Manual

LioN-X Hub Analog Output

0960 IOL 3858-001 (4 × Analog Output / 8 × Digital Input)

Contents

1 About this manual

1.1 General information

Download the latest version of this document at:
http://doc.beldensolutions.com

Read the assembly and operating instructions on the following pages carefully before starting up the modules. Keep this information where it is accessible to all users.

The texts, figures, diagrams, and examples used in this document are exclusively used to explain how to operate and apply the modules.

Please contact us if you have any detailed questions on installing and starting up the devices.

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1.2 Explanation of symbols

1.2.1 Use of danger information

Danger information is denoted as follows:

Danger: Means that death, serious physical injury or substantial damage to property will occur if the required safety measures are not taken.

Warning: Means that death, serious physical injury or substantial damage to property can occur if the required safety measures are not taken.

Caution: Means that minor physical injury or damage to property can occur if the required safety measures are not taken.

1.2.2 Use of general information

General information is denoted as follows:

Attention: Contains important information on the product, on how to manage the product, or on the respective section of the documentation to which your special attention is being drawn.

1.3 Version information

Version	Created	Changes
1.0	09/2026	

Table 1: Overview of manual revisions

Attention: In the interest of product improvement and further development, BELDEN reserves the right to change technical data in this manual or changes to the product without prior notice.

2 Safety instructions

2.1 Intended use

The products described in this manual are decentralized Input/Output assemblies on a fieldbus I/O network.

We adhere to all safety standards when developing, producing, testing, and documenting our products. When you adhere to the handling specifications and safety instructions described for the configuration, assembly, and correct operation, there should not normally be any risks for people or equipment.

The devices fulfill the requirements of the EMC guidelines (2014/30/EU) and the low voltage guideline (2014/35/EU).

The devices are designed to be used in the industrial sector. The industrial environment is distinguished by the fact that the consumer is not connected directly to the public low voltage network. Additional measures are required for use in residential areas or in business and commercial sectors.

Attention: This equipment may cause radio interference in residential areas. In this case the operator may be requested to carry out appropriate measures.

The proper and safe operation of this product depends on proper transportation, storage, assembly, and installation, and careful operation.

A completely assembled device housing is required for the proper operation of the devices. Only connect devices that fulfill the requirements of EN 61558-2-4 and EN 61558-2-6 to the Hubs.

During the configuration, installation, start-up, maintenance, and testing of the devices, adhere to the safety and accident-prevention guidelines for the specific application.

Only install cables and accessories that fulfill the requirements and regulations for safety, electromagnetic compatibility, and, where applicable, telecommunication end devices, as well as the specification information. Information on which cables and accessories are permitted for the installation

can be obtained from Belden Deutschland GmbH – Belden or is contained in this manual.

2.2 Qualified personnel

The configuration, installation, start-up, maintenance, and testing of the devices may only be performed by a qualified electrician who is familiar with the safety standards of the automation technology.

The personnel requirements are based on the requirement profiles described by ZVEI, VDMA, or equivalent organizations.

Only electricians who are familiar with the content of all provided device documentation are authorized to install and maintain the devices described. These are persons who

- based on their technical training, knowledge, and experience, and their knowledge of the pertinent standards, can evaluate the work to be carried out and identify any potential risks or
- based on working for several years in a related sector, have the same level of knowledge as they would have from the relevant technical training.

Only Belden Deutschland GmbH – Belden is permitted to make changes to the hardware or software of the products that go beyond the scope of this manual.

Warning: Making unqualified changes to the hardware or software, or non-adherence to the warning information contained in this document, can result in serious personal injury or damage to equipment.

Attention: Belden Deutschland GmbH accepts no liability for any damage caused by unqualified personnel or improper use. This automatically voids the warranty.

3 Designations and synonyms

AI	Analog Input
AO	Analog Output, ports A1 .. A4
AOI	Add-On Instruction
API	Application Programming Interface
BF	Bus Fault LED
Big Endian	Data format with High-B on first place (PROFINET and IO-Link)
BUI	Back-Up Inconsistency (EIP diagnostics)
CC	CC-Link IE Field
C/Q	I/O port pin 4 mode, IO-Link communication/switching signal
Ch. A	Channel A (Pin 4) of I/O port
Ch. B	Channel B (Pin 2) of I/O port
CIP	Common Industrial Protocol (media independent protocol)
CIP Safety™	Common Industrial Protocol for Safety applications, CIP Safety™ is a registered trademark of ODVA
Class A	IO-Link port specification (Class A)
Class B	IO-Link port specification (Class B)
CoAP	Constrained Application Protocol
CSP+	Control & Communication System Profile Plus
DAT	Device Acknowledgement Time
DCP	Discovery and Configuration Protocol
DevCom	Device Comunicating (EIP diagnostics)
DevErr	Device Error (EIP diagnostics)
DI	Digital Input, ports D1 .. D4
DIA	Diagnostic LED
DO	Digital Output
DIO	Digital Input/Output

DTO	Device Temperature Overrun (EIP diagnostics)
DUT	Device under test
EIP	EtherNet/IP™ is a registered trademark of ODVA
ERP	Enterprise Resource Planning system
ETH	ETHERNET
FE	Functional Earth
FME	Force Mode Enabled (EIP diagnostics)
FS	Functional Safety
FSU	Fast Start-Up
GSDML	General Station Description Markup Language
High-B	High-Byte
HTTPS	Hyper Text Transfer Protocol Secure
ICE	IO-Link port COM Error (EIP diagnostics)
ICT	Invalid Cycle Time (EIP diagnostics)
IE	IO-Link port Error (EIP diagnostics)
IN	IO-Link port Notification (EIP diagnostics)
IW	IO-Link port Warning (EIP diagnostics)
IIoT	Industrial Internet of Things
ILE	Input process data Length Error (EIP diagnostics)
IME	Internal Module Error (EIP diagnostics)
I/O	Input / Output
I/O port	X1 .. X8
I/O port pin 2	Channel B of I/O ports
I/O port pin 4 (C/Q)	Channel A of I/O ports
IODD	I/O Device Description
IOL or IO-L	IO-Link
I/Q	I/O port pin 2 mode, Digital Input/switching signal
ISDU	Indexed Service Data Unit
IVE	IO-Link port Validation Error (EIP diagnostics)
I&M	Identification & Maintenance

JSON	JavaScript Object Notation (platform independent data format)
L+	I/O port pin 1, sensor power supply
LioN-X 60	LioN-X variants with a width of 60mm
Little Endian	Data format with Low-B on first place (EtherNet/IP)
LLDP	Link Layer Discovery Protocol
Low-B	Low-Byte
LSB	Least Significant Bit
LVA	Low Voltage Actuator Supply (EIP diagnostics)
LVS	Low Voltage System/Sensor Supply (EIP diagnostics)
MIB	Management Information Base
MP	Multi-protocol: PROFINET + EtherNet/IP + EtherCAT® + Modbus TCP (+ CC-Link IE Field Basic)
MQTT	Message Queuing Telemetry Transport (open networking protocol)
MSB	Most Significant Bit
M12	Metric thread according to DIN 13-1 with 12 mm diameter
n.a.	not applicable
n.c.	no connection / not connected
NTP	Network Time Protocol
OFDT	One Fault Delay Time
OLE	Output process data Length Error (EIP diagnostics)
OPC UA	Open Platform Communications Unified Architecture (platform independent, service-oriented architecture)
PFH	Probability of dangerous Failure per Hour [h -1]
PD	Process Data
PDCT	Port and Device Configuration Tool
PLC	Programmable Logic Controller
PN	PROFINET
PWR	Power
Qualifier	Validity on a process value. Valid = "1"
REST	REpresentational State Transfer
RFC	Request for Comments

