Manual

CC-Link IE Field Basic

LioN-X IO-Link Master Multiprotocol:
0980 XSL 3912-121-007D-01F (8 x IO-Link Class A)
0980 XSL 3912-121-027D-01F (8 x IO-Link Class A)
0980 XSL 3913-121-007D-01F (8 x IO-Link Class A/B Mixmodule)
0980 XSL 3913-121-027D-01F (8 x IO-Link Class A/B Mixmodule)

LioN-Xlight IO-Link Master CC-Link IE Field Basic:
0980 LSL 3411-121-0006-010 (8 x IO-Link Class A)
0980 LSL 3410-121-0006-010 (4 x IO-Link Class A + 8 x DI)

Manual CC-Link IE Field Basic
Version 1.5 10/2023

Technical Support
lumberg-automation-support.belden.com

Contents

1 About this manual 8
1.1 General information 8
1.2 Explanation of symbols 9
  1.2.1 Use of danger information 9
  1.2.2 Use of general information 9
1.3 Version information 10

2 Safety instructions 11
2.1 Intended use 11
2.2 Qualified personnel 12

3 Designations and synonyms 13

4 System description 17
4.1 About LioN-X 17
4.2 Device variants 18
4.3 I/O port overview 20

5 Overview of product features 23
5.1 CC-Link IE Field Basic product features 23
5.2 I/O port features 24
5.3 Integrated Web server 25
5.4 Security features 26
5.5 Other features 27

6 Assembly and wiring 28

6.1 General information 28
6.2 Outer dimensions 29
  6.2.1 LioN-X multiprotocol variants with CC-Link IE Field Basic 29
  6.2.2 LioN-Xlight variants with CC-Link IE Field Basic 33
  6.2.3 Notifications 35
6.3 Port assignments 36
  6.3.1 Ethernet ports, M12 socket, 4-pin, D-coded 36
  6.3.2 Power supply with M12 power L-coded 37
    6.3.2.1 IO-Link Master with Class A ports 38
    6.3.2.2 IO-Link Master with Class A/B ports 39
  6.3.3 I/O ports as M12 sockets 39
    6.3.3.1 IO-Link ports (Class A and Class B) 40

7 Starting operation 42

7.1 CSP+ file 42
7.2 MAC addresses 42
7.3 State on delivery 43
7.4 Setting the rotary encoding switches 44
  7.4.1 CC-Link IE Field Basic 47
  7.4.2 Factory reset 47
7.5 Setting network parameters 48

8 Configuration CC-Link IE Field Basic 49

8.1 General settings 50
  8.1.1 Force mode lock 51
  8.1.2 Web interface lock 51
  8.1.3 Report U_L/U_{AUX} supply voltage fault 51
  8.1.4 Report actuator fault without U_L/U_{AUX} voltage 51
  8.1.5 Report U_S voltage fault 51

8.1.6 External configuration lock 51
8.2 Port configuration X1 .. X8 52
8.2.1 Port Mode 56
8.2.2 Validation and Backup 56
8.2.3 IQ Mode 60
8.2.4 Cycle Time 60
8.2.5 Vendor ID 61
8.2.6 Device ID 61
8.2.7 IOL Failsafe 61
8.2.8 IOL Failsafe values 62
8.2.9 Swapping Length 62
8.2.10 Swapping Offset 63
8.2.11 Swapping Count 63
8.2.12 Sensor Supply Disabled 63
8.2.13 Suppress all Diagnosis 63
8.2.14 DO Surveillance Timeout 63
8.2.15 DO Failsafe 63
8.2.16 DO Restart Mode 64
8.2.17 DI Logic 64
8.2.18 DI Filter 65
8.2.19 Error LED Disable 65
8.2.20 Level LED Disable 65
8.2.21 Use Push Pull 65
8.2.22 Current Limit 65

9 Process data assignment 66

9.1 Consuming data (output) 67
9.2 Producing data (input) 68

10 Diagnostics processing 69

10.1 Error of the system/sensor power supply 69
10.2 Error of the auxiliary/actuator power supply 70

10.3 Overload/short circuit of the digital outputs 70
10.4 Overload/short circuit of the actuator power supply P24 72
10.5 Overload/short-circuit of the I/O port sensor supply outputs 73

11 Configuration and operation with GxWorks3® 74

11.1 Integration of a CSP+ file 74
11.2 Network parameters 75
11.3 Parameter processing 77

12 IIoT functionality 80

12.1 MQTT 81
  12.1.1 MQTT configuration 81
  12.1.2 MQTT topics 84
    12.1.2.1 Base topic 84
    12.1.2.2 Publish topic 87
    12.1.2.3 Command topic (MQTT Subscribe) 92
  12.1.3 MQTT configuration - Quick start guide 96
    12.1.3.1 MQTT configuration via JSON 96
12.2 OPC UA 98
  12.2.1 OPC UA configuration 99
  12.2.2 OPC UA address space 101
  12.2.3 OPC UA configuration - Quick start guide 102
    12.2.3.1 OPC UA configuration via JSON 102
12.3 REST API 104
  12.3.1 Standard device information 106
  12.3.2 Structure 107
  12.3.3 Configuration and forcing 113
  12.3.4 Reading and writing ISDU parameters 115
    12.3.4.1 Reading ISDU 115
    12.3.4.2 Writing ISDU 117
  12.3.5 Example: Reading ISDU 119

12.3.6 Example: Writing ISDU 119
12.4 CoAP server 120
12.4.1 CoAP configuration 120
12.4.2 REST API access via CoAP 121
12.4.3 CoAP configuration - Quick start guide 124
12.4.3.1 CoAP configuration via JSON 124
12.5 Syslog 126
12.5.1 Syslog configuration 126
12.5.2 Syslog configuration - Quick start guide 129
12.5.2.1 Syslog configuration via JSON 129
12.6 Network Time Protocol (NTP) 131
12.6.1 NTP configuration 131
12.6.2 NTP configuration - Quick start guide 133
12.6.2.1 NTP configuration via JSON 133

13 The integrated Web server 135

13.1 LioN-X 0980 XSL... variants 136
13.1.1 The Status page 136
13.1.2 The Ports page 137
13.1.3 The System page 138
13.1.3.1 HTTPS 140
13.1.3.2 HTTPS certificate manager 140
13.1.4 The User page 140
13.1.5 Certificate creation – example 141
13.2 LioN-Xlight 0980 LSL... variants 144
13.2.1 The System page 144

14 IODD 146

14.1 IO-Link Device parameters and ISDU requests 146
14.2 Web GUI functionality 147
14.2.1 Port Details page 147
14.2.2 Parameters page 149

14.2.3 IODD Management page 150

15 Technical data 151

15.1 General 152
15.2 CC-Link IE Field Basic protocol 153
15.3 Power supply of the module electronics/sensors 154
15.4 Power supply of the actuators 155
  15.4.1 IO-Link Class A devices (U_L) 155
  15.4.2 IO-Link Class A/B devices (U_{AUX}) 155
15.5 I/O ports Channel A (Pin 4) 156
  15.5.1 Configured as digital input, Ch. A (Pin 4) 156
  15.5.2 Configured as digital output, Ch. A (Pin 4) 157
  15.5.3 Configured as IO-Link port in COM mode, Ch. A 158
15.6 I/O ports Channel B (Pin 2) 159
  15.6.1 Configured as a digital input, Ch. B (Pin 2) 159
  15.6.2 Configured as a digital output, Ch. B (Pin 2) 160
15.7 LEDs 163
15.8 Data transfer times 166

16 Accessories 168

1 About this manual

1.1 General information

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

Index	Created	Changes
1.0	03/2022	
1.1	06/2022	Temporarily excluded device variant information for 0980 XSL 3913-121-007D-01F (shipping in 2023)
1.2	10/2022	Device variant information for 0980 XSL 3913-121-007D-01F included. Ch. 7.4: LED description
1.3	12/2022	Ch. 8.1 ("External configuration lock")
1.4	07/2023	Warning in ch. Setting the rotary encoding switches on page 44
1.5	10/2023	Added new feature HTTPS (several chapters updated). New device variants: 0980 XSL 3912-121-027D-01F 0980 XSL 3913-121-027D-01F

Table 1: Overview of manual revisions

2 Safety instructions

2.1 Intended use

The products described in this manual are decentralized IO-Link Masters on an Industrial Ethernet 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 modules fulfill the requirements of the EMC guidelines (2014/30/EU) and the low voltage guideline (2014/35/EU).

The IO-Link Masters 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 IO-Link Masters. Only connect devices that fulfill the requirements of EN 61558-2-4 and EN 61558-2-6 to the IO-Link Masters.

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 – Lumberg Automation™ 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 – Lumberg Automation™ – 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.

ℹ **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

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)
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
DIA	Diagnostic LED
DO	Digital Output
DIO	Digital Input/Output
DTO	Device Temperature Overrun (EIP diagnostics)
DTU	Device Temperature Underrun (EIP diagnostics)
DUT	Device under test
EIP	EtherNet/IP

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)
IDE	IO-Link port Device Error (EIP diagnostics)
IDN	IO-Link port Device Notification (EIP diagnostics)
IDW	IO-Link port Device 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	Multiprotocol: 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
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
RPI	Requested Packet Interval
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

Table 2: Designations and synonyms

4 System description

The LioN modules (**L**umberg Automation™ **I**nput/**O**utput **N**etwork) 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 and LioN-Xlight variants convert standard input, standard output or IO-Link signals from sensors & actuators into an industrial Ethernet protocol (PROFINET, EtherNet/IP, EtherCAT®, Modbus TCP, CC-Link IE Field Basic) and/or into a cloud protocol (REST API, OPC UA, MQTT). For the first time, there is now Syslog on board. The robust 8 port housing design allows the use even in harsh environments where e.g. weld field immunity, high temperature ranges or protection class IP67 & IP69K are needed. There are also LioN-Xlight single protocol versions available with a limited feature set at a highly attractive price point.

Use all benefits of the Lumberg Automation™ product solution by additionally downloading the configuration tool *LioN-Management Suite V2.0* from 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 Device variants

The following variants are available in the LioN-X and the LioN-Xlight family:

Article number	Product designation	Description	I/O port functionality
935700001	0980 XSL 3912-121-007D-00F	LioN-X M12-60 mm, IO-Link Master Multiprotocol (PN, EIP, EC, MB) Security	8 x IO-Link Class A
935700002	0980 XSL 3912-121-007D-01F	LioN-X M12-60 mm, IO-Link Master Multiprotocol (PN, EIP, EC, MB, CC) Security	8 x IO-Link Class A
935710001	0980 XSL 3912-121-027D-01F	LioN-X M12-60 mm, IO-Link Master Multiprotocol (PN, EIP, EC, MB, CC) Security, HTTPS	8 x IO-Link Class A
935703001	0980 XSL 3913-121-007D-01F	LioN-X M12-60 mm, IO-Link Master Multiprotocol (PN, EIP, EC, MB, CC) Security	8 x IO-Link Class A/B Mixmodule
935711001	0980 XSL 3913-121-027D-01F	LioN-X M12-60 mm, IO-Link Master Multiprotocol (PN, EIP, EC, MB, CC) Security, HTTPS	8 x IO-Link Class A/B Mixmodule
935701001	0980 LSL 3011-121-0006-001	LioN-Xlight M12-60 mm, IO-Link Master PROFINET	8 x IO-Link Class A
935702001	0980 LSL 3010-121-0006-001	LioN-Xlight M12-60 mm, IO-Link Master PROFINET	4 x IO-Link Class A + 8 x DI

Article number	Product designation	Description	I/O port functionality
935701002	0980 LSL 3111-121-0006-002	LioN-Xlight M12-60 mm, IO-Link Master EtherNet/IP	8 x IO-Link Class A
935702002	0980 LSL 3110-121-0006-002	LioN-Xlight M12-60 mm, IO-Link Master EtherNet/IP	4 x IO-Link Class A + 8 x DI
935701003	0980 LSL 3211-121-0006-004	LioN-Xlight M12-60 mm, IO-Link Master EtherCAT®	8 x IO-Link Class A
935702003	0980 LSL 3210-121-0006-004	LioN-Xlight M12-60 mm, IO-Link Master EtherCAT®	4 x IO-Link Class A + 8 x DI
935701004	0980 LSL 3311-121-0006-008	LioN-Xlight M12-60 mm, IO-Link Master Modbus TCP	8 x IO-Link Class A
935702004	0980 LSL 3310-121-0006-008	LioN-Xlight M12-60 mm, IO-Link Master Modbus TCP	4 x IO-Link Class A + 8 x DI
935701005	0980 LSL 3411-121-0006-010	LioN-Xlight M12-60 mm, IO-Link Master CC-Link IE Field Basic	8 x IO-Link Class A
935702005	0980 LSL 3410-121-0006-010	LioN-Xlight M12-60 mm, IO-Link Master CC-Link IE Field Basic	4 x IO-Link Class A + 8 x DI

Table 3: Overview of LioN-X and LioN-Xlight variants

4.3 I/O port overview

The following tables show the main I/O port differences of the LioN-X IO-Link Master family. Pin 4 and Pin 2 of the I/O ports can be configured partly to IO-Link, Digital Input or Digital Output.

LioN-X Class A IO-Link ports

Device variant	**Port**	**Pin 1 U_S**	**Pin 4 / Ch. A (C/Q)**				**Pin 2 / Ch. B (I/Q)**	
0980 XSL 3x12...	**Info:**	–	Class A	Type 1	Supply by U_S 1)	Supply by U_L 2)	Type 1	Supply by U_L 2)
	X8:	Out (4 A)	IOL	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)
	X7:	Out (4 A)	IOL	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)
	X6:	Out (4 A)	IOL	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)
	X5:	Out (4 A)	IOL	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)
	X4:	Out (4 A)	IOL	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)
	X3:	Out (4 A)	IOL	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)
	X2:	Out (4 A)	IOL	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)
	X1:	Out (4 A)	IOL	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)

Table 4: Port configuration of 0980 XSL 3x12... variants

1) DO switch mode configured as "Push-Pull" (description in the configuration chapters).

2) DO switch mode configured as "High-Side" (description in the configuration chapters).

LioN-X Class A/B IO-Link ports

Device variant	**Port**	**Pin 1 U_S**	**Pin 4 / Ch. A (C/Q)**				**Pin 2 / Ch. B (I/Q)**		
0980 XSL 3x13...	**Info:**	–	4 x Class A 4 x Class B	Type 1	Supply by U_S1)	Supply by U_S2)	Type 1	Supply by U_S1)	Supply by U_{Aux}
	X8:	Out (4 A)	IOL (Class B)	DI	DO (0.5 A)	DO (2 A)	–	–	DO/Pwr (2 A)
	X7:	Out (4 A)	IOL (Class B)	DI	DO (0.5 A)	DO (2 A)	–	–	DO/Pwr (2 A)
	X6:	Out (4 A)	IOL (Class B)	DI	DO (0.5 A)	DO (2 A)	–	–	DO/Pwr (2 A)
	X5:	Out (4 A)	IOL (Class B)	DI	DO (0.5 A)	DO (2 A)	–	–	DO/Pwr (2 A)
	X4:	Out (4 A)	IOL (Class A)	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)	–
	X3:	Out (4 A)	IOL (Class A)	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)	–
	X2:	Out (4 A)	IOL (Class A)	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)	–
	X1:	Out (4 A)	IOL (Class A)	DI	DO (0.5 A)	DO (2 A)	DI	DO (2 A)	–

Table 5: Port configuration of 0980 XSL 3x13... variants

1) DO switch mode configured as "Push-Pull" (description in the configuration chapters).

2) DO switch mode configured as "High-Side" (description in the configuration chapters).

LioN-Xlight Class A IO-Link ports

Device variant	Port	Pin 1 U_S	Pin 4 / Ch. A (C/Q)			Pin 2 / Ch. B (I/Q)
0980 LSL 3x11...	**Info:**	–	Class A	Type 1	Supply by U_S 1)	Type 1
	X8:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X7:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X6:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X5:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X4:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X3:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X2:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X1:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI

Table 6: Port configuration of 0980 LSL 3x11... variants

Device variant	Port	Pin 1 U_S	Pin 4 / Ch. A (C/Q)			Pin 2 / Ch. B (I/Q)
0980 LSL 3x10...	**Info:**	–	Class A	Type 1	Supply by U_S 1)	Type 1
	X8:	Out (0.7 A)	–	DI	–	DI
	X7:	Out (0.7 A)	–	DI	–	DI
	X6:	Out (0.7 A)	–	DI	–	DI
	X5:	Out (0.7 A)	–	DI	–	DI
	X4:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X3:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X2:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI
	X1:	Out (2 A)	IOL	DI	DO (0.5 A*)	DI

Table 7: Port configuration of 0980 LSL 3x10... variants

1) With DO Switch Mode configured as "Push-Pull" (see description in the configuration chapters).

* For **UL applications**: Max. 0.25 A DO.

5 Overview of product features

5.1 CC-Link IE Field Basic product features

CC-Link IE Field Basic network

- Number of stations: 4 (2 for device variant 0980 LSL 3410-121-0006-010).
- RX – 64 bits (per station)
- RY – 64 bits (per station)
- RWw – 32 words (per station)
- RWr – 32 words (per station)

Data connection

The connection option provided by LioN-X is the widely-used M12 connector with D-coding for the CC-Link IE Field Basic network.

The connectors are also color-coded to prevent the ports from being mixed up.

Data transmission rates

Featuring a transmission rate of up to 100 MBit/s, the CC-Link IE Field Basic devices can handle both fast transmission of I/O data and transmission of larger volumes of data.

Diagnostic data

The devices support diagnosis flags and extended diagnostic data that can be appended to the I/O data.

5.2 I/O port features

IO-Link specification.

LioN-X is ready for IO-Link specification v1.1.3.

8 x IO-Link Master ports

Depending on the device variant, the device has 4 IO-Link Class A ports, 4 IO-Link Class A ports and 4 IO-Link Class B ports, or 8 IO-Link Class A ports with an additional digital input and optional output (0980 XSL 3x13... variants) on pin 2 of the I/O port. For detailed information see chapter I/O port overview on page 20.

Warning: If modules with electric isolation and modules without electric isolation are used within the same system, the electric isolation of all connected modules is annulled.

IO-Link port connections

The IO-Link port connection option provided by the module series is the 5-pin M12 connector.

Validation & Backup

The Validation & Backup function checks if the right device is connected and stores / monitors the parameters of the IO-Link Device. The function thus gives you an easy option for replacing the IO-Link Device.

This is possible as of IO-Link specification V1.1 and only if the IO-Link Device **and** the IO-Link Master support the function.

LED

You can see the status of a port by the color of the matching LEDs and their flash pattern. For details on the meanings of the LED colors, please see section LEDs on page 163.

5.3 Integrated Web server

Network parameter display

Get an overview of network parameters such as the IP address, subnet mask and gateway.

Displaying diagnostics

View diagnostics via the integrated Web server.

User management

Use the integrated Web server for convenient management of all users.

IO-Link Device parameters

Reading and writing of IO-Link Device parameters is supported. The system command Store parameters is needed after parameter writing, to take over the changed parameter into the IO-Link Master backup memory when enabled.

HTTPS

LioN-X supports several security mechanisms (see also Security features on page 26). One of them is HTTPS (only applicable for device variants 0980 XSL 3912-121-027D-01F and 0980 XSL 3913-121-027D-01F), which allows encryption-based secure communication to access Web pages.

5.4 Security features

Firmware signature

The official firmware update packages contain a signature which helps prevent the system against manipulated firmware updates.

Syslog

The LioN-X multiprotocol variants support the traceability of messages centrally managed and logged via Syslog.

User manager

The Web server provides a user manager to help protect the Web interface against unauthorized access. You can manage the users by groups with different access levels “Admin” or “Write”.

Default user settings:

User: admin

Password: private

Attention: Change the default settings to help protect the device against unauthorized access.

5.5 Other features

Interface protection

The devices have reverse polarity, short-circuit and overload protection for each interface.

For more details, see section Port assignments on page 36.

Failsafe

The devices support a failsafe function. This allows you to define the behavior of every single channel configured as an output in the case of invalid PLC data (e.g. PLC in STOP) or of lost PLC communication.

Industrial Internet of Things

LioN-X is industry 4.0 ready and supports the integration in IIoT networks via REST API and the IIoT-relevant protocols MQTT, OPC UA and CoAP.

Color-coded connectors

The colored connectors help you avoid confusion in your cabling.

IP protection classes: IP65 / IP67 / IP69K

The IP protection class describes environmental influences that the devices can be exposed to without risk and without suffering damage or causing a risk for the user.

The whole LioN-X family offers IP65, IP67 and IP69K.

6 Assembly and wiring

6.1 General information

Mount the device on a flat surface using 2 screws (M4x 25/30). The torque required here is 1 Nm. Use washers for all fastening methods as per DIN 125.

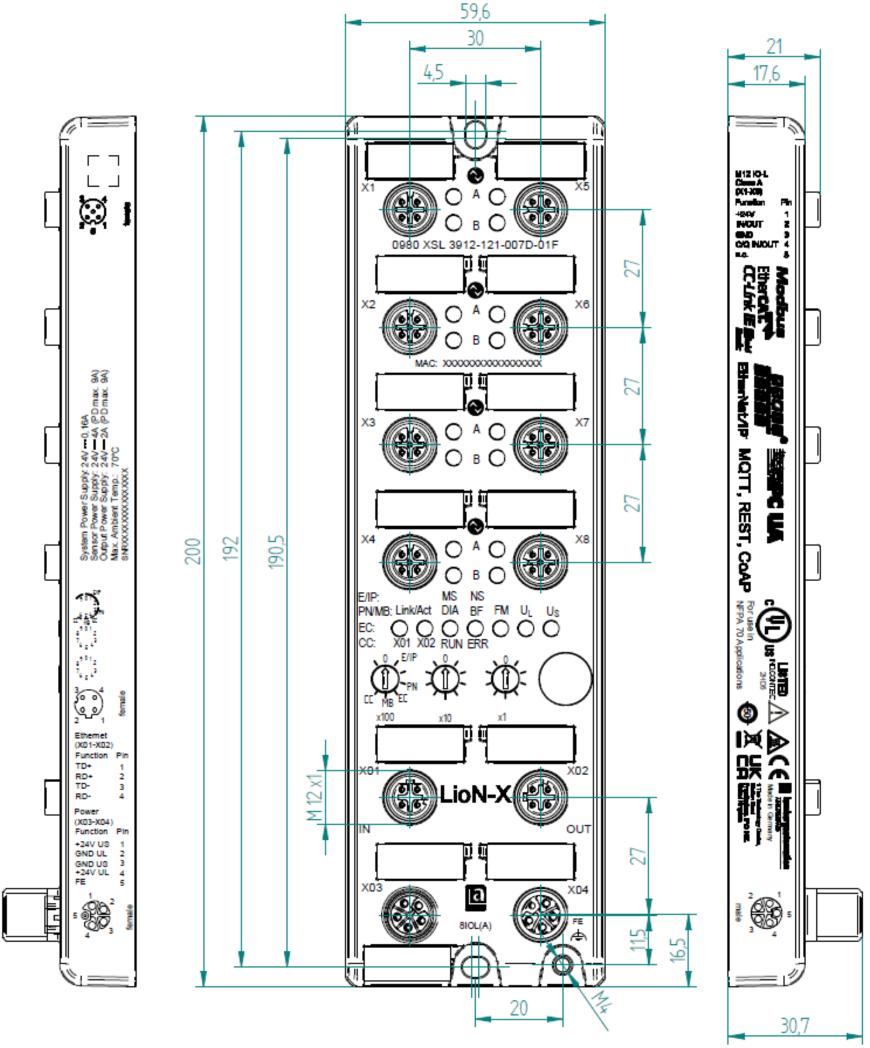
Attention: The devices have a ground connection with an M4 thread for the conduction of interference currents and the EMC immunity. This is labeled with the symbol for the ground and the designation "FE"

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.

6.2 Outer dimensions

6.2.1 LioN-X multiprotocol variants with CC-Link IE Field Basic


59,6
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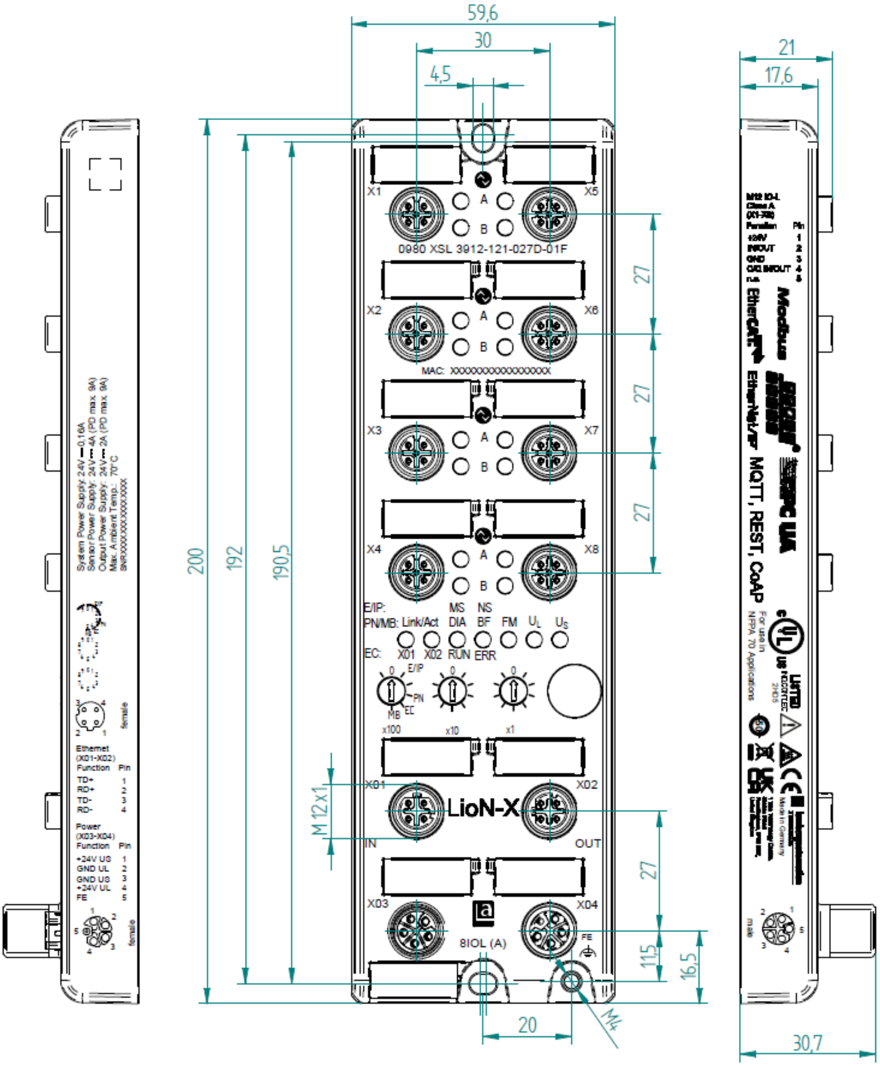
M 12 x1
11,5
16,5
20
M4
30,7
X1
X5
X2
X6
X3
X7
X4
X8
A
B
0980 XSL 3912-121-007D-01F
MAC: XXXXXXXXXXXXXXXXX
E/IP:
PN/MB: Link/Act
EC:
CC:
MS
NS
DIA
BF
FM
UL
US
X01
X02
RUN
ERR
x100
x10
x1
X01
X02
IN
OUT
LioN-X
X03
X04
8IOL(A)
FE
female
male
Ethernet (X01-X02)
Function Pin
TD+ 1
RD+ 2
TD- 3
RD- 4
Power (X03-X04)
Function Pin
+24V US 1
GND UL 2
GND US 3
+24V UL 4
FE 5
EtherNet/IP MQTT, REST, CoAP
For use in NFPA 79 Applications

