



Operating Manual

CC50I.AIM/CC50I.AOM
IO-Link converter

EN-US

1 About this document

1.1 Purpose and scope of application

This document instructs the technical staff of the machine manufacturer or machine operator on the safe use of the described devices.

It does not include instructions on the safe use of the machine in which the devices are integrated. Information on this is found in the operating manual of the machine.

- Read this chapter carefully before you start working with the device.
- Study the documentation carefully before device commissioning.
- Store the manual in a place that is accessible to all users at all times for the entire service life of the device.

Understanding the present manual requires general knowledge about automation technology. In addition, planning and using automation systems requires technical knowledge which is not included in this manual.

1.2 Applicable documents



- Available for download at www.baumer.com:
 - Instruction manual
 - Data sheet
 - Device description file
 - EU Declaration of Conformity
 - Certificates and Approvals
- Attached to product:
 - General information sheet (11042373)

1.3 Labels in this manual

Identifier	Usage	Example
<i>Dialog element</i>	Indicates dialog elements.	Click the OK button.
<i>Unique name</i>	Indicates the names of products, files, etc.	<i>Internet Explorer</i> is not supported in any version.
Code	Indicates entries.	Enter the following IP address: 192.168.0.250

1.4 Warnings in this manual

Warnings draw attention to potential personal injury or material damage. The warnings in this manual indicate different hazard levels:

Symbol	Warning term	Explanation
	DANGER	Indicates an imminent potential danger with high risk of death or serious personal injury if not being avoided.
	WARNING	Indicates potential danger with medium risk of death or (serious) personal injury if not being avoided.
	CAUTION	Indicates a danger with low risk, which could lead to light or medium injury if not avoided.
	NOTE	Indicates a warning of material damage.
	INFO	Indicates practical information and tips that enable optimal use of the devices.

1.5 Trademarks

The present documentation uses the trademarks of the following companies and institutions:

IO-Link

c/o PROFIBUS User Organisation e.V. (PNO)

2 General information

Intended use

The device has been designed and manufactured for:

- Communication and process control
- General tasks in control and automation
- To be operated in ambient conditions as specified in the data sheet
- For industrial use up to protection IP67/IP69K

Intended use includes EMC-compliant electrical installation.

Commissioning

Assembly, installation, and calibration of this product may only be performed by a specialist.

Installation

Only use the fasteners and fastener accessories intended for this product for installation. Outputs not in use must not be wired. Unused wires of cable outputs must be insulated. Do not go below the permissible cable bending radii. Disconnect the system from power before the product is electrically connected. Use shielded cables to prevent electro-magnetic interference. If the customer assembles plug connections on shielded cables, then EMC-version plug connections should be used and the cable shield must be connected to the plug housing across a large surface area.

Disposal (environmental protection)



Used electrical and electronic devices may not be disposed of in household waste. The product contains valuable raw materials that can be recycled. Therefore dispose of this product at the appropriate collection point. For additional information visit www.baumer.com.

3 Safety

3.1 General safety instructions



⚠ DANGER

High electrical voltage in the machine/system.

Death or severe injuries resulting from electric shock.

- a) While working on the machine/devices, comply with the five safety rules of electrical engineering.

Protection of persons and material assets

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

The 5 Safety Rules

Protect against *high electrical voltage*

1. Switch off the device.
2. Secure against unwanted switchon.
3. Ensure that each pole is not live respectively under voltage.
4. Grounding and short-circuiting.
5. Cover or block neighboring parts under voltage.

Qualified personnel

The appliance may only be installed, commissioned and operated by qualified personnel who have received safety training.

Qualified means fulfilling the following requirements:

- the personnel underwent suitable training in electrical engineering,
- the personnel is familiar with the safety standards which are common practice in automation engineering,
- the personnel has access to the Operating instructions and the present Instruction Manual,
- are familiar with the safety standards of automation technology,
- the personnel is familiar with the related and applicable basic and technical standards.

Intended use of the device

- During project engineering, installation, commissioning, operation, and testing of the device comply with the existing regulations on accident prevention as well as health and safety at work.
- Check material resistance against aggressive media.



INFO

Any manipulation/modification of hardware and software only qualified *Baumer* personnel, except for firmware updates.

4 Description

IO-Link converter Analog input (CC50I.AIM)

- Input M12 female connector A-coded
- IO-Link M12 connector A-coded
- Resolution 16 bits
- Accuracy 0.1 %
- Drift 45 ppm
- Sampling rate ≤ 200 Hz



IO-Link converter Analog output (CC50I.AOM)

- Output M12 female connector A-coded
- IO-Link M12 connector A-coded
- Resolution 16 bits
- Accuracy 0.1 %
- Drift 45 ppm
- Conversion rate ≤ 200 Hz



5 Technical data

5.1 Electrical Data

Module supply		
Operating voltage IO-Link	Via pin 1	24 V
Operating voltage range US	Via pin 1	18 ... 30 V
Power consumption	U _b = 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
IO-Link transmission protocol		Version 1.1
Cycle time		≥2.3 ms
Port class		Class A
Data length	Process data resolution	16-bit / 2-byte
Sensor supply +		
Sensor supply current		≤200 mA
Sensor supply output range		17 ... 29.8 V
Input		
Temperature drift		45 ppm / °K
Transformation principle	ADC	Sigma-Delta
Resolution	ADC	24 bits
	Process data	16 bits
Sampling rate		≤200 Hz
Filter	Process data, averaging throughout 0...64 IO-Link cycles	Yes, averaging is capable of parameterization
Sensor cable		<30 m
Output		
Temperature drift		45 ppm / °K
Transformation principle	DAC	SAR
Resolution	DAC	24 bits
	Process data	16 bits
Sampling rate		≤200 Hz
Filter	Process data, averaging throughout 0...64 IO-Link cycles	Yes, averaging is capable of parameterization
Sensor cable		<30 m

5.2 Analog inputs

Measuring range parameterizable				
Variants	Nominal measuring range	Maximum 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
3	0 ... 10 V	0 ... 11.76 V	100 Ω	361.7 μV
4	-10 ... +10 V	-11.76 ... +11.76 V	100 Ω	361.7 μV

5.3 Analog outputs

Parameterizable output ranges			
Variants	Nominal output range	Max. Output range	Value 1 LSB
1	0 ... 20 mA	0 ... 22.81 mA	348 nA
2	4 ... 20 mA	4 ... 22.81 mA	348 nA
3	0 ... 10 V	0 ... 11.76 V	361.7 μV
4	-10 ... +10 V	-11.76 ... +11.76 V	361.7 μV

5.4 Measuring accuracy

Measuring accuracy	At 25 °C (full deflection)	
	Analog inputs	Analog outputs
0 ... 20 mA	0.1 %	0.1 %
4 ... 20 mA	0.1 %	0.1 %
0 ... 10 V	0.1 %	0.1 %
-10 ... +10 V	0.2 %	0.1 %

