wenglor
the innovative family

Operating Instructions

EP1A001

IO-Link Analog Converter 1 × M12, Multi U/I

EN

Translation of the original operating instructions
Subject to change without notice
Available as PDF file only
Version 1.0

Table of Contents

1 General

1.1 Information Concerning these Instructions

- These instructions make it possible to use the product safely and efficiently.
- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Local accident prevention regulations and national work safety regulations must be complied with as well.
- The product is subject to further technical development, and thus the information contained in these operating instructions may also be subject to change. The current version can be found at www.wenglor.com in the product's separate download area.

INFORMATION

The operating instructions must be read carefully before using the product and must be kept on hand for later reference.

1.2 Explanation of Symbols

- Safety precautions and warnings are emphasized by means of symbols and signal words.
- Safe use of the product is only possible if these safety precautions and warnings are adhered to.

The safety precautions and warnings are laid out in accordance with the following principle:

SIGNAL WORD

Type and source of danger!

Possible consequences in the event that the hazard is disregarded.

→ Measures for averting the hazard.

The meanings of the signal words, as well as the scope of the associated hazards, are listed below:

⚠ DANGER

This signal word indicates a hazard with a high degree of risk which, if not avoided, results in death or severe injury.

⚠ WARNING

This signal word indicates a hazard with a medium degree of risk which, if not avoided, may result in death or severe injury.

⚠ CAUTION

This signal word indicates a hazard with a low degree of risk which, if not avoided, may result in minor or moderate injury.

NOTICE

This signal word draws attention to a potentially hazardous situation which, if not avoided, may result in property damage.

INFORMATION

Information draws attention to useful tips and suggestions, as well as information on efficient, error-free use.

1.3 Limitation of Liability

- The product has been developed in consideration of the current state-of-the-art technology, as well as applicable standards and guidelines. Subject to change without notice.
- A valid declaration of conformity can be accessed at www.wenglor.com in the product's separate download area.
- wenglor sensoric elektronische Geräte GmbH (hereinafter referred to as "wenglor") excludes all liability in the event of:
  - Non-compliance with the instructions
  - Use of the product for purposes other than those intended.
  - Use by untrained personnel.
  - Use of unapproved spare parts.
  - Unapproved modification of products.
- These operating instructions do not include any guarantees from wenglor with regard to the described procedures or specific product characteristics.
- wenglor assumes no liability for printing errors or other inaccuracies contained in these operating instructions unless wenglor was verifiably aware of such errors at the point in time at which the operating instructions were prepared.

1.4 Copyrights

- The contents of these instructions are protected by copyright law.
- All rights are reserved by wenglor.
- Commercial reproduction or any other commercial use of the provided content and information, in particular graphics and images, is not permitted without previous written consent from wenglor.

2 For Your Safety

2.1 General Safety Precautions

General Safety Precautions

⚠ DANGER

High electrical voltage in the machine/system.

Death or serious injury from electric shock.

→ Comply with the five safety rules of electrical engineering when working on the machine/equipment.

Protection of Persons and Property

According to DIN VDE 0105-100 – Operation of electrical systems – Part 100: General specifications

The Five Safety Rules

Protect against high voltage

1. Enable.
2. Secure against being switched on again.
3. Check that there is no voltage at all poles.
4. Ground and short-circuit.
5. Cover or cordon off adjacent live parts.

Specialist Personnel

Only qualified and safety-technically instructed personnel may install, commission and operate the device.

You are qualified if you meet the following conditions:

- You have suitable electrical training.
- You have been instructed by the machine operator in the operation of the system and the applicable safety regulations.
- You have access to the operating instructions and the manual.
- You are familiar with the safety standards of automation technology.

Use of the Device

Observe all safety and accident prevention regulations during project planning, installation, initial startup, operation and testing of the device.

When using aggressive media, check the material resistance.

INFORMATION

Only qualified personnel from wenglor sensoric GmbH may perform interventions in the hardware and software, with the exception of firmware updates.

2.2 Use for Intended Purpose

The device is designed and manufactured for:

- Communication and process control
- General control and automation tasks
- Operation within the ambient conditions specified in the technical data
- Industrial use up to degree of protection IP67/IP69K

Intended use also includes EMC-compliant electrical installation.

NOTICE

Possible radio interference in the residential and mixed-use area.

1. Observe applicable standards for the residential or mixed-use area!
2. Take suitable measures to eliminate radio interference.