Figure 1: 0980 XSL 3912-121-007D-01F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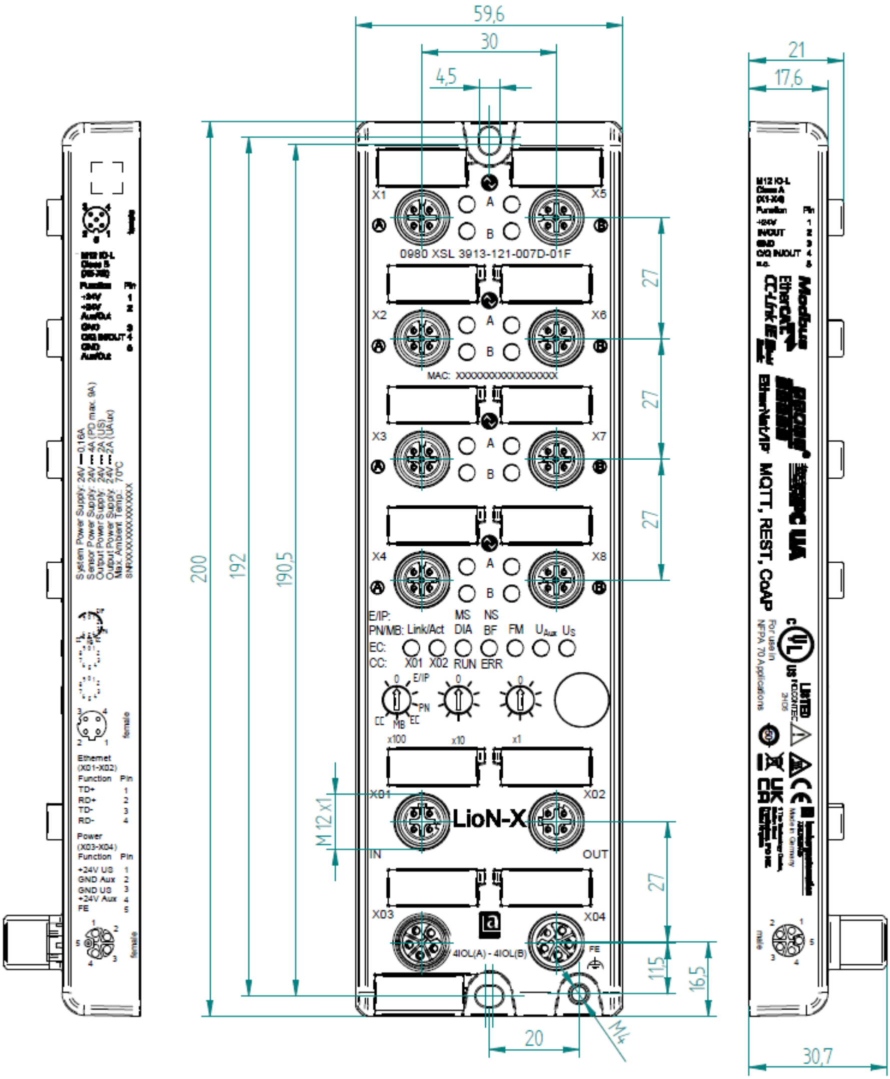
M 12x1
11,5
16,5
20
M4
30,7
X1
X2
X3
X4
X5
X6
X7
X8
A
B
0980 XSL 3912-121-027D-01F
MAC: XXXXXXXXXXXXXXXXX
E/IP:
PN/MB: Link/Act
MS
DIA
NS
BF
FM
U_L
U_S
EC: X01 X02 RUN ERR
E/IP
PN
MB
EC
x100
x10
x1
X01
X02
IN
OUT
LioN-X
X03
X04
8IOL (A)
FE
System Power Supply: 24V — 0,16A
Sensor Power Supply: 24V ⎓ 4A (PD max. 9A)
Output Power Supply: 24V ⎓ 2A (PD max. 9A)
Max. Ambient Temp.: 70°C
SNRXXXXXXXXXXXXXXXX
female
Ethernet
(X01-X02)
Function Pin
TD+ 1
RD+ 2
TD- 3
RD- 4
Power
(X03-X04)
Function Pin
+24V US 1
GND UL 2
GND US 3
+24V UL 4
FE 5
female
M12 IO-L
Class A
(X1-X8)
Function Pin
+24V 1
IN/OUT 2
GND 3
C/Q IN/OUT 4
n.a. 5
Modbus
EtherCAT
EtherNet/IP
OPC UA
MQTT, REST, CoAP
For use in NFPA 70 Applications
LISTED
Made in Germany
male

Figure 2: 0980 XSL 3912-121-027D-01F


59,6
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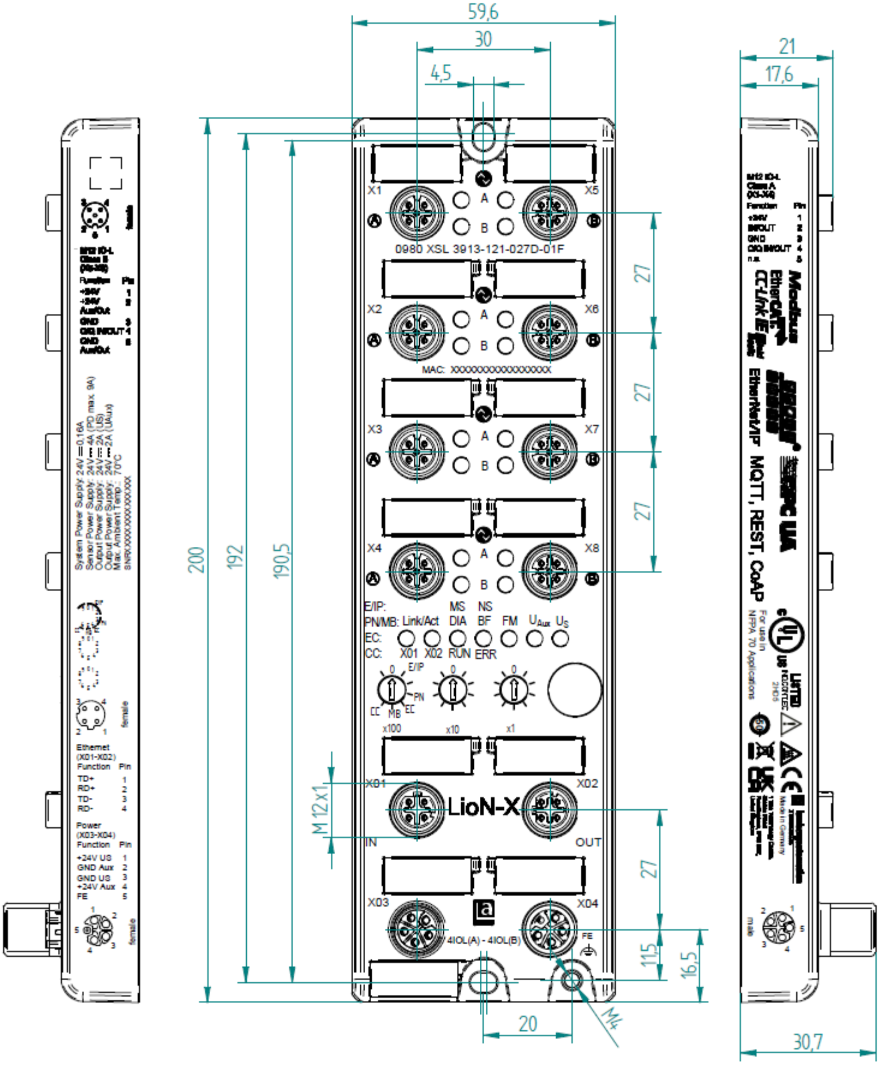
11,5
16,5
20
M4
M12 x1
30,7
X1
X2
X3
X4
X5
X6
X7
X8
A
B
0980 XSL 3913-121-007D-01F
MAC: XXXXXXXXXXXXXXXXX
E/IP:
PN/MB: Link/Act
EC:
CC:
MS
NS
DIA
BF
FM
UAux
US
X01
X02
RUN
ERR
E/IP
PN
EC
MB
CC
x100
x10
x1
LioN-X
X01
X02
IN
OUT
X03
X04
4IOL(A) - 4IOL(B)
FE
M12 IO-L
Class B
(X5-X8)
Function Pin
+24V 1
+24V 2
Aux/Out
GND 3
C/Q IN/OUT 4
GND 5
Aux/Out
System Power Supply: 24V — 0,16A
Sensor Power Supply: 24V — 4A (PD max. 9A)
Output Power Supply: 24V — 2A (US)
Max. Ambient Temp.: 24V — 2A (UAux)
70°C
SNRXXXXXXXXXXXXXX
female
Ethernet
(X01-X02)
Function Pin
TD+ 1
RD+ 2
TD- 3
RD- 4
Power
(X03-X04)
Function Pin
+24V US 1
GND Aux 2
GND US 3
+24V Aux 4
FE 5
female
M12 IO-L
Class A
(X1-X4)
Function Pin
+24V 1
IN/OUT 2
GND 3
C/Q IN/OUT 4
n.c. 5
Modbus
EtherCAT
CC-Link IE Field Basic
EtherNet/IP
MQTT, REST, CoAP
OPC UA
For use in NFPA 79 Applications
LISTED
UK CA
Made in Germany
male

Figure 3: 0980 XSL 3913-121-007D-01F


59,6
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190,5
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M 12x1
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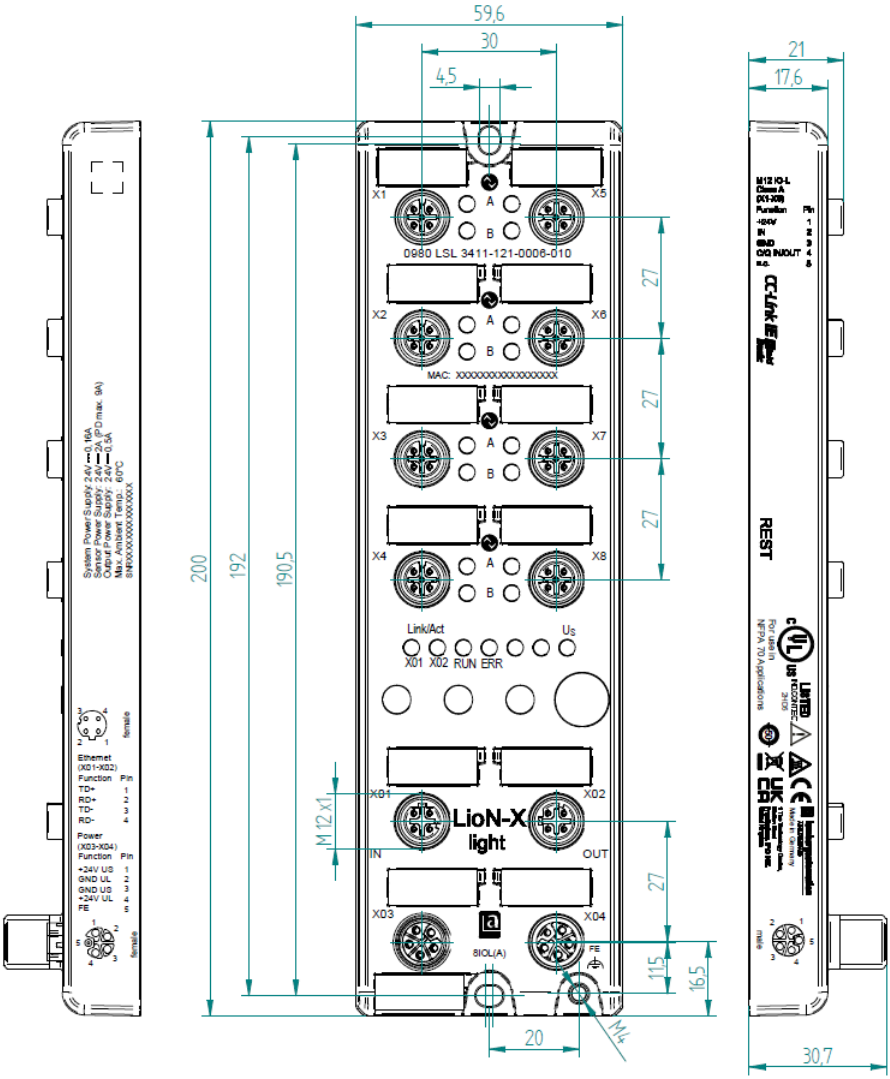
11,5
16,5
20
M4
30,7
X1
X2
X3
X4
X5
X6
X7
X8
A
B
0980 XSL 3913-121-027D-01F
MAC: XXXXXXXXXXXXXXXX
E/IP:
PN/MB: Link/Act
EC:
CC: X01 X02
MS DIA RUN
NS BF ERR
FM
U_Aux
U_S
E/IP
PN
CC MB EC
x100
x10
x1
X01
X02
LioN-X
IN
OUT
X03
X04
4IOL(A) - 4IOL(B)
FE
Ethernet (X01-X02)
Function Pin
TD+ 1
RD+ 2
TD- 3
RD- 4
Power (X03-X04)
Function Pin
+24V US 1
GND Aux 2
GND US 3
+24V Aux 4
FE 5
female
male
Modbus
EtherCAT
CC-Link IE Field Basic
EtherNet/IP
MQTT, REST, CoAP
For use in NFPA 79 Applications
LISTED
Made in Germany

Figure 4: 0980 XSL 3913-121-027D-01F

6.2.2 LioN-Xlight variants with CC-Link IE Field Basic


59,6
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17,6
200
192
190,5
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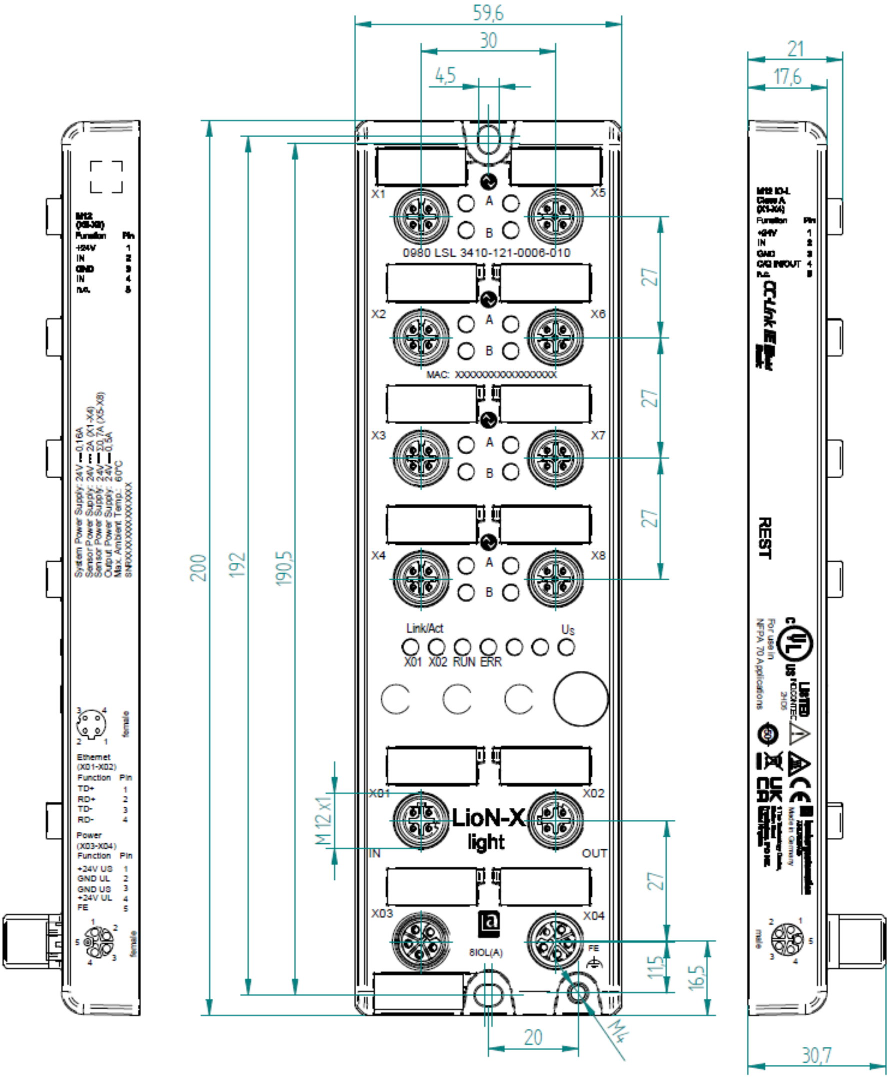
27
11,5
16,5
20
M4
30,7
M 12 x1
X1
X5
X2
X6
X3
X7
X4
X8
A
B
0980 LSL 3411-121-0006-010
MAC: XXXXXXXXXXXXXXXXX
Link/Act
Us
X01
X02
RUN
ERR
X01
X02
IN
OUT
LioN-X
light
X03
X04
8IOL(A)
FE
System Power Supply: 24V ⎓ 0,16A
Sensor Power Supply: 24V ⎓ 2A (PD max. 9A)
Output Power Supply: 24V ⎓ 0,5A
Max. Ambient Temp.: 60°C
SNRXXXXXXXXXXXXXXX
Ethernet
(X01-X02)
Function Pin
TD+ 1
RD+ 2
TD- 3
RD- 4
Power
(X03-X04)
Function Pin
+24V US 1
GND UL 2
GND US 3
+24V UL 4
FE 5
female
male
CC-Link IE Field Basic
REST
For use in NFPA 70 Applications
LISTED
UK CA

Figure 5: 0980 LSL 3411-121-0006-010


59,6
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17,6
200
192
190,5
27
27
27
27
11,5
16,5
20
M4
30,7
M12 x1
X1
X2
X3
X4
X5
X6
X7
X8
A
B
0980 LSL 3410-121-0006-010
MAC: XXXXXXXXXXXXXXXXX
Link/Act
US
X01 X02 RUN ERR
X01
X02
IN
OUT
LioN-X
light
X03
X04
8IOL(A)
FE
Ethernet
(X01-X02)
Function Pin
TD+ 1
RD+ 2
TD- 3
RD- 4
Power
(X03-X04)
Function Pin
+24V US 1
GND UL 2
GND US 3
+24V UL 4
FE 5
female
male
REST
CC-Link IE Field Basic
For use in NFPA 70 Applications
LISTED
UK CA
CE

Figure 6: 0980 LSL 3410-121-0006-010

6.2.3 Notifications

Attention:

For **UL applications**, 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.

Only approved for interior use. Please note the maximum elevation of 2000 meters. Approved up to a maximum soiling level of 2.

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

Warning: For **UL applications** at a maximum ambient temperature of +70 °C (158 °F):

Use temperature-resistant cables with heat resistance up to at least +125 °C (257 °F) for all LioN-X and LioN-Xlight variants.

Warning: Observe the following maximum output power for the sensor supply of Class A devices:

Max. 4.0 A per port; for **UL applications** max. 5 A for every port pair X1/X2, X3/X4, X5/X6, X7/X8; max. 9.0 A in total (with derating) for the whole port group X1 .. X8.

Warning: Observe the following maximum output power for the sensor supply of Class A/B devices:

Max. 4.0 A per port; for **UL applications** max. 5.0 A from U_S power supply for every port pair X1/X2, X3/X4, X5/X6, X7/X8 and max. 5.0 A from U_{AUX} power supply in total for port group X5/X6/X7/X8; max. 9.0 A in total (with derating) for the whole port group X1 .. X8.

6.3 Port assignments

All the contact arrangements shown in this chapter show the frontal view of the connection area for the connectors.

6.3.1 Ethernet ports, M12 socket, 4-pin, D-coded

Color coding: green

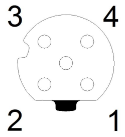


Figure 7: Schematic drawing, ports X01, X02

Port	Pin	Signal	Function
Ethernet Ports X01, X02	1	TD+	Transmit data plus
	2	RD+	Receive data plus
	3	TD-	Transmit data minus
	4	RD-	Receive data minus

Table 8: Assignment of ports X01, X02

Caution: Risk of destruction! Never connect the power supply to the data cables.

6.3.2 Power supply with M12 power L-coded

Color coding: gray

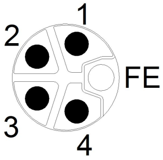


Figure 8: Schematic diagram of the M12 L-coding (connector X03 for Power In)

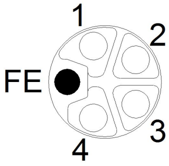


Figure 9: Schematic diagram of the M12 L-coding (socket X04 for Power Out)

6.3.2.1 IO-Link Master with Class A ports

Power supply	Pin	Signal	Function
	1	U_S (+24 V)	Sensor/system power supply
	2	GND_U_L	Ground/reference potential U_L
	3	GND_U_S	Ground/reference potential U_S[1]
	4	U_L (+24 V)	Load supply (**NOT** electrically isolated to U_S internally in device)
	5	FE	Functional ground

Table 9: Power supply with M12-Power Class A

Attention: Only use power supply units for the system/sensor and actuator supply that correspond to PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage). Power supplies according to EN 61558-2-6 (transformers) or EN 60950-1 (switching power supply units) fulfill these requirements.

---

[1] U_L and U_S ground connected in device

6.3.2.2 IO-Link Master with Class A/B ports

Power supply	Pin	Signal	Function
Mixed IO-Link (Class A/B) I/O ports	1	U_S (+24 V)	Sensor/system power supply
	2	GND_U_{AUX}	Ground/reference potential U_{AUX} (electrically **isolated** to GND_U_S internally in device)
	3	GND_U_S	Ground/reference potential U_S
	4	U_{AUX} (+24 V)	Auxiliary supply (electrically **isolated** to U_S internally in device)
	5	FE	Functional ground

Table 10: Power supply with M12-Power Class A/B

Attention: Only use power supply units for the system/sensor and actuator supply that correspond to PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage). Power supplies according to EN 61558-2-6 (transformers) or EN 60950-1 (switching power supply units) fulfill these requirements.

6.3.3 I/O ports as M12 sockets

Color coding: black

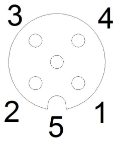


Figure 10: Schematic drawing I/O port as M12 socket IO-Link

6.3.3.1 IO-Link ports (Class A and Class B)

0980 XSL 3x12-121...	Pin	Signal	Function
IO-Link Class A, ports X1 .. X8	1	+24 V	power supply +24 V
	2	IN/OUT	Ch. B: Digital input or digital output
	3	GND	Ground/reference potential
	4	C/Q	Ch. A: IO-Link data communication, digital input or digital output
	5	n.c.	not connected

0980 XSL 3x13-121...	Pin	Signal	Function
IO-Link Class A, ports X1 .. X4	1	+24 V	power supply +24 V
	2	IN/OUT	Ch. B: Digital input or digital output
	3	GND	Ground/reference potential
	4	C/Q	Ch. A: IO-Link data communication, digital input or digital output
	5	n.c.	not connected
IO-Link Class B, ports X5 .. X8	1	+24 V	power supply +24 V
	2	+24 V AUX/OUT	Ch. B: Auxiliary power supply (electrically isolated with respect to the sensor/ system power supply U_S) or digital output
	3	GND	Ground/reference potential of +24 V
	4	C/Q	Ch. A: IO-Link data communication, digital input or digital output
	5	GND AUX	Ground/reference potential of +24 V AUX/ OUT

0980 LSL 3x11-121...	Pin	Signal	Function
IO-Link Class A, ports X1 .. X8	1	+24 V	power supply +24 V
	2	IN	Ch. B: Digital input
	3	GND	Ground/reference potential
	4	C/Q	Ch. A: IO-Link data communication, digital input or digital output
	5	n.c.	not connected

0980 LSL 3x10-121...	Pin	Signal	Function
IO-Link Class A, ports X1 .. X4	1	+24 V	power supply +24 V
	2	IN	Ch. B: Digital input
	3	GND	Ground/reference potential
	4	C/Q	Ch. A: IO-Link data communication, digital input or digital output
	5	n.c.	not connected
Digital Input, ports X5 .. X8	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	n.c.	not connected

Table 11: I/O ports as IO-Link Class A and Class B

Used signal names compared to the IO-Link specification conventions:

Pin	LioN-X	IO-Link specification	Comment
1	+24 V	L+	Supplied by U_S
2	IN/OUT	I/Q	
	+24 V AUX/OUT	2L	Supplied by U_{AUX}
3	GND	L-	
4	C/Q IN/OUT	C/Q	
5	GND AUX	2M	

7 Starting operation

7.1 CSP+ file

A CSP+ file describes the information of a CC-Link device and is required to configure the LioN-X and LioN-Xlight variants in an engineering tool. Each device variant requires its own CSP+ file. The file can be downloaded from the product pages on our online catalog: catalog.belden.com

On request, the CSP+ file is also sent by the support team.

The CSP+ file and the associated icons are grouped together in an archive file named "0x4DF_0980 XSL 3912-121-007D-01F_1.0_en.CSPP.zip".

"0xDF" stands for the vendor ID of Belden Deutschland GmbH, "0980 XSL 3912-121-007D-01F" is the model number of the LioN-X variant.

Download this file and install it as described in chapter Configuration and operation with GxWorks3 on page 74.

Install the CSP+ file for the respective device variant by using the hardware or network configuration tool of your controller manufacturer.

In GxWorks®, install the files with the CSP+ Hardware Installation Tool.

The LioN-X and LioN-Xlight variants are then available in the hardware catalog as Communications Adapter.

7.2 MAC addresses

Every device has three unique assigned MAC addresses that cannot be changed by the user. The first assigned MAC address is printed onto the device.

7.3 State on delivery

CC-Link IE Field Basic parameters in state on delivery or after a factory reset:

Network mode:	Static
Static IP address:	192.168.3.XXX (XXX = rotary switch position or last stored data)
Subnet mask:	255.255.255.0
Gateway address	192.168.3.100
Device designations:	0980 XSL 3912-121-007D-01F 0980 XSL 3912-121-027D-01F 0980 XSL 3913-121-007D-01F 0980 XSL 3913-121-027D-01F 0980 LSL 3411-121-0006-010 0980 LSL 3410-121-0006-010
Product type:	CC-Link IE Field Basic Slave Station

7.4 Setting the rotary encoding switches

The following LioN-X IO-Link Master variants support multiprotocol application for the protocols EtherNet/IP (E/IP), PROFINET (P), EtherCAT® (EC) and Modbus TCP (MB):

- 0980 XSL 3912-121-007D-00F

The following LioN-X IO-Link Master variants additionally provide the protocol CC-Link IE Field Basic (CC):

- 0980 XSL 3912-121-007D-01F
- 0980 XSL 3912-121-027D-01F
- 0980 XSL 3913-121-007D-01F
- 0980 XSL 3913-121-027D-01F

Caution: Risk of device damage due to corrupt device memory

Any interruption of the power supply to the device during and after protocol selection can lead to a corrupt device memory.

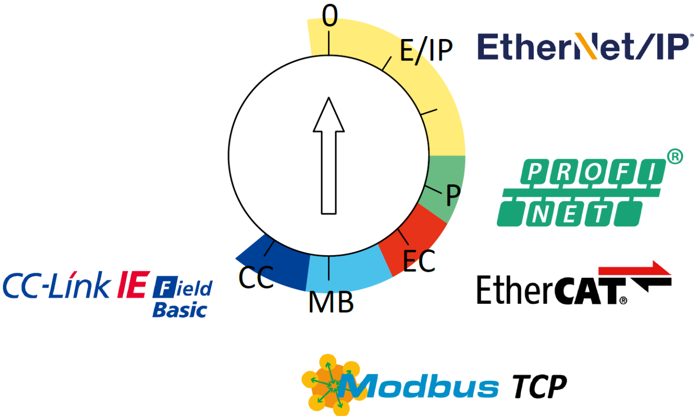
After selecting a protocol followed by a restart of the device, the new protocol is initialized. This can take up to 15 seconds. During this time the device is not usable and the LED indicators are out of function. When the protocol change is complete, the LED indicators return to normal operation and the device can be used again.

- Make sure that the power supply is maintained during the entire process.

The LioN-X multiprotocol variants allow you to select different protocols for communication within an industrial Ethernet system. In this way the IO-Link Masters with multiprotocol function can be integrated into different networks without it being necessary to purchase products specific for each protocol. This technology also gives you the option to use the same IOL-Master in different environments.

Using rotary encoding switches at the lower front of the devices, you can easily and conveniently set both the protocol and the address of the device, if the protocol to be used supports this. Once you have made a protocol selection and started the cyclical communication, the device stores this setting permanently and uses the selected protocol from this point on. To use another supported protocol with this device, perform a factory reset.

The multiprotocol devices have a total of three rotary encoding switches. With the first rotary encoding switch (x100) you set the protocol by using the corresponding switch position. Additionally, x100 is used to set the third last digit of the IP address for EIP.



With the other rotary encoding switches (x10 / x1), you set the last two digits of the IP address when you are using EtherNet/IP, Modbus TCP or CC-Link IE Field Basic.

Protocol	x100	x10	x1
EtherNet/IP	0-2	0-9	0-9
PROFINET	P	–	–
EtherCAT®	EC	–	–
Modbus TCP	MB	0-9	0-9
CC-Link IE Field	CC	0-9	0-9

Table 12: Assignment of the rotary encoding switches for each protocol

The setting you make to select a protocol is described detailed in the protocol-specific sections.

In delivery state no protocol settings are stored in the device. In this case only the desired protocol has to be chosen. To take over a changed rotary encoding switch setting (protocol setting), a power cycle or “Reset” from the Web interface is necessary.

Once you have set the protocol using the rotary encoding switches, the device stores this setting when it starts in cyclic communication. Changing the protocol using the rotary encoding switch is no longer possible after this point. The device will always start using the stored protocol from that point on. The IP address can be changed depending on the selected protocol.

To change the protocol, carry out a factory reset. In this way you restore the factory settings of the respective device. How you perform the factory reset for your device is described in chapter Factory reset on page 47.

If you position the rotary encoding switch in a manner that is invalid, the device signals this to you with a blink code (the RUN LED blinks continuously).

7.4.1 CC-Link IE Field Basic

If you decide to use CC-Link IE Field Basic as a protocol, use the first rotary encoding switch to select the protocol. The second rotary encoding switch (x10) can be used to configure the 10 position of the last octet of the IP address, and the third rotary encoding switch (x1) allows you to configure the 1 position. Values between 0 and 9 can be selected for the second and third switches. The first three octets of the IP address are set by default to 192.168.3.

For example, the rotary encoding switch setting 6(x100), 1(x10) and 0(x1) gives you an IP address of 192.168.3.10 for CC-Link IE Field Basic. It is only possible to assign IP addresses between 192.168.3.1 and 192.168.3.99 for CC-Link IE Field Basic via the rotary switches.

Rotary switch setting	Function
600 (network parameters already saved)	The network parameters last saved are used (IP address, subnet mask, gateway address).
600 ... 699	The last 2 digits of the saved or preset IP address are overwritten by the setting of the rotary switch.
979	The device performs a reset to the factory settings. The network parameters are also reset to the default values. Communication is not possible in this operation mode.

Table 13: Setting options of the rotary encoding switches for CC-Link IE Field Basic

7.4.2 Factory reset

A factory reset restores the original factory settings and thus resets the changes and settings you have made up to that point. It also resets the protocol selection. To perform a factory reset, set the first rotary encoding switch (x100) to 9, the second (x10) to 7, and the third (x1) also to 9.

Afterwards perform a power cycle and wait 10 seconds due to internal memory write processes.

During the factory reset, the U_S LED is blinking red. After the internal memory write processes have finished, the U_S LED returns to display static green or red light, in dependency of the actual U_S voltage.

	x100	x10	x1
Factory Reset	9	7	9

Follow the steps from section Setting the rotary encoding switches again to select a new protocol.