RO	Read Only
RPI	Requested Packet Interval
RTD	Resistance Temperature Detector
RW	Read/Write
RWr	Word data input as seen from the master station (CC-Link)
RWw	Word data output as seen from the master station (CC-Link)
RX	Bit data input as seen from the master station (CC-Link)
RY	Bit data output as seen from the master station (CC-Link)
SCA	Short Circuit Actuator/U_L/U_{AUX} (EIP diagnostics)
SCS	Short Circuit Sensor (EIP diagnostics)
SFRT	Safety Function Response Time
SIO mode	Standard Input Output mode
SLMP	Seamless Message Protocol
SNMP	Simple Network Management Protocol
SP	Single Protocol (PROFINET, EtherNet/IP, EtherCAT®, Modbus TCP or CC-Link IE Field Basic)
SPE	Startup Parameterization Error (EIP diagnostics)
T-B	Test Channel B
T-A	Test Channel A
U_{AUX}	$U_{Auxiliary}$, supply voltage for the load circuit (Actuator supply on Class B ports of Class A/B IO-Link Master)
UDP	User Datagram Protocol
UDT	User-Defined Data Types
UINT8	Byte in PLC (IB, QB)
UINT16	Unsigned integer with 16 bits or word in PLC (IW, QW)
U_L	U_{Load}, supply voltage for the load circuit (Actuator supply on Class A IO-Link-Master)
UL	Underwriters Laboratories Inc. (certification company)
UTC	Coordinated Universal Time (Temps Universel Coordonné)
WCDT	Worst Case Delay Time

WO	Write Only

Table 2: Designations and synonyms

4 System description

The LioN-Modules function as the interface in an industrial Ethernet system: A central controller on the management level is able to communicate with the decentralized sensors and actuators on the field level. The line or ring topologies for which LioN modules can be used ensure not only reliable data communication but also significantly reduce the number of cables required and thus also the costs for installation and maintenance. They additionally enable easy and quick extension.

4.1 About LioN-X

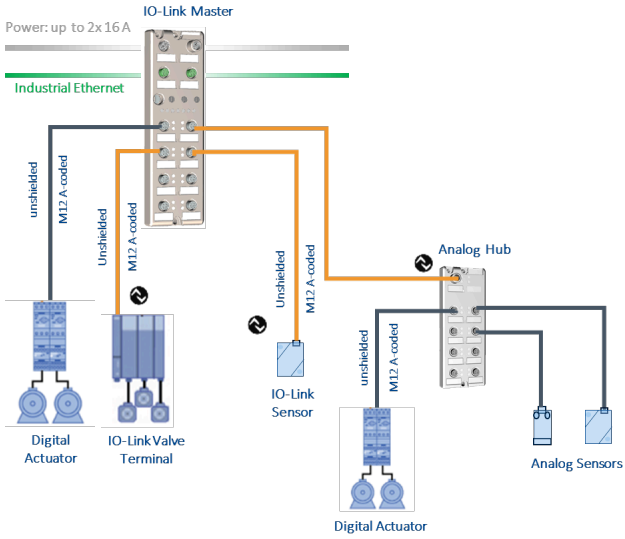
The LioN-X device variants convert input, standard output or IO-Link signals from sensors & actuators via an industrial Ethernet protocol (PROFINET, EtherNet/IP, EtherCAT®, Modbus TCP, CC-Link IE Field Basic) and/or into an IIoT protocol (REST API, CoAP, OPC UA, MQTT). For a logging functionality, there is Syslog on board. The robust 8 port housing design allows the use even in harsh environments where, for example, weld field immunity, high-temperature ranges, or protection classes IP67 and IP69K are needed.

Use all benefits of the Belden product solution by additionally downloading the configuration tool *LioN-Management Suite* from https://www.belden.com to enable e.g. a fast and easy parameterization of the connected IO-Link devices via the embedded IODD interpreter.

4.2 IO-Link basics

IO-Link is a globally standardized technology that enables communication between devices ranging from complex and intelligent sensors through to the central control unit. The IO-Link standard is specified according to the standard IEC 61131-9 and represents the basis of communication.

In the following graphic, IO-Link connections are shown in orange, digital connections (standard I/O) in black and ethernet connections in green.



IO-Link connections
Digital connections (standard I/O)
Ethernet connections

Table 3: Connection types

An IO-Link system consists of an IO-Link Master and an IO-Link Device (e.g., sensors, actuators, valves, I/O modules). An IO-Link Master provides the interface to the higher-level controller and controls the communication to the

connected IO-Link Device. The connection between master and device can be achieved with a standard unshielded connection cable.

An IO-Link-Master can have multiple IO-Link ports. An IO-Link Device can be connected to each port. Therefore, the connection is referred to as point-to-point communication.

4.3 Device variants

The following LioN-X Analog Hub variants are available:

Article number	Product designation	Description	Port functionality
935713001	0960 IOL 3857-001	LioN-X M12 60 mm, 4AI/8DI Analog Hub	4 x universal Analog Input, 8 x Digital Input
935714001	0960 IOL 3858-001	LioN-X M12 60 mm, 4AO/8DI Analog Hub	4 x Analog Output, 8 x Digital Input

Table 4: Overview of LioN-X Analog Hub variants

Hub – 4AO/8DI

The Hub 0960 IOL 3858-001 offers 4 industrial analog outputs configurable as voltage or current outputs. Additionally, 8 digital inputs are available. The digital input sensors and analog output actuators are powered by the IO-Link Master supply voltage on Pin1/L+.

5 Assembly and wiring

5.1 General information

Mount the device on a flat surface using 2 screws (M4x25/30). The torque required is 1 Nm. Use washers compliant with DIN 125 for all types of mounting, maintaining a distance of **149.3 mm (5.878 in) to 150.8 mm (5.937 in)** between the mounting holes.

Connect the IO-Link interface of the Hub to the IO-Link Master via a standardized M12 connecting lead.

For the intended use of a Hub, the connection to an IO-Link Master is absolutely necessary.

Attention: The devices have a ground connection with an M4 thread for the conduction of interference currents and the EMC immunity. This is labeled with the symbol functional earth and the designation "FE".

Attention: Use a low-impedance connection to connect the device to the reference ground. When using a grounded mounting surface, you can make the connection directly via the fixing screws.

Attention: If the mounting surface is ground-free, use a ground strap or a suitable FE line (FE = Functional Earth). Use an M4 screw to connect the ground strap or the FE line to the ground point and if possible put a washer and a toothed washer below the fixing screw.

Attention: For UL application:

Be sure to use a UL-certified cable with a suitable evaluation to connect the devices (CYJV or PVVA). To program the control, please refer to the OEM information, and only use suitable accessories.

Attention: For UL application:

The installation and operation of the devices is only permitted for interior use. Please observe the maximum installation and operating height of 2000 m (6561 ft) above sea level. Approved up to a maximum pollution degree of 2.

Warning: Terminals, housings of field-wired terminal boxes or components may exceed a temperature of +60° C (+140° F).

Warning: Any work on the electrical wiring of the modules may only be carried out when they are disconnected from the power supply.

Warning: For UL application with max. ambient temperature +70° C (+158° F):

Use temperature-resistant cables with following properties:

→ heat resistance up to at least +103° C.

Warning: The power supply may only be provided via the IO-Link port X01 of the module.

