



 IO-Link



Device Manual
IO-Link Master with PROFINET interface
CabinetLine
8 Ports
IP 20

AL1900

IO-Link: 1.1.2
ifm firmware: 2.1.35 or higher
LR DEVICE: 1.3.1.x or higher

English

7391164 / 01 05 / 2018

© ifm electronic gmbh

www.ifm.com

Table of Contents

1	Preliminary note	5
1.1	Legal and copyright information	5
1.2	Purpose of the document	5
1.3	Symbols and styles used	5
1.4	Modification history	6
2	Safety instructions	7
2.1	General	7
2.2	Required background knowledge	7
2.3	Safety symbols on the device	7
2.4	Tampering with the unit	8
3	Intended use	9
3.1	Permitted use	9
3.2	Prohibited use	9
4	Function	10
4.1	Communication, parameter setting, evaluation	11
4.1.1	IO-Link	11
4.1.2	PROFINET	11
4.1.3	Internet of Things (IoT)	11
4.1.4	Parameter setting	11
4.1.5	Visual indication	12
4.2	Digital inputs	12
4.3	IO-Link supply	12
5	Mounting	13
5.1	Install the device	13
6	Electrical connection	14
6.1	Remarks	15
6.2	PROFINET ports	15
6.3	IoT port	16
6.4	IO-Link ports	17
6.4.1	Input circuit	18
6.4.2	IO-Link circuits	18
6.5	Connect the device	19
7	Operating and display elements	20
7.1	Overview	20
7.2	LED indicators	21
7.2.1	Status LEDs	21
7.2.2	Ethernet interface	21
7.2.3	IoT port	22
7.2.4	Power supply	22
7.2.5	IO-Link ports (Class A)	22

8	Configuration	23
8.1	LR DEVICE	24
8.1.1	Remarks	25
8.1.2	IoT: Configure access rights	26
8.1.3	IoT: Configure IP settings	27
8.1.4	IoT: Configure the interface to the LR SMARTOBSERVER	28
8.1.5	Fieldbus: Configure the PROFINET port	28
8.1.6	IO-Link ports: Activate data transfer to the LR SMARTOBSERVER	28
8.1.7	IO-Link ports: Configure operating mode	30
8.1.8	IO-Link ports: Set the device validation and data storage	31
8.1.9	Firmware: Reset device to factory settings	32
8.1.10	Firmware: Reboot the device	32
8.1.11	Configure IO-Link devices	33
8.2	PROFINET	34
8.2.1	Install GSD file	35
8.2.2	Add the IO-Link master to the PROFINET network	36
8.2.3	Configure access rights	38
8.2.4	Configure IO-Link ports	39
8.2.5	Configure the PROFINET port	40
8.2.6	Configure IO-Link devices	40
8.2.7	Read and write data cyclically	41
8.2.8	PROFINET: Read & write device information	41
8.2.9	PROFINET: Programmers' notes	42
8.3	IoT Core	44
8.3.1	Configure IoT interface	45
8.3.2	Configure the fieldbus interface	45
8.3.3	Configure IO-Link ports	46
8.3.4	Configure IO-Link devices	46
8.3.5	Set application identification	47
8.3.6	Read / write cyclic process data	47
8.3.7	Read diagnostic data	47
8.3.8	Control IO-Link master	48
8.3.9	Read device information	48
8.3.10	Read information about IO-Link devices	49
8.3.11	Examples	50
8.3.12	Programmers' notes	54
9	Operation	58
9.1	Firmware update	58
9.2	Web interface: Read device and diagnostic information	59
9.3	Replace IO-Link device	60
10	Maintenance	61
11	Factory settings	62
12	Accessories	63
13	Appendix	64
13.1	Technical data	65
13.1.1	Application	65
13.1.2	Electrical data	65
13.1.3	Inputs / outputs	65
13.1.4	Inputs	66

Content

13.1.5	Outputs.....	66
13.1.6	Interfaces.....	66
13.1.7	Environmental conditions	67
13.1.8	Approvals / tests	67
13.1.9	Mechanical data	67
13.1.10	Electrical connection	68
13.2	PROFINET	69
13.2.1	Parameter data.....	69
13.2.2	Cyclic data.....	72
13.2.3	Acyclic data	74
13.3	ifm IoT Core	77
13.3.1	Overview: IoT profile	78
13.3.2	Overview: IoT types.....	81
13.3.3	Overview: IoT services	82
14	Index	89

1 Preliminary note

Contents

Legal and copyright information	5
Purpose of the document	5
Symbols and styles used.....	5
Modification history	6

14801

1.1 Legal and copyright information

1631

© All rights reserved by **ifm electronic gmbh**. No part of this manual may be reproduced and used without the consent of **ifm electronic gmbh**.

- All product names, pictures, companies or other brands used on our pages are the property of the respective rights owners:
- AS-i is the property of the AS-International Association, (→ (www.as-interface.net))
- CAN is the property of the CiA (CAN in Automation e.V.), Germany (→ (www.can-cia.org))
- CODESYS™ is the property of the 3S – Smart Software Solutions GmbH, Germany (→ (www.codesys.com))
- DeviceNet™ is the property of the ODVA™ (Open DeviceNet Vendor Association), USA (→ (www.odva.org))
- EtherNet/IP® is the property of the →ODVA™
- EtherCAT® is a registered trade mark and patented technology, licensed by Beckhoff Automation GmbH, Germany
- IO-Link® (→ (www.io-link.com)) is the property of the →PROFIBUS Nutzerorganisation e.V., Germany
- ISOBUS is the property of the AEF – Agricultural Industry Electronics Foundation e.V., Deutschland (→ (www.aef-online.org))
- Microsoft® is the property of the Microsoft Corporation, USA (→ (www.microsoft.com))
- PROFIBUS® is the property of the PROFIBUS Nutzerorganisation e.V., Germany (→ (www.profibus.com))
- PROFINET® is the property of the →PROFIBUS Nutzerorganisation e.V., Germany
- Windows® is the property of the →Microsoft Corporation, USA

1.2 Purpose of the document

22044

This document is only for device types "IO-Link master - PROFINET gateway (CabinetLine) 8 port IP 20" (art. no.: AL1900).

It is part of the device and contains information about the correct handling of the product.

- ▶ Read this document before using the device.
- ▶ Keep this document during the service life of the device.

1.3 Symbols and styles used

15989

 **WARNING**

Death or serious irreversible injuries may result.

CAUTION

Slight reversible injuries may result.

NOTICE

Property damage is to be expected or may result.



Important note
Non-compliance can result in malfunction or interference



Information
Supplementary note



... Request for action



... Reaction, result



... "see"

abc

Cross-reference

123

Decimal number

0x123

Hexadecimal number

0b010

Binary number

[...]

Designation of pushbuttons, buttons or indications

1.4 Modification history

13066

Version	Topic	Date
00	New creation of document	11 / 2017
01	<ul style="list-style-type: none"> ▪ Update to firmware 2.1.26 ▪ Correction: wiring port X31 ▪ Correction: example for IoT service getdatamulti ▪ Added: electrical connection of IO-Link devices for Class B port operation ▪ Added: enable/disable transmission of events (Feldbus) 	05 / 2018

2 Safety instructions

Contents	
General.....	7
Required background knowledge.....	7
Safety symbols on the device.....	7
Tampering with the unit.....	8

213

2.1 General

22068



The plant manufacturer is responsible for the safety of the plant in which the device is installed.

If the device is used in a way that is not intended by the manufacturer, the protection supported by the device may be impaired.

Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

- ▶ Observe these operating instructions.
- ▶ Adhere to the warning notes on the product.

2.2 Required background knowledge

22046

This document is intended for specialists. Specialists are people who, based on their relevant training and experience, are capable of identifying risks and avoiding potential hazards that may be caused during operation or maintenance of the product.

The document contains information about the correct handling of the product.

2.3 Safety symbols on the device

15021



General warning

Observe instructions in chapter "Electrical connection" (→ **Electrical connection** (→ p. 14))!

2.4 Tampering with the unit

11242

WARNING

Tampering with the units can affect the safety of operators and machinery!

Tampering with the units is not allowed.

In case of non-compliance our liability and warranty expire.

- ▶ Do not open the devices!
- ▶ Do not insert any objects into the devices!
- ▶ Prevent metal foreign bodies from penetrating!

3 Intended use

Contents

Permitted use	9
Prohibited use.....	9

18761

3.1 Permitted use

11028

The IO-Link master serves as a gateway between intelligent IO-Link devices and the fieldbus. The device is designed for use as cabinet module in plant construction.

3.2 Prohibited use

22053

The device may not be used beyond the limits of the technical data (→ **Technical data** (→ p. [65](#)))!

4 Function

Contents

Communication, parameter setting, evaluation	11
Digital inputs	12
IO-Link supply.....	12

7482

4.1 Communication, parameter setting, evaluation

Contents

IO-Link	11
PROFINET	11
Internet of Things (IoT)	11
Parameter setting	11
Visual indication	12

7485

4.1.1 IO-Link

7773

The device offers the following IO-Link functions:

- IO-Link master (IO-Link revision 1.0 and 1.1)
- 8 IO-Link ports for connection of IO-Link devices
- Provision of process data of the connected IO-Link devices for LR SMARTOBSERVER monitoring software (→ www.ifm.com)

4.1.2 PROFINET

2259

The device offers the following PROFINET functions:

- Provision of the functions of a Profinet RT Device (Class B)
- 2 port switch for access to the PROFINET interface (X21/X22)
- Gateway for transmission of the process and parameter data between the connected IO-Link devices and the higher-level PROFINET controller

4.1.3 Internet of Things (IoT)

8355

The device has an Ethernet port (X23) for Internet-of-Things applications. The interface allows separate access from IT networks to parameters, process and monitoring data of the IO-Link master and the connected IO-Link devices. Different protocols (e.g. TCP/IP JSON) are supported.

