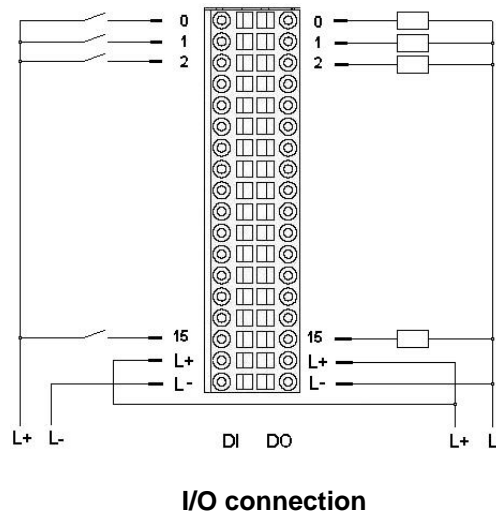
Approval:.....

5.3 Digital FIO Modules

5.3.1 DI16/DO16



Front view of DI16/DO16 I/O module



Terminals

Power supply to module I/Os

L+ 24 VDC

L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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




NOTE

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

LED "Power"

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

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

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

LEDs "Channel"

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

Function

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

Variable

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

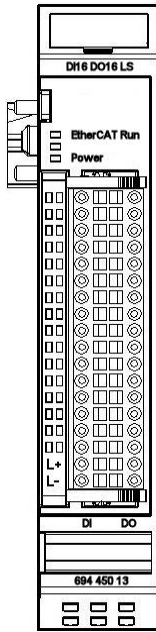
Technical Data

- Digital inputs 16
- Rising delay 1 ms / 5 ms (typically)
- Signal level Off: -3V ... 5V (EN 61131-3, type 1)
On: 15V ... 30V
- Digital outputs 16
- Max. current 0.5 A each
- Max. total current 8 A
- IO/power connection 36-pin plug
- Controller ASIC ET1200
- Baud rate 100 Mbit/s
- E-bus connector 10-pole system plug in side wall
- Terminating module not required
- Power supply 24 VDC -20% +25%
- E-bus load 135 mA
- Part no.
- Kuhnke FIO DI16/DO16 5ms/0.5A 694.450.01
- Kuhnke FIO DI16/DO16 1ms/0.5A 694.450.03

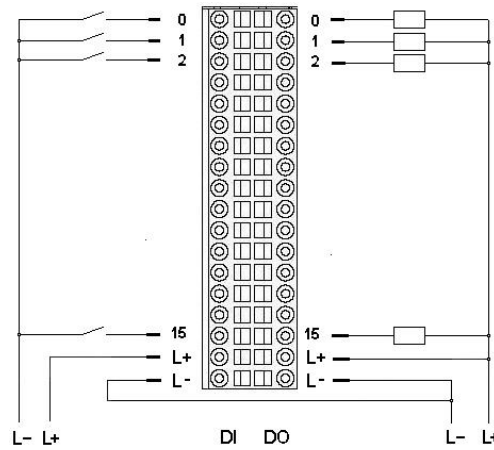


Approval:.....

5.3.2 DI16/DO16 LS (Low Side)



Front view of DI16/DO16 LS I/O module



I/O connection

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

There is no LED labelled "IO".

LED "Power"

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


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


LEDs "Channel"

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

Function

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

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

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

Variable

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

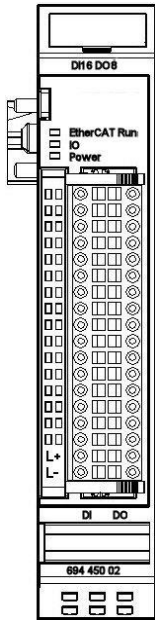
Technical Data

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

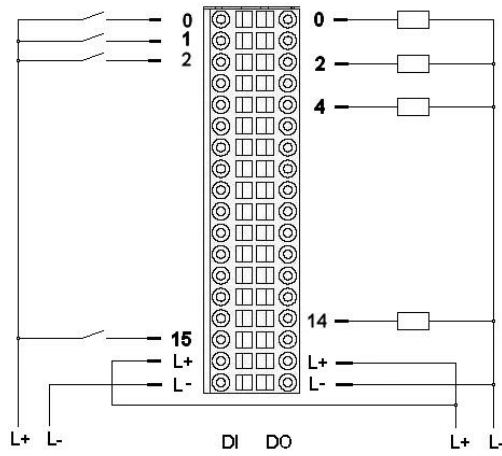
Approval:.....



5.3.3 DI16/DO8



Front view of DI16/DO8 I/O module



I/O connection

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

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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


NOTE

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

LED "Power"

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

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

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

LEDs "Channel"

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

Function

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

Variable

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

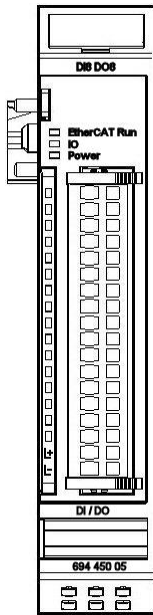
Technical Data

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

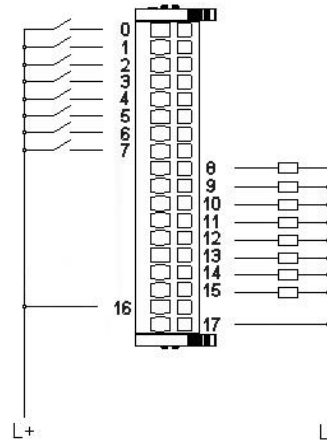


Approval:.....

5.3.4 DI8/DO8



Front view of DI8/DO8 I/O module



I/O connection

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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




NOTE

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

LED "Power"

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

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

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

LEDs "Channel"

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

Function

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

Variable

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

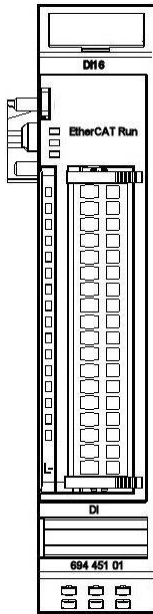
Technical Data

- Digital inputs 8
- Rising delay 1 ms / 5 ms (typically)
- Signal level Off: -3V ... 5V (EN 61131-3, type 1)
On: 15V ... 30V
- Digital outputs 8
- Max. current 0.5 A each
- Max. total current 8 A
- IO/power connection 18-pin plug
- Controller ASIC ET1200
- Baud rate 100 Mbit/s
- E-bus connector 10-pole system plug in side wall
- Terminating module not required
- Power supply 24 VDC -20% +25%
- E-bus load 135 mA
- Part no.
- Kuhnke FIO DI8/DO8 5ms/0.5A 694.450.04
- Kuhnke FIO DI8/DO8 1ms/0.5A 694.450.05

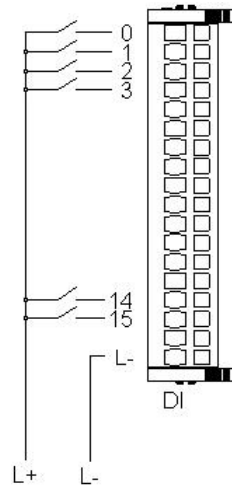
Approval:.....



5.3.5 DI16



Front view of DI16 I/O module



I/O connection

Terminals

Power supply to module I/Os

L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

There is no LED labelled "IO".

LED "Power"

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

LEDs "Channel"

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

Function

The DI16 module has 16 digital inputs.

Variable

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

Technical Data

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

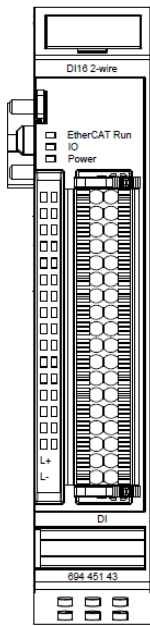


LISTED
59DM
E202287

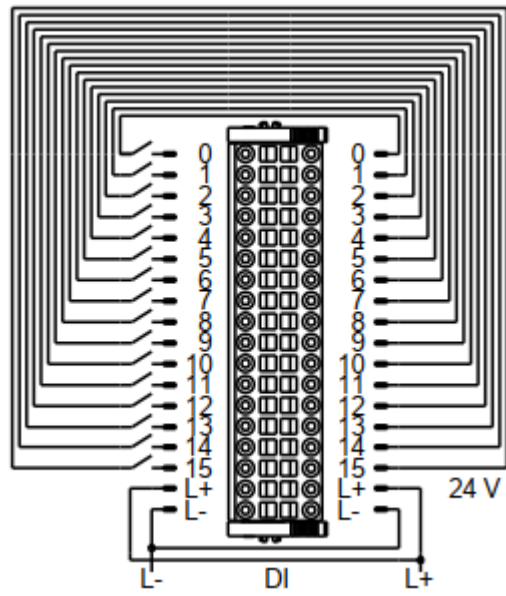
EtherCAT
Conformance tested

Approval:.....

5.3.6 DI16 2-Wire



Front view of DI16 I/O module



I/O connection

Terminals

Power supply to module I/Os

L+ 24 V DC

L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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


LED "IO"

There is no LED labelled "IO".

LED "Power"

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

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

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

LEDs "Channel"

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

Function

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

**CAUTION**

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

**NOTE**

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

Variable

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

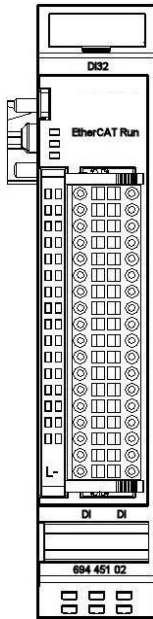
Technical Data

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

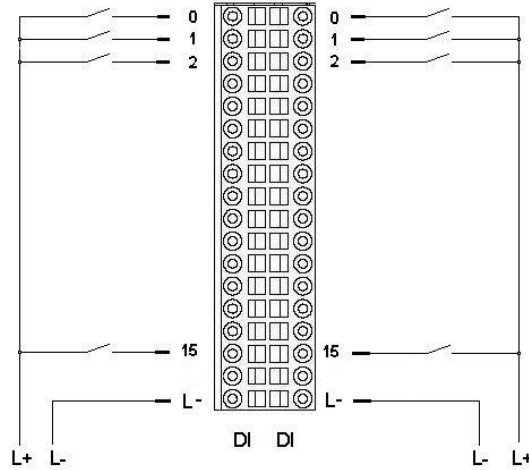


Approval:.....

5.3.7 DI32



Front view of DI32 I/O module



I/O connection

Terminals

Power supply to module I/Os

L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

There is no LED labelled "IO".

LED "Power"

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

LEDs "Channel"

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

Function

The DI32 module has 32 digital inputs.

Variable

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

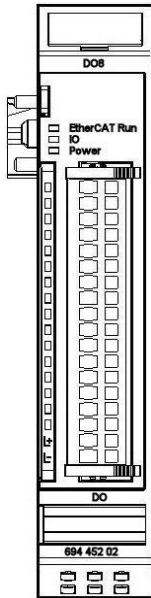
Technical Data

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

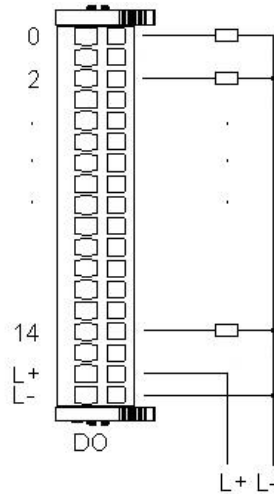


Approval:.....

5.3.8 DO8



Front view of DO8 I/O module



I/O connection

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

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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


NOTE

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

LED "Power"

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

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

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

LEDs "Channel"

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

Function

The DO8 module has 8 digital outputs.

Variable

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

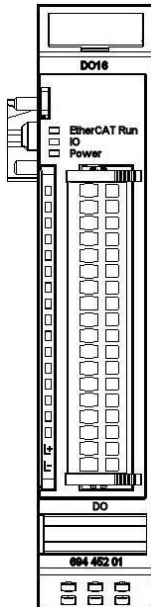
Technical Data

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

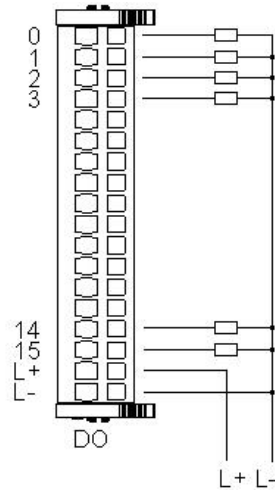


Approval:.....

5.3.9 DO16



Front view of DO16 I/O module



I/O connection

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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


NOTE

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

LED "Power"

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

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

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

LEDs "Channel"

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

Function

The DO16 module has 16 digital outputs.

Variable

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

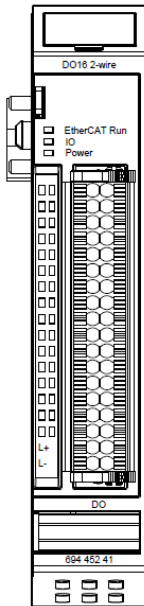
Technical Data

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

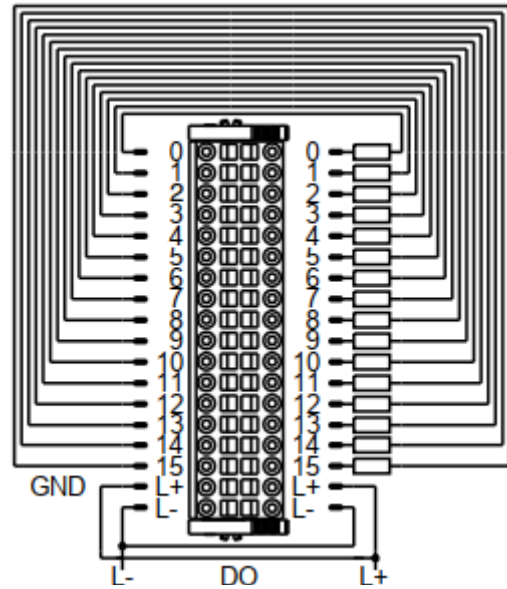


Approval:.....

5.3.10 DO16 2-Wire



Front view of DO16 I/O module



I/O connection

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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

NOTE

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

LED "Power"

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

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

**Information**

The module is not monitored for low voltage states.

LEDs "Channel"

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

Function

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

Variable

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

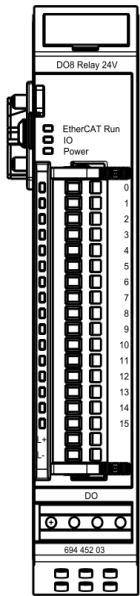
Technical Data

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

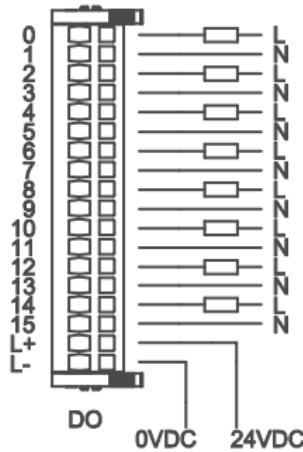


Approval:.....

5.3.11 DO8 Relay NO 24V



Front view of DO8 Relay NO 24V module



I/O connection

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

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

LED "IO" has no function.

LED "Power"

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

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

LEDs "Channel"

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

Function


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


Variable

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

Module State

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

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

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

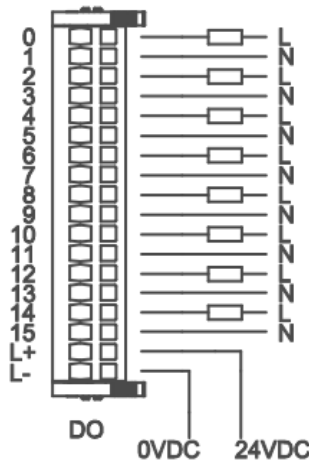
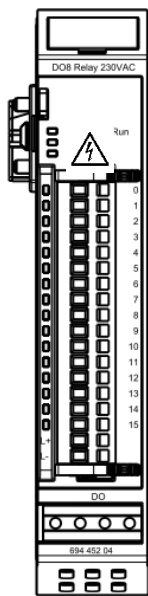
Technical Data

- Digital outputs 8 normally open relays
- Max. switching current (resistive) 5.0 A each
- Max. switching current (inductive) 2.0 A each
- Min. admissible load 10 mA @ 5 VDC
- Min. mech. switching cycles 2 x 10⁷
- Min. electr. switching cycles 3 x 10⁵ (2A/30 VDC)
- Switching voltage..... max. 24 VDC/VAC
- IO/power connection..... 18-pin plug
- Controller ASIC ET1200
- Baud rate 100 Mbit/s
- E-bus connector 10-pole system plug in side wall
- Terminating module not required
- Power supply 24 VDC -20% +25%
- E-bus load..... 130 mA
- Part no. 694.452.03

Approval:.....



5.3.12 DO8 Relay NO 230VAC



I/O connection

Front view of DO8 Relay NO 230V module

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

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

LED "IO" has no function.

LED "Power"

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

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

LEDs "Channel"

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

Function

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

Variable

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

Module State

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



NOTE

In case of undervoltage the switching of the relays is prevented and already energized relays fall off.



NOTE

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

Technical Data

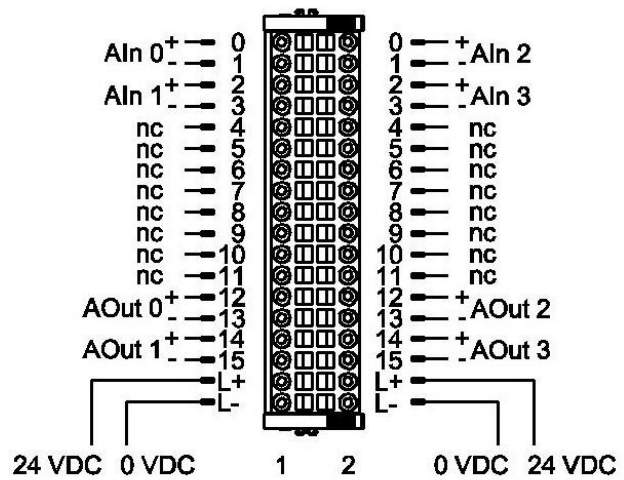
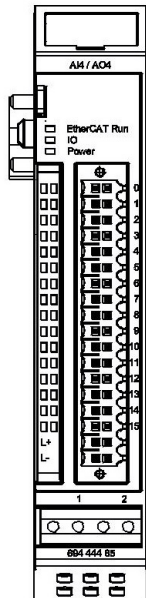
Digital outputs	8 normally open relays
Max. switching current (resistive)	5.0 A each
Max. switching current (inductive)	2.0 A each
Min. admissible load	10 mA @ 5 VDC
Min. mech. switching cycles	2 x 10 ⁷
Min. electr. switching cycles	3 x 10 ⁵ (2A/30 VDC)
Switching voltage.....	max. 24 VDC/230 VAC
IO/power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



Approval:.....

5.4 Analogue FIO Modules

5.4.1 AI4 12Bit / AO4 16Bit CoE



I/O connection

Front view of I/O AI4/AO4 modul

Terminals

Power supply to module I/Os

L+ 24 VDC

L- 0 V

Funktionserde / Schirm der Analogleitungen → Abschnitt Earth

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On Inoperative if E-bus LED = Off
	Red, 1x	Short circuit
	Red, 2x	Low voltage
	Red, 4x	EtherCAT watchdog control
	Red, 6x	Module-specific fault
	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

LEDs "Channel"

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

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Short circuit
	Red, 3x	Wire failure
	Red, 5x	Excessive temp. of output drivers

Functions

The module AI4 12Bit / AO4 16Bit has 4 analog inputs and 4 analog outputs. All channels can be parameterized almost independently of each other, giving the module a high degree of flexibility.

Input and output values can be easily scaled according to their use so that, for example, the measured value of a sensor can be read directly in the desired unit.

Configuration examples

Input mapping

Depending on the configuration of the analog inputs, various predefined mappings are available.

A basic distinction is made between the following display formats:

- Field Value Physical: Input value in [V] or [mA] as REAL
Mapping 1A01_h active
- Field Value Increments: Input value in digits as UINT
Mapping 1A02_h active
- Process Value: Scaled input value (Process value) as REAL
Mapping 1A03_h active

View of the mapped process data in CODESYS V3:

Ausgänge auswählen			
Startadresse	Typ	Index	
<input checked="" type="checkbox"/> 16#1600 Device Control			
Device Control	UINT	16#2201:00	
<input checked="" type="checkbox"/> 16#1601 AO Field Value Physical			
AO Output FV 1 (Phy)	REAL	16#6330:01	
AO Output FV 2 (Phy)	REAL	16#6330:02	
AO Output FV 3 (Phy)	REAL	16#6330:03	
AO Output FV 4 (Phy)	REAL	16#6330:04	
<input type="checkbox"/> 16#1602 AO Field Value Increments (a			
AO Output FV 1 (Inc)	UINT	16#7330:01	
AO Output FV 2 (Inc)	UINT	16#7330:02	
AO Output FV 3 (Inc)	UINT	16#7330:03	
AO Output FV 4 (Inc)	UINT	16#7330:04	
<input type="checkbox"/> 16#1603 AO Process Value (ausgeschlo			
AO Output PV 1	REAL	16#6300:01	
AO Output PV 2	REAL	16#6300:02	
AO Output PV 3	REAL	16#6300:03	
AO Output PV 4	REAL	16#6300:04	

Eingänge auswählen			
Name	Typ	Index	
<input checked="" type="checkbox"/> 16#1A00 Error Field			
ErrorCode	UINT	16#213F:00	
<input checked="" type="checkbox"/> 16#1A01 AI Field Value Physical			
AI input FV 1 (Phy)	REAL	16#6100:01	
AI input FV 2 (Phy)	REAL	16#6100:02	
AI input FV 3 (Phy)	REAL	16#6100:03	
AI input FV 4 (Phy)	REAL	16#6100:04	
<input type="checkbox"/> 16#1A02 AI Field Value Increments			
AI input FV 1 (Inc)	UINT	16#7100:01	
AI input FV 2 (Inc)	UINT	16#7100:02	
AI input FV 3 (Inc)	UINT	16#7100:03	
AI input FV 4 (Inc)	UINT	16#7100:04	
<input type="checkbox"/> 16#1A03 AI Process Value			
AI input PV 1	REAL	16#6130:01	
AI input PV 2	REAL	16#6130:02	
AI input PV 3	REAL	16#6130:03	
AI input PV 4	REAL	16#6130:04	

Using the analog inputs

The analog inputs are parameterized as voltage input 0...10 V at delivery. Depending on the connected sensor, these can be parameterised via the following object:

Object	Explanation
AI Sensor Type 6110 _h	42 = 0...10 V (Default) 52 = 0...20 mA 51 = 4...20 mA

Input scaling

Input values can be scaled channel by channel by specifying two set points or by specifying factor and offset. The scaled input values are output as process values (PV). These are output in a separately map able object.

Objekt	Beschreibung
AI Input PV 6130 _h	Mapable object of the scaled analog input values The predefined mapping object 1A03h can be selected for this purpose.
AI Channel Control 2001 _h	Bit 1 = 0: Scaling by factor and offset Bit 1 = 1: Scaling by set points
AI Input Scaling 1 FV 6120 _h	Set point 1 Field value [V] or [mA]
AI Input Scaling 1 PV 6121 _h	Set point 1 Process value
AI Input Scaling 2 FV 6122 _h	Set point 2 Field value [V] or [mA]
AI Input Scaling 2 PV 6123 _h	Set point 2 Process value
AI Scaling Factor 6126 _h	Scaling factor [Process value / Field value]
AI Scaling Offset 6127 _h	Scaling offset [Process value]

Ausgangsmapping

Depending on the configuration of the analog outputs, various predefined mappings are available.

A basic distinction is made between the following display formats:

- Field Value Physical: Output value in [V] or [mA] as REAL
Mapping 1601_h active
- Field Value Increments: Output value in digits as UINT
Mapping 1602_h active
- Process Value: Scaled output value (Process value) as REAL
Mapping 1603_h active

The above mappings are exclusive of each other, so only one of the 3 mappings can be activated.

Using the Analog Outputs

The analog outputs are not active on delivery. To use an analog output, it must be activated. The analog outputs are activated by configuring the output type of the respective output.

Objekt	Beschreibung
AO Output Type 6310 _h	0 = Disabled (Default) 10 = 0...10 V 11 = +/- 10 V 20 = 0...20 mA 21 = 4...20 mA

Output scaling

Output values can be scaled channel by channel by specifying two set points.

The scaled output values are output as a process value (PV).

These are output in a separately mapable object.

Objekt	Beschreibung
AO Output PV 6300 _h	Mapable object contains the process value (PV) of the corresponding analog output. The predefined mapping object 1603 _h can be selected for this, other possibly selected mapping objects 1601 _h or 1602 _h must be deselected.
AO Output Scaling 1 FV 6320 _h	Set point 1 Field value [V] or [mA]
AO Output Scaling 1 PV 6321 _h	Set point 1 Process value
AO Output Scaling 2 FV 6322 _h	Set point 2 Field value [V] or [mA]
AO Output Scaling 2 PV 6323 _h	Set point 2 Process value

Distributed Clocks Operation

In order to acquire or output data in an EtherCAT network at a certain time on all participants simultaneously, all participants must work synchronously. For this purpose there is a local clock in the EtherCAT slave controllers, which is automatically synchronised by the EtherCAT master with the master clock in the EtherCAT network with an accuracy of less than 100ns.

The EtherCAT slave controllers in the EtherCAT network generate interrupts synchronously. This interrupt collects input data or processes output data simultaneously.

Several DC modes are available on the AI4 / AO4:

The screenshot shows the configuration interface for an EtherCAT slave controller. The window title is "AI4_12_Bit_AO4_16_Bit_694_444_63_x". The interface is divided into several sections:

- Allgemein (General):** Includes a sidebar with options like "Prozessdaten", "Startparameter", and "Information".
- Adresse (Address):** Contains fields for "AutoInc Adresse" (set to -1) and "EtherCAT-Adresse" (set to 1002).
- Zusätzlich (Additional):** Includes checkboxes for "Experteneinstellungen aktivieren" (checked) and "Optional" (unchecked).
- Verteilte Uhren (Distributed Clocks):**
 - Select DC:** A dropdown menu is open, showing options: "DC-Synchron", "SM-Synchron", "DC-Synchron", "DC-Synchron 2 x oversampling", "DC-Synchron 3 x oversampling", "DC-Synchron 4 x oversampling", and "DC-Synchron 5 x oversampling".
 - Aktivieren (Activate):** A checked checkbox.
 - Sync0:** A checked checkbox for "Sync 0 aktivieren".
 - Sync Unit Cycle:** A radio button selected, with a dropdown set to "x 1", a numeric field set to "4000", and the label "Zykluszeit (µs)".
 - Benutzerdefiniert (User-defined):** A radio button unselected, with a numeric field set to "0" and the label "Shift Time (µs)".

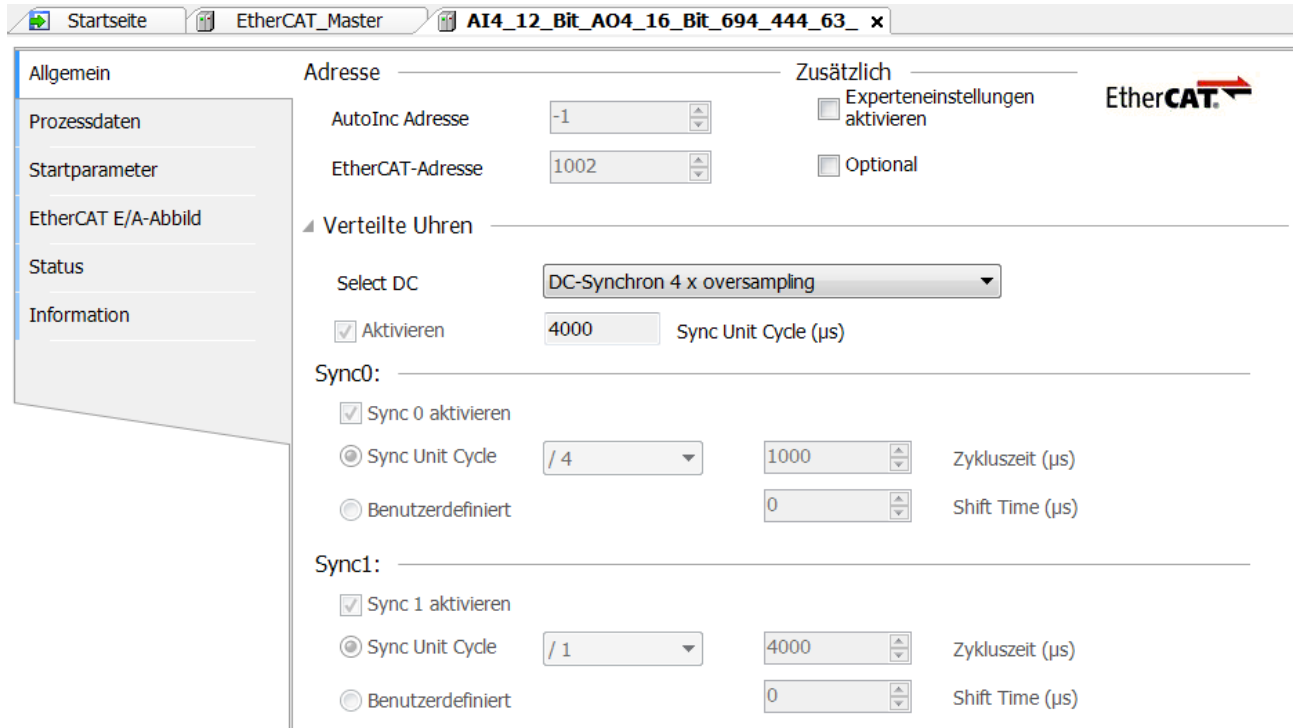
DC synchronous oversampling operation

In oversampling mode, it is possible to acquire up to 5 measured values in one bus cycle, enabling the acquisition of rapidly changing measured values.

For n-times oversampling, one of the DC synchronous operating modes with the desired factor n is selected in the EtherCAT slave setting.

Example:

- DC- Cycle time 4000µs
- 4-times oversampling



Every 1000µs the Sync 0 interrupt is triggered on the module, in which the input values are read.

These are available in the following objects:

Field Value (Real)	Process Value (Real)
AI1 Oversample Data FV 2101 _h	AI1 Oversample Data PV 2131 _h
AI2 Oversample Data FV 2102 _h	AI2 Oversample Data PV 2132 _h
AI3 Oversample Data FV 2103 _h	AI3 Oversample Data PV 2133 _h
AI4 Oversample Data FV 2104 _h	AI4 Oversample Data PV 2134 _h

Furthermore, every 4000µs the Sync 1 interrupt is triggered, with which the output values are written and the average value of the sampled input values is calculated.

Object dictionary

Device Type 1000h

Name	Device Type
Index	1000 _h
Object Code	VARIABLE
No. of Elements	-
Data Type	UNSIGNED32
Access	read only
PDO Mapping	No
Value Range	Fix
Default Value	800A 0192 _h

Additional Information [16] Bit 31...16

Bit 16 = Digital Input FB	0
Bit 17 = Analog Input FB	✓
Bit 18 = Digital Output FB	0
Bit 19 = Analog Output FB	✓
Bit 20 = Controller FB	0
Bit 21 = Alarm FB	0
Bit 22 = Device FB	✓
Bit 23 bis 26 = Specific Function	0
Bit 27 bis 29 = Reserved	0
Bit 30 = Reserved	0
Bit 31 = Manufacturer-specific PDO mapping	✓

Device Profile number [16] Bit 15..0

0194_h = 404_d = 404 Device Profile Nummer

Error Register 1001_h

Name	Error Register
Index	1001 _h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED8
Access	read only
PDO Mapping	Yes, TX-PDO
Value Range	
Default Value	00 _h

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

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

Manufacturer Device Name 1008_h

Name	Manufacturer Device Name
Index	1008 _h
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING
Access	read only
PDO Mapping	No
Units	-
Value Range	Fix
Default Value	FIO AI4AO4

Subindex 0 of this object contains the length of the character string. As of subindex 1, the individual characters are contained. The character string is not terminated by null characters.

Manufacturer Hardware Version 1009_h

Name	Manufacturer Hardware Version
Index	1009 _h
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING
Access	read only
PDO Mapping	No
Units	-
Value Range	Fix
Default Value	1.00

Subindex 0 of this object contains the length of the character string. As of subindex 1, the individual characters are contained. The character string is not terminated by null characters.

Manufacturer Software Version 100A_h

Name	Manufacturer Software Version
Index	100A _h
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING
Access	read only
PDO Mapping	No
Value Range	Fix
Default Value	1.00

Identity Object 1018h

Name	Identity object
Index	1018 _h
Object Code	RECORD
No. of Elements	0
Data Type	IDENTITY

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	Vendor-ID
Subindex	01 _h
Data type	UNSIGNED32
Access	read only
PDO Mapping	No
Default Value	0048554B _h

Name	Product Code
Subindex	02 _h
Data type	UNSIGNED32
Access	read only
PDO Mapping	No
Default Value	0002EF68 _h

Name	Revision number
Subindex	03 _h
Data type	UNSIGNED32
Access	Read only
PDO Mapping	No
Default Value	

Name	Serial number
Subindex	04 _h
Data type	UNSIGNED32
Access	Read only
PDO Mapping	No
Default Value	

The object contains information about the manufacturer, the product code and the revision and serial number.