5.2 Outer dimensions

5.2.1 4AO/8DI variant

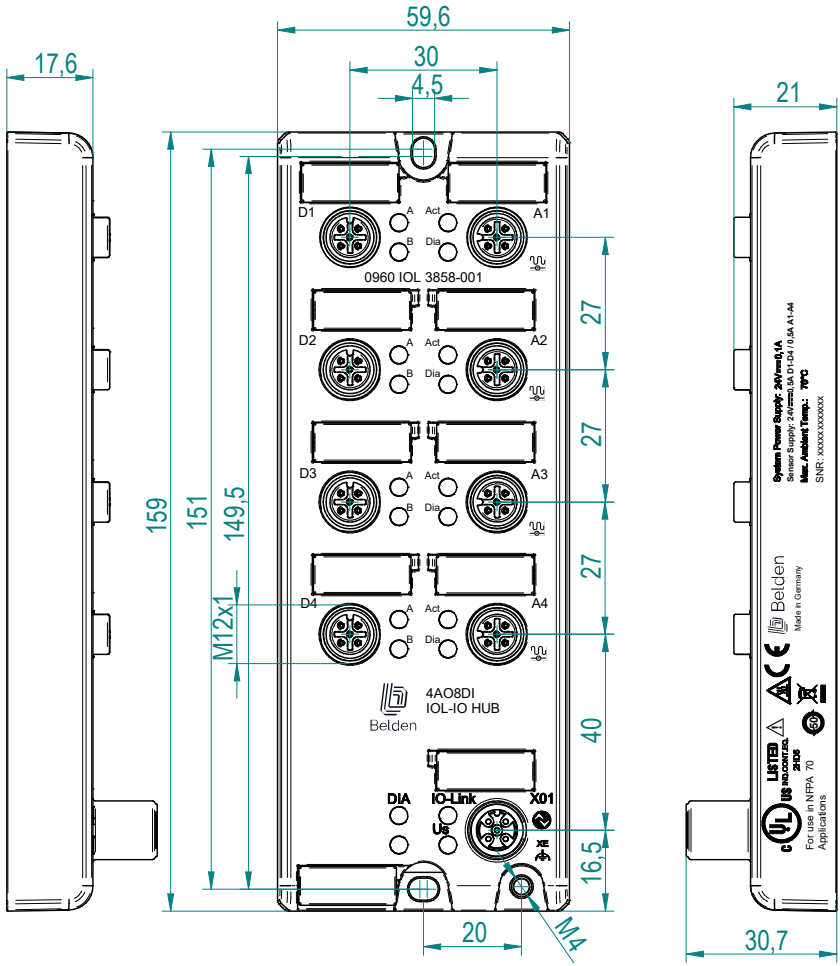


Figure 1: 0960 IOL 3858-001

5.3 Port assignments

All contact arrangements shown in this chapter are front views of the connector side of the device.

5.3.1 IO-Link interface

- Design: M12 socket (male), 5-pin, A-coded
- Color coding: black

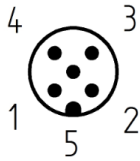


Figure 2: Schematic diagram port X01

Pin	Analog Hub	Function
1	+24 V DC (L+)	Supply voltage from the IO-Link Master
2	nc	
3	GND (L-)	Reference potential to L+
4	C/Q (IO-Link)	IO-Link data channel
5	nc	

Table 5: IO-Link interface

5.3.2 DI ports as M12 sockets

Color coding: black

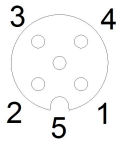


Figure 3: Schematic drawing DI port as M12 socket (female)

Pin	Signal	Function
1	+24 V	power supply +24 V
2	IN	Ch. B: Digital input
3	GND	Ground/reference potential
4	IN	Ch. A: Digital input
5	FE	Functional ground

Table 6: Pin assignments DI ports, D1 .. D4

5.3.3 Analog ports as M12 sockets

Color coding: black

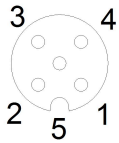


Figure 4: Schematic drawing Analog port as M12 socket, A1 .. A4

5.3.3.1 Analog Output ports

Device variant 0960 IOL 3858-001, ports A1 .. A4.

Pin	Signal	Function
1	U_S (+24 V)	Power supply +24 V
2	n.c.	–
3	GND	Ground/reference potential
4	AO	Analog Output
5	FE	Functional ground

Table 7: Pin assignments Analog Output ports, A1 .. A4

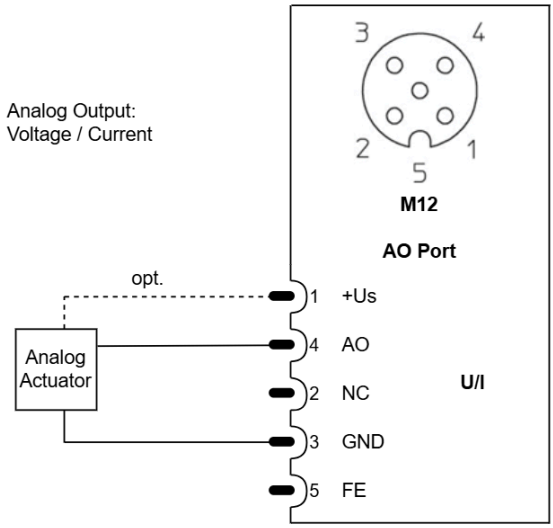


Figure 5: Connection diagram for analog output

6 Configuration and startup

The Belden Hub variants are operated with an IO-Link Master from version 1.1 (the Belden IO-Link-Masters support only the standard 1.1 version).

The data storage mechanism is only supported in conjunction with an IO-Link Master with the standard 1.1 version.

7 Parameterization of the Hub

The parameters set during system commissioning are transferred to the Hub. The Hub and the IO-Link Master store these parameters. The behavior of the IO-Link Master and the connected Hub is defined on the IO-Link Master port.

7.1 IO-Link data storage

The Belden Hub and the Belden IO-Link Masters support the data storage functionality. All user-configurable parameters are stored on the hub and on the master (Exceptions: user serial number, index 0x48 and tool identification, index 0x60). In *IO-Link data storage* mode, the stored parameters can be transferred automatically to the new device in case of a device exchange.

7.2 IO-Link block parameterization

IO-Link features the option to transfer all parameter data from the controller as a block. Block communication is activated by the command "ParamDownloadStart", index 0x02, subindex 0, 3. Following successful configuration, deactivation is performed by means of the command "ParamDownloadEnd", index 0x02, subindex 0, 4.

The Belden Hub supports the block configuration described.

7.3 IO-Link factory reset

The device can be reset by activating the IO-Link-specified system command “Restore Factory Settings”. The command requires that "0x82" is written to the index 0x02, subindex 0.

7.4 Identification parameters

Index	Sub-Index	Parameter	Access	Data length [byte]	Data type	Default value
0	8, 9	Vendor ID	RO (read only)	2	String	0x016A (362dec)
0	10, 11, 12	Device ID	RO	3	String	0x385701
0	10, 11, 12	Bootloader Device ID	RO	3	String	0x999001
0x0010	0	Vendor name	RO	64	String	Belden Deutschland GmbH
0x0011	0	Vendor text	RO	64	String	https://www.belden.com
0x0012	0	Product name	RO	64	String	0960 IOL 3858-001
0x0013	0	Product ID	RO	64	String	935714001
0x0014	0	Product Text	RO	64	String	LioN-X Analog Hub with 4 universal analog outputs
0x0015	0	Serial number	RO	16	String	(Production/user serial number)
0x0016	0	Hardware revision	RO	64	String	(Current HW version)
0x0017	0	Firmware revision	RO	64	String	(Current FW version)
0x0018	0	Application Specific tag	R/W	32	String	***
0x0019	0	Function tag	R/W	32	String	***

Index	Sub-Index	Parameter	Access	Data length [byte]	Data type	Default value
0x001A	0	Location tag	R/W	32	String	***

Table 8: Identification parameters

7.5 Digital Input parameters

Index	Sub-Index	Parameter	Access	Data length [byte]	Data type	Default value
0x0043	0	Input filter	R/W	16	UINT8	3 ms
0x0044	0	Input signal extension	R/W	16	UINT8	Off
0x0045	0	Input logic setting	R/W	16	UINT8	NO (Normally Open)
0x43BE	0	HW ID key	RO	64		HW1000_833410002
0x000D	0	Profile Characteristic	RO	6		0x0000 0x0031 (FW Update) 0x0040 0x0000 (Common Profile) 0x0081 0x0001 (Locator)
0x000E	0	PDInputDescriptor	RO			0x02 0x07 0x00 0x01 0x28 0x08 0x01 0x08 0x38