5.5 Ambient conditions

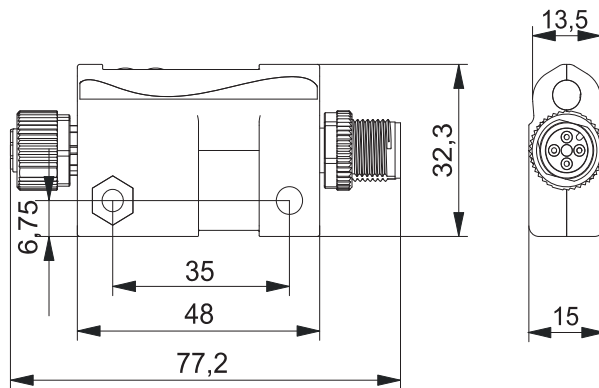
Mechanical		
Oscillation test	EN 60068 Part 2-6	10 ... 58 Hz, vibration amplitude 0.35 mm, 58 ... 150 Hz; 20 g
Shock test	EN 60068 Part 2-27	50 g, duration 11 ms, 3 axes
Climate		
Storage temperature		-40 °C ... +85 °C
Operating temperature		-30 °C ... +70 °C
Ambient temperature	UL 61010	-30 °C ... +70 °C
Climate class	EN 60721	3K3
Installation height	Above sea level	≤2000 m
Relative humidity		≤85 %
Electrical safety		
Protection	All connections established	IP67
Overvoltage category		II
Level of contamination		3
EMC emission		
Radio interference emission	EN 61000-6-4	30 ... 230 MHz 40 dB μ V/m (@10 m) 230 ... 1000 MHz 47 dB μ V/m (@10 m)
EMC-immunity		
Electromagnetic HF fields	EN 61000-4-3	80 ... 1000 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 precision 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

5.6 Protection

Device protection		
Reverse polarity protection Module supply		Yes, always on
Reverse polarity protection Sensor supply		Yes, always on
Regenerative power supply Sensor supply		Yes, always on
Short-circuit protection sensor supply		Yes, always on
Overvoltage protection input analog		Yes, 30 V DC
Reverse polarity protection Analog input		Yes, always on

5.7 Mechanical data

Material data		
Housing		Plastic PC + PBT
M12 female / mating connector Knurled nut / knurled screw		Zinc casting with Cu/Ni finish
FE connection sleeve		Brass with Cu/Ni finish



5.8 Product reliability

Analog inputs


Product reliability		
MTTF	SN 29500 (at 40 °C and rated data)	209 years

Analog outputs

Product reliability		
MTTF	SN 29500 (at 40 °C and rated data)	189 years

5.9 Conformity, Approvals

Conformity, Approvals		
Product standard	EN 61131-2, EN 61131-9 Programmable logic controllers	
CE	2014/30/EU 2011/65/EU	
UKCA		
ULus	UL 61010-2-201, UL 61010-1	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	GB/T 26572	25 EPUP

Hazardous substance (有害物質)							
	Part Name 零件名稱	Lead (Pb) 鉛	Mercury (Hg) 汞	Cadmium (Cd) 鎘	Hexavalent Chromium (Cr (VI)) 六价铬	Polybrominated biphenyls (PBB) 多溴联苯	Polybrominated diphenyl ethers (PBDE) 多溴联苯醚
	Component part PCB ^{1 2} 組件部分 印刷电路板	X	0	0	0	0	0
	Connection Terminal / Screws / Housing ³ 接线端子 / 拧 / 外壳	X	0	0	0	0	0
0: Indicates that the content of the harmful substance in all homogeneous materials of the component part is below the limit defined in GB/T 26572. 0: 表明該有害物質在組成部分的所有均質材料的含量低於按GB/ T26572定義的限制。 X: Indicates that the content of the harmful substance in at least one homogeneous material of the component part exceeds the limit defined in GB/T 26572. X: 表示該有害物質在組成部分中的至少一個均質材料的含量超過按GB / T26572定義的限制。							

¹ EU RoHS Directive 2011/65/EU, Annex III: Exemption 7(a) Lead in high melting temperature type solders (i.e., lead-based alloys containing 85 % by weight or more lead)

² EU RoHS Directive 2011/65/EU, Annex III: Exemption 7(c)-I Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g., piezoelectronic devices, or in a glass or ceramic matrix compound.

³ EU RoHS Directive 2011/65/EU, Annex III: Exemption 6(c) Copper alloy containing up to 4 % lead by weight.

6 Installation

6.1 Requirements

Installation requirements:

- Mounting point in immediate vicinity of sensor/actuator.
- Even mounting surface to avoid mechanical tension.
- Earthed mounting surface for earthing of ring terminal.
- Short cable distance to all components.
- Sufficient space to ease replacement and plug-in connections.
- Suitable installation site in terms of vibration and shock load, temperature and humidity (see Technical data).
- Protected site to prevent connection cables from being torn off accidentally.
- Diagnostic LEDs visible in operation.

⚠ DANGER

High electrical voltage in the machine/system.

Death or severe injuries resulting from electric shock.

- a) While working on the machine/devices, comply with the five safety rules of electrical engineering.



INFO

Only use a power unit capable of limiting voltage to max. 60 VDC resp. 25 AC at the occurrence of error. Power supply must comply with SELV or PELV.

6.2 Sensor attachment

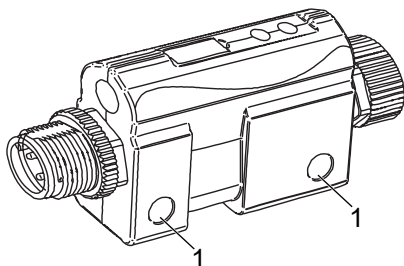


⚠ WARNING

Material damage due to incorrect installation.

Use fastening screws that are appropriate for the mounting surface.

- a) Fastening screws and tightening torques depend on mounting surface.
- b) Tighten the screws carefully. Observe the specified tightening torques.

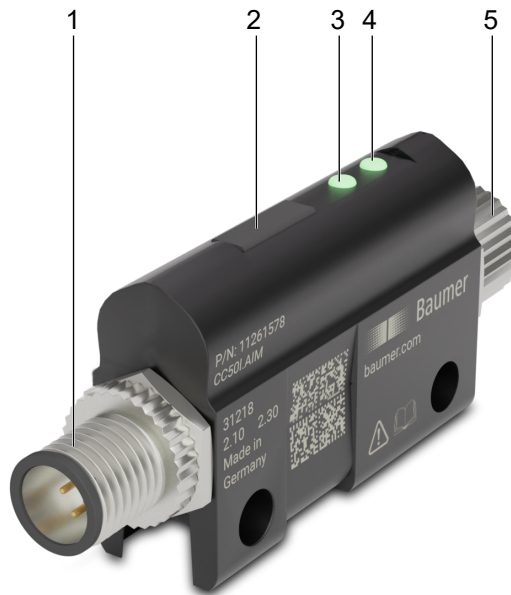


III. 1: Sensor attachment

1 M5 mounting hole Ø 5.2 mm

7 Installation

7.1 Connection



III. 2: Device structure

1	IO-Link port 4-pin M12 connector A-coded	2	Product label, can be exchanged
3	LED 1 Device status / diagnostics	4	LED 2 IO-Link status
5	Sensor input M12 female connector 5-pin A-coded		

7.2 Connection lines

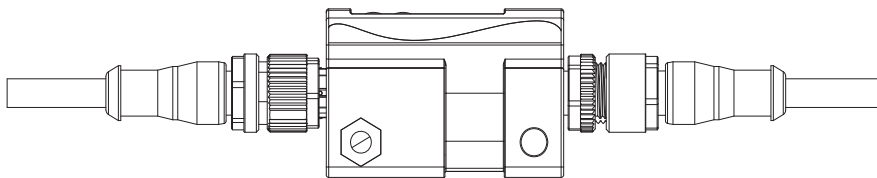


⚠ CAUTION

Hot surface.

