AXL E IOL AI1 I M12 S



Axioline E IO-Link/analog converter for connecting an analog sensor, 4 mA ... 20 mA, straight version

Data sheet
8594_en_11

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1 Description

The IO-Link/analog converter is an IO-Link device that converts analog signals into the IO-Link protocol.
It therefore enables you to acquire the signals of analog sensors via an IO-Link master.

Features

- Connection to an IO-Link master with M12 connector (A-coded, 4-pos.)
- 1 IO-Link interface
- IO-Link A port
- IO-Link specification V1.1.1
- Straight version
- 1 analog input
- Connection of the sensor in 3-conductor technology via M12 connector (A-coded, 5-pos.)
- Current range: 4 mA ... 20 mA
- Functional ground connection for local connection to functional ground
- Supply of the module electronics and the sensor via the IO-Link interface of the IO-Link master
- Local status indicator
- IP65/IP67 degree of protection

Make sure you always use the latest documentation.
It can be downloaded at: phoenixcontact.net/product/2700338

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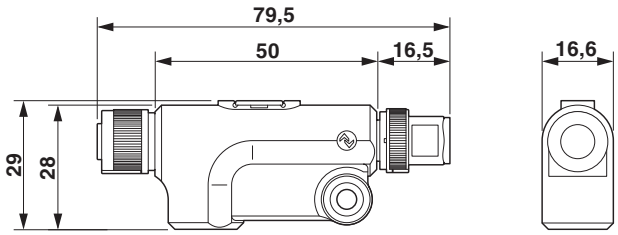
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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Axioline E-IO-Link/analog converter for connecting an analog sensor, 4 mA ... 20 mA, M12 fast connection technology, straight version	AXL E IOL AI1 I M12 S	2700338	1

4 Technical data

Dimensions (nominal sizes in mm)



Width	16.6 mm
Height	29 mm
Depth	79.5 mm

General data	
Weight	34 g
Ambient temperature (operation)	-25 °C ... 60 °C
Ambient temperature (storage/transport)	-25 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 %
Permissible humidity (storage/transport)	5 % ... 95 %
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP65/IP67
Protection class	III (IEC 61140, EN 61140, VDE 0140-1)
Degree of pollution	2

IO-Link	
Specification	V1.1.1
Reverse polarity protection	yes
Transmission speed	230.4 kbps (COM3)
Frame type	1
Cycle Time	min. 2 ms
Process data update	2 ms
Amount of process data	16 Bit (Input data), 16 Bit (Output data)

IO-Link ports	
Number of ports	1
Connection method	M12 connector, A-coded
IO-Link port supply L+	
Nominal voltage for I/O supply	24 V DC (This supply voltage is provided via the IO-Link interface of the IO-Link master.)
Sensor supply voltage	24 V DC (This supply voltage is provided via the I/O supply.)
Current consumption	typ. 16.5 mA ±15 % (at 24 V DC) max. 120 mA
Nominal current for every IO-Link port	max. 100 mA
Reverse polarity protection	yes
Short-circuit protection	yes
Overload protection	yes
Analog input	
Number of inputs	1 (current)
Connection method	M12 connector, A-coded
Connection technology	3-conductor
Current input signal	4 mA ... 20 mA
Input resistance current input	max. 500 Ω
A/D converter resolution	12 bit
Data formats	IB IL, S7-compatible
Filtering	None or mean-value generation over 4, 16, or 32 measured values
Tolerance, relative	< 0.25 % (From the measuring range final value)
Permissible cable length	max. 30 m (Shielded cable)
Error messages to the higher level control or computer system	
Overrange or underrange	Message in the diagnostic code (in the IB IL format)
Measured value invalid/no valid measured value present	Message in the diagnostic code (in the IB IL format)
Short circuit	Message in the diagnostic code (in the IB IL format)
Wire break; goes to 0 mA	Message in the diagnostic code (in the IB IL format)
Module faulty	Message in the diagnostic code (in the IB IL format)
Mechanical tests	
Vibration resistance in acc. with EN 60068-2-6/IEC 60068-2-6	Operation: 2g
Vibration resistance in acc. with EN 60068-2-6/IEC 60068-2-6	Storage/transport: 5g
Shock in acc. with EN 60068-2-27/IEC 60068-2-27	Operation: 30g, 11 ms, three shocks in each space direction
Shock in acc. with EN 60068-2-27/IEC 60068-2-27	Storage/transport: 50g, 11 ms, three shocks in each space direction
Continuous shock in acc. with EN 60068-2-27/IEC 60068-2-27	10g, 16 ms, 1000 shocks, in all space directions