For performing a factory reset via software configuration, see chapter OPC UA configuration on page 99 and the configuration section.

7.5 Setting network parameters

Use the two right-hand rotary switches (x10 and x1) on the front of the device to set the last octet of the static IP address. Each rotary switch in the range of CC-Link IE Field Basic is assigned to one decimal digit, so that you can configure a number between **0 – 99**. During startup, the position of the rotary switches is typically read within one time cycle.

The complete IP address, the subnet mask, the gateway address and the network mode can be configured and stored via the Web server or any other available configuration interfaces. New configuration interfaces can only be applied to after a restart of the device.

For additional information, see chapter Setting the rotary encoding switches.

8 Configuration CC-Link IE Field Basic

Parameters of the LioN-X device can be configured via SNMP, the Web server or IIoT protocols. Acyclic messages over SNMP are sent to read and write the configuration. When sending, all existing parameters will be overwritten by this data and the content of the SNMP messages has the highest valence.

To avoid parameter overwriting by the Web server or IIoT protocols during operation, some lock parameters can be enabled in the PLC configuration respectively in the configuration assembly.

The following chapters represent different setting groups with its configuration parameters. The default values are highlighted.

8.1 General settings

Setting	Description	Default value
Suppress U_{Aux} Diagnosis Mode	Report U_L/U_{Aux} supply voltage fault 0 = Report U_L/U_{Aux} supply voltage fault enabled 1 = Report U_L/U_{Aux} supply voltage fault disabled 2 = Auto	0
Suppress Actuator Diagnosis without U_L	Report actuator fault without U_L/U_{Aux} voltage 0 = Report actuator fault without U_L/U_{Aux} voltage enabled 1 = Report actuator fault without U_L/U_{Aux} voltage disabled	0
Suppress U_S Diagnosis	Report U_S voltage fault 0 = Diagnosis disabled 1 = Diagnosis enabled	0
Reserved	Reserved	0
Output Auto Restart	Output auto restart 0 = Output auto restart disabled 1 = Output auto restart enabled	0
Web Interface Lock	Web interface lock 0 = Web interface lock disabled 1 = Web interface lock enabled	0
Forcing Lock	Force mode lock 0 = Force lock disabled 1 = Force lock enabled	0
External Configuration Lock	External configuration lock 0 = External configuration lock disabled 1 = External configuration lock enabled	1

8.1.1 Force mode lock

The input and output process data can be forced via different interfaces (e.g. Web interface, REST, OPC UA, MQTT). The support of interfaces depends on the available software features. If the *Force mode lock* is enabled, it is no longer possible to force input and output process data through these interfaces.

⚠ **Danger:** Risk of physical injury or death! Unattended forcing can lead to unexpected signals and uncontrolled machine movements.

8.1.2 Web interface lock

The Web interface access can be configured. If *Web interface lock* is enabled, the Web pages are no longer reachable.

8.1.3 Report U_L/U_{AUX} supply voltage fault

During commissioning, it is possible that no power supply is connected to the U_L/U_{AUX} pins. Therefore it can be helpful to suppress and disable the *U_L/U_{AUX} supply voltage fault* diagnosis.

8.1.4 Report actuator fault without U_L/U_{AUX} voltage

During commissioning, it is possible that no power supply is connected to the U_L/U_{AUX} pins. Therefore it can be helpful to suppress and disable the *Report actuator fault without U_L/U_{AUX} voltage* diagnosis.

8.1.5 Report U_S voltage fault

During commissioning, it is possible that no power supply is connected to the U_S pins. Therefore it can be helpful to suppress and disable the *Report U_S voltage fault* diagnosis.

8.1.6 External configuration lock

Configuration parameters can be set via different alternative interfaces (e.g. Web interface, REST, OPC UA, MQTT). An external configuration can only be done, if no cyclic PLC connection is active. Every new PLC configuration overwrites the external configuration settings.

8.2 Port configuration X1 .. X8

Setting	Description	Default value
Port Mode	Port Mode 0: Deactivated 1: IO-Link Manual 2: IO-Link Auto 3: Digital Input 4: Digital Output	3
Validation Check	Validation Option 0: No device check and clear (no data storage) 1: Type compatible V1.0 device (no data storage) 2: Type compatible V1.1 device (no data storage) 3: Type compatible V1.1 device with Backup & Restore (download + upload) 4: Type compatible V1.1 device with Restore (download master to device)	0
IQ (Pin 2) Mode	IQ Mode 0: Deactivated 1: Digital Input 2: Digital Output 5: Aux* *exclusively applicable for Class A/B Mixmodules	1
Cycle Time	Cycle Time 0: As fast as possible 1: 1.6 ms 2: 3.2 ms 3: 4.8 ms 4: 8.0 ms 5: 20.8 ms 6: 40.0 ms 7: 80.0 ms 8: 120.0 ms	0
Vendor ID	Vendor ID 0 .. 65535 ("0")	0
Device ID	Device ID 0 .. 16777215 ("0")	0

Setting	Description	Default value
IO-Link Failsafe Mode	Failsafe Mode 0: Set Low 1: Set High 2: Hold Last 3: Replacement Value 4: IO-Link Master Command	0
IO-Link Failsafe Value 0..31	IOL Failsafe replacement values Between 0 .. 255	0
Swap Length Consuming	Swap Length (Consuming data) 0: DWORD 1: WORD	0
Offset Consuming	Swap Offset (Consuming data) 0 .. 30 Byte	0
Swap Count Consuming	Swap Count (Consuming data) 0 .. 30 Byte	0
Swap Length Producing	Swap Length (Producing data) 0: DWORD 1: WORD	0
Offset Producing	Swap Offset (Producing data) 0 .. 30 Byte	0
Swap Count Producing	Swap Count (Producing data) 0 .. 30 Byte	0
Sensor Supply Disabled	Sensor Supply Disabled 0: Supply electric voltage to sensor 1: Do not supply electric voltage to sensor	0
Suppress all Diagnosis	Suppress all Diagnosis 0: Generate diagnosis on this channel 1: Do not generate any diagnosis on this channel	0
Surv. Timeout (Pin 2)	DO Surveillance Timeout for Pin 2 (IQ) Valid values: 0 .. 255	80
Surv. Timeout (Pin 4)	DO Surveillance Timeout for Pin 4 (CQ) Valid values: 0 .. 255	80

Setting	Description	Default value
Failsafe Mode SIO (Pin 2)	DO Failsafe for Pin 2 (IQ) 0: Set Low 1: Set High 2: Hold Last	0
Failsafe Mode SIO (Pin 4)	DO Failsafe for Pin 4 (CQ) 0: Set Low 1: Set High 2: Hold Last	0
DI Filter (Pin 2)	DI Filter for Pin 2 (IQ) 0: Disabled 1: 10 ms 2: 20 ms 3: 30 ms 4: 60 ms 5: 100 ms 6: 150 ms	0
DI Filter (Pin 4)	DI Filter for Pin 4 (CQ) 0: Disabled 1: 10 ms 2: 20 ms 3: 30 ms 4: 60 ms 5: 100 ms 6: 150 ms	0
DI Logic (Pin 2)	DI Logic for Pin 2 (IQ) 0: Normally Open 1: Normally Close	0
DI Logic (Pin 4)	DI Logic for Pin 4 (CQ) 0: Normally Open 1: Normally Close	0
DO Restart (Pin 2)	DO Restart for Pin 2 (IQ) 0: Disable 1: Enable	0
DO Restart (Pin 4)	DO Restart for Pin 4 (CQ) 0: Disable 1: Enable	0

Setting	Description	Default value
Error LED Disable (Pin 2)	Disable Pin 2 Error LED 0: Enable LED on channel B 1: Disable LED on channel B	0
Error LED Disable (Pin 4)	Disable Pin 4 Error LED 0: Enable LED on channel A 1: Disable LED on channel A	0
Level LED Disable (Pin 2)	Disable Pin 2 Level LED 0: Enable LED on channel B 1: Disable LED on channel B	0
Level LED Disable (Pin 4)	Disable Pin 4 Level LED 0: Enable LED on channel A 1: Disable LED on channel A	0
Use Push-Pull (Pin 4)	Use Push-Pull for Pin 4 0: Use High-Side switches 1: Use Push-Pull	0
Current limit (Pin 2)	Pin 2 current limit (maximum current limit till Pin 2 is turned off) 0 .. 65535	65535
Current limit (Pin 4)	Pin 4 current limit (maximum current limit till Pin 4 is turned off) 0 .. 65535	65535

8.2.1 Port Mode

The *Port Mode* describes how the IO-Link Master handles the presence of an IO-Link device at the port.

Deactivated:

The IO-Link port is deactivated but can be configured for later use. No diagnostics are generated if the IO-Link device is not connected.

IO-Link Manual:

The IO-Link port is activated and explicit port configuration can be done for the parameters *Validation and Backup* (Inspection Level), *Vendor ID*, *Device ID* and *Cycle Time*.

IO-Link Auto:

The IO-Link port is activated and no explicit port configuration is needed. Configurations such as *Validation and Backup* (Inspection Level), *Vendor ID*, *Device ID* and *Cycle Time* are not required.

Digital Input:

In this mode, the channel operates as digital input. The channel state can be seen in the *Digital Input Channel* status of the cyclic process data.

Digital Output:

In this mode, the channel operates as digital output. The channel can be controlled by the *Digital Output Channel Control* (first two bytes of the output data) or by the *IO-Link Output Data* (first byte of each IO-Link device output data) of the cyclic process data. This depends on the *Digital Output Control* parameter in the general settings.

8.2.2 Validation and Backup

With this parameter, the user can set the behavior of the IO-Link ports regarding the type compatibility and data storage mechanism of the connected IO-Link Device.

The precondition for using *Validation and Backup* is that you configure the *Port Mode* to "IO-Link Manual".

The IO-Link Master has a backup memory which can be used for storing the device parameters and for restoring them on the device. This backup memory can be deleted by the following events:

- IO-Link Master factory reset
- *Channel Mode* reconfiguration, e.g. from “Digital-Input” to “IO-Link”
- *Validation and Backup* reconfiguration, e.g. from “No device check” to “Type compatible V1.1 device with Backup & Restore”

For further information refer to the ‘IO-Link Interface and System Specification’ version 1.1.3 which can be downloaded from https://io-link.com/

No device check (no data storage):

No check of connected Vendor ID or Device ID and no "Backup and Restore" support of the IO-Link Master parameter server.

Type compatible V1.0 device (no data storage):

Type compatible according IO-Link specification V1.0 which includes validation of Vendor ID and Device ID. The IO-Link specification V1.0 does not support IO-Link Master parameter server.

Type compatible V1.1 device (no data storage):

Type compatible according IO-Link specification V1.1 which includes validation of Vendor ID and Device ID. "Backup and Restore" is disabled.

Type compatible V1.1 device with Backup + Restore (upload + download):

Type compatible according IO-Link specification V1.1 which includes validation of Vendor ID and Device ID. "Backup and Restore" is enabled.

Pay attention to the following explanations regarding *Backup and Restore* conditions:

- Backup (Device to Master):

  A Backup (upload from IOL-Device to IOL-Master) is performed when an IO-Link Device is connected and the Master does not have any valid parameter data. The read parameter data are permanently stored on the IO-Link Master.

  An upload will also be performed, when the IO-Link Device has set the DS_UPLOAD_FLAG (Data Storage Upload Flag). This IOL-Device flag can be set in two ways:

  - Parameters written to IOL-Device in *Block Parameter* mode: An IO-Link Device sets the DS_UPLOAD_FLAG self-dependent, if the parameters were written in block parameter mode to the IO-Link Device with the last system command ParamDownloadStore (e.g. by a third party USB IO-Link Master for commissioning).
  - Parameters written to IOL-Device in *Single Parameter* mode: If single parameter data is changed on the IOL-Device during runtime, the stored device parameters on the IOL-Master can be updated using the ParamDownloadStore (index 0x0002, subindex 0x00, value 0x05) command. This command sets the DS_UPLOAD_REQ flag on the IOL-Device and thus the IO-Link Master executes an upload procedure from the IO-Link Device.

- Restore (Master to Device):

  A Restore (download from IOL-Master to IOL-Device) is performed when an IO-Link Device is connected and the IO-Link Master has valid parameter data stored which are usable for the IOL-Device and not equal compared to the device parameters.

  The restore procedure can be blocked by the IO-Link Device via the *Device Access Locks* parameter when supported by the IO-Link Device (Index 0x000C, refer to vendor specific IO-Link Device documentation).

Type compatible V1.1 device with Restore (download Master to Device):

Type compatible according IO-Link specification V1.1 which includes validation of Vendor ID and Device ID. Only "Restore" is enabled.

Pay attention to the following explanations regarding *Restore* conditions:

- Restore (Download / IOL-Master to IOL-Device):

  A Restore (download from IOL-Master to IOL-Device) is performed when an IO-Link Device is connected and the IO-Link Master has valid parameter data stored which are usable for the IOL-Device and not equal compared to the device parameters.

  In the *Restore* mode no change of the IOL-Device parameters will be stored permanently on the IOL-Master. When the IOL-Device sets the DS_UPLOAD_FLAG in this mode, the device parameters will be restored by the IOL-Master.

  The restore procedure can be blocked by the IO-Link Device via the *Device Access Locks* parameter when supported by the IO-Link Device (Index 0x000C, refer to vendor specific IO-Link Device documentation).

8.2.3 IQ Mode

The operating mode of Pin 2 (Channel B) of the respective IO-Link channel can be configured via this parameter.

Digital Output:

In this mode, the channel operates as digital output. The channel can be controlled by the *Digital Output Channel Control* (first two bytes of the output data) or by the *IO-Link Output Data* (first byte of each IO-Link device output data) of the cyclic process data. This depends on the *Digital Output Control* parameter in the general settings.

Digital Input:

In this mode, the channel operates as digital input. The channel state can be seen in the *Digital Input Channel* status of the cyclic process data.

AUX:

This option is exclusively applicable for Class A/B Mixmodules.

In this mode, Pin 2 of the IO-Link port acts as an auxiliary voltage output. The auxiliary voltage is fed by the U_{AUX} supply input. The auxiliary voltage output cannot be controlled.

8.2.4 Cycle Time

The IO-Link cycle time can be configured by this parameter.

The precondition for using *Cycle Time* is that you configure *Port Mode* to "IO-Link Manual".

As fast as possible:

The IO-Link port uses the max. supported IO-Link Device and Master update cycle time for the cyclic I/O data update between IO-Link Master and IO-Link Device.

1.6 ms, 3.2 ms, 4.8 ms, 8.0 ms, 20.8 ms, 40.0 ms, 80.0 ms, 120.0 ms:

The cycle time can be set manually to the provided options. This option can be used e.g. for IO-Link devices which are connected over inductive couplers. Inductive couplers are normally the bottleneck in the update cycle time between IO-Link Master and IO-Link Device. In this case, please refer to the data sheet of the inductive coupler.

8.2.5 Vendor ID

The *Vendor ID* is needed for the validation of the IO-Link device and can be configured with this parameter.

Precondition for using the *Vendor ID* is that you configure *Port Mode* to "IO-Link Manual". *Validation and Backup* must be set to a type compatible V1.X device.

8.2.6 Device ID

The *Device ID* is needed for the validation of the IO-Link device and can be configured with this parameter.

Precondition for using the *Device ID* is that you configure *Port Mode* to "IO-Link Manual". *Validation and Backup* must be set to a type compatible V1.X device.

8.2.7 IOL Failsafe

The LioN-X devices support a failsafe function for the output data of the IO-Link channels. In case of an internal device error, the PLC is in STOP state and cannot provide valid process data, the connection is interrupted or the communication is lost: The output data of the IO-Link channels is controlled by the configured failsafe values.

Set Low:

If failsafe is active, all bits of the IO-Link output data are set to low ("0").

Set High:

If failsafe is active, all bits of the IO-Link output data are set to high ("1").

Hold Last:

If failsafe is active, all bits of the IO-Link output data arel hold the last valid process data state ("0" or "1").

Replacement Value:

A replacement value can be set via the *IO-Link Failsafe* parameter object for every IO-Link device. If failsafe is active, these replacement values are transmitted to the IO-Link device. The current configured IO-Link output data size must be considered. Take into account that in the case of an error the replacement values are sent instead of the output process data so that a configured *Swapping Mode* has influence on the byte order.

IO-Link Master Command:

If failsafe is active, an IO-Link-specific mechanism for valid/invalid output process data is used and the IO-Link device determines the behavior itself.

8.2.8 IOL Failsafe values

IOL failsafe values represent byte-wise 32 replacement values. If failsafe is active, these values are transmitted to the IO-Link Device.

8.2.9 Swapping Length

The byte order of IO-Link is big endian. For setting output data in the correct format, the parameters *Swapping Mode* and *Swapping Offset* support the user. There can be selected up to 16 words or up to 8 double words for converting the output data.

Raw IO-Link Data:

No byte swap

Data type DWORD:

Data byte order: Byte 1, Byte 2, Byte 3, Byte 4

Order after Swap: Byte 4, Byte 3, Byte 2, Byte 1

Data type WORD:

Data byte order: Byte 1, Byte 2

Order after Swap: Byte 2, Byte 1

8.2.10 Swapping Offset

The *Swapping Offset* describes the start point in the process data for using the configured *Swapping Length*. Both parameters are dependent on the configured input or output data size.

8.2.11 Swapping Count

The *Swapping Count* describes the number of bytes in the process data to be swapped using the configured *Swapping Length*.

8.2.12 Sensor Supply Disabled

The supply of sensors can be disabled when *Sensor Supply Disabled* is set. The IO-Link Master will disable the supply for the respective IO-Link port.

8.2.13 Suppress all Diagnosis

By default, the IO-Link Master generates all possible diagnostics and will send reports via cyclic and cyclic data. All diagnostics can be suppressed by setting *Suppress all Diagnosis*.

8.2.14 DO Surveillance Timeout

The digital output channels are monitored during runtime. The error states are detected and reported as a diagnosis. To avoid error states during the switching of output channels, the surveillance timeout can be configured as a delay with deactivated monitoring.

The delay time begins with a rising edge of the output control bit. After delay time has elapsed, the output is monitored and error states are reported by diagnosis. When the channel is permanently switched on or off, the typical filter value (not changeable) is 5 ms.

8.2.15 DO Failsafe

The LioN-X devices support a failsafe function for the channels used as digital outputs. In case of an internal device error, the PLC is in STOP state and cannot provide valid process data. The connection is interrupted or the communication is lost. The outputs are controlled according to the configured failsafe values.

Set Low:

If failsafe is active, the physical output pin of the channel is set to low ("0").

Set High:

If failsafe is active, the physical output pin of the channel is set to high ("1").

Hold Last:

If failsafe is active, the physical output pin of the channel holds the last valid process data state ("0" or "1").

8.2.16 DO Restart Mode

In case of a short circuit or overload at an output channel, a diagnosis is reported and the output is switched to "off".

If *DO Restart Mode* is disabled, the output channel is not automatically turned on again. It can be turned on after a logical reset of the process output data of the channel.

If *DO Restart Mode* for this channel is enabled, the output will automatically be turned on again after a fix time delay for checking if the overload or short circuit condition is still active. When it is active, the channel is switched off again.

8.2.17 DI Logic

The logical state of an input channel can be configured via these parameters. If a channel is set to "Normally Open", a low signal ("0") is transferred to the process input data (e.g. if a non-damped sensor has an open switching output).

If a channel is set to "Normally Close", a high signal ("0") is transferred to the process input data (e.g. if a non-damped sensor has a closed switching output).

The channel LED shows, independent of these settings, the physical input state of the port pin.

8.2.18 DI Filter

A filter time for every digital input channel can be configured by these parameters. When there is no need for a filter it can be disabled.

8.2.19 Error LED Disable

Every channel of the ports X1 .. X8 has an error LED. The error LED can be disabled by enabling the parameter *Error LED Disable*. When this parameter is enabled, the LED status will not be "ON" in the case of an error on the port.

8.2.20 Level LED Disable

Every channel of the ports X1 .. X8 has a level LED. The level LED can be disabled by enabling the parameter *Level LED Disable*. When this parameter is enabled, the LED status will not be "ON" in case the input or output are high.

8.2.21 Use Push Pull

If *Use Push Pull* is enabled, the output will be switched active to high or low. In low state, the output can be a current sink. The digital output is supplied by U_S with a maximum current of 0.5 A.

When this option is not enabled, it will use option "High-Side switch" and the current limit is set according to the parameter *Current limit*. This option is not available for the Channel B of any port.

8.2.22 Current Limit

With this parameter you can configure the current limitations for the digital outputs. You can choose between different current limit options.

In low state, the output has a high impedance. The digital output is supplied by U_L or U_{AUX}, depending on the device variant, and has a selectable current limit. This means that the output is turned off and the actuator channel error diagnosis is reported when this limit is exceeded. If you set the level to *2.0 A max.*, the current limitation is not active and the maximum output current is available.

9 Process data assignment

The LioN-X devices in general support process data communication in both directions. The consuming data in this context is defined as the process output data which controls physical outputs and IO-Link output data. The producing data in this context is defined as the process input data which contains the physical inputs, diagnostics and IO-Link input data with optional extended status and event data.

The following chapters describe the data images for the consuming and producing data direction which are assigned to the output and input assemblies.

9.1 Consuming data (output)

Port No.	Pin	Register for DO	Register for IO-Link	Access
X1	4	Y0	RWw00 – RWw0F	RW ("Read/Write")
	2	Y1	–	RW
X2	4	Y2	RWw10 – RWw1F	RW
	2	Y3	–	RW
X3	4	Y4	RWw20 – RWw2F	RW
	2	Y5	–	RW
X4	4	Y6	RWw30 – RWw3F	RW
	2	Y7	–	RW
X5	4	Y8	RWw40 – RWw4F	RW
	2	Y9	–	RW
X6	4	YA	RWw50 – RWw5F	RW
	2	YB	–	RW
X7	4	YC	RWw60 – RWw6F	RW
	2	YD	–	RW
X8	4	YE	RWw70 – RWw7F	RW
	2	YF	–	RW

Register for DO = single bit

Register for IO-Link = WORD

9.2 Producing data (input)

Port No.	Pin	Register for DI	Register for IO-Link	Access
X1	4	X0	RWr00 – RWr0F	R ("Read Only")
	2	X1	–	R
X2	4	X2	RWr10 – RWr1F	R
	2	X3	–	R
X3	4	X4	RWr20 – RWr2F	R
	2	X5	–	R
X4	4	X6	RWr30 – RWr3F	R
	2	X7	–	R
X5	4	X8	RWr40 – RWr4F	R
	2	X9	–	R
X6	4	XA	RWr50 – RWr5F	R
	2	XB	–	R
X7	4	XC	RWr60 – RWr6F	R
	2	XD	–	R
X8	4	XE	RWr70 – RWr7F	R
	2	XF	–	R

Register for DI = single bit

Register for IO-Link = WORD

10 Diagnostics processing

Port No.	Register for Diagnosis	Description	Access
X1	X20	X1 IO-Link data valid	R ("Read only")
X2	X21	X2 IO-Link data valid	R
X3	X22	X3 IO-Link data valid	R
X4	X23	X4 IO-Link data valid	R
X5	X24	X5 IO-Link data valid	R
X6	X25	X6 IO-Link data valid	R
X7	X26	X7 IO-Link data valid	R
X8	X27	X8 IO-Link data valid	R

Sr. No.	Register for Diagnosis	Description	Access
1	X38	U_S supply present	R ("Read only")
2	X39	U_S supply Fault	R
3	X3A	U_L supply present	R
4	X3B	U_L supply Fault	R
5	X3C	Internal module error	R
6	X3D	Force mode diagnosis	R

10.1 Error of the system/sensor power supply

The voltage value for the incoming system/sensor power supply is also monitored globally. If the voltage drops below approx. 18 V, or exceeds approx. 30 V, an error diagnosis is generated. The IO-Link specification requires at least 20 V at the L+ (pin1) output supply of the I/O ports. At least 21 V of U_S supply voltage for the IO-Link Master are required to minimize the risk of internal voltage drops in the IO-Link Master.

The green U_S indicator is off.

The error diagnosis has no effect on the outputs.

Caution: It must definitely be ensured that the supply voltage, measured at the most remote participant is not below 21 V DC from the perspective of the system power supply.

10.2 Error of the auxiliary/actuator power supply

The voltage value for the incoming auxiliary/actuator power supply is also monitored globally. If *Report* U_L/U_{Aux} *Supply Voltage Fault* is enabled, an error message is generated when the voltage drops below approx. 18 V or exceeds approx. 30 V. The U_L/U_{Aux} indicator shows red.

If output channels are set to *High State* and *Report DO Fault without* U_L/U_{Aux}, additional error diagnostics, caused by the voltage failure, are generated on the channels.

If *Report* U_L/U_{Aux} *Supply Voltage Fault* is disabled, no U_L/U_{Aux} or channel diagnostics appear.

10.3 Overload/short circuit of the digital outputs

In case of an overload or a short circuit of an output channel, the following channel-specific diagnostics are generated in the producing data image.

Port No.	**Pin**	**Register for Diagnosis**	**Description**	**Access**
X1	4	X10	Short circuit X1 Channel A	R ("Read only")
	2	X11	Short circuit X1 Channel B	R
X2	4	X12	Short circuit X2 Channel A	R
	2	X13	Short circuit X2 Channel B	R
X3	4	X14	Short circuit X3 Channel A	R
	2	X15	Short circuit X3 Channel B	R
X4	4	X16	Short circuit X4 Channel A	R
	2	X17	Short circuit X4 Channel B	R
X5	4	X18	Short circuit X5 Channel A	R
	2	X19	Short circuit X5 Channel B	R
X6	4	X1A	Short circuit X6 Channel A	R
	2	X1B	Short circuit X6 Channel B	R
X7	4	X1C	Short circuit X7 Channel A	R
	2	X1D	Short circuit X7 Channel B	R
X8	4	X1E	Short circuit X8 Channel A	R
	2	X1F	Short circuit X8 Channel B	R

A channel error is determined by comparing the target value set of a controller to the physical value of an output channel.

When an output channel is activated (rising edge of the channel state), the channel errors are filtered for the period that is set by the "Surveillance-Timeout" parameter via the configuration of the device. The value of this parameter can range from 0 to 255 ms; the default setting is 80 ms.

The filter is used to avoid premature error messages during the activation of a capacitive load, the deactivation of an inductive load or during any other voltage peak when changing a status.

10.4 Overload/short circuit of the actuator power supply P24

For the following device variant, the Channel B outputs of X5 .. X8 are supplied by the U_{AUX} power:

- 0980 XSL 3913-121-007D-01F

In case of an overload or a short circuit of the actuator power supply P24 (Class B) on the ports (X5 .. X8), the following channel-specific diagnostics in the producing data image are generated.

Port No.	Register for Diagnosis	Description	Access
X1	X30	reserved	R ("Read only")
X2	X31	reserved	R
X3	X32	reserved	R
X4	X33	reserved	R
X5	X34	X5 actuator supply P24 short circuit	R
X6	X35	X6 actuator supply P24 short circuit	R
X7	X36	X7 actuator supply P24 short circuit	R
X8	X37	X8 actuator supply P24 short circuit	R

10.5 Overload/short-circuit of the I/O port sensor supply outputs

In case of an overload or a short circuit between pin 1 and pin 3 on the ports (X1 .. X8), the following channel-specific diagnostics in the producing data image are generated.

Port No.	Register for Diagnosis	Description	Access
X1	X28	X1 sensor short circuit	R ("Read only")
X2	X29	X2 sensor short circuit	R
X3	X2A	X3 sensor short circuit	R
X4	X2B	X4 sensor short circuit	R
X5	X2C	X5 sensor short circuit	R
X6	X2D	X6 sensor short circuit	R
X7	X2E	X7 sensor short circuit	R
X8	X2F	X8 sensor short circuit	R

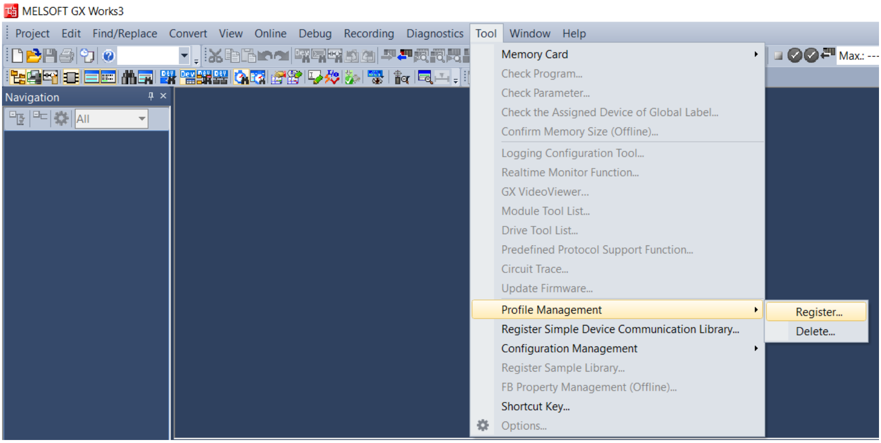
11 Configuration and operation with GxWorks3®

The configuration and start-up of LioN-X devices described in this chapter refers to the Mitsubishi Engineering Tool GxWorks®, V2. If you are using an engineering tool from another provider, please consider the related documentation.