Foreseeable Misuse

- Only operate the device if it is in perfect technical condition.
- Ensure that only qualified and authorized personnel work with/on this equipment.
- Do not modify the connected devices structurally, technically or electrically.
- Only use the device within the areas described in this manual and in the other applicable documents.
- Only use the device in an industrial environment or observe the applicable standards).
- Do not use the device:
  - outdoors,
  - in potentially explosive environments (EX zone),
  - for permanent operation in liquids.
- Do not clean the machine with high pressure.

Warranty and Liability

Warranty and liability claims are forfeited if:

- the product is not used as intended,
- damage is due to failure to observe the operating instructions,
- the personnel was/is not competent.

Notes on Assemblies at Risk of Electrostatic Discharge

NOTICE

Product at risk of electrostatic discharge!

The assemblies may be damaged.

→ Ensure that people and work equipment are sufficiently grounded!

NOTICE

Product at risk of electrostatic discharge!

The assemblies may be damaged.

→ Do not pull or plug connectors and lines under tension!

Handling

wenglor assemblies contain highly integrated components in MOS technology. These components are extremely sensitive to overvoltages, e.g. caused by electrostatic discharge. Endangered assemblies are marked with the adjacent symbol.

Shipment

Always use the original packaging for shipping electrostatically hazardous assemblies.

Measurement

Observe the following points for measurements on assemblies at risk of electrostatic discharge:

- Discharge potential-free measuring devices briefly.
- Ground the measuring equipment used.

Modification

Observe the following when making modifications to assemblies at risk of electrostatic discharge:

- Use a grounded soldering iron.

3 Description

IO-Link Converter Analog Input

- Input M12 socket A-coded
- IO-Link M12 plug A-coded
- 16-bit resolution
- Drift 45 ppm
- Sampling rate ≤200 Hz

4 Technical Data

Electrical Data		
Module Supply		
Operating voltage IO-Link	Via pin 1	24 V ⎓
Operating voltage range IO-Link	Via pin 1	18...30 V ⎓
Power consumption	Ub = 24 V ⎓, without sensor supply current	≤ 30 mA
Total current		≤ 230 mA

IO-Link Port		
IO-Link specification	EN 61131-9	Version 1.1
Communication mode	COM2	38.4 kbit/s
Transmission protocol IO-Link		Version 1.1
Cycle time		≥ 2.3 ms
Port class		Class A
Data length	Process data resolution	16 bit/2 byte
Sensor Power Supply		
Sensor supply power		≤200 mA
Sensor supply output voltage range		17...29.8 V ⎓
Input (DI)		
Temperature drift		45 ppm / °K
Conversion principle	ADC	Sigma-Delta
Resolution	ADC	24 bit
Resolution	Process data	16 bit
Sampling rate		≤200 Hz
Filter	process data, Mean value over N, IO-Link cycles	Yes, averaging, parameterizable N = 0...64
Sensor cable		<30 m
Output		
Temperature drift		45 ppm / °K
Conversion principle	DAC	SAR
Resolution	DAC	16 bit
Resolution	Process data	16 bit
Conversion rate		≤200 Hz
Filter	process data, Mean value over N, IO-Link cycles	Yes, averaging, parameterizable N = 0...64
Sensor cable		<30 m

Measuring Ranges				
Analog Inputs				
Parameterizable measuring ranges				
Variants	Nominal measuring range	Max. measuring range	Input resistance	Value 1 LSB
1	0...20 mA	0...22.81 mA	232 Ω	348 nA
2	4...20 mA	4...22.81 mA	232 Ω	348 nA

Measuring Ranges				
3	0...10 V	0...11.76 V	100 kΩ	361.7 µV
4	–10...+10 V	-11.76...+11.76 V	100 kΩ	361.7 µV

Ambient Conditions		
Mechanical Characteristics		
Vibration testing	EN 60068 Part 2-6	10...58 Hz, 0.35 mm 58...150 Hz, 15 g
Shock test	EN 60068 Part 2-27	50 g, 11 ms, 3 axes
Climatic Conditions		
Storage temperature		–40 °C...+85°C
Operating temperature		–30 °C...+70 °C
Ambient temperature		–30 °C...+75°C
Climate class	EN 60721	3K3
Installation altitude	Above normal height	≤ 2,000 m
Relative humidity		≤ 85%
Electric Safety		
Degree of protection	All connectors connected	IP 67
Overvoltage category		II
Pollution degree		3
EMC Interference Emission		
Radio interference field strength	EN 61000-6-4 Emission	30...230 MHz 40 dBµV/m (@10 m) 230...1,000 MHz 47 dBµV/m (@10 m)
EMC Interference Immunity		
Electromagnetic HF fields	EN 61000-4-3	80...1,000 MHz,10 V/m 1.4...2 GHz, 3 V/m 2...2.7 GHz, 1 V/m
Fast transients (burst)	EN 61000-4-4	±1 kV, 5 kHz Measuring accuracy 5% FS without filter 0.2% FS with max. filter
Conducted HF interference	EN 61000-4-6	0.15...80 MHz 10 V, 80% AM; 1 kHz
Electrostatic discharge (ESD)	EN 61000-4-2	Contact ±4 kV Air: ±8 kV