Minor personal injuries and damage to the device when contacting hot surfaces.

- a) Wear suitable isolating gloves.
- b) Only use connection cables that meet thermal requirements.



M12	0.6 Nm		Art.-No. 11238694
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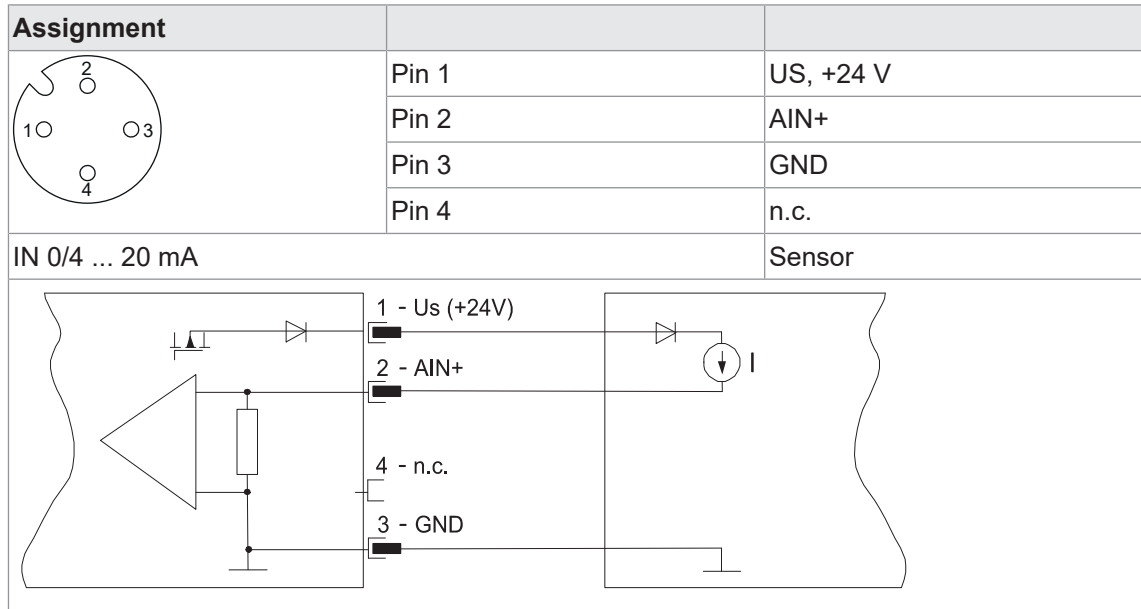
7.3 Analog inputs

Usable sensors

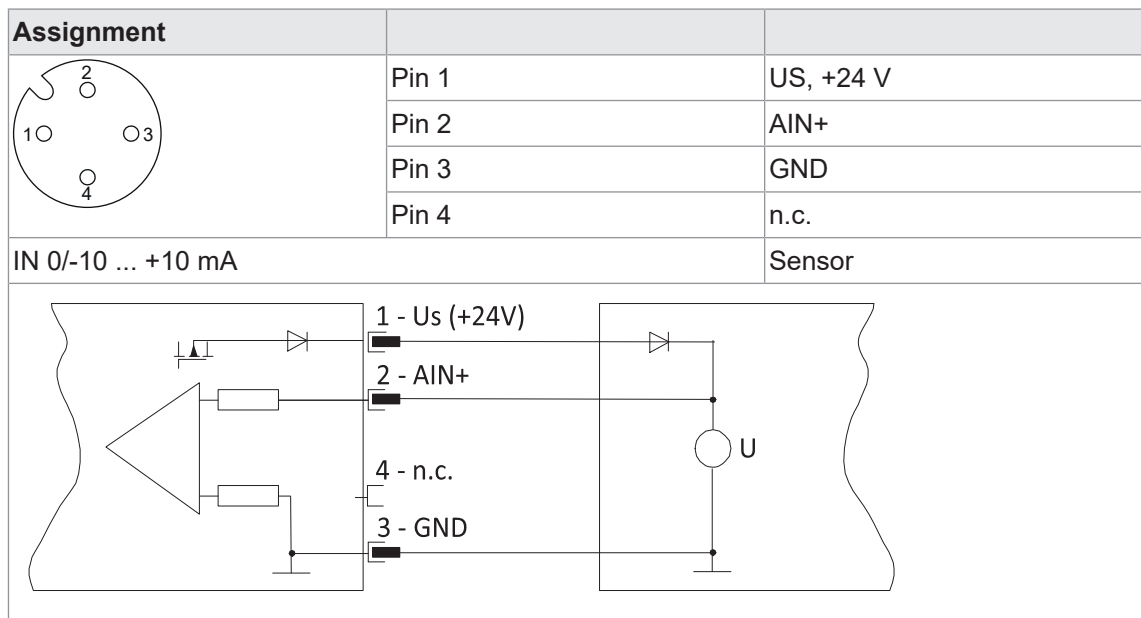
- Sensors with analog output 0 ... 20 mA; 4 ... 20 mA; 0 ... 10 V; +/-10 V