4.1.4 Parameter setting

7284

The device provides the following configuration options:

- Parameter setting of the IO-Link master of the AL1900 with LR DEVICE parameter setting software, PROFINET projection software or ifm IoT-Core services.
- Parameter setting of the connected IO-Link devices (sensors, actuators) with LR DEVICE parameter setting software, PROFINET projection software or ifm IoT-Core services
- Storage of parameter sets of the connected IO-Link devices for automatic recovery (data storage)

4.1.5 Visual indication

7772

The device has the following visual indicators:

- Status and error indication of the gateway, of the PROFINET connection and of the system
- Status display of the voltage supply
- Status and activity display of the Ethernet connection
- Status, error and short circuit/overload indication of the IO-Link ports

4.2 Digital inputs

7584

The device has 8 additional digital inputs (type 2 according to EN 61131-2).

The digital inputs are on clamp 2 of the IO-Link ports X01 ... X08.

All inputs refer to the potential of the device supply (clamp 3).

4.3 IO-Link supply

7623

The device has 8 supplies for IO-Link devices.

The IO-Link ports X01...X08 are ports class A.

Every supply provides short circuit monitoring.

The device ensures fire protection for the connected IO-Link devices by providing a power-restricted circuit at the IO-Link ports (according to IEC61010-1 and Class 2 according to UL1310).

5 Mounting

Contents

Install the device.....	13
-------------------------	----

22016

5.1 Install the device

16676



- ▶ Disconnect power before installation.

The device contains components that can be damaged or destroyed by electrostatic discharge.

- ▶ When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD).
 - ▶ Only operate the device when mounted on a grounded DIN rail.
-
- ▶ Install the device in a control cabinet of protection rating IP 54 or higher. The control cabinet has to be installed in accordance with local and national regulations.
 - ▶ Fix the device vertically onto a 35 mm raised rail.
 - ▶ Leave enough space between the unit and the top or bottom of the control cabinet as well as to adjacent devices to enable air circulation and to avoid inadmissible heating.

6 Electrical connection

Contents

Remarks	15
PROFINET ports	15
IoT port	16
IO-Link ports	17
Connect the device	19

22017

6.1 Remarks

23709



A qualified electrician must connect the unit.

- ▶ Observe the national and international regulations for the installation of electrical equipment.

Device is only suitable for operation on SELV/PELV voltages.

- ▶ Observe the information concerning IO-Link circuits (→ **IO-Link circuits** (→ p. [18](#)))!

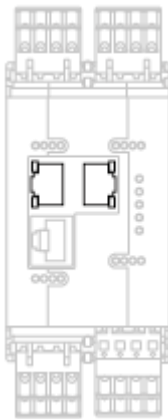
The IP rating depends on the individual protection ratings of the unit, the applied connection elements and the corresponding protective covers.

- ▶ For UL applications: For connecting the device and the IO-Link devices use UL certified cables of category CYJV or PVVA with a minimum temperature rating of 100°C.

Wiring: → **Technical data** (→ p. [65](#))

6.2 PROFINET ports

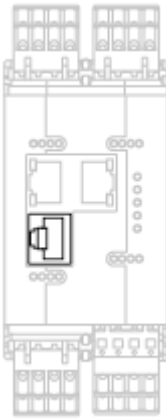
17858



- ▶ Connect the unit via the sockets X21 and/or X22 to the PROFINET network.
- ▶ To connect the devices, use connectors with protection rating IP 20 or higher (→ **Accessories** (→ p. [63](#))).

6.3 IoT port

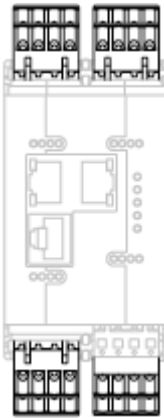
17859



- ▶ Connect the device via the socket "IoT" (X23) to the IT network (e.g. laptop/PC with the installed LR DEVICE parameter setting software, laptop/PC with installed LR SMARTOBSERVER monitoring software).
- ▶ To connect the devices, use connectors with protection rating IP 20 or higher (→ **Accessories** (→ p. [63](#))).

6.4 IO-Link ports

17860



- ▶ Connect the IO-Link devices to the terminals X01 ... X08.
 - Wiring: → **Technical data** (→ p. [65](#))
 - Maximum cable length per IO-Link port: 20 m
- ▶ To connect the devices, use cables with protection rating IP 20 or higher.



If operating as IO-Link port class B:

- ▶ Observe notes regarding IO-Link circuits (→ **IO-Link circuits** (→ p. [18](#)))!

6.4.1 Input circuit

17863

The inputs of the ports X01...X08 (clamp 2) are of type 2 according to the standard EN61131-2, the connected electronics must be designed for this purpose.

6.4.2 IO-Link circuits

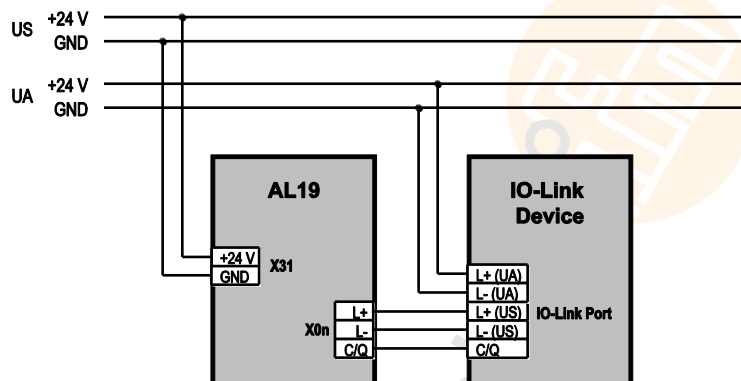
7260

The IO-Link ports of the device meet the requirements of the IO-Link specification 1.0 bis 1.1.2.



The power supply of the connected IO-Link devices may only take place via the AL1900. Exception: Connection of IO-Link devices with additional external power supply to ports X01...X08 for port class B operation

Wiring:



Maximum admissible current for UA: 4 A

The external supply for port class B operation must be galvanically separated from the circuit of the AL1900 by assuring basic isolation (according to EN61010-1, secondary circuit with maximum 30 V DC derived from applied voltage up to 300 V of overvoltage category II)!

NOTICE

Risk of material damage

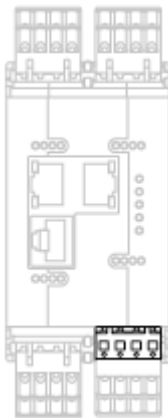
If the requirements of galvanic separation of the circuits are not observed, the fire protection of the device can not be assured.

- Observe the requirements of the electrical connection of IO-Link devices for port class B operation!

Further information: → [Technical data](#) (→ p. [65](#))

6.5 Connect the device

17851



- ▶ Disconnect power.
- ▶ Connect the IO-Link master via port X31 to 24 V DC (20...30 V SELV/PELV; according to IEC 61010-1, secondary circuit with max. 30 V DC, supplied from main circuit up to 300 V of overvoltage category II).
 - Wiring: → **Technical data** (→ p. 65)
 - Recommended maximum cable length: 25 m
- ▶ To connect the device, use cables with protection rating IP 20 or higher.



With cable lengths greater than 25 m observe the voltage drop and the necessary minimum supply voltage of 20 V!

7 Operating and display elements

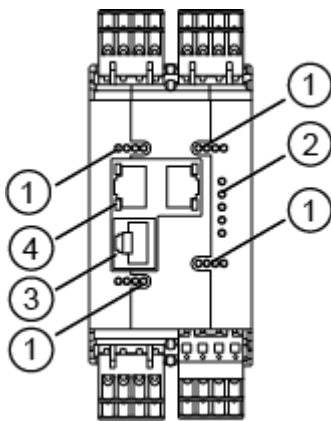
Contents

Overview.....	20
LED indicators.....	21

5440

7.1 Overview

10998



- ① IOL and DI status-LEDs of the IO-Link port (X01...X08) (→ **IO-Link ports (Class A)** (→ p. [22](#)))
- ② PWR status LED of the voltage supply (X31) (→ **Power supply** (→ p. [22](#)))
RDY, BF und SF Status LEDs (→ **Status LEDs** (→ p. [21](#)))
IoT status LED of the IoT port (X23) (→ **IoT port** (→ p. [22](#)))
- ③ LNK status LED of the IoT port (X23) (→ **IoT port** (→ p. [22](#)))
- ④ LNK and ACT status LEDs of the PROFINET ports 1 (X21) and 2 (X22) (→ **Ethernet interface** (→ p. [21](#)))

7.2 LED indicators

22024

The device only has the following LED indicators:

7.2.1 Status LEDs

22034

The RDY LED shows the status of the gateway.

The BF LED (Bus Failure) shows the status of the PROFINET connection.

The SF LED (System Failure) shows the status of the system.

Status LED			Description
RDY	green	on	Gateway functions properly
		flashes 1 Hz	Error
		flashes 5 Hz	Firmware update
		off	Gateway does not function; Unit reboots
BF	red	on	Bus error
		flashes 1 Hz	No connection to the PROFINET controller
		off	error-free
SF	red	on	<ul style="list-style-type: none"> ▪ Error in gateway ▪ At least 1 IO-Link device sends warning / alarm (temperature, over/under current, over/under voltage, shortcut)
		off	error-free

7.2.2 Ethernet interface

22027

Each Ethernet interface (X21, X22) has 2 LEDs (LNK and ACT). The LEDs indicate the status of the Ethernet connection.

Status LED			Description
LNK	green	on	Ethernet connection established
		off	No Ethernet connection
ACT	yellow	flashes	Data is transmitted via the Ethernet interface.
		off	No data transmission

7.2.3 IoT port

7722

The IoT port (X23) has the 3 LNK, ACT and IoT LEDs. The LEDs indicate the status of the Ethernet connection and the device identification.

Status LED			Description
LNK	green	on	Ethernet connection established
		off	No Ethernet connection
ACT	yellow	flashes	Data is transmitted via the Ethernet interface.
		off	No data transmission
IoT	green	flashes	Device identification active

7.2.4 Power supply

17856

The interface for voltage supply (X31) has the PWR LED. The LED indicates the status of the voltage supply.

Status LED			Description
PWR	green	on	Supply voltage Us is applied
		off	No supply voltage is applied or the applied supply voltage is too low

7.2.5 IO-Link ports (Class A)

22029

Each IO-Link port Class A (X01 ... X08) has 2 LEDs marked as IOL and DI. The LEDs indicate the status of the IO-Link port.