Protection		
Equipment Protection		
Reverse polarity protection module supply		Yes, permanently
Reverse polarity protection sensor supply		Yes, permanently
Feedback-proof sensor supply		Yes, permanently
Short-circuit protection sensor supply		Yes, permanently
Overvoltage protection, analog input		Yes, 30 V ⎓
Reverse polarity protection analog input		Yes, permanently

Mechanical Data		
Material Data		
Housings		Plastic PC + PBT
M12 socket/plug Knurled nut/knurled screw		Cast zinc with Cu/Ni surface
FE connector sleeve		Brass with Cu/Ni surface
Mounting Data		
Weight	Net	44 g
Dimensions	L × W × H	77.2 × 15 × 32.3 mm

Product Reliability		
Product Reliability		
Analog Inputs		
MTTF	SN 29500 and rated data (40 °C)	209 years

Conformity, Approvals		
Product standard	EN 61131-2, EN 61131-9 Programmable logic controllers	
CE	2014/30/EU 2011/65/EU	
UKCA		
ULus		E201820
cUL	CSA 22.2 No. 61010-2-201, 61010-1	E201820
REACH	(EC) No 1272/2008	SVHC List
WEEE	2012/19/EU	Category 5
China RoHS	SJ/T 11364-2014	25 EPUP

5 Installation

5.1 Prerequisites

Establish the following prerequisites for mounting the device:

- Installation location in the immediate vicinity of the sensor/actuator
- Flat mounting surface for mechanically stress-free mounting
- Grounded mounting surface for grounding the ring cable lug
- Short cable paths to all components
- Sufficient space for easy device replacement and for connecting the plug connections
- Suitable installation location with regard to vibration and shock load, temperature and humidity (see section Technical Data)
- Protected to prevent tearing of the connection lines by personnel or equipment
- Diagnostic LEDs of the device visible during operation

⚠ WARNING

High electrical voltage in the machine/system.

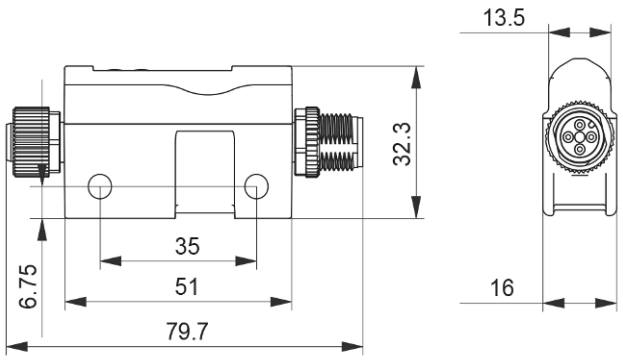
This can result in death or serious injury.

1. Observe the five safety rules!
2. Connect the device to the electricity supply.

NOTICE

Only use a power supply unit that allows max. 60 V DC or 25 V AC in the event of a fault. It must comply with SELV or PELV.

5.2 Dimensions



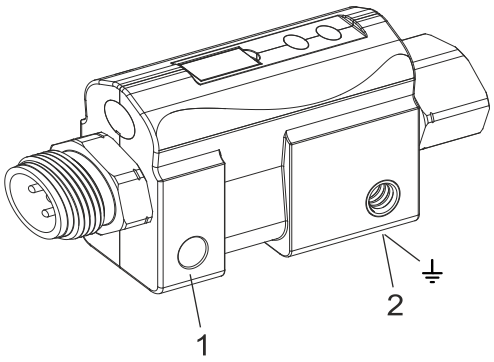
Dimensions specified in mm (1 mm = 0.03937")

5.3 Mounting

NOTICE

Material damage due to unsuitable mounting screws!

Use mounting screws according to the condition of the mounting surface.