7.3.1 Converter with single-wire connection

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



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



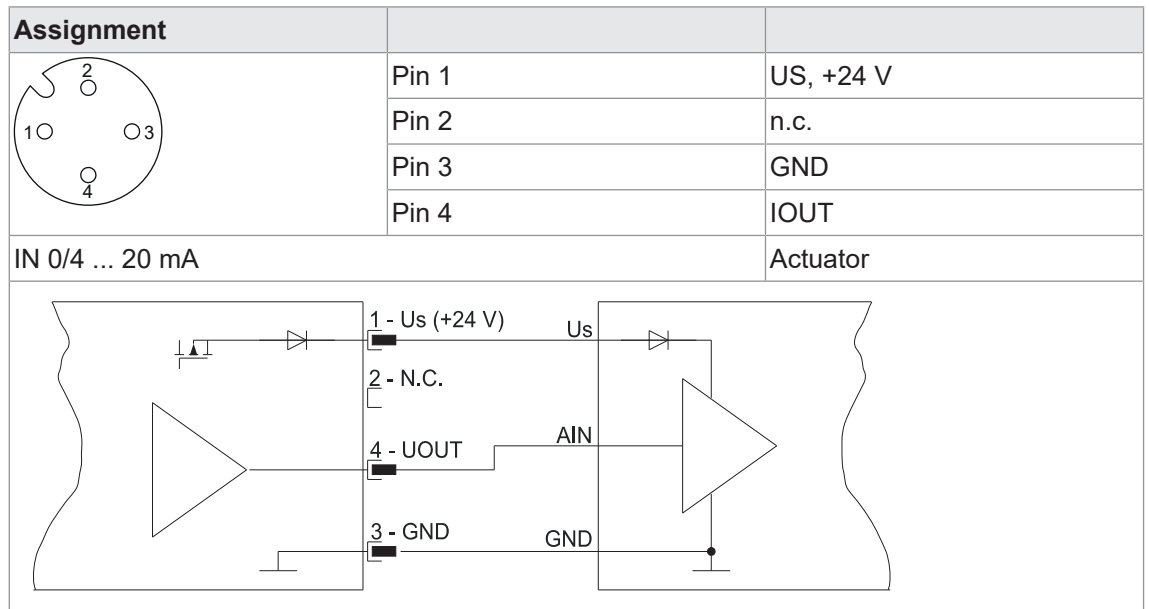
7.4 Analog outputs

Usable actuators for any variant

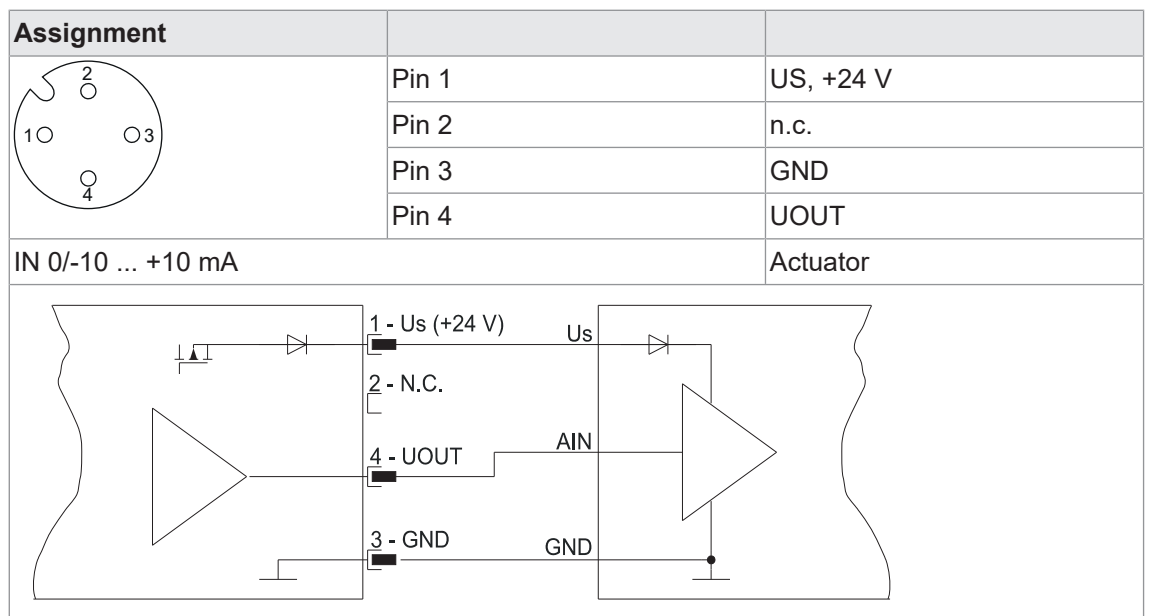
- Adaptor-specific: actuators with analog input 0 ... 20 mA; 4 ... 20 mA; 0 ... 10 V; +/-10 V

7.4.1 Actuator connection

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



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



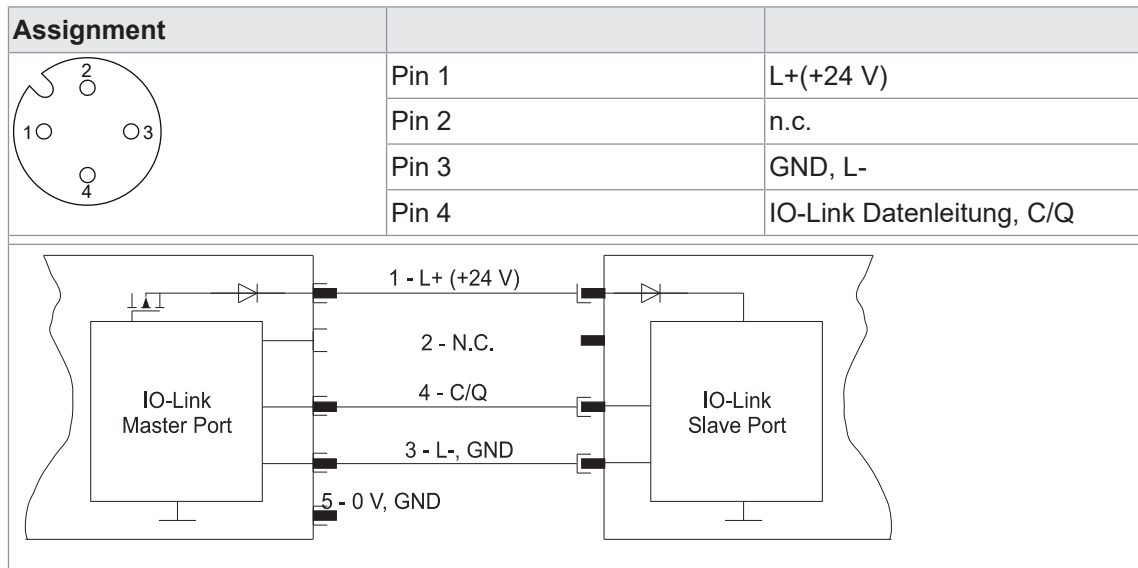
7.5 IO-Link interface

Usable IO-Link masters

- Any IO-Link master supporting IO-Link standard 1.12 or 1.0

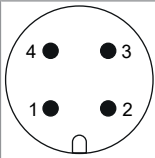
7.5.1 IO-Link interface port

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

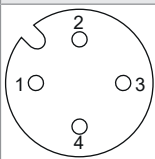


7.6 Pin assignment

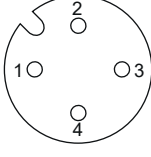
IO-Link M12 plug A-coded

AIM / AOM		
	Pin 1	+24 V
	Pin 2	n.c.
	Pin 3	GND, L-
	Pin 4	IO-Link data cable, C/Q

Input Analog M12 female connector A-coded, single wire variants

AIM		
	Pin 1	+US
	Pin 2	AIN (U/I)
	Pin 3	GND (Analog Us)
	Pin 4	n.c.

Output analog M12 female connector A-coded, all variants

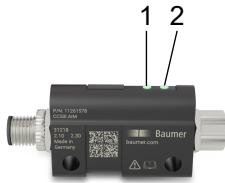
AOM		
	Pin 1	+US
	Pin 2	n.c.
	Pin 3	GND (Analog Us)
	Pin 4	AOUT (U/I)

8 Operation

8.1 LED indicator

LED indicators

The IO-Link converter features 2 LEDs for status indication.



1 LED 1 bicolor red/green

2 LED 2 monicolor green

LED 1 Device status

Bicolor red/green:

- Provides device and function-related status information.
- Green indicates the overall device status.
- Red indicates the analog channel status.