Approvals	
For the current approvals, go to:	www.phoenixcontact.net/product/2700338

Manufacturer's declarations	
For the current manufacturer’s declarations, go to:	www.phoenixcontact.net/product/2700338

5 Additional tables

The data is valid for nominal operation (supply voltage = 24 V) in the default configuration (measuring range 4 mA ... 20 mA).

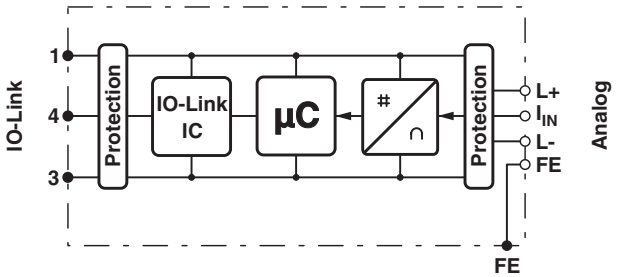
Tolerance and temperature response at T_A = -25 °C ... +60 °C	
Drift	
Typical	**Maximum**
±45 ppm/K	±75 ppm/K

The tolerance values refer to the measuring range final value.

Tolerances influenced by electromagnetic interference			
Type of electromagnetic interference	**Standard**	**Tolerance**	**Criterion**
Electromagnetic fields	EN 61000-4-3/ IEC 61000-4-3	< ±1.0 %	A
Fast transients (burst)	EN 61000-4-4/ IEC 61000-4-4	< ±1.0 %	A
Conducted interference	EN 61000-4-6/ IEC 61000-4-6	< ±0.5 %	A

6 Internal circuit diagram

Figure 1 Internal wiring of connections



Key:



Protective circuit



IO-Link circuit



Microprocessor

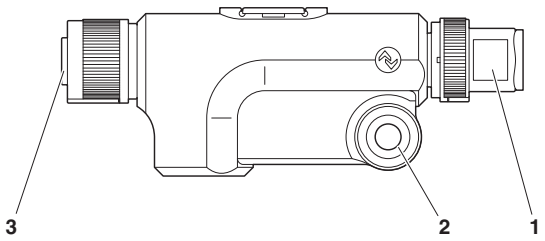


Analog/digital converter

7 Pin assignment

7.1 Connections on the device

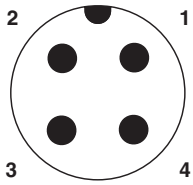
Figure 2 Connections on the converter



No.	Connection
1	IO-Link interface (indicated by IO-Link symbol)
2	Attachment options; Option for connection to the functional ground
3	Analog input

7.2 Pin assignment of the IO-Link interface

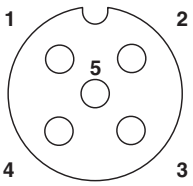
Figure 3 Pin assignment of the I/O link interface (M12 A-coded, pin)



Pin	Signal	Meaning
1	L+	+24 V supply voltage; from IO-Link master
2	-	Not used
3	L-	GND, reference potential for L+
4	C/Q	IO-Link data transmission channel

7.3 Pin assignment of the analog input

Figure 4 Pin assignment of the analog input (M12 A-coded, socket)