Status LED			Description
IOL	yellow	on	Interface configured as DI/DO: clamp 4 (C/Q) = ON
		off	Interface configured as DI/DO: clamp 4 (C/Q) = OFF
	green	on	IO-Link transmission functions properly
		flashes 1 Hz	Interface configured as IO-Link, but no IO-Link transmission
	red	on	Short circuit or overload in supply voltage
		flashes 1 Hz	Transmission error
DI	yellow	on	Digital input: clamp 2 (DI) = ON
		off	Digital input : clamp 2 (DI) = OFF

8 Configuration

Contents

LR DEVICE.....	24
PROFINET.....	34
IoT Core.....	44

22367



8.1 LR DEVICE

Contents

Remarks	25
IoT: Configure access rights	26
IoT: Configure IP settings	27
IoT: Configure the interface to the LR SMARTOBSERVER	28
Fieldbus: Configure the PROFINET port.....	28
IO-Link ports: Activate data transfer to the LR SMARTOBSERVER	28
IO-Link ports: Configure operating mode	30
IO-Link ports: Set the device validation and data storage.....	31
Firmware: Reset device to factory settings	32
Firmware: Reboot the device.....	32
Configure IO-Link devices	33

22822

On delivery, the AL1900 is configured with the factory settings (→ **Factory settings** (→ p. [62](#))).

Required software: LR DEVICE (1.3.1.x or higher) (art.-no.: QA0011/QA0012)

8.1.1 Remarks

Contents

Offline parameter setting	25
VPN connection	25

22369

Offline parameter setting

22405

The AL1900 supports the offline parameter setting. In this context, the user creates and stores a configuration for the IO-Link master and the connected IO-Link devices without being connected to the AL1900 (OFFLINE mode). The configuration created in this way can be stored as a file (*.lrp) and loaded to the AL1900 and activated at a later date.



Further information about offline parameter setting: → Operating instructions LR DEVICE

VPN connection

22762



An active VPN connection blocks the access of the parameter setting software LR DEVICE to the PROFINET interface of the AL1900.

- ▶ Deactivate the VPN connection in order to be able to access the AL1900 with the LR DEVICE.

8.1.2 IoT: Configure access rights

16555

The access rights define which instance may read and / or write the parameter data, process data and event/diagnostic messages.

In order to configure the access rights to the IO-Link master:

- ▶ Select [IoT] menu.
- > The menu page shows the current settings.
- ▶ Set the following parameters as required:

Name	Description	Possible values	
[Access Rights]	The access rights to the parameter data, process data and the event/diagnostic messages of the IO-Link master as well as the connected IO-Link devices	[PROFINET + IoT]	<ul style="list-style-type: none"> ▪ PROFINET and IoT Core have read and write access rights to parameters and process data ▪ PROFINET and <IoT Core> have read access rights to events/alarms
		[PROFINET + IoT (read-only)]	<ul style="list-style-type: none"> ▪ PROFINET has read and write access rights to parameters and process data ▪ PROFINET has read access rights to events/alarms ▪ IoT Core only has read access rights to parameters, process data and events/alarms
		[IoT only]	<ul style="list-style-type: none"> ▪ IoT Core has read and write access rights to parameters and process data ▪ IoT has read access rights to events/alarms ▪ PROFINET has no access rights

- ▶ Save changed values on the device.



Parameter [Access Rights]:

Different parameter settings in the PROFINET projection software and the IoT applications can result in undesired system behaviour. The set values of the PROFINET projection software apply.



Changes of the parameter [Access Rights] are only effective after restarting the device.

To activate the changed access rights:

- ▶ **Firmware: Reboot the device** (→ p. [32](#))

8.1.3 IoT: Configure IP settings

17713

For access to the IO-Link master via the IT infrastructure the user has to set the IP settings of the IoT port.



To configure the IP settings with DHCP, a DHCP server has to be active in the IT network. If no DHCP server can be reached in the IT network, an IP address is automatically assigned to the IoT port with the Zeroconfig protocol (address range: → Factory settings).

To configure the IP settings of the IoT port:

- ▶ Select [IoT] menu.
- > The menu page shows the current settings.
- ▶ Set the following parameters as required:

Name	Description	Possible values	
[DHCP]	Activate/deactivate the DHCP client of the device	[Static IP]	IP settings were set by the user
		[DHCP]	IP settings are set by a DHCP server in the network.
[IP address]*	IP address of the IoT port	Factory setting: 169.254.X.X	
[Subnet mask]*	Subnet mask of the Ethernet network	Factory setting: 255.255.0.0	
[Default gateway IP address]*	IP address of the network gateway	Factory setting: 0.0.0.0	
[MAC address]	MAC address of the IoT port	The value is firmly set.	

* ... can only be edited if parameter [DHCP] = [Static IP]

- ▶ Save changed values on the device.

8.1.4 IoT: Configure the interface to the LR SMARTOBSERVER

16552

To enable data transfer between the device and the LR SMARTOBSERVER monitoring software, the LR SMARTOBSERVER monitoring software interface has to be configured.

- ▶ Select [IoT] menu.
- > The menu page shows the current settings.
- ▶ Set the following parameters as required:

Name	Description	Possible values	
[IP address LR SMARTOBSERVER]	IP address of the PC on which the LR SMARTOBSERVER is installed.	Factory setting: 255.255.255.255	
[Port LR SMARTOBSERVER]	Port number that is used to send process data to the LR SMARTOBSERVER	0 ... 65535	Factory setting: 35100
[Interval LR SMARTOBSERVER]	Cycle time for the transfer of the process data to the LR SMARTOBSERVER (value in milliseconds)	[Off]	no transfer
		500 ... 2147483647	500 ms ... 2147483647 ms
[Application Tag]	Source identifier of the IO-Link master in the structure of the LR SMARTOBSERVER (String32)	Factory setting: AL1900	



After changing the parameter [Port LR SMARTOBSERVER] or [Application Tag], it may take 120 seconds before the device establishes a new TCP connection.

To prevent the delay:

- ▶ Reboot the device after the parameter change.
- ▶ Save changed values on the device.

8.1.5 Fieldbus: Configure the PROFINET port

16581

The PROFINET ports X21/X22 have to be configured via the PROFINET for access to the device.

To set the IP properties of the fieldbus port:

- ▶ Select [Fieldbus] menu.
- > The menu page shows the current settings.
- ▶ Set the following parameters as required:

Parameter	Description	Possible values
[IP address]	IP address of the PROFINET port	Factory setting: 0.0.0.0
[Subnet mask]	Subnet mask of the IP network	Factory setting: 0.0.0.0
[Default gateway IP address]	IP address of the gateway	Factory setting: 0.0.0.0
[Profinet name]	Name of the device in the PROFINET network	e.g. al1xxx
[MAC address]	MAC address of the device	The value is firmly set.

- ▶ Save changed values on the device.

8.1.6 IO-Link ports: Activate data transfer to the LR SMARTOBSERVER

16551

The user can decide separately for each IO-Link port if the process data of the connected IO-Link devices should be transferred to the LR SMARTOBSERVER.



To transfer process data the interfaces to the LR SMARTOBSERVER have to be correctly configured (→ **IoT: Configure the interface to the LR SMARTOBSERVER** (→ p. [28](#))).

To activate / deactivate data transfer:

- ▶ Select [Port x] menu (x = 1...8).
- > The menu page shows the current settings.
- ▶ Set the following parameters as required:

Name	Description	Possible values	
[Transmission to LR SMARTOBSERVER]	Transfer of process data of the connected IO-Link device to LR SMARTOBSERVER	[Disabled]	Process data is not transferred
		[Enabled]	Process data is transferred

- ▶ Save changed values on the device.

8.1.7 IO-Link ports: Configure operating mode

17439

The IO-Link ports X01...X08 of the device support the following operating modes:

- Digital input (DI): binary input signal at clamp 4 (C/Q) of the IO-Link port
- Digital output (DO): binary output signal at clamp 4 (C/Q) of the IO-Link port
- IO-Link: IO-Link data transfer via clamp 4 (C/Q) of the IO-Link port

The user can set the operating mode separately for each IO-Link port.

To set the operating mode of an IO-Link port:

- ▶ Select [Port x] menu (x = 1...8).
- > The menu page shows the current settings.
- ▶ Set the following parameters as required:

Name	Description	Possible values	
[Mode]	Operating mode of the IO-Link port	[Disabled]	Port deactivated
		[DI]	Operation as digital input
		[DO]	Operation as digital output
		[IO-Link]	Operation as IO-Link interface
[Cycle time actual]**	Current cycle time of the data transfer between IO-Link master and IO-Link device on the port (value in microseconds)	Parameter can only be read	
[Cycle time preset]*	Cycle time of the data transfer between the IO-Link master and the IO-Link device at the port (value in microseconds)	0	The device automatically sets the fastest possible cycle time.
		1	1 microsecond
	
		132800	132800 microseconds
[Bitrate]**	Current transmission rate of the data transfer between the IO-Link master and the IO-Link device on the port	Parameter can only be read	

* ... Parameter only available if [Mode] = [IO-Link]

** ... Parameter only visible if the IO-Link device is connected to the IO-Link port.

- ▶ Save changed values on the device.

8.1.8 IO-Link ports: Set the device validation and data storage

17945

In the operating mode "IO-Link" the user can set the behaviour of the IO-Link port with regard to device validation and the storage / restoration of the parameter data of the connected IO-Link device.

To configure the device validation and the data storage:

- ▶ Select [Port x] menu (x = 1...8).
- > The menu page shows the current settings.
- ▶ Set the following parameters as required:

Name	Description	Possible values	
[Validation / Data Storage]	Supported IO-Link standard and behaviour of the device during connection of a new IO-Link device on port x (x = 1...8)	[No check and clear]	<ul style="list-style-type: none"> ▪ No verification of the vendor ID and device ID ▪ No data storage
		[Type compatible V1.0 device]	<ul style="list-style-type: none"> ▪ IO-Link device is compatible with the V1.0 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ No data storage
		[Type compatible V1.1 device]	<ul style="list-style-type: none"> ▪ IO-Link device is compatible with the V1.1 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ No data storage
		[Type compatible V1.1 device with Backup + Restore]	<ul style="list-style-type: none"> ▪ IO-Link device is compatible with the V1.1 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ The IO-Link master saves the parameter values of the connected IO-Link device; modifications of the parameter values are also saved (observe the note!) ▪ When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.
		[Type compatible V1.1 device with Restore]	<ul style="list-style-type: none"> ▪ IO-Link device is compatible with the V1.1 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ The IO-Link master saves the parameter values of the connected IO-Link device once. ▪ When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.
[Vendor ID]	ID of the manufacturer that is to be validated	0 ... 65535	Factory setting: 0 ifm electronic: 310
[Device ID]	ID of the IO-Link device that is to be validated	0 ... 16777215	Factory setting: 0

- ▶ Save changed values on the device.