INFO

Red and green being on at the same time, LED1 may look amber.

8.1.1 LED 1

LED green

Indicates the overall device status.

Indicator	Status	Description
 Green	On continuous	Device power on, status ok.
 Green	Flashing at 1 Hz	Device supply undervoltage ($U_b < 18\text{ V}$)
 Green	Flashing at 2 Hz	Device supply critical ($U_b < 12\text{ V}$)
 Green	Flashing irregularly (4 Hz/1 Hz)	Device supply Overvoltage ($U_b > 30\text{ V}$)
 Off	Off	No power supply present.

Tab. 1: Device status

8.1.2 LED 1 red






INFO

Indicates the analog channel status




Several diagnostics occurring all at once, the LED indicator will prioritize the status according to the order in the related table. Top entry has highest priority.

Variant AI-U 0/-10 ... +10 V

Indicator	Status	Description
 Red	Flashing at 1 Hz	Input voltage outside the nominal measuring range / outside the parameterizable range
 Red	Flashing at 2 Hz	Overcurrent in sensor supply
 Off	Off	OK





Tab. 2: Device status AI-U 0 /-10 ... +10 V

Variant AI-I 0/4 ... +20 V

Indicator	Status	Description
 Red	Flashing at 1 Hz	Input current outside the nominal measuring range / outside the parameterizable range
 Red	Flashing at 2 Hz	Overcurrent in sensor supply
 Off	Off	OK





Tab. 3: Device status AI-I 0/4 ... 20 mA

Variant AO-U 0/-10 ... +10 V

Indicator	Status	Description
 Red	Flashing at 1 Hz	Voltage specification outside the nominal output range / outside the parameterizable range
 Red	Flashing at 2 Hz	Overcurrent in sensor supply
 Red	Flashing irregularly (4 Hz /1 Hz)	Channel error $U_{out} > U_{soll}$ / Channel error $U_{out} < U_{soll}$
 Off	Off	OK

Tab. 4: Device status AO U 0/-10 ... +10 V

Variant AO-I 0/4 ... 20 mA




Indicator	Status	Description
 Red	Flashing at 1 Hz	Current output outside the nominal output range / outside the parameterizable range
 Red	Flashing at 2 Hz	Overcurrent in sensor supply
 Red	Flashing irregularly (4 Hz / 1 Hz)	Cable break
 Off	Off	OK

Tab. 5: Device status AO I 0/4 ... 20 mA

8.1.3**LED 2****IO-Link status**

LED monochrome green

- Provides the IO-Link communication status.

Indicator	Status	Description
 Green	On continuous	No IO-Link process data communication (pre-operate mode)
 Green	Flashing irregularly 1 Hz 250 ms On/750 ms Off	IO-Link process data communication (operate mode)
 Off	Off	No IO-Link communication

Tab. 6: LED indicator IO-Link on green

8.2**Process data****8.2.1****IO-Link object directory****Identification**

ISDU Index	ISDU Subindex	Object name	Access	Length in bytes	Meaning/0xdefault value	
0x00	0x07	VendorID	R	2	0x015E	
	0x08					
	0x09	DeviceID	R	3	Analog inputs	Analog outputs
	0x0A				0x18AA7	0x18AA9
0x0B						
0x10		VendorName	R	19	Baumer	
0x11		VendorText	R	29	www.baumer.com	
0x12		ProductName	R	30	CC50I.AIM	CC50I.AOM
0x13		ProductID	R	18	11261578	11261579
0x14		ProductText	R	64	IOL/Analog Converter, AI Multi U/I	IOL/Analog Converter, AO Multi U/I
0x15		SerialNumber	R	16	Consecutive serial number, set by default	

ISDU Index	ISDU Subindex	Object name	Access	Length in bytes	Meaning/0xdefault value	
0x16		HardwareRevision	R	5	e.g. "01.00"	
0x17		FirmwareRevision	R	10	e.g. "01.00.01-T"	
0x18		ApplicationSpecificTag	R	Max. 32	User-specific name, e.g. "System 3 / Port 4"	
0x24		DeviceStatus	R	1	Value	Definition
					0	Device is working properly
					1	Maintenance required
					2	Outside specification
					3	Functional test
					4	Error
					5-255	Reserved
0x25		DetailedDeviceStatus	R	18	Currently present events	
0x28		ProcessDataInput	R	2	Recently valid process data (AI types only)	
0x29		ProcessDataOutput	R	2	Recently valid process data (AO types only)	

Parameterization

ISDU Index	ISDU Subindex	Object name	Access	Length in bytes	Meaning/0xdefault value	
0x40		ParamDiagnosisSetup	RW	2	CC50I.AOM: <ul style="list-style-type: none"> ▪ 0xCC3E (I 0...20 mA) ▪ 0xCC3E (I 4...20 mA) ▪ 0xC8FE (U 0...10 V) ▪ 0xC8FE (U -10...10 V) CC50I.AIM: <ul style="list-style-type: none"> ▪ 0xC83E (I 0...20 mA) ▪ 0xC83E (I 4...20 mA) ▪ 0xC83E (U 0...10 V) ▪ 0xC83E (U -10...10 V) 	
0x41		ParamLowerLimit	RW	2	0x8000	
0x42		ParamUpperLimit	RW	2	0x7FFF	
0x43		ParamFilterTime	RW	1	0x00	
0x44		ParamDeviceFunction	RW	1	Value	Definition
					06	Analog Out U Unipolar 0..10V
					07	Analog Out U Bipolar -10..10V
					08	Analog Out I Unipolar 0..20mA
					09	Analog Out I Unipolar 4..20mA
0x45		DiagnosisState	R	4	Currently pending diagnostics and device status. 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 to users.	
0x97		Processor Temperature	R	1	Processor temperature Dies	

8.2.2 Object description Analog inputs

ISDU-Index 0x40

Object *ParamDiagnosisSetup*

- is used to parameterize the diagnostic events that the IO-Link converter should generate.

A set bit activates the generation of the relevant event.

AI-I-0 ... 20 mA unipolar

Bit 15 ... 0	Description
Bit 0	Reserved
Bit 1	Below minimum alert threshold
Bit 2	Maximum alert threshold exceeded
Bit 3	Overtemperature T(uC) >85 °C
Bit 4	Overvoltage in supply (Ub >30 V)
Bit 5	Undervoltage in supply (Ub <18 V)
Bit 6	Reserved
Bit 7	Reserved
Bit 8	Device defective
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Overcurrent in sensor supply
Bit 12	Reserved
Bit 13	Reserved
Bit 14	$I_{IN} < 0$ mA underdrive
Bit 15	$I_{IN} > 20$ mA overdrive

AI-I-4 ... 20 mA unipolar

Bit 15 ... 0	Description
Bit 0	Reserved
Bit 1	Below minimum alert threshold
Bit 2	Maximum alert threshold exceeded
Bit 3	Overtemperature T(uC) >85 °C
Bit 4	Overvoltage in supply (Ub >30 V)
Bit 5	Undervoltage in supply (Ub <18 V)
Bit 6	Reserved
Bit 7	Reserved
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Overcurrent in sensor supply
Bit 12	Reserved
Bit 13	Reserved
Bit 14	$I_{IN} < 4$ mA underdrive
Bit 15	$I_{IN} > 20$ mA overdrive