Error Settings 10F1_h

Name	Error Settings
Index	10F1 _h
Object Code	RECORD
No. of Elements	3
Data Type	

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	02 _h

Name	Local Error Reaction
Subindex	01 _h
Data type	UNSIGNED32
Access	read only
PDO Mapping	No
Default Value	00000001 _h

Name	Sync Error Counter Limit
Subindex	02 _h
Data type	UNSIGNED16
Access	read only
PDO Mapping	No
Default Value	0004 _h

Unused

Mapping 1600_h (Device Control)

Name	Drive Control
Index	1600 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read write
PDO Mapping	No
Default Value	01 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2201 00 10 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	60600008 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1601_h (AO Field Value Physical)

Name	AO Field Value Physical
Index	1601 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING
Exclude	1602 _h , 1603 _h

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6330 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6330 02 20 _h

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6330 03 20 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6330 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1602_h (AO Field Value Increments)

Name	AO Field Value Increments
Index	1602 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING
Exclude	1601 _h , 1603 _h

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	7330 01 10 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	7330 02 10 _h

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	7330 03 10 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	7330 04 10 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1603_h (AO Process Value)

Name	AO Process Value
Index	1603 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING
Exclude	1601 _h , 1602 _h

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	04

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6300 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6300 02 20 _h

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6300 03 20 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6300 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A00_h (Error Field)

Name	Error Field
Index	1A00 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	01 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	213F 00 10 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A01_h (AI Field Value Physical)

Name	AI Field Value Physical
Index	1A01 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6100 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6100 02 20 _h

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6100 03 20 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6100 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A02_h (AI Field Value Increments)

Name	AI Field Value Increments
Index	1A02 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	7100 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	7100 02 20 _h

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	7100 03 20 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	7100 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A03_h (AI Process Value)

Name	AI Process Value
Index	1A03 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6130 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6130 02 20

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6130 03 20 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	6130 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A04_h (Oversample FV AI1)

Name	Oversample FV AI1
Index	1A04 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	05 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2101 01 10 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2101 02 10

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2101 03 10 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2101 04 10 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2101 05 10 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A05_h (Oversample FV AI2)

Name	Oversample FV AI2
Index	1A05 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	05 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2102 01 10 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2102 02 10

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2102 03 10 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2102 04 10 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2102 05 10 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A06_h (Oversample FV AI3)

Name	Oversample FV AI3
Index	1A06 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	05 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2103 01 10 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2103 02 10

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2103 03 10 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2103 04 10 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2103 05 10 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A07_h (Oversample FV AI4)

Name	Oversample FV AI4
Index	1A07 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	05 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2104 01 10 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2104 02 10

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2104 03 10 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2104 04 10 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2104 05 10 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A08_h (Oversample PV AI1)

Name	Oversample PV AI1
Index	1A08 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	05 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2131 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2131 02 20

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2101 03 10 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2131 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2131 05 20 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A09_h (Oversample PV AI2)

Name	Oversample PV AI2
Index	1A09 _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	05 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2132 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2132 02 20 _h

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2132 03 20 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2132 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2132 05 20 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A0A_h (Oversample PV AI3)

Name	Oversample PV AI3
Index	1A0A _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	05 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2133 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2133 02 20

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2133 03 20 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2133 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2133 05 20 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

Mapping 1A0B_h (Oversample PV AI4)

Name	Oversample PV AI4
Index	1A0B _h
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest sub index supported
Subindex	00 _h
Data type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	05 _h

Name	1st Object to be mapped
Subindex	01 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2134 01 20 _h

Name	2nd Object to be mapped
Subindex	02 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2134 02 20

Name	3rd Object to be mapped
Subindex	03 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2134 03 20 _h

Name	4th Object to be mapped
Subindex	04 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2134 04 20 _h

Name	5th Object to be mapped
Subindex	05 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2134 05 20 _h

Name	6th Object to be mapped
Subindex	06 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	7th Object to be mapped
Subindex	07 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	8th Object to be mapped
Subindex	08 _h
Data type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

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

AI Channel Control 2001_h

Name	AI Channel Control
Index	2001 _h
Object Code	ARRAY
No. of Elements	5
Data Type	UINT8

Name	Highest sub index supported
Subindex	00 _h
Data type	UINT8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Channel Control 1
Subindex	01 _h
Data type	UINT8
Access	read write
PDO Mapping	Yes, RX-PDO
Default Value	00000000 _h

Name	AI Channel Control 2
Subindex	02 _h
Data type	UINT8
Access	read write
PDO Mapping	Yes, RX-PDO
Default Value	00000000 _h

Name	AI Channel Control 3
Subindex	03 _h
Data type	UINT8
Access	read write
PDO Mapping	Yes, RX-PDO
Default Value	00000000 _h

Name	AI Channel Control 4
Subindex	04 _h
Data type	UINT8
Access	read write
PDO Mapping	Yes, RX-PDO
Default Value	00000000 _h

7	6	5	4	3	2	1	0
					COMP	SCAL	ACT

ACT:

0 = Input inactive

1 = Input active (Default)

SCAL:

0 = Input values scaled by factor and offset (Default)

1 = Input values scaled by set points

COMP:

0 = Comparator inactive (Default)

1 = Comparator active

AI Channel Status 2002_h

Name	AI Channel State
Index	2002 _h
Object Code	ARRAY
No. of Elements	5
Data Type	UINT8

Name	Highest sub index supported
Subindex	00 _h
Data type	UINT8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Channel Status 1
Subindex	01 _h
Data type	UINT8
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Channel Status 2
Subindex	02 _h
Data type	UINT8
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Channel Status 3
Subindex	03 _h
Data type	UINT8
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Channel Status 4
Subindex	04 _h
Data type	UINT8
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Kanalzustand:

7	6	5	4	3	2	1	0
						UpLim	LoLim

LoLim (Lower Limit) / UpLim (Upper Limit)

0 = Limit not exceeded

1 = Limit exceeded

Error Log 2003_h

Name	Error Log
Index	2003 _h
Object Code	RECORD
No. of Elements	9
Data Type	UNSIGNED32

Name	Number of errors
Subindex	00 _h
Data type	UNSIGNED8
Access	read write
PDO Mapping	No
Default Value	00 _h

Name	Standard error field
Subindex	01 _h .. 08 _h
Data type	UNSIGNED32
Access	read only
PDO Mapping	No
Default Value	00000000 _h

If a new error occurs, it is written to subindex 1. The existing entries in subindexes 1 to 7 are moved one position backwards. The error on subindex 7 is removed.

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

The object contains the error numbers from the object Error Code 213F_h

Sample Count 2100_h

Name	Sample Count
Index	2100 _h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32
Access	read only
PDO Mapping	Yes, TX-PDO
Value Range	
Default Value	00 _h

Number of samples since reset / restart

AI1 Oversample Data FV 2101_h

Name	AI1 Oversample Data FV
Index	2101 _h
Object Code	ARRAY
No. of Elements	6

Name	Highest sub index supported
Subindex	00 _h
Data type	INT16
Access	read only
PDO Mapping	NO
Default Value	05 _h

Name	AI1 Sample N+0 .. N+4
Subindex	01 _h .. 05 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Oversampling input values AI1

AI2 Oversample Data FV 2102_h

Name	AI2 Oversample Data FV
Index	2102 _h
Object Code	ARRAY
No. of Elements	6

Name	Highest sub index supported
Subindex	00 _h
Data type	INT16
Access	read only
PDO Mapping	NO
Default Value	05 _h

Name	AI2 Sample N+0 .. N+4
Subindex	01 _h .. 05 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Oversampling input values AI2

AI3 Oversample Data FV 2103_h

Name	AI3 Oversample Data FV
Index	2103 _h
Object Code	ARRAY
No. of Elements	6

Name	Highest sub index supported
Subindex	00 _h
Data type	INT16
Access	read only
PDO Mapping	NO
Default Value	05 _h

Name	AI3 Sample N+0 .. N+4
Subindex	01 _h .. 05 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Oversampling input values AI3

AI4 Oversample Data FV 2104_h

Name	AI4 Oversample Data FV
Index	2104 _h
Object Code	ARRAY
No. of Elements	6

Name	Highest sub index supported
Subindex	00 _h
Data type	INT16
Access	read only
PDO Mapping	NO
Default Value	05 _h

Name	AI4 Sample N+0 .. N+4
Subindex	01 _h .. 05 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Oversampling input values AI4

AI Input Calibration Gain 2125_h

Name	AI Input Calibration Gain
Index	2125 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input Calibration Gain 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	1.0

Name	AI Input Calibration Gain 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	1.0

Name	AI Input Calibration Gain 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	1.0

Name	AI Input Calibration Gain 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	1.0

Channel dependent calibration factor for correction of gain error

AI1 Oversample Data PV 2131_h

Name	AI1 Oversample Data PV
Index	2101 _h
Object Code	ARRAY
No. of Elements	6

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	NO
Default Value	05 _h

Name	AI1 Sample N+0 .. N+4
Subindex	01 _h .. 05 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Oversampling input values AI1

AI2 Oversample Data PV 2132_h

Name	AI2 Oversample Data PV
Index	2102 _h
Object Code	ARRAY
No. of Elements	6

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	NO
Default Value	05 _h

Name	AI2 Sample N+0 .. N+4
Subindex	01 _h .. 05 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Oversampling input values AI2

AI3 Oversample Data PV 2133_h

Name	AI3 Oversample Data PV
Index	2103 _h
Object Code	ARRAY
No. of Elements	6

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	NO
Default Value	05 _h

Name	AI3 Sample N+0 .. N+4
Subindex	01 _h .. 05 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Oversampling input values AI3

AI4 Oversample Data PV 2134_h

Name	AI4 Oversample Data PV
Index	2104 _h
Object Code	ARRAY
No. of Elements	6

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	NO
Default Value	05 _h

Name	AI4 Sample N+0 .. N+4
Subindex	01 _h .. 05 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Oversampling input values AI4

Error Code 213F_h

Name	Error Code
Index	213F _h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	read only
PDO Mapping	Yes, TX-PDO
Value Range	
Default Value	00 _h

2320_h AO0 Temperature to high

2321_h AO1 Temperature to high

2322_h AO2 Temperature to high

2323_h AO3 Temperature to high

2330_h AI0 Overvoltage or wire break

2331_h AI1 Overvoltage or wire break

2332_h AI2 Overvoltage or wire break

2333_h AI3 Overvoltage or wire break

3120_h Module undervoltage

5100_h AI0 Input value outside the parameterized limits

5101_h AI1 Input value outside the parameterized limits

5102_h AI2 Input value outside the parameterized limits

5103_h AI3 Input value outside the parameterized limits

5300_h AI0 sensor fault (Current less than 4mA)

5301_h AI1 sensor fault (Current less than 4mA)

5302_h AI2 sensor fault (Current less than 4mA)

5303_h AI3 sensor fault (Current less than 4mA)

6010_h Watchdog

8000_h Communication error

Device Control 2201_h

Name	Device Control
Index	2201 _h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	read write
PDO Mapping	Yes, RX-PDO
Value Range	
Default Value	00 _h

7	6	5	4	3	2	1	0
							RES

RES:

- 0 = keine Aktion
- 1 = Reset Device durchführen

Device Status 2202_h

Name	Device Status
Index	2202 _h
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16
Access	read only
PDO Mapping	Yes, TX-PDO
Value Range	
Default Value	00 _h

Unused

AI Input FV 6100_h

Name	AI Input FV
Index	6100 _h
Object Code	ARRAY
No. of Elements	5
Data Type	REAL32

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input FV 1
Subindex	01 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input FV 2
Subindex	02 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input FV 3
Subindex	03 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input FV 4
Subindex	04 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Analog input values as real measured variable. When oversampling is active, the average value of the sampled process input values is displayed

AI Sensor Type 6110_h

Name	AI Sensor Type
Index	6110 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	UINT16
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Sensor Type 1
Subindex	01 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Sensor Type 2
Subindex	02 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Sensor Type 3
Subindex	03 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Sensor Type 4
Subindex	04 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Channel-dependent setting of the connected sensor:

42 = 0...10 V (Default)

52 = 0...20 mA

51 = 4...20 mA

AI Input Scaling 1 FV 6120_h

Name	AI Input Scaling 1 FV
Index	6120 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input Scaling 1 FV 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 1 FV 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 1 FV 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 1 FV 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

AI Input Scaling 1 PV 6121_h

Name	AI Input Scaling 1 PV
Index	6121 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input Scaling 1 PV 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 1 PV 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 1 PV 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 1 PV 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

AI Input Scaling 2 FV 6122_h

Name	AI Input Scaling 2 FV
Index	6122 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input Scaling 2 FV 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 2 FV 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 2 FV 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 2 FV 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

AI Input Scaling 2 PV 6123_h

Name	AI Input Scaling 2 PV
Index	6123 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input Scaling 2 PV 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 2 PV 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 2 PV 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Scaling 2 PV 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

AI Input Offset 6124_h

Name	AI Input Offset
Index	6124 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input Offset 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Offset 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Offset 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Input Offset 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Channel-dependent offset in [V] or [mA].

AI Scaling Factor 6126_h

Name	AI Scaling Factor
Index	6126 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Scaling Factor 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Scaling Factor 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Scaling Factor 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Scaling Factor 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Scaling factor [Process value / Field value]

AI Scaling Offset 6127_h

Name	AI Scaling Offset
Index	6127 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Scaling Offset 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Scaling Offset 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Scaling Offset 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Scaling Offset 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Scaling offset [Process value]

AI Input PV 6130_h

Name	AI Input PV
Index	6130 _h
Object Code	ARRAY
No. of Elements	5
Data Type	REAL32

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input PV 1
Subindex	01 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input PV 2
Subindex	02 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input PV 3
Subindex	03 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input PV 4
Subindex	04 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Analog process input values as real measured variables, determined by the scaling values.

When oversampling is active, the average value of the sampled process input values is displayed.

AI Filter Type 61A0_h

Name	AI Filter Type
Index	61A0 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	UINT8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Filter Type 1
Subindex	01 _h
Data type	ENUM
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Filter Type 2
Subindex	02 _h
Data type	ENUM
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Filter Type 3
Subindex	03 _h
Data type	ENUM
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Filter Type 4
Subindex	04 _h
Data type	ENUM
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Object for activating the input filter.

0 = No Filter active

1 = PT1 Filter

AI Filter Constant 61A1_h

Name	AI Filter Constant
Index	61A1 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	UINT8
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Filter Constant 1
Subindex	01 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Filter Constant 2
Subindex	02 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Filter Constant 3
Subindex	03 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AI Filter Constant 4
Subindex	04 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

PT1 Filter time in [ms]

AO Output PV 6300_h

Name	AO Output PV
Index	6300 _h
Object Code	ARRAY
No. of Elements	5
Data Type	REAL32

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AO Output PV 1
Subindex	01 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output PV 2
Subindex	02 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output PV 3
Subindex	03 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output PV 4
Subindex	04 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

AO Output Type 6310_h

Name	AO Sensor Type
Index	6310 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	UINT16
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AO Sensor Type 1
Subindex	01 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Sensor Type 2
Subindex	02 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Sensor Type 3
Subindex	03 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Sensor Type 4
Subindex	04 _h
Data type	UINT16
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Channel-dependent setting of the output variable:

0 = Disabled (Default)

10 = 0...10 V

11 = +/- 10 V

20 = 0...20 mA

21 = 4...20 mA

AO Output Scaling 1 FV 6320_h

Name	AO Output Scaling 1 FV
Index	6320 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AO Output Scaling 1 FV 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 1 FV 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 1 FV 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 1 FV 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

AO Output Scaling 1 PV 6321_h

Name	AO Output Scaling 1 PV
Index	6321 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AO Output Scaling 1 PV 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 1 PV 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 1 PV 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 1 PV 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

AO Output Scaling 2 FV 6322_h

Name	AO Output Scaling 2 FV
Index	6322 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AO Output Scaling 2 FV 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 2 FV 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 2 FV 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 2 FV 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

AO Output Scaling 2 PV 6323_h

Name	AO Output Scaling 2 PV
Index	6323 _h
Object Code	RECORD
No. of Elements	5

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AO Output Scaling 2 PV 1
Subindex	01 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 2 PV 2
Subindex	02 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 2 PV 3
Subindex	03 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

Name	AO Output Scaling 2 PV 4
Subindex	04 _h
Data type	REAL32
Access	read write
PDO Mapping	No
Default Value	00000000 _h

AO Output FV 6330_h

Name	AO Output FV
Index	6330 _h
Object Code	ARRAY
No. of Elements	5
Data Type	REAL32

Name	Highest sub index supported
Subindex	00 _h
Data type	REAL32
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AO Output FV 1
Subindex	01 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 2
Subindex	02 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 3
Subindex	03 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 4
Subindex	04 _h
Data type	REAL32
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Analoge Eingangswerte als Real Messgröße

AI Input FV 7100_h

Name	AI Input FV
Index	7100 _h
Object Code	ARRAY
No. of Elements	5
Data Type	INT16

Name	Highest sub index supported
Subindex	00 _h
Data type	INT16
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AI Input FV 1
Subindex	01 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input FV 2
Subindex	02 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input FV 3
Subindex	03 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AI Input FV 4
Subindex	04 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Analog input values as integer measured variable. When oversampling is active, the average value of the sampled process input values is displayed.

AO Output FV 7330_h

Name	AO Output FV
Index	7330 _h
Object Code	ARRAY
No. of Elements	5
Data Type	INT16

Name	Highest sub index supported
Subindex	00 _h
Data type	INT16
Access	read only
PDO Mapping	No
Default Value	04 _h

Name	AO Output FV 1
Subindex	01 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 2
Subindex	02 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 3
Subindex	03 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 4
Subindex	04 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 2
Subindex	02 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 3
Subindex	03 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Name	AO Output FV 4
Subindex	04 _h
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	00000000 _h

Analog output values as integer values

Technical data

Analog inputs

Analoge Eingänge	4
Resolution.....	12 Bit
Start AD-Wandlung.....	DC-synchronous, SM-synchronous
Oversampling	2.5
Intrinsic error.....	$\pm 0,2\%$
Temperature error	$\pm 0,005\%/K$
Internal resistance	$< 300\Omega$
Cut-off frequency of input filter	$< 100kHz$

Spannung:

Measurement range	0 ... 10V
Settling time	0→10V: $\leq 22\mu s$ at $2k\Omega / < 200pF$
Measurement error	$< \pm 0,5\%$, typical $< \pm 0,4\%$ of final value
Conversion time.....	235 μs (when all channels are active)

Strom:

Measurement range	0...20mA, 4...20mA
Settling time	0→16V: $\leq 25\mu s$ at $300\Omega / < 1mH$
Measurement error	$< \pm 0,5\%$, typical $< \pm 0,4\%$ of final value
Conversion time.....	200 μs (when all channels are active)

Analog Outputs

Analog Outputs	4
Resolution.....	16 Bit
Output rate.....	SM-/DC-synchronous,
Intrinsic error.....	$\pm 0,2\%$
Temperature error	$\pm 0,005\%/K$
Destruction limit against external stresses.....	15V

Voltage:

Output range.....	0 ... 10V, $\pm 10V$
Short circuit protection.....	Ja
Short circuit current	max. 30mA
Load resistance	min. $1k\Omega$
Settling time	0→10V: $\leq 22\mu s$ bei $2k\Omega / < 200pF$

Current:

Output range	0...20mA, 4...20mA, 0...24mA
Load resistance	max. 500Ω , max. 1mH (induktive)
Settling time	0→16V: $\leq 25\mu s$ at $300\Omega / < 1mH$

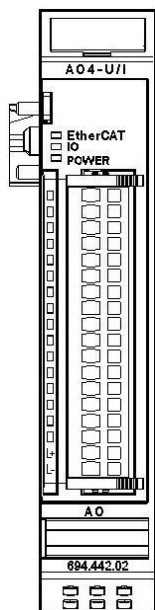
General information

Baud rate	100 Mbit/s
Controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
Terminating module	not required
IO/power connection.....	36-pin plug
Power supply	24 VDC -20% +25%
E-bus load.....	150 mA
Order-No.....	694.444.65

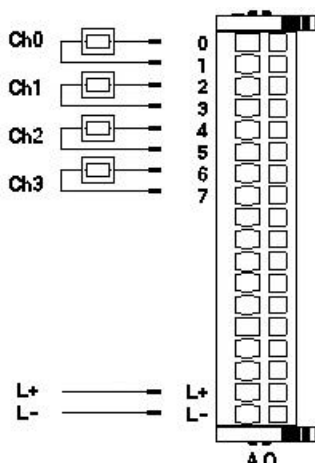


Approvals:.....

5.4.2 AO4-U/I - 12-Bit



Front view of AO4 I/O module



I/O connection

	+	-
Channel0	0	1
Channel1	2	3
Channel2	4	5
Kanal3	6	7

Terminals

Power supply to module I/Os

- L+ 24 VDC
- L- 0 V

	<p>Information</p> <p>Module 694 442 02 Kuhnke FIO AO4 12-Bit is the successor module (see below for exception) compatible with module 694 442 02 Ventura FIO AO4 12-Bit. That is to say, the modules are interchangeable within the same FIO block without having to modify the device description in the EtherCAT master's control program.</p>
--	--

Please note the following differences if you have a program including the old variant:

Ventura FIO AO4 12-Bit (old)	Kuhnke FIO AO4 12-Bit (new)
Current: 0...±20mA	Current: 0...+20mA To be able to use the current outputs, verify that variable "Channel_n_n+1_Unipolar" of these outputs is set to True. Refer to section Module Options
Short-circuit detectable	Short-circuit not detectable but outputs are short circuit-protected
Data type of output: UINT	Data type of output: INT Run the development environment and convert the data type from UINT to INT.

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On Inoperative if E-bus LED = Off
	Red, 1x	Short circuit
	Red, 2x	Low voltage
	Red, 4x	EtherCAT watchdog control
	Red, 6x	Module-specific fault
	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

LEDs "Channel"

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

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Short circuit
	Red, 3x	Wire failure
	Red, 5x	Excessive temp. of output drivers

Function

The AO4 module has 4 analogue outputs. Every channel can be separately set to the unipolar or bipolar output of voltages or currents.

Table "Analogue voltage/current values"

Measured value			Variable value				
±10	0 .. 10	0 .. 20	Bipolar [INT]		Unipolar *Data type conversion required		
V	V	mA	Decimal	Hexadecimal	Decimal [INT]	Decimal [UINT*]	Hexadecimal
-10			-32768	16#8000			
-9			-29492	16#8CCC			
-8			-26215	16#9999			
-7			-22938	16#A666			
-6			-19661	16#B333			
-5			-16384	16#C000			
-4			-13108	16#CCCC			
-3			-9831	16#D999			
-2			-6554	16#E666			
-1			-3292	16#F324			
0			0	0	0	0	0
1	1	2	3276	16#0CCC	6553	6553	16#1999
2	2	4	6553	16#1999	13107	13107	16#3332
3	3	6	9830	16#2666	19660	19660	16#4CCC
4	4	8	13106	16#3332	26214	26214	16#6665
5	5	10	16383	16#3FFF	32767	32767	16#7FFF
6	6	12	19660	16#4CCC	-26216	39320	16#9998
7	7	14	22936	16#5998	-19662	45874	16#B332
8	8	16	26213	16#6665	-13109	52427	16#CCCB
9	9	18	29490	16#7332	-6555	58981	16#E665
10	10	20	32767	16#7FFF	-2	65534	16#FFFE

Analogue Outputs

Write the output values into the following variables:

Variable	Data type	Explanation
Channel_n	INT	Output value of channel n (n=0...3).

Module Control

The module provides you with various operational options.

To set up the module choose the options as appropriate and accept by setting control bit "SetOptions" to a rising edge.

The module will confirm by returning "OptionsSet".

There are various "module error" bits that the module uses to indicate errors. The states of the error bits are retained and also used for error indication by the "IO" LED.

To reset the error bits set control bit "ResetError" to a rising edge.

Variable	Data type	Explanation
SetOptions	BOOL	Rising edge → accepts module options
ResetError	BOOL	Rising edge → acknowledges error

Module Options

The following options are available for module AO4:

Variable	Data type	Explanation	
Channel_n_On	BOOL	Enables channel n. (set to high impedance to disable)	
Channel_n_Current	BOOL	Sets channel n to current output mode	
Channel_n_n+1_Unipolar	BOOL	Channels 0 & 1 or 2 & 3 in unipolar mode	
Outputs_Active_Shortcut	BOOL	Leave outputs unchanged after short circuit	
Outputs_Active_Undervoltage	BOOL	Leave outputs unchanged after low voltage	
Outputs_Active_Specific_Error	BOOL	Leave outputs unchanged after module-specific error (see 0)	
Outputs_Active_EtherCAT_Error	BOOL	Leave outputs unchanged after short circuit	
n		0 ... 3	Channel number

To set and accept options, see section Module Control.

Module State

The following module states are indicated:

Variable	Data type	Explanation
Shortcut	BOOL	Short circuit (not used)
Undervoltage	BOOL	Low voltage (supplied power < 19.2V)
Watchdog	BOOL	Internal watchdog of module
EtherCAT_Error	BOOL	Configuration error or watchdog control
Specific_Error	BOOL	Module-specific fault
OptionsSet	BOOL	Sent by module to acknowledge SetOptions

To reset the messages, see section Module Control.

Module-specific Messages

Apart from the module state, there is a set of messages containing details about the current state of the module:

Variable	Data type	Explanation
Channel_n_Overtemp	BOOL	Short circuit in output driver of channel n, i.e. the temperature is > 140 °C (automatic switch-off) (see Module Options, Outputs_Active_Shortcut)
Undervoltage_24	BOOL	Less than 19.2 V supplied to the module (see Module Options, Outputs_Active_Undervoltage)
Channel_n_Open	BOOL	Current mode: channel n load is gt 500Ω Specific_Error=TRUE
Channel_n_Shortcut	BOOL	Voltage mode: channel n load is lt 600Ω Specific_Error=TRUE

These messages are automatically reset when the state concerned has returned to normal. Messages Channel_n_Open and Channel_n_Shortcut are combined into a single "Specific_Error" state of the module and output to the IO LED as "module-specific error".

Conversion Time

The AO4 module's cycle time (time from importing the output values till starting the DA converters) is 320 µs, irrespective of the number of active channels.

Technical Data

Analogue outputs.....	4
Resolution.....	12 bit
Output frequency.....	Free run
Intrinsic error.....	±0.2%
Temperature error.....	±0.005%/K
Destruction limit (external voltages).....	15V

Voltage:

Measuring range.....	0 ... 10V, ± 10V
Short circuit protection.....	Yes
Short circuit current.....	max. 30mA
Load resistance.....	min. 1kΩ
Settling time.....	0→10V: ≤22μs at 2kΩ/<200pF

Current:

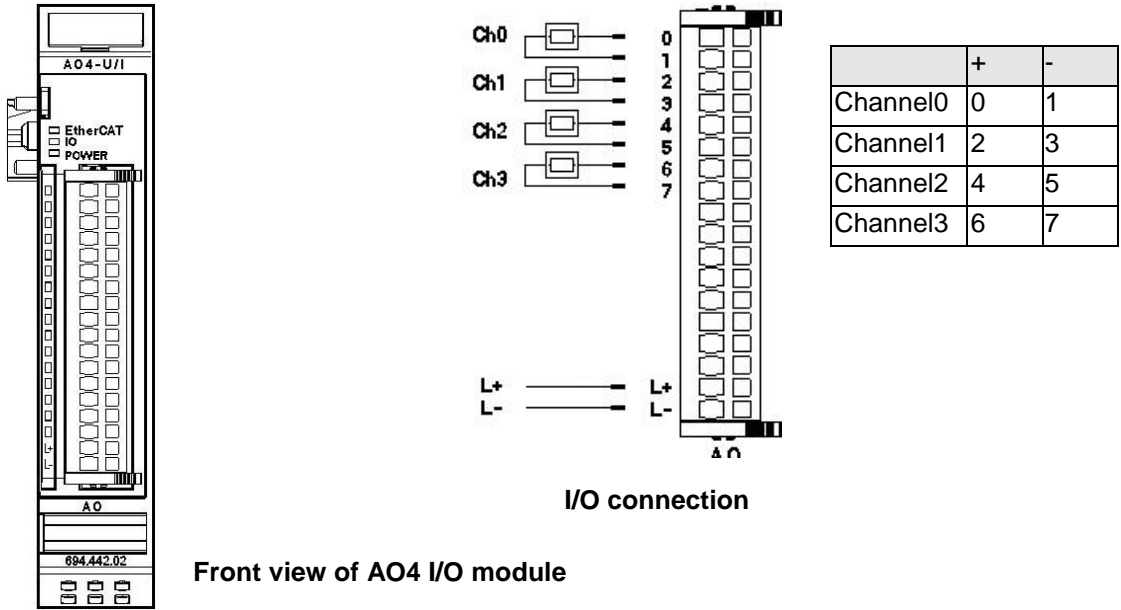
Measuring range.....	0...20mA
Load resistance.....	max. 500Ω, max. 1mH (inductive)
Settling time.....	0→16V: ≤25μs at 300Ω/<1mH

Baud rate.....	100 Mbit/s
Controller.....	ASIC ET1200
E-bus connector.....	10-pole system plug in side wall
Terminating module.....	not required
IO/power connection.....	18-pin plug
Power supply.....	24 VDC -20% +25%
E-bus load.....	150 mA
Part no.	694.442.02 12-bit



Approval:.....


5.4.3 AO4-U/I - 16-Bit CoE



Terminals

Power supply to module I/Os

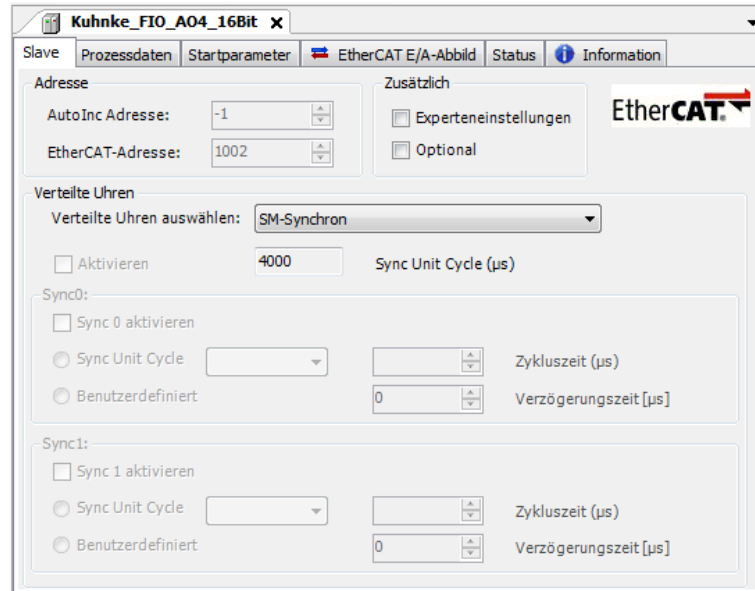
- L+ 24 VDC
- L- 0 V

	<p>Information</p> <p><i>Module 694 442 52 Kuhnke FIO AO4 16-Bit is the successor module NOT compatible with module 694 442 02 Ventura FIO AO4 12-Bit.</i></p> <p><i>The module complies with ETG guidelines.</i></p> <p><i>Before replacing a Ventura/Kuhnke FIO AO4 12-Bit module (694 442 02) with a Kuhnke FIO AO4 16-Bit module (694 442 52), you must modify the EtherCAT master's control program.</i></p>
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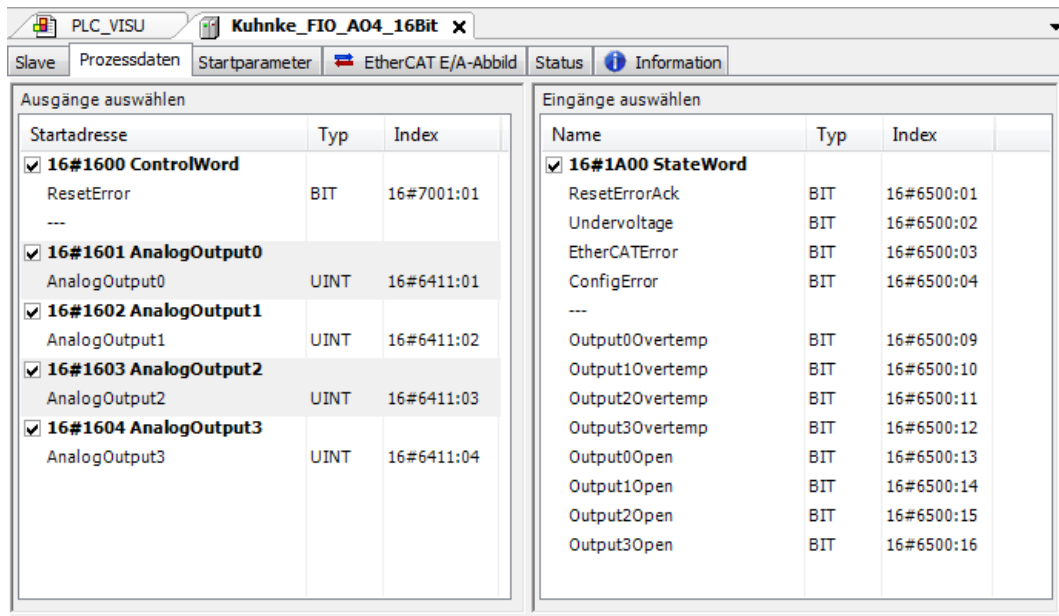
Please note the following differences:

Ventura FIO AO4 12-Bit (old)	Kuhnke FIO AO4 16-Bit (new)
Current: 0...±20mA	Current: 0...+20mA
Short-circuit detectable	Short-circuit not detectable but outputs are short circuit-protected
Output not synchronised with EtherCAT	Output synchronised with SM or DC

Output of the analogue values can be synchronised with DC (Distributed Clocks) or SM (Sync Manager).