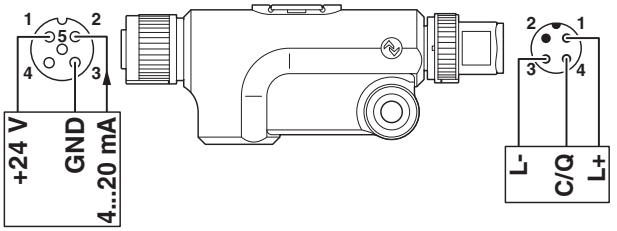
Pin	Assignment
1	+24 V, 100 mA sensor supply
2	Current input 4 mA ... 20 mA
3	GND
4	Not used
5	Not used

8 Connection notes

Always connect the analog sensors using shielded, twisted pair cables.

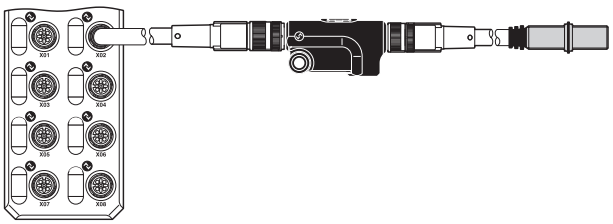
9 Connection example

Figure 5 Connection example



10 Mounting

Figure 6 Connection of a sensor to an IO-Link master via the converter

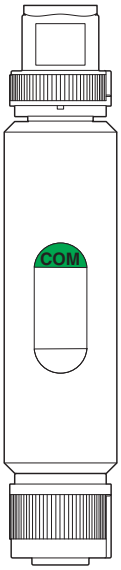


- Connect the IO-Link interface of the converter to an IO-Link port of the higher-level IO-Link master using a standardized 3-pos. cable.
- Connect the analog sensor directly to the analog converter input or using a shielded 4-pos. cable.
- Fasten each connection using the M12 connectors.

Phoenix Contact recommends connecting the converter to the functional ground at an appropriate point using an M4 screw, especially in environments with high levels of interference.

11 Local status indicator

Figure 7 Local status indicator



Designation	Color	Meaning	State	Description
COM	Green	Status of IO-Link device	On	Supply voltage OK
			Flashing	Supply voltage OK, SDCI communication active
			Off	No supply voltage, no communication

12 Process data

The device occupies one word of IN process data and one word of OUT process data.

12.1 IN process data

The measured values are depicted in IB IL or S7-compatible format.

For both formats the measured value is represented in bits 14 to 3. Bit 15 is available as a sign bit. Bits 2 to 0 are not relevant for the measured value.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
V	Analog value												x	x	x

V Sign bit (= 0, not relevant)
x Not relevant for the measured value (= 0 must be set)

In the event of an error, a diagnostic code is mapped to the input data:

IB IL format

The values > 8000_{hex} and < 8100_{hex} indicate an error.

Code (hex)	Cause
8001	Overrange (overflow)
8002	Wire break
8003	Short-circuit
8004	Measured value invalid or no valid measured value available
8040	Device faulty
8080	Underrange (underflow)

S7-compatible format

In the S7-compatible format, there are two diagnostic codes, depicted as follows.

Code (hex)	Cause
7FFF	Overrange (overflow)
8000	Wire break/short circuit/underrange

12.2 OUT process data

The device can be configured via the process data output word.

The following configurations are possible:

– Selection of formats for representing measured values
– Setting mean-value generation

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Configuration	Reserved					Filter		Reserved		Format		Reserved			

For the exact meaning of the individual bits, please refer to “Parameterization (80_{hex}: ParaWord)”.

12.3 Parameterization via OUT process data

Reparameterization can be carried out via the output process data, however this is not saved permanently on the device.

Only carry out re-parameterization when starting up the device!

The following sequence applies regardless of the format (IB IL or S7-compatible):

– The master sends parameter data (OutputProcessData with bit 15 = 1)

In order to start configuration, bit 15 of the output word must be set to 1. If bit 15 = 0, the default configuration is active.