AI-U-0...10 V unipolar

Bit 15 ... 0	Description
Bit 0	Reserved
Bit 1	Below minimum alert threshold
Bit 2	Maximum alert threshold exceeded
Bit 3	Overtemperature T(uC) >85 °C
Bit 4	Overvoltage in supply (Ub >30 V)
Bit 5	Undervoltage in supply (Ub <18 V)
Bit 6	Reserved
Bit 7	Reserved
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Overcurrent in sensor supply
Bit 12	Reserved
Bit 13	Reserved
Bit14	$U_{IN} < 0$ V underdrive
Bit 15	$U_{IN} > 10$ mA overdrive

AI-U -10 ... +10V bipolar

Bit 15 ... 0	Description
Bit 0	Reserved
Bit 1	Below minimum alert threshold
Bit 2	Maximum alert threshold exceeded
Bit 3	Overtemperature T(uC) >85 °C
Bit 4	Overvoltage in supply (Ub >30 V)
Bit 5	Undervoltage in supply (Ub <18 V)
Bit 6	Reserved
Bit 7	Reserved
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Overcurrent in sensor supply
Bit 12	Reserved
Bit 13	Reserved
Bit14	$U_{IN} < -10$ V underdrive
Bit 15	$U_{IN} > 10$ mA overdrive

AI-U/I capable of multiple parameterization

Significance of bits 0 ... 15 in object *ParamDiagnosisSetup* (ISDU IDX 0x40) depends on the parameterized channel function in object *ParamDeviceFunction* (ISDU IDX 0x44).

Bit significance applied depends on the parameterized channel function.

Setting ISDU Idx 0x44	Channel mode	Valid definition of DiagnosisSetup according to variant
0x01	AI U Unipolar 0 ... 10 V	AI U 0 ... 10 V
0x02	AI U Bipolar -10 ... +10 V	AI U -10 ... +10 V
0x03	AI I Unipolar 0 ... 20 mA	AI I 0 ... 20 mA
0x04	AI I Unipolar 4 ... 20 mA	AI I 4 ... 20 mA

8.2.3 Object description Analog outputs

ISDU-Index 0x40

Object *ParamDiagnosisSetup*

- is used to parameterize the diagnostic events that the IO-Link converter should generate.

A set bit activates the generation of the relevant event.

AO-I-0 ... 20 mA unipolar

Bit 15 ... 0	Description
Bit 0	Reserved
Bit 1	Below minimum alert threshold
Bit 2	Maximum alert threshold exceeded
Bit 3	Overtemperature T(uC) >85 °C
Bit 4	Overvoltage in supply (Ub >30 V)
Bit 5	Undervoltage in supply (Ub <18 V)
Bit 6	Reserved
Bit 7	Reserved
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Sensor cable break
Bit 11	Overcurrent in sensor supply
Bit 12	Reserved
Bit 13	Reserved
Bit 14	PDOOUT-DATA <0d underdrive
Bit 15	PDOOUT-DATA >27648d overdrive

AO-I-4 ... 20 mA unipolar

Bit 15 ... 0	Description
Bit 0	Reserved
Bit 1	Below minimum alert threshold
Bit 2	Maximum alert threshold exceeded
Bit 3	Overtemperature T(uC) >85 °C
Bit 4	Overvoltage in supply (Ub >30 V)
Bit 5	Undervoltage in supply (Ub <18 V)
Bit 6	Reserved
Bit 7	Reserved
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Sensor cable break
Bit 11	Overcurrent in sensor supply
Bit 12	Reserved
Bit 13	Reserved
Bit 14	PDOOUT-DATA <0d underdrive
Bit 15	PDOOUT-DATA >27648d overdrive

AI-U-0...10 V unipolar

Bit 15 ... 0	Description
Bit 0	Reserved
Bit 1	Below minimum alert threshold
Bit 2	Maximum alert threshold exceeded
Bit 3	Overtemperature T(uC) >85 °C
Bit 4	Overvoltage in supply (Ub >30 V)
Bit 5	Undervoltage in supply (Ub <18 V)
Bit 6	Channel error Uout <Utarget
Bit 7	Channel error Uout >Utarget
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Overcurrent in sensor supply
Bit 12	Reserved
Bit 13	Reserved
Bit 14	PDOOUT-DATA <0d underdrive
Bit 15	PDOOUT-DATA >27648d overdrive

AO-U -10 ... +10V bipolar

Bit 15 ... 0	Description
Bit 0	Reserved
Bit 1	Below minimum alert threshold
Bit 2	Maximum alert threshold exceeded
Bit 3	Overtemperature T(uC) >85 °C
Bit 4	Overvoltage in supply (Ub >30 V)
Bit 5	Undervoltage in supply (Ub <18 V)
Bit 6	Channel error Uout <Utarget
Bit 7	Channel error Uout >Utarget
Bit 8	Reserved
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Overcurrent in sensor supply
Bit 12	Reserved
Bit 13	Reserved
Bit 14	PDOOUT-DATA <-27648d underdrive
Bit 15	PDOOUT-DATA >27648d overdrive

AO-U/I multiple parameterizable

Significance of bits 0 ... 15 in object *ParamDiagnosisSetup* (ISDU IDX 0x40) depends on the parameterized channel function in object *ParamDeviceFunction* (ISDU IDX 0x44).

Bit significance applied depends on the parameterized channel function.

Setting ISDU Idx 0x44	Channel mode	Valid definition of DiagnosisSetup according to variant
0x06	AO U Unipolar 0 ... 10 V	AO U 0 ... 10 V
0x07	AO U Bipolar -10 ... +10 V	AO U -10 ... +10 V
0x08	AO I Unipolar 0 ... 20 mA	AO I 0 ... 20 mA
0x09	AO I Unipolar 4 ... 20 mA	AO I 4 ... 20 mA

8.2.4**Object description****ISDU-Index 0x41**

Object *ParamLowerLimit*

- is for parameterization of the minimum alert threshold an IO-Link event will be generated when falling below.

Value scaling corresponds to process data scaling of the respective IO-Link converter variant or the selected channel function selected in the multifunction variant, see also *ParamDeviceFunction*. Only values from the nominal measuring range are permitted, see also Process data.

With AO variants, threshold monitoring is only applied to the output process data sent by master.

With AI variants, the threshold monitoring will act on the input process data transmitted to master.

ISDU-Index 0x42

Object *ParamUpperLimit*

- is for parameterization of the maximum alert threshold an IO-Link event will be generated when being exceeded.

Value scaling corresponds to process data scaling of the respective IO-Link converter variant or the channel function selected for multifunction variants, see also *ParamDeviceFunction*. Only values from the nominal measuring range are permitted, see also Process data.

With AO variants, threshold monitoring is only applied to the output process data sent by master.

With AI variants, the threshold monitoring will act on the input process data transmitted to master.