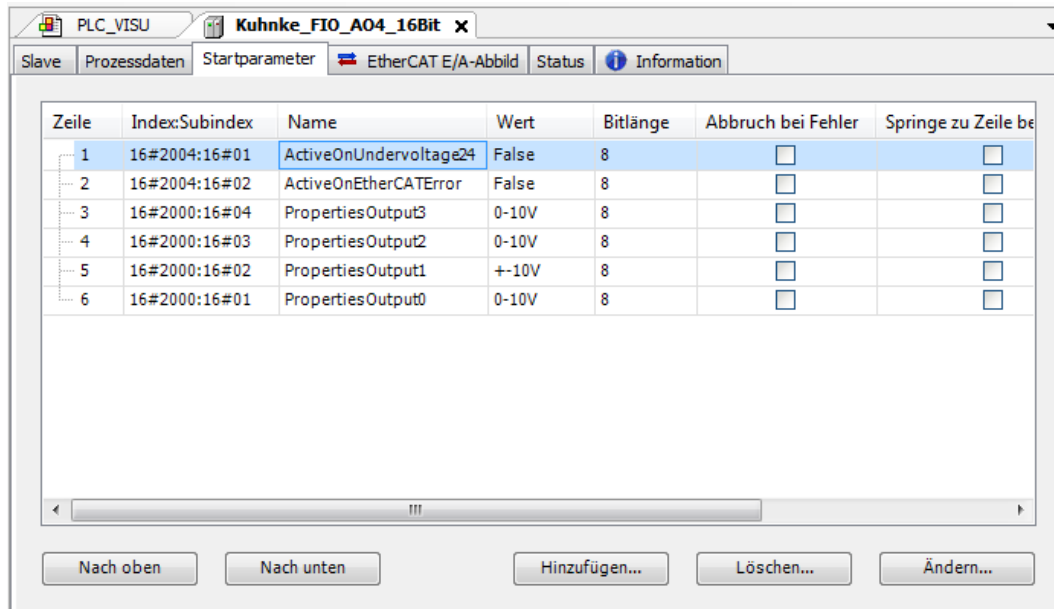


The process data objects stored as variables in the EtherCAT master's control program are used to access the output values and the module state.

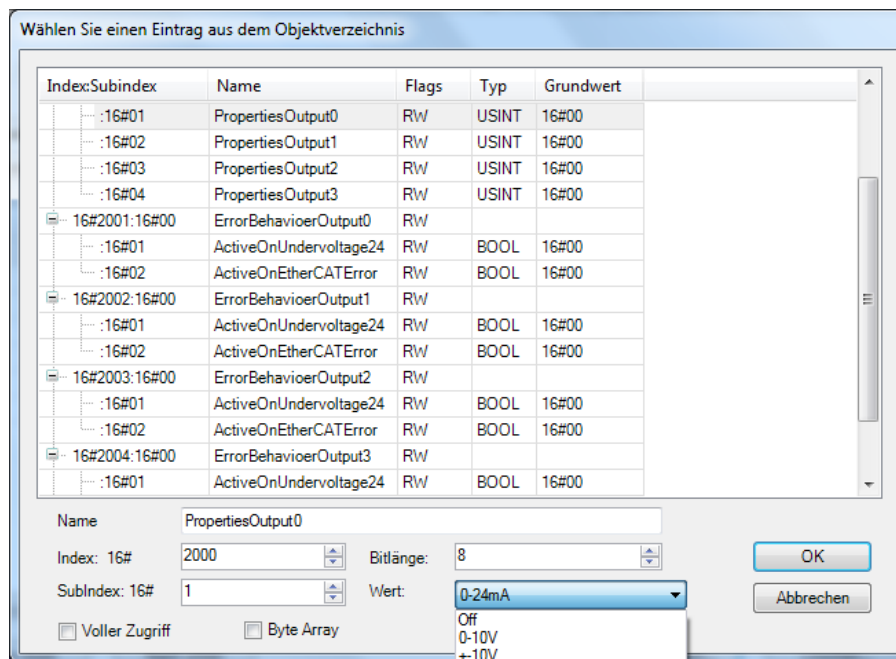


Service data objects (SDO) are available for details and settings.

You may run the configuration tool offline to change some settings of module AO4 16-Bit (such as the properties of each of the outputs). 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.



Click/tap on "Add...", choose an object, and set the appropriate value.



Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On Inoperative if E-bus LED = Off
	Red, 1x	Short circuit
	Red, 2x	Low voltage
	Red, 4x	EtherCAT watchdog control
	Red, 6x	Module-specific fault
	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

LEDs "Channel"

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

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Short circuit
	Red, 3x	Wire failure
	Red, 5x	Excessive temp. of output drivers

Function

The AO4 module has 4 analogue outputs. Every channel can be separately set to the unipolar or bipolar output of voltages or currents.

To output voltage or current readings (measured values) to the analogue outputs, verify that the associated output variables contain these values in the 2-byte two's complement format. The letter 'n' in the tables below represents the channel number (n=0...3).

Table "Analogue voltage/current values"

Measured value				Variable value (@ 16 bits)			
±10 / 10	0..20	4..20	0..24	Bipolar [UINT]		Unipolar [UINT]	
Volt	mA	mA	mA	Decimal	Hexadecimal	Decimal	Hexadecimal
-10				32768	16#8000		
-9				36044	16#8CCC		
-8				39321	16#9999		
-7				42598	16#A666		
-6				45875	16#B333		
-5				49152	16#C000		
-4				52428	16#CCCC		
-3				55705	16#D999		
-2				58982	16#E666		
-1				62244	16#F324		
0	0	4	0	0	0	0	0
1	2	5.6	2.4	3276	16#0CCC	6553	16#1999
2	4	7.2	4.8	6553	16#1999	13107	16#3332
3	6	8.8	7.2	9830	16#2666	19660	16#4CCC
4	8	10.4	9.6	13106	16#3332	26214	16#6665
5	10	12.0	12.0	16383	16#3FFF	32767	16#7FFF
6	12	13.6	14.4	19660	16#4CCC	39320	16#9998
7	14	15.2	16.8	22936	16#5998	45874	16#B332
8	16	16.8	19.2	26213	16#6665	52427	16#CCCB
9	18	18.4	21.6	29490	16#7332	58981	16#E665
10	20	20.0	24.0	32767	16#7FFF	65534	16#FFFE

StateWord

The state word is indicative of the module state:

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	Undervoltage24	24V supply low
2	EtherCATError	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4	-	
5	-	
6	-	
7	-	
8	Output 0 Overtemp	Over-temperature detected by output driver (automatic switch-off)
9	Output 1 Overtemp	Over-temperature detected by output driver (automatic switch-off)
10	Output 2 Overtemp	Over-temperature detected by output driver (automatic switch-off)
11	Output 3 Overtemp	Over-temperature detected by output driver (automatic switch-off)
12	Output 0 Open	If there is no current in Current mode
13	Output 1 Open	If there is no current in Current mode

Bit	Name	Explanation
14	Output 2 Open	If there is no current in Current mode
15	Output 3 Open	If there is no current in Current mode

Analogue Outputs

Write the output values into the following variables:

Variable	Data type	Explanation
AnalogOutputn	UINT	Output value of channel n (n=0...3).

ControlWord

The control word contains a bit for acknowledging errors.

Bit	Name	Explanation
0	ResetError	0 -> errors are retained, 1 -> errors cleared after removing their cause
1-15	-	not used

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0xF0191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String			RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	ARRAY			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32			RO
1018, 3	Revision Number	UINT32	2		RO
1018, 4	Serial Number	UINT32	0		RO
2000	Analogue Output Properties	Array			
2000, 0	Number of Entries	UINT8	4		RO
2000, 1	Properties Output 0	UINT8	0-10V	Off (0), 0-10V (1), +10V (3), 0-20mA (6), 4-20mA (5), 0-24mA (7)	RW
2000, 2	Properties Output 1	UINT8	0-10V	Off, 0-10V, +10V, 0-20mA, 4-20mA, 0-24mA	RW
2000, 3	Properties Output 2	UINT8	0-10V	Off, 0-10V, +10V, 0-20mA, 4-20mA, 0-24mA	RW

Index	Name	Type	Default	Min Max	Access
2000, 4	Properties Output 3	UINT8	0-10V	Off, 0-10V, +-10V, 0-20mA, 4-20mA, 0-24mA	RW
2001	ErrorBehavior Output 0	Array			
2001, 0	Number of Entries	UINT8	2		RO
2001, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2001, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2002	ErrorBehavior Output 1	Array			
2002, 0	Number of Entries	UINT8	2		RO
2002, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2002, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2003	ErrorBehavior Output 2	Array			
2003, 0	Number of Entries	UINT8	2		RO
2003, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2003, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2004	ErrorBehavior Output 3	Array			
2004, 0	Number of Entries	UINT8	2		RO
2004, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2004, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
6411	Analogue Outputs	Array			
6411, 0	Number of Entries	UINT8	4		RO
6411, 1	Analogue Output 0	UINT16			RW P
6411, 2	Analogue Output 1	UINT16			RW P
6411, 3	Analogue Output 2	UINT16			RW P
6411, 4	Analogue Output 3	UINT16			RW P
6500	State Word	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	Reset Error Ack	BOOL			RO P
6500, 2	Undervoltage24	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5	-	BOOL			RO P
6500, 6	-	BOOL			RO P
6500, 7	-	BOOL			RO P
6500, 8	-	BOOL			RO P
6500, 9	Output 0 Overtemp	BOOL			RO P
6500, 10	Output 1 Overtemp	BOOL			RO P
6500, 11	Output 2 Overtemp	BOOL			RO P
6500, 12	Output 3 Overtemp	BOOL			RO P
6500, 13	Output 0 Open	BOOL			RO P
6500, 14	Output 1 Open	BOOL			RO P
6500, 15	Output 2 Open	BOOL			RO P
6500, 16	Output 3 Open	BOOL			RO P
7001	Control Word	Array			

Index	Name	Type	Default	Min Max	Access
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

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

Technical Data

Analogue outputs..... 4
 Resolution..... 16 bit
 Output frequency Synchronised with SM/DC
 Intrinsic error..... ±0.2%
 Temperature error ±0.005%/K
 Destruction limit
 (external voltages) 15V

Voltage:

Measuring range..... 0 ... 10V, ± 10V
 Short circuit protection..... Yes
 Short circuit current max. 30mA
 Load resistance min. 1kΩ
 Settling time 0→10V: ≤22µs at 2kΩ/<200pF

Current:

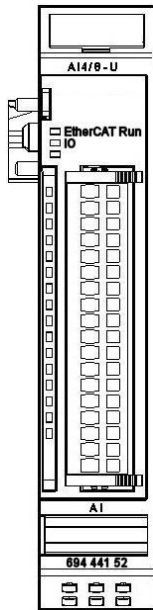
Measuring range 0...20mA, 4...20mA, 0...24mA
 Load resistance max. 500Ω, max. 1mH (inductive)
 Settling time 0→16V: ≤25µs at 300Ω/<1mH

Baud rate 100 Mbit/s
 Controller ASIC ET1200
 E-bus connector 10-pole system plug in side wall
 Terminating module..... not required
 IO/power connection..... 18-pin plug
 Power supply 24 VDC -20% +25%
 E-bus load..... 150 mA
 Part no. 694.442.52 16-Bit (CoE)

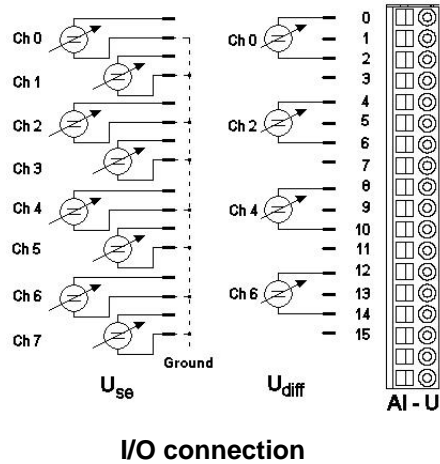


Approval:.....

5.4.4 AI4/8-U



Front view of AI4/8-U I/O module



I/O connection

Terminals

The module needs no separate 24V connector. Power is supplied to the module through the E-bus connector.

Operative earth / shielding of analogue wires → section 0

	<p>Information</p> <p>Module 694 441 52 Kuhnke FIO AI4 8-U is the successor module NOT compatible with module 694 441 02 Ventura FIO AI4 8-U.</p> <p>The module complies with ETG guidelines.</p> <p>Before replacing a Ventura/Kuhnke FIO AI4 8-U module (694 441 02) with a Kuhnke FIO AI4 8-U module (694 441 52), you must modify the EtherCAT master's control program.</p>
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Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On
		Inoperative if E-bus LED = Off
	Red, 4x	EtherCAT watchdog control
	Red, 7x	Configuration error (E-bus pre-operational), no. of

State	LED flash code	Explanation
		process data differs from that in the module
Defective	Red, on	Module defective

LED "Power"

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

LEDs "Channel"

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

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled


Function

The AI4/8-U module has 8 analogue inputs. If signal lines are single-ended (measured against earth, L-), 8 channels are available. To measure differential signals, you will need 2 channels for every signal, i.e. you can pick up no more than 4 differential signals. Channels can be combined as follows: 0/1, 2/3, 4/5 and 6/7.

Measured Value

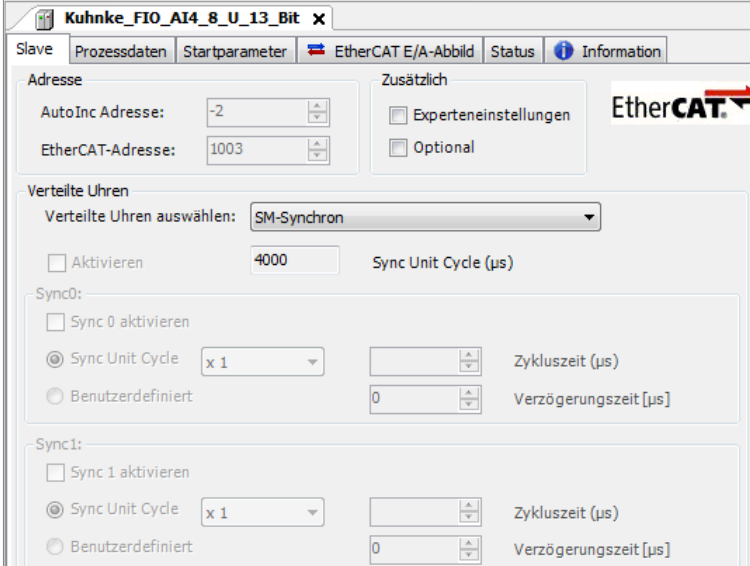
Table "Analogue voltage values"

Measured value			Variable value (@ 16 bits)			
±10 V	±5 V	±2,5 V	Bipolar		Unipolar [UINT*]	
					*Data type conversion required	
Volt	Volt	Volt	Decimal	Hexadecimal	Decimal	Hexadecimal
-10	-5	-2.5	-32768	16#8000		
-9	-4.5	-2.25	-29492	16#8CCC		
-8	-4	-2	-26215	16#9999		
-7	-3.5	-1.75	-22938	16#A666		
-6	-3	-1.5	-19661	16#B333		
-5	-2.5	-1.25	-16384	16#C000		
-4	-2	-1	-13108	16#CCCC		
-3	-1.5	-0.75	-9831	16#D999		
-2	-1	-0.5	-6574	16#E666		
-1	-0.5	-0.25	-3292	16#F324		
0	0	0	0	0	0	0
1	0.5	0.25	3276	16#0CCC	6553	16#1999
2	1	0.5	6553	16#1999	13107	16#3332
3	1.5	0.75	9830	16#2666	19660	16#4CCC
4	2	1	13106	16#3332	26214	16#6665
5	2.5	1.25	16383	16#3FFF	32767	16#7FFF
6	3	1.5	19660	16#4CCC	39320	16#9998
7	3.5	1.75	22936	16#5998	45874	16#B332
8	4	2	26213	16#6665	52427	16#CCCB
9	4.5	2.25	29490	16#7332	58981	16#E665
10	5	2.5	32767	16#7FFF	65534	16#FFFE

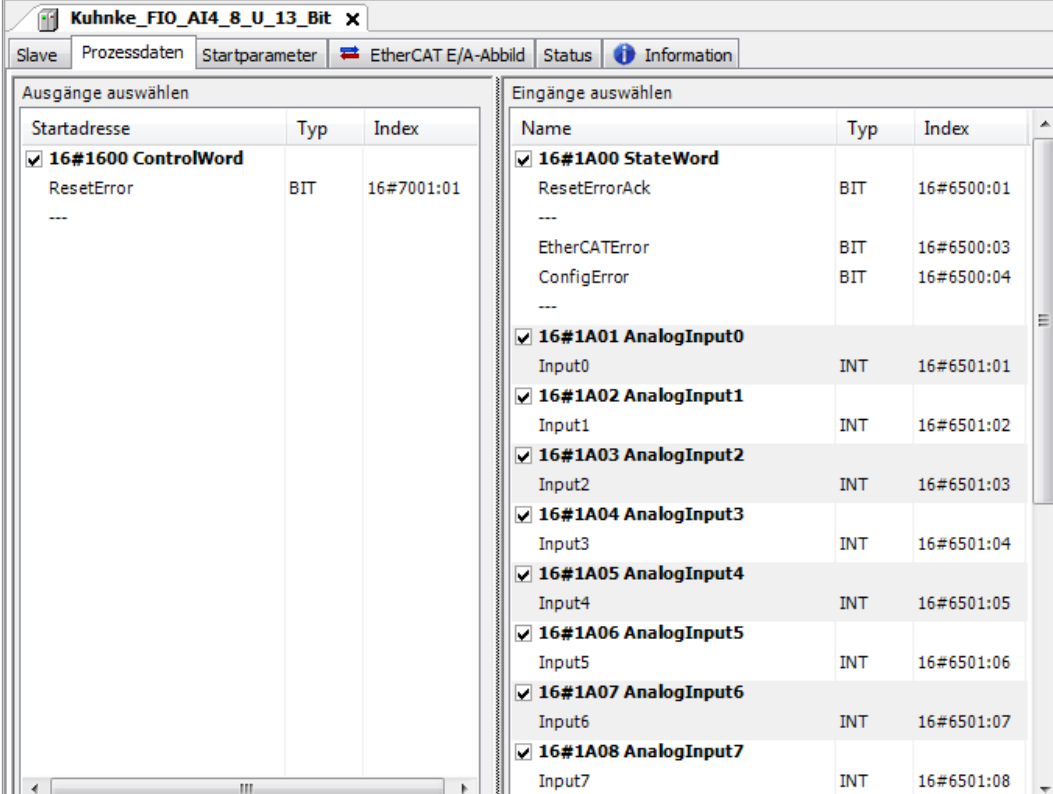
	<p>Information</p> <p><i>If the inputs are not used but switched on, the measured values displayed in the I / O image are floated. To prevent this, you should deactivate the measurement channel at the start parameters or set the input to ground (short-circuit when measuring differential signals).</i></p>
---	--

To Set up the Options

Conversion of the analogue values can be synchronised with DC (Distributed Clocks) or SM (Sync Manager).



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



Ausgänge auswählen			Eingänge auswählen		
Startadresse	Typ	Index	Name	Typ	Index
<input checked="" type="checkbox"/> 16#1600 ControlWord			<input checked="" type="checkbox"/> 16#1A00 StateWord		
ResetError	BIT	16#7001:01	ResetErrorAck	BIT	16#6500:01
---			---		
			EtherCATError	BIT	16#6500:03
			ConfigError	BIT	16#6500:04

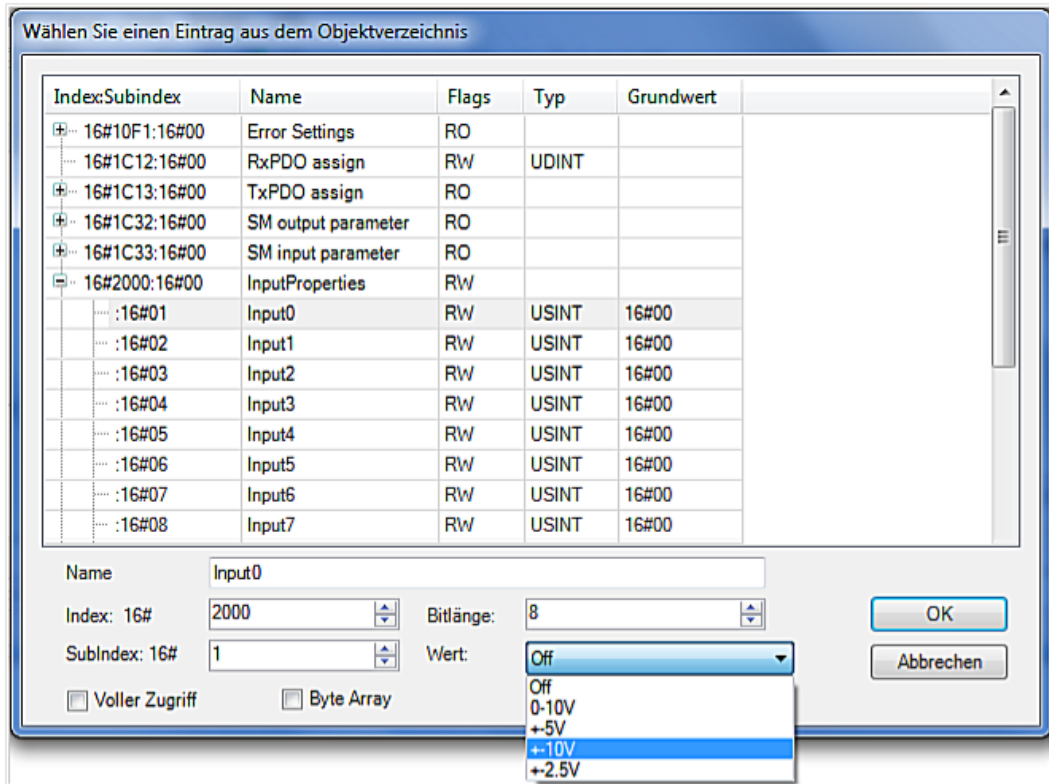
			<input checked="" type="checkbox"/> 16#1A01 AnalogInput0		
			Input0	INT	16#6501:01
			<input checked="" type="checkbox"/> 16#1A02 AnalogInput1		
			Input1	INT	16#6501:02
			<input checked="" type="checkbox"/> 16#1A03 AnalogInput2		
			Input2	INT	16#6501:03
			<input checked="" type="checkbox"/> 16#1A04 AnalogInput3		
			Input3	INT	16#6501:04
			<input checked="" type="checkbox"/> 16#1A05 AnalogInput4		
			Input4	INT	16#6501:05
			<input checked="" type="checkbox"/> 16#1A06 AnalogInput5		
			Input5	INT	16#6501:06
			<input checked="" type="checkbox"/> 16#1A07 AnalogInput6		
			Input6	INT	16#6501:07
			<input checked="" type="checkbox"/> 16#1A08 AnalogInput7		
			Input7	INT	16#6501:08

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

You may run the configuration tool offline and choose the "Startup Parameters" to change some settings of module AI4/8U 16-Bit (such as the properties of each of the inputs). 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.

Click/tap on "Add...", choose an object, and set the appropriate value.



Options

You can set up the following options:

Name	Value	Explanation
InputProperties	0	Off (default)
	1	0-10V
	2	±5 V
	3	±10 V
	4	±2,5 V
InputSwitch	0	Single-Ended (default)
	1	Differential
Average	n=1..255	Inputn= average after n cycles (default=1)

StateWord

The state word is indicative of the module state:

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1		not used
2	EtherCATErrror	Sync Manager Watchdog

3	ConfigError	Mismatch of Sync Manager's quantity structure
4-15		not used

Analogue Inputs

Check the following variables for the digitised input values:

Variable	Data type	Explanation
Inputn	INT	Value of channel n (n=0...7).

ControlWord

The control word contains a bit for acknowledging errors.

Bit	Name	Explanation
0	ResetError	0 -> errors are retained, 1 -> errors cleared after removing their cause
1-15	-	not used

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI4/8-U 13-Bit		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185340		RO
1018, 3	Revision Number	UINT32	2		RO
1018, 4	Serial Number	UINT32	0		RO
2000	Analog Input Properties	Array			
2000, 0	Number of Entries	UINT8	8		RO
2000, 1	Input 0	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 2	Input 1	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 3	Input 2	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 4	Input 3	UINT8	Off	Off (0), 0-10V (1),	RW

Index	Name	Type	Default	Min Max	Access
				+5V (2) +10V (3) +2.5V (4)	
2000, 5	Input 4	UINT8	Off	Off (0), 0-10V (1), +5V (2) +10V (3) +2.5V (4)	RW
2000, 6	Input 5	UINT8	Off	Off (0), 0-10V (1), +5V (2) +10V (3) +2.5V (4)	RW
2000, 7	Input 6	UINT8	Off	Off (0), 0-10V (1), +5V (2) +10V (3) +2.5V (4)	RW
2000, 8	Input 7	UINT8	Off	Off (0), 0-10V (1), +5V (2) +10V (3) +2.5V (4)	RW
2001	Input Switch	Array			
2001, 0	Number of Entries	UINT8	4		RO
2001, 1	Input 0_1 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 2	Input 2_3 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 3	Input 4_5 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 4	Input 6_7 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2003	Input Filter	Array			
2003, 0	Number of Entries	UINT8	8		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
2003, 5	Input 4 Average	UINT8	1	1..255	RW
2003, 6	Input 5 Average	UINT8	1	1..255	RW
2003, 7	Input 6 Average	UINT8	1	1..255	RW
2003, 8	Input 7 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	8		RO
6401, 1	Analog Input 0	UINT16			RO P
6401, 2	Analog Input 1	UINT16			RO P
6401, 3	Analog Input 2	UINT16			RO P

Index	Name	Type	Default	Min Max	Access
6401, 4	Analog Input 3	UINT16			RO P
6401, 5	Analog Input 4	UINT16			RO P
6401, 6	Analog Input 5	UINT16			RO P
6401, 7	Analog Input 6	UINT16			RO P
6401, 8	Analog Input 7	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

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

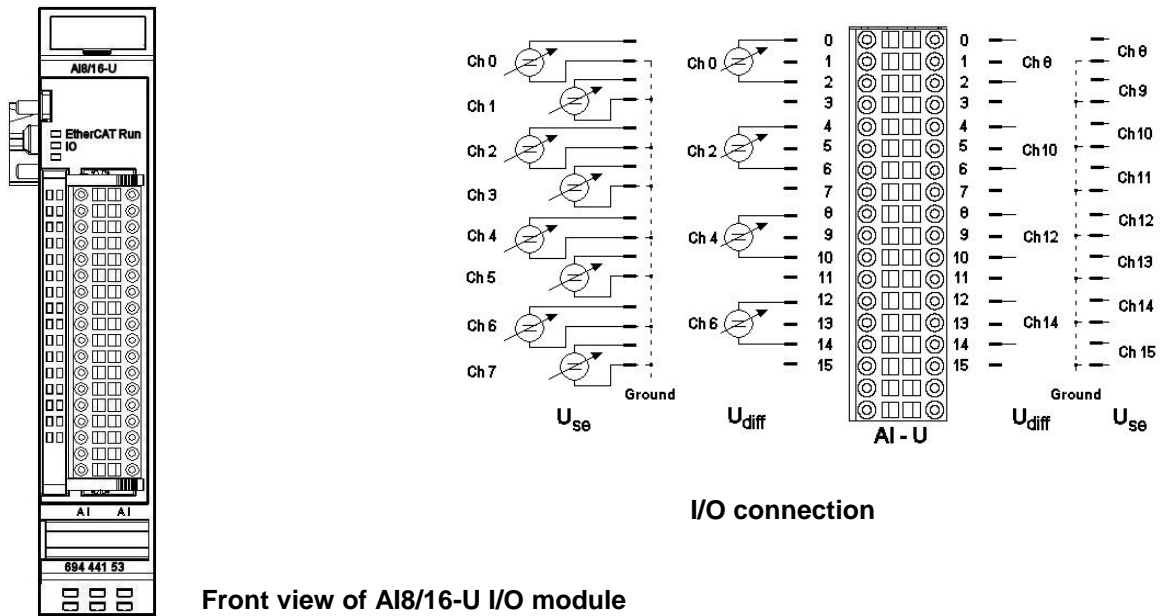
Technical Data

Analogue inputs.....	8 single-ended or 4 differential
Measuring range.....	0 ...10V, $\pm 5V$, $\pm 10V$, $\pm 2,5V$
Resolution.....	13 bit
Start AD conversion.....	synchronised with DC / SM
Conversion time.....	464 μs (if all channels are active)
Internal resistance	> 1M Ω
Input filter cutoff frequency	typ. 1kHz
Measuring error	< $\pm 0.4\%$, typ. < $\pm 0.2\%$ of final value
Baud rate	100 Mbit/s
Controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
Terminating module.....	not required
IO/power connection.....	18-pin plug
Power supply	24 VDC -20% +25%
E-bus load.....	190 mA
Part no.	694.441.52 13-Bit (CoE)



Approval:.....

5.4.5 AI8/16-U



Terminals

The module needs no separate 24V connector. Power is supplied to the module through the E-bus connector.

Operative earth / shielding of analogue wires → section 0

	<p>Information</p> <p>Module 694 441 53 Kuhnke FIO AI8/16-U is the successor module NOT compatible with module 694 441 03 Ventura FIO AI8/16-U.</p> <p>The module complies with ETG guidelines.</p> <p>Before replacing a Ventura/Kuhnke FIO AI8/16-U module (694 441 03) with a Kuhnke FIO AI8/16-U module (694 441 53), you must modify the EtherCAT master's control program.</p>
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Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On
		Inoperative if E-bus LED = Off

State	LED flash code	Explanation
	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"

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

LEDs "Channel"

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


State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled

Function

The AI8/16-U module has 16 analogue inputs. If signal lines are single-ended (measured against earth, L-), 16 channels are available. To measure differential signals, you will need 2 channels for every signal, i.e. you can pick up no more than 8 differential signals. Channels can be combined as follows: 0/1, 2/3, 4/5, 6/7, 8/9, 10/11, 12/13 and 14/15.

Table of measured values:

Measured value			Variable value (@ 16 bits)			
±10 V	±5 V	±2,5 V	Bipolar		Unipolar [UINT*]	
					*Data type conversion required	
Volt	Volt	Volt	Decimal	Hexadecimal	Decimal	Hexadecimal
-10	-5	-2.5	-32768	16#8000		
-9	-4.5	-2.25	-29492	16#8CCC		
-8	-4	-2	-26215	16#9999		
-7	-3.5	-1.75	-22938	16#A666		
-6	-3	-1.5	-19661	16#B333		
-5	-2.5	-1.25	-16384	16#C000		
-4	-2	-1	-13108	16#CCCC		
-3	-1.5	-0.75	-9831	16#D999		
-2	-1	-0.5	-6574	16#E666		
-1	-0.5	-0.25	-3292	16#F324		
0	0	0	0	0	0	0
1	0.5	0.25	3276	16#0CCC	6553	16#1999
2	1	0.5	6553	16#1999	13107	16#3332
3	1.5	0.75	9830	16#2666	19660	16#4CCC
4	2	1	13106	16#3332	26214	16#6665
5	2.5	1.25	16383	16#3FFF	32767	16#7FFF
6	3	1.5	19660	16#4CCC	39320	16#9998
7	3.5	1.75	22936	16#5998	45874	16#B332
8	4	2	26213	16#6665	52427	16#CCCB
9	4.5	2.25	29490	16#7332	58981	16#E665
10	5	2.5	32767	16#7FFF	65534	16#FFFE

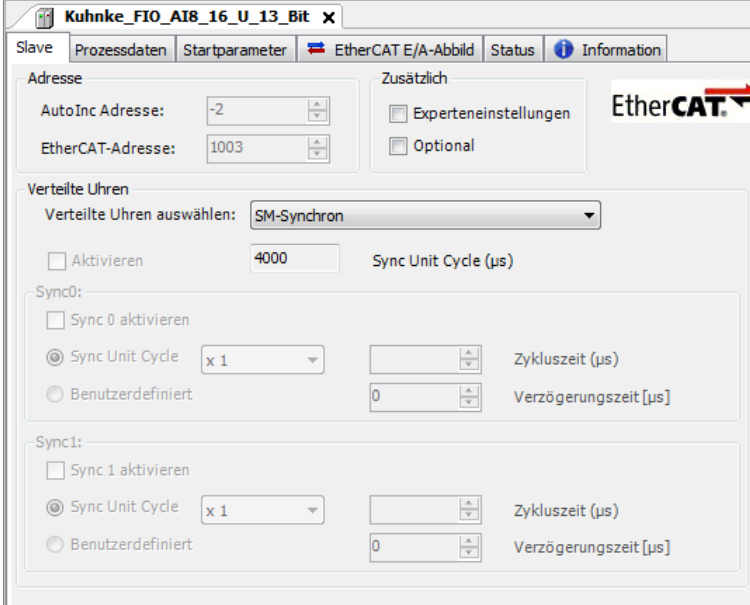


Information

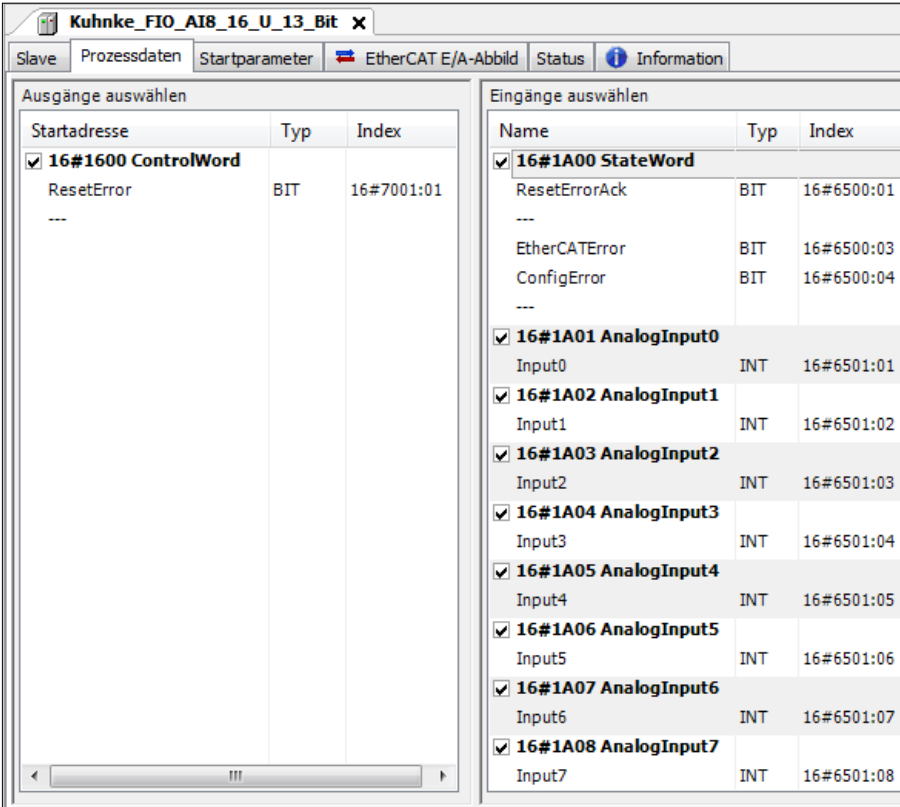
If the inputs are not used but switched on, the measured values displayed in the I / O image are floated. To prevent this, you should deactivate the measurement channel at the start parameters or set the input to ground (short-circuit when measuring differential signals).