1 = M5 mounting hole ⌀ 5.2 mm

2 = FE connector sleeve M5

M5 tightening torque 2.5 Nm

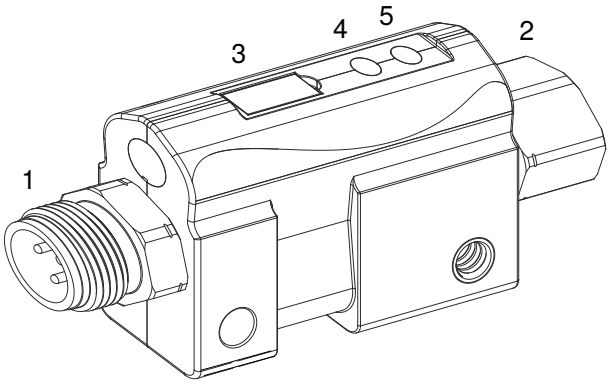
6 Installation

6.1 Connection

NOTICE

Material damage due to unsuitable mounting screws!

Use mounting screws according to the condition of the mounting surface.



1	IO-Link port M12 connector 4-pin A-coded	2	Sensor input M12 socket 5-pin A-coded
3	Identification label, replaceable	4	LED 1 device status/diagnosis
5	LED 2 IO-Link status		

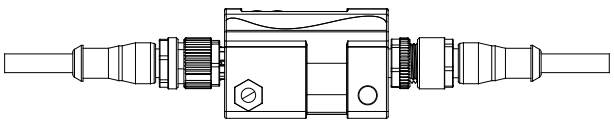
6.1.1 Connection Lines

⚠ CAUTION

Temperatures above 70 °C!

This can result in minor injuries and cable damage!

1. Wear heat-resistant gloves.
2. Only use thermally suitable lines.



M12 tightening torque 0.6 Nm

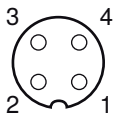
6.2 Analog Inputs

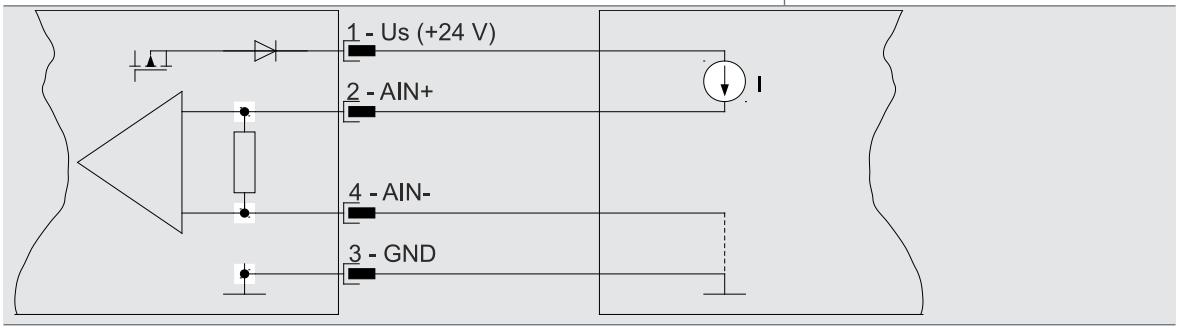
Usable Sensors

Depending on the adapter type: Sensors with analog output
0...20 mA / 4...20 mA / 0...10 V / +/−10 V

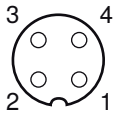
Sensors with Differential Connection

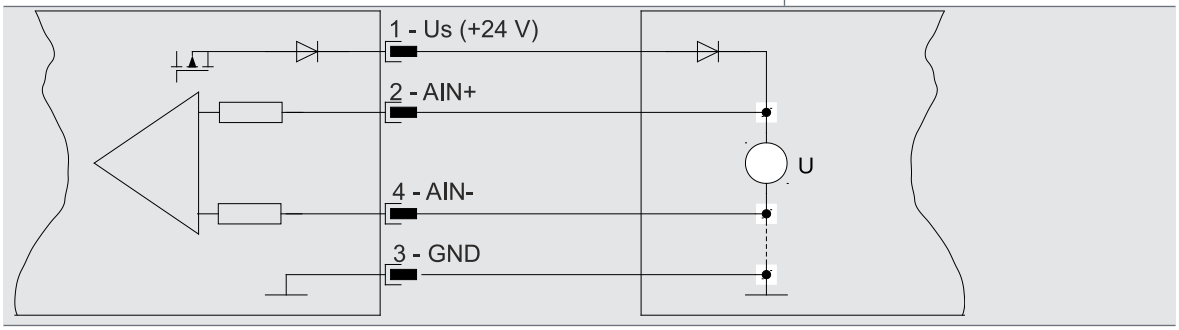
Sensors with current output (0/4 ... 20 mA)