11.1 Integration of a CSP+ file

Perform the following work steps to integrate a CSP+ file in GxWorks3®:

1. Open GxWorks3® and navigate to **Tool** > **Profile Management** > **Register**.


MELSOFT GX Works3
Project
Edit
Find/Replace
Convert
View
Online
Debug
Recording
Diagnostics
Tool
Window
Help
Navigation
All
Max.: ---
Memory Card
Check Program...
Check Parameter...
Check the Assigned Device of Global Label...
Confirm Memory Size (Offline)...
Logging Configuration Tool...
Realtime Monitor Function...
GX VideoViewer...
Module Tool List...
Drive Tool List...
Predefined Protocol Support Function...
Circuit Trace...
Update Firmware...
Profile Management
Register Simple Device Communication Library...
Configuration Management
Register Sample Library...
FB Property Management (Offline)...
Shortcut Key...
Options...
Register...
Delete...

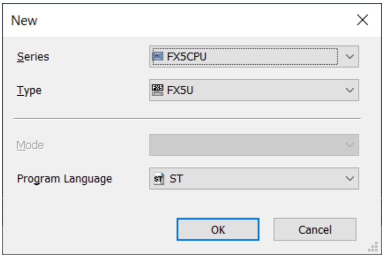
2. Select *0x4DF_0980 XXX_1.0_en.CSPP.zip* and the CSP+ file will be registered.

11.2 Network parameters

Perform the following work steps to change the Network parameters:

1. Open GxWorks3® and create a new project.

2. Select the series and the type of the used PLC.


New

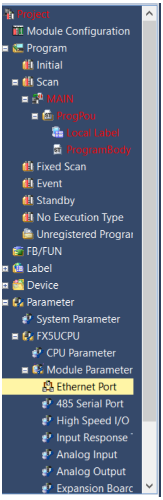
Series: FX5CPU

Type: FX5U

Mode:

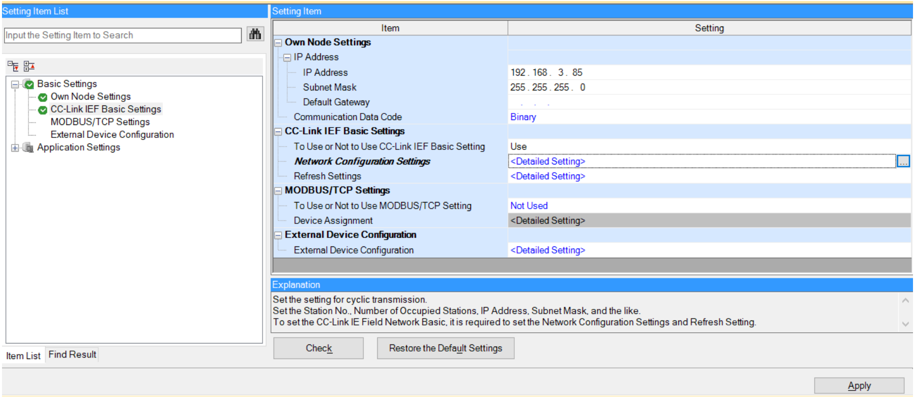
Program Language: ST

3. To open the setting window, navigate to **Project** > **Parameter** > **"the selected CPU module"** > **Module Parameter**


Project
Module Configuration
Program
Initial
Scan
MAIN
ProgPou
Local Label
ProgramBody
Fixed Scan
Event
Standby
No Execution Type
Unregistered Progra
FB/FUN
Label
Device
Parameter
System Parameter
FX5UCPU
CPU Parameter
Module Parameter
Ethernet Port
485 Serial Port
High Speed I/O
Input Response
Analog Input
Analog Output
Expansion Boar

In the appearing window, the CC-Link IE Field Basic Master station can be configured.

4. Navigate to *Own Node Settings* to configure the PLC or Master station.


Setting Item List
Input the Setting Item to Search
Basic Settings
Own Node Settings
CC-Link IEF Basic Settings
MODBUS/TCP Settings
External Device Configuration
Application Settings
Item List
Find Result
Setting Item
Explanation
Check
Restore the Default Settings
Apply

Item	Setting
Own Node Settings	
IP Address	
IP Address	192 . 168 . 3 . 85
Subnet Mask	255 . 255 . 255 . 0
Default Gateway	. . .
Communication Data Code	Binary
CC-Link IEF Basic Settings	
To Use or Not to Use CC-Link IEF Basic Setting	Use
Network Configuration Settings	<Detailed Setting>
Refresh Settings	<Detailed Setting>
MODBUS/TCP Settings	
To Use or Not to Use MODBUS/TCP Setting	Not Used
Device Assignment	<Detailed Setting>
External Device Configuration	
External Device Configuration	<Detailed Setting>

Set the setting for cyclic transmission.
Set the Station No., Number of Occupied Stations, IP Address, Subnet Mask, and the like.
To set the CC-Link IE Field Network Basic, it is required to set the Network Configuration Settings and Refresh Setting.

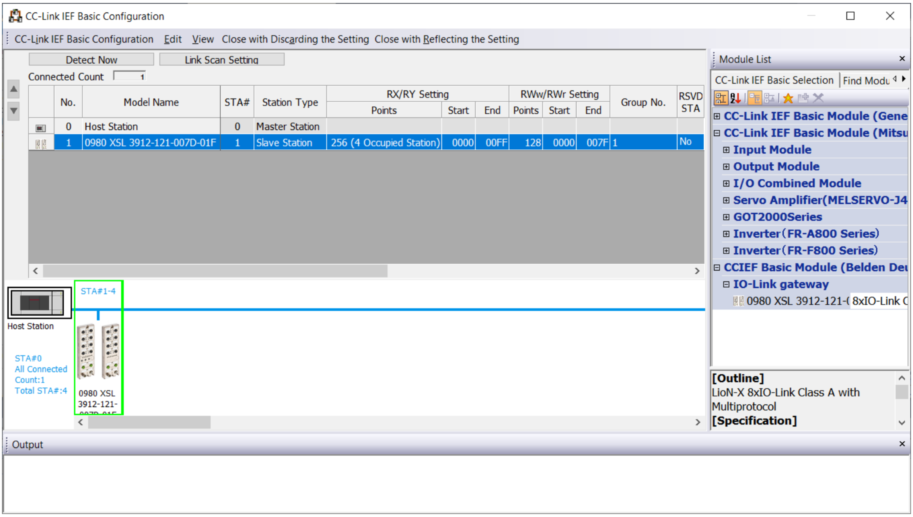
5. Under **CC-Link IEF Basic settings** > **To Use or Not to Use CC-Link IEF Basic Setting** select "Use".

- The option *Network Configuration Settings* allows you to configure a CC-Link IE Field Basic Master, connected stations, a Network, parameters and many more.
- Settings under *Refresh Settings* are necessary for the automatic data transfer between Link side and CPU side.

11.3 Parameter processing

Under *Network Configuration Settings*, individual stations can be configured. Perform the following work steps to configure a LioN-X device:

1. Select the LioN-X device from the *Module List*. Alternatively, click the button **Detect Now** for automatic detection of devices.

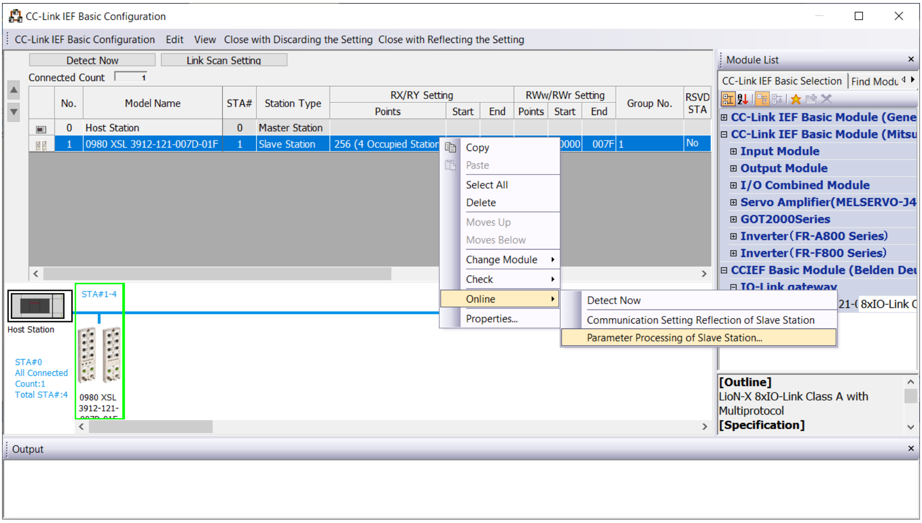

CC-Link IEF Basic Configuration
CC-Link IEF Basic Configuration
Edit
View
Close with Discarding the Setting
Close with Reflecting the Setting
Detect Now
Link Scan Setting
Module List
CC-Link IEF Basic Selection
Find Modu
CC-Link IEF Basic Module (Gene
CC-Link IEF Basic Module (Mitsu
Input Module
Output Module
I/O Combined Module
Servo Amplifier(MELSERVO-J4
GOT2000Series
Inverter(FR-A800 Series)
Inverter(FR-F800 Series)
CCIEF Basic Module (Belden De
IO-Link gateway
0980 XSL 3912-121-(8xIO-Link C
Host Station
STA#0
All Connected
Count:1
Total STA#:4
STA#1-4
0980 XSL
3912-121-
Output

Connected Count 1

No.	Model Name	STA#	Station Type	RX/RY Setting			RWw/RWr Setting			Group No.	RSVD STA
				Points	Start	End	Points	Start	End		
0	Host Station	0	Master Station								
1	0980 XSL 3912-121-007D-01F	1	Slave Station	256 (4 Occupied Station)	0000	00FF	128	0000	007F	1	No

[Outline]
LioN-X 8xIO-Link Class A with Multiprotocol
[Specification]

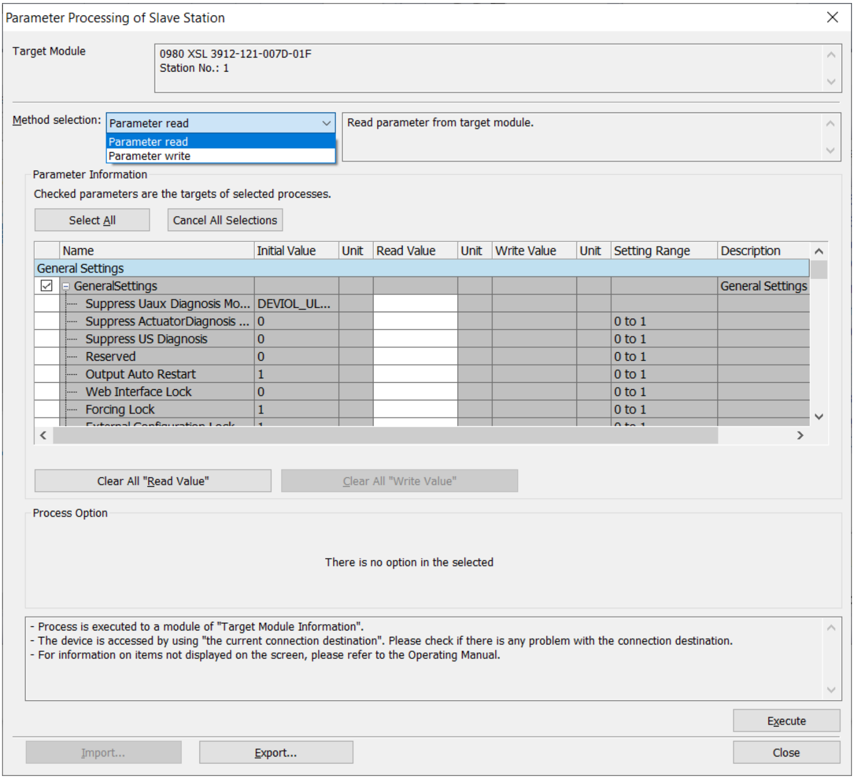
2. Right-click on "Slave Station" and select **Online** > **Parameter Processing of Slave Station...**.



No.	Model Name	STA#	Station Type	RX/RY Setting Points	RX/RY Setting Start	RX/RY Setting End	RWw/RWr Setting Points	RWw/RWr Setting Start	RWw/RWr Setting End	Group No.	RSVD STA
0	Host Station	0	Master Station								
1	0980 XSL 3912-121-007D-01F	1	Slave Station	256 (4 Occupied Statior				000	007F	1	No

CC-Link IEF Basic Configuration
CC-Link IEF Basic Configuration
Edit
View
Close with Discarding the Setting
Close with Reflecting the Setting
Detect Now
Link Scan Setting
Connected Count
1
Copy
Paste
Select All
Delete
Moves Up
Moves Below
Change Module
Check
Online
Properties...
Detect Now
Communication Setting Reflection of Slave Station
Parameter Processing of Slave Station...
Host Station
STA#0
All Connected
Count:1
Total STA#:4
STA#1-4
0980 XSL
3912-121-
Module List
CC-Link IEF Basic Selection
Find Modu
CC-Link IEF Basic Module (Gene
CC-Link IEF Basic Module (Mitsu
Input Module
Output Module
I/O Combined Module
Servo Amplifier(MELSERVO-J4
GOT2000Series
Inverter(FR-A800 Series)
Inverter(FR-F800 Series)
CCIEF Basic Module (Belden Deu
IO-Link gateway
21-(8xIO-Link C
[Outline]
LioN-X 8xIO-Link Class A with
Multiprotocol
[Specification]
Output

3. In the next window under *Method selection*, choose “Parameter read” or “Parameter write”, depending on which method you want to configure for the LioN-X device. For details on the different parameters please refer to chapter Configuration CC-Link IE Field Basic on page 49.



Parameter Processing of Slave Station

Target Module: 0980 XSL 3912-121-007D-01F
Station No.: 1

Method selection: Parameter read

Read parameter from target module.

Parameter Information

Checked parameters are the targets of selected processes.

	Name	Initial Value	Unit	Read Value	Unit	Write Value	Unit	Setting Range	Description
	General Settings								
☑	GeneralSettings								General Settings
	Suppress Uaux Diagnosis Mo...	DEVIOL_UL...							
	Suppress ActuatorDiagnosis ...	0						0 to 1	
	Suppress US Diagnosis	0						0 to 1	
	Reserved	0						0 to 1	
	Output Auto Restart	1						0 to 1	
	Web Interface Lock	0						0 to 1	
	Forcing Lock	1						0 to 1	

Process Option

There is no option in the selected

- Process is executed to a module of "Target Module Information".
- The device is accessed by using "the current connection destination". Please check if there is any problem with the connection destination.
- For information on items not displayed on the screen, please refer to the Operating Manual.

4. After having adjusted the parameters, click on **Communication Setting Reflection of Slave Station** to apply the changes to the respective module.

12 IIoT functionality

The LioN-X variants offer a number of new interfaces and functions for the optimal integration into existing or future IIoT (Industrial Internet of Things) networks. The devices continue to work as field bus devices which communicate with and are controlled by a PLC (Programmable Logic Controller).

In addition, the devices offer common IIoT interfaces, which enable new communication channels besides the PLC. The communication is performed via IIoT-relevant protocols MQTT and OPC UA. With the help of these interfaces not only all information in a LioN-X device can be read. They also enable its configuration and control, if the user wishes. All interfaces can be configured extensively and offer read-only functionality.

All LioN-X variants provide user administration, which is also applicable for accessing and configuring the IIoT protocols. This allows you to manage all modification options for the device settings via personalized user authorizations.

All IIoT protocols can be used and configured independently of the field bus. It is also possible to use the devices completely without the help of a PLC and control them via IIoT protocols.

Attention: When using the IIoT functionality, a protected local network environment without direct access to the Internet is recommended.

12.1 MQTT

MQTT functions are **only** applicable for the following LioN-X variants:

- 0980 XSL 3912-121-007D-00F
- 0980 XSL 3912-121-007D-01F
- 0980 XSL 3912-121-027D-01F
- 0980 XSL 3913-121-007D-01F
- 0980 XSL 3913-121-027D-01F

The MQTT (Message Queuing Telemetry Transport) protocol is an open network protocol for machine-to-machine communication, which provides the transmission of telemetric data messages between devices. The integrated MQTT client allows the device to publish a specific set of information to an MQTT broker.

The publishing of messages can either occur periodically or be triggered manually.

12.1.1 MQTT configuration

In **delivery state**, MQTT functions are **disabled**. The MQTT client can be configured either using the Web interface or directly via a JSON object sent in an HTTP/HTTPS request. For more information see chapter MQTT configuration - Quick start guide on page 96.

The configuration URL is:

`http://[ip-address]/w/config/mqtt.json`

The configuration can also read back as a JSON file:

`http://[ip-address]/r/config/mqtt.json`

The configuration is a JSON object. Each JSON member is a configuration element. The object must not contain all elements. Only the provided elements will be changed. The configuration changes apply only after a device restart.

The following configuration elements are available (default values in bold):

Element	Data type	Description	Example data
mqtt-enable	boolean	Master switch for the MQTT client.	true / **false**
broker	string	IP address of the MQTT Broker	**"192.168.1.1"**
login	string	Username for MQTT Broker	"admin" (Default: **null**)
password	string	Password for MQTT Broker	"private" (Default: **null**)
port	number	Broker port	**1883**
base-topic	string	Base topic	"iomodule_[mac]" (Default: "**lionx**")
will-enable	boolean	If true, the device provides a last will message to the broker	true / **false**
will-topic	string	The topic for the last will message.	(Default: **null**)
auto-publish	boolean	If true, all enabled domains will be published automatically in the specified interval.	**true** / false
publish-interval	number	The publish interval in ms if auto-publish is enabled. Minimum is 250 ms.	**2000**
publish-identity	boolean	If true, all identity domain data will be published	**true** / false
publish-config	boolean	If true, all config domain data will be published	**true** / false
publish-status	boolean	If true, all status domain data will be published	**true** / false
publish-process	boolean	If true, all process domain data will be published	**true** / false
publish-devices	boolean	If true, all IO-Link Device domain data will be published	true / **false**
commands-allowed	boolean	Master switch for MQTT commands. If false, the device will not subscribe to any command topic, even if specific command topics are activated below.	true / **false**
force-allowed	boolean	If true, the device accepts force commands via MQTT.	true / **false**
reset-allowed	boolean	If true, the device accepts restart and factory reset commands via MQTT.	true / **false**
config-allowed	boolean	If true, the device accepts configuration changes via MQTT.	true / **false**

Element	Data type	Description	Example data
qos	number	Selects the "Quality of Service" status for all published messages.	**0 = At most once** 1 = At least once 2 = Exactly once

Table 14: MQTT configuration

MQTT response:

The resulting response is a JSON object with a "status" field. Status should be "0" if no error occurred and "-1" if there is an error.

In case of an error, the response contains an error array.

The error array contains an error object for each error occurred. The object consists of a field "Element" which names the config element which caused the error, and a field "Message" for the error message.

- A malformed JSON object produces an error.
- Not existing parameters produce an error.
- Parameters with a wrong data type produce an error.

It is not allowed to write all available parameters at once. You may write only one or a limited number of parameters.

Examples:

```
{"status": -1, "error": [{"Element": "publish-interval", "Message": "Integer
 expected"}]}

{"status": 0}

{"status": -1, "error": [{"Element": "root", "Message": "Not a JSON
 object"}]}
```

For more information see chapter MQTT topics on page 84.

12.1.2 MQTT topics

MQTT mainly relates to topics. All messages are attached to a topic which adds context to the message itself. Topics may consist of any string and they are allowed to contain slashes (`/`) as well as wildcard symbols (`*, #`).

12.1.2.1 Base topic

For all LioN-X variants there is a configurable Base topic which is the prefix for all topics. The Base topic can be chosen freely by the user. The Base topic can also contain selected variables as shown in Table 15: Base topic variables on page 84.

Variables in the Base topic have to be written in brackets ("[ ]"). The following variables are possible:

Variable	Description
mac	The MAC address of the device
name	The name of the device
order	The ordering number of the device
serial	The serial number of the device

Table 15: Base topic variables

Example:

The Base topic `"io_[mac]"` translates to `"io_A3B6F3F0F2F1"`.

All data is organized in domains. The domain name is the first level in the topic after the Base topic. Note the following notation:

`Base-Topic/domain/.….`

There are the following domains:

Domain name	Definition	Example content
identity	All fixed data which is defined by the used hardware and which cannot be changed by configuration or at runtime.	Device name, ordering number, MAC address, port types, port capabilites and more.
config	Configuration data which is commonly loaded once at startup, mostly by a PLC.	IP address, port modes, input logic, failsafe values and more.
status	All (non-process) data which changes quite often in normal operation.	Bus state, diagnostic information, IO-Link Device status and data.
process	All process data which is produced and consumed by the device itself or by attached devices.	Digital inputs, digital outputs, cyclic IO-Link data.
iold	IO-Link Device parameters according to the IO-Link specification.	Vendor name, product name, serial number, hardware revision, software revision and more.

Table 16: Data domains

There is often one topic used for all gateway related information and topics for each port. All identity topics are published just once at start-up, because this information should never change. All other topics are published either in a fixed interval or just triggered manually, according to the configuration.

Topic	Content examples	Total publish count	Publish interval
[base-topic]/identity/gateway	Name, ordering number, MAC, vendor, I&M etc.	1	Startup
[base-topic]/identity/port/n	Port name, port type	8	Startup
[base-topic]/config/gateway	Configuration parameters, ip address etc.	1	Interval
[base-topic]/config/port/n	Port mode, data storage, mapping, direction	8	Interval
[base-topic]/status/gateway	Bus state, device diagnosis, master events	1	Interval
[base-topic]/status/port/n	Port or channel diagnosis, IO-Link state, IO-Link Device events	8	Interval
[base-topic]/process/gateway	All Digital IN/OUT	1	Interval
[base-topic]/process/port/n	Digital IN/OUT per port, IOL-data, pdValid	8	Interval
[base-topic]/iold/port/n	IO-Link Device parameter	8	Interval

Table 17: Data model

An MQTT client which wants to subscribe to one or more of these topics can also use wildcards.

Full topic	Description
[base-topic]/identity/gateway	Receive only indentity objects for the gateway
[base-topic]/identity/#	Receive all data related to the identity domain
[base-topic]/status/port/5	Receive only status information for port number 5
[base-topic]/+/port/2	Receive information of all domains for port number 2
[base-topic]/process/port/#	Receive only process data for all ports
[base-topic]/config/#	Receive config data for the gateway and all ports.

Table 18: Use case examples

12.1.2.2 Publish topic

Overview of all publish JSON data for the defined topics:

Key	Data type
product_name	json_string
ordering_number	json_string
device_type	json_string
serial_number	json_string
mac_address	json_string
production_date	json_string
fw_name	json_string
fw_date	json_string
fw_version	json_string
hw_version	json_string
vendor_name	json_string
vendor_address	json_string
vendor_phone	json_string
vendor_email	json_string
vendor_techn_support	json_string
vendor_url	json_string
vendor_id	json_integer
device_id	json_integer

Table 19: Identity/gateway

Key	Data type	Range	Default value	Remarks
fieldbus_protocol	json_string	PROFINET, EtherNet/IP, EtherCAT®		
ip_address	json_string		192.168.1.1	
subnet_mask	json_string		255.255.255.0	
report_alarms	json_boolean		0.0.0.0	
report_ul_alarm	json_boolean	true / false	true	
report_do_fault_without_ul	json_boolean	true / false	false	
force_mode_lock	json_boolean	true / false	false	
web_interface_lock	json_boolean	true / false	false	
do_auto_restart	json_boolean	true / false	true	
fast_startup	json_boolean	true / false	false	PROFINET and EIP only

Table 20: Config/gateway

Key	Data type	Range	Default value	Remarks
protocol	json_string	wait_for_io_system wait_for_io_Connection failsafe connected error		
ethernet_port1	json_string	100_mbit/s_full 100_mbit/s 10_mbit/s_full 100_mbit/s		
ethernet_port2	json_string	100_mbit/s_full 100_mbit/s 10_mbit/s_full 100_mbit/s		
module_restarts	json_integer	0 .. 4294967295		
channel_diagnosis	json_boolean	true / false		
failsafe_active	json_boolean	true / false		
system_voltage_fault	json_boolean	true / false		
actuator_voltage_fault	json_boolean	true / false		
internal_module_error	json_boolean	true / false		
simulation_active_diag	json_boolean	true / false		
us_voltage	json_integer	0 .. 32		in Volts
ul_voltage	json_integer	0 .. 32		in Volts
forcemode_enabled	json_boolean	true / false		

Table 21: Status/gateway

Key	Data type	Range	Default value	Remarks
Input_data	json_integer[]			
output_data	json_integer[]			

Table 22: Process/gateway

Key	Data type	Range	Default value	Remarks
port	json_integer	1 .. 8		
type	json_string	digital_universal digital_input digital_Output io_link		
max_output_power_cha	json_string	2.0_mA 0.5_mA		
max_output_power_chb	json_string	2.0_mA 0.5_mA		
channel_cha	json_string	input/output input output io_link aux		
channel_chb	json_string	input/output input output io_link aux		

Table 23: Identity/port/1 .. 8

Key	Data type	Range	Default value	Remarks
port	json_integer	1 .. 8		
direction_cha	json_string	input/output input output		
restart_mode_cha	json_string	Manual Auto		
restart_mode_chb	json_string	Manual Auto		
input_polarity_cha	json_string	NO NC		
input_polarity_chb	json_string	NO NC		
input_filter_cha	json_integer			ms
input_filter_chb	json_integer			ms
do_auto_restart_cha	json_boolean	true / false		
do_auto_restart_chb	json_boolean	true / false		

Table 24: Config/port/1 .. 8

Key	Data type	Range	Default value	Remarks
port	json_integer	1 .. 8		
physical_state_cha	json_integer	0 .. 1		
physical_state_chb	json_integer	0 .. 1		
actuator_short_circuit_cha	json_boolean	true / false		
actuator_short_circuit_chb	json_boolean	true / false		
sensor_short_circuit	json_boolean	true / false		
current_cha	json_integer			mA
current_chb	json_integer			mA
current_pin1	json_integer			mA

Table 25: Status/port/1 .. 8

12.1.2.3 Command topic (MQTT Subscribe)

The main purpose of MQTT is to publish data from the device to a broker. This data can then be received by any subscriber who is interested in this data. But also the other way round is possible. The device can subscribe to a topic on the broker and is then able to receive data. This data can contain configuration or forcing data. This allows the user to fully control a device via MQTT only, without using other ways of communication like Web or REST.

If the configuration allows commands in general, the device subscribes to special Command topics on which it can receive commands from other MQTT clients. The Command topic is based upon the Base topic. It always has the following form:

```
[base-topic]/command
```

After the Command topic, there are fixed topics for different writeable objects. The data format of the MQTT payload is always JSON. It is possible to set only a subset of the possible objects and fields.

[…]/forcing

Use the Command topic `[base-topic]/command/forcing` for *Force object* data. The *Force object* can contain any of the following properties:

Property	Data type	Example values	Remarks
forcemode	boolean	true / false	Forcing Authority: on/off
digital	array (Table 27: Force object: Digital on page 93)		
iol	array (Table 28: Force object: IOL (IO-Link devices only) on page 93)		

Table 26: Force object properties

For the *Force object* properties `digital` and `iol`, there are several value specifications arrayed:

Property	Data type	Example values	Remarks
port	integer	1, 2, 5	
channel	string	"a", "b"	
force_dir	string	"out", "in", "clear"	
force_value	integer	0, 1	

Table 27: Force object: Digital

Property	Data type	Example values	Remarks
port	integer	0, 1, 5	
output	array[integer]	[55, 88, 120]	
input	array[integer]		Input-Simulation

Table 28: Force object: IOL (IO-Link devices only)

[…]/config

Use the Command topic `[base-topic]/command/config` for *Config object* data. The *Config object* can contain any of the following properties:

Property	Data type	Example values	Remarks
portmode	array (Table 30: Config object: Portmode on page 94)		
ip_address	string	"192.168.1.5"	
subnet_mask	string	"255.255.255.0"	
gateway	string	"192.168.1.100"	

Table 29: Config object properties

For the *Conig object* property `portmode`, there are several value specifications arrayed:

Property	Data type	Example values	Remarks
port	integer	2	
channelA*	string	"dio", "di", "do", "iol", "off"	
channelB*	string	"dio", "di", "do", "iol", "off", "aux"	
inlogicA	string	"no", "nc"	
inlogicB	string	"no", "nc"	
filterA	integer	3	input filter in ms
filterB	integer	3	input filter in ms
autorestartA	boolean		
autorestartB	boolean		
iolValidation	integer	0 = NoCheck 1 = Type 1.0 2 = Type 1.1 3 = Type 1.1 BR 4 = Type 1.1 RES	
iolDeviceID	integer		for validation
iolVendorID	integer		for validation

Table 30: Config object: Portmode

*channelA = Pin 4, channelB = Pin 2

[…]/reset

Use the Command topic `[base-topic]/command/reset` for *Reset object* data about restart and factory reset issues. The *Reset object* can contain any of the following properties:

Property	Data type	Example values	Remarks
factory_reset	boolean	true / false	
system_reset	boolean	true / false	

Table 31: Reset object properties

[…]/publish

Use the Command topic `[base-topic]/command/publish` for *Publish object* data.

Trigger publish of all topics manually (can be used when auto publish is off or long interval is set).