To Set up the Options

Conversion of the analogue values can be synchronised with DC (Distributed Clocks) or SM (Sync Manager).



The screenshot shows the 'Startparameter' tab of the configuration window. Under 'Verteilte Uhren', 'SM-Synchron' is selected. The 'Aktivieren' checkbox is unchecked, and the 'Sync Unit Cycle (µs)' is set to 4000. For both Sync0 and Sync1, 'Sync Unit Cycle' is selected with a multiplier of 'x 1', and the 'Verzögerungszeit [µs]' is set to 0.



The screenshot shows the 'Ausgänge auswählen' and 'Eingänge auswählen' sections. The 'Ausgänge' table has one entry checked: '16#1600 ControlWord' with type 'BIT' and index '16#7001:01'. The 'Eingänge' table has several entries checked, including '16#1A00 StateWord' and eight 'AnalogInput' channels (0-7).

Ausgänge auswählen			Eingänge auswählen		
Startadresse	Typ	Index	Name	Typ	Index
<input checked="" type="checkbox"/> 16#1600 ControlWord			<input checked="" type="checkbox"/> 16#1A00 StateWord		
ResetError	BIT	16#7001:01	ResetErrorAck	BIT	16#6500:01
---			---		
			EtherCATError	BIT	16#6500:03
			ConfigError	BIT	16#6500:04

			<input checked="" type="checkbox"/> 16#1A01 AnalogInput0		
			Input0	INT	16#6501:01
			<input checked="" type="checkbox"/> 16#1A02 AnalogInput1		
			Input1	INT	16#6501:02
			<input checked="" type="checkbox"/> 16#1A03 AnalogInput2		
			Input2	INT	16#6501:03
			<input checked="" type="checkbox"/> 16#1A04 AnalogInput3		
			Input3	INT	16#6501:04
			<input checked="" type="checkbox"/> 16#1A05 AnalogInput4		
			Input4	INT	16#6501:05
			<input checked="" type="checkbox"/> 16#1A06 AnalogInput5		
			Input5	INT	16#6501:06
			<input checked="" type="checkbox"/> 16#1A07 AnalogInput6		
			Input6	INT	16#6501:07
			<input checked="" type="checkbox"/> 16#1A08 AnalogInput7		
			Input7	INT	16#6501:08

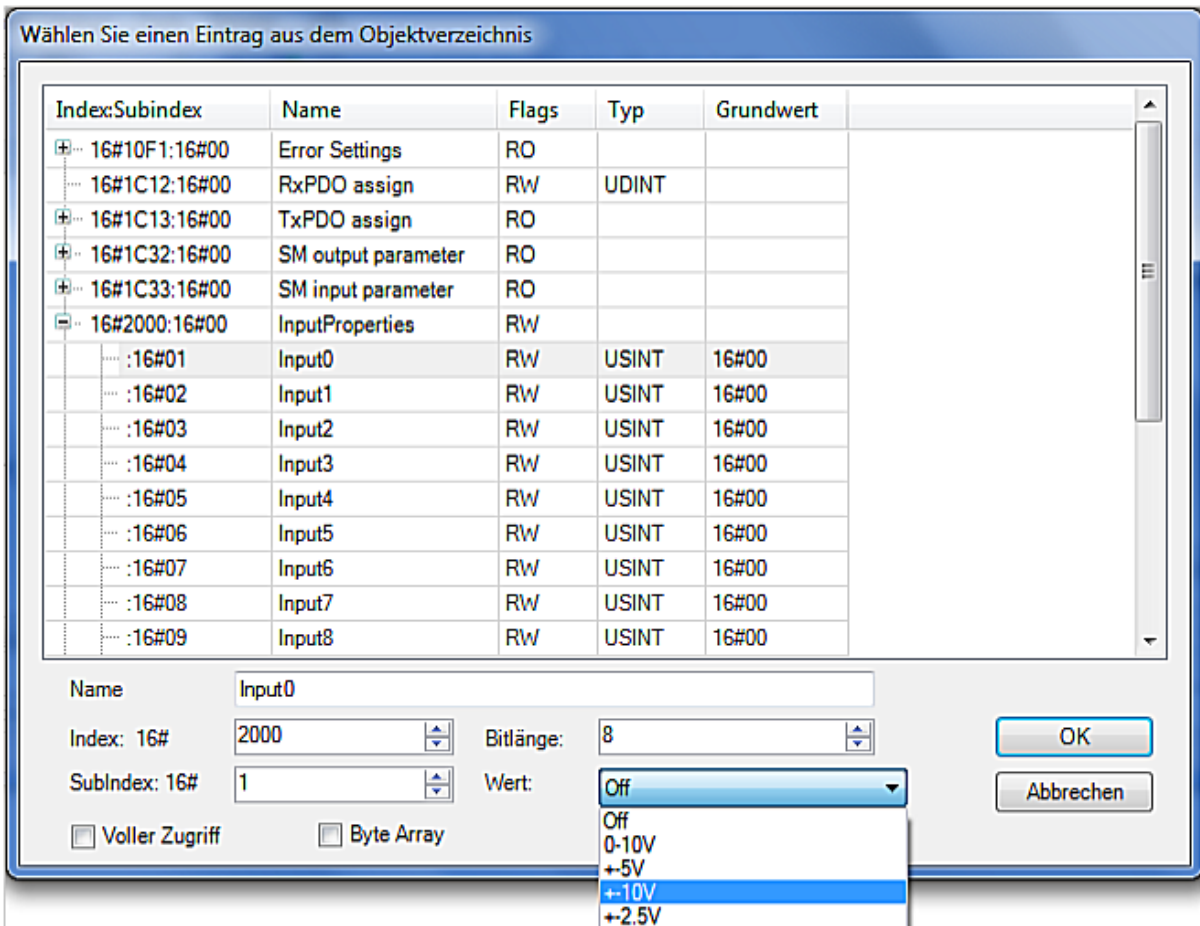
The process data objects stored as variables in the EtherCAT master's control program are used to access the input values and the module state.

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

You may run the configuration tool offline and choose the "Startup Parameters" to change some settings of module AI4/8U 16-Bit (such as the properties of each of the inputs). 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.

Click/tap on "Add...", choose an object, and set the appropriate value.



Options

You can set up the following options for every channel:

Name	Value	Explanation
InputProperties	0	Off (default)
	1	0-10V
	2	±5 V
	3	±10 V
	4	±2,5 V
InputSwitch	0	Single-Ended (default)
	1	Differential
Average	n=1..255	Inputn= average after n cycles (default=1)

StateWord

The state word is indicative of the module state:

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1		not used
2	EtherCATErrror	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-15		not used

Analogue Inputs

Check the following variables for the digitised input values:

Variable	Data type	Explanation
Inputn	INT	Value of channel n (n=0...15).

ControlWord

The control word contains a bit for acknowledging errors.

Bit	Name	Explanation
0	ResetError	0 -> errors are retained, 1 -> errors cleared after removing their cause
1-15	-	not used

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI4/8-U 13-Bit		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185341		RO
1018, 3	Revision Number	UINT32	2		RO
1018, 4	Serial Number	UINT32	0		RO
2000	Analog Input Properties	Array			
2000, 0	Number of Entries	UINT8	16		RO
2000, 1	Input 0	UINT8	Off	Off (0), 0-10V (1), +5V (2) +-10V (3) +-2.5V (4)	RW
2000, 2	Input 1	UINT8	Off	Off (0), 0-10V (1), +5V (2) +-10V (3) +-2.5V (4)	RW
2000, 3	Input 2	UINT8	Off	Off (0), 0-10V (1),	RW

Index	Name	Type	Default	Min Max	Access
				+5V (2) +-10V (3) +-2.5V (4)	
2000, 4	Input 3	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 5	Input 4	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 6	Input 5	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 7	Input 6	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 8	Input 7	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 9	Input 8	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 10	Input 9	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 11	Input 10	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 12	Input 11	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW

Index	Name	Type	Default	Min Max	Access
2000, 13	Input 12	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 14	Input 13	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 15	Input 14	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 16	Input 15	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2001	Number of Entries	UINT8	8		RO
2001, 1	Input 0_1 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 2	Input 2_3 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 3	Input 4_5 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 4	Input 6_7 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 5	Input 8_9 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 6	Input 10_11 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 7	Input 12_13 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 8	Input 14_15 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2003	Input Average	Array			
2003, 0	Number of Entries	UINT8	16		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
2003, 5	Input 4 Average	UINT8	1	1..255	RW
2003, 6	Input 5 Average	UINT8	1	1..255	RW
2003, 7	Input 6 Average	UINT8	1	1..255	RW
2003, 8	Input 7 Average	UINT8	1	1..255	RW
2003, 9	Input 8 Average	UINT8	1	1..255	RW

Index	Name	Type	Default	Min Max	Access
2003, 10	Input 9 Average	UINT8	1	1..255	RW
2003, 11	Input 10 Average	UINT8	1	1..255	RW
2003, 12	Input 11 Average	UINT8	1	1..255	RW
2003, 13	Input 12 Average	UINT8	1	1..255	RW
2003, 14	Input 13 Average	UINT8	1	1..255	RW
2003, 15	Input 14 Average	UINT8	1	1..255	RW
2003, 16	Input 15 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	16		RO
6401, 1	Analog Input 0	UINT16			RO P
6401, 2	Analog Input 1	UINT16			RO P
6401, 3	Analog Input 2	UINT16			RO P
6401, 4	Analog Input 3	UINT16			RO P
6401, 5	Analog Input 4	UINT16			RO P
6401, 6	Analog Input 5	UINT16			RO P
6401, 7	Analog Input 6	UINT16			RO P
6401, 8	Analog Input 7	UINT16			RO P
6401, 9	Analog Input 8	UINT16			RO P
6401, 10	Analog Input 9	UINT16			RO P
6401, 11	Analog Input 10	UINT16			RO P
6401, 12	Analog Input 11	UINT16			RO P
6401, 13	Analog Input 12	UINT16			RO P
6401, 14	Analog Input 13	UINT16			RO P
6401, 15	Analog Input 14	UINT16			RO P
6401, 16	Analog Input 15	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

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

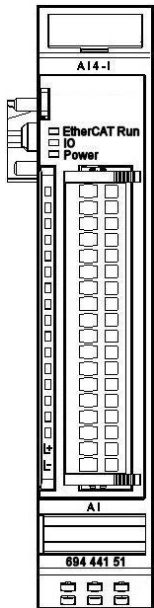
Technical Data

Analogue inputs.....	16 single-ended or 8 differential
Measuring range.....	0 ...10V, $\pm 5V$, $\pm 10V$, $\pm 2,5V$
Resolution.....	13 bit
Start AD conversion.....	synchronised with DC / SM
Conversion time.....	580 μs (if all channels are active)
Internal resistance	> 1M Ω
Input filter cutoff frequency	typ. 1kHz
Measuring error	< $\pm 0.4\%$, typ. < $\pm 0.2\%$ of final value
Baud rate	100 Mbit/s
Controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
Terminating module.....	not required
IO/power connection.....	36-pin plug
Power supply	24 VDC -20% +25%
E-bus load.....	190 mA
Part no.	694.441.53 13-Bit (CoE)

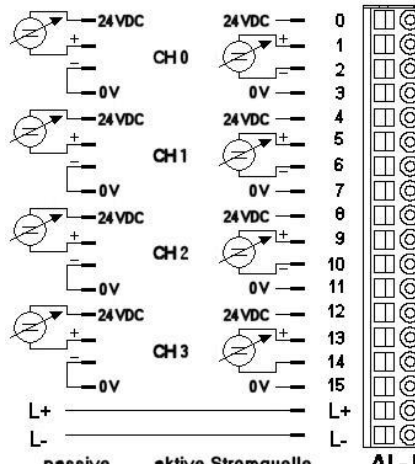


Approval:.....

5.4.6 AI4-I



Front view of AI4-I I/O module



I/O connection

Terminals

The 24 V connector supplies power to the sensors.
 Power is supplied to the module through the E-bus connector.
 Operative earth / shielding of analogue wires → section 0

	Information
	<p>Module 694 441 51 Kuhnke FIO AI4-I 12-Bit is the successor module NOT compatible with module 694 441 01 Ventura FIO AI4-I 12-Bit.</p> <p>The module complies with ETG guidelines.</p> <p>Before replacing a Ventura/Kuhnke FIO AI4-I 12-Bit module (694 441 01) with a Kuhnke FIO AI4-I 12-Bit module (694 441 51), you must modify the EtherCAT master's control program.</p>

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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

State	LED flash code	Explanation
Defective	Red, on	Module defective

LED "Power"

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

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

LEDs "Channel"

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

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Added to the CoE variant (694 441 51 Kuhnke FIO AI4-I 12-Bit)		
Error	Red, 1x	Current > 20.5 mA
	Red, 2x	Current < 3.5 mA (4..20 mA mode)

Function

The AI4-I module has four analogue current signal inputs. Their measuring range can be set separately for every channel, i.e. either to 0..20mA or to 4..20mA.

Analogue Inputs

Check the following variable for the digitised input values:

Variable	Data type	Explanation
AnalogInputn	INT	Value measured on channel n (n= 0...3)

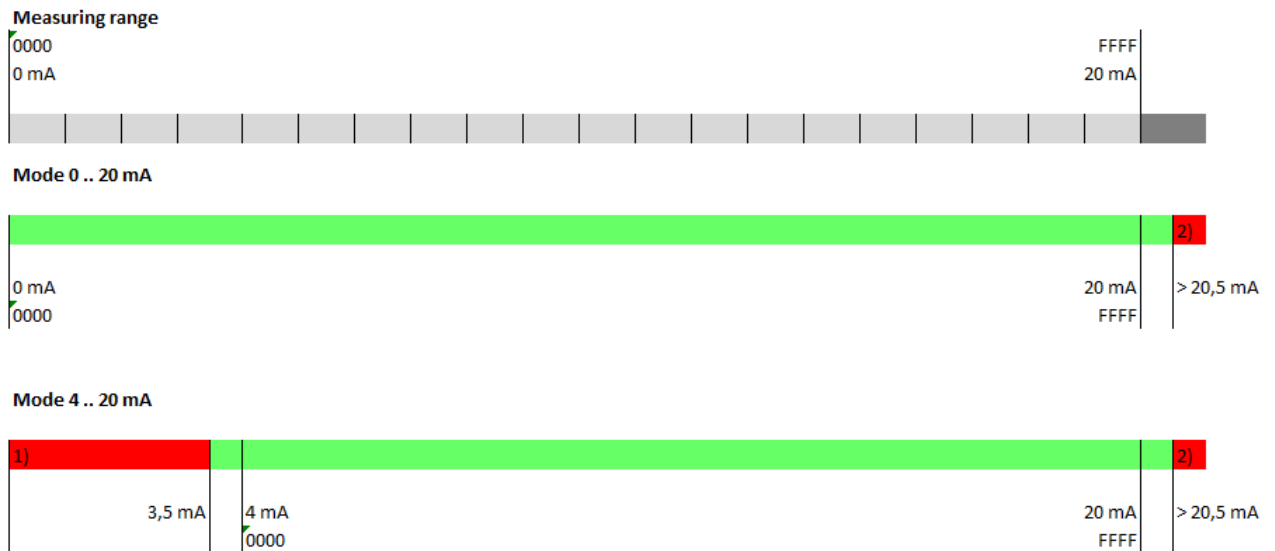
Measured value

Table "0-20 mA current mode"

Current [mA]	Value [hex]
0	0x0
10	0x7FFF
20	0xFFFF

Table "4-20 mA current mode"

Current [mA]	Value [hex]
4	0x0
12	0x7FFF
20	0xFFFF

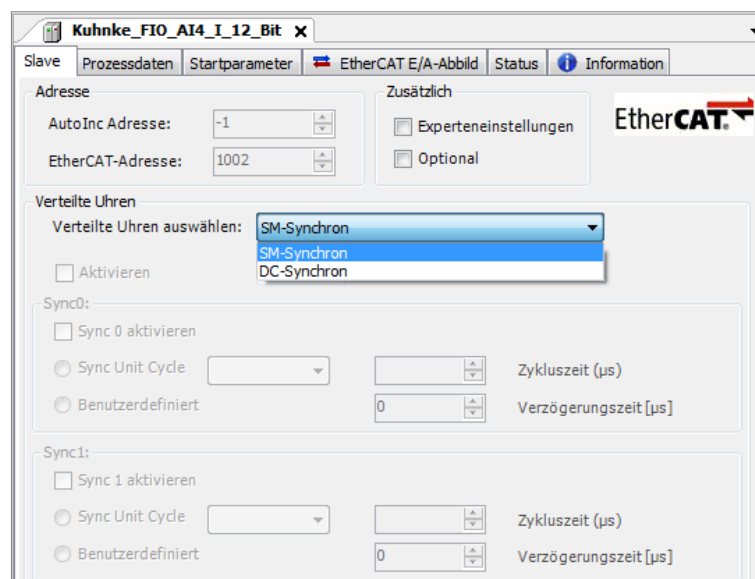


- 1) At a current of < 3.5 mA: EtherCat process image message "Input x low" and flash code at the input (red LED flashes 1x)
 2) At a current of < 20.5 mA: EtherCat process image message "Input x high" and flash code at the input (red LED flashes 2x)

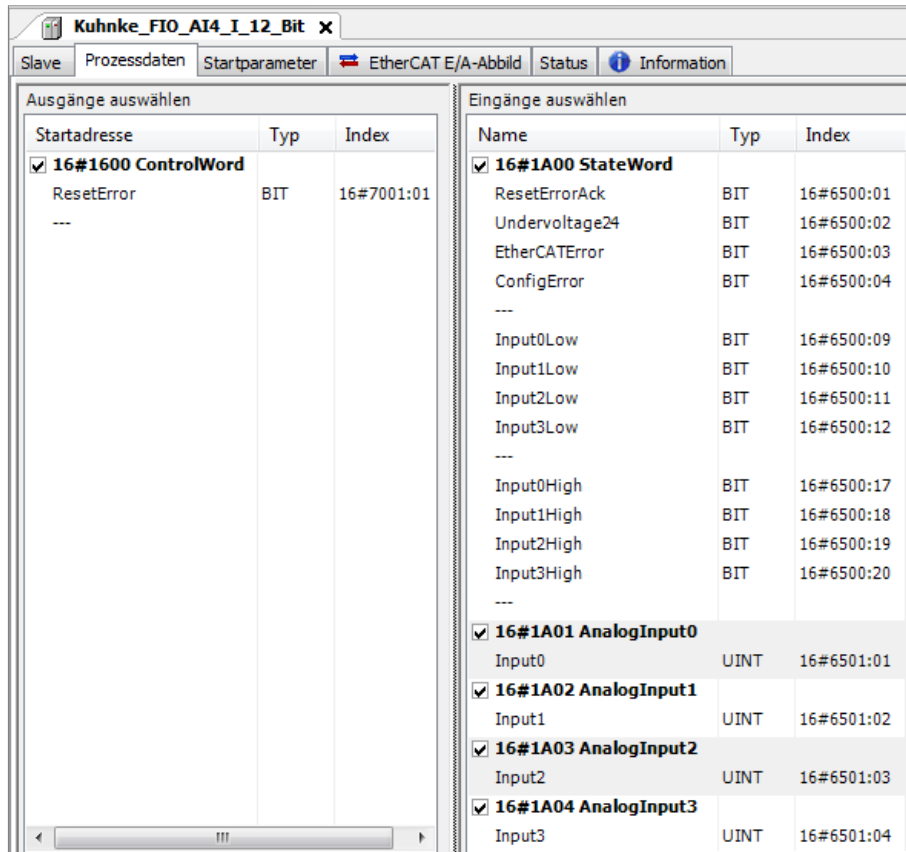
Measured & variable values and state of AI4-I CoE

To Set up the Options

Conversion of the analogue values can be synchronised with DC (Distributed Clocks) or SM (Sync Manager).



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

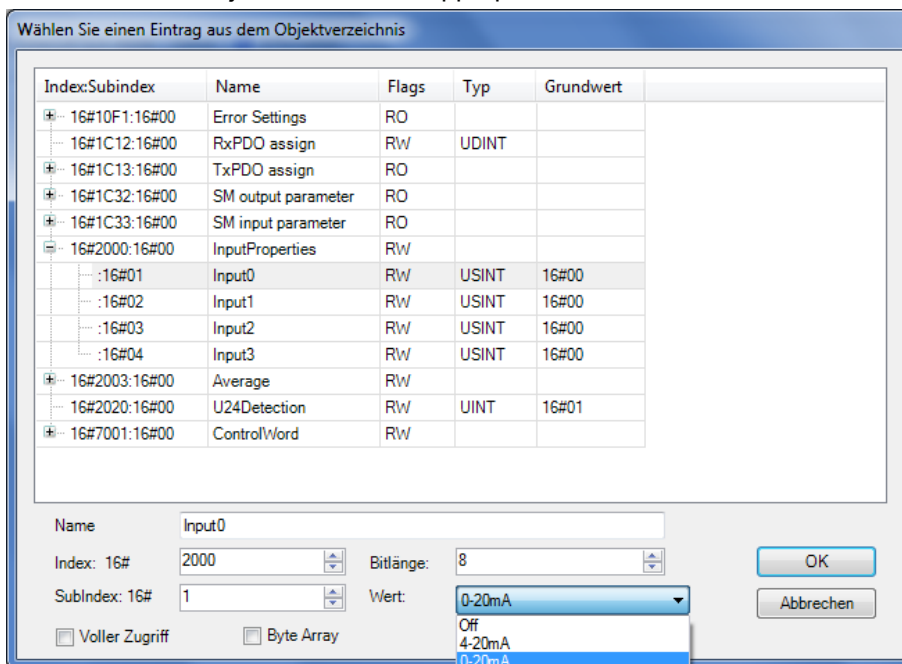


Service data objects (SDO) are available for details and settings.

You may run the configuration tool offline and choose the "Startup Parameters" to change some settings of module AI4-I 12-Bit (such as the properties of each of the inputs). 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.

Click/tap on "Add...", choose an object, and set the appropriate value.



Options

You can set up the following options for every channel:

Name	Value	Explanation
InputProperties	0	Off (default)
	5	4-20mA
	6	0-20mA
Average	n=1..255	Inputn= average after n cycles (default=1)

StateWord

The state word (DWORD) is indicative of the module state:

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	Undervoltage24	Power to passive sensors < 19 V (no error, just info)
2	EtherCATError	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-7		not used
8	Input0low	Current at 4-20mA < 3.5mA
9	Input1low	Current at 4-20mA < 3.5mA
10	Input2low	Current at 4-20mA < 3.5mA
11	Input3low	Current at 4-20mA < 3.5mA
12-15		not used
16	Input0high	Current > 20.5 mA
17	Input1high	Current > 20.5 mA
18	Input2high	Current > 20.5 mA
19	Input3high	Current > 20.5 mA
20-31	-	not used

Analogue Inputs

Check the following variables for the digitised input values:

Variable	Data type	Explanation
Inputn	INT	Value of channel n (n=0...3).

ControlWord

The control word contains a bit for acknowledging errors.

Bit	Name	Explanation
0	ResetError	0 -> errors are retained, 1 -> errors cleared after removing their cause
1-15	-	not used

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI4-I 12-Bit		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO

Index	Name	Type	Default	Min Max	Access
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185339		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32			RO
2000	Analog Input Properties	Array			
2000, 0	Number of Entries	UINT8	4		RO
2000, 1	Input 0	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 2	Input 1	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 3	Input 2	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 4	Input 3	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2003	Input Average	Array			
2003, 0	Number of Entries	UINT8	4		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	4		RO
6401, 1	Analog Input 0	UINT16			RO P
6401, 2	Analog Input 1	UINT16			RO P
6401, 3	Analog Input 2	UINT16			RO P
6401, 4	Analog Input 3	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	32		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	Undervoltage24	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5..8	-	BOOL			RO P
6500, 9	Input 0 low	BOOL			RO P
6500, 10	Input 1 low	BOOL			RO P
6500, 11	Input 2 low	BOOL			RO P
6500, 12	Input 3 low	BOOL			RO P
6500, 13..16	-	BOOL			RO P
6500, 17	Input 0 high	BOOL			RO P
6500, 18	Input 1 high	BOOL			RO P
6500, 19	Input 2 high	BOOL			RO P
6500, 20	Input 3 high	BOOL			RO P
6500, 21..32	-	BOOL			RO P

Index	Name	Type	Default	Min Max	Access
6500, 1	ResetErrorAck	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

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

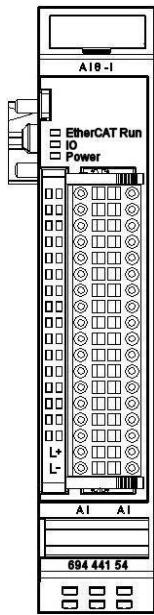
Technical Data

Analogue inputs.....	4
Measuring range.....	0...20mA, 4...20mA (final value: 20mA)
Resolution.....	12 bit
Start AD conversion.....	synchronised with DC / SM
Conversion time.....	235 µs (if all channels are active)
Internal resistance	< 300Ω
Input filter cutoff frequency	100 kHz
Measuring error	< ±0.5%, typ. < ±0.4% of final value
Supply of Sensors	24VDC, a total of max. 200mA
Baud rate	100 Mbit/s
Controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
Terminating module	not required
IO/power connection.....	18-pin plug
Power supply	24 VDC -20% +25%
E-bus load.....	190 mA
Part no.	694.441.51 (CoE)

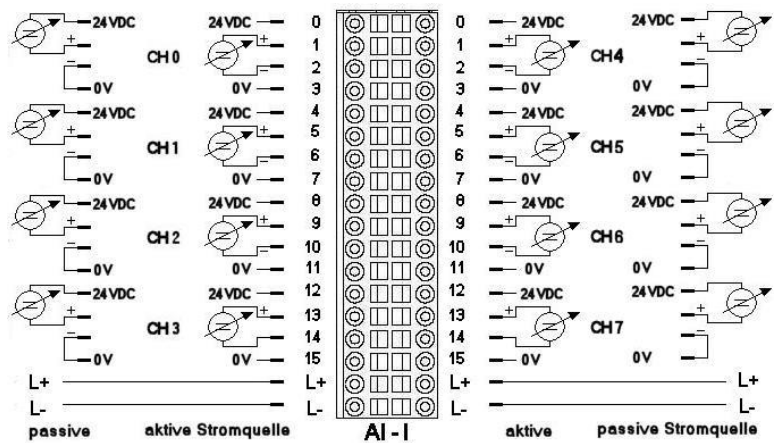
Approval:.....



5.4.7 AI8-I



Front view of AI8-I I/O module



I/O connection

Terminals

The 24 V connector supplies power to the sensors.
 Power is supplied to the module through the E-bus connector.
 Operative earth / shielding of analogue wires → section 0

	Information
	Module 694 441 54 Kuhnke FIO AI8-I 12-Bit is the successor module NOT compatible with module 694 441 04 Ventura FIO AI8-I 12-Bit.
	The module complies with ETG guidelines.
	Before replacing a Ventura/Kuhnke FIO AI8-I 12-Bit module (694 441 04) with a Kuhnke FIO AI8-I 12-Bit module (694 441 54), you must modify the EtherCAT master's control program.

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On

State	LED flash code	Explanation
		Inoperative if E-bus LED = Off
	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 power supplied to the I/O module's I/O sensors.

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

LEDs "Channel"

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

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Added to the CoE variant (694 441 51 Kuhnke FIO AI4-I 12-Bit)		
Error	red	Current > 20.5 mA
		Current < 3.5 mA (4..20 mA mode)

Function

The AI8-I module has eight analogue current signal inputs. Their measuring range can be set separately for every channel, i.e. either to 0..20mA or to 4..20mA.

Analogue Inputs

Check the following variable for the digitised input values:

Variable	Data type	Explanation
AnalogInputn	INT	Value measured on channel n (n= 0...7)

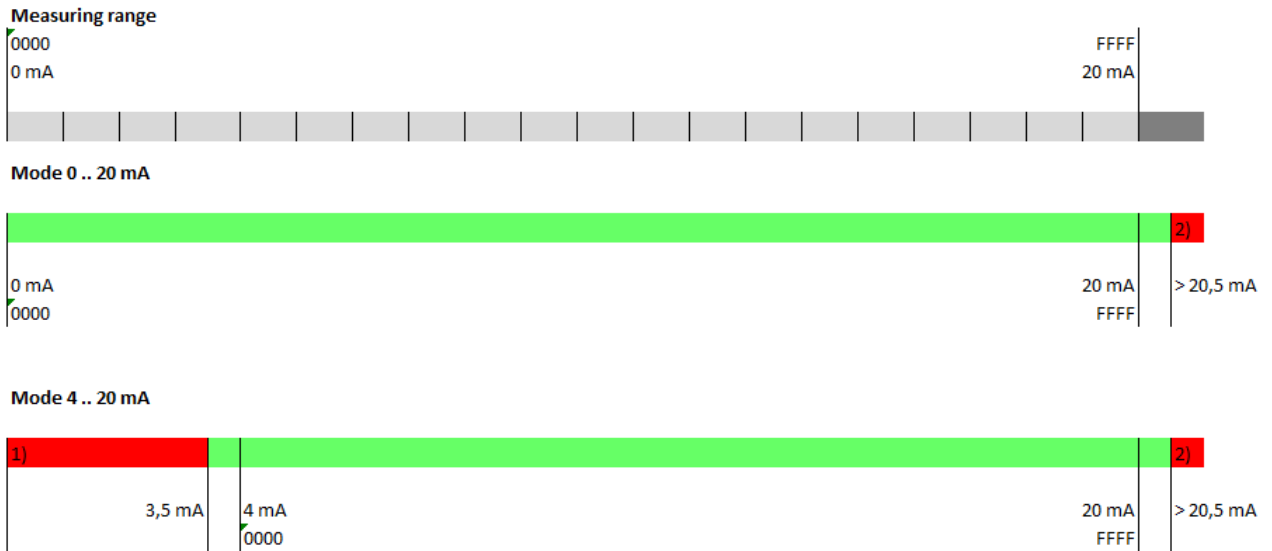
Measured value

Table "0-20 mA current mode"

Current [mA]	Value [hex]
0	0x0
10	0x7FFF
20	0xFFFF

Table "4-20 mA current mode"

Current [mA]	Value [hex]
4	0x0
12	0x7FFF
20	0xFFFF

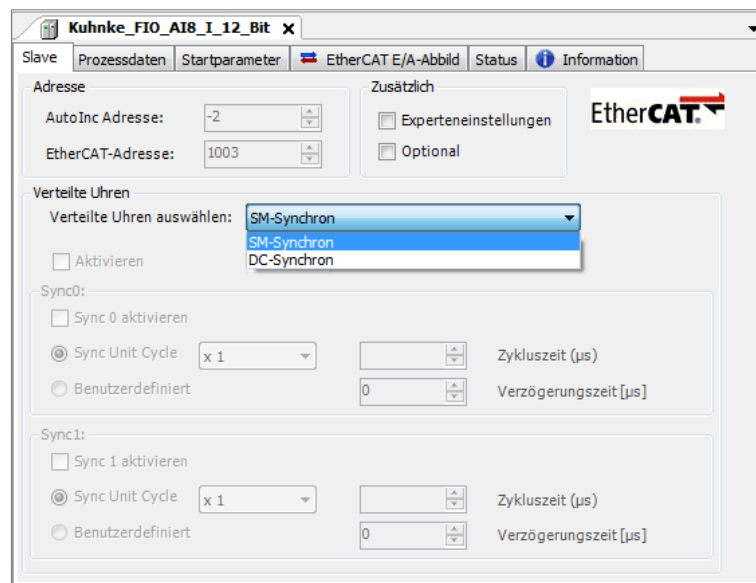


- 1) At a current of < 3.5 mA: EtherCat process image message "Input x low" and flash code at the input (red LED flashes 1x)
- 2) At a current of < 20.5 mA: EtherCat process image message "Input x high" and flash code at the input (red LED flashes 2x)

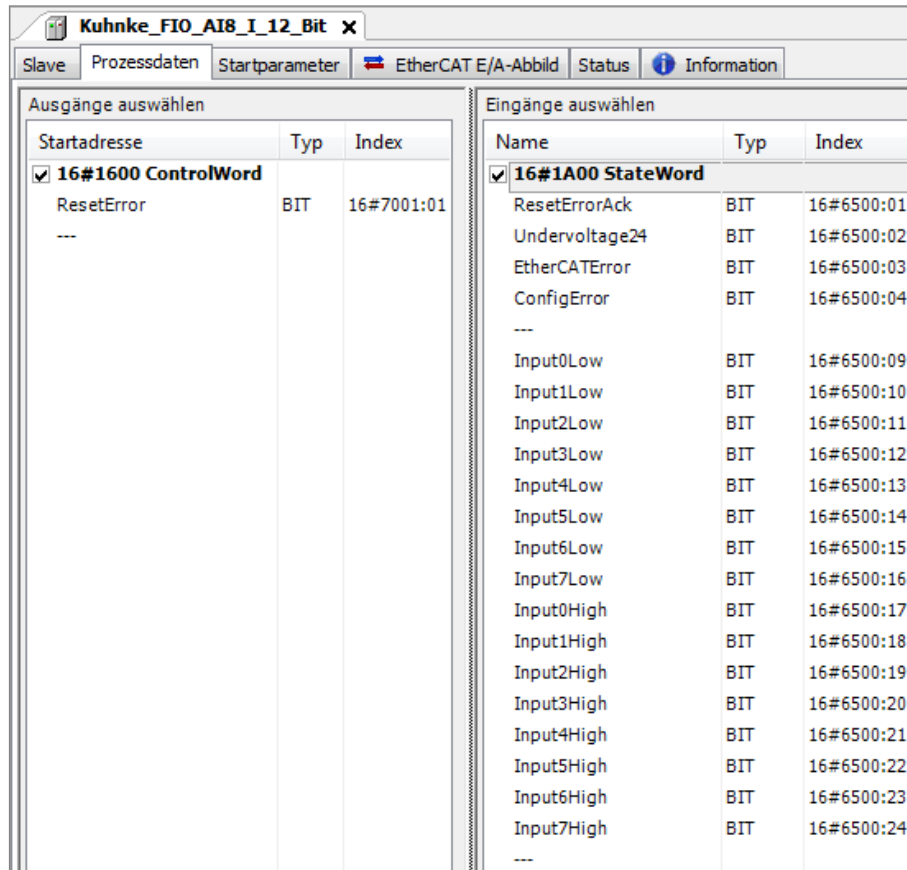
Measured & variable values and state of AI8-I CoE

To Set up the Options

Conversion of the analogue values can be synchronised with DC (Distributed Clocks) or SM (Sync Manager).