Pin assignments		
	Pin 1	US, +24 V ⎓
	Pin 2	AIN+
	Pin 3	GND
	Pin 4	AIN
IN 0/4...20 mA		Sensor



Sensors with voltage output (0...10 V/+/- 10 V)

Pin assignments		
	Pin 1	US, +24 V ⎓
	Pin 2	AIN+
	Pin 3	GND
	Pin 4	AIN
IN 0/-10...+10 V		Sensor



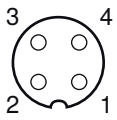
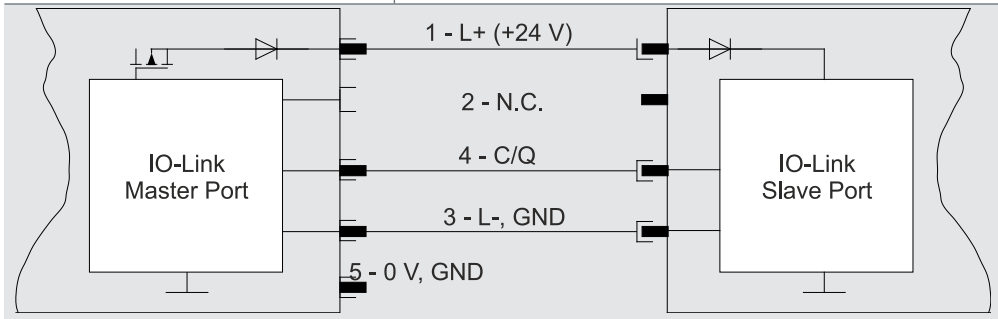
6.3 IO-Link Interface

Usable IO-Link Masters:

All IO-Link masters support IO-Link standard 1.12 or 1.0

IO-Link Interface Connection

Sensors with current output (0/4...20 mA)

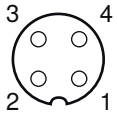
Pin assignments		
	Pin 1	L+ (+24 V ⎓)
	Pin 2	n. c.
	Pin 3	GND, L-
	Pin 4	IO-Link Data cable, C/Q
IO-Link master Port	IO-Link converter	
		

6.4 Pin Assignments

IO-Link M12 Plug A-Coded

AI		
	Pin 1	+24 V ⎓ (L+)
	Pin 2	n. c.
	Pin 3	GND (L-)
	Pin 4	C/Q, IO-Link data line

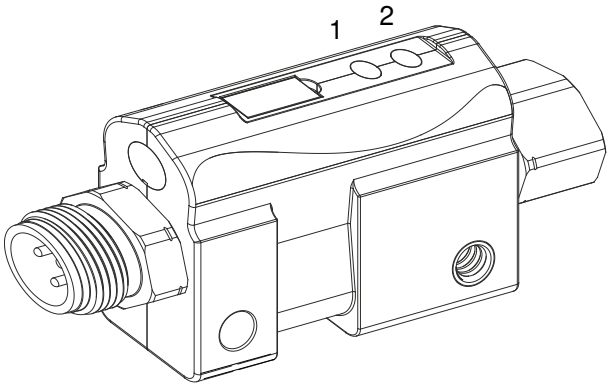
Analog Input M12 Socket A-Coded

AI		
	Pin 1	+Us
	Pin 2	A+
	Pin 3	GND (Analog Us)
	Pin 4	A-

7 Operation

7.1 LED Indicators

An IO-Link converter has 2 LEDs for status indication



1	LED 1 two-color red/green	2	LED 2 solid green

LED 1 Device Status

Bicolor Red/Green

Displays device and function-related status information.

- Green indicates the general device status.
- Red indicates the status of the analog channel.

NOTICE

If the red and green components light up simultaneously, the color of LED1 may appear orange.

7.1.1 LED 1

LED Display Green

Indicates the general device status.

LED display	LED status	Description
Green	Continuous light	Device is on, status OK.
Green	Flashing **1 Hz**	Device supply undervoltage (Ub <18 V)
Green	Flashing **2 Hz**	Device supply critical (Ub <12 V)

LED display	LED status	Description
Green	Asymmetrically flashing **(4 Hz/1 Hz)**	Device supply overvoltage (Ub >30 V)
Off		Device without power supply

LED Display Device Status Red

Indicates the status of the analog channel.