– The device interrupts the transmission of current process data and responds with the following diagnostic code in the process data:

Code (hex)	Cause
8800	Parameter OK
8801	Parameter ERROR

– If the diagnostic code is OK, the parameter data is accepted immediately. The master can end parameterization (OutputProcessData with bit 15 = 0). The device returns to normal operation with cyclic process data transmission.
– In the event of the ERROR diagnostic code, the master can abort parameterization without modified parameter data (OutputProcessData with bit 15 = 0) or transmit the modified parameterization (return to step 1).

12.4 Example

The example applies for the following changes:

– Switching the formats from S7-compatible (default) to IB IL
– For 16-sample mean-value generation

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Configuration	Reserved					Filter		Reserved		Format		Reserved			
1	Reserved					1	0	Reserved		1	0	Reserved			

13 Significant values in various formats

13.1 IB IL format

Resolution: 1 bit (0000 -> 0008) corresponds to 4.27 µA.

Input data		4 mA ... 20 mA
hex	**dec**	**mA**
8001	-32769 (Overrange)	> 21.339
7F00	32512	21.339
7538	30008	20.00427
7530	30000	20.0
3A98	15000	12.0
0008	8	4.00427
0000	0	4.0
8080	-32896 (Underrange)	< 4.0
8002	-32770 (wire break)	0

13.2 Format S7 compatible

Resolution: 1 bit (0000 -> 0008) corresponds to 4.63 µA.

Input data		4 mA ... 20 mA
hex	**dec**	**mA**
7FFF	32767 (overrange)	> 22.81
7EF8	32504	22.81
6C08	27656	20.00463
6C00	27648	20.0
3600	13824	12.0
0008	8	4.00463
0000	0	4.0
ED00	-4864	1.185
8000	-32768 (Underrange; open circuit/short circuit)	< 1.185

The value 8000_{hex} is specified in S7-compatible format for all errors for which diagnostic codes 8001_{hex} to 8040_{hex} are output in IB IL format.

14 IO-Link objects

14.1 Overview of the objects

Index (hex)		Object name	Length in bytes	Access	Meaning	Contents
DPP	ISDU					
Identification						
0007		Vendor ID	2	R	Vendor ID	00_{hex}
0008						$B0_{hex}$
0009		Device ID	3	R	Device ID	01_{hex}
000A						00_{hex}
000B						15_{hex}
	0010	VendorName	64	R	Vendor name	Phoenix Contact
	0011	VendorText	64	R	Notes	phoenixcontact.com
	0012	ProductName	64	R	Product name	AXL E IOL AI1 I M12 S
	0013	Product ID	64	R	Item No.	2700338
	0014	ProductText	64	R	Product text	IO-Link/analog converter current input straight
	0015	SerialNumber	max. 16	R	Serial number	Stored in the production process.
	16	HardwareVersion	64	R	Hardware version	E.g., 01
	0017	FirmwareVersion	64	R	Firmware version	E.g., 001
Diagnostics						
	0020	ErrorCount	2	R	Errors since power up	Number of errors
	0028	InputProcessData	2	R	Input process data	Last current data
Parameter						
	0080	ParaWord	2	R/W	Parameterization	0000_{hex}

Abbreviation	Meaning
R	Read
W	Write

14.2 Parameterization (80_{hex}: ParaWord)

Parameterize the device using this object.

In the case of valid parameters, the parameterization is permanently stored on the device.

After a reset, the device operates with the last permanently stored data. Upon delivery, the device operates with the default data (default settings).

Saving data to the device leads to a communication failure of around 30 ms.

This object is only available with firmware 1.10 or later.

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

In the following tables the values in **bold** are default settings.

Format	
Code (bin)	**Meaning**
00	**S7-compatible**
10	IB IL
Other	Reserved

Filter	
Code (bin)	**Meaning**
00	**No filter**
01	4-sample mean-value
10	16-sample mean-value
11	32-sample mean-value