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

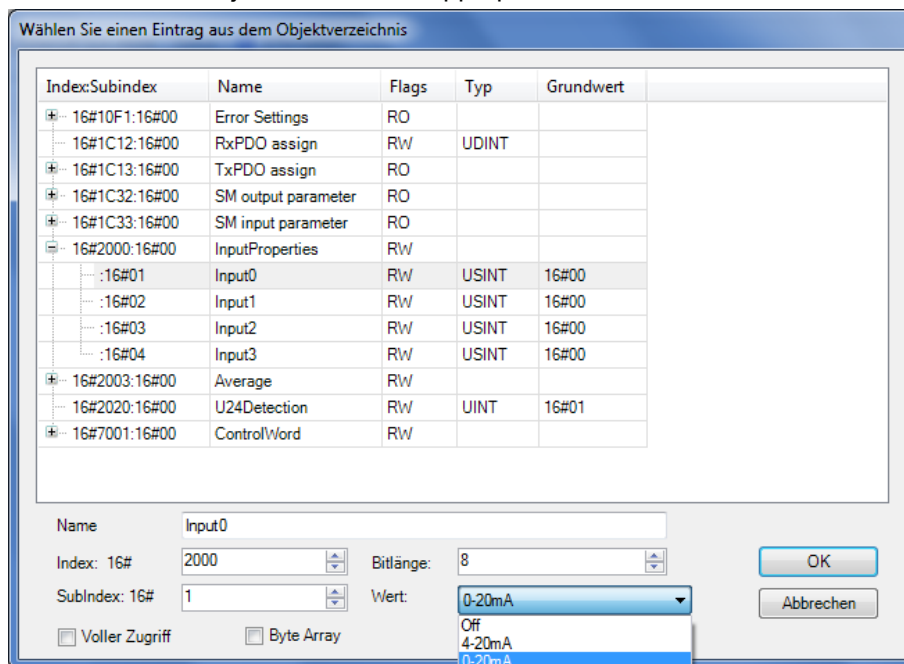


Service data objects (SDO) are available for details and settings.

You may run the configuration tool offline and choose the "Startup Parameters" to change some settings of module AI8-I 12-Bit (such as the properties of each of the inputs). 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.

Click/tap on "Add...", choose an object, and set the appropriate value.



Options

You can set up the following options for every channel:

Name	Value	Explanation
InputProperties	0	Off (default)
	5	4-20mA
	6	0-20mA
Average	n=1..255	Inputn= average after n cycles (default=1)

StateWord

The state word (DWORD) is indicative of the module state:

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	Undervoltage24	Power to passive sensors < 19 V (no error, just info)
2	EtherCATErr	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-7		not used
8	Input0low	Current at 4-20mA < 3.5mA
9	Input1low	Current at 4-20mA < 3.5mA
10	Input2low	Current at 4-20mA < 3.5mA
11	Input3low	Current at 4-20mA < 3.5mA
12	Input4low	Current at 4-20mA < 3.5mA
13	Input5low	Current at 4-20mA < 3.5mA
14	Input6low	Current at 4-20mA < 3.5mA
15	Input7low	Current at 4-20mA < 3.5mA
16	Input0high	Current > 20.5 mA
17	Input1high	Current > 20.5 mA
18	Input2high	Current > 20.5 mA
19	Input3high	Current > 20.5 mA
20	Input4high	Current > 20.5 mA
21	Input5high	Current > 20.5 mA
22	Input6high	Current > 20.5 mA
23	Input7high	Current > 20.5 mA
24-31	-	not used

Analogue Inputs

Check the following variables for the digitised input values:

Variable	Data type	Explanation
Inputn	INT	Value of channel n (n=0...7).

ControlWord

The control word contains a bit for acknowledging errors.

Bit	Name	Explanation
0	ResetError	0 -> errors are retained, 1 -> errors cleared after removing their cause
1-15	-	not used

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	A18-I 12-Bit		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185345		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32			RO
2000	Analog Input Properties	Array			
2000, 0	Number of Entries	UINT8	8		RO
2000, 1	Input 0	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 2	Input 1	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 3	Input 2	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 4	Input 3	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 5	Input 4	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 6	Input 5	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 7	Input 6	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 8	Input 7	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2003	Input Average	Array			
2003, 0	Number of Entries	UINT8	8		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
2003, 5	Input 4 Average	UINT8	1	1..255	RW
2003, 6	Input 5 Average	UINT8	1	1..255	RW
2003, 7	Input 6 Average	UINT8	1	1..255	RW

Index	Name	Type	Default	Min Max	Access
2003, 8	Input 7 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	8		RO
6401, 1	Analog Input 0	UINT16			RO P
6401, 2	Analog Input 1	UINT16			RO P
6401, 3	Analog Input 2	UINT16			RO P
6401, 4	Analog Input 3	UINT16			RO P
6401, 5	Analog Input 4	UINT16			RO P
6401, 6	Analog Input 5	UINT16			RO P
6401, 7	Analog Input 6	UINT16			RO P
6401, 8	Analog Input 7	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	32		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	Undervoltage24	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5..8	-	BOOL			RO P
6500, 9	Input 0 low	BOOL			RO P
6500, 10	Input 1 low	BOOL			RO P
6500, 11	Input 2 low	BOOL			RO P
6500, 12	Input 3 low	BOOL			RO P
6500, 13	Input 4 low	BOOL			RO P
6500, 14	Input 5 low	BOOL			RO P
6500, 15	Input 6 low	BOOL			RO P
6500, 16	Input 7 low	BOOL			RO P
6500, 17	Input 0 high	BOOL			RO P
6500, 18	Input 1 high	BOOL			RO P
6500, 19	Input 2 high	BOOL			RO P
6500, 20	Input 3 high	BOOL			RO P
6500, 21	Input 4 high	BOOL			RO P
6500, 22	Input 5 high	BOOL			RO P
6500, 23	Input 6 high	BOOL			RO P
6500, 24	Input 7 high	BOOL			RO P
6500, 25..32	-	BOOL			RO P
6500, 1	ResetErrorAck	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

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

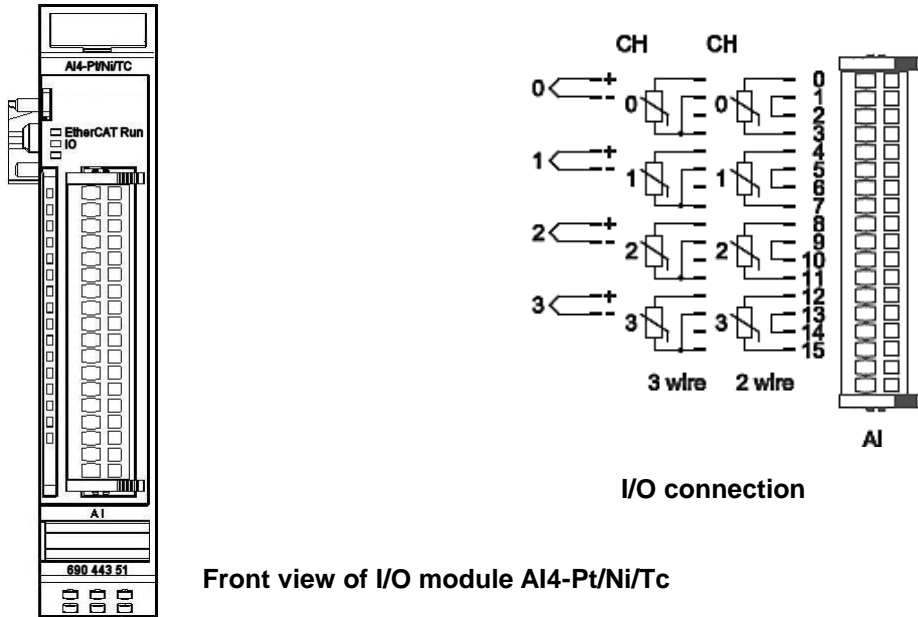
Technical Data

Analogue inputs.....	8
Measuring range.....	0...20mA, 4...20mA (final value: 20mA)
Resolution.....	12 bit
Start AD conversion.....	synchronised with DC / SM
Conversion time.....	290 µs (if all channels are active)
Internal resistance	< 300Ω
Input filter cutoff frequency	100 kHz
Measuring error	< ±0.5%, typ. < ±0.4% of final value
Supply of Sensors	24VDC, a total of max. 200mA
Baud rate	100 Mbit/s
Controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
Terminating module.....	not required
IO/power connection.....	36-pin plug
Power supply	24 VDC -20% +25%
E-bus load.....	190 mA
Part no.	694.441.54 (CoE)



Approval:.....

5.4.8 AI4-Pt/Ni/TC



Terminals

The module needs no separate 24V connector. Power is supplied to the module through the E-bus connector.

Operative earth / shielding of analogue wires → section 0

	<p>Information</p> <p>Module 694 443 57 Kuhnke FIO AI4-Pt/Ni/TC is the INCOMPATIBLE successor to the following modules:</p> <p style="margin-left: 40px;">694 443 01 Ventura FIO AI4-Pt/Ni100</p> <p style="margin-left: 40px;">694 443 03 Ventura FIO AI4-Pt/Ni1000</p> <p style="margin-left: 40px;">694 443 05 Ventura FIO AI4-TE</p> <p>The module complies with ETG guidelines.</p> <p>Before replacing a Ventura FIO AI4-Pt/Ni100 or 694 443 03 Ventura FIO AI4-Pt/Ni1000 or 694 443 05 Ventura FIO AI4-TE (694 443 01) with a Kuhnke FIO AI4-Pt/Ni/TC module (694 443 57), you must modify the EtherCAT master's control program.</p>
--	---

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error

State	LED flash code	Explanation
Error	Off	Malfunction of module if E-bus LED = On
		Inoperative if E-bus LED = Off
	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

LEDs "Channel"

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

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Sensor low
	Red, 2x	Sensor high



Note on Pt100/Ni100 mode

Error "input high" is not shown in the Pt100 and Ni100 modes, unless a temperature sensor is connected. Check that your wiring is correct (jumped 2-wire or 3-wire connection) to ensure that all errors are detected/shown properly.



Note on thermocouple mode

- Errors *input low* and *input high* are just indicative of the temperature being out of the set range.
- A short circuit (input low) is not detected in thermocouple mode (types J,K) because the thermal voltage is too small for a short circuit to be relevant to the measured result.
- Since a broken wire is not detected, the floating module values may provoke an indication of error *input high* or *input low*.

Function

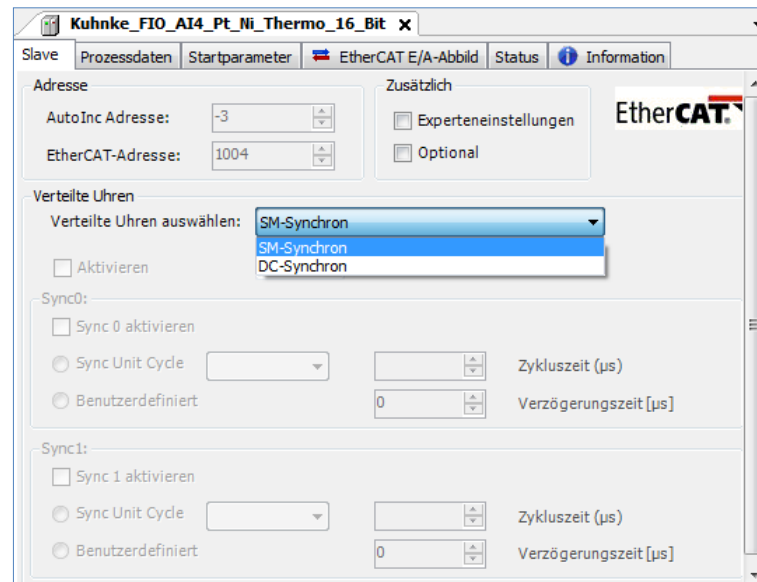
Module AI4-Pt/Ni/TC features four analogue inputs for temperature sensors. Every channel can be separately set to one of the following sensor types: millivolt, Pt100, Pt1000, Ni100, Ni1000 (DIN 43760) or thermocouple.

Measured value

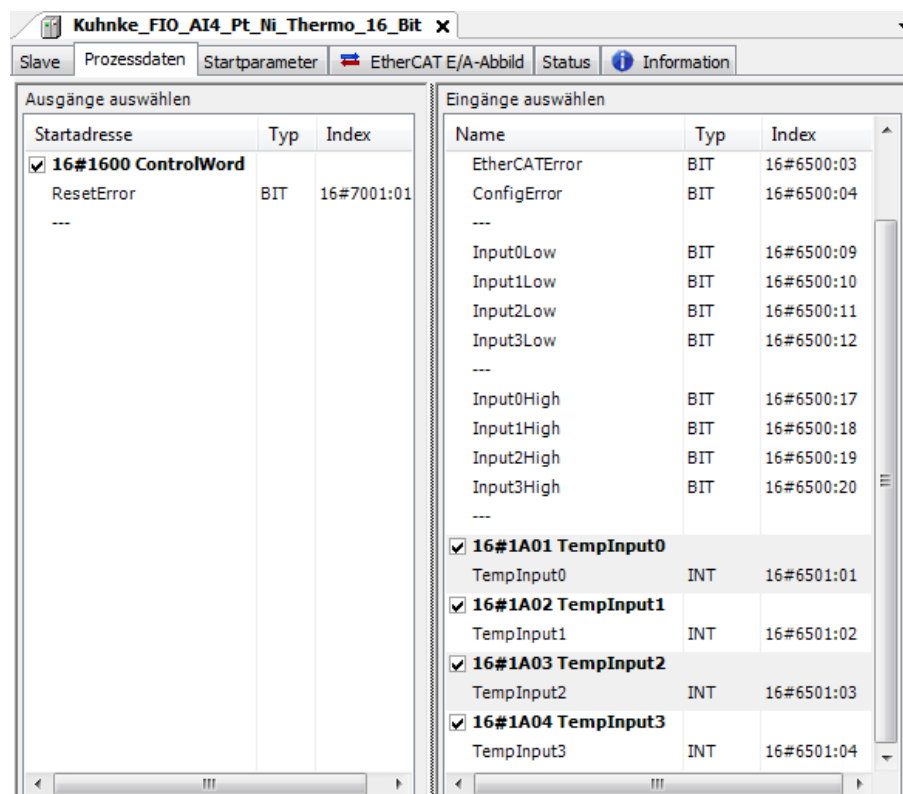
Readings are shown in 0.1 °C steps (default). Alternatively, you can choose to show them as Ohm/Volt or raw data.

To Set up the Options

Conversion of the analogue values can be synchronised with DC (Distributed Clocks) or SM (Sync Manager).



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



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

You may run the configuration tool offline and choose the "Startup Parameters" to change some settings of module AI4-Pt/Ni/TC (such as the properties of each of the inputs). 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.

Click/tap on "Add...", choose an object, and set the appropriate value.

Wählen Sie einen Eintrag aus dem Objektverzeichnis

Index:Subindex	Name	Flags	Typ	Grundwert
16#10F1:16#00	Error Settings	RO	USINT	
16#1C12:16#00	RxPDO assign	RW	UDINT	
16#1C13:16#00	TxPDO assign	RO	USINT	
16#1C32:16#00	SM output parameter	RO	USINT	
16#1C33:16#00	SM input parameter	RO	USINT	
16#2000:16#00	SensorType	RW	USINT	
:16#01	Sensor0	RW	USINT	16#00
:16#02	Sensor 1	RW	USINT	16#00
:16#03	Sensor 2	RW	USINT	16#00
:16#04	Sensor 3	RW	USINT	16#00
16#2001:16#00	InputFormat	RW	USINT	
16#2002:16#00	DataRateAndFilter	RW	USINT	
16#2003:16#00	Average	RW	USINT	
16#2010:16#00	CalibrationSwitch	RW	USINT	
16#2011:16#00	CalibrationValue	RW	USINT	
16#2012:16#00	CalibrationState	RW	USINT	

Name: Sensor0

Index: 16# 2000 Bitlänge: 8

SubIndex: 16# 1 Wert: Off

Voller Zugriff Byte Array

OK Abbrechen

Off
Internal
PT 100
PT 1000
NI 100
NI 1000
Thermo_K
Thermo_J

Options

You can set up the following options for every channel:

Name	Value	Explanation
SensorType	0	Off (default)
	1	Internal (Cold junction)
	2	Pt100
	3	Pt1000
	4	Ni100
	5	Ni1000 (DIN43760)
	6	Thermo K
	7	Thermo J
InputFormat	0	0.1°C
	1	Ω / V
	2	Raw (raw data)
Data rate and filter	0	1000 readings per second
	1	600 readings per second
	2	330 readings per second
	3	175 readings per second
	4	90 readings per second
	5	45 readings per second
	6	20 readings per second
	7	20 readings per second plus 50 & 60 Hz filter
8	20 readings per second plus 50 Hz filter	

Name	Value	Explanation
	9	20 readings per second plus +60 Hz filter
Average	n=1..255	Inputn= average after n cycles (default=1)

StateWord

The state word (DWORD) is indicative of the module state:

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	-	not used
2	EtherCATErr	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-7	-	not used
8	Input0low	Incorrect range of connected reading
9	Input1low	Incorrect range of connected reading
10	Input2low	Incorrect range of connected reading
11	Input3low	Incorrect range of connected reading
12-15	-	not used
16	Input0high	Incorrect range of connected reading
17	Input1high	Incorrect range of connected reading
18	Input2high	Incorrect range of connected reading
19	Input3high	Incorrect range of connected reading
20-31	-	not used

Analogue Inputs

Check the following variables for the digitised input values:

Variable	Data type	Explanation
TempInputn	INT	Value of channel n (n=0...3) in 0.1°C, Ω or 2μV

ControlWord

The control word contains a bit for acknowledging errors.

Bit	Name	Explanation
0	ResetError	0 -> errors are retained, 1 -> errors cleared after removing their cause
1-15	-	not used

Cold Point Compensation

Cold points are automatically compensated if thermocouples are used. Temperature readings are taken immediately at the plug near the connection

Calibration

This module need not be calibrated by the end user because it is calibrated after fabrication.

It can only be calibrated once because the calibration values are kept on memory.

The calibration objects (2010:n; 2011:n and 2012:n) in the Startup Parameters are intended for internal use only.

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI4_Pt/Ni/Thermo		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185345		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32			RO
2000	Sensor Type	Array			
2000, 0	Number of Entries	UINT8	4		RO
2000, 1	Sensor0	UINT8	Off	Off (0), Internal (1), PT100 (2), PT1000 (3), NI100 (4), NI1000 (5), Thermo_K (6), Thermo_J (7),	RW
2000, 2	Sensor1	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2000, 3	Sensor2	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2000, 4	Sensor3	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2001	Input Format	Array			
2001, 0	Number of Entries	UINT8	4		RO

Index	Name	Type	Default	Min Max	Access
2001, 1	Input0Format	UINT8	0.1°C	0.1°C (0), Ω / V (1) Raw (2)	RW
2001, 2	Input1Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2001, 3	Input2Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2001, 4	Input3Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2002	Data RateAndFilter	Array			
2002, 0	Number of Entries	UINT8	4		
2002, 1	Input0DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 2	Input1DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 3	Input2DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 4	Input3DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3)	RO

Index	Name	Type	Default	Min Max	Access
				90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	
2003	Average	Array			
2003, 0	Number of Entries	UINT8	4		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	4		RO
6401, 1	Analog Input 0	UINT16			RO P
6401, 2	Analog Input 1	UINT16			RO P
6401, 3	Analog Input 2	UINT16			RO P
6500	StateWord	Array			RO P
6500, 0	Number of Entries	UINT8	32		RO P
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	-	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5..8	-	BOOL			RO P
6500, 9	Input 0 low	BOOL			RO P
6500, 10	Input 1 low	BOOL			RO P
6500, 11	Input 2 low	BOOL			RO P
6500, 12	Input 3 low	BOOL			RO P
6500, 13..16	-	BOOL			RO P
6500, 17	Input 0 high	BOOL			RO P
6500, 18	Input 1 high	BOOL			RO P
6500, 19	Input 2 high	BOOL			RO P
6500, 20	Input 3 high	BOOL			RO P
6500, 21..32	-	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

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

Technical Data

Analogue inputs 4
 Resolution 16 bit
 Input filter cutoff frequency typ. 0.33 Hz
 Conversion time 50 ms (adjustable)
 Measuring error $\leq \pm 0.54\%$ (of final measuring range value)
 Temperatur drift $\leq \pm 50$ ppm (of final measuring range value)

Thermocouple

Sensor types J, K, Internal (Cold junction)
 Cold point compensation Yes
 Measuring range Type K $-200^{\circ}\text{C} \dots +1372^{\circ}\text{C}$
 Measuring range Type J $-50^{\circ}\text{C} \dots +760^{\circ}\text{C}$
 Measuring range mV $-40 \dots +65$ mV

Pt100 / Ni100

Measuring range Pt $-75^{\circ}\text{C} \dots +670^{\circ}\text{C}$
 Measuring range Ni $-60^{\circ}\text{C} \dots +250^{\circ}\text{C}$
 Input resistance $70 \dots 320\Omega$
 Measuring current 1mA (typ.)

Pt1000 / Ni1000 DIN43760

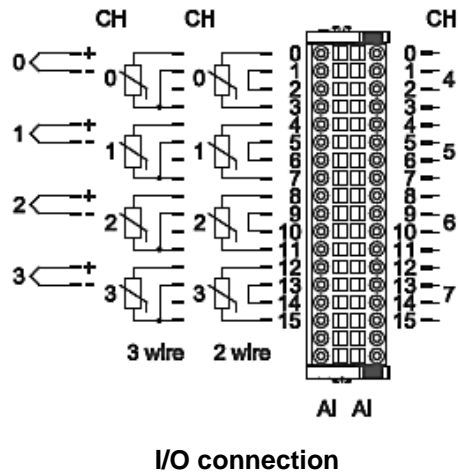
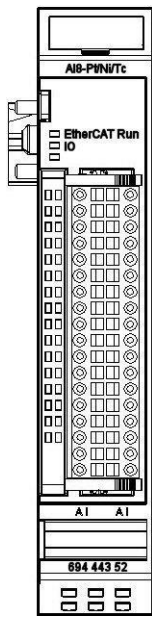
Measuring range Pt $-75^{\circ}\text{C} \dots +670^{\circ}\text{C}$
 Measuring range Ni $-60^{\circ}\text{C} \dots +250^{\circ}\text{C}$
 Input resistance $700 \dots 3200\Omega$
 Measuring current 0,1mA (typ.)

Baud rate 100 Mbit/s
 Controller ASIC ET1200
 E-bus connector 10-pole system plug in side wall
 Terminating module not required
 IO connection 18-pin plug
 Power supply none
 E-bus load 170 mA
 Part no. 694.443.57 (CoE)

Approval:.....



5.4.9 AI8-Pt/Ni/TC



Front view of I/O module AI8-Pt/Ni/TC

Terminals

The module needs no separate 24V connector. Power is supplied to the module through the E-bus connector.

Operative earth / shielding of analogue wires → section 0

	<p>Information</p> <p>Module 694 443 58 Kuhnke FIO AI8-Pt/Ni/TC is the INCOMPATIBLE successor to the following modules:</p> <p style="margin-left: 40px;">694 443 02 Ventura FIO AI8-Pt/Ni100</p> <p style="margin-left: 40px;">694 443 04 Ventura FIO AI8-Pt/Ni1000</p> <p style="margin-left: 40px;">694 443 06 Ventura FIO AI8-TE</p> <p>The module complies with ETG guidelines.</p> <p>Before replacing a Ventura FIO AI8-Pt/Ni100 (694 443 02) or Ventura FIO AI8-Pt/Ni1000 (694 443 04) or Ventura FIO AI4-TE (694 443 06) with a Kuhnke FIO AI8-Pt/Ni/TC module (694 443 58), you must modify the EtherCAT master's control program.</p>
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Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

State	LED flash code	Explanation
Ok	Green, on	No error
Error	Off	Malfunction of module if E-bus LED = On
		Inoperative if E-bus LED = Off
	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

LEDs "Channel"

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

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Sensor low
	Red, 2x	Sensor high



Note on Pt100/Ni100 mode

Error "input high" is not shown in the Pt100 and Ni100 modes, unless a temperature sensor is connected. Check that your wiring is correct (jumped 2-wire or 3-wire connection) to ensure that all errors are detected/shown properly.



Note on thermocouple mode

- Errors *input low* and *input high* are just indicative of the temperature being out of the set range.
- A short circuit (input low) is not detected in thermocouple mode (types J,K) because the thermal voltage is too small for a short circuit to be relevant to the measured result.
- Since a broken wire is not detected, the floating module values may provoke an indication of error *input high* or *input low*.

Function

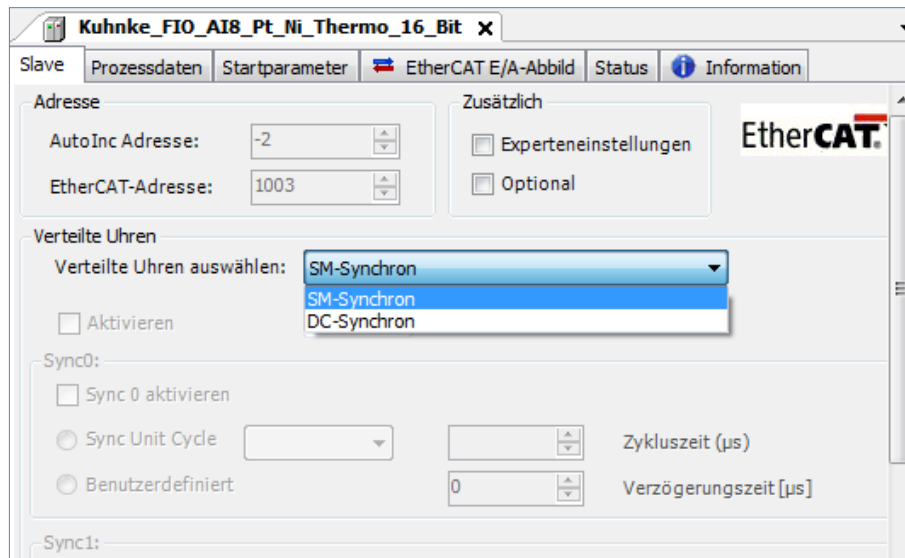
The AI8-I module has eight analogue temperature sensor inputs. Every channel can be separately set to one of the following sensor types: millivolt, Pt100, Pt1000, Ni100, Ni1000 (DIN 43760) or thermocouple.

Measured value

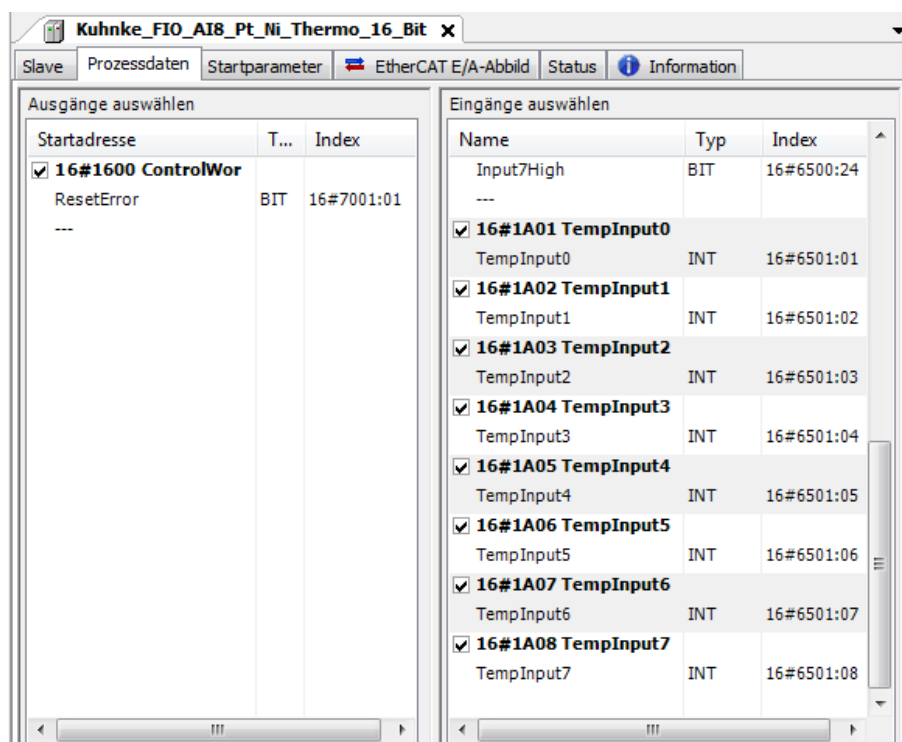
Readings are shown in 0.1 °C steps (default). Alternatively, you can choose to show them as Ohm/Volt or raw data.

To Set up the Options

Conversion of the analogue values can be synchronised with DC (Distributed Clocks) or SM (Sync Manager).



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

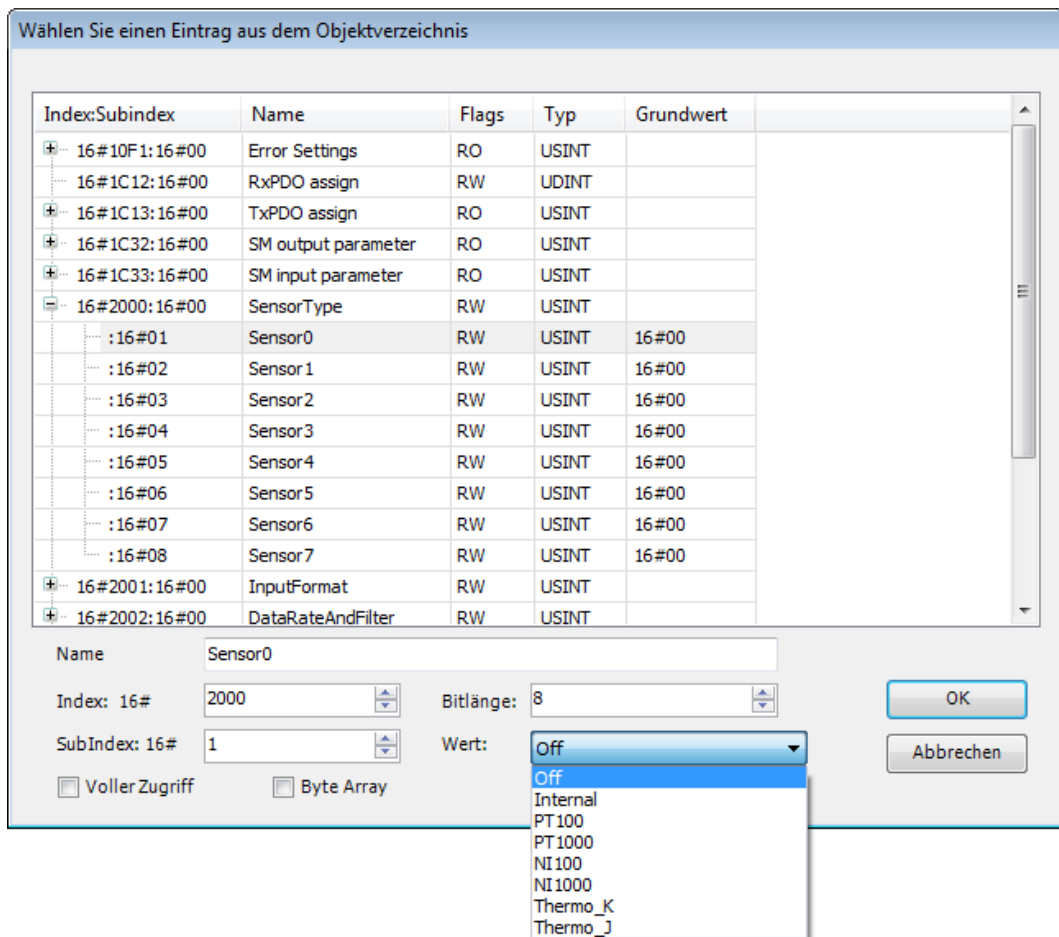


Service data objects (SDO) are available for details and settings.

You may run the configuration tool offline and choose the "Startup Parameters" to change some settings of module AI8-Pt/Ni/TC (such as the properties of each of the inputs). 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.

Click/tap on "Add...", choose an object, and set the appropriate value.



Options

You can set up the following options for every channel:

Name	Value	Explanation
SensorType	0	Off (default)
	1	Internal (Cold junction)
	2	Pt100
	3	Pt1000
	4	Ni100
	5	Ni1000 (DIN43760)
	6	Thermo K
	7	Thermo J
InputFormat	0	0.1°C
Data rate and filter	1	Ω / V
	2	Raw (raw data)
	0	1000 readings per second
Average	1	600 readings per second
	2	330 readings per second
	3	175 readings per second
	4	90 readings per second
	5	45 readings per second
	6	20 readings per second
	7	20 readings per second plus 50 & 60 Hz filter
	8	20 readings per second plus 50 Hz filter

Name	Value	Explanation
	9	20 readings per second plus +60 Hz filter
	n=1..255	Inputn= average after n cycles (default=1)

StateWord

The state word (DWORD) is indicative of the module state:

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	-	not used
2	EtherCATErrror	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-7	-	not used
8	Input0low	Incorrect range of connected reading
9	Input1low	Incorrect range of connected reading
10	Input2low	Incorrect range of connected reading
11	Input3low	Incorrect range of connected reading
12	Input4low	Incorrect range of connected reading
13	Input5low	Incorrect range of connected reading
14	Input6low	Incorrect range of connected reading
15	Input7low	Incorrect range of connected reading
16	Input0high	Incorrect range of connected reading
17	Input1high	Incorrect range of connected reading
18	Input2high	Incorrect range of connected reading
19	Input3high	Incorrect range of connected reading
20	Input4high	Incorrect range of connected reading
21	Input5high	Incorrect range of connected reading
22	Input6high	Incorrect range of connected reading
23	Input7high	Incorrect range of connected reading
24-31	-	not used

Analogue Inputs

Check the following variables for the digitised input values:

Variable	Data type	Explanation
TempInputn	INT	Value of channel n (n=0...7) in 0.1°C, Ω or 2μV

ControlWord

The control word contains a bit for acknowledging errors.