NOTICE

If several diagnoses occur simultaneously, the LED status is prioritized according to the order in the relevant table. The top entry has the highest priority.

Variant AI-U (0/-10…+10 V)

LED display	LED status	Description
Red	Flashing **1 Hz**	Input voltage outside the nominal measuring range / outside the parameterizable range
Red	Flashing **2 Hz**	Overcurrent sensor supply
Off		OK

Variant AI-I (0/4…20 mA)

LED display	LED status	Description
Red	Flashing **1 Hz**	Input current outside the nominal measuring range / outside the parametrrizable range
Red	Flashing **2 Hz**	Overcurrent sensor supply
Off		OK

7.1.2 LED 2

IO-Link Status

LED Solid Green

Shows the status of the IO-Link communication connection.

LED Indicator IO-Link Status Green

LED display	LED status	Description
Green	Continuous light	No IO-Link process data communication (pre-operate mode)

LED display	LED status	Description
 Green	Asymmetrically flashing **1 Hz** 250 ms On/750 ms Off	IO-Link process data communication (operate mode)
Off		No IO-Link communication

7.2 Parameter Data

7.2.1 IO-Link Object Directory

ISDU index	ISDU sub-index	Object name	Access	Length in bytes	Meaning/default value
Identification					
0x00	0x07	VendorID	R	2	0x0057
	0x08				
					Analog inputs
	0x09	DeviceID	R	3	0x00
	0x0A				0x00
	0x0B				0x35
0x10		VendorName	R	19	wenglor
0x11		VendorText	R	29	the innovative family
					Analog inputs
0x12		ProductName	R	30	EP1A001
0x13		ProductID	R	18	EP1A001
0x14		ProductText	R	64	IOL/Analog Converter, AI Multi U/I
0x15		SerialNumber	R	16	Consecutive serial number set in production
0x16		HardwareRevision	R	5	e.g. “01.00”
0x17		FirmwareRevision	R	10	e.g. “01.00.01-T”
0x18		ApplicationSpecific-Tag	RW	Max. 32	User-specific designation e.g. “System 3 / Port 4”
Diagnosis					
0x24		DeviceStatus	R	1	0: Device is working properly 1: Service is required 2: Out-of-specification 3: Function test 4: Error 5...255: Reserved
0x25		DetailedDeviceStatus	R	18	Current events
0x28		ProcessDataInput	R	2	Last valid process data
Parameterization					
0x40		ParamDiagnosisSetup	RW	2	0xC83E (I 0...20 mA) 0xC83E (I 4...20 mA) 0xC83E (U 0...10 V)

ISDU index	ISDU sub-index	Object name	Access	Length in bytes	Meaning/default value
					0xC83E (U -10...10 V)
0x41		ParamLowerLimit	RW	2	0x8000
0x42		ParamUpperLimit	RW	2	0x7FFF
0x43		ParamFilterTime	RW	1	0x00
0x44		ParamDeviceFunction	R (W)	1	0x01
0x45		DiagnosisState	R	4	Currently pending diagnostics and device status. The meaning of bits 0...15 corresponds to the meaning of bits 0...15 in ISDU IDX 0x40. Bits 16...31 are reserved and have no meaning for the user.
0x97		Processor Temperature	R	1	Processor die temperature

7.2.2 Object Description Analog Inputs

ISDU Index 0x40

The **ParamDiagnosisSetup** object

- is used for parameterization of the diagnostic events to be generated by the IO-Link converter.

A set bit activates the generation of the event in question.

AI-U/I Multi Parameterizable

The meaning of bits 0...15 in the object ParamDiagnosisSetup (ISDU IDX 0x40) depends on the parameterized channel function in the object ParamDeviceFunction (ISDU IDX 0x44). Depending on the parameterized channel function, the bit meanings apply.

Setting ISDU Idx 0x44	Channel mode	Valid diagnosis setup Definition corresponds to variant
0x01	AI U Unipolar 0...10 V	EP1A001 AI U 0...10 V
0x02	AI U Bipolar –10...+10 V	EP1A001 AI U –10...+10 V
0x03	AI I Unipolar 0...20 mA	EP1A001 AI I 0...20 mA
0x04	AI I Unipolar 4...20 mA	EP1A001 AI I 4...20 mA

7.2.3 Object Description

ISDU-Index 0x41

The **ParamLowerLimit** object

- is used for parameterization of the lower warning threshold, **below which** an IO-Link event is generated.