8.1.9 Firmware: Reset device to factory settings

7209

When the IO-Link master is reset, all parameters are set to the factory settings:

To reset the device to factory settings:

- ▶ Select [Firmware] menu.
- > The menu page shows the current settings.
- ▶ Click on [Factory Reset] to reset the device.
- > LR DEVICE sets the device to the factory settings.

8.1.10 Firmware: Reboot the device

18105

When rebooting the device, all settings are kept.

To restart the AL1900:

- ▶ Select [Firmware] menu.
- > The menu page shows the current settings.
- ▶ Click on [Reboot] to reboot the device.
- > LR DEVICE reboots the ifm IO-Link master.

8.1.11 Configure IO-Link devices

11033

To configure the IO-Link devices connected to the device with the LR DEVICE parameter setting software:

Requirements:

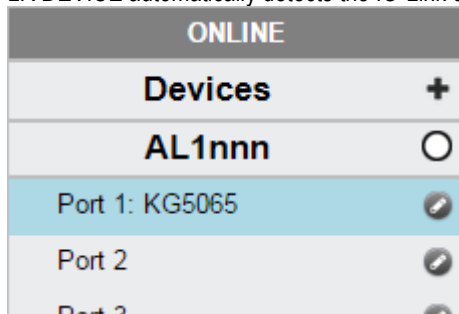
- > IO-Link master is correctly installed and connected to the LR DEVICE parameter setting software.
- > The IO-Link device is correctly connected to the AL1900.
- > Operating mode of the IO-Link port is "IO-Link" (→ **IO-Link ports: Configure operating mode** (→ p. 30)).
- > IoT has write access rights to the IO-Link master (→ **IoT: Configure access rights** (→ p. 26)).

1 Select IO-Link master

- ▶ Start LR DEVICE.
- ▶ Update IODD file library
OR:
Import IODD file of the IO-Link device manually.
- ▶ Scan network for devices.
- > LR DEVICE detects IO-Link master.

2 Add IO-Link device

- ▶ Under [ONLINE]: Click on the required IO-Link master.
- > LR DEVICE automatically detects the IO-Link devices connected to the IO-Link master (e.g. ifm sensor KG5065).



3 Configure IO-Link device

- ▶ Mouse click on the port to which the IO-Link device is connected.
- > LR DEVICE reads and shows the current parameter values of the IO-Link device.
- ▶ Configure IO-Link device.



Information about the available parameters of the IO-Link device: → IO Device Description (IODD) of the IO-Link device

- ▶ Save the changed configuration on the IO-Link device.

8.2 PROFINET

Contents

Install GSD file	35
Add the IO-Link master to the PROFINET network	36
Configure access rights	38
Configure IO-Link ports	39
Configure the PROFINET port.....	40
Configure IO-Link devices	40
Read and write data cyclically	41
PROFINET: Read & write device information	41
PROFINET: Programmers' notes	42

22758

On the field bus side, the device can be configured with the following options:

- PROFINET projection software STEP 7 (version 5.5 SP 4 or higher)
- PROFINET projection software TIA portal



Further information about operation and functions of the PROFINET parameter setting software:

- ▶ Use the help function of the PROFINET projection software!

8.2.1 Install GSD file

22410

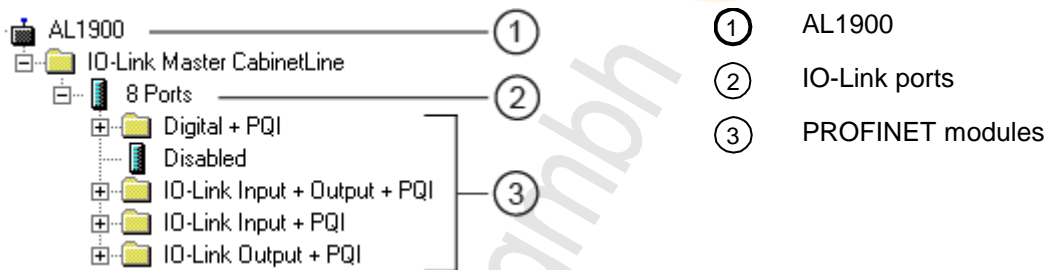
To represent the AL1900 in a field bus projection software (e.g. STEP 7), ifm provides a GSD file. The user can download the GSD file from the ifm website (→ (www.ifm.com)). In the GSD file, all parameters, process data, and their valid value ranges are defined.

To add the AL1900 to the STEP 7 hardware catalogue:

- ▶ Download GSD file of the AL1900 from the ifm website.
- ▶ Start STEP 7 application "HW Config".
- ▶ Select [Options] > [Install GSD files...].
- > The [Install GSD files] window appears.
- ▶ Click on [Browse ...].
- ▶ Select the GSD file of the AL1900 and click on [OK] to adopt the file.
- > The selected GSD file appears in the list.
- ▶ Select the GSD file in the list and click on [Install].
- > STEP 7 installs the GSD file and adds the IO-Link master to the hardware catalogue.

After installation of the GSD file, the AL1900 is in the hardware catalogue in the following folder:

- > [PROFINET IO] > [Additional Field Devices] > [IO] > [ifm electronic]



8.2.2 Add the IO-Link master to the PROFINET network

22406

The configuration of the PROFINET parameters is done via the PROFINET projection software. The PROFINET parameters define which data is transmitted between AL1900 and the higher-level PROFINET controller.

Requirements:

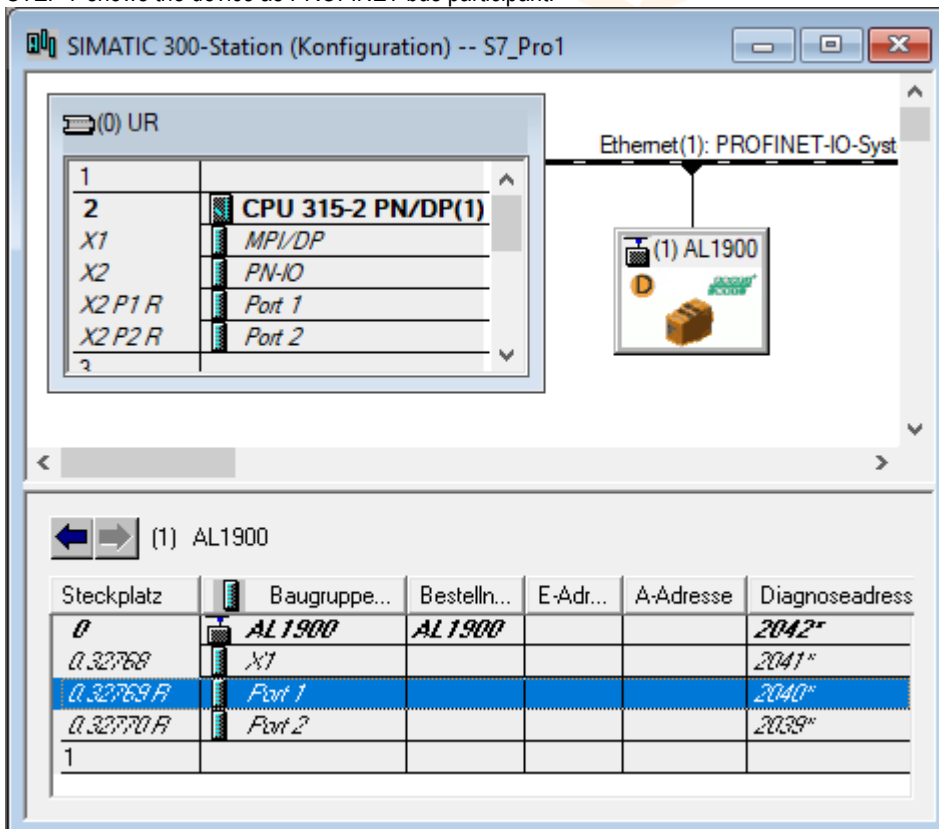
- > PROFINET has read and write permission on the AL1900 (→ **IoT: Configure access rights** (→ p. 26))
- > The GSD file of the AL1900 is installed (→ **Install GSD file** (→ p. 35))

1 Create/open project

- ▶ Create new PROFINET project.
OR
Open an existing PROFINET project.
- ▶ Configure PROFINET connection.

2 Add the IO-Link master to project

- ▶ Open STEP-7 application "HW Config".
- > Program window shows the hardware structure of the project.
- ▶ Open hardware catalogue.
- ▶ Move the [AL1900] node via drag&drop from the hardware catalogue to the PROFINET connection.
- > STEP 7 shows the device as PROFINET bus participant.



3 Add IO-Link ports

- ▶ Move the [8 Ports] node via drag&drop from the hardware catalogue to slot 1 of the AL1900.
- > Step 7 shows available IO-Link interfaces.

The screenshot shows the SIMATIC 300-Station configuration interface. The rack configuration is as follows:

Slot	Module
1	
2	CPU 315-2 PN/DP(1)
X1	MPI/DP
X2	PN-IO
X2 P1 R	Port 1
X2 P2 R	Port 2
3	

The detailed view of the AL1900 module shows the following configuration:

Steckplatz	Baugruppe...	Bestelln...	E-Adr...	A-Adre...	Diagn...	Kom...
0	AL 1900	AL 1900			2042*	
0.32768	X1				2041*	
0.32769 R	Port 1				2040*	
0.32770 R	Port 2				2039*	
1	8 Ports	AL1900			2038*	
1.1	IO-Link Master				2038*	
1.2						
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						

- ▶ Save the project.