Bit	Name	Explanation
0	ResetError	0 -> errors are retained, 1 -> errors cleared after removing their cause
1-15	-	not used

Cold Point Compensation

Cold points are automatically compensated if thermocouples are used. Temperature readings are taken immediately at the plug near the connection

Calibration

This module need not be calibrated by the end user because it is calibrated after fabrication.

It can only be calibrated once because the calibration values are kept on memory.

The calibration objects (2010:n; 2011:n and 2012:n) in the Startup Parameters are intended for internal use only.

Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI8_Pt/Ni/Thermo		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185346		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32			RO
2000	Sensor Type	Array			
2000, 0	Number of Entries	UINT8	8		RO
2000, 1	Sensor0	UINT8	Off	Off (0), Internal (1), PT100 (2), PT1000 (3), NI100 (4), NI1000 (5), Thermo_K (6), Thermo_J (7),	RW
2000, 2	Sensor1	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2000, 3	Sensor2	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2000, 4	Sensor3	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000,	RW

Index	Name	Type	Default	Min Max	Access
				Thermo_K, Thermo_J,	
2000, 5	Sensor4	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2000, 6	Sensor5	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2000, 7	Sensor6	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2000, 8	Sensor7	UINT8	Off	Off, Internal, PT100, PT1000, NI100, NI1000, Thermo_K, Thermo_J,	RW
2001	Input Format	Array			
2001, 0	Number of Entries	UINT8	8		RO
2001, 1	Input0Format	UINT8	0.1°C	0.1°C (0), Ω / V (1) Raw (2)	RW
2001, 2	Input1Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2001, 3	Input2Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2001, 4	Input3Format	UINT8	0.1°C	0.1°C, Ω / V	RW

Index	Name	Type	Default	Min Max	Access
				Raw	
2001, 5	Input4Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2001, 6	Input5Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2001, 7	Input6Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2001, 8	Input Format	UINT8	0.1°C	0.1°C, Ω / V Raw	RW
2002	Data RateAndFilter	Array			
2002, 0	Number of Entries	UINT8	8		
2002, 1	Input0DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 2	Input1DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 3	Input2DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 4	Input3DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1)	RO

Index	Name	Type	Default	Min Max	Access
				330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	
2002, 5	Input4DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 6	Input5DataRateAnd Filter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 7	Input6DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60Hz (9)	RO
2002, 8	Input7DataRateandFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8)	RO

Index	Name	Type	Default	Min Max	Access
				20 + 60Hz (9)	
2003	Average	Array			
2003, 0	Number of Entries	UINT8	8		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
2003, 5	Input 4 Average	UINT8	1	1..255	RW
2003, 6	Input 5 Average	UINT8	1	1..255	RW
2003, 7	Input 6 Average	UINT8	1	1..255	RW
2003, 8	Input 7 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	8		RO
6401, 1	Analog Input 0	UINT16			RO P
6401, 2	Analog Input 1	UINT16			RO P
6401, 3	Analog Input 2	UINT16			RO P
6401, 4	Analog Input 3	UINT16			RO P
6401, 5	Analog Input 4	UINT16			RO P
6401, 6	Analog Input 5	UINT16			RO P
6401, 7	Analog Input 6	UINT16			RO P
6401, 8	Analog Input 7	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	32		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	-	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5...8	-	BOOL			RO P
6500, 9	Input 0 low	BOOL			RO P
6500, 10	Input 1 low	BOOL			RO P
6500, 11	Input 2 low	BOOL			RO P
6500, 12	Input 3 low	BOOL			RO P
6500, 13	Input 4 low	BOOL			RO P
6500, 14	Input 5 low	BOOL			RO P
6500, 15	Input 6 low	BOOL			RO P
6500, 16	Input 7 low	BOOL			RO P
6500, 17	Input 0 high	BOOL			RO P
6500, 18	Input 1 high	BOOL			RO P
6500, 19	Input 2 high	BOOL			RO P
6500, 20	Input 3 high	BOOL			RO P
6500, 21	Input 4 high	BOOL			RO P
6500, 22	Input 5 high	BOOL			RO P
6500, 23	Input 6 high	BOOL			RO P
6500, 24	Input 7 high	BOOL			RO P
6500, 25..32	ResetErrorAck	BOOL			RO P
6500, 1	EtherCAT Error	BOOL			RO P

Index	Name	Type	Default	Min Max	Access
6500, 3	ConfigError	BOOL			RO P
6500, 4	Module Control	Array			
7001	Number of Entries	UINT8	1		RO
7001, 0	Reset Error	BOOL			RW P
7001, 1					

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

Technical Data

Analogue inputs	8
Resolution	16 bit
Input filter cutoff frequency	typ. 0.33 Hz
Conversion time	50 ms (adjustable)
Measuring error	<±0.54% (of final measuring range value)
Temperatur drift	<±50 ppm (of final measuring range value)

Thermocouple

Sensor types	J, K, Internal (Cold junction)
Cold point compensation	Yes
Measuring range Type K	-200°C...+1372°C
Measuring range Type J	-50°C...+760°C
Measuring range mV	-40 ... +65 mV

Pt100 / Ni100

Measuring range Pt	-75°C...+670°C
Measuring range Ni	-60°C...+250°C
Input resistance	70...320Ω
Measuring current	1mA (typ.)

Pt1000 / Ni1000 DIN43760

Measuring range Pt	-75°C...+670°C
Measuring range Ni	-60°C...+250°C
Input resistance	700...3200Ω
Measuring current	0.1mA (typ.)

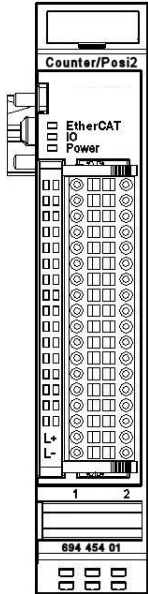
Baud rate	100 Mbit/s
Controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
Terminating module	not required
IO connection	36-pin plug
Power supply	none
E-bus load	170 mA
Part no.	694.443.58 (CoE)

Approval:.....

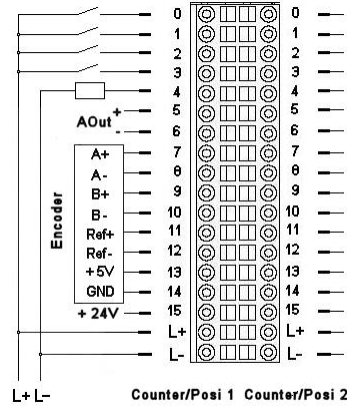


5.5 Counter / Posi / Drive / CAM Modules

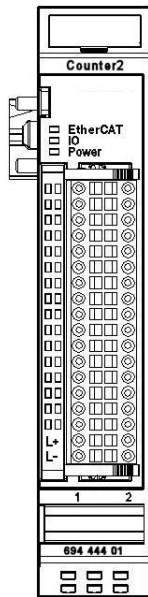
5.5.1 Counter/Posi2 5V, Counter2 5V



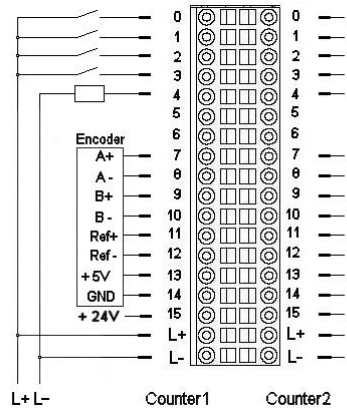
Front view of I/O module Counter/Posi2



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

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 217 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 212)

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)

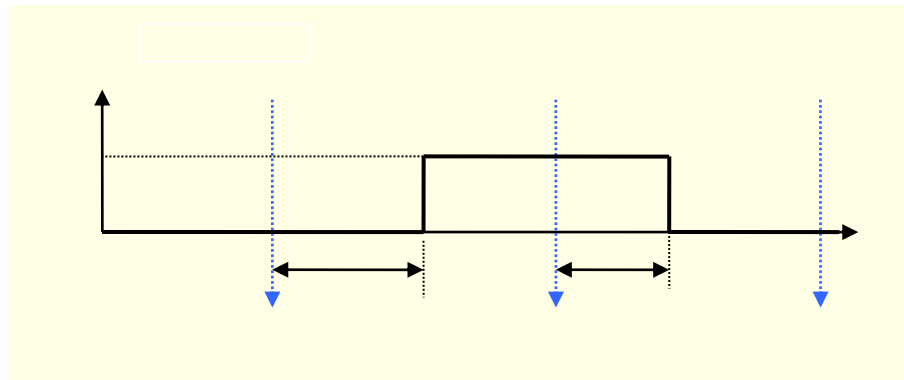


Information

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:

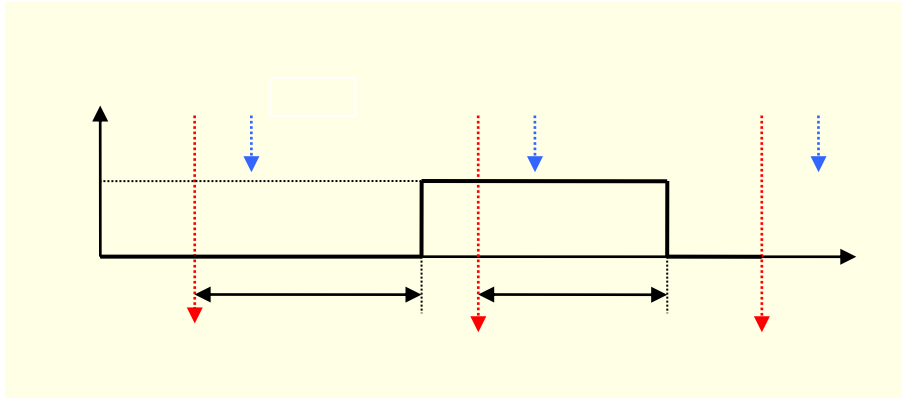
The time stamp saves the time between the last frame interrupt and the change of input state and sends that time to the EtherCAT master with the next frame.



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.

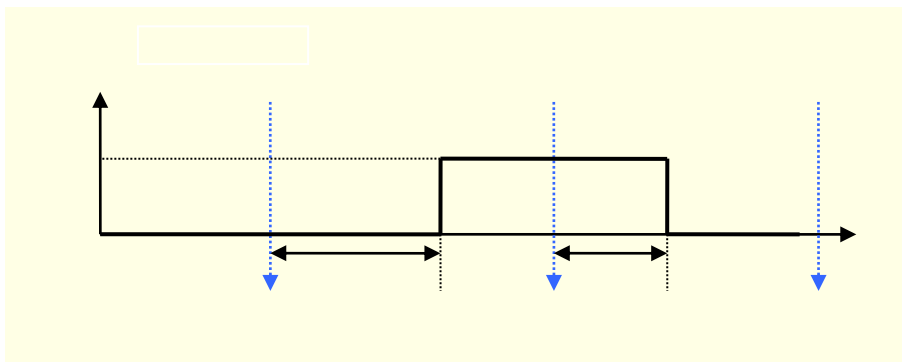
Variable	Data type	Explanation
Output_0_0	BOOL	Digital output 0

Output delay (underway)

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

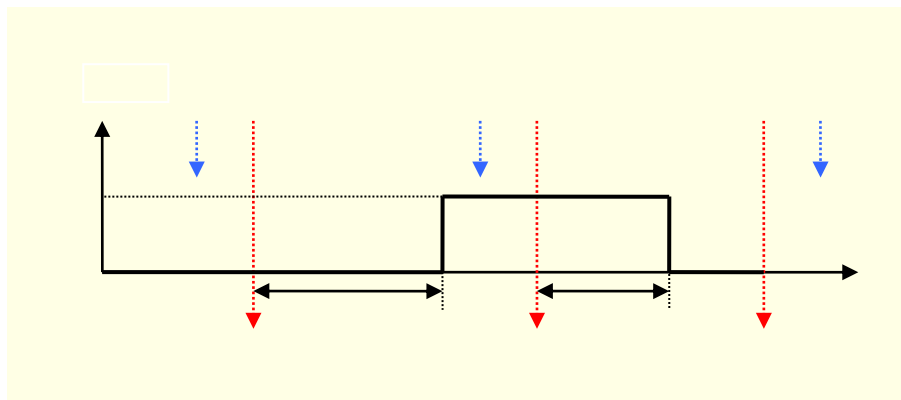
Variable	Data type	Explanation
Output_0_0_Del	UINT	Output delay, in μ s

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 214: 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 220 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 214: 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 220 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 214: 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 220 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

blnit: BOOL := TRUE ;

Steplnit: USINT;

blnitReady: BOOL;

Step: USINT;

END_VAR

 (*1. Initialising: enable counter and set preset value*)

IF blnit THEN

CASE Steplnit 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;

Steplnit:=1;

(*Wait until accepting "OptionsSet" and "PresetSet" has been confirmed*)

1: IF Term2_OptionsSet_1 AND Term2_PresetSet_1 THEN

Steplnit:=2;

END_IF

(*Reset "Set_Options" and " Set_Preset" to default*)

2: Term2_SetOptions_1:=FALSE;

Term2_SetPreset_1:=FALSE;

Steplnit:=0;

blnit:=FALSE;

blnitReady:=TRUE;

END_CASE

END_IF

(*2. Control referencing*)

IF blnitReady 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)	
Power	24V 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

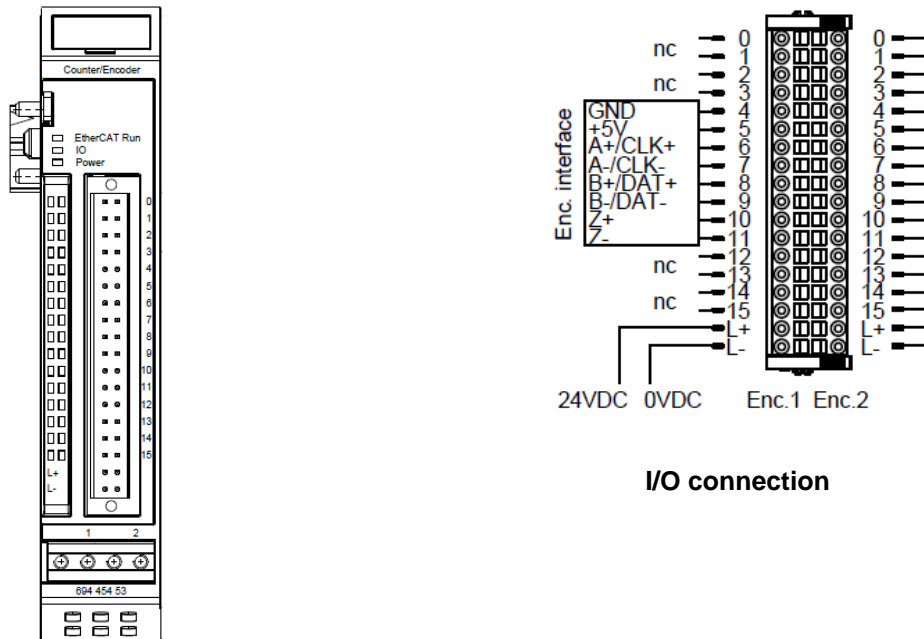
Extra	
Analogue outputs	2
Voltage	-10V ... +10V
Resolution	12 bit
Part no.	694.454.01



Approval:

5.5.2 Counter / Encoder

Front view and I/O connection



Front view I/O-Modul Counter / Encoder

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"

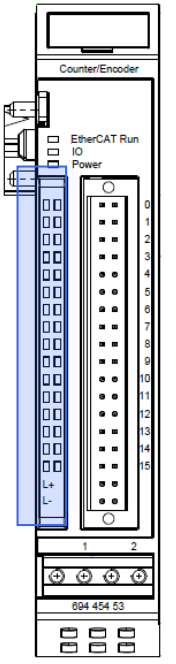
The LED labelled "Power" indicates the state of the I/O module's I/O power supply.

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

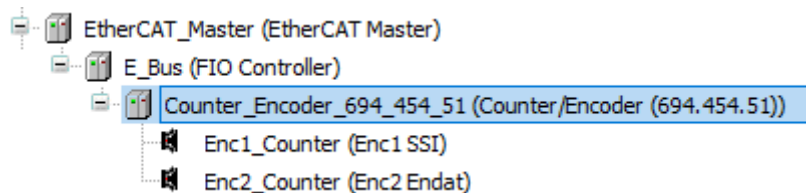
All channels can be parameterized almost independently of each other, which gives the module a high degree of flexibility.

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
	<i>All slots must be equipped with a module.</i>

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
Enc2	0x2903 Enc2 Digital Interface Config	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
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
Enc2	0x2903 Enc2 Digital Interface Config	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
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
Enc2	0x2903 Enc2 Digital Interface Config	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
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
Enc2	0x2903 Enc2 Digital Interface Config	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
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:

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

Object overview

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

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

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:

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

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:

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

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 ARef

Object Code	Variable
-------------	----------

Sub	0x00
Name	Enc1 Encoder Track ARef
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1EncoderTrackARef

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 ARef

Object Code	Variable
-------------	----------

Sub	0x00
Name	Enc2 Encoder Track ARef
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2EncoderTrackARef

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 divider 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

5.5.2.1.1 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

5.5.2.1.2 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 divider 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

5.5.3 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

5.5.4 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.

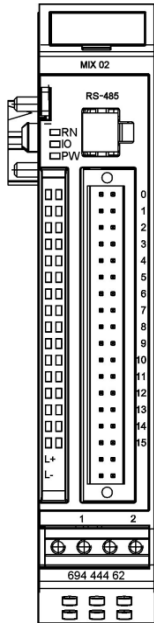
Link to the documentation: <http://productfinder.kuhnke.kendrion.com/de>

Technical Data

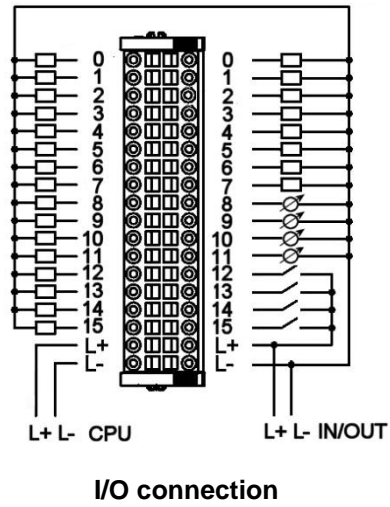
Type	Kuhnke FIO CAM Control
Cam tracks (outputs)	24 x 0.5 A (dead time compensation 1 to 5000 ms) & 8 software tracks, 8 cams per track
Total output current I_{tot}	4.5 A
Inputs	1x 24 VDC, 1 ms, 4x 24 VDC or 0...10 V (configurable)
Encoder interface	incremental 24 VDC, A, B, Ref., absolute via CAN or EtherCAT
Cam programs	32
Cycle Time	20 μ s
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

5.6 Mixed Modules

5.6.1 MIX 02



Front view of I/O module MIX 02



I/O connection

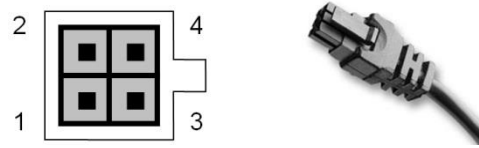
Terminals

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"

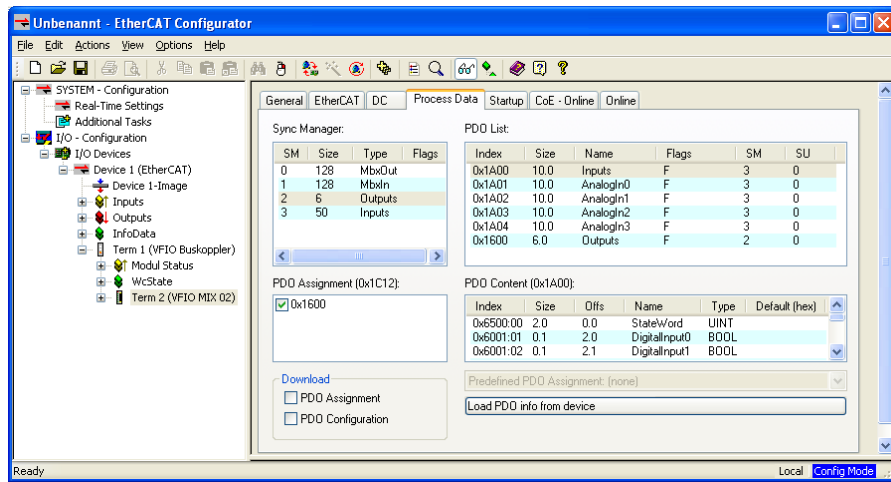
The LEDs labelled "Channel" indicate the state of the associate input/output signal.

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

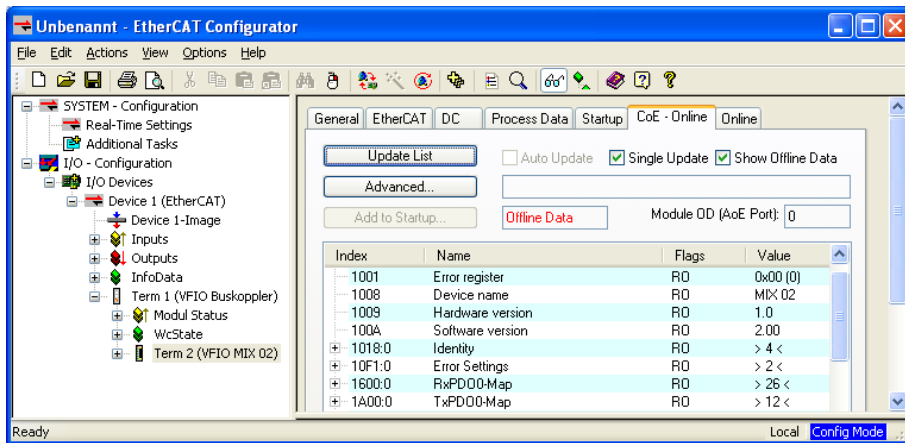
Function (CoE Variant)

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

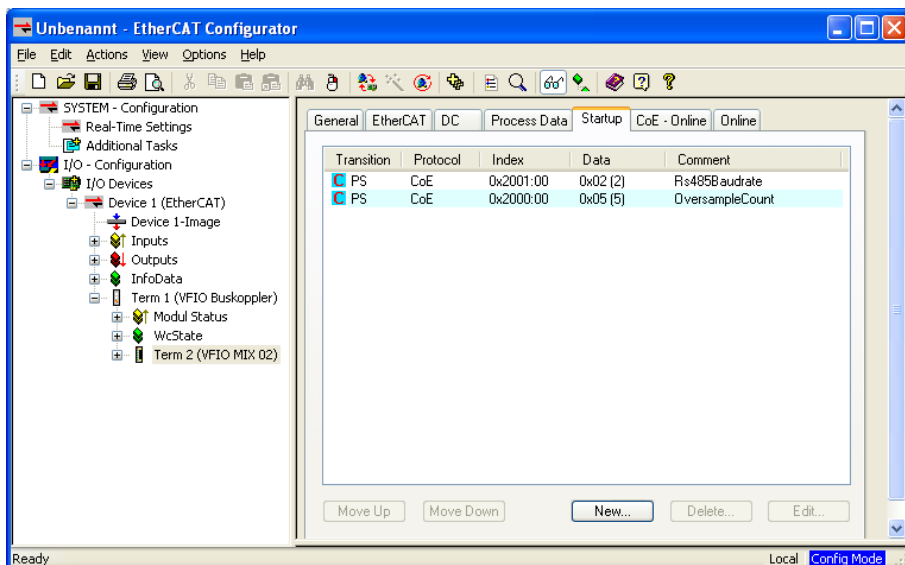
The process data objects stored as variables in the EtherCAT master's control program are used to access the IOs and the module state.



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

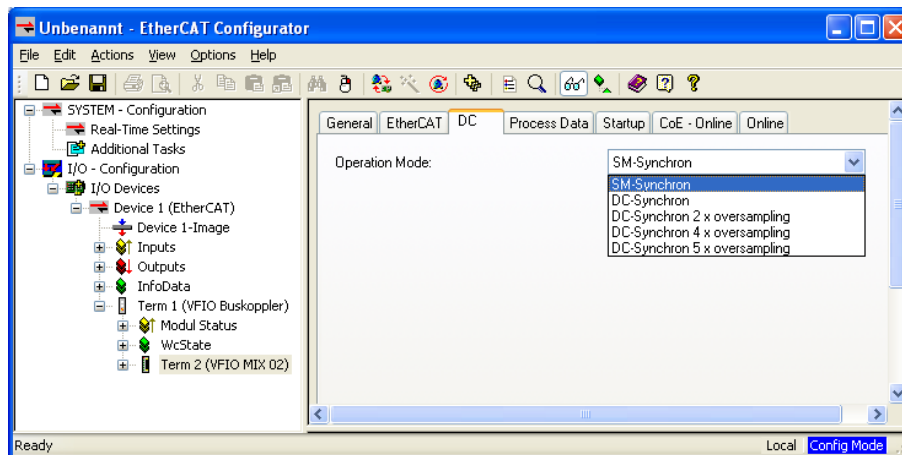
Analogue Inputs / Oversampling

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. Sample 1 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
	<i>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.</i>

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

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

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)	

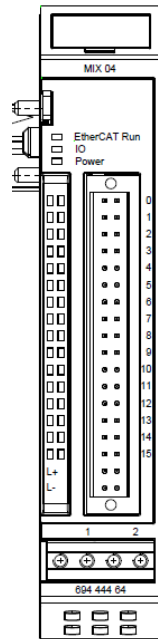


Approval:.....

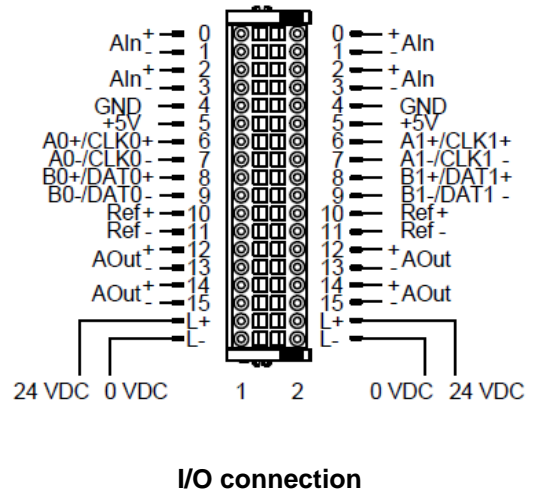
² Value between brackets applies to ideal clock signal and ground.

5.6.2 MIX 04

Front view and I/O connection



Front view I/O-Module MIX 04



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"

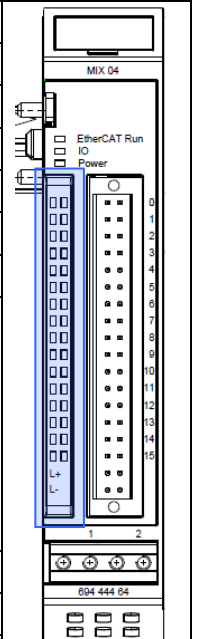
The LED labelled "Power" indicates the state of the I/O module's power supply.

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.

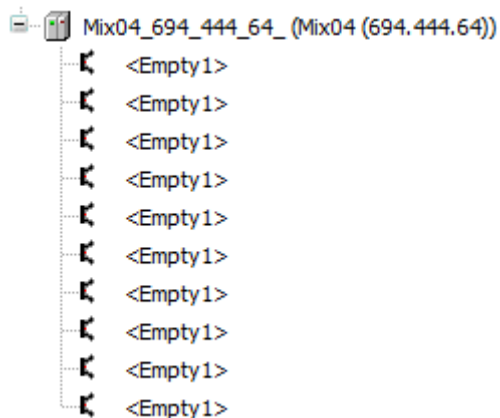
All channels can be parameterized almost independently of each other, which gives the module a high degree of flexibility.

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
	<i>All slots must be equipped with a module.</i>

View CODESYS- device tree



TwinCAT2 Slot- configuration

General	EtherCAT	DC	Process Data	Slots	Startup	CoE - Online	Online																		
				<table border="1"> <thead> <tr> <th>Slot</th> </tr> </thead> <tbody> <tr><td>● AI0</td></tr> <tr><td>● AI1</td></tr> <tr><td>● AI2</td></tr> <tr><td>● AI3</td></tr> <tr><td>● AO0</td></tr> <tr><td>● AO1</td></tr> <tr><td>● AO2</td></tr> <tr><td>● AO3</td></tr> <tr><td>● Enc1</td></tr> <tr><td>● Enc2</td></tr> </tbody> </table>	Slot	● AI0	● AI1	● AI2	● AI3	● AO0	● AO1	● AO2	● AO3	● Enc1	● Enc2	<table border="1"> <thead> <tr> <th>Module</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>● AI0 Voltage</td><td>AI0 Voltage</td></tr> <tr><td>● AI0 Current</td><td>AI0 Current</td></tr> </tbody> </table>	Module	Description	● AI0 Voltage	AI0 Voltage	● AI0 Current	AI0 Current			
Slot																									
● AI0																									
● AI1																									
● AI2																									
● AI3																									
● AO0																									
● AO1																									
● AO2																									
● AO3																									
● Enc1																									
● Enc2																									
Module	Description																								
● AI0 Voltage	AI0 Voltage																								
● AI0 Current	AI0 Current																								

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
Enc2	0x2903 Enc2 Digital Interface Config	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
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
Enc2	0x2903 Enc2 Digital Interface Config	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
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
Enc2	0x2903 Enc2 Digital Interface Config	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
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
Enc2	0x2903 Enc2 Digital Interface Config	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
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:

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

Object overview

Slot	Object	Explanation
Enc1	0x208f Enc1 Position Encoder Resolution	$\frac{\text{Encoder Increments}}{\text{Motor Revolutions}}$
Enc2	0x288f Enc2 Position Encoder Resolution	
Enc1	0x2091 Enc1 Gear Ratio	$\frac{\text{Motor Shaft Revolutions}}{\text{Driving Shaft Revolutions}}$
Enc2	0x2891 Enc2 Gear Ratio	
Enc1	0x2092 Enc1 Feed Constant	$\frac{\text{Feed}}{\text{Shaft Revolutions}}$
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 AllInputScaling1FV	01	Scaling of the analogue input values by specifying interpolation points. To output the scaled values, add object 0x7130 AllInputPV the object to the mapping
AI1	0x7122 AllInputScaling2FV	02	
AI2	0x7121 AllInputScaling1PV	03	
AI3	0x7123 AllInputScaling2PV	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 AllInputPV the object to the mapping
AI1		02	
AI2		03	
AI3		04	
AI0	0x7130 AllInputPV	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	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	0x7321 AOOutputScaling1PV	02	
AO2	0x7322 AOOutputScaling2FV	03	
AO3	0x7323 AOOutputScaling2PV	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:

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:

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

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:

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

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 ARef

Object Code	Variable
-------------	----------

Sub	0x00
Name	Enc1 Encoder Track ARef
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc1EncoderTrackARef

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 ARef

Object Code	Variable
-------------	----------

Sub	0x00
Name	Enc2 Encoder Track ARef
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	Enc2EncoderTrackARef

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 AllInputCalibrationGain

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	AllInputCalibrationGain.AllInputcalibrationgain0

Sub	0x02
Name	AI Input calibration gain 1
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AllInputCalibrationGain.AllInputcalibrationgain1

Sub	0x03
Name	AI Input calibration gain 2
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AllInputCalibrationGain.AllInputcalibrationgain2

Sub	0x04
Name	AI Input calibration gain 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AllInputCalibrationGain.AllInputcalibrationgain3

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

5.6.2.1.1 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 divider 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 divider 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 AllInputFV_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	AllInputFV_Real[0]

Sub	0x02
Name	AI Input FV 1
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputFV_Real[1]

Sub	0x03
Name	AI Input FV 2
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputFV_Real[2]

Sub	0x04
Name	AI Input FV 3
Data Type	UNSIGNED8
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputFV_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 AllInputScaling1FV

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	AllInputScaling1FV.AllInputscaling1FV0

Sub	0x02
Name	AI Input scaling 1 FV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling1FV.AllInputscaling1FV1

Sub	0x03
Name	AI Input scaling 1 FV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling1FV.AllInputscaling1FV2

Sub	0x04
Name	AI Input scaling 1 FV 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling1FV.AllInputscaling1FV3

0x7121 AllInputScaling1PV

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	AllInputScaling1PV.AllInputscaling1PV0

Sub	0x02
Name	AI Input scaling 1 PV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling1PV.AllInputscaling1PV1

Sub	0x03
Name	AI Input scaling 1 PV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling1PV.AllInputscaling1PV2

Sub	0x04
Name	AI Input scaling 1 PV 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling1PV.AllInputscaling1PV3

0x7122 AllInputScaling2FV

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	AllInputScaling2FV.AllInputscaling2FV0

Sub	0x02
Name	AI Input scaling 2 FV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling2FV.AllInputscaling2FV1

Sub	0x03
Name	AI Input scaling 2 FV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling2FV.AllInputscaling2FV2

Sub	0x04
Name	AI Input scaling 2 FV 3
Data Type	REAL32
Access	rw
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling2FV.AllInputscaling2FV3

0x7123 AllInputScaling2PV

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	AllInputScaling2PV.AllInputscaling2PV0

Sub	0x02
Name	AI Input scaling 2 PV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling2PV.AllInputscaling2PV1

Sub	0x03
Name	AI Input scaling 2 PV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling2PV.AllInputscaling2PV2

Sub	0x04
Name	AI Input scaling 2 PV 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputScaling2PV.AllInputscaling2PV3

0x7124 AllInputOffset

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	AllInputOffset.AllInputoffset0

Sub	0x02
Name	AI Input offset 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputOffset.AllInputoffset1

Sub	0x03
Name	AI Input offset 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputOffset.AllInputoffset2

Sub	0x04
Name	AI Input offset 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	no
Accessname	AllInputOffset.AllInputoffset3

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

Scaling offset [Process value]

0x7130 AllInputPV

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	AllInputPV[0]

Sub	0x02
Name	AI Input PV 1
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputPV[1]

Sub	0x03
Name	AI Input PV 2
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputPV[2]

Sub	0x04
Name	AI Input PV 3
Data Type	REAL32
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputPV[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 AOperatingMode

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,

10 = Output Field Value Decimal,

1 = Output Process Value,

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 AOutputFV_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	AOutputFV_Dec[0]

Sub	0x02
Name	AO Output FV 1
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOutputFV_Dec[1]

Sub	0x03
Name	AO Output FV 2
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOutputFV_Dec[2]

Sub	0x04
Name	AO Output FV 3
Data Type	UNSIGNED8
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOutputFV_Dec[3]

0x8100 AllInputFV_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	AllInputFV_Int[0]

Sub	0x02
Name	AI Input FV 1
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputFV_Int[1]

Sub	0x03
Name	AI Input FV 2
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputFV_Int[2]

Sub	0x04
Name	AI Input FV 3
Data Type	INTEGER16
Access	ro
Defaultvalue	
PDO Mapping	optional, TPDO only
Accessname	AllInputFV_Int[3]

Analogue input value as integer measured variable, with active oversampling mean value of the samples input values.