12.1.3 MQTT configuration - Quick start guide

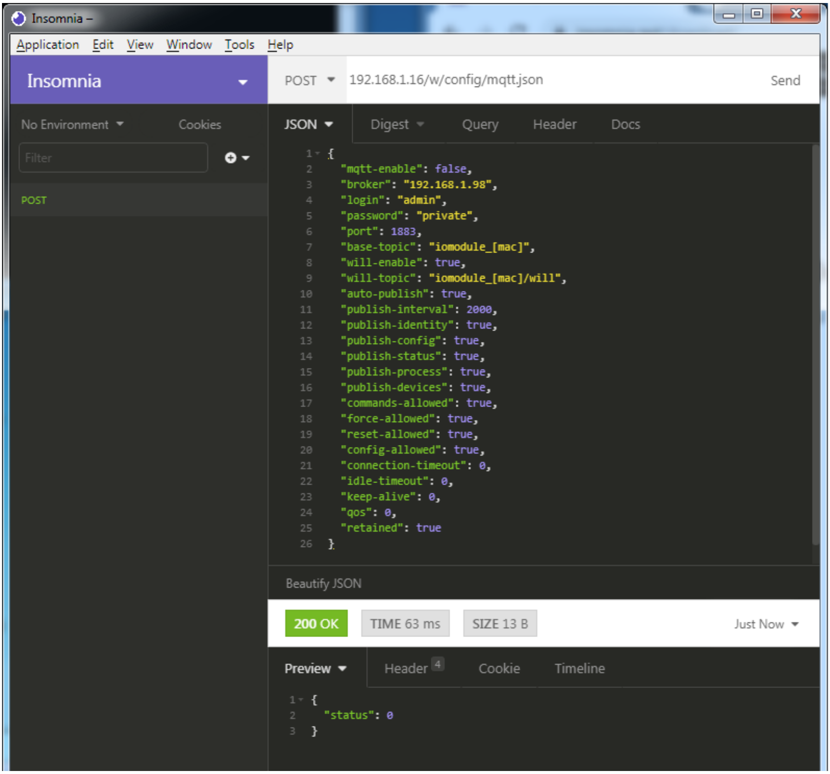
Attention: Lumberg Automation™ is not responsible for any content of the referenced Web pages and provides no warranty for any functionality of the named third party software.

12.1.3.1 MQTT configuration via JSON

1. Depending on your application case, download and install *Insomnia* or a comparable application: https://insomnia.rest/download/

2. Configure MQTT:

POST: `[IP-address]/w/config/mqtt.json`

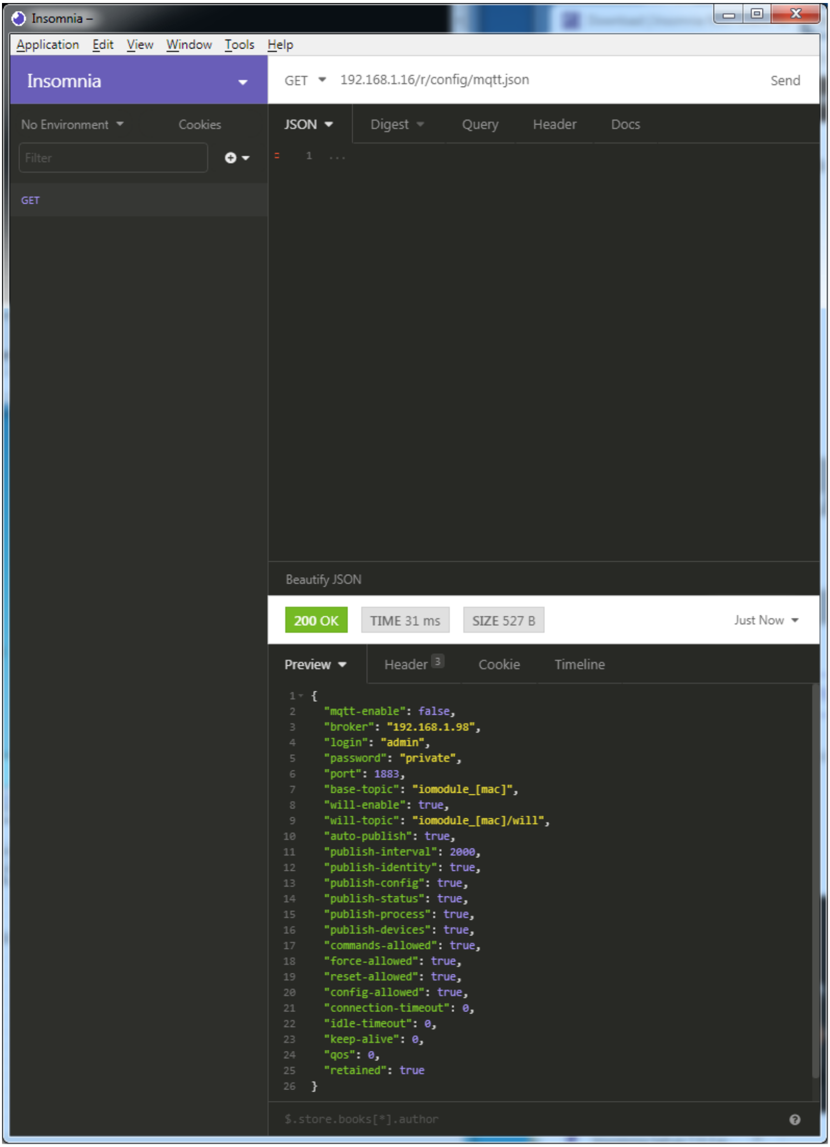

Insomnia –
Application Edit View Window Tools Help
Insomnia
POST
192.168.1.16/w/config/mqtt.json
Send
No Environment
Cookies
Filter
POST
JSON
Digest
Query
Header
Docs
Beautify JSON
200 OK
TIME 63 ms
SIZE 13 B
Just Now
Preview
Header 4
Cookie
Timeline

```
{
  "mqtt-enable": false,
  "broker": "192.168.1.98",
  "login": "admin",
  "password": "private",
  "port": 1883,
  "base-topic": "iomodule_[mac]",
  "will-enable": true,
  "will-topic": "iomodule_[mac]/will",
  "auto-publish": true,
  "publish-interval": 2000,
  "publish-identity": true,
  "publish-config": true,
  "publish-status": true,
  "publish-process": true,
  "publish-devices": true,
  "commands-allowed": true,
  "force-allowed": true,
  "reset-allowed": true,
  "config-allowed": true,
  "connection-timeout": 0,
  "idle-timeout": 0,
  "keep-alive": 0,
  "qos": 0,
  "retained": true
}
```

```
{
  "status": 0
}
```

3. Read MQTT:

GET: `[IP-address]/r/config/mqtt.json`



Insomnia –
Application Edit View Window Tools Help
Insomnia
GET 192.168.1.16/r/config/mqtt.json Send
No Environment Cookies
Filter
GET
JSON Digest Query Header Docs
Beautify JSON
200 OK TIME 31 ms SIZE 527 B Just Now
Preview Header 3 Cookie Timeline
$.store.books[*].author

```
{
  "mqtt-enable": false,
  "broker": "192.168.1.98",
  "login": "admin",
  "password": "private",
  "port": 1883,
  "base-topic": "iomodule_[mac]",
  "will-enable": true,
  "will-topic": "iomodule_[mac]/will",
  "auto-publish": true,
  "publish-interval": 2000,
  "publish-identity": true,
  "publish-config": true,
  "publish-status": true,
  "publish-process": true,
  "publish-devices": true,
  "commands-allowed": true,
  "force-allowed": true,
  "reset-allowed": true,
  "config-allowed": true,
  "connection-timeout": 0,
  "idle-timeout": 0,
  "keep-alive": 0,
  "qos": 0,
  "retained": true
}
```

12.2 OPC UA

OPC UA functions are **only** applicable for the following LioN-X variants:

- 0980 XSL 3912-121-007D-00F
- 0980 XSL 3912-121-007D-01F
- 0980 XSL 3912-121-027D-01F
- 0980 XSL 3913-121-007D-01F
- 0980 XSL 3913-121-027D-01F

OPC Unified Architecture (OPC UA) is a platform-independent standard with a service-oriented architecture for communication in and with industrial automation systems.

The OPC UA standard is based on the client-server principle and lets machines and devices, regardless of any preferred field bus, communicate horizontally among each other as well as vertically to the ERP system or the cloud. LioN-X provides an OPC UA server on field device level, with which an OPC UA client can connect for information exchange secure in transmission.

For OPC UA, we comply (apart from the exceptions listed below) with the IO-Link Companion Specification, which can be downloaded from catalog.belden.com or directly from io-link.com.

Feature	**Support**
Managing IODDs (chapter 6.1.6 in the specification)	Not supported
Mapping IODD information to OPC UA ObjectTypes (chapter 6.3 in the specification)	Not supported
IOLinkIODDDeviceType (chapters 7.2 ff. in the specification)	Not supported
ObjectTypes generated based on IODDs (chapters 7.3 ff. in the specification)	Not supported
Creation of Instances based on ObjectTypes generated out of IODDs (chapter 7.4 in the specification)	Not supported
IODDManagement Object (chapter 8.2 in the specification)	Not supported
RemoveIODD Method (chapter 8.3 in the specification)	Not supported

Table 32: Non-supported OPC UA features according to the IO-Link Companion Specification

12.2.1 OPC UA configuration

In **delivery state**, OPC UA functions are **disabled**. The OPC UA Server can be configured either using the Web interface or directly via a JSON Object sent in an HTTP/HTTPS request. For more information see OPC UA configuration - Quick start guide on page 102.

The configuration URL is:

`http://[ip-address]/w/config/opcua.json`

The configuration can also read back as a JSON file:

`http://[ip-address]/r/config/opcua.json`

The configuration is a JSON object. Each JSON member is a configuration element. The object must not contain all elements. Only the provided elements will be changed. All configuration changed applies only after a device restart.

There are the following configuration elements (default values in bold):

Element	Data type	Description	Example data
port	integer	Server port for the OPC UA server.	0, **4840**, 0xFFFF
opcua-enable	boolean	Master switch for the OPC UA server.	true / **false**
anon-allowed	boolean	If true, anonymous login is allowed.	**true** / false
commands-allowed	boolean	Master switch for OPC UA commands. If false there will be no writeable OPC UA objects.	true / **false**
force-allowed	boolean	If true, the device accepts force commands via OPC UA.	true / **false**
reset-allowed	boolean	If true, the device accepts restart and factory reset commands via OPC UA.	true / **false**
config-allowed	boolean	If true, the device accepts configuration changes via OPC UA.	true / **false**

Table 33: OPC UA Configuration

All configuration elements are optional and do not need a specific order. Not every element is required to be sent. This means that only configuration changes will be taken over.

Optional: The configuration parameters of OPC UA can be set directly via the Web interface. It is possible to download the Web interface for sharing with other devices.

Response:

The resulting response is a JSON object with a status field. Status should be "0" if no error occurred and "-1" if there is an error.

In case of an error, the response contains an error array.

The error array contains an error object for each error occurred. The object consists of a field "Element" which names the config element which caused the error, and a field "Message" for the error message.

Examples:

```
{"status": -1, "error": [{"Element": "upcua-enable", "Message": "Boolean
 expected"}]}

{"status": 0}

{"status": -1, "error": [{"Element": "root", "Message": "Not a JSON
 object"}]}
```

12.2.2 OPC UA address space

OPC UA provides different services on the LioN-X devices with which a client can navigate through the hierarchy of the address space and read or write variables. In addition, the client can monitor up to 10 attributes from the address space for value changes.

A connection to an OPC UA server is established via the endpoint URL:

```
opc.tcp://[ip-address]:[port]
```

Various device data such as MAC address, device settings, diagnostics or status information can be read via *Identity objects*, *Config objects*, *Status objects* and *Process objects*.

Command objects can be read and written. This makes it possible, for example, to transfer new network parameters to the device, to use Force Mode or to reset the entire device to its factory settings.

The following figures illustrate the OPC UA address space of the LioN-X devices. The objects and information displayed depend on the device variant used.

12.2.3 OPC UA configuration - Quick start guide

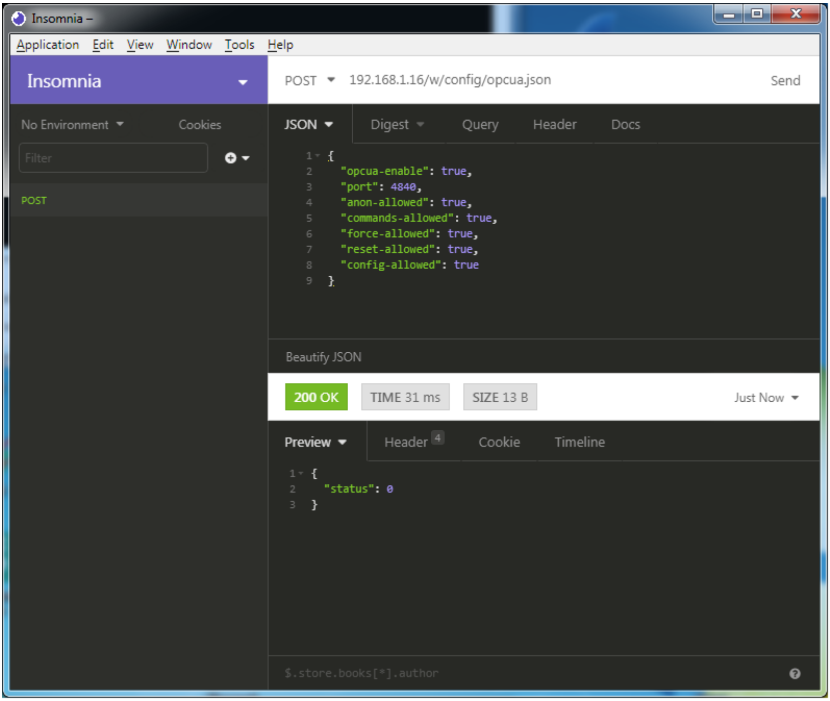
Attention: Lumberg Automation^{TM} is not responsible for any content of the referenced Web pages and provides no warranty for any functionality of the named third party software.

12.2.3.1 OPC UA configuration via JSON

1. Depending on your application case, download and install *Insomnia* or a comparable application: https://insomnia.rest/download/

2. Configure OPC UA:

POST: `[IP-address]/w/config/opcua.json`


Insomnia –
Application Edit View Window Tools Help
Insomnia
No Environment
Cookies
Filter
POST
Send
JSON
Digest
Query
Header
Docs
Beautify JSON
Just Now
Preview
Header 4
Cookie
Timeline
$.store.books[*].author

POST 192.168.1.16/w/config/opcua.json

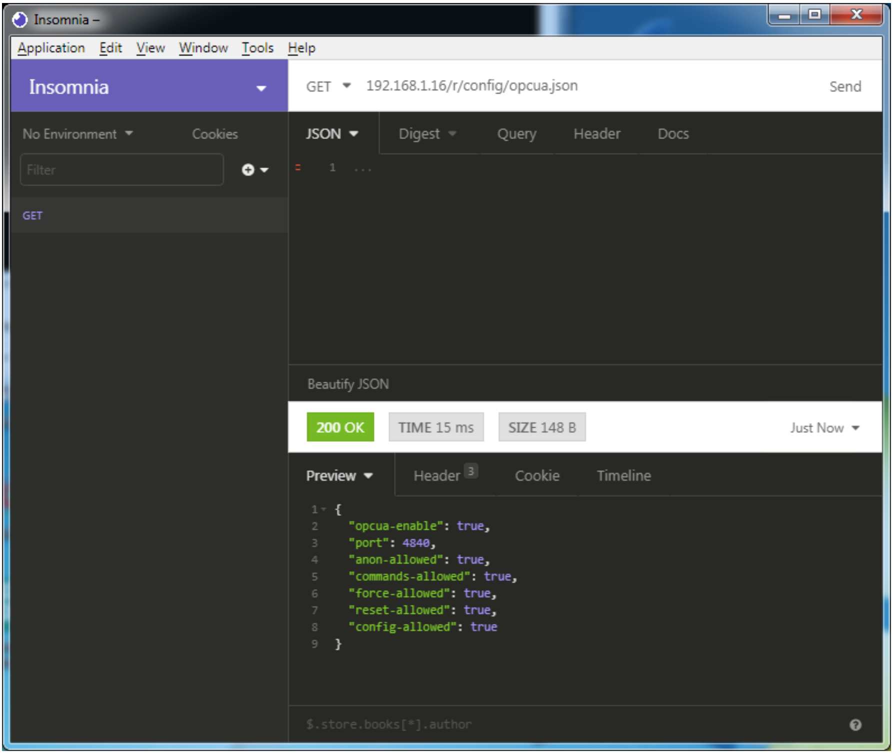
```
{
  "opcua-enable": true,
  "port": 4840,
  "anon-allowed": true,
  "commands-allowed": true,
  "force-allowed": true,
  "reset-allowed": true,
  "config-allowed": true
}
```

200 OK TIME 31 ms SIZE 13 B

```
{
  "status": 0
}
```

3. Read OPC UA:

GET: `[IP-address]/r/config/opcua.json`


Insomnia –
Application Edit View Window Tools Help
Insomnia
No Environment
Cookies
Filter
GET
JSON
Digest
Query
Header
Docs
Send
Beautify JSON
Just Now
Preview
Header 3
Cookie
Timeline
$.store.books[*].author

GET 192.168.1.16/r/config/opcua.json

200 OK TIME 15 ms SIZE 148 B

```
{
  "opcua-enable": true,
  "port": 4840,
  "anon-allowed": true,
  "commands-allowed": true,
  "force-allowed": true,
  "reset-allowed": true,
  "config-allowed": true
}
```

12.3 REST API

The Representational State Transfer – Application Programming Interface (REST API) is a programmable interface which uses HTTP/HTTPS requests to GET and POST data. This enables the access to detailed device information.

For all LioN-X variants, the REST API can be used to read the device status. For the LioN-X multiprotocol variants, the REST API can also be used to write configuration and forcing data.

There are two different REST API standards you can use for the requests:

1. A standardized REST API that has been specified by the IO-Link Community and is described separately:

   `JSON_Integration_10222_V100_Mar20.pdf`

   Please download the file from catalog.belden.com or directly from io-link.com.

   Attention: Consider the following table to get an overview of the supported features of the IO-Link specification:

Feature		Supported
Gateway	GET /identification	Yes
	GET /capabilities	Yes
	GET /configuration	Yes
	POST /configuration	Yes
	POST /reset	Yes
	POST /reboot	Yes
	GET /events	Yes
Master	GET /masters	Yes
	GET /capabilities	Yes
	GET /identification	Yes
	POST /identification	Yes

Feature		Supported
Port	GET /ports	Yes
	GET /capabilities	Yes
	GET /status	Yes
	GET /configuration	Yes
	POST /configuration	Yes
	GET /datastorage	Yes
	POST /datastorage	Yes
Devices	GET /devices	Yes
	GET /capabilities	Yes
	GET /identification	Yes
	POST /identification	Yes
	GET /processdata/value	Yes
	GET /processdata/getdata/value	Yes
	GET /processdata/setdata/value	Yes
	POST /processdata/value	Yes
	GET /parameters	Not supported
	GET /parameters/{index}/subindices	Not supported
	GET /parameters/{parameterName}/subindices	Not supported
	GET /parameters/{index}/value	Not supported
	GET /parameters/{index}/subindices/{subindex}/value	Not supported
	GET /parameters/{parameterName}/value	Not supported
	GET /parameters/{parameterName}/subindices/{subParameterName}/value	Not supported
	POST /parameters/{index}/value	Not supported
	POST /parameters/{parameterName}/value	Not supported
	POST /parameters/{index}/subindices/{subindex}/value	Not supported
	POST /parameters/{parameterName}/subindices/{subParameterName}/value	Not supported
	POST /blockparametrization	Yes
	GET /events	Yes

Feature		Supported
IODD	GET /iodds	Not supported
	POST /iodds/file	Not supported
	DELETE /iodds	Not supported
	GET /iodds/file	Not supported

Table 34: Support of REST API features according to the IO-Link specification

2. A customized Belden REST API that is described in the following chapters.

12.3.1 Standard device information

Request method:	http GET
Request URL:	`<ip>/info.json`
Parameters	n.a.
Response format	JSON

The goal of the "Standard device information" request is to get a complete snapshot of the current device status. The format is JSON. For IO-Link devices, all ports with connected IO-Link device information are included.

12.3.2 Structure

Name	Data type	Description	Example
name	string	Device name	"0980 XSL 3912-121-007D-00F"
order-id	string	Ordering number	"935 700 001"
fw-version	string	Firmware version	"V.1.1.0.0 - 01.01.2021"
hw-version	string	Hardware version	"V.1.00"
mac	string	MAC address of the device	"3C B9 A6 F3 F6 05"
bus	number	0 = No connection 1 = Connection with PLC	1
failsafe	number	0 = Normal operation 1 = Outputs are in failsafe	0
ip	string	IP address of the device	
snMask	string	Subnet Mask	
gw	string	Default gateway	
rotarys	array of numbers (3)	Current position of the rotary switches: Array element 0 = x1 Array element 1 = x10 Array element 2 = x100	
ulPresent	boolean	True, if there is a UL voltage supply detected within valid range	
usVoltage_mv	number	US voltage supply in mV	
ulVoltage_mv	number	UL voltage supply in mV (only available for devices with UL supply)	
inputs	array of numbers (2)	Real state of digital inputs. **Element 0 = 1 Byte:** Port X1 Channel A to Port X4 Channel B **Element 0 = 1 Byte:** Port X5 Channel A to Port X8 Channel B	\[128,3\]
output	array of numbers (2)	Real State of digital outputs. **Element 0 =1 Byte:** Port X1 Channel A to port X4 Channel B **Element 0 = 1 Byte:** Port X5 Channel A to port X8 Channel B	\[55,8\]

Name	Data type	Description	Example
consuming	array of numbers (2)	Cyclic data from PLC to device	
producing	array of numbers (2)	Cyclic data from device to PLC	
diag	array of numbers (4)	Diagnostic information **Element 0 = 1 Byte:** Bit 7: Internal module error (IME) Bit 6: Forcemode active Bit 3: Actuator short Bit 2: Sensor short Bit 1: U_L fault Bit 0: U_S fault **Element 1 = 1 Byte:** Sensor short circuit ports X1 .. X8. **Element 2 =1 Byte:** Actuator short circuit ports X1 Channel A to X4 Channel B **Element 3 = 1 Byte:** Actuator short circuit ports X5 Channel A to X8 Channel B	
fieldbus	FIELDBUS Object		
FIELDBUS Object			
fieldbus_name	string	Currently used fieldbus	
state	number	Fieldbus state	
state_text	number	Textual representation of fieldbus state: 0 = Unknown 1 = Bus disconnected 2 = Preop 3 = Connected 4 = Error 5 = Stateless	
forcing	FORCING Object	Information about the forcing state of the device	
channels	Array of CHANNEL (16)	Basic information about all input/output channels	

Name	Data type	Description	Example
iol	IOL Object	Contains all IO-Link related information such as events, port states, device parameters.	
iol/diagGateway	array of DIAG	Array of currently active device/ gateway related events	
iol/diagMaster	array of DIAG	Array of currently active IOL-Master related events	
iol/ports	array of PORT (8)	Contains one element for each IO-Link port	
CHANNEL Object			
name	string	Name of channel	
type	number	Hardware channel type as number: 0 = DIO 1 = Input 2 = Output 3 = Input/Output 4 = IO-Link 5 = IOL AUX 6 = IOL AUX with DO 7 = IOL AUX with DO. Can be deactivated. 8 = Channel not available	
type_text	string	Textual representation of the channel type	
config	number	Current configuration of the channel: 0 = DIO 1 = Input 2 = Output 3 = IO-Link 4 = Deactivated 5 = IOL AUX	
config_text	string	Textual representation of the current config	
inputState	boolean	Input data (producing data) bit to the PLC	
outputState	boolean	Output data bit to the physical output pin	

Name	Data type	Description	Example
forced	boolean	True, if the output pin of this channel is forced	
simulated	boolean	True, if the input value to the PLC of this channel is simulated	
actuatorDiag	boolean	True, if the output is in short circuit / overload condition	
sensorDiag	boolean	True, if the sensor supply (Pin 1) is in short circuit / overload condition	
maxOutputCurrent_mA	number	Maximum output current of the output in mA	
current_mA	number	Measured current of the output in mA (if current measurement is available)	
voltage_mV	number	Measured voltage of this output in mV (if voltage measurement is available)	
PORT Object			
port_type	string	Textual representation of the IO-Link port type	
iolink_mode	number	**Current port mode:** 0 = Inactive 1 = Digital output 2= Digital input 3 = SIO 4 = IO-Link	
iolink_text	string	Textual representation of the current port mode	"Digital Input"
aux_mode	number	Indicates the configured mode for the Pin 2: 0 = No AUX 1 = AUX output (always on) 2 = Digital output (can be controlled by cyclic data) 3 = Digital input	
aux_text	string	Textual representation of the current aux mode	"AUX Output"
cq_mode	number	Port mode according to IOL specification	
iq_mode	number	Pin2 mode according to IOL specification	

Name	Data type	Description	Example
port_status	number	Port status according to IOL specification	
ds_fault	number	Data storage error number	
ds_fault_text	string	Textual data storage error.	
device	DEVICE Object	IO-Link device parameters. → Null if no IO-Link communication active	
diag	array of DIAG (n)	Array of port related events	
DIAG Object			
error	number	Error code	
source	string	Source of the current error.	"device" "master"
eventcode	number	Event code according to IO-Link specification	
eventqualifier	number	Event qualifier according to IO-Link specification	
message	string	Error message	"Supply Voltage fault"
DEVICE Object		Standard parameters of the IOL-Device	
device_id	number		
vendor_id	number		
serial	string		
baudrate	string	Baudrate (COM1,2,3)	
cycle_time	number	Cycle time in microseconds	
input_len	array of numbers (n)	IOL input length in bytes	
output_len	array of numbers (n)	IOL output length in bytes	
input_data	array of numbers (n)	IOL input data	
output_data	array of numbers (n)	IOL output data	
pd_valid	number	"1", if IOL input data is valid	
pdout_valid	number	"1", if IOL output data is valid	
FORCING Object		Forcing information of the device	
forcingActive	boolean	Force mode is currently active	

Name	Data type	Description	Example
forcingPossible	boolean	True, if forcing is possible and force mode can be activated	
ownForcing	boolean	True, if forcing is performed by REST API at the moment	
forcingClient	string	Current forcing client identifier	
digitalOutForced	array of numbers (2)	The force values of all 16 digital output channels.	
digitalOutMask	array of numbers (2)	The forcing mask of all 16 digital output channels.	
digitalInForced	array of numbers (2)	The force values of all 16 digital input channels.	
digitalInMask	array of numbers (2)	The forcing mask of all 16 digital input channels.	

12.3.3 Configuration and forcing

Method:	POST
URL:	`<ip>/w/force.json`
Parameters:	None
Post-Body:	JSON Object

Property	Data type	Example values	Description
forcemode	boolean	true / false	Forcing authority on/off
portmode	array (Port mode object)		
digital	array (Digital object)		
iol	array (IOL object)		

Table 35: Root object

Property	Data type	Example values	Remarks
port	integer	0..7	
channel	integer	"a","b"	optional default is "a"
direction	string	"dio","di","do","iol", "off", "aux"	
aux	string	"dio","di","do","iol", "off", "aux"	IOL only, but optional
inlogica	string	"no","nc"	
inlogicb	string	"no","nc"	

Table 36: Port mode object

Property	Data type	Example values	Remarks
port	integer	0..7	
channel	string	"a","b"	
force_dir	string	"phys_out","plc_in","clear"	optional default is "phys_out"
force_value	integer	0,1	

Table 37: Digital object

Property	Data type	Example values	Remarks
port	integer	0..7	
output	array[integer] or null to clear forcing	[55,88,120]	Output forcing
input	array[integer] or null to clear forcing	[20,0,88]	Input simulation to PLC

Table 38: IOL object

12.3.4 Reading and writing ISDU parameters

The *Indexed Service Data Unit* (ISDU) provides a highly flexible message format, which can contain single or multiple commands.

LioN-X IOL-Masters with IIoT support reading and writing ISDU parameters from connected IOL-Devices. It is possible to do this as a bulk transfer by reading and writing of multiple ISDU parameters via a single request.

12.3.4.1 Reading ISDU

Method:	POST
URL:	`<ip>/r/isdu.json`
Parameters:	port (0-7)
Example:	`192.168.1.20/r/isdu.json?port=5`
Post-Body:	JSON array of read ISDU object

Property	Data type	Example values	Remarks
ix	integer	0-INT16	Index to be read
subix	integer	0-INT8	Subindex to be read

Table 39: Read ISDU object

Property	Data type	Example values	Remarks
status	integer	0, -1	0 = no error, -1= an error occured
message	string		Error Message if error occured
data	array (Read ISDU data object)		data, if no error occured. otherweise null

Table 40: Read ISDU response object

Property	Data type	Example values	Remarks
ix	integer	0-INT16	Index that was read
subix	integer	0-INT8	Subindex that was read
status	integer	0, -1	0 = no error, -1= an error occured
eventcode	integer		IOL eventcode if status is -1
data	array[integer]		data, if no error occured. otherweise null

Table 41: Read ISDU data object

12.3.4.2 Writing ISDU

Method:	POST
URL:	`<ip>/w/isdu.json`
Parameters:	port (0-7)
Post-Body:	JSON array of write ISDU object

Property	Data type	Example values	Remarks
ix	integer	0-INT16	Index to be read
subix	integer	0-INT8	Subindex to be read
data	array[integer]		Data to be written

Table 42: Write ISDU object

Response: Write ISDU response object

Property	Data type	Example values	Remarks
status	integer	0, -1	0 = no error, -1= an error occured
message	string		Error Message if error occured
data	array (Write ISDU data object)		data, if no error occured. otherweise null

Table 43: Write ISDU response object

Property	Data type	Example values	Remarks
ix	integer	0-INT16	Index that was written
subix	integer	0-INT8	Subindex that was written
status	integer	0, -1	0 = no error, -1= an error occured
eventcode	integer		IOL eventcode if status is -1

Table 44: Write ISDU data object

Attention: For LioN-X device variants with HTTPS feature, https:// must be used in front of <ip> for every REST API.