© ifm electronic

8.2.3 Configure access rights

22760

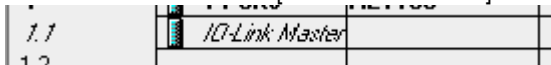
In order to configure the access rights to the device:

1 Open device editor

- ▶ Open STEP-7 application "HW Config".
- > Program window shows the hardware structure of the project.
- ▶ Click on IO-Link master.
- > The device editor shows the current configuration of the IO-Link master.

2 Configure access rights

- ▶ Double click on the slot line [1.1 IO-Link Master]



1.1	IO-Link Master
1.2	

- > The window [Properties IO-Link master] appears.
- ▶ Select [Parameters] tab.
- ▶ Set the following parameter as required: [Access Rights] (→ **Parameter of the IO-Link master** (→ p. 69))
- ▶ Click on [Add] to save the changes.



If parameter [Access Rights] = PROFINET + IoT:

Different parameter settings in the PROFINET projection software and the LR DEVICE may cause undesired system behaviour. Parameter settings applied by the PROFINET projection software always overrule the settings applied by LR DEVICE.



Changes of the parameter [Access Rights] are only effective after restarting the device (→ **Firmware: Reboot the device** (→ p. 32))

8.2.4 Configure IO-Link ports

17306

In STEP 7, the following assignment of the PROFINET slots to the IO-Link ports of the device applies:

Slot	Subslot	IO Link port of AL1900
1	2	X01
	3	X02

	9	X08

Each sub-slot can be configured for cyclic transmission of process data with a PROFINET module. The selected PROFINET module determines the operation type of the IO-link interface and the configurable parameters.

Overview of the available PROFINET modules: → **PROFINET modules** (→ p. [72](#))

To add a PROFINET module to a sub-slot:

1 Open device editor

- ▶ In "HW Config": Click on IO-Link master.
- > The device editor shows the current configuration of the IO-Link master.

2 Add PROFINET module

- ▶ Open hardware catalogue.
- ▶ Drag and drop the required PROFINET module of the IO-Link master from the hardware catalogue to the slot.
- > The device editor shows the slot with the selected PROFINET module.

3 Set parameters of the PROFINET module

- ▶ Double click on the added slot.
- > Window [Properties] appears.
- ▶ Select [Parameters] tab.
- > The page shows the current parameter settings of the IO-Link ports.
- ▶ Set the parameters as required (marked with X in table):

Operating mode of the IO-Link ports	Available parameters						
	Fail Safe Mode	Pattern Value	Validation / Data storage	Vendor ID (VID)	Device ID	Port cycle time	IO-Link Events
DI: Digital input	--	--	--	--	--	--	X
DO: Digital output	X	--	--	--	--	--	X
IO-Link: Input	--	--	X	X	X	X	X
IO-Link: Output	X	X	X	X	X	X	X
IO-Link: Input and output	X	X	X	X	X	X	X



Further information about the parameters of the PROFINET modules: → **Parameters of the IO-Link ports** (→ p. [70](#))

- ▶ Click on [OK] to save the changes.
- > Changed settings are applied.

8.2.5 Configure the PROFINET port

22761

In order to configure the Ethernet interface of the AL1900:

Prerequisites

- > AL1900 is correctly integrated in the PROFINET project (→ **Add the IO-Link master to the PROFINET network** (→ p. 36)).

1 Open object characteristics

- ▶ Start the application "HW Config"
- ▶ Click on AL1900.
- ▶ Select [Target System] > [Ethernet ...] > [Edit Ethernet Users].
- > [Edit Ethernet Users] window appears.

2 Search AL1900

- ▶ Click on [Browse ...] button.
- > [Browse Network] window appears.
- ▶ Click on [Start] button.
- > STEP 7 browses the PROFINET network for devices.
- > List shows found devices.
- ▶ Select AL1900 in list and click [OK] to adopt the device.
- > The [MAC address] shows the MAC address of the AL1900

3 Set IP address and network mask

- ▶ Click on the [Use IP parameters] selection field in group [Set IP configuration].
- ▶ Enter the required IP address in the [IP address] field.
- ▶ Enter the required subnet mask in the [Subnet mask] field.

4 Assign device names

- ▶ Enter the required PROFINET name in the [Device name] field.
- ▶ Click on the [Assign Name] button.
- > STEP 7 assigns the selected name to the AL1900.
- ▶ Click on the [Close] button to close the window.

8.2.6 Configure IO-Link devices

18428

The AL1900 supports the configuration of the connected IO-Link devices out of the PROFINET projection software. The configurable parameters depend on the corresponding IO-Link device. Information about the usable functions: → **PROFINET: Programmers' notes** (→ p. 42)



Available parameters of the IO-Link devices: → Operating instructions of the IO-Link device

8.2.7 Read and write data cyclically

17372



- ▶ To check the validity of the cyclic process data, evaluate the PQI byte (→ **Mapping: IO-Link port information**).

Even with an interruption of the fieldbus connection the PQI byte indicates that the process data is valid. This can have unintended impact on the control process.

- ▶ Take suitable measures to detect an interruption of the fieldbus connection.

8.2.8 PROFINET: Read & write device information

22783

I&M0 provide the user with device-specific basic information. This ensures reliable identification of the device, the device's hardware and software components, and the manufacturer.

The datasets I&M1 to 3 offer the programmer the possibility to store project-specific information on the device.

The programmer can access the I&M0 datasets of the slots 0 and 1 in the PROFINET projection software via the following functions:



Information about the usable function blocks: → **PROFINET: Programmers' notes** (→ p. [42](#))

Further information about the I&M datasets: → **I&M datasets** (→ p. [74](#))

8.2.9 PROFINET: Programmers' notes

12761

The programmer can access on the following data from the PLC application:

- Read device information of the AL1900
- Read diagnostics and alarms
- Set parameters of the connected IO-Link devices

The following sections show the available options.



Further information about the functional/operational blocks: → Help function of the PROFINET projection software

Read and write I&M datasets

2261

Symbol / function block	Meaning	Remarks
GET_IM_DATA / FB	Function block for reading the I&M datasets of a device GET_IM_DATA only supports the reading of the I&M0 dataset	Input parameters: <ul style="list-style-type: none"> ▪ IM_TYPE = 0
RDREC	Function block for acyclic reading of datasets	Input parameters: <ul style="list-style-type: none"> ▪ I&M0: Index = 0xAFF0 ▪ I&M1: Index = 0xAFF1 ▪ I&M2: Index = 0xAFF2 ▪ I&M3: Index = 0xAFF3
WRREC	Function block for acyclic writing of datasets Observe access rights on datasets!	Input parameters: <ul style="list-style-type: none"> ▪ I&M1: Index = 0xAFF1 ▪ I&M2: Index = 0xAFF2 ▪ I&M3: Index = 0xAFF3

Detect diagnostics and alarms

2272

Symbol / operational block	Meaning	Remarks
I/O_FLT1 / OB82	Diagnostic alarms	
I/O_FLT2 / OB83	Pull/plug in alarms	
RACK_FLT / OB86	Module rack failure	



Available alarms and diagnostic messages: → **Diagnostic and alarms** (→ p. [76](#))

Configure IO-Link devices

1860

Symbol / function block	Description	Remarks
IO_LINK_DEVICE / FB5001	Acyclic access to the parameters of an IO-Link device	Input parameters: <ul style="list-style-type: none"> ▪ CAP: Access point for function AL1900: 0xB400 ▪ PORT: HW-ID: Slot/sub-slot of the IO-Link port with connected IO-Link device Port X01: 1 Port X02: 2 ... Port X08: 8 ▪ IOL_INDEX and IOL_SUBINDEX: depends on the IO-Link device (→ operating instructions of the IO-Link device)
IOL_CALL / FB1	Acyclic access to the parameters of an IO-Link devices (obsolete)	→ IO_LINK_DEVICE

8.3 IoT Core

Contents

Configure IoT interface	45
Configure the fieldbus interface	45
Configure IO-Link ports	46
Configure IO-Link devices	46
Set application identification	47
Read / write cyclic process data	47
Read diagnostic data	47
Control IO-Link master	48
Read device information	48
Read information about IO-Link devices	49
Examples	50
Programmers' notes	54

17302



Access to the IoT core only via port<IOL_IoT_Core>.

General notes on the ifm IoT Core: → **Programmers' notes** (→ p. [54](#))

The AL1900 is of type device (→ **Overview: IoT types** (→ p. [81](#))).

It has the following sub-structures:

Structure	Contents
processdatamaster	<ul style="list-style-type: none"> Diagnostic data (temperature, voltage, current) Status of the current / voltage supply
deviceinfo	Device identification
timer[1]	Subscribe to data
timer[2]	Subscribe to data
iotsetup	Parameters of the IoT port (access rights, IP settings, IP settings of the LR SMARTOBSERVER)
fieldbussetup	Parameters of the fieldbus port (IP settings, device identification in fieldbus projection software)
iolinkmaster/port[n]	<ul style="list-style-type: none"> Parameters of the IO-Link port (operating mode, transmission rate, cycle time, validation and data storage) Digital input data (clamp 2) Port event
iolinkmaster/port[n]/iolinkdevice	<ul style="list-style-type: none"> Status information IO-Link devices on the IO-Link port Device information of the IO-Link device Process data on input/output Application-specific identification
firmware	<ul style="list-style-type: none"> Firmware of the device Reset devices Reboot the device

The user can request the available data points and services in the substructures with `gettree`(→ **Service: `gettree`** (→ p. [82](#))). The service returns the device description as tree structure. It shows the services supported by a data point: In the sub-element "subs" each data point lists all services that can be applied to it.