Index	Sub-Index	Parameter	Access	Data length [byte]	Data type	Default value
0x000F	0	PDOutputDescriptor	RO			0x03 0x10 0x00 0x03 0x10 0x10 0x03 0x10 0x20 0x03 0x10 0x30 (AO)

Table 9: Digital Input parameters

7.6 Generic parameters

Index	Sub-Index	Parameter	Access	Data length [byte]	Data type	Default value
0x0048	0	User serial number	R/W	16	String	0
0x0060	0	Tool identification	R/W	1	UINT8	0 (b7: res. + b6 ... b0)
0x0002	0	Device Reset	WO (write only)	1	UINT8	(Write `0x80` to execute the command)
0x0002	0	Application Reset	WO	1	UINT8	(Write `0x81` to execute the command)
0x0002	0	Factory Reset	WO	1	UINT8	(Write `0x82` to execute the command)
0x0002	0	Back-to-Box	WO	1	UINT8	(Write `0x83` to execute the command)
0x0002	0	LocatorStart	WO	1	UINT8	(Write `0x7E` to execute the command)

Index	Sub-Index	Parameter	Access	Data length [byte]	Data type	Default value
0x0002	0	LocatorStop	WO	1	UINT8	(Write 0x7F to execute the command)

Table 10: General parameters

7.7 Description of parameter data

7.7.1 Input filter

An input filter time is specified by the parameter setting.

The filter times are variably configurable for each channel via the device parameter 0x43.

Index	Subindex Data length 8 bytes	Bit number	I/O channel / port	Parameter value
0x43	1	0-7	0 / D1A	0 = Off, 1-255 = Input filter in ms
0x43	2	0-7	1 / D1B	0 = Off, 1-255 = Input filter in ms
0x43	3	0-7	2 / D2A	0 = Off, 1-255 = Input filter in ms
0x43	4	0-7	3 / D2B	0 = Off, 1-255 = Input filter in ms
0x43	5	0-7	4 / D3A	0 = Off, 1-255 = Input filter in ms
0x43	6	0-7	5 / D3B	0 = Off, 1-255 = Input filter in ms
0x43	7	0-7	6 / D4A	0 = Off, 1-255 = Input filter in ms
0x43	8	0-7	7 / D4B	0 = Off, 1-255 = Input filter in ms

7.7.2 Input signal extension

The parameter setting specifies a minimum input switching time.

This minimum switching time is used for both the Logic-1 and Logic-0 status.

The switching time extensions are variably configurable for each channel via the device parameter index 0x44.

Index	Subindex Data length 8 bytes	Bit number	I/O channel / port	Parameter
0x44	1	0-7	0 / D1A	0 = Off, 1-255 = Input signal extension in ms
0x44	2	0-7	1 / D1B	0 = Off, 1-255 = Input signal extension in ms
0x44	3	0-7	2 / D2A	0 = Off, 1-255 = Input signal extension in ms
0x44	4	0-7	3 / D2B	0 = Off, 1-255 = Input signal extension in ms
0x44	5	0-7	4 / D3A	0 = Off, 1-255 = Input signal extension in ms
0x44	6	0-7	5 / D3B	0 = Off, 1-255 = Input signal extension in ms
0x44	7	0-7	6 / D4A	0 = Off, 1-255 = Input signal extension in ms
0x44	8	0-7	7 / D4B	0 = Off, 1-255 = Input signal extension in ms

7.7.3 Input logic settings (NO/NC)

The parameter determines whether the switched input is displayed as logic 1 (normal mode) or alternatively as logic 0 (inverted mode).

Index	Subindex Data length 8 bytes	Bit number	I/O channel / port	Parameter
0x45	1	0	0 / D1A	NO (Normally Open) = 0, NC (Normally Closed) = 1
0x45	2	0	1 / D1B	NO (Normally Open) = 0, NC (Normally Closed) = 1
0x45	3	0	2 / D2A	NO (Normally Open) = 0, NC (Normally Closed) = 1
0x45	4	0	3 / D2B	NO (Normally Open) = 0, NC (Normally Closed) = 1
0x45	5	0	4 / D3A	NO (Normally Open) = 0, NC (Normally Closed) = 1
0x45	6	0	5 / D3B	NO (Normally Open) = 0, NC (Normally Closed) = 1
0x45	7	0	6 / D4A	NO (Normally Open) = 0, NC (Normally Closed) = 1

Index	Subindex, Data length 8 bytes	Bit number	I/O channel / port	Parameter
0x45	8	0	7 / D4B	NO (Normally Open) = 0, NC (Normally Closed) = 1

7.7.4 User serial number

This parameter allows the user to set a user-specific serial number. The user-specific serial number is displayed when the identification parameter, index 0x15, is read.

If the contents of index 0x48 are equal to zero, the production serial number is displayed on index 0x15.

This parameter is excluded from factory reset and always keeps its value. In case the user-specific serial number should be cleared, this parameter must be written to zero manually.

Index	Subindex/Data length 16 bytes	Bit number	Parameter
0x48	1-16	16 x 0 ... 7	User serial number (default: 16 x 0x00)

7.7.5 Identification

This parameter can be used to display different tool configurations. The content of this parameter is transmitted to the cyclic input data.

Index	Subindex/Data length 1 bytes	Bit number	Parameter
0x60	1	0 ... 6	Identification

Table 11: ID for detecting correct tool change

The parameter (index 0x60) is outside the data storage range.

7.8 Parameterization Analog Output (AO)

The AO parameters can be configured per analog port to meet your specific needs.

7.8.1 Channel parameters AO

Index	Subindex	Parameter	Access	Data length
0x50	1 .. 4 for A1 .. A4	Port mode & Data representation	RW (Read/Write)	4 Byte
0x51	1 .. 4 for A1 .. A4	Voltage range	RW	4 Byte
0x52	1 .. 4 for A1 .. A4	Current range	RW	4 Byte
0x5C	1 .. 4 for A1 .. A4	Failsafe settings	RW	4 Byte
0x5D	1 .. 4 for A1 .. A4	Replacement value	RW	8 Byte
0x5E	1 .. 4 for A1 .. A4	Analog output restart after failure	RW	4 Byte
0x5F	1 .. 4 for A1 .. A4	Filtering	RW	4 Byte
0x62	1 .. 4 for A1 .. A4	Actuator error	RW	4 Byte
0x63	1 .. 4 for A1 .. A4	Wire break error	RW	4 Byte

Table 12: Channel device parameters for Analog Output

7.8.1.1 Port mode & Data representation

With this parameter you set the port mode (voltage / current / resistance / RTD / TC) and the individual data representation (Standard, Extended or NE43) for each analog output port. The default value is highlighted.

Name	Index	Subindex	Length	Access	Values
Port mode & Data representation	0x50	1: Port A1	1 Byte	RW	**0: Deactivated (Yellow Port LED off)** 1: Voltage - Data representation: Standard 2: Voltage - Data representation: Extended (Similar Siemens S7) 3: Voltage - Data representation: NE43 4: Current - Data representation: Standard 5: Current - Data representation: Extended (Similar Siemens S7) 6: Current - Data representation: NE43
		2: Port A2	1 Byte	RW	
		3: Port A3	1 Byte	RW	
		4: Port A4	1 Byte	RW	

7.8.1.2 Voltage range

With this parameter you set the voltage range per analog channel. The default value is highlighted.

Name	Index	Subindex	Length	Access	Values
Voltage range	0x51	1: Port A1	1 Byte	RW	**0: -10 V .. 10 V** 1: 0 V .. +10 V 2: +2 V .. +10 V 3: 0 V .. +5 V 4: +1 V .. +5 V
		2: Port A2	1 Byte	RW	
		3: Port A3	1 Byte	RW	
		4: Port A4	1 Byte	RW	

7.8.1.3 Current range

With this parameter you set the current range per analog channel. The default value is highlighted.