12.3.5 Example: Reading ISDU

ISDU read request

```
[
 {"ix":5,"subix":0},
 {"ix":18,"subix":0},
 {"ix":19,"subix":0},
 {"ix":20,"subix":0}
]
```

Response

```
{
 "message":"OK",
 "data":
[
 {"ix":5,"subix":0,"status":-1,"eventcode":32785},
 {"ix":18,"subix":0,"data":[79,68,83,49,48,76,49,46,56,47,76,65,54,44,50,
        48,48,45,77,49,50],"status":0},
 {"ix":19,"subix":0,"data":[53,48,49,50,57,53,51,53],"status":0},
 {"ix":20,"subix":0,"data":[100,105,115,116,97,110,99,101,32,115,101,110,
        115,111,114],"status":0}
],
"status":0}
```

12.3.6 Example: Writing ISDU

ISDU write request

```
[
 {"ix":24,"subix":0,"data":[97,98,99,100,101,102]},
 {"ix":9,"subix":0,"data":[97,97,97,97,97,98]}
]
```

Response

```
{
 "message":"OK",
 "data":[
 {"ix":24,"subix":0,"status":0},
 {"ix":9,"subix":0,"eventcode":32785,"status":-1}
],
"status":0}
```

12.4 CoAP server

The CoAP server functions are **only** applicable for the following LioN-X variants:

- 0980 XSL 3912-121-007D-00F
- 0980 XSL 3912-121-007D-01F
- 0980 XSL 3912-121-027D-01F
- 0980 XSL 3913-121-007D-01F
- 0980 XSL 3913-121-027D-01F

The **Co**nstrained **A**pplication **P**rotocol (CoAP) is a specialized Internet application protocol for constrained networks such as lossy or low power networks. CoAP is useful especially in M2M (Machine to Machine) communication and can be used to translate simplified HTTP/HTTPS requests of low speed networks.

CoAP is based on the Server-Client principle and a service layer protocol that lets nodes and machines communicate with each other. The LioN-X multiprotocol variants provide CoAP server functionalities via a REST API interface over UDP.

12.4.1 CoAP configuration

In delivery state, CoAP functions are *disabled*. The CoAP server can be configured either using the Web interface or directly via a JSON object sent in an HTTP/HTTPS request. For more information see chapter CoAP configuration - Quick start guide on page 124.

The configuration URL is:

`http://[ip-address]/w/config/coapd.json`

The configuration can also read back as a JSON file:

`http://[ip-address]/r/config/coapd.json`

The configuration is a JSON object. Each JSON member is a configuration element. The object must not contain all elements. Only the provided elements will be changed. The configuration changes apply only after a device restart.

The following configuration elements are available (default values in bold):

Element	Data type	Description	Example data
enable	boolean	Master switch for the CoAP server	true / **false**
port	integer (0 to 65535)	Port of the CoAP server	**5683**

Table 45: CoAP configuration

CoAP response:

The resulting response is a JSON object with a "status" field. Status should be "0" if no error occurred, and "-1" if there is an error.

In case of an error, the response contains an error array.

The error array contains an error object for each error occurred. The object consists of a field "Element" which names the config element that caused the error, and of a field "Message" for the error message.

Examples:

```
{"status": -1, "error": [{"Element": "upcua-enable", "Message": "Boolean
 expected"}]}

{"status": 0}

{"status": -1, "error": [{"Element": "root", "Message": "Not a JSON
 object"}]}
```

12.4.2 REST API access via CoAP

A connection to the CoAP server running on the LioN-X multiprotocol variants can be established via the following URL:

```
coap://[ip-address]:[port]/[api]
```

For LioN-X, the following REST API Requests (JSON format) can be accessed via a CoAP endpoint:

Type	API	Note
GET	/r/status.lr	
GET	/r/system.lr	
GET	/info.json"	
GET	/r/config/net.json	
GET	/r/config/mqtt.json	
GET	/r/config/opcua.json	
GET	/r/config/coapd.json	
GET	/r/config/syslog.json	
GET	/contact.json	
GET	/fwup_status	
GET	/iolink/v1/gateway/identification	
GET	/iolink/v1/gateway/capabilities	
GET	/iolink/v1/gateway/configuration	
GET	/iolink/v1/gateway/events	
GET	/iolink/v1/masters	
GET	/iolink/v1/masters/1/capabilities	
GET	/iolink/v1/masters/1/identification	
GET	/iolink/v1/masters/1/ports	
GET	/iolink/v1/masters/1/ports/{port_number}/capabilities	This API is available for all 8 ports. {port_number} should be between "1" and "8".
GET	/iolink/v1/masters/1/ports/{port_number}/status	This API is available for all 8 ports. {port_number} should be between "1" and "8".
GET	/iolink/v1/masters/1/ports/{port_number}/configuration	This API is available for all 8 ports. {port_number} should be between "1" and "8".
GET	/iolink/v1/devices/master1port{port_number}/identification	This API is available for all 8 ports. {port_number} should be between "1" and "8".

Type	API	Note
GET	/iolink/v1/devices/master1port{port_number}/capabilities	This API is available for all 8 ports. {port_number} should be between "1" and "8".
GET	/iolink/v1/devices/master1port{port_number}/processdata/getdata/value	This API is available for all 8 ports. {port_number} should be between "1" and "8".
GET	/iolink/v1/devices/master1port{port_number}/events	This API is available for all 8 ports. {port_number} should be between "1" and "8".

Table 46: REST API access via CoAP

12.4.3 CoAP configuration - Quick start guide

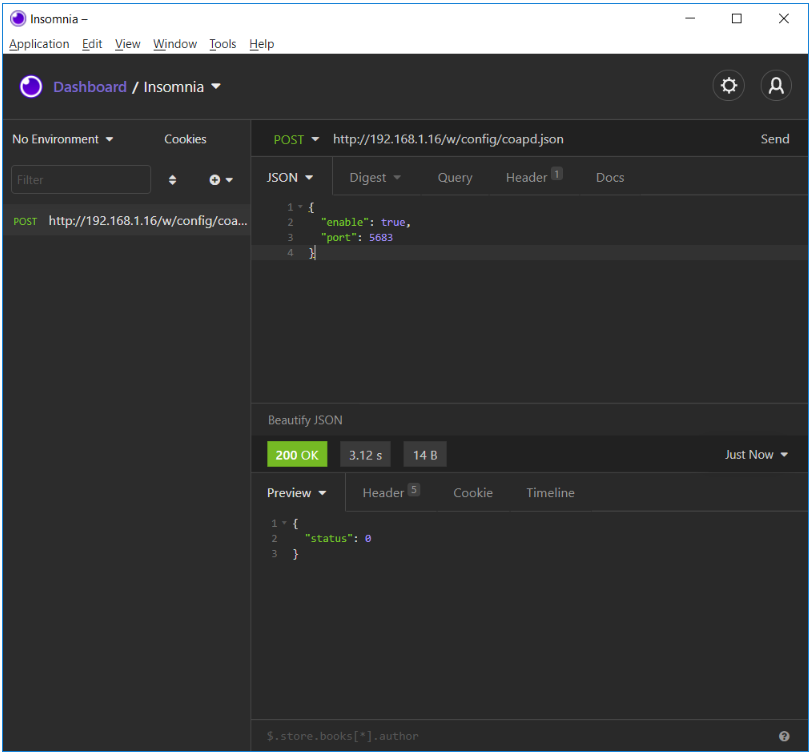
Attention: Lumberg Automation™ is not responsible for any content of the referenced Web pages and provides no warranty for any functionality of the named third party software.

12.4.3.1 CoAP configuration via JSON

1. Depending on your application case, download and install *Insomnia* or a comparable application: https://insomnia.rest/download/

2. Configure CoAP:

POST: `[IP-address]/w/config/coapd.json`


Insomnia –
Application Edit View Window Tools Help
Dashboard / Insomnia
No Environment
Cookies
Filter
POST http://192.168.1.16/w/config/coa...
JSON
Digest
Query
Header 1
Docs
Send
Beautify JSON
Just Now
Preview
Header 5
Cookie
Timeline
$.store.books[*].author

POST http://192.168.1.16/w/config/coapd.json

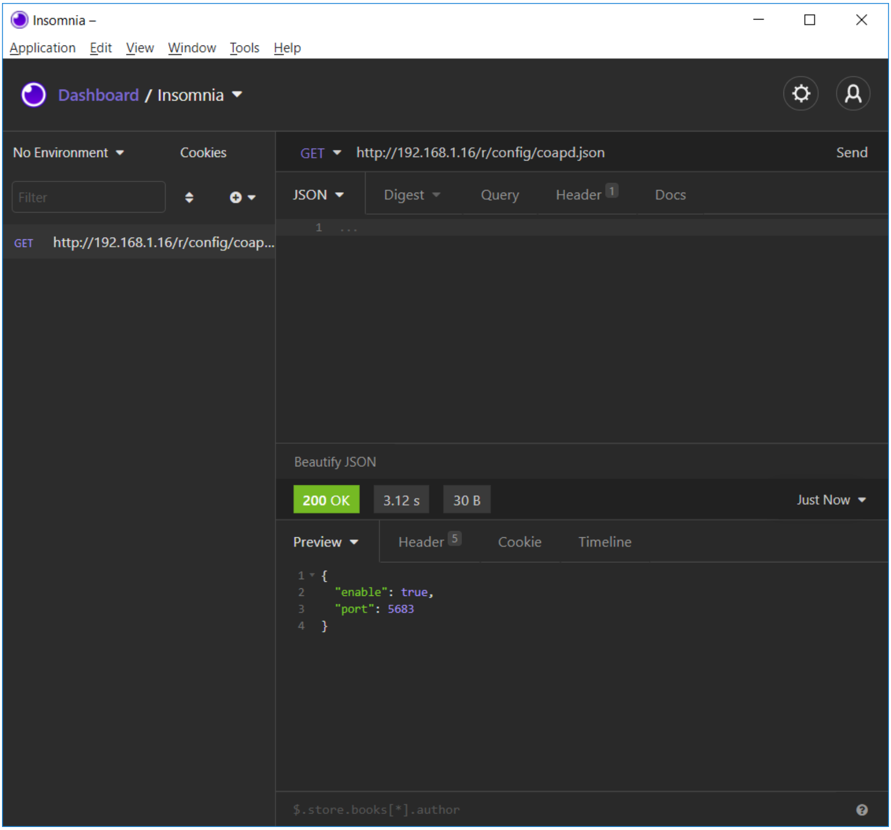
```
{
    "enable": true,
    "port": 5683
}
```

200 OK 3.12 s 14 B

```
{
    "status": 0
}
```

3. Read CoAP configuration:

GET: `[IP-address]/r/config/coapd.json`



GET http://192.168.1.16/r/config/coapd.json

200 OK 3.12 s 30 B

```
{
  "enable": true,
  "port": 5683
}
```

Insomnia –
Application Edit View Window Tools Help
Dashboard / Insomnia
No Environment
Cookies
Filter
GET http://192.168.1.16/r/config/coap...
Send
JSON
Digest
Query
Header 1
Docs
Beautify JSON
Just Now
Preview
Header 5
Cookie
Timeline
$.store.books[*].author

12.5 Syslog

Syslog functions are **only** applicable for the following LioN-X variants:

- 0980 XSL 3912-121-007D-00F
- 0980 XSL 3912-121-007D-01F
- 0980 XSL 3912-121-027D-01F
- 0980 XSL 3913-121-007D-01F
- 0980 XSL 3913-121-027D-01F

The LioN-X multiprotocol variants provide a Syslog client which can connect with a configured Syslog server and is able to log messages.

Syslog is a platform-independent standard for logging messages. Each message contains a timestamp as well as information about the severity level and the subsystem. The Syslog protocol RFC5424 is based on the Server-Client principle and lets machines and devices send messages in the network and collect them centrally. (For more details on the used syslog standard, please refer to https://datatracker.ietf.org/doc/html/rfc5424.)

LioN-X supports the storage of 256 messages in a ring buffer which are sent to the configured Syslog server. When the ring is full with 256 messages, the oldest message is always replaced by the newly arriving messages. All messages can be saved on the Syslog server. The Syslog client of the IO-Link Master will not store any message permanently.

12.5.1 Syslog configuration

In **delivery state**, Syslog functions are **disabled**. The Syslog client can be configured either using the Web interface or directly via a JSON object sent in an HTTP/HTTPS request. For more information see chapter Syslog configuration - Quick start guide on page 129.

The configuration URL is:

```
http://[ip-address]/w/config/syslog.json
```

The configuration can also read back as a JSON file:

```
http://[ip-address]/r/config/syslog.json
```

The configuration is a JSON object. Each JSON member is a configuration element. The object must not contain all elements. Only the provided elements will be changed. The configuration changes apply only after a device restart.

The following configuration elements are available (default values in bold):

Element	Data type	Description	Example data
syslog-enable	boolean	Master switch for the Syslog client	true / **false**
global-severity	integer	Severity level of Syslog client 0 – Emergency 1 – Alert 2 – Critical **3 – Error** 4 – Warning 5 – Notice 6 – Info 7 – Debug The client will log all messages of severity according to the setting, including all below levels.	0/1/2/**3**/4/5/6/7
server-address	string (IP address)	IP address of the Syslog server	192.168.0.51 (Default: **null**)
server-port	integer (0 to 65535)	Server port of the Syslog server	**514**
server-severity	integer (0 to 7)	Severity level of Syslog server 0 – Emergency 1 – Alert 2 – Critical **3 – Error** 4 – Warning 5 – Notice 6 – Info 7 – Debug	0/1/2/**3**/4/5/6/7

Table 47: Syslog configuration

Syslog response:

The resulting response is a JSON object with a "status" field. Status should be "0" if no error occurred, and "-1" if there is an error.

In case of an error, the response contains an error array.

The error array contains an error object for each error occurred. The object consists of a field "Element" which names the config element that caused the error, and of a field "Message" for the error message.

Examples:

```
{"status": -1, "error": [{"Element": "upcua-enable", "Message": "Boolean expected"}]}

{"status": 0}

{"status": -1, "error": [{"Element": "root", "Message": "Not a JSON object"}]}
```

12.5.2 Syslog configuration - Quick start guide

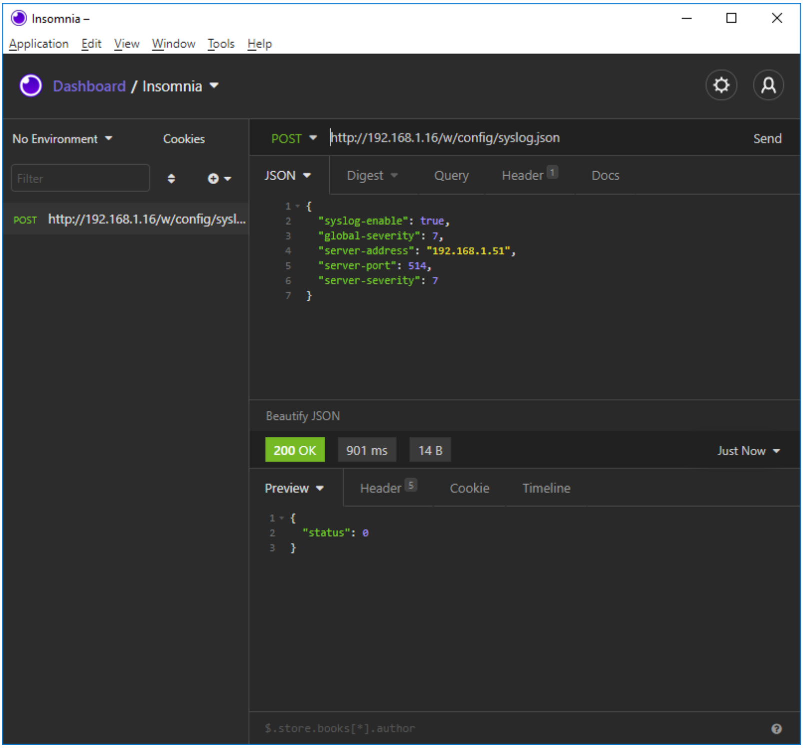
Attention: Lumberg Automation^{TM} is not responsible for any content of the referenced Web pages and provides no warranty for any functionality of the named third party software.

12.5.2.1 Syslog configuration via JSON

1. Depending on your application case, download and install *Insomnia* or a comparable application: https://insomnia.rest/download/

2. Configure Syslog:

POST: `[IP-address]/w/config/syslog.json`


Insomnia –
Application Edit View Window Tools Help
Dashboard / Insomnia
No Environment
Cookies
Filter
POST http://192.168.1.16/w/config/sysl...
Send
JSON
Digest
Query
Header 1
Docs
Beautify JSON
200 OK
901 ms
14 B
Just Now
Preview
Header 5
Cookie
Timeline
$.store.books[*].author

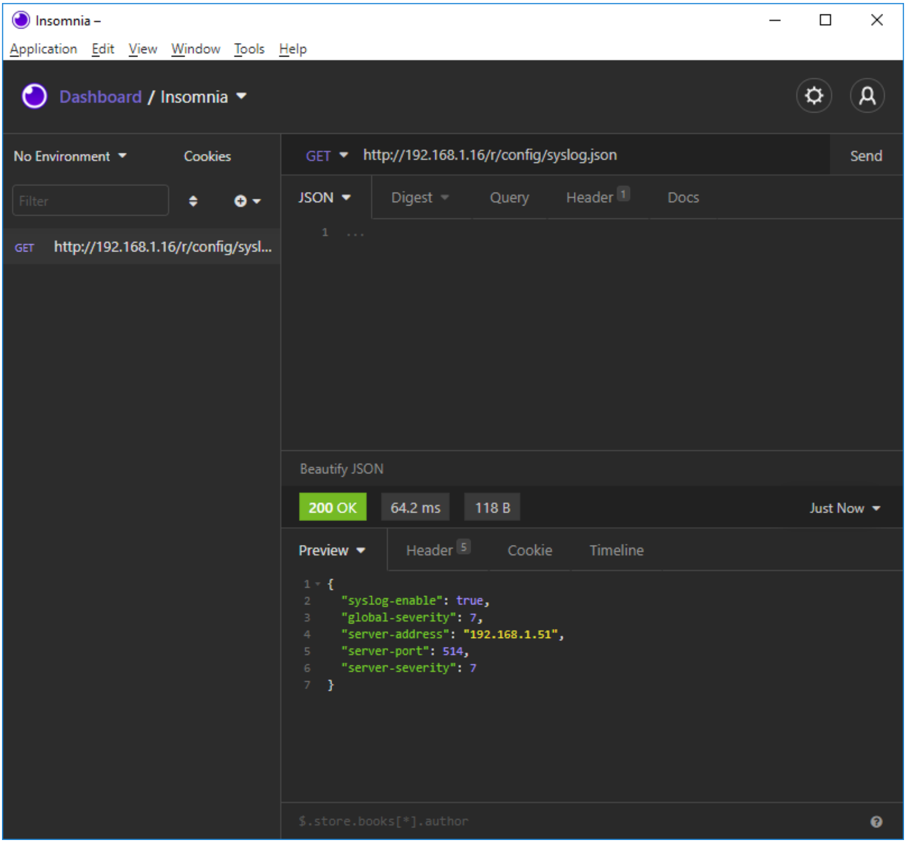
POST http://192.168.1.16/w/config/syslog.json

```
{
  "syslog-enable": true,
  "global-severity": 7,
  "server-address": "192.168.1.51",
  "server-port": 514,
  "server-severity": 7
}
```

```
{
  "status": 0
}
```

3. Read Syslog configuration:

GET: `[IP-address]/r/config/syslog.json`


Insomnia –
Application Edit View Window Tools Help
Dashboard / Insomnia
No Environment
Cookies
Filter
GET http://192.168.1.16/r/config/sysl...
GET
http://192.168.1.16/r/config/syslog.json
Send
JSON
Digest
Query
Header 1
Docs
Beautify JSON
200 OK
64.2 ms
118 B
Just Now
Preview
Header 5
Cookie
Timeline
$.store.books[*].author

```
{
  "syslog-enable": true,
  "global-severity": 7,
  "server-address": "192.168.1.51",
  "server-port": 514,
  "server-severity": 7
}
```

12.6 Network Time Protocol (NTP)

The NTP function is **only** applicable for the following LioN-X variant:

- 0980 XSL 3912-121-007D-00F
- 0980 XSL 3912-121-007D-01F
- 0980 XSL 3912-121-027D-01F
- 0980 XSL 3913-121-007D-01F
- 0980 XSL 3913-121-027D-01F

The LioN-X multiprotocol variants provide an NTP client (version 3) which can connect with a configured NTP server and is able to synchronize the network time at a configurable interval.

NTP is a network protocol which uses UDP datagrams to send and receive timestamps in order to synchronize with a local clock. The NTP protocol RFC1305 is based on the Server-Client principle and exclusively supplies the synchronization with Coordinated Universal Time (UTC). (For more details on the used NTP standard, please refer to https://datatracker.ietf.org/doc/html/rfc1305.)

12.6.1 NTP configuration

In **delivery state**, the NTP client is **disabled**. The NTP client can be configured either using the Web interface or directly via a JSON object sent in an HTTP/HTTPS request. For more information see chapter NTP configuration - Quick start guide on page 133.

The configuration URL is:

`http://[ip-address]/w/config/ntpc.json`

The configuration can also read back as a JSON file:

`http://[ip-address]/r/config/ntpc.json`

The configuration is a JSON object. Each JSON member is a configuration element. The object must not contain all elements. Only the provided elements will be changed. The configuration changes apply only after a device restart.

The following configuration elements are available (default values in bold):

Element	Data type	Description	Example data
NTP client state	boolean	Master switch for the NTP client	true / **false**
Server address	string	IP address of the NTP server	192.168.1.50
Server port	integer	Port of the NTP server	**123**
Update interval	integer	Interval at which the client will connect with the configured NTP server (see table row "Server address"). **Note: This value is in seconds.**	1/2/10/**60**

Table 48: NTP configuration

NTP response:

The resulting response is a JSON object with a "status" field. Status should be "0" if no error occurred, and "-1" if there is an error.

In case of an error, the response contains an error array.

The error array contains an error object for each error occurred. The object consists of a field "Element" which names the configuration element that caused the error, and of a field "Message" for the error message.

Examples:

```
{"status": -1, "error": [{"Element": "ntpc-enable", "Message": "Boolean
 expected"}]}

{"status": 0}

{"status": -1, "error": [{"Element": "root", "Message": "Not a JSON
 object"}]}
```

12.6.2 NTP configuration - Quick start guide

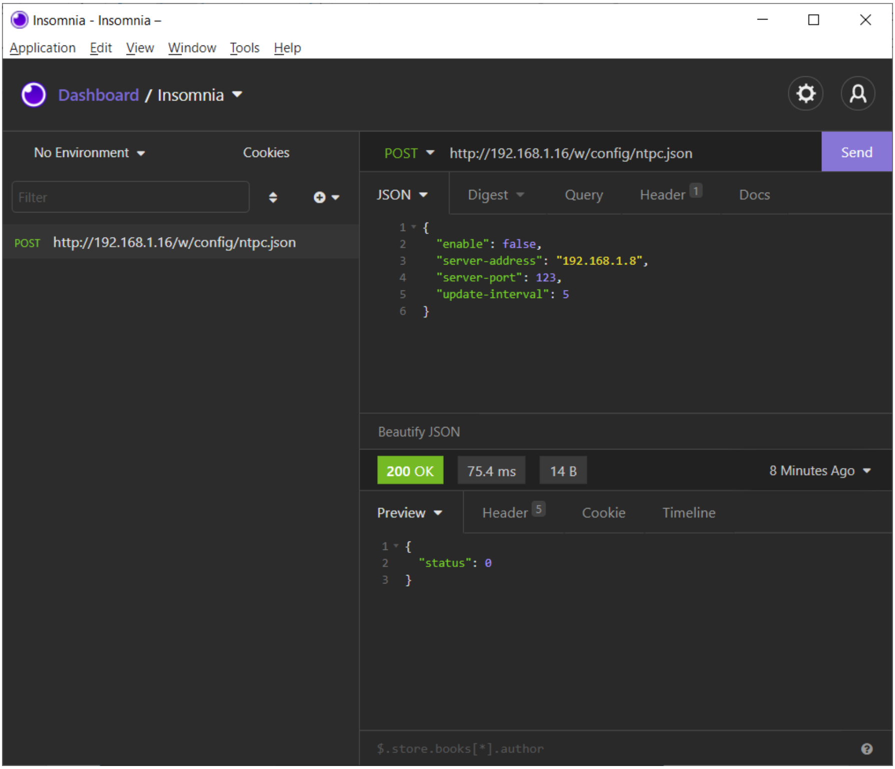
Attention: Lumberg Automation^{TM} is not responsible for any content of the referenced Web pages and provides no warranty for any functionality of the named third party software.

12.6.2.1 NTP configuration via JSON

1. Depending on your application case, download and install *Insomnia* or a comparable application: https://insomnia.rest/download/

2. Configure NTP:

POST: `[IP-address]/w/config/ntpc.json`


Insomnia - Insomnia –
Application Edit View Window Tools Help
Dashboard / Insomnia
No Environment
Cookies
Filter
Send
JSON
Digest
Query
Header 1
Docs
Beautify JSON
Preview
Header 5
Cookie
Timeline
$.store.books[*].author

POST http://192.168.1.16/w/config/ntpc.json

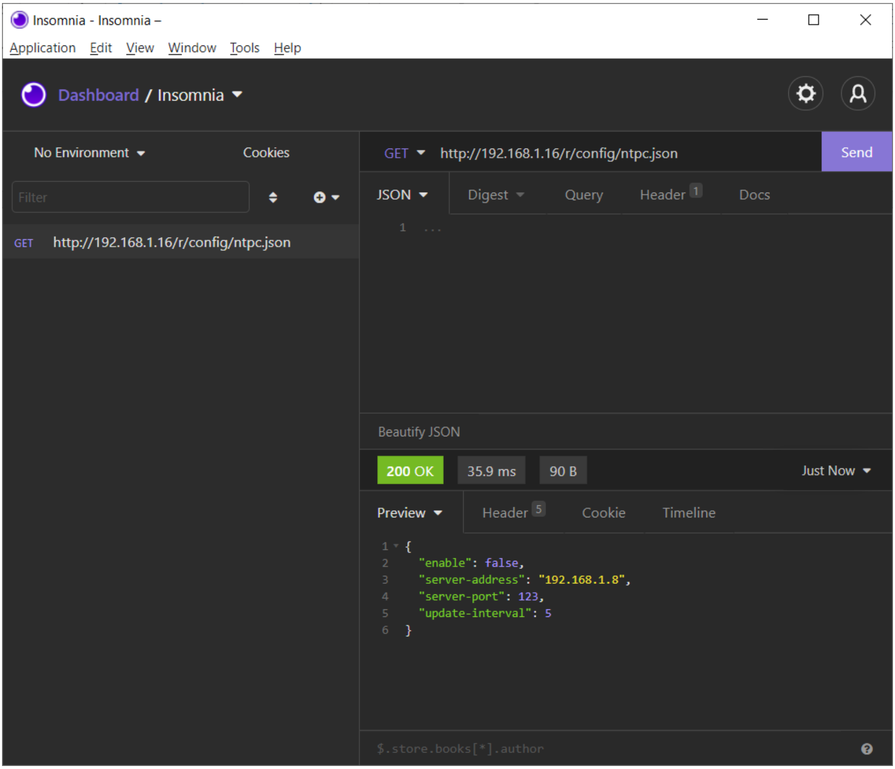
```
{
  "enable": false,
  "server-address": "192.168.1.8",
  "server-port": 123,
  "update-interval": 5
}
```

200 OK 75.4 ms 14 B 8 Minutes Ago

```
{
  "status": 0
}
```

3. Read NTP configuration:

GET: `[IP-address]/r/config/ntpc.json`


Insomnia - Insomnia –
Application Edit View Window Tools Help
Dashboard / Insomnia
No Environment
Cookies
Filter
GET http://192.168.1.16/r/config/ntpc.json
Send
JSON
Digest
Query
Header 1
Docs
Beautify JSON
200 OK
35.9 ms
90 B
Just Now
Preview
Header 5
Cookie
Timeline
$.store.books[*].author

GET http://192.168.1.16/r/config/ntpc.json

```
{
  "enable": false,
  "server-address": "192.168.1.8",
  "server-port": 123,
  "update-interval": 5
}
```

13 The integrated Web server

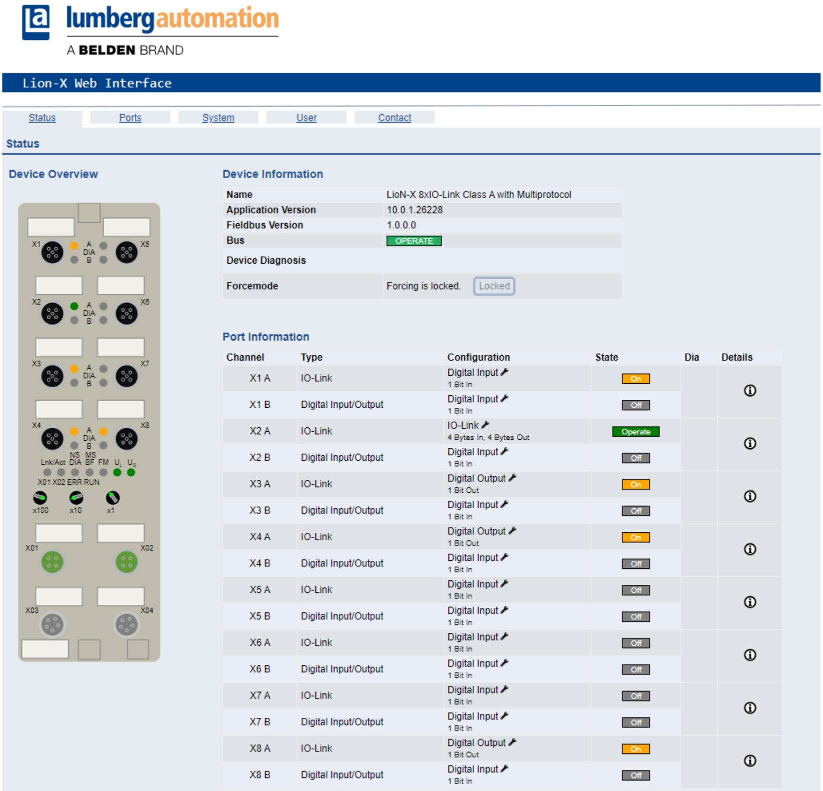
All device variants are equipped with an integrated Web server which makes functions for the device configuration and the display of status and diagnostic information available via a Web interface.