8.3.1 Configure IoT interface

16540

The parameters of the IoT port X23 are saved in the `iotsetup` substructure. The user can access the following data points:

Name	Description	Access
<code>iotsetup/accessrights</code>	Access rights to the IO-Link master <ul style="list-style-type: none"> ▪ 0 = PROFINET + IoT ▪ 1 = PROFINET + IoT (read only) ▪ 2 = IoT only 	rw
<code>iotsetup/smobip</code>	IP address of the LR SMARTOBSERVER	rw
<code>iotsetup/smobport</code>	Port number of the LR SMARTOBSERVER	rw
<code>iotsetup/smobinterval</code>	Cycle time for data transmission to LR SMARTOBSERVER (value in milliseconds)	rw
<code>iotsetup/network/dhcp</code>	Configuration of the IP settings of the IoT port <ul style="list-style-type: none"> ▪ 0 = STATIC_IP/OFF ▪ 1 = DHCP/ON 	rw
<code>iotsetup/network/ipaddress</code>	IP address of the IoT port	rw
<code>iotsetup/network/subnetmask</code>	Subnet mask of the network segment	rw
<code>iotsetup/network/ipdefaultgateway</code>	IP address of the network gateway	rw

rw ... read and write



Data point [`iotsetup/accessrights`]:

Different parameter settings in the PROFINET projection software and the IoT applications can result in undesired system behaviour. The values set in the PROFINET projection software apply.

8.3.2 Configure the fieldbus interface

12741

The parameter of the fieldbus interface (ports X21/X22) are stored in the sub-structure `fieldbussetup`. The user can access the following data points:

Name	Description	Access
<code>fieldbussetup/hostname</code>	Name of the IO-Link master in the fieldbus project	rw
<code>fieldbussetup/fieldbusfirmware</code>	Firmware version of the IO-Link master	r
<code>fieldbussetup/network/macaddress</code>	MAC address of the fieldbus interface	r
<code>fieldbussetup/network/ipaddress</code>	IP address of the fieldbus interface	rw
<code>fieldbussetup/network/subnetmask</code>	Subnet mask of the network segment	rw
<code>fieldbussetup/network/ipdefaultgateway</code>	IP address of the network gateway	rw
<code>fieldbussetup/connectionstatus</code>	Status of the connection to the PROFINET network	r

r ... read only

rw ... read and write

8.3.3 Configure IO-Link ports

16454

Parameters of the IO-Link ports of the IO-Link master are saved in the `iolinkmaster/port[n]` substructure. There are the following data points for each IO-Link-Port X01...X08 :

Name	Description	Access
<code>iolinkmaster/port[n]/senddatatosmob</code>	Send process data to LR SMARTOBSERVER	rw
<code>iolinkmaster/port[n]/mastercycletime_preset</code>	Cycle time of the data transfer at the IO-Link port (value in microseconds)	rw
<code>iolinkmaster/port[n]/mastercycletime_actual</code>	Current cycle time of the data transfer at the IO-Link port (value in microseconds)	r
<code>iolinkmaster/port[n]/portevent</code>	Activity indication	rw
<code>iolinkmaster/port[n]/mode</code>	Operating mode of the IO-Link port	rw*
<code>iolinkmaster/port[n]/comspeed</code>	Data transfer rate of the IO-Link port	rw
<code>iolinkmaster/port[n]/validation_datastorage_mode</code>	Response of the IO-Link port when a new IO-Link device is connected	rw*
<code>iolinkmaster/port[n]/validation_vendorid</code>	IO-Link ID of the manufacturer that is to be validated	rw*
<code>iolinkmaster/port[n]/validation_deviceid</code>	IO-Link ID of the device that is to be validated	rw*

n ... 1...8)

r = read only

rw ... read and write

* ... only available if PROFINET PLC is separated from the device

8.3.4 Configure IO-Link devices

11002

The ifm IoT Core supports the configuration of the connected IO-Link devices. A parameter is accessed via IO-Link index and subindex (→ IO Device Description (IODD) of the device)

The user can use the following services:

Service	Description	Access
<code>iolinkmaster/port[n]/iolinkdevice/iolreadacyclic</code>	Acyclic reading of a parameter of an IO-Link device	r
<code>iolinkmaster/port[n]/iolinkdevice/iolwriteacyclic</code>	Acyclic writing of a parameter of an IO-Link device	rw

n ... 1...8

r = read only

rw ... read and write

8.3.5 Set application identification

16580

The application name of the IO-Link master is saved in the `devicetag` substructure. The user can access the following data points:

Name	Description	Access
<code>devicetag/applicationtag</code>	Name of the IO-Link master in the fieldbus project (application tag)	rw

rw ... read and write

8.3.6 Read / write cyclic process data

10994

Cyclic process data of the IO-Link ports X01...X08 is saved in the `iolinkmaster/port[n]` substructure. The user can access the following data points:

Name	Description	Access
<code>iolinkmaster/port[n]/pin2in</code>	Digital input signal to clamp 2 of the IO-Link port n	r
<code>iolinkmaster/port[n]/iolinkdevice/pdin</code>	IO-Link input signal at clamp 4 of the IO-Link port n	r
<code>iolinkmaster/port[n]/iolinkdevice/pdout</code>	IO-Link output signal at clamp 4 of the IO-Link port n	rw*

n ... 1...8

r = read only

rw ... read and write

* ... only available if PROFINET PLC is separated from the device

8.3.7 Read diagnostic data

16571

Diagnostic data is saved in the `processdatamaster` substructure. The user can access the following data points:

Name	Description	Access
<code>processdatamaster/temperature</code>	Temperature of the IO-Link master (value in °C)	r
<code>processdatamaster/voltage</code>	Voltage applied (value in V)	r
<code>processdatamaster/current</code>	Current (value in A)	r
<code>processdatamaster/supervisionstatus</code>	Diagnostic information of the device supply <ul style="list-style-type: none"> ▪ 0 = no error ▪ 1 = short circuit ▪ 2 = overload ▪ 3 = undervoltage 	r

r = read only

8.3.8 Control IO-Link master

17963

The device can be controlled via the following services:

Service	Description	Access
firmware/version	Firmware version of the IO-Link master	r
firmware/reboot	Reboot IO-Link master	rw
firmware/signal	Identify IO-Link master	rw
firmware/factoryreset	Reset IO-Link master to factory settings	rw

r ... read only
 rw ... read and write

8.3.9 Read device information

17133

Device information is saved in the deviceinfo substructure. The user can access the following data points:

Name	Description	Access
deviceinfo/productcode	Article Number	r
deviceinfo/vendor	Vendor	r
deviceinfo/devicefamily	Device family	r
deviceinfo/hwrevision	Hardware revision	r
deviceinfo/serialnumber	Serial number	r
deviceinfo/swrevision	Firmware version	r
deviceinfo/bootloaderrevision	Bootloader revision	r
deviceinfo/extensionrevisions		r
deviceinfo/fieldbustype	Fieldbus	r

r = read only

Additional information about the AL1900 can be read with the getidentity service (→ **Service: getidentity** (→ p. 84)).

8.3.10 Read information about IO-Link devices

16553

Information about an IO-Link device connected via an IO-Link port is saved in the `iolinkmaster/port[n]/iolinkdevice/` substructure. The user can access the following data points:

Name	Description	Access
<code>iolinkmaster/port[n]/iolinkdevice/status</code>	Status of the connected IO-Link device 0 = SENSOR_NOT_CONNECTED 1 = SENSOR_IN_PREOPERATE 2 = SENSOR_IN_OPERATE 3 = SENSOR_WRONG	r
<code>iolinkmaster/port[n]/iolinkdevice/vendorid</code>	IO-Link ID of the manufacturer	r
<code>iolinkmaster/port[n]/iolinkdevice/deviceid</code>	IO-Link ID of the IO-Link device	r
<code>iolinkmaster/port[n]/iolinkdevice/productname</code>	Product name of the IO-Link device	r
<code>iolinkmaster/port[n]/iolinkdevice/serial</code>	Serial number of the IO-Link device	r
<code>iolinkmaster/port[n]/iolinkdevice/applicationspecifictag</code>	Device-specific identification (application tag)	rw

n ... 1...8

r ... read only

rw ... read and write

8.3.11 Examples

Contents

Example: Read process data of an IO-Link device	50
Example: Read several parameter values of the IO-Link master simultaneously.....	51
Example: Change name of the IO-Link master	51
Example: Read the parameter value of an IO-Link device.....	52
Example: Change the parameter value of an IO-Link device.....	52
Example: Subscribe to event.....	53

16577

Example: Read process data of an IO-Link device

16574

Task: Read the current measured value of the ifm temperature sensor TN2531 at IO-Link port X06

Solution: Read the data point for the process input data with the `getdata` service.

- **Request object:**

```
{  
  "code":10,  
  "cid":4711,  
  "adr":"/iolinkmaster/port[6]/iolinkdevice/pdin/getdata"  
}
```

- **Return object:**

```
{  
  "cid":4711,  
  "data":{"value": "03C9"},  
  "code":200  
}
```

The return value is given in hexadecimal format. Besides the temperature value the return value comprises additional information (→ IO Device Description (IODD) of the sensor). The temperature value is shown in bits 2 to 15.

0x03C9 = 0b1111001001

Temperature value: 0b11110010 = 242

Therefore: The current temperature value is 24.2 °C.

Example: Read several parameter values of the IO-Link master simultaneously

17310

Task: The following current values are to be read by the IO-Link master. Temperature, serial number

Solution: Read the current parameter values using the `getdatamulti` service (data point temperature: `/processdatamaster/temperature`; data point serial number: `/deviceinfo/serialnumber`)

- **Request object:**

```
{
  "code":10,
  "cid":4711,
  "adr":"/getdatamulti",
  "data":{"datatosend":["/processdatamaster/temperature","/deviceinfo/serialnumber"]}
}
```

- **Return object:**

```
{
  "cid":4711,
  "data":{"processdatamaster/temperature":{"code":200,"data":44},
  "deviceinfo/serialnumber":{"code":200,"data":"000174210147"}},
  "code":200
}
```

Example: Change name of the IO-Link master

10987

Task: Set the name of the IO-Link master to AL1900 for the representation in the LR SMARTOBSERVER.

Solution: Change the parameter [Application Tag] with the `setdata` service to the value [AL1900].

The data point of the parameter [Application Tag] in the device description object is `/devicetag/applicationtag`.