0x8331 AOutputFV_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	AOutputFV_Inc[0]

Sub	0x02
Name	AO Output FV 1
Data Type	INTEGER16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOutputFV_Inc[1]

Sub	0x03
Name	AO Output FV 2
Data Type	INTEGER16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOutputFV_Inc[2]

Sub	0x04
Name	AO Output FV 3
Data Type	INTEGER16
Access	rw
Defaultvalue	
PDO Mapping	optional, RPDO only
Accessname	AOutputFV_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

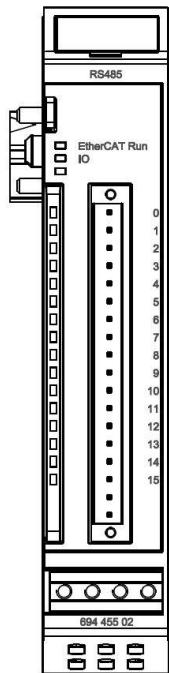
RS422	32Bit, 5 MHz
5/24V Single Ended	32Bit, 1,6 MHz
SSI	18-32 Bit, 80-1000 Kbit/s
EnDAT 2.1	100 kHz – 2 MHz
Event counter (CNT0-5)	6 x HTL/TTL 32Bit, 1 kHz

Encoder supply:..... 5V/150mA / encoder

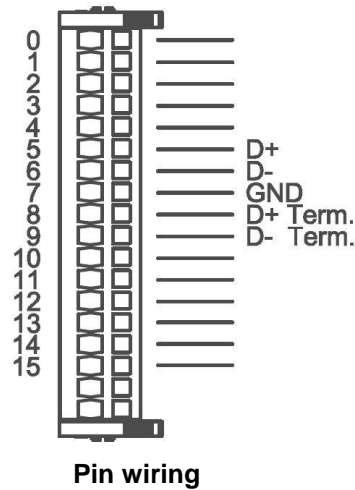
Wire length:..... <30m shielded cable

5.7 Interface and Communication Modules

5.7.1 RS485 1 Port



Front view of the RS485 module



Pin wiring

The module provides a RS485 interface accessible by EtherCAT.

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

Terminals

IO Connection, Male 18-pin

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

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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

LED "Power"

Not used

LEDs "Channel [COM State]"

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

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

Process Image

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

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

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

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

ControlData:

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

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

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

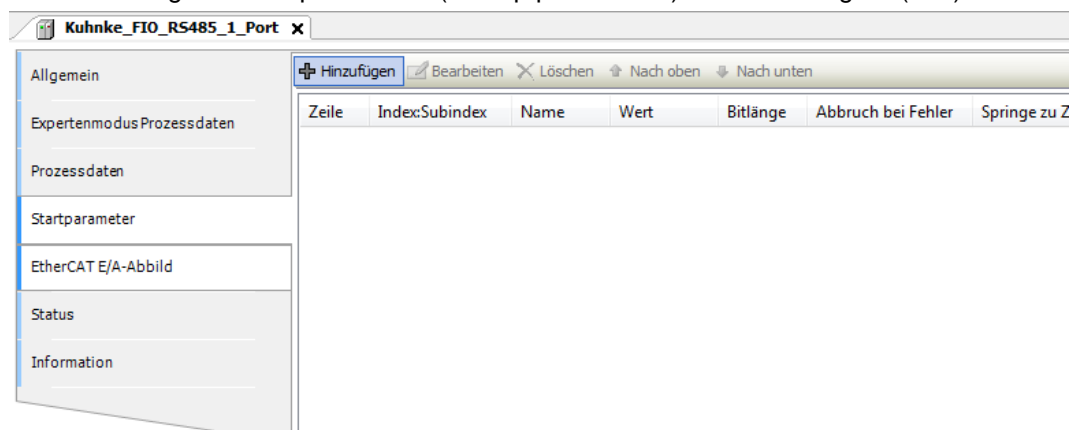
StateData:

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

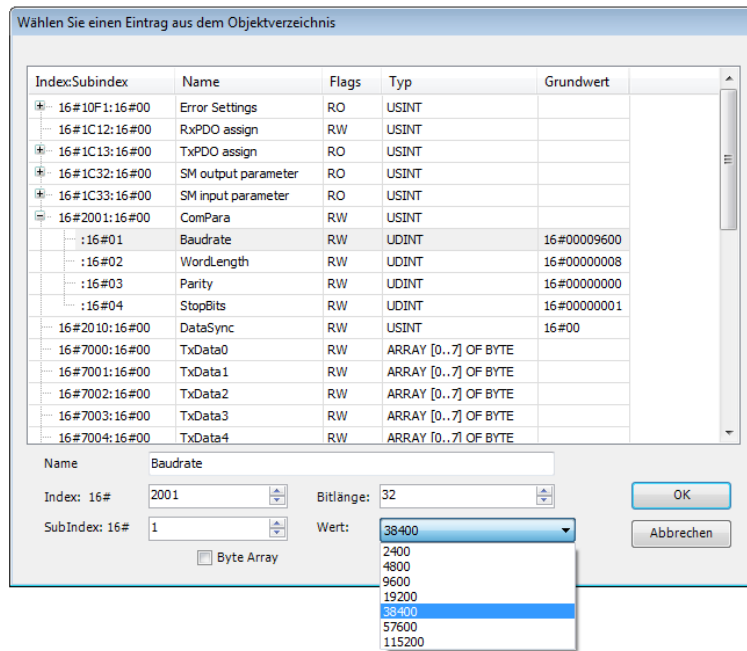
Configuration

Run CoE to configure the RS485 module. You can directly set the startup parameters.

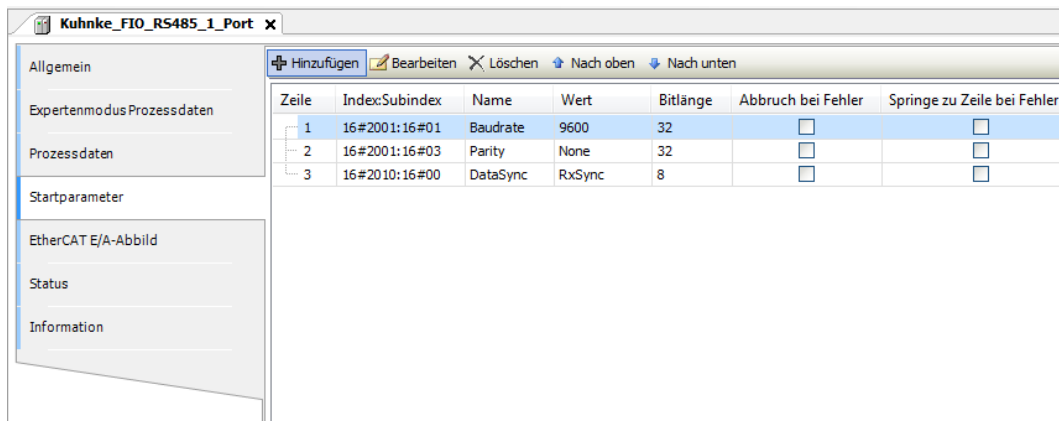
Select the module and go to "Startparameter" (startup parameters) and "Hinzufügen" (add).



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



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



Sample Program

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

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

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

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

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

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

Transfer Data:

Initial state:

TxCounter = 0 TxCounterCon = 0

TxNrOfMsg := 6;

TxData1[0] = `H`

TxData1[1] = `e`

TxData1[2] = `l`

TxData1[3] = `l`

TxData1[4] = `o`

TxData1[5] = ``

Increment TxCounter by 1:

TxCounter = 1 TxCounterCon = 0

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

TxCounter = 1 TxCounterCon = 1

TxNrOfMsg := 4;

TxData1[0] = `W`

TxData1[1] = `o`

TxData1[2] = `r`

TxData1[3] = `l`

TxData1[4] = `d`

Increment TxCounter by 1:

TxCounter = 2 TxCounterCon = 1

Slave module accepts data. TxCounterCon = TxCounter acknowledges.

TxCounter = 2 TxCounterCon = 2

Receive Data

Initial state:

RxCounter = 0 RxCounterCon = 0

The module increments RxCounter by 1:

RxCounter = 1 TxCounterCon = 0

RxNrOfMsg := 4;

RxData1[0] = `T`

RxData1[1] = `e`

RxData1[2] = `s`

RxData1[3] = `t`

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

RxCounter = 1 RxCounterCon = 1

Response to Errors

- EtherCAT error.
Sync Manager watchdog.
LED "Error" flashes 4x.
Unit changes from Op to Safe-Op.
Use "Reset Error" to acknowledge the error.
- Out-queue overflow (COM_TxQueueOvr).
Failure to send the data fast enough.
LED "Error" flashes 5x.
Use "Reset Error" to acknowledge the error.
- In-queue overflow (COM_RxQueueOvr).
Too much data is being received and cannot be transferred to the control unit fast enough.
LED "Error" flashes 6x.
Use "Reset Error" to acknowledge the error.
- TxCount error (TxCounterMiss).
The TxCounter received is not "last TxCounter + 1".
The gateway probably missed an EtherCAT frame. The EtherCAT master is sending the data too quickly (< 1ms for 9 messages).
LED "Error" flashes 7x.
Use "Reset Error" to acknowledge the error.
- Com controller wrror (COM_CtrlErr).
Indicates bit errors or overruns of the control unit concerned.
The applicable LED "COM State" is red and flashes rapidly or alternates green/red while communicating.
Use "Reset Error" to acknowledge the error.

Object Dictionary

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

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

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

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

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

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

Index	Name	Type	Default	Min Max	Access
1C33, 6	Calc and Copy Time	UINT32			RO
1C33, 8	Cycle Time	UINT16			RW
1C33, 9	Delay Time	UINT32			RO
1C33, 10	Sync0 Cycle Time	UINT32			RW
1C33, 11	SM-Event Missed	UINT16			RO
1C33, 12	Cycle Time too small	UINT16			RO
1C33, 32	Sync Error	BOOL			RO
2001	ComPara	Array			
2001, 0	Number of Entries	UINT8	4		RO
2001, 1	Baud Rate	UINT32	38400	2400 4800 9600 19200 38400 57600 115200	RW
2001, 2	WordLength	UINT32	8 Bits 8..	8 bit	
2001, 3	including the baud rate, parity, stop bits, etc.	UINT32	None (0)	None (0) Odd (1) Even (2)	
2001, 4	StopBits	UINT32	1..1	1..1 2 stop bits (2)	
2010	DataSync	UINT8	NoSync	NoSync (0) RxSync (1)	RW
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	EtherCAT Error	BOOL			RO P
6500, 3	unused0	BOOL			RO P
6500, 4	unused1	BOOL			RO P
6500, 5	TxCounterMiss	BOOL			RO P
6500, 6	unused2	BOOL			RO P
6500, 7	COM_TxQueueOvr	BOOL			RO P
6500, 8	COM_RxQueueOvr	BOOL			RO P
6500, 9	unused3	BOOL			RO P
6500, 10	COM2_CtrlErr	BOOL			RO P
6500, 11	unused4	BOOL			RO P
6500, 12	unused5	BOOL			RO P
6500, 13	unused6	BOOL			RO P
6500, 14	unused7	BOOL			RO P
6500, 15	COM_TxBusy	BOOL			RO P
6500, 16	Unused8	BOOL			RO P
6600	TxCounterCon	UINT16		0..65535	RO P
6601	RxCounter	UINT16		0..65535	RO P
6602	RxNrOfMsg	UINT16		0..152	RO P
7000	TxData0	UINT64	0		RW P
7001	TxData1	UINT64	0		RW P

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

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

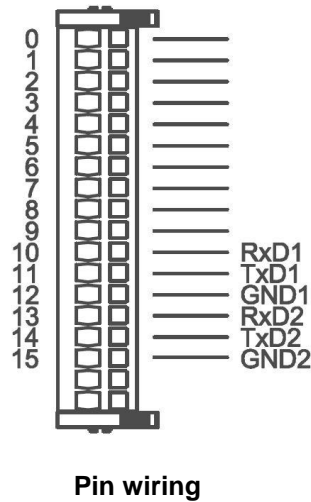
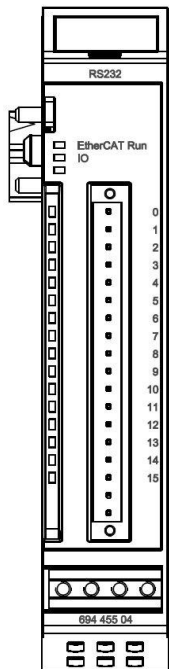
Technical Data

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



Approval.....

5.7.2 RS232 2 Port



Front view of the RS232 module

The module provides 2 RS232 interfaces accessible by EtherCAT.

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

Terminals

IO Connection, Male 18-pin

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

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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

LED "Power"

Not used

LEDs "Channel [COM State]"

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

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

process image

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

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

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

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

ControlData:

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

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

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

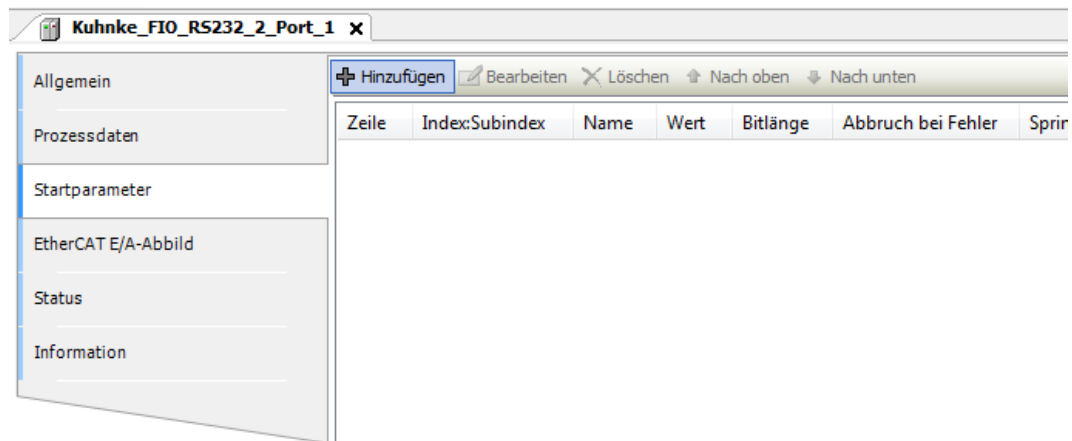
StateData:

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

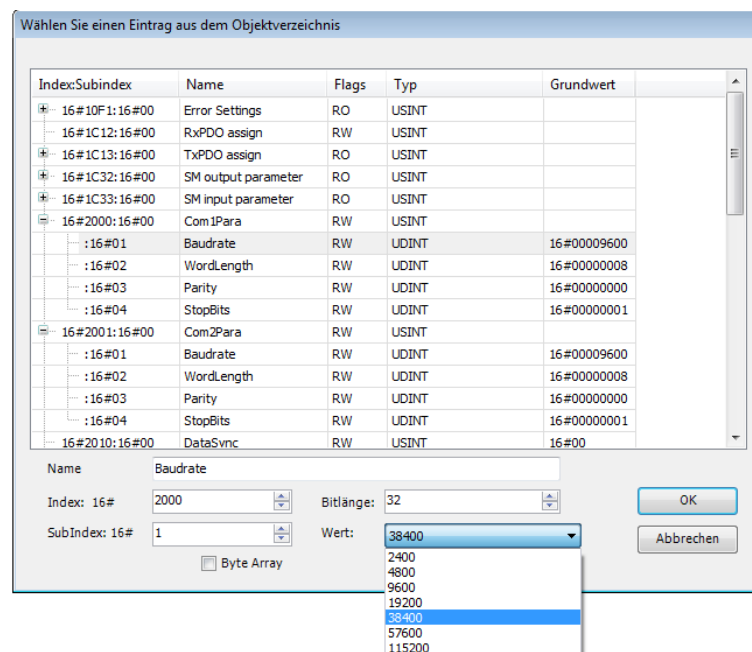
Configuration

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

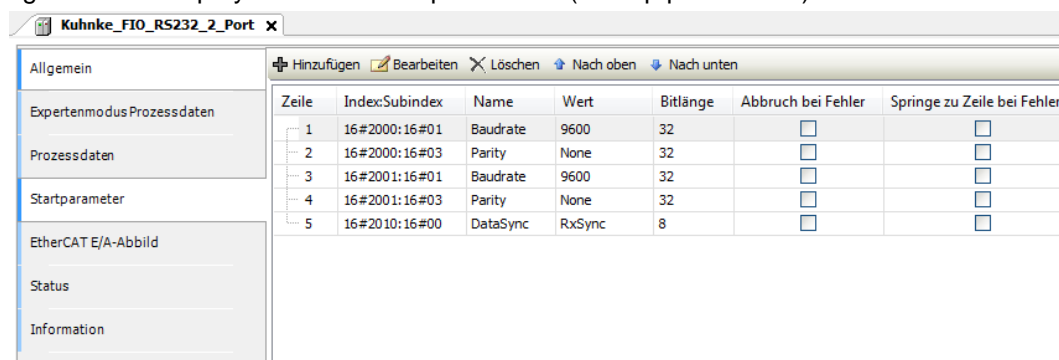
Select the module and go to "Startparameter" (startup parameters) and "Hinzufügen" (add).



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



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



Sample Program

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

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

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

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

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

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

Transfer Data:

Initial state: TxCounter = 0 TxCounterCon = 0

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

TxNrOfMsg := 6;

TxData1[0] = `H`

TxData1[1] = `e`

TxData1[2] = `l`

TxData1[3] = `l`

TxData1[4] = `o`

TxData1[5] = ``

Increment TxCounter by 1:

TxCounter = 1 TxCounterCon = 0

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

TxCounter = 1 TxCounterCon = 1

TxNrOfMsg := 4;

TxData1[0] = `W`

TxData1[1] = `o`

TxData1[2] = `r`

TxData1[3] = `l`

TxData1[4] = `d`

Increment TxCounter by 1:

TxCounter = 2 TxCounterCon = 1

Slave module accepts data. TxCounterCon = TxCounter acknowledges.

TxCounter = 2 TxCounterCon = 2

Receive Data:

Initial state: RxCounter = 0 RxCounterCon = 0

The module increments RxCounter by 1:

RxCounter = 1 TxCounterCon = 0

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

RxNrOfMsg := 4;

RxData1[0] = `T`

RxData1[1] = `e`

RxData1[2] = `s`

RxData1[3] = `t`

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

RxCounter = 1 RxCounterCon = 1

Response to Errors

- EtherCAT error.
Sync Manager watchdog.
LED "Error" flashes 4x.
Unit changes from Op to Safe-Op.
Use "Reset Error" to acknowledge the error.
- Out-queue overflow (COM1_TxQueueOvr, COM2_TxQueueOvr).
Failure to send the data fast enough.
LED "Error" flashes 5x.
Use "Reset Error" to acknowledge the error.
- In-queue overflow (COM1_RxQueueOvr, COM2_RxQueueOvr).
Too much data is being received and cannot be transferred to the control unit fast enough.
LED "Error" flashes 6x.
Use "Reset Error" to acknowledge the error.
- TxCount error (TxCounterMiss).
The TxCounter received is not "last TxCounter + 1".
The gateway probably missed an EtherCAT frame. The EtherCAT master is sending the data too quickly (< 1ms for 9 messages).
LED "Error" flashes 7x.
Use "Reset Error" to acknowledge the error.
- Com controller error (COM1_CtrlErr, COM2_CtrlErr).
Indicates bit errors or overruns of the control unit concerned.
The applicable LED "COM State" is red and flashes rapidly or alternates green/red while communicating.
Use "Reset Error" to acknowledge the error.

Object Dictionary

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

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

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

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

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

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

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

Index	Name	Type	Default	Min Max	Access
6500, 5	TxCounterMiss	BOOL			RO P
6500, 6	unused0	BOOL			RO P
6500, 7	COM2_TxQueueOvr	BOOL			RO P
6500, 8	COM2_RxQueueOvr	BOOL			RO P
6500, 9	COM1_CtrlErr	BOOL			RO P
6500, 10	COM2_CtrlErr	BOOL			RO P
6500, 11	unused1	BOOL			RO P
6500, 12	unused2	BOOL			RO P
6500, 13	Unused3	BOOL			RO P
6500, 14	COM1_TxBusy	BOOL			RO P
6500, 15	COM2_TxBusy	BOOL			RO P
6500, 16	RxComSwitch	BOOL			RO P
6600	TxCounterCon	UINT16		0..65535	RO P
6601	RxCounter	UINT16		0..65535	RO P
6602	RxNrOfMsg	UINT16		0..152	RO P
7000	TxData0	UINT64	0		RW P
7001	TxData1	UINT64	0		RW P
7002	TxData2	UINT64	0		RW P
7003	TxData3	UINT64	0		RW P
7004	TxData4	UINT64	0		RW P
7005	TxData5	UINT64	0		RW P
7006	TxData6	UINT64	0		RW P
7007	TxData7	UINT64	0		RW P
7008	TxData8	UINT64	0		RW P
7009	TxData9	UINT64	0		RW P
700A	TxData10	UINT64	0		RW P
700B	TxData11	UINT64	0		RW P
[700C]	TxData12	UINT64	0		RW P
[700D]	TxData13	UINT64	0		RW P
700E	TxData14	UINT64	0		RW P
F) 700.	TxData15	UINT64	0		RW P
7010	TxData16	UINT64	0		RW P
7011	TxData17	UINT64	0		RW P
7012	TxData18	UINT64	0		RW P
7013	TxData19	UINT64	0		RW P
7100	TxCounter	UINT16		0..65535	RW P
7101	RxCounterCon	UINT16		0..65535	RW P
7102	TxNrOfMsg	UINT16		0..152	RW P
7110	ControlWord	Array			
7110, 0	Number of Entries	UINT8	16		RO
7110, 1	ResetError	BOOL			RW P
7110, 2	unused0	BOOL			RW P
7110, 3	unused1	BOOL			RW P
7110, 4	unused2	BOOL			RW P
7110, 5	unused3	BOOL			RW P
7110, 6	unused4	BOOL			RW P
7110, 7	unused5	BOOL			RW P

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

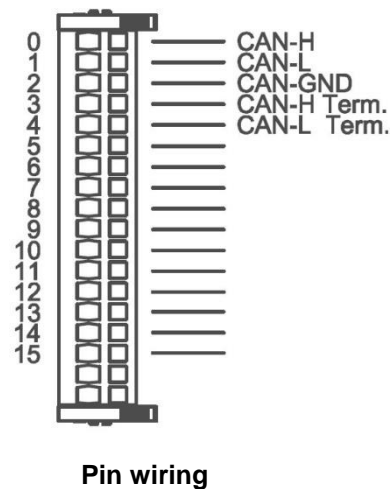
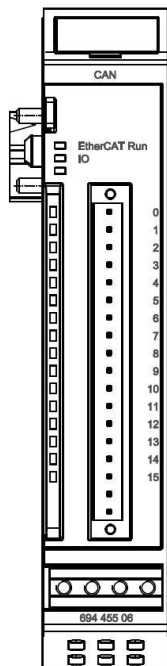
Technical Data

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



Approval.....

5.7.3 CAN Master/Slave



Front view of the CAN Master/Slave module

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

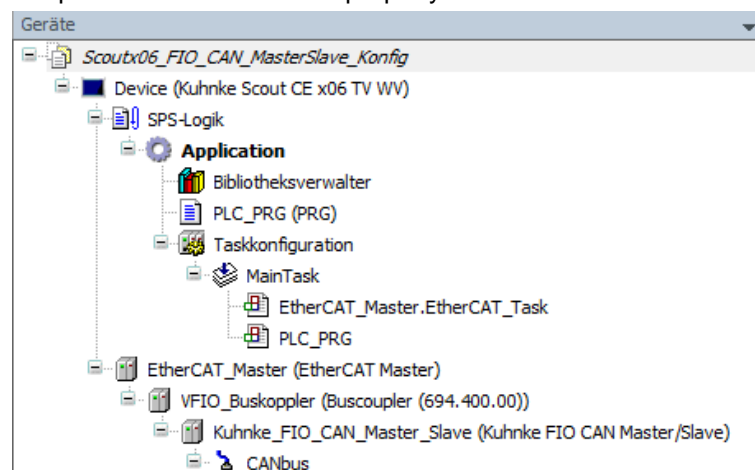
In CODESYS 3, the module provides a CANbus port that further configurations can be connected to. A device description available for CODESYS 3 contains all the required details. Mind that you also need the device driver (CAN Mini Driver).

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

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

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

Screen if the device description has been installed properly



Terminals

IO Connection, 18-pin, Male

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

Status LEDs

LED "EtherCAT Run"

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

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

LED "IO"

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

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

LED "Power"

Not used

LEDs "Channel [COM State]"

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

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

Process Image

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

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

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

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

ControlData:

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

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

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

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

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

StateData:

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

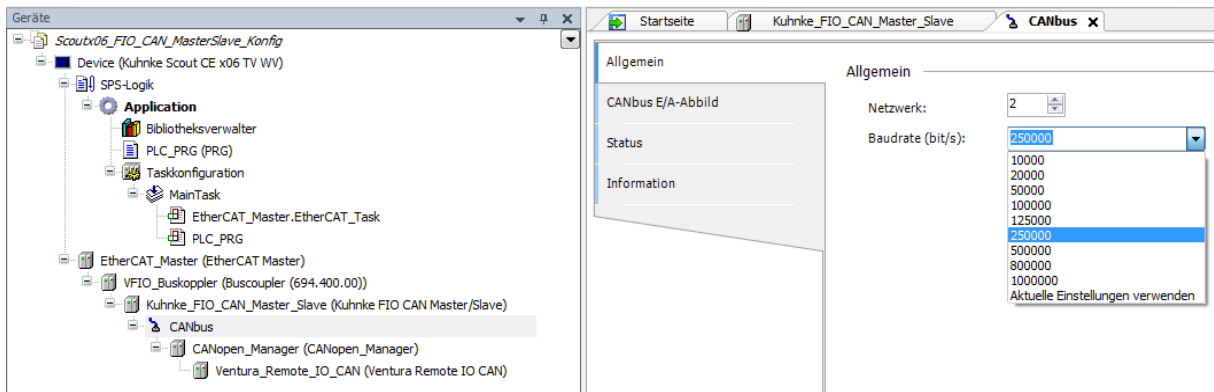
RxData1,2 / 3,4 / 5,6 / 7,8 / 9,10 / 11,12 / 13,14 / 15,16 / 17,18 :


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

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

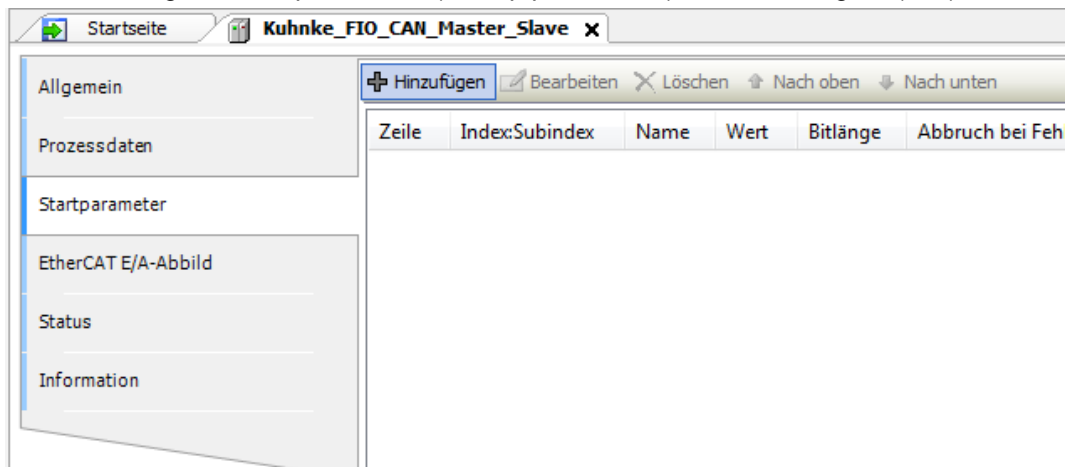
Configuration

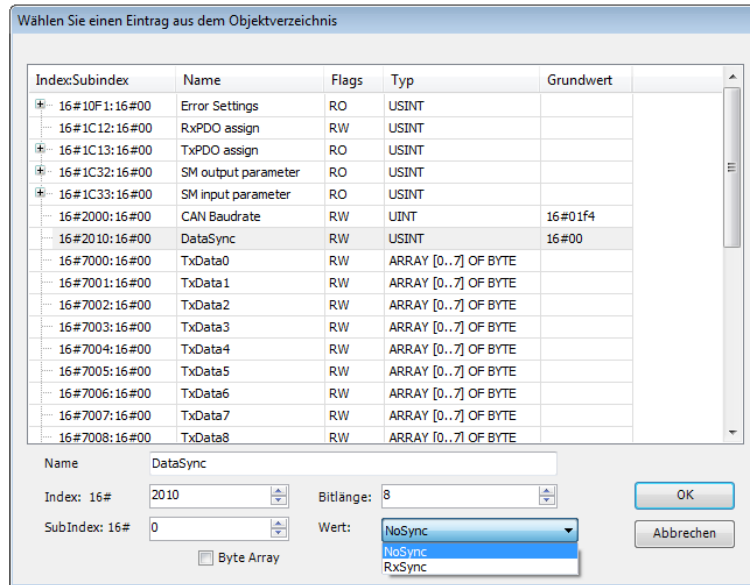
To set the baud rate, go down the device tree and find the CAN node immediately underneath the Kuhnke FIO CAN Master/Slave module.



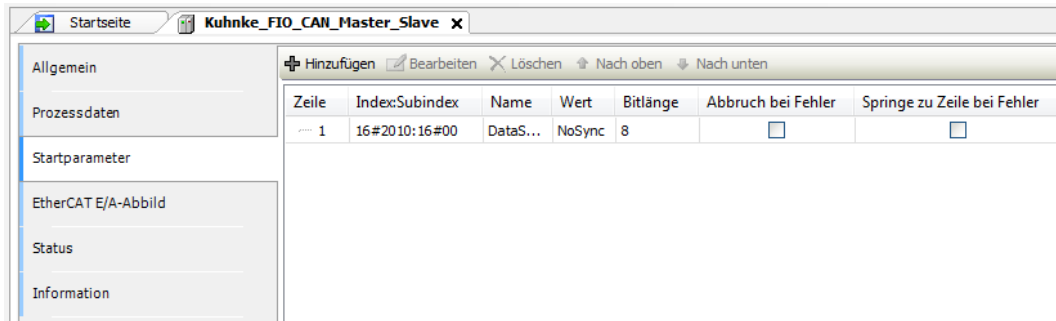
	<p>Information</p> <p>The Kuhnke FIO CAN Master/Slave module does NOT support all CODESYS baud rates (refer to the object dictionary).</p> <p>The following baud rates are supported:</p> <ul style="list-style-type: none"> 100, 125, 250, 500 and 1000 kBit/s
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Go to the startup parameters of the CAN module to enable or disable data synchronisation. Select the module and go to "Startparameter" (startup parameters) and "Hinzufügen" (add).





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



Response to Errors

- EtherCAT error.
Sync Manager watchdog.
LED "Error" flashes 4x.
Unit changes from Op to Safe-Op.
Use "Reset Error" to acknowledge the error.
- Out-queue overflow (CanTxQueueOvr).
Failure to send the data fast enough across the CAN bus.
LED "Error" flashes 5x.
Use "Reset Error" to acknowledge the error.
- In-queue overflow (CanRxQueueOvr).
Too much data is being received via the CAN bus. and cannot be transferred to the control unit fast enough.
LED "Error" flashes 6x.
Use "Reset Error" to acknowledge the error.
- TxCount error (TxCounterMiss).
The TxCounter received is not "last TxCounter + 1".
The gateway probably missed an EtherCAT frame. The EtherCAT master is sending the data too quickly (< 1ms for 9 messages).
LED "Error" flashes 7x.
Use "Reset Error" to acknowledge the error.
- CAN warning.
Indicates the CAN controller states "CAN Warning" and "Error Passive". These states are retained unless several frames are sent and received without errors.LED "CAN" is red and flashes rapidly (or alternates between green and red while communicating).
"Reset Error" is NOT required to acknowledge the error.
- CAN Bus Off.
Massive problems have changed the CAN controller's state to "bus off". The controller will quit this error state automatically.LED "CAN" lights up red.
Use "Reset Error" to acknowledge the error.