ISDU-Index 0x43

Object *ParamFilterTime*

- is used for software filter parameterization of the measured values. IO-Link converters implement a simple floating average filter.
- specifies the floatomg average length as number of IO-Link cycles.

With AO variants, the filter will act on the output data sent by master.

With AI variants, the filter will act on the measured values sent to master.

ParamFilterTime	
Permitted value range	
0	No averaging
1 ... 64	Averaging over 1 ... 64 measured values
Any other value will generate an error message by the IO-Link converter	

ISDU-Index 0x44

Object *ParamDeviceFunction*

- is for parameterization of the IO-Link converter channel function. Write parameter only with MULTI variants and will set the channel function.

Read only, if it is a fix variant.

Write access but value will not be adopted.

Permitted value range for analog input MULTI variants	
Settings	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 will generate an error alert by the IO-Link converter.	

Permitted value range for analog output of MULTI variants	
Settings	Channel mode
0x06	Analog OUT U unipolar 0 ... 10 V (default)
0x07	Analog OUT U bipolar -10 ... +10 V
0x08	Analog OUT I unipolar 0 ... 20 mA
0x09	Analog OUT I unipolar 4 ... 20 mA
Any other value will generate an error alert by the IO-Link converter.	

8.3 Diagnostic tools

8.3.1 IO-Link events

Depending on the IO-Link converter or the channel function selected for multi-variants, the device will transmit specific IO-Link events.

Event code	Description	Device status (ISDU IDX 0x24)	Event type	Qualifier	Note
General events					
0x0000	No malfunction	0	Notification		
0x4210	Device excess temperature	2	Warning	appearing disappearing	corresponds to bit 3 in ISDU Idx 0x40
0x5110	Primary device supply overvoltage - check tolerance	2	Warning	appearing disappearing	Ub >30 V corresponds to bit 4 in ISDU Idx 0x40
0x5111	Primary device supply undervoltage - check tolerance	2	Warning	appearing disappearing	Ub <18 V corresponds to bit 5 in ISDU Idx 0x40
0x6320	Parameter error - check data sheet and/or parameters	4	Error	appearing disappearing	Invalid parameter value (to be avoided)
0x7700	Cable break at connected device - check wiring	4	Error	appearing disappearing	corresponds to bit 10 in ISDU Idx 0x40 Only AO I 0/4 ... 20 mA
0x8C10	Process value exceeding the valid range	2	Warning	appearing disappearing	corresponds to bit 15 in ISDU index 0x40 AO types only
0x8C30	Process value below the valid range	2	Warning	appearing disappearing	corresponds to bit 14 in ISDU index 0x40 AO types only

As there is no PNIO integration for IO-Link mapping the predefined event codes of IO-Link Spec. 1.1 correctly to PNIO diagnostics, the ISDU index 0x45 must be read out as well.

In conjunction with a master supporting the Baumer IO-Link extended integration, ISDU index 0x45 readout is not required.

Event-Code	Description	Device-Status (ISDU IDX 0x24)	Event type	Qualifier	Note
Manufacturer-specific events					
0x1800	Production data range contains invalid data	4	Error	appearing disappearing	No masking by event parameterization in ISDU Idx 0x40
0x1801	Parameter data range contains invalid data	4	Error	appearing disappearing	No masking by event parameterization in ISDU Idx 0x40
0x1802	Below minimum alert threshold	2	Warning	appearing disappearing	corresponds to bit 1 in ISDU Idx 0x40
0x1803	Maximum alert threshold exceeded	2	Warning	appearing disappearing	corresponds to bit 2 in ISDU Idx 0x40
0x1804	Overcurrent in sensor supply	4	Error	appearing disappearing	corresponds to bit 11 in ISDU Idx 0x40
0x1805	Analog input overdrive - check sensor signal	2	Warning	appearing disappearing	corresponds to bit 15 in ISDU Idx 0x40 AIN types only
0x1806	Analog input underdrive - check sensor signal	2	Warning	appearing disappearing	corresponds to bit 14 in ISDU Idx 0x40 AIN types only
0x1809	Analog output error - output voltage exceeding target value	4	Error	appearing disappearing	corresponds to bit 7 in ISDU Idx 0x40 AO types only 0 ... 10 V -10 ... 10 V
0x180A	Analog output error - output voltage lower than setpoint value	4	Error	appearing disappearing	corresponds to bit 6 in ISDU Idx 0x40 AO types only 0 ... 10 V -10 ... 10 V
0x180B	Analog output error - output overdrive	4	Error	appearing disappearing	corresponds to bit 6 in ISDU Idx 0x40 AO types and HW 1.xx only 0 ... 10 V -10 ... 10 V

Validity matrix for IO-Link events

Not every variants of analog IO-Link converters features the same diagnostic events.

Depending on variant and/or the set channel function, only specific events are available.

The following tables show the availability of events according to variant/channel function.

Channel function: Analog inputs

Bit ISDU IDX 0x40	AI U 0 ... 10 V	AI U -10 ... +10 V	AI U 0 ... 20 mA	AI U 4 ... 20 mA
15	$U_{IN} > 10$ V overdrive	$U_{IN} > 10$ V overdrive	$I_{IIN} > 20$ mA overdrive	$I_{IIN} > 20$ mA overdrive
14	$U_{IN} < 0$ V underdrive	$U_{IN} < -10$ V underdrive	$I_{IN} < 0$ mA underdrive	$I_{IN} < 4$ mA underdrive
13	Reserved	Reserved	Reserved	Reserved
12	Reserved	Reserved	Reserved	Reserved
11	Overcurrent in sensor supply	Overcurrent in sensor supply	Overcurrent in sensor supply	Overcurrent in sensor 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 in supply ($U_b < 18$ V)	Undervoltage in supply ($U_b < 18$ V)	Undervoltage in supply ($U_b < 18$ V)	Undervoltage in supply ($U_b < 18$ V)
4	Overvoltage in supply ($U_b > 30$ V)	Overvoltage in supply ($U_b > 30$ V)	Overvoltage in supply ($U_b > 30$ V)	Overvoltage in supply ($U_b > 30$ V)
3	Overtemperature $T(uC) > 85$ °C	Overtemperature $T(uC) > 85$ °C	Overtemperature $T(uC) > 85$ °C	Overtemperature $T(uC) > 85$ °C

Channel function: Analog outputs

Bit ISDU IDX 0x40	AO U 0 ... 10 V	AO U -10 ... +10 V	AO U 0 ... 20 mA	AO U 4 ... 20 mA
15	PDOUT-DATA $> 27648d$ overdrive	PDOUT-DATA $> 27648d$ overdrive	PDOUT-DATA $> 27648d$ overdrive	PDOUT-DATA $> 27648d$ overdrive
14	PDOUT-DATA $< 0d$ underdrive	PDOUT-DATA $< -27648d$ underdrive	PDOUT-DATA $< 0d$ underdrive	PDOUT-DATA $< 0d$ underdrive
13	Reserved	Reserved	Reserved	Reserved
12	Reserved	Reserved	Reserved	Reserved
11	Overcurrent in sensor supply	Overcurrent in sensor supply	Overcurrent in sensor supply	Overcurrent in sensor supply
10	Reserved	Reserved	Sensor cable break	Sensor cable break
9	Reserved	Reserved	Reserved	Reserved
8	Reserved	Reserved	Reserved	Reserved
7	Channel error $U_{out} > U_{target}$	Channel error $U_{out} > U_{target}$	Reserved	Reserved
6	Channel error $U_{out} < U_{target}$	Channel error $U_{out} < U_{target}$	Reserved	Reserved