Name	Index	Subindex	Length	Access	Values
Current range	0x52	1: Port A1	1 Byte	RW	**0: +4 mA .. +20 mA** 1: 0 mA .. +20 mA
		2: Port A2	1 Byte	RW	
		3: Port A3	1 Byte	RW	
		4: Port A4	1 Byte	RW	

7.8.1.4 Failsafe settings

With this parameter you set the failsafe values per analog port. For the range 4 mA .. 20 mA, the default failsafe setting is 4 mA. For the +/-10 V mode, the default failsafe setting is 0 V.

This means that after powering up the analog device, these values are set as default values for the analog output, regardless of whether valid output data is received or not. If IO-Link communication is interrupted, the set fail-safe values are activated.

The default value is highlighted.

Name	Index	Subindex	Length	Access	Values
Failsafe settings	0x5C	1: Port A1	1 Byte	RW	**0: Minimum nominal value (e.g. 4 mA in 4 mA .. 20 mA range, or 0 V in +/-10 V mode)** 1: Off (0 mA or 0 V) 2: Hold last value 3: Replacement value
		2: Port A2	1 Byte	RW	
		3: Port A3	1 Byte	RW	
		4: Port A4	1 Byte	RW	

7.8.1.5 Replacement value

In case the replacement value '3' is configured in the failsafe settings as described in Failsafe settings on page 34, the value to replace is stored here (2 Byte per channel).

Name	Index	Subindex	Byte	Acces	Values
Replacement value	0x5D	1: Port A1	0: Low Byte A1	RW	
			1: High Byte A1		
		2: Port A2	2: Low Byte A2	RW	
			3: High Byte A2		
		3: Port A3	4: Low Byte A3	RW	
			5: High Byte A3		
		4: Port A4	6: Low Byte A4	RW	
			7: High Byte A4		

7.8.1.6 Analog output restart after failure

With this parameter you set the analog output restart after actuator or wire break error per analog port. The default value is highlighted.

Name	Index	Subindex	Length	Access	Values
Analog output restart after actuator error	0x5E	1: Port A1	1 Byte	RW	**0: Automatic restart after failure** 1: Restart after output reset
		2: Port A2	1 Byte	RW	
		3: Port A3	1 Byte	RW	
		4: Port A4	1 Byte	RW	

7.8.1.7 Actuator error

With this parameter you set the actuator error warning per analog port (overload or short circuit of analog port). Per analog port, the actuator error warning can be enabled or disabled. This only affects the IO-Link event, the corresponding error bit of the process data always represents the actual error state. The default value is highlighted.

Name	Index	Subindex	Length	Access	Values
Actuator error	0x62	1: Port A1	1 Byte	RW	0: Disabled **1**: **Enabled**
		2: Port A2	1 Byte	RW	
		3: Port A3	1 Byte	RW	
		4: Port A4	1 Byte	RW	

7.8.1.8 Filtering

With this parameter you set the filtering per analog port. The default value is highlighted.

Name	Index	Subindex	Length	Access	Values
Filtering	0x5F	1: Port A1	1 Byte	RW	**0: Deactivated** 1: Fast - Slew rate limited to ~1 ms/ FSR to 1.8 ms/FSR 2: Medium – Slew rate limited to ~4 ms/FSR to 7 ms/FSR 3: Slow – Slew rate limited to ~30 ms/FSR to 60 ms/FSR
		2: Port A2	1 Byte	RW	
		3: Port A3	1 Byte	RW	
		4: Port A4	1 Byte	RW	

7.8.1.9 Wire break error

With this parameter you set the Wire break error per analog channel. Per analog port, the wire break error warning can be enabled or disabled. This only affects the IO-Link event, the corresponding error bit of the process data always represents the actual error state. The default value is highlighted.

Name	Index	Subindex	Length	Access	Values
Wire break error	0x63	1: Port A1	1 Byte	RW	0: Disabled **1**: **Enabled**
		2: Port A2	1 Byte	RW	
		3: Port A3	1 Byte	RW	
		4: Port A4	1 Byte	RW	

8 Process data assignment

This chapter describes the assignment of the process data of the controller to the I/O channels.

The process data length is invariable for all LioN-X Analog Hubs. The following tables show the structure of the data. It is not possible to configure the process data length.

Explanations of the abbreviations used:

D1A .. D4A:	Current status of input channel A (pin 4) of the M12 connectors 1 to 4.
D1B .. D4B:	Current status of input channel B (pin 2) of M12 connectors 1 to 4.
MD-LVS	Module diagnosis – system/sensor power supply voltage too low
PD-SE-D1 .. D4	Port diagnosis – supply error (short-circuit or overload) on D1 .. D4
PD-SE-A1 .. A4	Port diagnosis – supply error (short-circuit or overload) on A1 .. A4 (separate bits)
PD-An Diagn.	Port diagnosis for port A1 .. A4 is active, check corresponding port diagnosis byte (byte 11-4 or byte 3-6) for detailed information.
ID	ID byte for identification of a tool change, 0 = default, ID = 0–127
WBR	Wire Break on A1 .. A4
AAE	Analog Actuator Error on A1 .. A4, AO (overload/overcurrent of analog Output)

8.1 Input data for 4AO/8DI modules

Device 0960 IOL 3858-001 supplies a total of 8 bytes of input data as follows:

Byte	Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Digital Inputs	D4B	D4A	D3B	D3A	D2B	D2A	D1B	D1A
1	reserved	–							
2	Modul diagnosis	PD-A4	PD-A3	PD-A2	PD-A1	PD-SE-A1 .. A4	PD-SE-D1 .. D4	–	MD-LVS
3	Port diagnosis A1			A1 AAE			A1 WBR		
4	Port diagnosis A2			A2 AAE			A2 WBR		
5	Port diagnosis A3			A3 AAE			A3 WBR		
6	Port diagnosis A4			A4 AAE			A4 WBR		
7	Device identification		ID						

Table 13: Input process data 0960 IOL 3858-001

8.2 Output data for 4AO/8DI modules

Device 0960 IOL 3858-001 supplies a total of 8 bytes of output data as follows:

Byte	Description	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Analog value	High Byte AO A1							
1	Analog value	Low Byte AO A1							
2	Analog value	High Byte AO A2							
3	Analog value	Low Byte AO A2							
4	Analog value	High Byte AO A3							
5	Analog value	Low Byte AO A3							
6	Analog value	High Byte AO A4							
7	Analog value	Low Byte AO A4							

Table 14: Output process data 0960 IOL 3858-001

8.3 Value representation for the voltage range

The following tables show measurement representations for the different values from Voltage range on page 33.

8.3.1 Voltage range -10 V .. +10 V

The failsafe default values are highlighted.