The Web interface provides an overview of the configuration and status of the device. It is also possible to use the Web interface to trigger a reboot, reset to the factory defaults, or perform a firmware update.

Enter "http://" or "https://" followed by the IP address, such as "http://192.168.1.5", in your Web browser’s address bar. If the status page of the device is not displayed, check your browser and firewall settings.

13.1 LioN-X 0980 XSL... variants

13.1.1 The Status page


lumbergautomation
A BELDEN BRAND
Lion-X Web Interface
Status
Ports
System
User
Contact
Device Overview
X1
X2
X3
X4
X5
X6
X7
X8
A
DIA
B
NS
MS
Lnk/Act
DIA
BF
FM
U_L
U_S
X01 X02 ERR RUN
x100
x10
x1
X01
X02
X03
X04

Status

Device Information

Name	LioN-X 8xIO-Link Class A with Multiprotocol
Application Version	10.0.1.26228
Fieldbus Version	1.0.0.0
Bus	OPERATE
Device Diagnosis	
Forcemode	Forcing is locked. Locked

Port Information

Channel	Type	Configuration	State	Dia	Details
X1 A	IO-Link	Digital Input 1 Bit In	On		ⓘ
X1 B	Digital Input/Output	Digital Input 1 Bit In	Off		
X2 A	IO-Link	IO-Link 4 Bytes In, 4 Bytes Out	Operate		ⓘ
X2 B	Digital Input/Output	Digital Input 1 Bit In	Off		
X3 A	IO-Link	Digital Output 1 Bit Out	On		ⓘ
X3 B	Digital Input/Output	Digital Input 1 Bit In	Off		
X4 A	IO-Link	Digital Output 1 Bit Out	On		ⓘ
X4 B	Digital Input/Output	Digital Input 1 Bit In	Off		
X5 A	IO-Link	Digital Input 1 Bit In	Off		ⓘ
X5 B	Digital Input/Output	Digital Input 1 Bit In	Off		
X6 A	IO-Link	Digital Input 1 Bit In	Off		ⓘ
X6 B	Digital Input/Output	Digital Input 1 Bit In	Off		
X7 A	IO-Link	Digital Input 1 Bit In	Off		ⓘ
X7 B	Digital Input/Output	Digital Input 1 Bit In	Off		
X8 A	IO-Link	Digital Output 1 Bit Out	On		ⓘ
X8 B	Digital Input/Output	Digital Input 1 Bit In	Off		

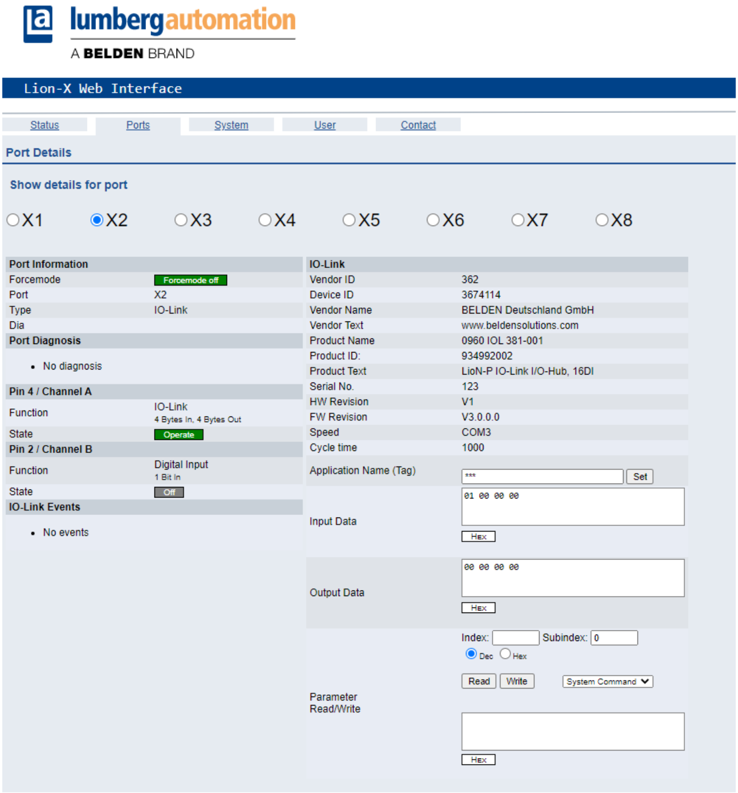
The status page provides a quick overview of the current state of the device.

The left side shows a graphical representation of the module with all its LEDs and the positions of the rotary encoding switches.

The right side shows the "Device Information" table with some basic data for the module; for example, the variant, the cyclic communication status and a diagnostic indicator. The indicator shows whether diagnostics for the module exist.

The "Port Information" table shows the configuration and state of the I/O ports.

13.1.2 The Ports page


lumbergautomation
A BELDEN BRAND
Lion-X Web Interface
Status
Ports
System
User
Contact
Port Details
Show details for port
Set
Hex
Read
Write
System Command
Hex
Hex

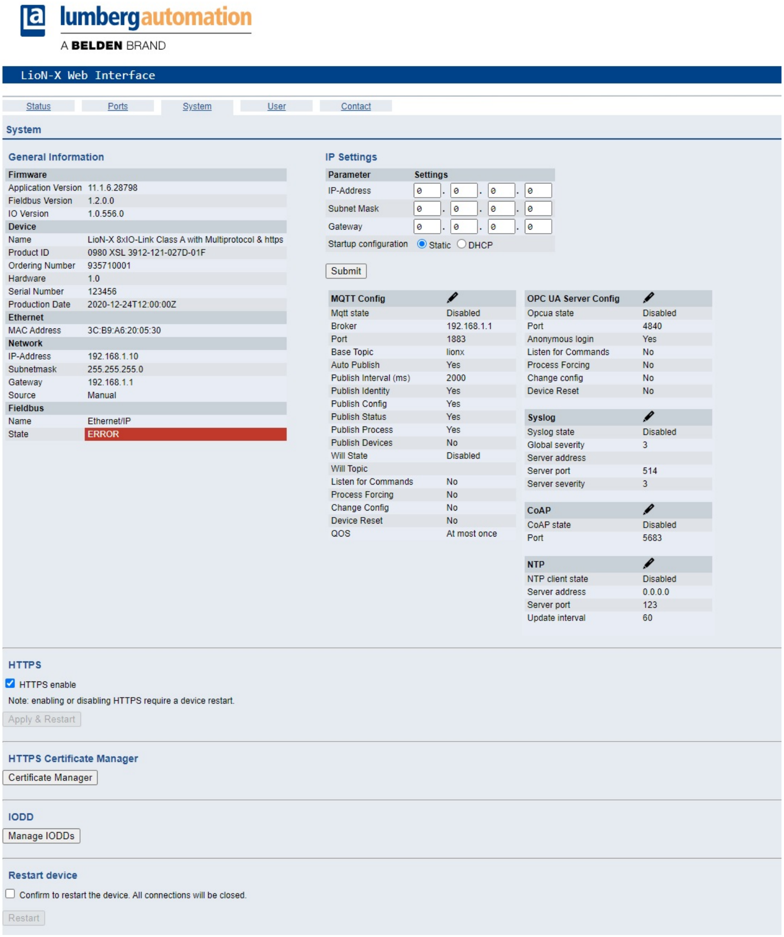
○X1 ●X2 ○X3 ○X4 ○X5 ○X6 ○X7 ○X8

Port Information	
Forcemode	Forcemode off
Port	X2
Type	IO-Link
Dia	
Port Diagnosis	
- No diagnosis	
Pin 4 / Channel A	
Function	IO-Link 4 Bytes In, 4 Bytes Out
State	Operate
Pin 2 / Channel B	
Function	Digital Input 1 Bit In
State	Off
IO-Link Events	
- No events	

IO-Link	
Vendor ID	362
Device ID	3674114
Vendor Name	BELDEN Deutschland GmbH
Vendor Text	www.beldensolutions.com
Product Name	0960 IOL 381-001
Product ID:	934992002
Product Text	LioN-P IO-Link I/O-Hub, 16DI
Serial No.	123
HW Revision	V1
FW Revision	V3.0.0.0
Speed	COM3
Cycle time	1000
Application Name (Tag)	***
Input Data	01 00 00 00
Output Data	00 00 00 00
Parameter Read/Write	Index: Subindex: 0 ● Dec ○ Hex

The page shows detailed port information. In the field **Port Diagnosis**, incoming and outgoing diagnostics are displayed as clear text. **Pin 2** and **Pin 4** contain information about the configuration and state of the port. For IO-Link ports, additional information relating to the connected sensor and the process data is displayed.

13.1.3 The System page



System

General Information

Firmware	
Application Version	11.1.6.28798
Fieldbus Version	1.2.0.0
IO Version	1.0.556.0
Device	
Name	LioN-X 8xIO-Link Class A with Multiprotocol & https
Product ID	0980 XSL 3912-121-027D-01F
Ordering Number	935710001
Hardware	1.0
Serial Number	123456
Production Date	2020-12-24T12:00:00Z
Ethernet	
MAC Address	3C:B9:A6:20:05:30
Network	
IP-Address	192.168.1.10
Subnetmask	255.255.255.0
Gateway	192.168.1.1
Source	Manual
Fieldbus	
Name	Ethernet/IP
State	ERROR

IP Settings

Parameter	Settings
IP-Address	0 . 0 . 0 . 0
Subnet Mask	0 . 0 . 0 . 0
Gateway	0 . 0 . 0 . 0
Startup configuration	● Static ○ DHCP

MQTT Config	
Mqtt state	Disabled
Broker	192.168.1.1
Port	1883
Base Topic	lionx
Auto Publish	Yes
Publish Interval (ms)	2000
Publish Identity	Yes
Publish Config	Yes
Publish Status	Yes
Publish Process	Yes
Publish Devices	No
Will State	Disabled
Will Topic	
Listen for Commands	No
Process Forcing	No
Change Config	No
Device Reset	No
QOS	At most once

OPC UA Server Config	
Opcua state	Disabled
Port	4840
Anonymous login	Yes
Listen for Commands	No
Process Forcing	No
Change config	No
Device Reset	No

Syslog	
Syslog state	Disabled
Global severity	3
Server address	
Server port	514
Server severity	3

CoAP	
CoAP state	Disabled
Port	5683

NTP	
NTP client state	Disabled
Server address	0.0.0.0
Server port	123
Update interval	60

HTTPS

☑ HTTPS enable

Note: enabling or disabling HTTPS require a device restart.

HTTPS Certificate Manager

IODD

Restart device

☐ Confirm to restart the device. All connections will be closed.

The System page shows the basic information for the module like Firmware version, Device information, Ethernet, Network and Fieldbus information.

Restart Device

The module initializes a software reset.

Reset to Factory Settings

The module restores to the default factory settings.

IP Settings

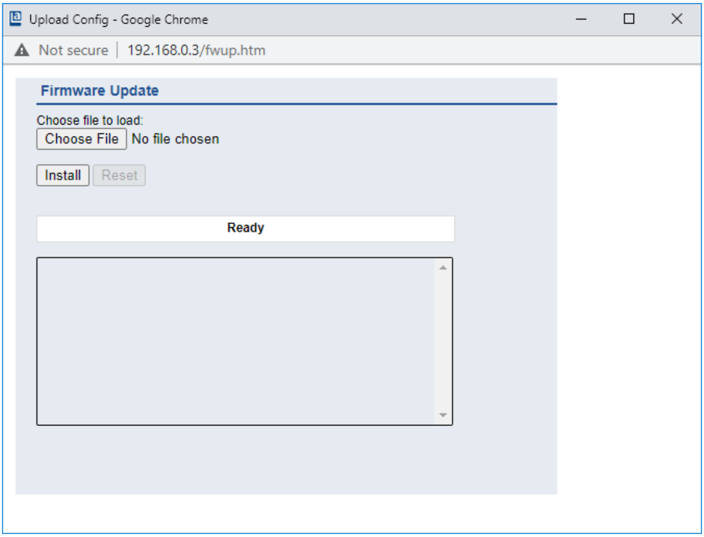
Use this parameter to change the current IP address of the module.

For PROFINET, this is only useful during commissioning. Normally, the PLC sets the IP address at start-up by detecting the PROFINET module via its device name.

Firmware Update

The module initializes a Firmware update.

For a firmware update choose the **.ZIP* container available on our website or ask our support team. Afterwards follow the instructions shown on your screen.


Upload Config - Google Chrome
Not secure | 192.168.0.3/fwup.htm
Firmware Update
Choose file to load:
Choose File
No file chosen
Install
Reset
Ready

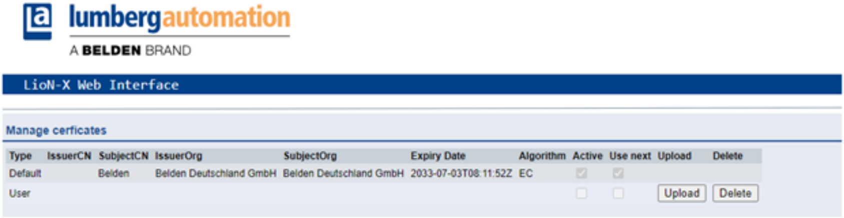
13.1.3.1 HTTPS

Https-based or http-based communication with the LioN-X Web server. If this option is selected, the communication with the LioN-X Web server will be secure and encryption-based.

13.1.3.2 HTTPS certificate manager

The HTTPS certificate manager shows a default certificate and the currently active certificate for the Web server. Your are allowed to delete, upload and select new certificates. For an example of how to create and sign your own certificate with *Mako Server* by Real Time Logic LLC, refer to chapter Certificate creation – example on page 141.

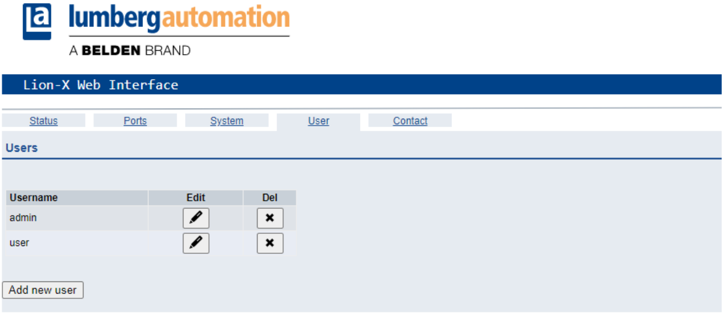
Attention: It is not possible to delete the default certificate.


lumbergautomation
A BELDEN BRAND
LioN-X Web Interface

Manage cerficates

Type	IssuerCN	SubjectCN	IssuerOrg	SubjectOrg	Expiry Date	Algorithm	Active	Use next	Upload	Delete
Default		Belden	Belden Deutschland GmbH	Belden Deutschland GmbH	2033-07-03T08:11:52Z	EC	☑	☑		
User							☐	☐	Upload	Delete

13.1.4 The User page


lumbergautomation
A BELDEN BRAND
Lion-X Web Interface
Status
Ports
System
User
Contact
Add new user

Users

Username	Edit	Del
admin	✎	✖
user	✎	✖

The User page provides the user management of the Web interface. New users with access rights "Admin" or "Write" can be added here. For security reasons please change the default admin password immediately after configuring the device.

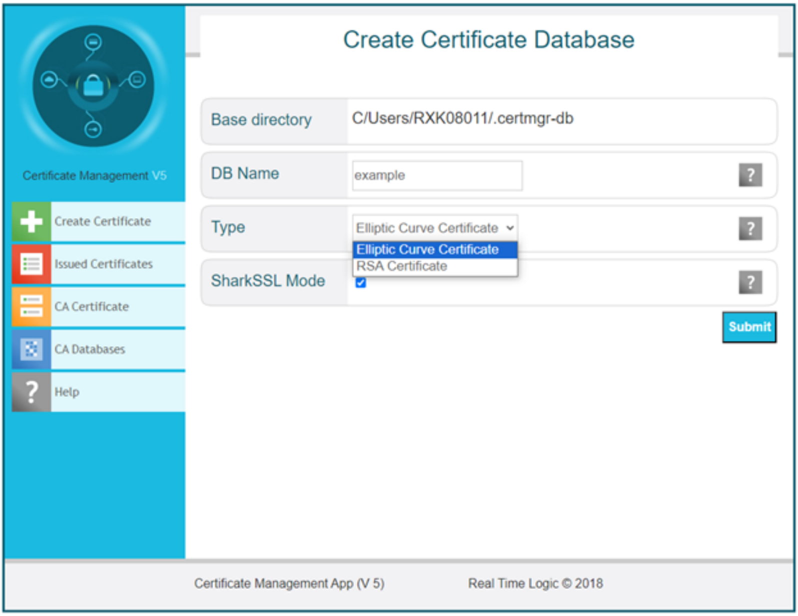
Default user login data:

- User: admin
- Password: private

13.1.5 Certificate creation – example

1. Create certificate database:

   In *Makro server* by Real Time Logic LLC, navigate to *Create Certificate Database*. Enter *DB Name*, select *Type* as “Eliptic Curve Certificate”, and select *SharkSSL Mode* as shown below.



Create Certificate Database

Base directory: C/Users/RXK08011/.certmgr-db

DB Name: example

Type: Elliptic Curve Certificate

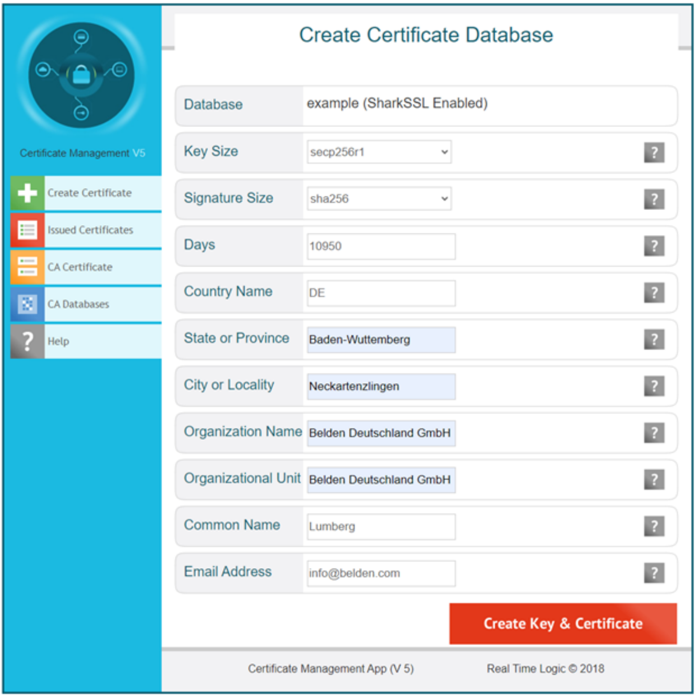
SharkSSL Mode: ☑

Certificate Management V5
Create Certificate
Issued Certificates
CA Certificate
CA Databases
Help
Elliptic Curve Certificate
RSA Certificate
?
Submit
Certificate Management App (V 5)
Real Time Logic © 2018

2. Create certificate:

   - Key Size: Any value from drop down list can be selected. “secp256r1” is recommended.
   - Signature size: "sha256" → The higher the number in the encryption, the higher the security level of communication.

- Days: Enter the number of days you wish this certificate to be valid (e.g. "10950" for 10 years).
- Country name: "DE" ("DE" stands for Germany. For other countries, please refer to https://www.ssl.com/country-codes/).
- State or Province: Enter your local province or state (e.g. "Baden-Württemberg").
- City or Locality: Enter name of city (e.g. "Neckartenzlingen").
- Organization Name: Enter name of organization (e.g. "Belden Deutschland GmbH").
- Organization Unit: Enter name of organization unit (e.g. "Belden Deutschland GmbH").
- Common Name: The common name here belongs to domain name. It must reflect fully or in parts the domain name of where LioN-X device is accessible.
- Email address: The e-mail address of the certificate's creator.


Certificate Management V5
Create Certificate
Issued Certificates
CA Certificate
CA Databases
Help
?
Create Key & Certificate
Certificate Management App (V 5)
Real Time Logic © 2018

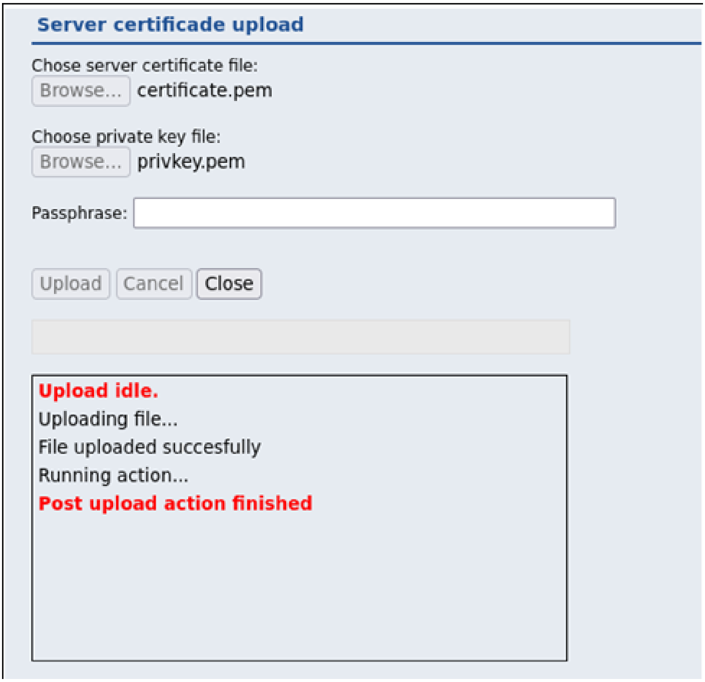
Create Certificate Database

Database	example (SharkSSL Enabled)
Key Size	secp256r1
Signature Size	sha256
Days	10950
Country Name	DE
State or Province	Baden-Wuttemberg
City or Locality	Neckartenzlingen
Organization Name	Belden Deutschland GmbH
Organizational Unit	Belden Deutschland GmbH
Common Name	Lumberg
Email Address	info@belden.com

3. Upload the certificate onto the LioN-X device:

   In the HTTPS certificate manager (Belden Web interface), click on the button *Upload* and choose the ".pem" and ".key" files generated in the previous step for the upload.

   Click on *Upload*.


Server certificade upload
Browse...
Browse...
Upload
Cancel
Close

Chose server certificate file: certificate.pem

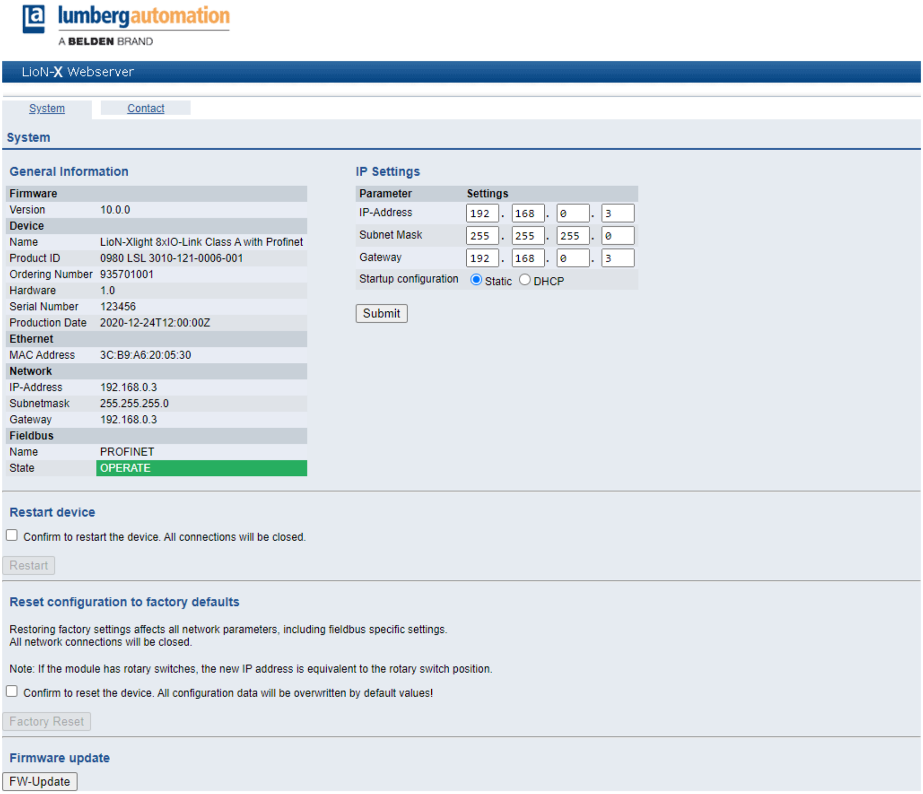
Choose private key file: privkey.pem

Passphrase:

Upload idle.
Uploading file...
File uploaded succesfully
Running action...
Post upload action finished

13.2 LioN-Xlight 0980 LSL... variants

13.2.1 The System page



System

General Information

Firmware	
Version	10.0.0
Device	
Name	LioN-Xlight 8xIO-Link Class A with Profinet
Product ID	0980 LSL 3010-121-0006-001
Ordering Number	935701001
Hardware	1.0
Serial Number	123456
Production Date	2020-12-24T12:00:00Z
Ethernet	
MAC Address	3C:B9:A6:20:05:30
Network	
IP-Address	192.168.0.3
Subnetmask	255.255.255.0
Gateway	192.168.0.3
Fieldbus	
Name	PROFINET
State	OPERATE

IP Settings

Parameter	Settings
IP-Address	192 . 168 . 0 . 3
Subnet Mask	255 . 255 . 255 . 0
Gateway	192 . 168 . 0 . 3
Startup configuration	● Static ○ DHCP

Restart device

☐ Confirm to restart the device. All connections will be closed.

Reset configuration to factory defaults

Restoring factory settings affects all network parameters, including fieldbus specific settings.
All network connections will be closed.

Note: If the module has rotary switches, the new IP address is equivalent to the rotary switch position.

☐ Confirm to reset the device. All configuration data will be overwritten by default values!

Firmware update

The System page shows the basic information for the module like Firmware version, Device information, Ethernet, Network and Fieldbus information.

Restart Device

The module initializes a software reset.

Reset to Factory Settings

The module restores to the default factory settings.

IP Settings

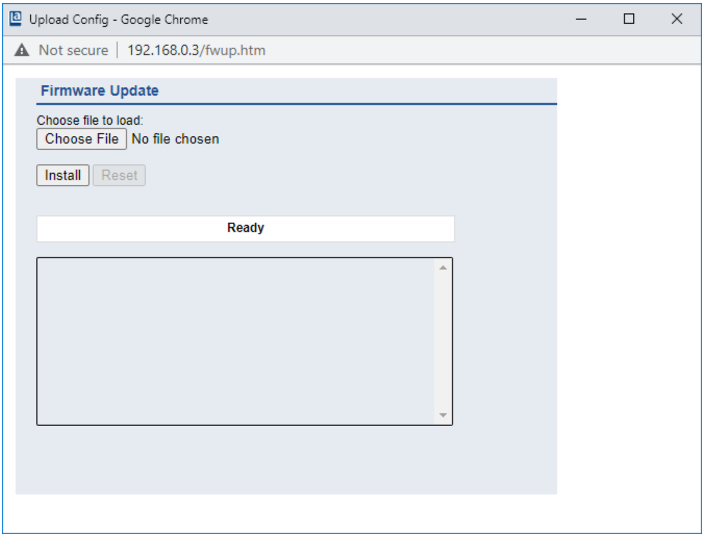
Use this parameter to change the current IP address of the module.

For PROFINET, this is only useful during commissioning. Normally, the PLC sets the IP address at start-up by detecting the PROFINET module via its device name.

Firmware Update

The module initializes a Firmware update.

For a firmware update choose the **.ZIP* container available on our website or ask our support team. Afterwards follow the instructions shown on your screen.


Upload Config - Google Chrome
Not secure
192.168.0.3/fwup.htm
Firmware Update
Choose file to load:
Choose File
No file chosen
Install
Reset
Ready

14 IODD

IODD functions are **only** applicable for the following device variants:

- 0980 XSL 3912-121-007D-00F
- 0980 XSL 3912-121-007D-01F
- 0980 XSL 3912-121-027D-01F
- 0980 XSL 3913-121-007D-01F
- 0980 XSL 3913-121-027D-01F

The **IO D**evice **D**escription (IODD) is a set of files formally describing an IO-Link Device. The IODD is created by the vendor and is mandatory for each IO-Link Device.

Belden LioN-X IO-Link Masters with the "IODD on Module" functionality are ready to use IODDs in order to make the IO-Link Device configuration much more easier and the process data human readable in a better way. IODDs can be uploaded via the Web Interface and remanently stored on the IO-Link Master afterwards.

If a corresponding IO-Link Device is connected, the stored IODD is used to provide a user friendly configuration page, where all parameters of the device can be viewed and edited. Additionally, according to the IODD, the process data will also be formatted and displayed to the user.

14.1 IO-Link Device parameters and ISDU requests

Every IO-Link Device provides parameters that can be read and written via the special IO-Link service ISDU (**I**ndexed **S**ervice **D**ata **U**nit).