Bit ISDU IDX 0x40	AO U 0 ... 10 V	AO U -10 ... +10 V	AO U 0 ... 20 mA	AO U 4 ... 20 mA
5	Undervoltage in supply (Ub <18 V)	Undervoltage in supply (Ub <18 V)	Undervoltage in supply (Ub <18 V)	Undervoltage in supply (Ub <18 V)
4	Overvoltage in supply (Ub >30 V)	Overvoltage in supply (Ub >30 V)	Overvoltage in supply (Ub >30 V)	Overvoltage in supply (Ub >30 V)
3	Overtemperature T(uC) >85 °C	Overtemperature T(uC) >85 °C	Overtemperature T(uC) >85 °C	Overtemperature T(uC) >85 °C
2	Maximum alert threshold exceeded	Maximum alert threshold exceeded	Maximum alert threshold exceeded	Maximum alert threshold exceeded
1	Below minimum alert threshold	Below minimum alert threshold	Below minimum alert threshold	Below minimum alert threshold
0	Reserved	Reserved	Reserved	Reserved

8.3.2 Process data

Analog input I: 0 ...20 mA

Values		Measured value	Area
Dec.	Hex.	0 ... 20 mA	
32767	7FFF	>23.5178 mA	Overflow
32511	7EFF	23.5178 mA	Range of overdrive
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	Range of underdrive
-4864	ED00	-3.5185 mA	
-32768	8000	<-3.5185 mA	Underflow

Analog input I: 4 ...20 mA

Values		Measured value	Area
Dec.	Hex.	4 ... 20 mA	
32767	7FFF	>22.8142 mA	Overflow
32511	7EFF	22.8142 mA	Range of overdrive
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	Range of underdrive
-4864	ED00	1.1852 mA	
-32768	8000	<1.1852 mA	Underflow

Analog input U: 0 ...10 V

Values		Measured value	Area
Dec.	Hex.	0 ... 10 V	
32767	7FFF	>11.7589 V	Overflow
32511	7EFF	11.7589 V	Range of overdrive
27649	6C01	10.0004 V	
27648	6C00	10.0000 V	
1	0001	361.7 μ V	Nominal range
0	0000	0 μ V	
-1	FFFF	-361.7 μ V	
-4864	ED00	-1.7593 V	Range of underdrive
-32768	8000	<-1.7593 V	Underflow

Analog input U: -10 ... +10 V

Values		Measured value	Area
Dec.	Hex.	-10 ... +10 V	
32767	7FFF	>11.7589 V	Overflow
32511	7EFF	11.7589 V	Range of overdrive
27649	6C01	10.0004 V	
27648	6C00	10.0000 V	
1	0001	361.7 μ V	Nominal range
0	0000	0 μ V	
-1	FFFF	-361.7 μ V	
-27648	9400	-10.0000 V	Range of underdrive
-27649	93FF	-10.0004 V	
-32512	8100	-11.7593 V	
-32768	8000	<-11.7593 V	Underflow

Analog output I: 0 ...20 mA

Values		Measured value	
Dec.	Hex.	0 ... 20 mA	Area
>32511	>7EFF	>23.5178 mA	Max. Output value
32511	7EFF	23.5178 mA	Range of overdrive
27649	6C01	20.0007 mA	
27648	6C00	20.0000 mA	Nominal range
1	0001	723.4 nA	
0	0000	0 μ A	
<0	<0000	0.000 mA	Min. output value

Analog output I: 4 ...20 mA

Values		Measured value	
Dec.	Hex.	4 ... 20 mA	Area
>32511	>7EFF	>22.8142 mA	Max. Output value
32511	7EFF	22.8142 mA	Range of overdrive
27649	6C01	20.0007 mA	
27648	6C00	20.0000 mA	Nominal range
1	0001	4 mA +578.7 nA	
0	0000	4 mA	
<0	<0000	<4 mA	Min. output value

**INFO**

The process data is transmitted in big-endian order.

Analog output U: 0 ...10 V

Values		Measured value	
Dec.	Hex.	0 ... 10 V	Area
>32511	>7FFF	>11.7589 V	Max. Output value
32511	7EFF	11.7589 V	Range of overdrive
27649	6C01	10.0004 V	
27648	6C00	10.0000 V	Nominal range
1	0001	361.7 μ V	
0	0000	0 V	
<0	<0000	<0 V	Min. output value

Analog output U: -10 ... +10 V

Values		Measured value	Area
Dec.	Hex.	-10 ... +10 V	
>32511	>7FFF	>11.7589 V	Max. Output value
32511	7EFF	11.7589 V	Range of overdrive
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	
-27649	93FF	-10.0004 V	Range of underdrive
-32512	8100	-11.7593 V	
<-32512	<8100	<-11.7593 V	Min. output value

8.3.3**Filter description**

FIR filter implemented for analog signals or the output values:

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

Formula symbol	Explanation
y(n)	Filtered value at time 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 event of sudden a change in input value or in the specified process data, there will be a linear increase in the filtered value until the final value is achieved after N IO-Link cycles.

Example: At a cycle time of 2.3 ms and a filter time of $N = 10$, after 23 ms the final value is being read/output.

9 Maintenance

Bus nodes and device modules are free from maintenance. No inspection nor maintenance intervals required.

Instruction:

- ◆ Replace defective bus nodes and/or modules.

10**Annex****10.1****Accessories****10.1.1****Tools**

Designation	Art. no.
M12 installation wrench set SW 13	11238694
M12 mounting wrench bit SW 17	11238695



///. 3: Assembly wrench

**INFO****PRODUCTS AND ACCESSORIES**

You can find a large selection of products at: <https://www.baumer.com>

10.2 Glossary

Term	Significance
AI	Analog Input (Analog input)
Bit	Binary digit
Byte	Term from IEC 61158. Corresponds to 1 byte or 8 bits.
DC	Diagnostic Coverage (Degree of detection of errors)
DIN	German Institute for Standardization
EMV	Electromagnetic compatibility
EN	European standard
ESD	Electrostatic discharges
FE	Functional earth
IO-Link	Standardized communication system for connecting intelligent sensors and actuators to an automation system
IP67	Ingress protection (Protection class according to DIN EN 60529) 6: Dust-tight, protected against unauthorized access by wire 7: Protection against short-term submersion
ISDU (IO-Link)	Indexed Service Data Unit
LED	Light Emitting Diode
MTTFd	Mean Time To (dangerous) Failure (Average operating time to (dangerous) failure)
n.c.	Not connected (not used)
PELV	Protective Extra Low Voltage (safety extra-low voltage)
RTD	Resistive Temperature Detector (resistance thermometer)
SELV	Safety Extra Low Voltage (safety extra-low voltage)
TH	T/C Thermocouple (thermocouple)