Representation: Standard	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 3276.7 (1/V) × U_{out} (V)			
10.0000 V	Nominal range	32767	7FFF
9.9997 V …		32766 …	7FFE …
5.0002 V		16384	4000
…		…	…
0.000305 V		1	0001
0.00000 V		**0**	**0000**
-0.000305 V		-1	FFFF
…		…	…
-5.0000 V		-16384	C000
…		…	…
-9.9997 V		-32766	8002
-10.0000 V		-32767	8001
-10,0000 V		-32768	8000

Table 15: -10 V .. +10 V - Measurement value representation ‘Standard’

Representation: Extended	Diagnostics	Decimal	Hexadecimal (two´s complement)
2764.8 (1/V) × U_{out} (V)			
>11.759 V		32767	7FFF
11.759 V		32511	7EFF
11.75 V		32496	7EF0
10.0058 V		27664	6C10
10.0004 V		27649	6C01
10.000 V	Nominal range	27648	6C00
5.787 mV		16	0010
361.7 µV		1	0001
0 V		**0**	**0000**
-361.7 µV		-1	FFFF
-5.787 mV		-162	FFF0
-2.5 V		-6912	E500
-10 V		-27648	9400
-10.004 V		-27649	93FF
-10.0058 V		-27664	93F0
-11.759 V		-32512	8100
<-11.759 V		-32768	8000

Table 16: -10 V .. +10 V - Measurement value representation ‘Extended’ (similar to Siemens S7)

Representation: NE43	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1000 (1/V) × U_{out} (V)			
11.000 V		>11000	>2AF8
11.000 V		11000	2AF8
10.501 V		10501	2905
10.500 V		10500	2904
10.001 V		10001	2711
10.000 V	Nominal range	10000	2710
4.000 V		4000	0FA0
0.001 V		1	0001
0.000 V		**0**	**0000**
-0.001 V		-1	FFFF
-4.000 V		-4000	F060
-10.000 V		-10000	D8F0
-10.001 V		-10001	D8EF
-10.500 V		-10500	D6FC
-10.501 V		-10501	D6FB
-11.000 V		-11000	D508
-11.000 V		<-11000	<D508

Table 17: -10 V .. +10 V - Measurement value representation ‘NE43’

8.3.2 Voltage range 0 V .. +10 V

The failsafe default values are highlighted.

Representation: Standard	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 3276.7 (1/V) × U_{out} (V)			
10.0000 V	Nominal range	32767	7FFF
9.9997 V …		32766 …	7FFE …
5.0002 V		16384	4000
…		…	…
0.000305 V		1	0001
0 V		**0**	**0000**
0 V		-1	FFFF
…		…	…
0 V		-16384	C000
…		…	…
0 V		-32767	8001
0 V		-32768	8000

Table 18: 0 V .. +10 V - Measurement value representation ‘Standard’

Representation: Extended	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 2764.8 (1/V) × U_{out} (V)			
11.759 V		>32511	7EFF
11.759 V		32511	7EFF
11.75 V		32486	7EE6
10.0058 V		27664	6C10
10.0004 V		27649	6C01
10.000	Nominal range	27648	6C00
5.787 mV		16	0010
361.7 µV		1	0001
0 V		**0**	**0000**
0 V		-1	FFFF
0 V		<-1	<FFFF

Table 19: 0 V .. +10 V - Measurement value representation ‘Extended’ (similar to Siemens S7)

Representation: NE43	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1000 (1/V) × U_{out} (V)			
11.000 V		65535	FFFF
11.000 V		11001	2AF9
11.000 V		11000	2AF8
10.501 V		10501	2905
10.500 V		10500	2904
10.001 V		10001	2711
10.000 V	Nominal range	10000	2710
4.000 V		4000	0FA0
2.000 V		2000	07D0
0.001 V		1	0001
0 V		**0**	**0000**

Table 20: 0 V .. +10 V - Measurement value representation ‘NE43’

8.3.3 Voltage range +2 V .. +10 V

The failsafe default values are highlighted.

Representation: Standard	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 4095.875 (1/V) × (U_{out} (V) -2V)			
10.0000 V	Nominal range	32767	7FFF
9.9998 V …		32766 …	7FFE …
6.0001 V		16384	4000
…		…	…
2.0002 V		1	0001
2 V		**0**	**0000**
2 V		-1	FFFF
2 V		<-1	<FFFF

Table 21: +2 V .. +10 V - Measurement value representation ‘Standard’

Representation: Extended	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 3456 (1/V) × (U_{out} (V) – 2V)			
11.4074 V		>32511	>7EFF
11.4074 V		32511	7EFF
11.4028 V		32496	7EF0
10.0046 V		27664	6C10
10.0003 V		27649	6C01
10.0000 V	Nominal range	27648	6C00
2.0046 V		16	0010
2.0003 V		1	0001
2.0000 V		**0**	**0000**
1.9997 V		-1	FFFF
1.9954 V		-16	FFF0
0 V		-6912	E500
0 V		<-6912	<E500

Table 22: +2 V .. +10 V - Measurement value representation ‘Extended’ (similar to Siemens S7)

Representation: NE43	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1000 (1/V) × U_{out} (V)			
11.000 V		>11000	2AF8
11.000 V		11000	2AF8
10.000 V	Nominal range	10000	2710
4.000 V		4000	0FA0
2.000 V		**2000**	**07D0**
1.000 V		1000	03E8
0V		<1000	<03E8

Table 23: +2 V .. +10 V - Measurement value representation ‘NE43’

8.3.4 Voltage range 0 V .. +5 V

The failsafe default values are highlighted.

Representation: Standard	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 6553,4 (1/V) × U_{out} (V)			
5.00000 V		32767	7FFF
4.99985 V …	Nominal range	32766 …	7FFE …
2.50003 V		16384	4000
…		…	…
153 µV		1	0001
0 V		**0**	**0000**
0 V		-1	FFFF
0 V		<-1	<FFFF

Table 24: 0 V .. +5 V - Measurement value representation ‘Standard’

Representation: Extended	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 5529.6 (1/V) × (U_{out} (V)			
5.8794 V		>32511	>7EFF
5.8794 V		32511	7EFF
5.8767 V		32496	7EF0
5.0029 V		27664	6C10
5.0001 V		27649	6C01
5.0000 V	Nominal range	27648	6C00
2.893 mV		16	0010
181 µV		1	0001
0 V		**0**	**0000**
0 V		-1	FFFF
0 V		<-1	<FFFF

Table 25: 0 V .. +5 V - Measurement value representation ‘Extended’ (similar to Siemens S7)

Representation: NE43	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1000 (1/V) × U_{out} (V)			
5.500 V		65535	FFFF
5.500 V		5501	157D
5.500 V		5500	157C
5.000 V	Nominal range	5000	1388
4.000 V		4000	0FA0
2.000 V		2000	07D0
0.001 V		1	0001
0 V		**0**	**0000**

Table 26: 0 V .. +5 V - Measurement value representation ‘NE43’

8.3.5 Voltage range +1 V .. +5 V

The failsafe default values are highlighted.

Representation: Standard	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 8191.75 (1/V) × (U_{out} (V)-1V)			
5.00000 V	Nominal range	32767	7FFF
4.99988 V …		32766 …	7FFE …
3.00006 V		16384	4000
…		…	…
1.00012 V		1	0001
1 V		**0**	**0000**
1 V		-1	FFFF
1 V		<-1	<FFFF

Table 27: +1 V .. +5 V - Measurement value representation ‘Standard’

Representation: Extended	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 6912 (1/V) × (U_{out} (V) -1V)			
5.7036 V		>32511	>7EFF
5.7036 V		32511	7EFF
5.7014 V		32496	7EF0
5.0023 V		27664	6C10
5.0001 V		27649	6C01
5.0000 V	Nominal range	27648	6C00
1.0023 V		16	0010
1.0001 V		1	0001
1.0000 V		**0**	**0000**
0.9999 V		-1	FFFF
0.9977 V		-16	FFF0
0 V		-6912	E500
0 V		<-6912	<E500

Table 28: +1 V .. +5 V - Measurement value representation ‘Extended’ (similar to Siemens S7)

Representation: NE43	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1000 (1/V) × U_{out} (V)			
5.500 V		65535	FFFF
5.500 V		5501	157D
5.500 V		5500	157C
5.000 V	Nominal range	5000	1388
4.000 V		4000	0FA0
2.000 V		2000	07D0
1.000V		**1000**	
0.500V		500	
0.000V		<500	

Table 29: +1 V .. +5 V - Measurement value representation ‘NE43’

8.4 Value representation for the current range

The following tables show measurement representations for the different values from Current range on page 33.

8.4.1 Current range +4 mA .. +20 mA

The failsafe default values are highlighted.