- **Request object:**

```
{
  "code":10,
  "cid":4711,
  "adr":"/devicetag/applicationtag/setdata",
  "data":{"newvalue":"AL1900"}
}
```

- **Return object:**

```
{"cid":4711,"code":200}
```

Example: Read the parameter value of an IO-Link device

16546

Task: Read the serial number of the ifm temperature sensor TN2531 at IO-Link port X02

Solution: Read the serial number with the `iolreadacyclic` service from the IO-Link device (index: 21, subindex: 0)

- **Request object:**

```
{
  "code":10,
  "cid":4711,
  "adr":"/iolinkmaster/port[2]/iolinkdevice/iolreadacyclic",
  "data":{"index":21,"subindex":0}
}
```

- **Return object:**

```
{
  "cid":4711,
  "data":{"value":"4730323134323830373130"},
  "code":200
}
```

The returned value is given in hexadecimal format. The conversion of the HEX value in a STRING value is: G0214280710

Example: Change the parameter value of an IO-Link device

16578

Task: Set the output configuration OUT1 of the ifm temperature sensor TN2531 at IO-Link port X02 to the value "Hnc / hysteresis function, normally closed".

Solution: Change the parameter [ou1] of the sensor to the value 4 using the `iolwriteacyclicdata` service. The parameter can be accessed via IO-Link index 580, subindex 0 (→ IO-Link description of the sensor).

- **Request object:**

```
{
  "code":10,
  "cid":4711,
  "adr":"/iolinkmaster/port[2]/iolinkdevice/iolwriteacyclic",
  "data":{"index":580,"subindex":0,"value":"34"}
}
```

The value has to be given in hexadecimal format. The conversion of the STRING value in a HEX value is: 34.

- **Response object:**

```
{
  "cid":4711,
  "code":200
}
```

Example: Subscribe to event

17946

Task: The current values of the following parameters should be sent regularly to a network server with IP address 192.168.0.4: product name of the IO-Link device at IO-Link port X02, cyclic input data of the IO-Link device at IO-Link port X02 and the operating temperature of the IO-Link master.

Solution: Subscribe to the required data using the subscribe service.

- **Request object:**

```
{
"code":80,
"cid":4711,
"adr":"/timer[1]/counter/datachanged/subscribe",
"data":{"callback":"http://192.168.0.44/temp",
"datatosend":[
"/iolinkmaster/port[2]/iolinkdevice/productname",
"/iolinkmaster/port[2]/iolinkdevice/pdin",
"/processdatamaster/temperature"]
}
}
```

Additionally the interval of the timer[1] has to be set to a value between 500 ms and 2147483647 ms.

- **Request object:**

```
{
"code":10,
"cid":4712,
"adr":"/timer[1]/interval/setdata",
"data":{"newvalue":500}
}
```

- **Response object**

```
{
"cid":4712,
"code":200
}
```

8.3.12 Programmers' notes

Contents	
ifm IoT Core: General information	54
Device description	54
Access ifm-IoT Core	55
IoT Core: Diagnostic codes	57

10989

ifm IoT Core: General information

16576

The CabinetLine device family has one IoT Core. This component allows the user to address the IO-Link master from IT networks and to integrate it into Internet-of-Things applications.

The IoT Core provides the user with the following functions:

- Control device
- Monitoring of process data
- Read / write parameters of the IO-Link master
- Read / write parameters of the connected IO-Link devices
- Collect diagnostic data

Device description

14411

The IoT Core creates a device description on the AL1900. This device description is a structured, machine-readable data object in JSON format. All current values of parameters, diagnostic data and device information are mapped in this data object. The user can access this data object from IT networks.

The complete device description can be read using the `gettree` (→ service **Service: gettree** (→ p. [82](#))).

Access ifm-IoT Core

17561



To activate the changes of the parameter values the IoT Core must have the respective write access rights to the IO-Link master (→ Parameter [Access Rights]).

The ifm IoT Core supports HTTP requests. The following request methods are available.

GET method

21300

Using the GET method the user has read access to a data point.

The syntax of the request to the IoT Core is:

ip/datapoint/service

Description	Description
ip	IP address of the IoT port X23 of the IO-Link master
data_point	Data point which is to be accessed
service	Service

The syntax of the return of the IoT Core is:

```
{  
  "cid":id,  
  "data":{"value":resp_data},  
  "code":err_code  
}
```

parameter	Description
id	Correlation ID for the assignment of request and return
resp_data	Value of the data point; depending on the data type of the data point
err_code	Error code (→ IoT Core: Diagnostic codes (→ p. 57))

Example:

Request (via browser): 192.168.0.250/devicetag/applicationtag/getdata

Return: {"cid":-1,"data":{"value":"AL1900"}, "code":200}

POST method

16548

Using the POST method the user has read and write access to a data point. A form with the required information is transferred to the IP address of the IO-Link master (IoT port X23).

The syntax of the request to the IoT Core is:

```
{
"code":code_id,
"cid":id,
"adr":"data_point/service",
"data":{req_data}
}
```

Parameter	Description
code_id	ID of the service class
	10 Request
	11 Transaction
	80 Event
id	Correlation ID for the assignment of request and return
data_point	Data point which is to be accessed
service	Service to be performed (→ Overview: IoT services (→ p. 82))
req_data	Data to be transferred to the IoT Core (e.g. new values); indication optional (depending on the service)

The syntax of the return of the IoT Core is:

```
{
"cid":id,
"data":{"value":resp_data},
"code":err_code
}
```

Parameter	Description
id	Correlation ID for the assignment of request and return
resp_data	Value of the data point; depending on the data type of the data point
err_code	Error code (→ IoT Core: Diagnostic codes (→ p. 57))

Example:

Request: {"code":10,"cid":4711, "adr":"devicetag/applicationtag/getdata"}

Return: {"cid":4711,"data":{"value":"AL1900"}, "code":200}

IoT Core: Diagnostic codes

17437

The ifm IoT Core uses the following diagnostic codes:

Code	Description
200	OK
230	OK; but reboot required
231	OK, but block request not yet terminated
232	Data accepted but changed internally
233	IP settings changed; application has to reboot the device; Wait for min. 1 second before the device is rebooted
400	Invalid request
403	Unauthorised access
500	Internal server fault
503	Service not available
530	Requested data is invalid
531	IO-Link error
532	Error in PLC

9 Operation

Contents

Firmware update.....	58
Web interface: Read device and diagnostic information	59
Replace IO-Link device	60

22368

9.1 Firmware update

16582

The new firmware is installed via the device's web interface.



If the firmware update is not successful, deactivate all connections to the PROFINET PLC, LR SMARTOBSERVER and LR DEVICE and repeat the process.

- ▶ Close connection to PROFINET PLC.
- ▶ Set the parameter [IP address SmartObserver] to 255.255.255.255 or 0.0.0.0 (→ **IoT: Configure the interface to the LR SMARTOBSERVER** (→ p. 28)).
- ▶ Stop the LRAgent.LRDevice service in the Windows task manager.

After the firmware update check the settings of the LR SMARTOBSERVER interface!

To install a new firmware version on the device:

Requirements

- > Zip file with new firmware has been downloaded and unpacked.
- > Ethernet connection between laptop/PC and device is established.

1 Call up web interface

- ▶ Start web browser.
- ▶ Enter the following into the address field of the browser and press [ENTER] to confirm:
http://<IP address of the device>/update
- > Web browser shows the [Firmware Update] page.

2 Load new firmware to AL1900

- ▶ Click on [Search...].
- > Dialogue window appears.
- ▶ Select the firmware file (.bin) and click on [Open] in order to adopt the file.
- ▶ Click on [Submit] to start the firmware update.
- > Firmware is being loaded to the device.
- > After successful storage, the success message is displayed.

3 Restart the device

- ▶ Click on [Restart device now] to restart the device.
- > The status LED RDY flashes quickly.
- > Firmware is updating.
- ▶ Follow the instructions in the browser.

9.2 Web interface: Read device and diagnostic information

12744

In order to read the diagnostic information about the current device status via the web interface:

- ▶ Connect laptop/PC and AL1900 via the Ethernet internet.
- ▶ Start web browser.
- ▶ Enter the IP address of the AL1900 into the address field of the browser and press [ENTER] to confirm.
- > Web browser shows the web interface of the device.
- > The page shows the following data:
 - Table with connected IO-Link devices

Name	Description
[Port]	Number of the IO-Link interface
[Mode]	Operating mode of the IO-Link interface
[Comm. Mode]	Baud rate of the IO-Link interface
[MasterCycleTime]	Cycle time
[Vendor ID]	ID of the manufacturer of the IO-Link device
[Device ID]	ID of the IO-Link device
[Name]	Article number of the IO-Link device <ul style="list-style-type: none"> ▪ For ifm articles: This article number is stored along with a link to the produkt page on the ifm website.
[Serial]	Serial number of the IO-Link device
[LR Mode / Interval]	Cycle time for the communication with the SmartObserver

- Diagnostic information of the device

Name	Description
[SW-Version]	
[Current]	Current (in mA)
[Voltage]	Voltage (in mV)
[Short Circuit]	Number of detected short circuits
[Overload]	Number of detected overloads
[Undervoltage]	Number of detected under voltages
[Temperature]	Device temperature (in °C)

- Version information of the installed firmware components

Name	Description
[Firmware]	Firmware version
[Container]	Version of the firmware container
[Bootloader Version]	Version of the boot loader
[Fieldbus Firmware]	Version of the PROFINET firmware

9.3 Replace IO-Link device

7775

To replace an IO-Link device:

Requirement:

- > IO-Link device is with factory settings.
- > IO-Link device supports IO-Link standard 1.1 or higher.

1 Set data storage

- ▶ Set the following parameters of the IO-Link port:
Validation and Data Storage = [Type compatible V1.1 device with Restore]
- ▶ Save changes.

2 Replace IO-Link device

- ▶ Disconnect old IO-Link device from IO-Link master.
- ▶ Connect new IO-Link device with the same IO-Link port of the AL1900.
- > IO-Link master copies parameter values from the data memory to the new IO-Link device.

10 Maintenance

21577

The operation of the unit is maintenance-free.

- ▶ Clean the surface of the unit when necessary. Do not use any caustic cleaning agents for this!
- ▶ After use, dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.