Object Dictionary

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

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

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

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

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

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

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

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

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

Technical Data

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



Approval.....

5.8 Safety Modules

5.8.1 Kuhnke FIO Safety PLC

There is a separate instruction manual available for the Kuhnke FIO Safety PLC. For further information, please click the link below.

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

Technical Data

Type	Safety control unit
Safety protocol	FSoE
Safety standard	IEC 61508 SIL3 and DIN EN ISO 13849-1 PLe
Approval	CE, cULus, TÜV Rheinland
Runtime system	CODESYS RT Safety
Programming tool	CODESYS v3.5 SP5 or higher with integrated safety function modules
E-bus power consumption	200 mA – 300 mA
Supply voltage	From bus coupler through E-bus connector
Electrical interference	EN 61000-6-2/EN 61000-6-4
Resistance to vibration	EN 60068-2-6
Impact resistance	EN 60068-2-27
Fieldbus port	EtherCAT® 100 Mbps LVDS: E-bus
Installation / mounting position	35 mm DIN rail / horizontal
Signal indication	Status LEDs (EtherCAT, Safety, Power)
Shield	Provided directly by the module
Terminals	-
Ambient conditions	0 °C ...+55 °C, IP 20
Housing	Plastic shroud over aluminium frame, 25 x 120 x 90 [mm]

5.8.2 Kuhnke FIO Safety SDI4 SDO2

There is a separate instruction manual available for Kuhnke FIO Safety I/O. For further information, please click the link below.

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

Technical Data

Type	Safe input / output terminal
Safety protocol	FSoE
Safety standard	IEC 61508 SIL3 and DIN EN ISO 13849-1 PL _e
Number of inputs	4 safe inputs (configurable properties)
Number of outputs	2 safe outputs (I _{max} = 2.0 A)
Clock pulse outputs (OSSD)	4
Response time	< 1 ms (read input, write to E-bus)
Error response time	≤ watchdog time (configurable)
Extended diagnostic information	Via CoE
E-bus power consumption	275 mA
Supply voltage	24 VDC (-15 % / +20 %)
Electrical interference	EN 61000-6-2/EN 61000-6-4
Resistance to vibration	EN 60068-2-6
Impact resistance	EN 60068-2-27
Fieldbus port	EtherCAT® 100 Mbps LVDS: E-bus
Installation / mounting position	35 mm DIN rail / horizontal
Signal indication	LEDs per I/O: locally allocated to the terminal point, status LEDs: EtherCAT, Safety, Power
Shield	Provided directly by the module
Terminals	18-pin spring-assisted connector with mechanical ejector
Ambient conditions	0 °C ...+55 °C, IP 20
Housing (W x H x D)	Plastic shroud over aluminium frame, 25 x 120 x 90 [mm]
Approval	CE, EtherCAT Conformance tested, cULus, TÜV Rheinland

5.8.3 Kuhnke FIO Safety SDI8 SDO2

There is a separate instruction manual available for Kuhnke FIO Safety I/O. For further information, please click the link below.

Link to the documentation: <https://productfinder.kuhnke.kendrion.com>

Technical Data

Type	Safe input / output terminal
Safety protocol	FSoE
Safety standard	IEC 61508 SIL3 and DIN EN ISO 13849-1 PL _e
Number of inputs	8 safe inputs (configurable properties)
Number of outputs	2 safe outputs ($I_{max} = 2.0 A$)
Clock pulse outputs (OSSD)	4
Response time	< 1 ms (read input, write to E-bus)
Error response time	≤ watchdog time (configurable)
Extended diagnostic information	Via CoE
E-bus power consumption	Typ. 210 mA (max. 300 mA)
Supply voltage	24 VDC (-15 % / +20 %)
Electrical interference	EN 61000-6-2/EN 61000-6-4
Resistance to vibration	EN 60068-2-6
Impact resistance	EN 60068-2-27
Fieldbus port	EtherCAT® 100 Mbps LVDS: E-bus
Installation / mounting position	35 mm DIN rail / horizontal
Signal indication	LEDs per I/O: locally allocated to the terminal point, status LEDs: EtherCAT, Safety, Power
Shield	Provided directly by the module
Terminals	18-pin spring-assisted connector with mechanical ejector
Ambient conditions	0 °C ...+55 °C, IP 20
Housing (W x H x D)	Plastic shroud over aluminium frame, 25 x 120 x 90 [mm]
Approval	CE, EtherCAT Conformance tested, cULus, TÜV Rheinland

5.8.4 Kuhnke FIO Safety SDI16 SDO4

There is a separate instruction manual available for Kuhnke FIO Safety I/O. For further information, please click the link below.

Link to the documentation: <https://productfinder.kuhnke.kendrion.com>

Technical Data

Type	Safe input / output terminal
Safety protocol	FSoE
Safety standard	IEC 61508 SIL3 and DIN EN ISO 13849-1 PL _e
Number of inputs	16 safe inputs (configurable properties)
Number of outputs	4 safe outputs ($I_{max} = 2.0 \text{ A}$)
Clock pulse outputs (OSSD)	8
Response time	< 1 ms (read input, write to E-bus)
Error response time	≤ watchdog time (configurable)
Extended diagnostic information	Via CoE
E-bus power consumption	Typ. 210 mA (max. 300 mA)
Supply voltage	24 VDC (-15 % / +20 %)
Electrical interference	EN 61000-6-2/EN 61000-6-4
Resistance to vibration	EN 60068-2-6
Impact resistance	EN 60068-2-27
Fieldbus port	EtherCAT® 100 Mbps LVDS: E-bus
Installation / mounting position	35 mm DIN rail / horizontal
Signal indication	LEDs per I/O: locally allocated to the terminal point, status LEDs: EtherCAT, Safety, Power
Shield	Provided directly by the module
Terminals	36-pin spring-assisted connector with mechanical ejector
Ambient conditions	0 °C ...+55 °C, IP 20
Housing (W x H x D)	Plastic shroud over aluminium frame, 25 x 120 x 90 [mm]
Approval	CE, EtherCAT Conformance tested, cULus, TÜV Rheinland

5.8.5 Kuhnke FIO Safety SDI16

There is a separate instruction manual available for Kuhnke FIO Safety I/O. For further information, please click the link below.

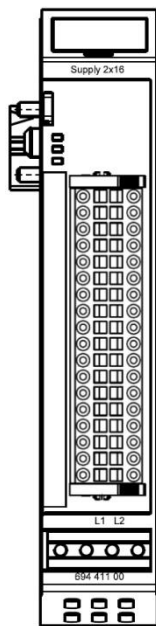
Link to the documentation: <https://productfinder.kuhnke.kendrion.com>

Technical Data

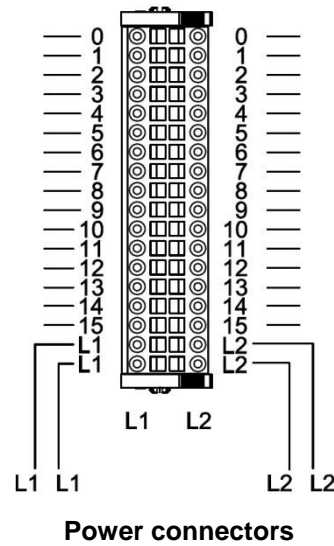
Type	Safe input / output terminal
Safety protocol	FSoE
Safety standard	IEC 61508 SIL3 and DIN EN ISO 13849-1 PLe
Number of inputs	16 safe inputs (configurable properties)
Clock pulse outputs (OSSD)	8
Response time	< 1 ms (read input, write to E-bus)
Error response time	≤ watchdog time (configurable)
Extended diagnostic information	Via CoE
E-bus power consumption	Typ. 210 mA (max. 300 mA)
Supply voltage	24 VDC (-15 % / +20 %)
Electrical interference	EN 61000-6-2/EN 61000-6-4
Resistance to vibration	EN 60068-2-6
Impact resistance	EN 60068-2-27
Fieldbus port	EtherCAT® 100 Mbps LVDS: E-bus
Installation / mounting position	35 mm DIN rail / horizontal
Signal indication	LEDs per I/O: locally allocated to the terminal point, status LEDs: EtherCAT, Safety, Power
Shield	Provided directly by the module
Terminals	36-pin spring-assisted connector with mechanical ejector
Ambient conditions	0 °C ...+55 °C, IP 20
Housing (W x H x D)	Plastic shroud over aluminium frame, 25 x 120 x 90 [mm]
Approval	CE, EtherCAT Conformance tested, cULus, TÜV Rheinland

6 Accessories

6.1 Power Distributor 2 x 16



Front view of power distributor



Terminals

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

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

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

Status LEDs

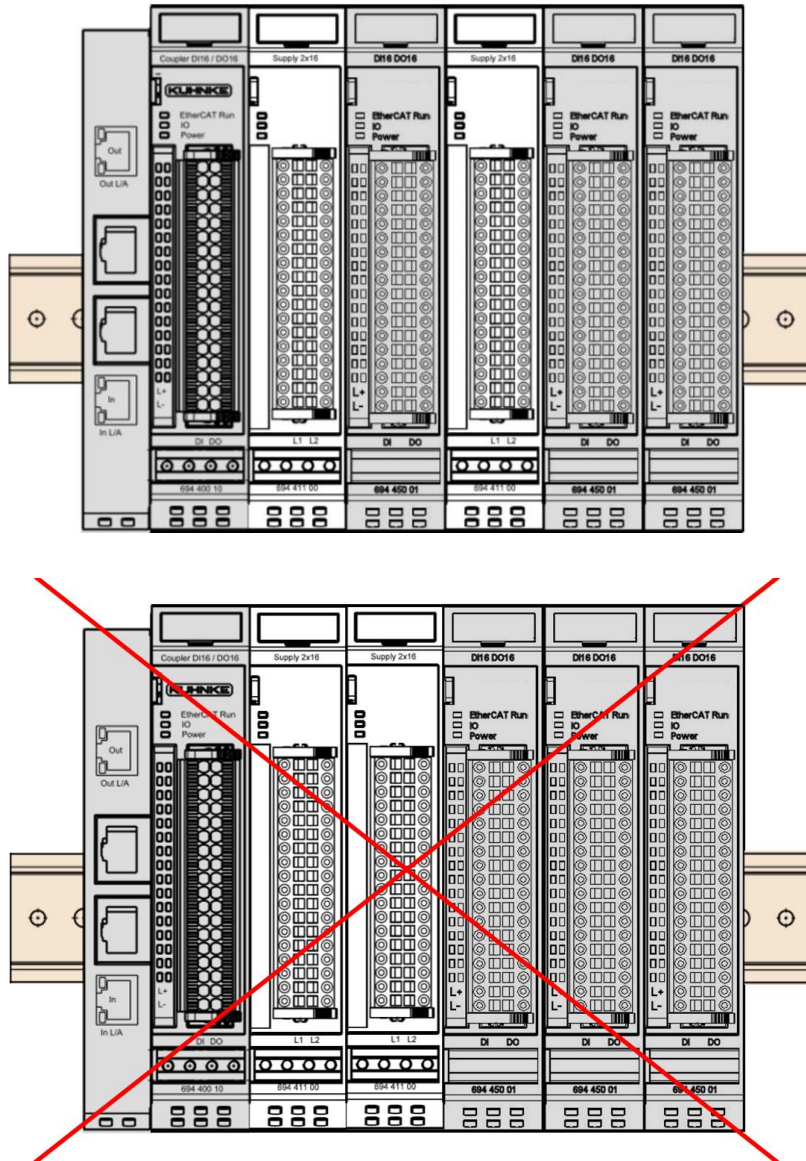
None.

Function

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

Mounting

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



Technical Data

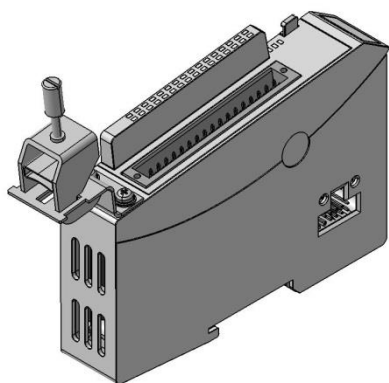
Power Distributor 2 x 16

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

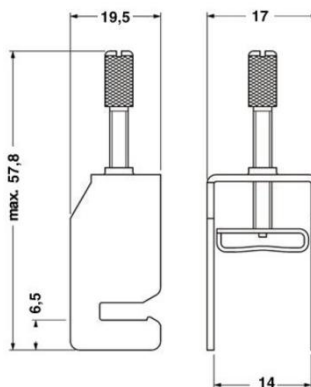


Approval:.....

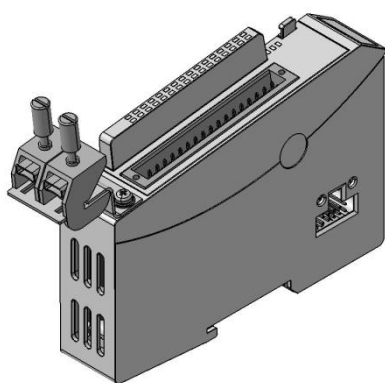
6.2 Shield Terminal



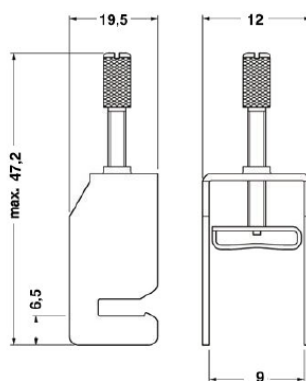
Shield terminal 1x14mm



Dimensions



Shield terminal 2x8mm



Dimensions

Terminals



The shield terminal assembly consists of the actual shield terminal, the terminal bracket, two M3x5 screws, 2 washers, and 2 spring washers. Use the 2 screws, washers and spring washers to mount the terminal bracket on the housing mount of the Kuhnke FIO module. Screw the screws into the 2 holes tapped into the bottom of the front side.

Function

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

	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.

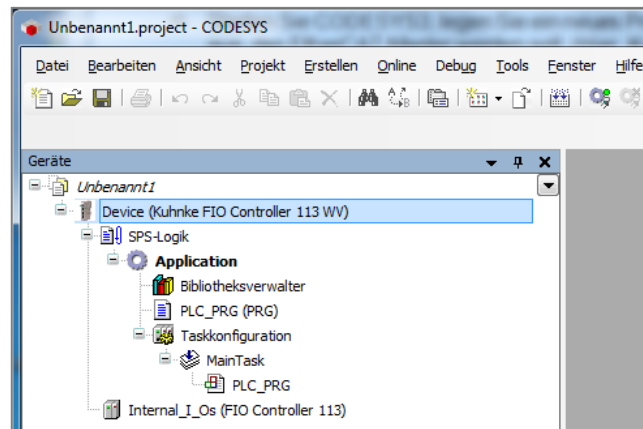
The file to use for Kuhnke FIO is called "KuhnkeEtherCATModulesAll.xml".

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.

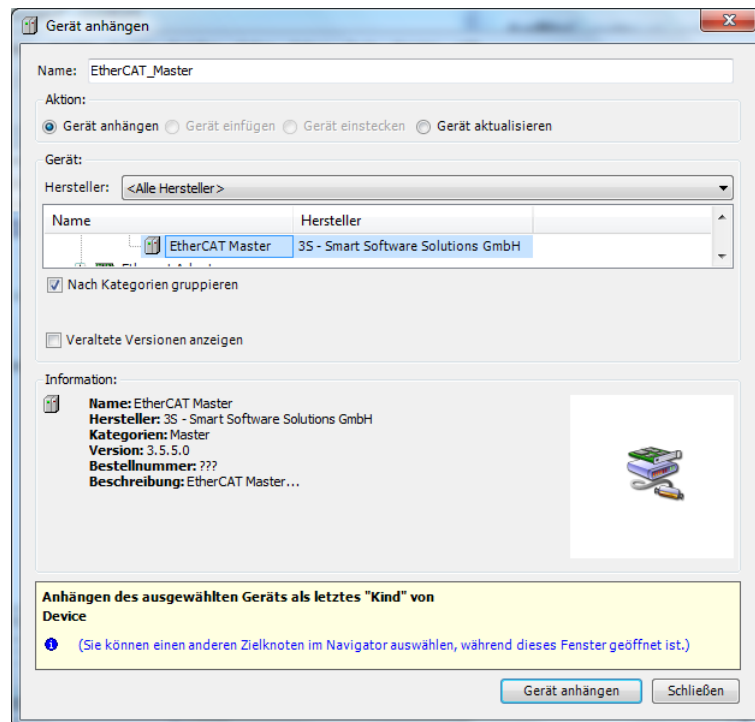
7.1 CODESYS V3 (CODESYS Configurator)

Offline Configuration

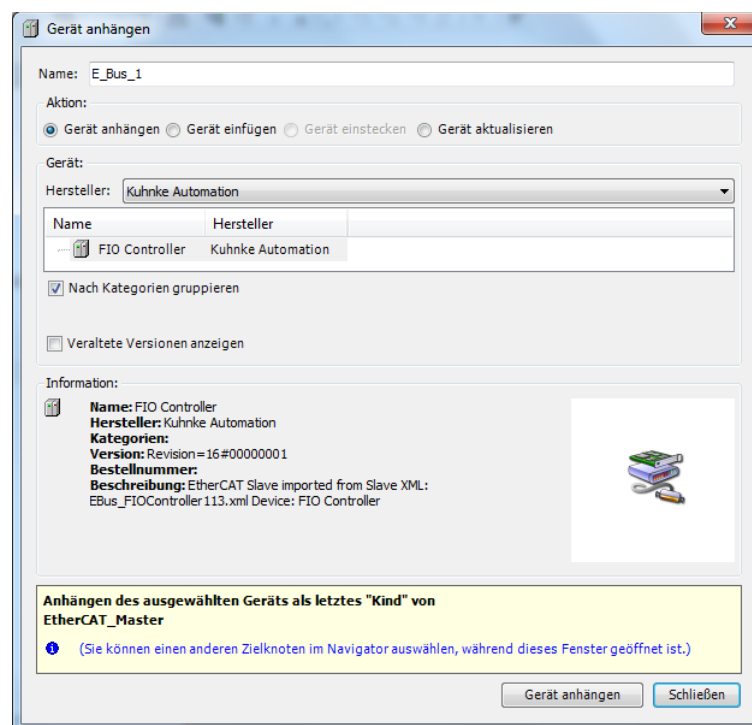
- Run CODESYS3, create a new project (default project), and select the device to become the EtherCAT master (here: "Kuhnke FIO Controller 113 WV").



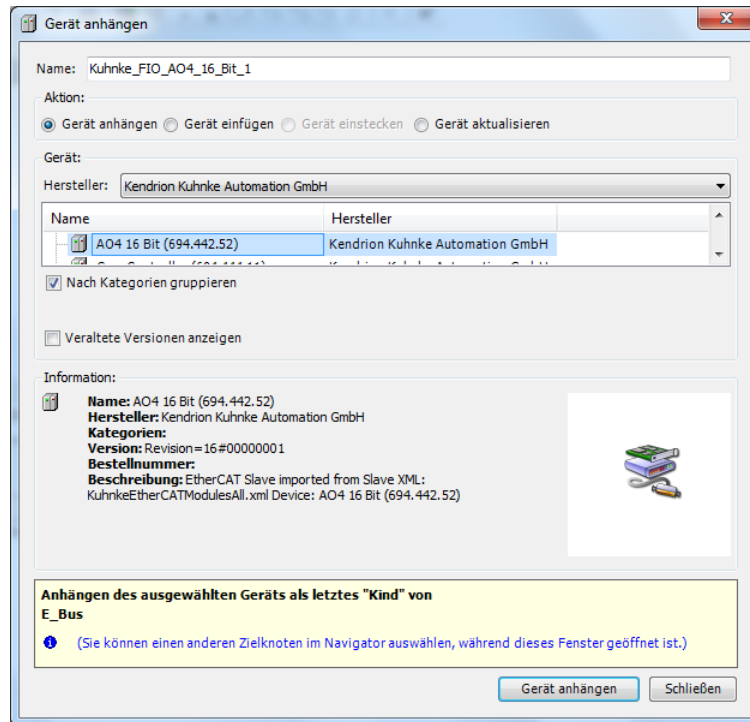
- Highlight the device and pick the 3S "EtherCAT Master" from the right-click menu.



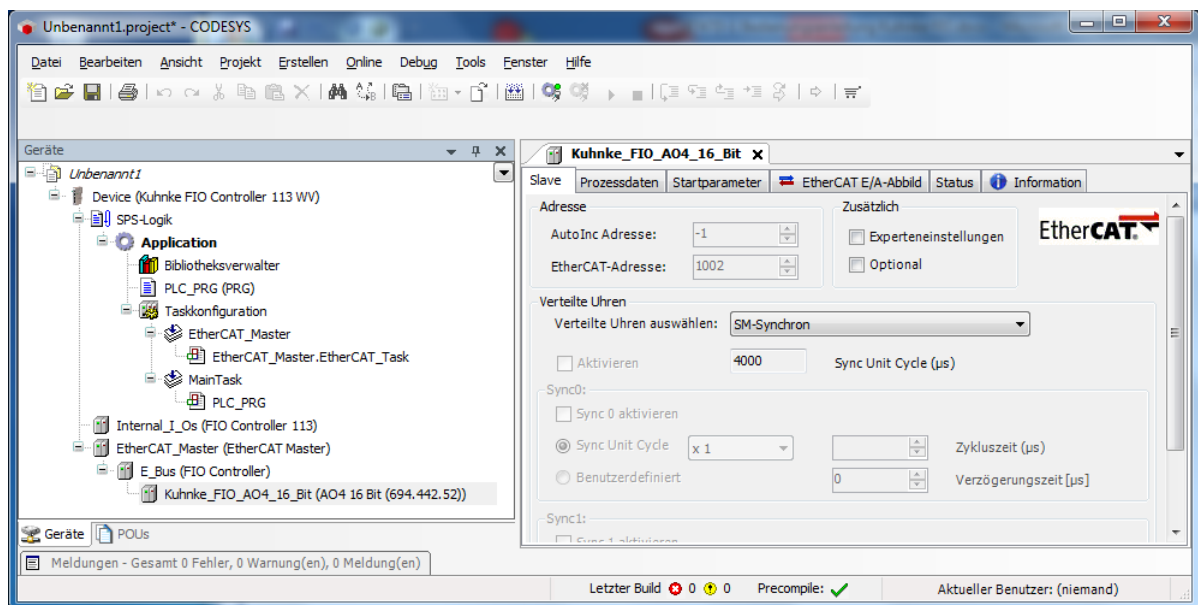
- Go down the list of devices, pick "EtherCAT_Master (EtherCAT Master)", and add Kuhnke Automation's "FIO Controller".



- 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.

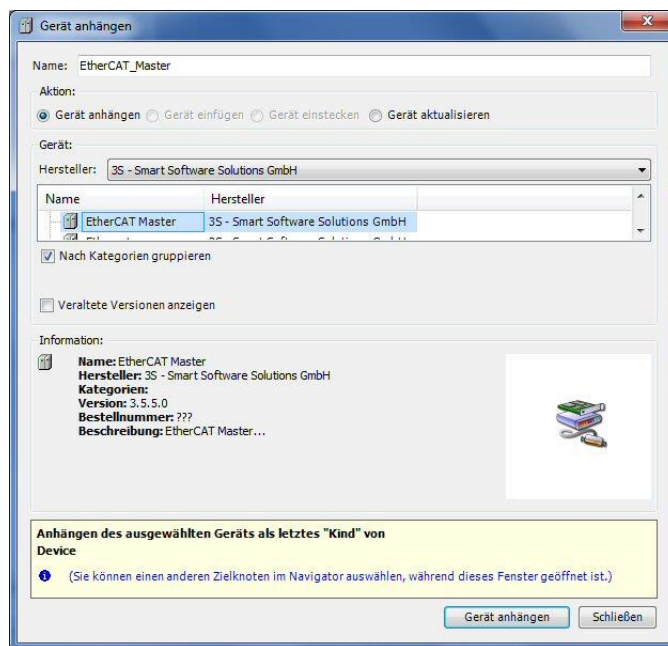
If the configuration is complete and all devices are connected to the programming PC, you can log in and run the configuration tool to test your Kuhnke FIO modules.

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

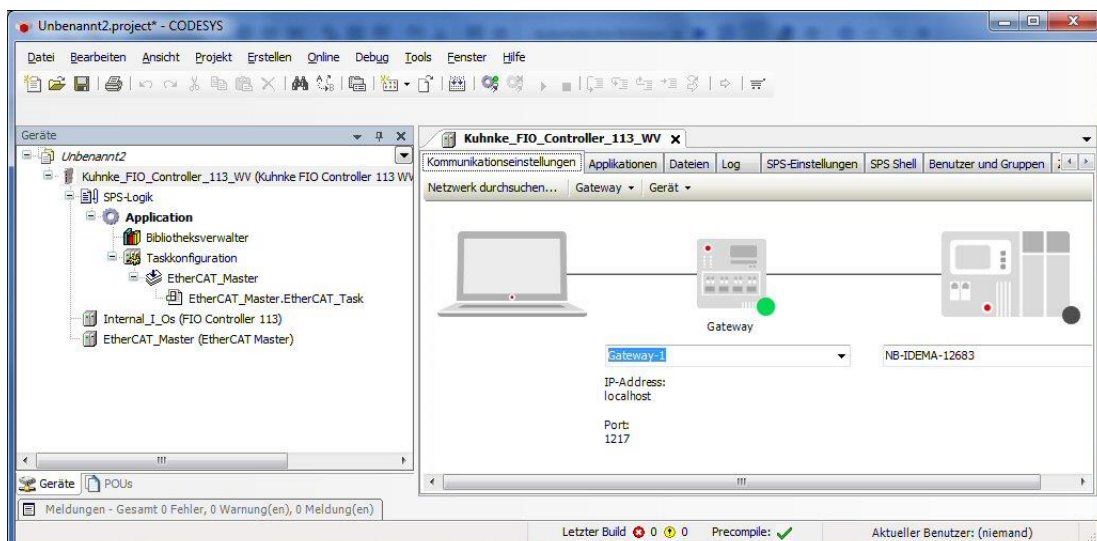
Online Configuration

EtherCAT allows you to scan the stations connected to an Ethernet line. The example below illustrates how to identify the actual configuration of an I/O unit consisting of a Kuhnke Controller 113, a Kuhnke FIO A18-I module, and a Kuhnke FIO A18-Pt/Ni/Tc module.

- Connect Kuhnke Controller 113 to the Kuhnke FIO A18-I module and the Kuhnke FIO A18-Pt/Ni/Tc module and turn on the power supply.
- Use a CAT5 cable to connect your PC's Ethernet port to your CoDeSys3 controm unit (Kuhnke Controller 113) (both a patch cable and a crossover cable will work).
- Run CoDeSys V3.
- Open a project for your CoDeSys3 control unit (Kuhnke Controller 113).
- Select "Device (.....Kuhnke FIO Controller 113)" and pick "Gerät anhängen" (add device).

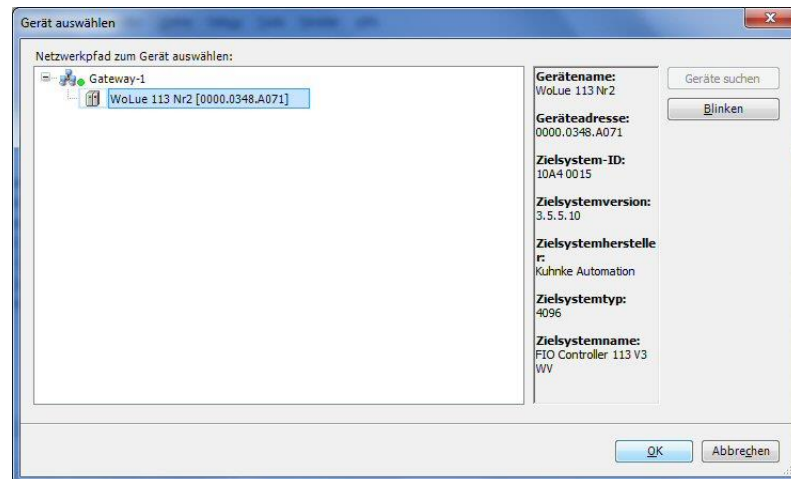


- Configure an EtherCAT master by adding an "EtherCAT Master" supplied by 3S-Smart Software Solutions GmbH to your device.

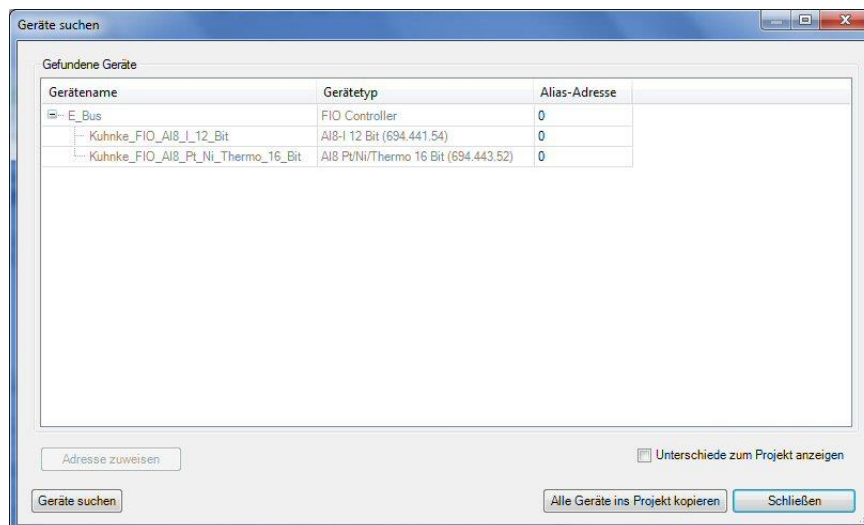


- Select "Device (.....Kuhnke FIO Controller 113)" and choose "Netzwerk durchsuchen" (search network).

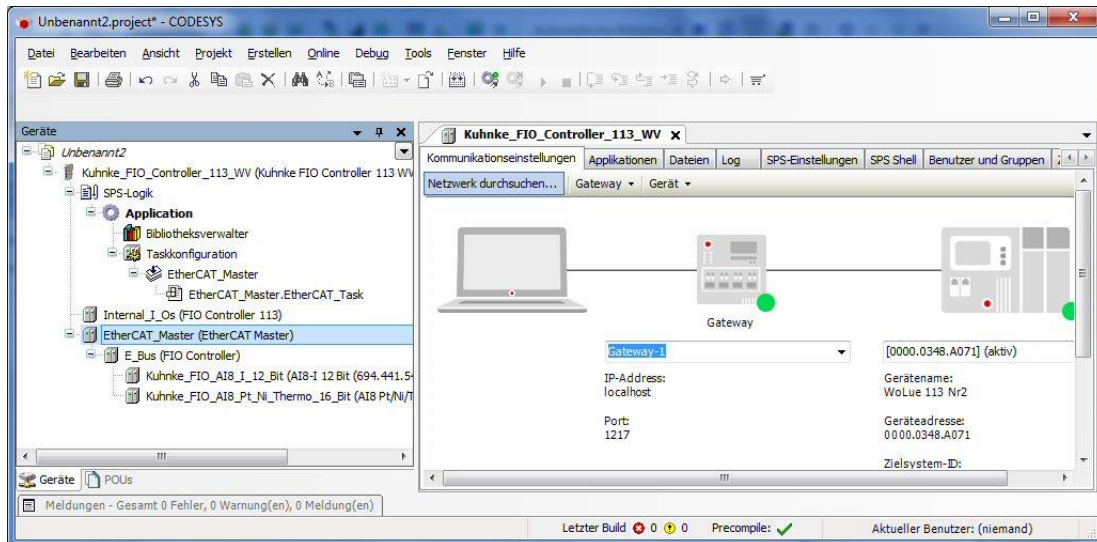
The software now scans the Ethernet network and finds the CoDeSys3 control unit connected to it.



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



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



- Test the EtherCAT IOs.

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

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 (Σ max. 10A), high-side semiconductor,

Kuhnke FIO DO16 0.5A

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

Kuhnke FIO DO16 2-wire

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

Kuhnke FIO DO8 NO Relay 24V

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

Kuhnke FIO DO8 NO Relay 230 VAC

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

Analogue FIO Modules**Kuhnke FIO AI4, 12 Bit / AO4, 16Bit**

Part no. 694.444.65
 Analogue Inputs 4
 Resolution 12 Bit
 Output signal 0..10V, (0→10V: $\leq 22\mu\text{s}$ at $2\text{k}\Omega / < 200\text{pF}$)
 0..20mA, 4..20mA, (0→16V: $\leq 25\mu\text{s}$ at $300\Omega / < 1\text{mH}$)

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

Kuhnke FIO AO4, 16-Bit

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

Kuhnke FIO AO4, 12-Bit

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

Kuhnke FIO AI4/8-U 13-Bit

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

Kuhnke FIO AI8/16-U 13-Bit

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

Kuhnke FIO AI4-I 12-Bit

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

Kuhnke FIO AI8-I 12-Bit

Part no.	694.441.54
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Analogue inputs.....	8
Resolution.....	12 bit
Measuring range.....	0 ...20mA, 4...20mA
Conversion time.....	290 µs (8 channels)

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

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

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

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

Mixed I/O Modules

Kuhnke FIO MIX 02

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

Counter / Posi / Drive / CAM Modules

Counter2 5V

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

Kuhnke FIO CounterPosi2 5V

Part no.	694.454.01
Encoder inputs.....	2
Counting frequency	max. 200 kHz
Digital inputs	8, 1 ms delay

Digital outputs 2, load: 2.0 A, high-side semiconductor
Analogue outputs 2, -10V..+10 V, 12 bit

Kuhnke FIO Drive Control

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

Kuhnke FIO CAM Control

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

Interface and Communication Modules

Kuhnke FIO RS485 1 Port

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

Kuhnke FIO RS232 2 Port

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

Kuhnke FIO CAN Master/Slave

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

FIO Safety Modules

Kuhnke FIO Safety PLC

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

Kuhnke FIO Safety SDI4/SDO2

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

8.2 Order Specifications


Kuhnke FIO Modules

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

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

Kuhnke FIO Accessories

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

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

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

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

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

9 Sales & Service

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



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