Representation: Standard	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 2047.9375 (1/mA) × (I_{out} (mA) - 4 mA)			
20.0000 mA	Nominal range	32767	7FFF
19.9995 mA …		32766 …	7FFE …
12.00024 mA		16384	4000
…		…	…
4.0004883 mA		1	0001
4.0000 mA		**0**	**0000**
4.0000 mA		-1	FFFF
4.0000 mA		<-1	<FFFF

Table 30: +4 mA .. +20 mA - Measurement value representation ‘Standard’

Representation: Extended	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1728 (1/mA) × (I_{out} (mA) - 4 mA)			
22.814 mA		>32511	7EFF
22.814 mA		>32511	7EFF
22.806 mA		32496	7EF0
20.0096 mA		27664	6C10
20.0006 mA		27649	6C01
20.0000 mA	Nominal range	27648	6C00
4.009259 mA		16	0010
4.000578 mA		1	0001
4.0000 mA		**0**	**0000**
3.999422 mA		-1	FFFF
3.990741 mA		-16	FFF0
0.0000 mA		-6912	E500
0.0000 mA		<-6913	E500

Table 31: +4 mA .. +20 mA - Measurement value representation ‘Extended’ (similar to Siemens S7)

Representation: NE43	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1000 (1/mA) × I_{out} (mA)			
22.000 mA		>22000	> 55F0
22.000 mA		22000	55F0
21.001 mA		21001	5209
21.000 mA		21000	5208
20.001 mA		20001	4E21
20.000 mA	Nominal range	20000	4E20
8.000 mA		8000	1F40
4.000 mA		**4000**	**0FA0**
3.999 mA		3999	0F9F
3.600 mA		3600	0E10
3.599 mA		3599	0E0F
2.000 mA		2000	07D0
0.000 mA		<2000	07D0

Table 32: +4 mA .. +20 mA - Measurement value representation ‘NE43’

8.4.2 Current range 0 mA .. +20 mA

The failsafe default values are highlighted.

Representation: Standard	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1638.35 (1/mA) × I_{out} (mA)			
20.0000 mA	Nominal range	32767	7FFF
19.9994 mA …		32766 …	7FFE …
10.0003 mA		16384	4000
…		…	…
0.6103 µA		1	0001
0.0000 mA		**0**	**0000**
0.0000 mA		-1	FFFF
0.0000 mA		<-1	<FFFF

Table 33: 0 mA .. +20 mA - Measurement value representation ‘Standard’

Representation: Extended	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1382.4 (1/mA) × I_{out} (mA)			
23.518 mA		>32511	>7EFF
23.518 mA		32511	7EFF
23.507 mA		32496	7EF0
20.0116 mA		27664	6C10
20.0007 mA		27649	6C01
20.0000 mA	Nominal range	27648	6C00
11.574 µA		16	0010
0,7234 µA		1	0001
0.0000 mA		**0**	**0000**
0.0000 mA		-1	FFFF
0.0000 mA		>-1	>FFFF

Table 34: 0 mA .. +20 mA - Measurement value representation ‘Extended’ (similar to Siemens S7)

Representation: NE43	Diagnostics	Decimal	Hexadecimal (two´s complement)
Dec. value = 1000 (1/mA) × I_{out} (mA)			
22.000 mA		>22000	55F0
22.000 mA		22000	55F0
21.001 mA		21001	5209
21.000 mA		21000	5208
20.001 mA		20001	4E21
20.000 mA		20000	4E20
8.000 mA	Nominal range	8000	1F40
4.000 mA		4000	0FA0
0.002 mA		2	0002
0.001 mA		1	0001
0.000 mA		**0**	**0000**

Table 35: 0 mA .. +20 mA - Measurement value representation ‘NE43’

9 Diagnostic Properties

The devices offer the following diagnostic messages dependent on their function:

9.1 Device Status

<table>
<tr><th>Index</th><th>Sub Index / Data length 1 Byte</th><th>Length</th><th>Parameter</th></tr>
<tr><td>0x24</td><td>0</td><td>Octet</td><td>
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td>0</td><td>Device is operating properly.</td></tr>
<tr><td>1</td><td>Maintenance-Required</td></tr>
<tr><td>2</td><td>Out-of-Specification</td></tr>
<tr><td>3</td><td>Functional-Check</td></tr>
<tr><td>4</td><td>Failure</td></tr>
<tr><td>5-255</td><td>Reserved</td></tr>
</table>
Table 36: Read only – Contains the current status of the device.
</td></tr>
</table>

9.2 Device status in detail

<table>
<tr><th>Index</th><th>Subindex / data length N x ArrayT</th><th>Parameter</th></tr>
<tr><td>0x25</td><td>1-24</td><td>
<table>
<tr><th>Subindex</th><th>Object name</th><th>Data type</th><th>Comment</th></tr>
<tr><td>1</td><td>Error_Warning_1</td><td>3 octets</td><td rowspan="4">All octets 0x00: no error/warning
Octet 1: Event qualifier
Octet 2, 3: Event code</td></tr>
<tr><td>2</td><td>Error_Warning_2</td><td>3 octets</td></tr>
<tr><td>3</td><td>Error_Warning_3</td><td>3 octets</td></tr>
<tr><td>4</td><td>Error_Warning_4</td><td>3 octets</td></tr>
<tr><td>:</td><td>:</td><td>:</td><td>:</td></tr>
<tr><td>n</td><td>Error_Warning_n</td><td>3 octets</td><td></td></tr>
</table>
Table 37: Read only – Contains the extended status of the device.
</td></tr>
</table>

<table>
<tr><th>Bits</th><th>Description</th></tr>
<tr><td>b7 ... b6</td><td>Mode</td><td>
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td>0</td><td>Reserved</td></tr>
<tr><td>1</td><td>Event single shot</td></tr>
<tr><td>2</td><td>Event disappears</td></tr>
<tr><td>3</td><td>Event appears</td></tr>
</table>
</td></tr>
<tr><td>b5 ... b4</td><td>Type</td><td>
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td>0</td><td>Reserved</td></tr>
<tr><td>1</td><td>Notification</td></tr>
<tr><td>2</td><td>Warning</td></tr>
<tr><td>3</td><td>Error</td></tr>
</table>
</td></tr>
<tr><td>b3</td><td>Source</td><td>
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td>0</td><td>Device (remote)</td></tr>
<tr><td>1</td><td>Master (local)</td></tr>
</table>
</td></tr>
<tr><td>b2 ... b0</td><td>Instance</td><td>
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td>0</td><td>Unknown</td></tr>
<tr><td>1 ... 3</td><td>Reserved</td></tr>
<tr><td>4</td><td>Application</td></tr>
<tr><td>5 ... 7</td><td>Reserved</td></tr>
</table>
</td></tr>
</table>

Table 38: Event qualifier

Event code	Type	Device Status	Description
0x5111	Warning	2	MD-LVS: Module diagnosis – system/sensor power supply voltage too low
0x7710	Error	4	PD-SE-D1...D4: Port diagnosis – supply error (short-circuit or overload) on D1 .. D4
0x8CA4	Error	4	SE: Supply error Pin 1 on A1
0x8CA5	Error	4	SE: Supply error Pin 1 on A2
0x8CA6	Error	4	SE: Supply error Pin 1 on A3
0x8CA7	Error	4	SE: Supply error Pin 1 on A4
0x8CAF	Error	4	PD-SE-An: Port diagnosis – supply error (short-circuit or overload) on A1/A2/A3/A4 über separate Bits (voltage from L+ sensor/system supply)
0x8CD4	Error	4	AAE: Analog actuator error on A1 (overload/overcurrent of analog output in voltage mode)
0x8CD5	Error	4	AAE: Analog actuator error on A2 (overload/overcurrent of analog output in voltage mode)
0x8CD6	Error	4	AAE: Analog actuator error on A3 (overload/overcurrent of analog output in voltage mode)
0x8CD7	Error	4	AAE: Analog actuator error on A4 (overload/overcurrent of analog output in voltage mode)
0x8CE4	Error	4	WBR: Wire break on A1
0x8CE5	Error	4	WBR: Wire break on A2
0x8CE6	Error	4	WBR: Wire break on A3
0x8CE7	Error	4	WBR: Wire break on A4

Table 39: Event codes for peripheral errors

Error code	Description
0x8011	Index not available
0x8012	Subindex not available
0x8023	Access denied
0x8033	Parameter length overrun
0x8034	Parameter length underrun

Error code	Description
0x8035	Function not available

Table 40: Error codes for access management

10 IO-Link IODD

There is an IODD device description file available for every Belden IO-Link device. The IODD file contains a variety of information about system integration, including communication properties, device parameters, and identification, process and diagnostic data.