The scaling of the values corresponds to the scaling of the process data of the relevant selected channel function, see also **ParamDeviceFunction**. Only values from the nominal measuring range are permissible, see also process data.

Threshold monitoring affects the input process data sent to the master.

ISDU Index 0x42

The **ParamUpperLimit** object

- is used for parameterization of the upper warning threshold. If this is **exceeded**, an IO-Link event is generated.

The scaling of the values corresponds to the scaling of the process data of the relevant selected channel function, see also **ParamDeviceFunction**. Only values from the nominal measuring range are permissible, see also process data.

Threshold monitoring affects the input process data sent to the master.

ISDU-Index 0x43

The **ParamFilterTime** object

- is used for parameterization of the software filtering of the measured values. The IO-Link converters implement a simple moving average filter.
- specifies the length of the moving average in number of IO-Link cycles.

The filter acts on the measured values sent to the master.

ParamFilterTime	
Permissible range	
0	No averaging
1...64	Averaging over 1...64 measured values
Any other value results in an error message from the IO-Link converter	

ISDU-Index 0x44

The **ParamDeviceFunction** object

- is used for parameterization of the channel function of the IO-Link converter. The parameter is writeable and sets the channel function.

Permissible value range analog input	
Setting	Channel mode
0x01	Analog IN U Unipolar 0...10 V (default)
0x02	Analog IN U Bipolar −10...+10 V
0x03	Analog IN I Unipolar 0...20 mA
0x04	Analog IN I Unipolar 4...20 mA
Any other value results in an error message from the IO-Link converter.	

8 Diagnosis

8.1 IO-Link Events

Depending on the set channel function, certain IO-Link events are available that the device can send.

Event code	Description	Device status (ISDU IDX 0x24)	Event type	Qualifier	Comment/note
		General events			
0x0000	No malfunction	0	Notification	appearing disappearing	
0x4210	Device overtemperature	2	Warning	appearing disappearing	corresponds to bit 3 in ISDU Idx 0x40
0x5110	Primary device supply Overvoltage – check tolerance	2	Warning	appearing disappearing	If Ub >30 V corresponds to bit 4 in ISDU Idx 0x40
0x5111	Primary device supply Undervoltage – check tolerance	2	Warning	appearing disappearing	If Ub <18 V corresponds to bit 5 in ISDU Idx 0x40
0x6320	Parameter error – check data sheet and/or values	4	Error	appearing disappearing	When an invalid value has been written to a parameter (should not happen)

Since there is no PNIO integration for IO-Link, the specified event codes of the IO-Link spec. 1.1 correctly on PNIO diagnoses, the ISDU index 0x45 must also be read out.

Event code	Description	Device status (ISDU IDX 0x24)	Event type	Qualifier	Comment/note
		Manufacturer-specific events			
0x1800	Manufacturing data range contains invalid data	4	Error	appearing disappearing	Cannot be masked by event parameterization in ISDU Idx 0x40
0x1801	Parameter data range contains invalid data	4	Error	appearing disappearing	Cannot be masked by event parameterization in ISDU Idx 0x40
0x1802	Lower warning threshold not reached	2	Warning	appearing disappearing	Corresponds to bit 1 in ISDU Idx 0x40
0x1803	Upper warning threshold exceeded	2	Warning	appearing disappearing	corresponds to bit 2 in ISDU Idx 0x40
0x1804	Overload current on the power supply	4	Error	appearing disappearing	corresponds to bit 11 in ISDU Idx 0x40
0x1805	Analog input overdriving – Check sensor signal	2	Warning	appearing disappearing	corresponds to bit 15 in ISDU Idx 0x40
0x1806	Analog input underdriving – Check sensor signal	2	Warning	appearing disappearing	corresponds to bit 14 in ISDU Idx 0x40

Validity Matrix for IO-Link Events

The following table shows the availability of the events.