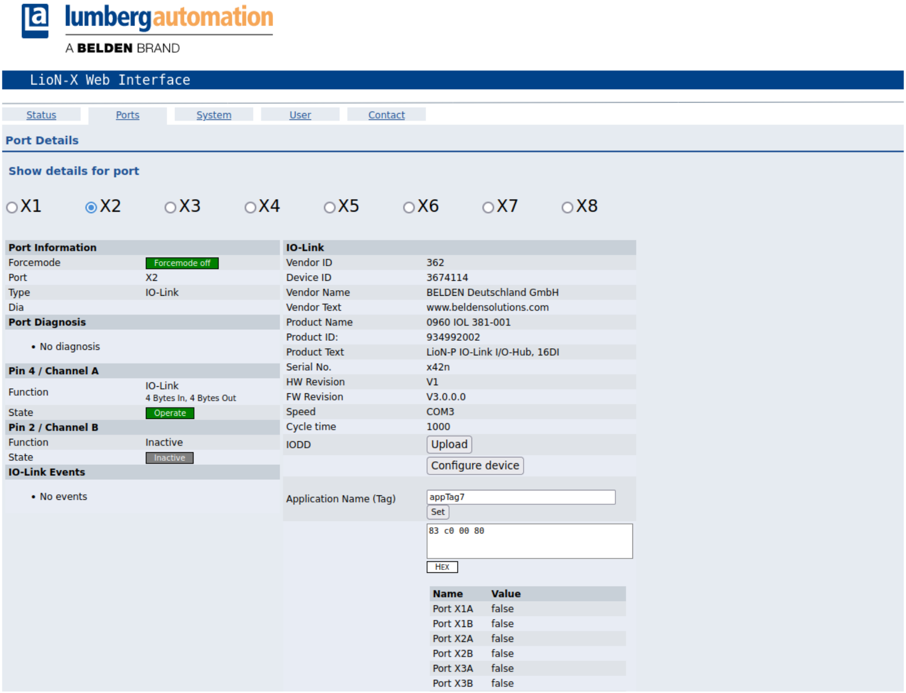
Every parameter is addressed by an index. Sub-indices are possible but optional. Some parameters (most of them read-only) are mandatory for IO-Link devices an can be found always on the same indices (See *Table B.8* in the *IO-Link Interface and System Specification*: https://io-link.com/share/Downloads/Package-2020/IOL-Interface-Spec_10002_V113_Jun19.pdf).

A vendor can use additional parameters and therefore more indices for their devices in order to provide additional configuration options. These vendor specific parameters can be described in an IODD. The "IODD on Module" feature of the LioN-X IO-Link Masters can read and parse this information out of an IODD and use it to provide the user viewing and editing options for vendor specific parameters without any additional knowledge about the vendor specific device features.

14.2 Web GUI functionality

All of the "IODD on Module" features are accessible via the LioN-X Web interface.

14.2.1 Port Details page



Port Details

Show details for port

○ X1 ● X2 ○ X3 ○ X4 ○ X5 ○ X6 ○ X7 ○ X8

Port Information	
Forcemode	Forcemode off
Port	X2
Type	IO-Link
Dia	
Port Diagnosis	

- No diagnosis

Pin 4 / Channel A	
Function	IO-Link 4 Bytes In, 4 Bytes Out
State	Operate
Pin 2 / Channel B	
Function	Inactive
State	Inactive
IO-Link Events	

- No events

IO-Link	
Vendor ID	362
Device ID	3674114
Vendor Name	BELDEN Deutschland GmbH
Vendor Text	www.beldensolutions.com
Product Name	0960 IOL 381-001
Product ID:	934992002
Product Text	LioN-P IO-Link I/O-Hub, 16DI
Serial No.	x42n
HW Revision	V1
FW Revision	V3.0.0.0
Speed	COM3
Cycle time	1000
IODD	Upload
	Configure device
Application Name (Tag)	appTag7 Set

```
83 c0 00 80
```

HEX

Name	Value
Port X1A	false
Port X1B	false
Port X2A	false
Port X2B	false
Port X3A	false
Port X3B	false

The Port Details Page shows all information about the selected port. In the left column, all port and channel specific information is displayed. If the port is configured as IO-Link and there is an IO-Link Device connected, all IO-Link information for the connected device is displayed in the right column.

IODD buttons

The row called *IODD* provides access to the "IODD on Module" features. The button *UPLOAD* will let the user upload an IODD file into the module, regardless of the original device the IODD has been designed for.

The maximum number of IODDs is limited due to storage space. If there is no more space left for new IODDs, there will be an error message. In this case, navigate to the IODD Management page to delete IODDs which are no longer used.

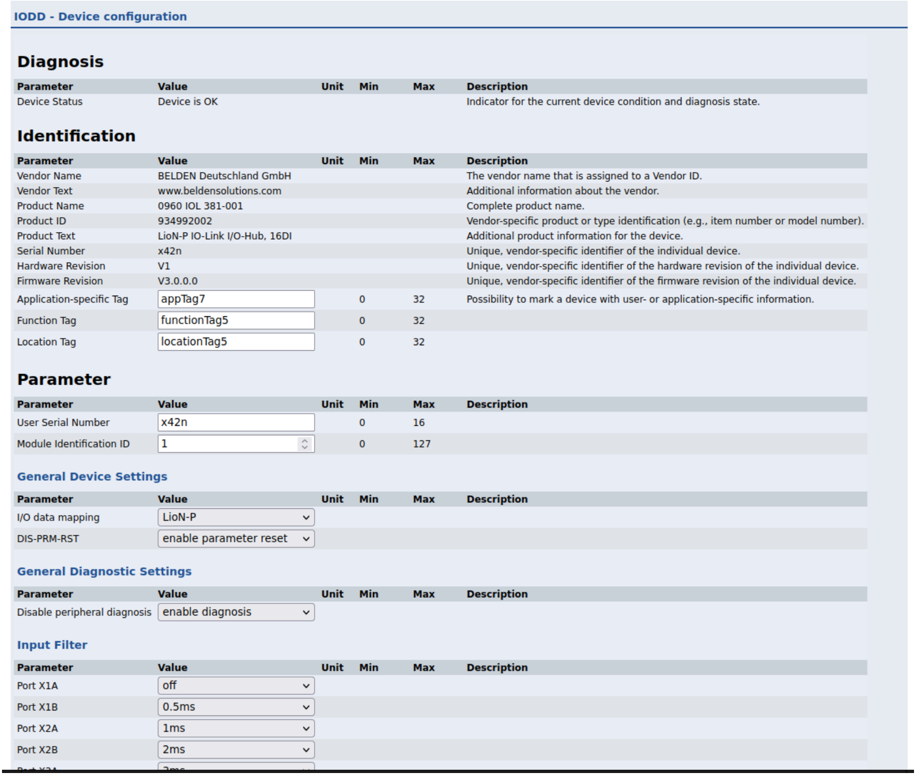
If there is a matching IODD for the currently connected device already stored in the system, the button *CONFIGURE* is shown in the interface. By clicking this button, the Parameter Page will open to configure the device.

Process data

For every connected IO-Link Device, raw process data for input and output direction (set of bytes) is on display.

If a matching IODD providing information about process data is already stored in the system, this data will also be displayed in a user-friendly format according to the IODD.

14.2.2 Parameters page



IODD - Device configuration

Diagnosis

Parameter	Value	Unit	Min	Max	Description
Device Status	Device is OK				Indicator for the current device condition and diagnosis state.

Identification

Parameter	Value	Unit	Min	Max	Description
Vendor Name	BELDEN Deutschland GmbH				The vendor name that is assigned to a Vendor ID.
Vendor Text	www.beldensolutions.com				Additional information about the vendor.
Product Name	0960 IOL 381-001				Complete product name.
Product ID	934992002				Vendor-specific product or type identification (e.g., item number or model number).
Product Text	LioN-P IO-Link I/O-Hub, 16DI				Additional product information for the device.
Serial Number	x42n				Unique, vendor-specific identifier of the individual device.
Hardware Revision	V1				Unique, vendor-specific identifier of the hardware revision of the individual device.
Firmware Revision	V3.0.0.0				Unique, vendor-specific identifier of the firmware revision of the individual device.
Application-specific Tag	appTag7		0	32	Possibility to mark a device with user- or application-specific information.
Function Tag	functionTag5		0	32	
Location Tag	locationTag5		0	32	

Parameter

Parameter	Value	Unit	Min	Max	Description
User Serial Number	x42n		0	16	
Module Identification ID	1		0	127	

General Device Settings

Parameter	Value	Unit	Min	Max	Description
I/O data mapping	LioN-P				
DIS-PRM-RST	enable parameter reset				

General Diagnostic Settings

Parameter	Value	Unit	Min	Max	Description
Disable peripheral diagnosis	enable diagnosis				

Input Filter

Parameter	Value	Unit	Min	Max	Description
Port X1A	off				
Port X1B	0.5ms				
Port X2A	1ms				
Port X2B	2ms				

The parameters page "IODD – Device configuration" shows all parameters which are provided by the IODD of the device. That means the parameter set is variable and depends on the connected IO-Link Device.

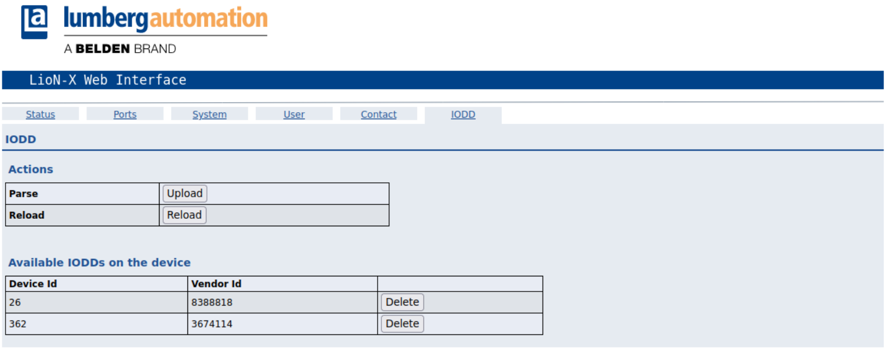
The stored IODD reads the parameter meta data, such as names, units, min/max values, descriptions etc. The values will be obtained directly from the connected device. For that reason it may take several seconds until the page is updated.

If not already saved into the browser, you will be asked for your credentials to continue. A valid user access with Web Interface group membership is needed in order to edit the device parameters. After the registration, enabled values can be changed. Disabled values cannot be changed and may be marked as "read-only" in the IODD. All values are directly written back to the device after any change.

Limitations

- Editing parameter values will directly change them inside the connected device. No parameter server action is triggered by that.
- There is a maximum size of the IODD in order to be uploaded into the system. This depends on several values, such as file size, parameter count, nesting levels etc.

14.2.3 IODD Management page



IODD

Actions

Parse	Upload
Reload	Reload

Available IODDs on the device

Device Id	Vendor Id	
26	8388818	Delete
362	3674114	Delete

The IODD Management Page can be accessed via the System page displaying all IODDs that are currently stored in the system. All IODDs matching connected devices are marked. On the IODD Management page, you can manually delete any IODD in the system.

Standard Definitions File

IODDs are usually referencing to a Standard Definitions File. The latest Standard Definitions File is already pre-installed on the system when the device is shipped. It can also be updated manually by clicking the button "Upload Standard Definitions File".

15 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 catalog.belden.com.

15.1 General

Protection class (Only applies if the connectors are screwed together or if protective caps are used.)[2]	IP65 IP67 IP69K	
Ambient temperature (during operation and storage)	0980 XSL 3x12-121... 0980 XSL 3x13-121...	-40 °C .. +70 °C (-40 °F .. +158 °F)
	0980 LSL 3x11-121...	-20 °C .. +60 °C (-4 °F .. +140 °F)
	0980 LSL 3x10-121...	
Weight	LioN-X 60 mm	approx. 500 gr. (17.6 oz)
Ambient moisture	Max. 98% RH (For UL applications: Max. 80% RH)	
Housing material	Die-cast zinc	
Surface finish	Frosted nickel	
Flammability class	UL 94 (IEC 61010)	
Vibration resistance (oscillation) DIN EN 60068-2-6 (2008-11)	15 g / 5-500 Hz	
Shock resistance DIN EN 60068-2-27 (2010-02)	50 g / 11 ms +/- X,Y,Z	
Fastening torques	M4 fixing screws	1 Nm
	M4 ground connection	1 Nm
	M12 connector	0.5 Nm
Permitted cables	Ethernet cables according to IEEE 802.3, min. CAT 5 (shielded) Max. length of 100 m, not routed out of facility (= local network)	

Table 49: General information

---

[2] Not under UL investigation.

15.2 CC-Link IE Field Basic protocol

Protocol	CC-Link IE Field Basic
Update cycle	1 ms
Transmission rate	100 Mbit/s, full duplex
Transmission procedure Autonegotiation	100BASE-TX supported
Product type	0x001F IO-Link Master
Product code	0980 XSL 3912-121-007D-01F, 935700002 0980 XSL 3912-121-027D-01F, 935710001 0980 XSL 3913-121-007D-01F, 935703001 0980 XSL 3913-121-027D-01F, 935711001 0980 LSL 3411-121-0006-010, 935701005 0980 LSL 3410-121-0006-010, 935702005
Supported Ethernet protocols	ICMP ARP HTTP / HTTPS SNMP
Switch functionality	Integrated
CC-Link IE Field Basic interface Connections Autocrossing	2 M12 sockets, 4-pin, D-coded (see pin assignments) 2 M12 Hybrid male/female, 8-pin supported
Electrically isolated Ethernet ports -> FE	2000 V DC

Table 50: CC-Link IE Field Basic protocol

15.3 Power supply of the module electronics/ sensors

Port X03, X04	M12-L-coded Power, connector/socket, 5-pole Pin 1 / Pin 3		
Nominal voltage U_S	24 V DC (SELV/PELV)		
Current U_S	Max. 16 A		
Voltage range	21 .. 30 V DC		
Power consumption of module electronics	Typically 160 mA (+/-20 % at U_S nominal voltage)		
Power supply interruption	Max. 10 ms		
Voltage ripple U_S	Max. 5 %		
Current consumption sensor system (L+ / Pin 1)	0980 XSL 3912-121... 0980 XSL 3913-121...	Port X1 .. X8 (Pin 1)	max. 4 A per port (at $T_{ambient}$ = 30° C)
	0980 LSL 3x11-121...	Port X1 .. X8 (Pin 1)	max. 2 A per port (at $T_{ambient}$ = 30° C)
	0980 LSL 3x10-121...	Port X1 .. X4 (L+ / Pin 1)	max. 2 A per port (at $T_{ambient}$ = 30° C)
		Port X5 .. X8 (Pin 1)	max. 0.7 A in total for ports X5 .. X8
Voltage level of the sensor power supply	Min. (U_S – 1.5 V)		
Short circuit/overload protection of sensor supply	Yes, per port		
Reverse polarity protection	Yes		
Operational indicator (U_S)	LED green:	18 V (+/- 1 V) < U_S	
	LED red:	U_S < 18 V (+/- 1 V)	

Table 51: Information on the power supply of the module electronics/ sensors

15.4 Power supply of the actuators

15.4.1 IO-Link Class A devices (U_L)

Nominal voltage U_L	24 V DC (SELV/PELV)
Voltage range	18 .. 30 V DC
Current U_L	Max. 16 A
Voltage ripple U_L	Max. 5 %
Reverse polarity protection	Yes
Operational indicator (U_L)	LED green: 18 V (+/- 1 V) < U_L LED red: U_L < 18 V (+/- 1 V) or U_L > 30 V (+/- 1 V) * if "Report U_L supply voltage fault" is enabled.
Port X03, X04	M12_L-coded Power, connector/socket, 5-pole Pin 2 / Pin 4

Table 52: Information on the power supply of the actuators

15.4.2 IO-Link Class A/B devices (U_{AUX})

Nominal voltage U_{AUX}	24 V DC (SELV/PELV)
Voltage range	18 .. 30 V DC
Current U_{AUX}	Max. 16 A
Voltage ripple U_{AUX}	Max. 5 %
Reverse polarity protection	Yes
Electric isolation $U_S \leftrightarrow U_{AUX}$	500 V
Operational indicator (U_{AUX})	LED green: 18 V (+/- 1 V) < U_{AUX} LED red: U_{AUX} < 18 V (+/- 1 V) or U_{AUX} > 30 V (+/- 1 V) * if "Report U_{AUX} supply voltage fault" is enabled.
Port X03, X04	M12_L-coded Power, connector/socket, 5-pole Pin 2 / Pin 4

Table 53: Information on the power supply of the actuators

15.5 I/O ports Channel A (Pin 4)

0980 XSL 3912-121...	Port X1 .. X8	Class A	IOL, DI, DO	M12 socket, 5-pin, Pin 4
0980 LSL 3x11-121...	Port X1 .. X8	Class A	IOL, DI, DO	
0980 LSL 3x10-121...	Port X1 .. X4	Class A	IOL, DI, DO	
	Port X5 .. X8	–	——, DI, ——	
0980 XSL 3913-121...	Port X1 .. X4	Class A	IOL, DI, DO	
	Port X5 .. X8	Class B	IOL, DI, DO	

Table 54: IO-Link Master ports: Functional overview for Ch. A (Pin 4)

15.5.1 Configured as digital input, Ch. A (Pin 4)

Input connection	0980 XSL 3912-121...		Type 1 as per IEC 61131-2
	0980 LSL 3x11-121...		
	0980 LSL 3x10-121...		
	0980 XSL 3913-121...		
Nominal input voltage	24 V DC		
Input current	Typically 3 mA		
Channel type	Normally open, p-switching		
Number of digital inputs	0980 XSL 3912-121...	X1 .. X8	8
	0980 LSL 3x11-121...		
	0980 LSL 3x10-121...		
	0980 XSL 3913-121...		
Status indicator	yellow LED		
Diagnostic indicator	red LED per channel		

Table 55: I/O ports Ch. A (Pin 4) configured as digital inputs

15.5.2 Configured as digital output, Ch. A (Pin 4)

Attention: For variants 0980 XSL 3912-121-007D-00F, 0980 XSL 3912-121-007D-01F and 0980 XSL 3912-121-027D-01F, the digital outputs of Channel A are **supplied by the U_L power** when parameterized to "High-Side Switch" mode.

Attention: For variants 0980 XSL 3913-121-007D-01F and 0980 XSL 3913-121-027D-01F, the digital outputs are supplied as follows:

- "X1 .. X8 / Channel A" are supplied by the U_S power

Attention: For variants 0980 LSL 3010-121-0006-001 and 0980 LSL 3011-121-0006-001 , the digital outputs of Channel A are **supplied by the U_S power**.

Output type	normally open, p-switching (parameterized to "High-Side Switch" mode)	
Nominal output voltage per channel		
Signal status “1”	min. (U_S -1 V) **or** min. (U_L -1 V) depending on the device variant	
Signal status “0”	max. 2 V	
Max. output current per device	0980 XSL 3912-121...	9 A (power supplied via U_L)
	0980 XSL 3913-121...	9 A (power supplied via U_S)
	0980 LSL 3x11-121...	4 A (power supplied via U_S)
	0980 LSL 3x10-121...	2 A (power supplied via U_S)
Max. output current per channel[3]	0980 XSL 3912-121... (X1 .. X8)	2 A (power supplied via U_S)
	0980 XSL 3913-121... (X1 .. X8)	2 A (power supplied via U_S)
	0980 LSL 3x11-121... (X1 .. X8)	0.5 A (power supplied via U_S) 0.25 A for **UL applications**
	0980 LSL 3x10-121... (X1 .. X4)	

---

[3] Max. 2.0 A per channel; for every port pair X1/X2, X3/X4, X5/X6, X7/X8 max. 6.5 A (for **UL applications** max. 5.0 A); for the whole port group X1 .. X8 max. 9.0 A in total (with derating).

Short-circuit/overload protected	yes/yes	
Behavior in case of short circuit or overload	deactivation with automatic power-on (parameterized)	
Number of digital outputs	0980 XSL 3912-121... (X1 .. X8)	8
	0980 XSL 3913-121... (X1 .. X8)	
	0980 LSL 3x11-121... (X1 .. X8)	
	0980 LSL 3x10-121... (X1 .. X4)	4
Status indicator	yellow LED per output	
Diagnostic indicator	red LED per channel	

Table 56: I/O ports Ch. A (Pin 4) configured as digital outputs

15.5.3 Configured as IO-Link port in COM mode, Ch. A

IO-Link Master specification	v1.1.3 ready, IEC 61131-9	
Communication rates	4.8 kbaud (COM 1) 38.4 kbaud (COM 2) 230.4 kbaud (COM 3)	
Line lengths in the IO-Link Device	max. 20 m	
Number of IO-Link ports	0980 XSL 3912-121... (X1 .. X8)	8
	0980 XSL 3913-121... (X1 .. X8)	8
	0980 LSL 3x11-121... (X1 .. X8)	8
	0980 LSL 3x10-121... (X1 .. X4)	4
Min. IO-Link cycle time	400 µs	

Table 57: Configured as IO-Link port in COM mode

15.6 I/O ports Channel B (Pin 2)

0980 XSL 3912-121...	Port X1 .. X8	Class A	DI, DO	M12 socket, 5-pin, Pin 2
0980 LSL 3x11-121...	Port X1 .. X8	Class A	DI	
0980 LSL 3x10-121...	Port X1 .. X4	Class A	DI	
	Port X5 .. X8	–	DI	
0980 XSL 3913-121...	Port X1 .. X4	Class A	DI, DO	
	Port X5 .. X8	Class B	DO, U_{AUX}	

Table 58: IO-Link Master ports: Functional overview for Ch. B (Pin 2)

15.6.1 Configured as a digital input, Ch. B (Pin 2)

Input connection	0980 XSL 3912-121...		Type 1 as per IEC 61131-2
	0980 XSL 3913-121...		
	0980 LSL 3x11-121...		
	0980 LSL 3x10-121...		
Nominal input voltage	24 V DC		
Input current	Typically 3 mA		
Channel type	Normally open, p-switching		
Number of digital inputs	0980 XSL 3912-121...	X1 .. X8	8
	0980 XSL 3913-121...	X1 .. X4	4
	0980 LSL 3x11-121...	X1 .. X8	8
	0980 LSL 3x10-121...	X1 .. X8	8
Status indicator	white LED		
Diagnostic indicator	red LED per channel		

Table 59: I/O ports Ch. B (Pin 2) configured as digital inputs

15.6.2 Configured as a digital output, Ch. B (Pin 2)

Attention: For variants 0980 XSL 3912-121-007D-00F, 0980 XSL 3912-121-007D-01F and 0980 XSL 3912-121-027D-01F, the digital outputs of Channel B are **supplied by the U_L power**.

Attention: For variants 0980 XSL 3913-121-007D-01F and 0980 XSL 3913-121-027D-01F, the digital outputs are supplied as follows:

- "X1 .. X4 / Channel B" are supplied by the U_S power
- "X5 .. X8 / Channel B" are supplied by the U_{AUX} power

Attention: For variants 0980 LSL 3010-121-0006-001 and 0980 LSL 3011-121-0006-001, the digital outputs of Channel B are **supplied by the U_S power**.

Output type	normally open, p-switching	
Nominal output voltage per channel Signal status “1” Signal status “0”	min. (U_S -1 V) **or** min. (U_L -1 V) **or** min. (U_{AUX} -1 V) depending on the device variant max. 2 V	
Max. output current per device	0980 XSL 3912-121...	9 A (power supplied via U_L)
	0980 XSL 3913-121...	8 A (power supplied via U_{AUX})
	0980 LSL 3x11-121...	4 A (power supplied via U_S)
	0980 LSL 3x10-121...	2 A (power supplied via U_S)
Max. output current per channel [4,5]	0980 XSL 3912-121...	2 A (power supplied via U_S)
	0980 XSL 3913-121...	X1 .. X4: 2 A (power supplied via U_S)
		X5 .. X8: 2 A (power supplied via U_{AUX})
	0980 LSL 3x11-121...	0 A (no outputs on Ch. B)
	0980 LSL 3x10-121...	0 A (no outputs on Ch. B)
Short-circuit/overload protected	yes/yes	
Behavior in case of short circuit or overload	deactivation with automatic power-on (parameterized)	
Number of digital outputs	0980 XSL 3912-121...	8
	0980 XSL 3913-121...	8
	0980 LSL 3x11-121...	–
	0980 LSL 3x10-121...	–
Status indicator	white LED per output	

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[4] For Class A devices: Max. 2.0 A per channel; for every port pair X1/X2, X3/X4, X5/X6, X7/X8 max. 6.5 A (for **UL applications** max. 5.0 A); for the whole port group X1 .. X8 max. 9.0 A in total (with derating).

[5] For Class A/B devices: Max. 2.0 A per channel; for every port pair X1/X2, X3/X4, X5/X6, X7/X8 max. 6.5 A (for **UL applications** max. 5.0 A); for port group X5/X6/X7/X8 max. 5.0 A from U_{AUX}; for the whole port group X1 .. X8 max. 9.0 A in total (with derating).

Diagnostic indicator	red LED per channel

Table 60: I/O ports Ch. B (Pin 2) configured as digital outputs

15.7 LEDs

LED	Color	Description
U_L/U_{AUX}	Green	Auxiliary sensor/actuator voltage OK 18 V (+/- 1 V) < U_L/U_{AUX} < 30 V (+/- 1 V)
	Red[*]	Auxiliary sensor/actuator voltage LOW U_L/U_{AUX} < 18 V (+/- 1 V) or U_L/U_{AUX} > 30 V (+/- 1 V) [*] if "Report U_L/U_{AUX} supply voltage fault" is enabled.
	OFF	None of the above conditions.
U_S	Green	System/sensor voltage OK 18 V (+/- 1 V) < U_S < 30 V (+/- 1 V)
	Red	System/sensor voltage LOW U_S < 18 V (+/- 1 V) or U_S > 30 V (+/- 1 V)
	Red flashing	Device performs a factory reset (position of rotary encoding switches: 9-7-9)
	OFF	None of the above conditions.
X1 .. X8 A	Green	IO-Link COM Mode: IO-Link communication exists.
	Green flashing	IO-Link COM Mode: No IO-Link communication.
	Yellow	Standard-I/O Mode: Status of digital input or output on C/Q (pin 4) line "on".
	OFF	None of the above conditions
X1 .. X8 B	White	Status of digital input or digital output on pin 2 line "on".
	Red	Short circuit on pin 4 and pin 2 line. / All modes: Overload or short circuit on L+ (pin 1) line / communication error
	OFF	None of the above conditions.
P1 Lnk/Act P2 Lnk/Act	Green	Ethernet connection to another subscriber exists. Link detected.
	Yellow flashing	Data exchange with another subscriber.
	OFF	No connection to another subscriber. No link, no data exchange.

LED	Color	Description
BF	Red	Bus fault. No configuration, no or slow physical connection.
	Red flashing at 2 Hz	Link exists but no communication link to the CC-Link IE controller.
	OFF	CC-Link IE controller has established an active connection to the device.
DIA	Red	CC-Link IE module diagnostic alarm active.
	Red flashing at 1 Hz	Watchdog time-out; fail safe mode is active.
	Red flashing at 2 Hz, 3 sec	DCP signal service is initiated via the bus.
	Red double flash	Firmware update
	OFF	None of the above conditions.
MS	Green	Device is ready for operation.
	Green flashing	Device is ready but not configured yet.
	Red	Serious error that cannot be resolved.
	Red flashing	Minor error that can be resolved Example: An incorrect or contradictory configuration is classified as a minor error.
	Flashing alternately: Red Green	The device is performing a self-test.
	OFF	The device is switched off.

LED	Color	Description
NS	Green	Connected: The device has at least one connection.
	Green flashing	No connection: The device has no connection. IP address exists.
	Red	Duplicate IP address: The device has detected that the assigned IP address is already being used by another device.
	Red flashing	Connection has exceeded time limit or connection interrupted.
	Flashing alternately: Red Green	The device is performing a self-test.
	OFF	The device is switched off or has not been assigned an IP address.

Table 61: Information on the LED colors

15.8 Data transfer times

The following tables give an overview of the internal data transfer times of the LioN-X IO-Link Master with a connected IO-Link Device as digital I/O extension (Belden article 0960 IOL 380-021 16DIO Hub with a minimum cycle time of 1 ms).

There are three measured data direction values for each use case:

- **PLC to DO:** Transfer of a changed PLC output data to IO-Link Device digital output.
- **DI to PLC:** Transfer of a changed digital input signal on IO-Link Device to PLC.
- **Round-trip time (RTT):** Transfer of a changed PLC output data to IO-Link Device digital output. The digital output is connected to an IO-Link Device digital input. Transfer of the changed digital input signal on IO-Link Device to PLC. RTT = [PLC to DO] + [DI to PLC].

The measured values are taken from the ethernet data transmission line. The values are therefore without PLC processing times and PLC cycle time.

The configurable digital input filter value on 0960 IOL 380-021 was set to "off" (0 ms).

For calculation of user specific data transfer and round-trip times of possible input filters, PLC processing and cycles times must be taken into calculation.

The measured values are valid for a maximum of 48 bytes of IO-Link data for the IO-Link Master in each direction (Input/Output).

Use case 1:

IO-Link Master configuration with enabled Web interface and *disabled* IIoT protocols

Data direction	Data transfer time in ms		
	Minimum	**Average**	**Maximum**
PLC to DO	3.7	6.0	7.7
DI to PLC	1.1	3.0	4.3
RTT	6.1	8.9	11.1

Use case 2:

IO-Link Master configuration with enabled Web interface and *enabled* IIoT protocols

Data direction	Data transfer time in ms		
	Minimum	**Average**	**Maximum**
PLC to DO	7.7	10.0	13.4
DI to PLC	3.3	4.4	5.6
RTT	12.1	14.3	17.0

16 Accessories

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

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