10.1 Device description file download

You can find the matching device description file in each case in the Belden download area at:

https://www.belden.com/products/i-o-systems

or in the IO-Link Community download area at

https://ioddfinder.io-link.com.

Attention: We recommend that you download and install the most up-to-date version of the relevant IODD from the download area.

11 Technical data

The following sections give an overview of the most important functional data needed to operate the device. For further information and detailed technical data, see the respective **Data Sheet** of your required product in the product specific download area on https://catalog.belden.com.

11.1 General

Ambient temperature during operation		-40 °C … +70 °C (-40 °F … +158 °F)
Ambient storage temperature		-40 °C … +85 °C (-40 °F … +185 °F)
Ambient humidity		95 % RH (for UL applications 80 % PRH)
Weight		Approx. 380 g (13.4 oz)
Housing material		Die-cast zinc
Protection class: Plugged in and properly screwed together (according to DIN EN 60529)		IP65, IP67 and IP69K (not subject to UL inspection)
Pollution Degree		3
Flammability class		UL 94
Vibration, sinusoidal		EN 60068-2-6 5-500 Hz / 15 g
Shock, semi-sinusoidal EN 60068-2-27		EN 60068-2-27 50 g / 11 ms
EMC immunity, EMC interference emission		EN 61000-6-2 EN 61000-6-4
Torques	Fixing screws M4/M6:	1.0 Nm
	M12 connector:	0.5 Nm
Installation position		Any
Approvals		CE, UL, IO-Link

Table 41: General information

11.2 IO-Link interface

Specification	IO-Link spec. v1.1.5
Physical transmission	IO-Link, 24 V Half duplex
Transfer rate	COM 3 (230.4 kBaud)
Limitation IO-Link expansion	max. 20 m (65.6 ft)
IO-Link standard	IEC 61131-9
Process data	8 bytes input data 8 bytes output data
Frame type	Type_2_V
Cycle time	Max. 4 ms

Table 42: Information on the bus system

11.3 Power supply for the device electronics/ sensors

Nominal voltage U_S	24 V DC
Nominal voltage range[1]	19.2 V DC .. 28.8 V DC (SELV/PELV to EN60950 - 1)
Max. voltage range	18 V DC .. 30 V DC
Power consumption/supply	Max. 100 mA
Reverse polarity protection	Yes
Overload protection	Yes
Fuse	An external fuse is recommended for the 4AO/8DI version.
Voltage level of the sensor power supply	Min. (U_S – 1.5 V)
Power consumption of sensors	max. 500 mA in total for ports D1 .. D4 and max. 500 mA in total for ports A1 .. A4 (at T_U = 30 °C / 86 °F) per device
Operational indicator (U_S)	LED green for U_S >18 V LED red for U_S <18 V

Table 43: Information on the power supply for the device electronics/ sensors

1 The device should be supplied with a Limited Energy power supply in accordance with UL 61010-1, 3rd edition, section 9.4, or with LPS (Limited Power Source) in accordance with UL 60950-1 or class 2 in accordance with UL 1310 or UL 1585.

11.4 Digital inputs

Standard digital input (8/16DIO)	Type 1 In accordance with IEC 61131-2
Input current at 24 V DC	Typically 4.6 mA
Input channels	8 ×
Input type	Normally open p-switching
Input filter	Configurable via software Off, 0.5 ms, 1 ms, 2 ms, 3 ms (default)
Input pulse extension	Configurable via software Off (default), 0.5 ms, 1 ms, 2 ms, 3 ms
Sensor power supply overload protection	Yes
Status indicator	Yellow LED for channel A (red for sensor voltage overload) White LED for channel B

Table 44: Information on the inputs

11.5 Analog ports

Caution: Device damage / loss of warranty or guarantee claims

Only signals/voltage levels that correspond to the permissible measuring ranges and limit values specified in this manual may be present at the analog M12 ports. Incorrect wiring (e.g., reverse polarity, incorrect pin assignment) as well as the connection of input values that do not comply with the specification (e.g., impermissible signal voltage/current, external overload, or faulty external signal sources) may lead to permanent device damage or failure. Damage resulting from operation outside the specification is excluded from the manufacturer's warranty/guarantee.

Attention: Configure the operating mode **BEFORE** connecting any sensors. Sensors may only be connected and operated in the operating modes intended for them; otherwise, there is a risk of damaging the sensors.

Attention: It is not permitted to supply the analog output with an external voltage.

Number of Analog Output Channels	4
Connection	M12, 5-poles, A-coded
Number of Ports	4 (A1 to A4)
Channel Type	0/+1 V.. +5 V, 0/+2 V.. +10 V, +/-10 V, 0/+4 mA.. +20 mA
Output Wiring	2-wire (un/shielded)
Resolution (D/A)	15 bit + sign (16 bit)
Accuracy / Precision	< 0,15 % (basic error at +25 °C / +77 °F)
Conversion Time (A/D)	
Process Data Update	
Temperature Fault	< +/- 0,01 %/K
Signal Delay	300µs
Switching Frequency	
Load Resistance	voltage > 1 kOhm, current < 600 Ohm
Data Format	Standard, Extended (Siemens S7), NE43
Permissible Conductor Length to the Sensor	max. 30 m
Protective Circuit	Suppressor diode
Status indicator	LED yellow per port
Diagnostic indicator	LED red per port
Operating modes	voltage, current
Outputsignal type	common ground
Operating mode Voltage (Input)	Single ended: max. +15 V Differential: max. +/-15 V
Operating mode Current (Input)	Single ended: max. +25 mA Differential: max. +/-25 mA
Error total (Full scale value)	< 0,3 %

Table 45: Information on the analog ports

11.6 LEDs

LED	LED color	Description
U_S	Off	Module de-energized
	Green	Power supply of system/sensor OK (U_S >18 V)
	Red	Power supply of system/sensor <18 V (+/-1 V)
IO-Link	Green	No communication
	Flashing green	IOL communication OK
	Red	Communication error
DIA	Off	No diagnosis exists
	Red	Module diagnosis available
A (DI ports D1 .. D4, channel A)	Off	Channel A – signal = ‘0’ / DI OFF
	Yellow	Channel A – signal = ‘1’ / DI ON
	Red	Sensor voltage overload
B (DI ports D1 .. D4, channel B)	Off	Channel B – signal = ‘0’ / DI OFF
	White	Channel B – signal = ‘1’ / DI ON
Act (Analog ports A1 .. A4, channel A)	Off	Port inactive
	Yellow	Port active
Dia (Analog ports A1 .. A4, channel B)	Off	No diagnosis
	Red	Diagnostic error (e.g. voltage error, overload, broken wire)

Table 46: Information on LED colors

12 Recycling note

The symbol of a crossed-out wheeled bin shown on the device indicates that the device MUST NOT be disposed of with household waste at the end of its service life.

After its service life, the used device must be disposed of properly as electronic waste in accordance with the locally applicable disposal regulations.

End users are responsible for deleting personal data from the used device prior to disposal.

End users are obliged to separate used batteries and accumulators that are not enclosed by the used device from the used device in a nondestructive manner before disposing of the used device. The used batteries and accumulators must be handed in for separate collection. This does not apply if the used device is handed in for reuse.

13 Accessories

In order to get access to various types of accessories, please visit our Web page:

https://www.belden.com