Channel function analog inputs

Bits ISDU IDX 0x40	AI U 0…10 V	AI U -10…10 V	AI I 0…20 mA	AI I 4…20 mA
15	Overdriving U_{IN} >10 V	Overdriving U_{IN} >10 V	Overdriving I_{IN} >20 mA	Overdriving I_{IN} >20 mA
14	Underdriving U_{IN} <0 V	Underdriving U_{IN} < -10 V	Underdriving I_{IN} <0 mA	Underdriving I_{IN} <4 mA
13	Reserved	Reserved	Reserved	Reserved
12	Reserved	Reserved	Reserved	Reserved
11	Overcurrent Sensor power supply	Overcurrent Sensor power supply	Overcurrent Sensor power supply	Overcurrent Sensor power supply
10	Reserved	Reserved	Reserved	Reserved
9	Reserved	Reserved	Reserved	Reserved
8	Reserved	Reserved	Reserved	Reserved
7	Reserved	Reserved	Reserved	Reserved
6	Reserved	Reserved	Reserved	Reserved
5	Undervoltage Supply (Ub <18 V)	Undervoltage Supply (Ub <18 V)	Undervoltage Supply (Ub <18 V)	Undervoltage Supply (Ub <18 V)
4	Overvoltage Supply (Ub >30 V)	Overvoltage Supply (Ub >30 V)	Overvoltage Supply (Ub >30 V)	Overvoltage Supply (Ub >30 V)
3	Over-temperature T(uC) >85 °C	Over-temperature T(uC) >85 °C	Over-temperature T(uC) >85 °C	Over-temperature T(uC) >85 °C

8.2 Process Data

Analog Input I 0…20 mA

Value		Measured value	Range
Dec.	**Hex.**	**0…20 mA**	
32767	7FFF	>23.5178 mA	Overflow
32511	7EFF	23.5178 mA	Overdrive range
27649	6C01	20.0007 mA	
27648	6C00	20.0000 mA	Nominal range
1	0001	723.4 nA	
0	0000	0 µA	
-1	FFFF	–723.4 nA	Underdrive range
-4864	ED00	–3.5185 mA	
-32768	8000	<-3.5185 mA	Underflow

Analog Input I 4…20 mA

Value		Measured value	Range
Dec.	**Hex.**	**4…20 mA**	
32767	7FFF	>22.8142 mA	Overflow
32511	7EFF	22.8142 mA	Overdrive range

Value		Measured value	Range
27649	6C01	20.0006 mA	
27648	6C00	20.0000 mA	Nominal range
1	0001	4 mA +578.7 nA	
0	0000	4 mA	
-1	FFFF	4 mA –578.7 nA	Underdrive range
-4864	ED00	1.1852 mA	
-32768	8000	<1.1852 mA	Underflow

Analog Input U 0…10 V

Value		Measured value	Range
Dec.	**Hex.**	**0…10 V**	
32767	7FFF	>11.7589 V	Overflow
32511	7EFF	11.7589 V	Overdrive range
27649	6C01	10.0004 V	
27648	6C00	10.0000 V	Nominal range
1	0001	361.7 µV	
0	0000	0 uV	
-1	FFFF	–361.7 µV	Underdrive range
-4864	ED00	–1.7593 V	
-32768	8000	<-1.7593 V	Underflow

Analog Input U –10…+10 V

Value		Measured value	Range
Dec.	**Hex.**	**0…10 V**	
32767	7FFF	>11.7589 V	Overflow
32511	7EFF	11.7589 V	Overdrive range
27649	6C01	10.0004 V	
27648	6C00	10.0000 V	Nominal range
1	0001	361.7 µV	
0	0000	0 µV	
-1	FFFF	–361.7 µV	
-27648	9400	–10.0000 V	
-27649	93FF	–10.0004 V	Underdrive range
-32512	8100	–11.7593 V	
-32768	8000	<-11.7593 V	Underflow

NOTICE

The process data is transferred in big endian order.

Filter Description

A FIR filter is implemented for analog signals or output values:

$$\frac{1}{N}\sum_{k=0}^{N-1} x\,[n-k]$$

Symbol	Explanation
y(n)	Filtered value at time point n
x(n)	Output value/measured value at time n
x(n-k	k-th predecessor of the output value/measured value at time n
N	Filter time in number of IO-Link cycles

If the input value or the specified process data changes suddenly, the filtered value increases linearly until the end value is reached after N IO-Link cycles.

Example: With a cycle time of 2.3 ms and a filter time of N = 10, the end value is read in/out after 23 ms.

9 Maintenance Instructions

NOTICE

This wenglor product is maintenance-free.

Cleaning and inspection of the plug connections at regular intervals are advisable.

Do not clean the product with solvents or cleaning agents that could damage the product.

The product must be protected against contamination during initial start-up.

10 Proper Disposal

wenglor sensoric GmbH does not accept the return of unusable or irreparable products. Respectively valid national waste disposal regulations apply to product disposal.

11 Declarations of Conformity

Declarations of conformity can be found on our website at www.wenglor.com in the product's separate download area.