11 Factory settings

16542

In the factory settings, the device has the following parameter settings:

Parameter	Factory setting
[IP address] (PROFINET)	0.0.0.0
[Subnet mask] (PROFINET)	0.0.0.0
[IP gateway address] (PROFINET)	0.0.0.0
[IP address] (IoT interface)	169.254.X.X
[Subnet mask] (IoT interface)	255.255.0.0
[IP gateway address] (IoT interface)	0.0.0.0
[PROFINET name]	blank
Data memory (Data Storage)	blank

12 Accessories

17853

List of accessories of AL1900: → www.ifm.com > Product page > Accessories



13 Appendix

Contents

Technical data	65
PROFINET	69
ifm IoT Core	77

7156

13.1 Technical data

Contents

Application	65
Electrical data	65
Inputs / outputs	65
Inputs	66
Outputs	66
Interfaces	66
Environmental conditions	67
Approvals / tests	67
Mechanical data	67
Electrical connection.....	68

9011

13.1.1 Application

23710

Application	
Application	I/O modules for control cabinet
Daisy-chain function	Fieldbus interface

13.1.2 Electrical data

22819

Electrical data	
Operating voltage [V]	20...30 DC; (US; to SELV/PELV)
Current Consumption [mA]	300...3900; (US)
Protection class	III
Sensor supply US	
Max. current load total [A]	3.6

13.1.3 Inputs / outputs

23711

Inputs / outputs	
Total number of inputs and outputs	16; (configurable)

13.1.4 Inputs

22820

Inputs	
Number of digital inputs	16; (IO-Link Port Class A: 8 x 2)
Switching level high [V]	11...30 DC
Switching level low [V]	0...5 DC
Digital inputs protected against short circuits	yes

13.1.5 Outputs

22821

Outputs (digital)	
Output function	8; (IO-Link Port Class A: 8 x 1)
Max. current load per output [mA]	200
Short-circuit protection	yes

13.1.6 Interfaces

10921

Interfaces	
Communication interface	Ethernet; IO-Link
Communication interface	IO-Link; TCP/IP; PROFINET IO
Ethernet	
Transmission standard	10Base-T; 100Base-TX
Transmission rate [MBit/s]	10; 100
Protocol	TCP/IP; PROFINET IO
Factory settings	<ul style="list-style-type: none"> ▪ IP address: 0.0.0.0 ▪ Subnet mask: 0.0.0.0 ▪ Gateway IP address: 0.0.0.0 ▪ MAC address: see type label
IO-Link master	
Type of transmission	COM 1 / COM 2 / COM 3
IO-Link revision	V1.1
Number of ports Class A	8
IoT interface	
Transmission standard	10Base-T; 100Base-TX
Transmission rate [Mbits/s]	10; 100
Protocol	DCP, DCHP, Auto IP
Factory settings	<ul style="list-style-type: none"> ▪ IP address: 169.254.X.X ▪ Subnet mask: 255.255.0.0 ▪ Gateway IP address: 0.0.0.0 ▪ MAC address: see type label

13.1.7 Environmental conditions

17862

Environmental conditions	
Applications	Control cabinet
Ambient temperature [°C]	-25...65
Storage temperature [°C]	-25...85
Max. perm. relative air humidity [%]	90, linearly decreasing to 50 % (40 °C)
Max. height above sea level [m]	2000
Protection	IP 20
Degree of soiling	2

13.1.8 Approvals / tests

22824

Approval / tests	
EMC	<ul style="list-style-type: none"> ▪ EN 61000-6-2 ▪ EN 61000-6-4
MTTF [Years]	90

13.1.9 Mechanical data

22825

Mechanical data	
Weight [g]	324.2
Materials	Housing: PA

13.1.10 Electrical connection

11030

Voltage supply IN X31	
Plug and socket connection	COMBICON
Wiring	1: GND (US) 2: GND (US) 3: + 24 V DC (US) 4: + 24 V DC (US)
Process connection IO-Link ports Class A X01...X0<IOL_AnzPorts>	
Plug and socket connection	COMBICON
Wiring	1: Sensor supply (US) L+ 2: DI 3: Sensor supply (US) L- 4: C/Q IO-Link
Ethernet IN / OUT X21, X22	
Plug and socket connection	RJ-45
IoT X32	
Plug and socket connection	RJ-45

13.2 PROFINET

Contents

Parameter data	69
Cyclic data	72
Acyclic data	74

22433

13.2.1 Parameter data

1630

Slot	Subslot	Name	Description
1	1	Master	Parameter data of the IO-Link master (→ Parameter of the IO-Link master (→ p. 69))
	2	Port X01	<ul style="list-style-type: none"> ▪ Parameter data of the IO-Link ports (→ Parameters of the IO-Link ports (→ p. 70)) ▪ modules (→ PROFINET modules (→ p. 72))
	3	Port X02	
	4	Port X03	
	5	Port X04	
	6	Port X05	
	7	Port X06	
	8	Port X07	
	9	Port X08	

Parameter of the IO-Link master

22788

Parameter	Description	Possible values	
[Access Rights]	The access rights to the parameter data, process data and events/diagnostic messages of the IO-Link master and the connected IO-Link devices	PROFINET + LineRecorder	<ul style="list-style-type: none"> ▪ PROFINET and LR DEVICE have read and write access rights to parameters and process data ▪ PROFINET and LR DEVICE have read access rights to events/alarms
		PROFINET + LineRecorder (ro)	<ul style="list-style-type: none"> ▪ PROFINET has read and write access rights to parameters and process data ▪ PROFINET has read access rights to events/alarms ▪ LR DEVICE only has read access rights to parameters, process data and events/alarms
		PROFINET only	<ul style="list-style-type: none"> ▪ PROFINET has read and write access rights to parameters and process data ▪ PROFINET has read access rights to events/alarms ▪ LR DEVICE has no access rights (parameters, process data, events/alarms, web interface, firmware update)
		keep setting	keeps settings

Parameters of the IO-Link ports

22787

Parameter	Description	Possible values	
[Fail-safe mode]	Behaviour in case the PROFINET connection is interrupted	No Fail Safe	deactivated
		Fail Safe Reset Value	reset to default values
		Fail Safe Old Value	maintain the most recent valid process value
		Fail Safe with Pattern	set user-defined values
[Pattern Value]*	<ul style="list-style-type: none"> required values for the process data in case the connection is interrupted (as hexadecimal value) Pattern depends on the size of the selected PROFINET module 	Per byte: 0x00 ... 0xFF	
[Port cycle time]	Cycle time of the data transmission at the IO-Link port	as fast as possible	The device automatically sets the fastest possible cycle time
		2.0 ms ... 128.0 ms	2 milliseconds ... 128 milliseconds
[Validation / Data Storage]	Supported IO-Link standard and behaviour of the AL1900 when a new IO-Link device is connected to the IO-Link port	no check and clear	<ul style="list-style-type: none"> no verification of the vendor ID and device ID no data storage
		Type compatible V1.0 device	<ul style="list-style-type: none"> IO-Link device is compatible with the V1.0 IO-Link standard Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) no data storage
		Type compatible V1.1 device	<ul style="list-style-type: none"> IO-Link device is compatible with the V1.1 IO-Link standard Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) no data storage
		Type compatible V1.1 device with Backup + Restore	<ul style="list-style-type: none"> IO-Link device is compatible with the V1.1 IO-Link standard Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) The IO-Link master saves the parameter values of the connected IO-Link device; modifications of the parameter values are also stored (→ observe the note!) When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.

Parameter	Description	Possible values	
		Type compatible V1.1 device with Restore	<ul style="list-style-type: none"> ▪ IO-Link device is compatible with the V1.1 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ The IO-Link master stores the parameter values of the connected IO-Link device once if the data memory of the AL1900 is empty. ▪ When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.
[Vendor ID (VID)]	ID of the manufacturer that is to be validated	0 ... 65535	ID of the manufacturer of the IO-Link device (ifm electronic: 310)
[Device ID]	ID of the IO-Link device that is to be validated	0 ... 16777215	ID of the IO-Link device
[IO-Link Events]	Enable / disable the transmission of IO-Link events	Disabled	IO-Link won't be transmitted
		Enabled	IO-Link events will be transmitted

* ... settings are only valid if [Fail Safe Mode] = Fail Safe with Pattern



If the parameter values of an IO-Link device are changed with IO_LINK_DEVICE, the backup mechanism remains ineffective. The changed parameter values are not stored on the IO-Link master.

13.2.2 Cyclic data

Contents

PROFINET modules	72
PQI (Port Qualifier Information)	73

22429

PROFINET modules

22685

Module	Description	
IO-Link 32I/32O + PQI	IO-Link activated	32 bytes input and output data and PQI
IO-Link 16I/16O + PQI		16 bytes input and output data and PQI
IO-Link 8I/8O + PQI		8 bytes input and output data and PQI
IO-Link 4I/4O + PQI		4 bytes input and output data and PQI
IO-Link 2I/ 2O + PQI		2 bytes input and output data and PQI
IO-Link 1I/1O + PQI		1 byte input and output data and PQI
IO-Link 1I/15O + PQI		1 byte input and 15 bytes output data and PQI
IO-Link 32I + PQI		32 bytes input data and PQI
IO-Link 16I + PQI		16 bytes input data and PQI
IO-Link 8I + PQI		8 bytes input data and PQI
IO-Link 4I + PQI		4 bytes input data and PQI
IO-Link 2I + PQI		2 bytes input data and PQI
IO-Link 1I + PQI		1 bytes input data and PQI
IO-Link 32O + PQI		32 bytes output data and PQI
IO-Link 16O + PQI		16 bytes output data and PQI
IO-Link 8O + PQI		8 bytes output data and PQI
IO-Link 4O + PQI		4 bytes output data and PQI
IO-Link 2O + PQI		2 bytes output data and PQI
IO-Link 1O + PQI		1 bytes output data and PQI
DI + PQI		IO-Link deactivated
DO + PQI	Digital output and PQI	
Disabled	deactivated	

PQI (Port Qualifier Information)

22686

Port Qualifier Information (PQI) contains diagnostic information about the IO-Link port. In addition to the process data, the IO-Link master sends the PQI to the PROFINET controller.

Bit							
7	6	5	4	3	2	1	0
PQ	DE	DA	--	--	--	DI2	DI4

Legend:

- [DI4] Signal status of the digital input on clamp 4 (DI)

FALSE	OFF
TRUE	ON
- [DI2] Signal status of the digital input on clamp 2 (if used)

FALSE	OFF
TRUE	ON
- [DA] Device Available: shows if the IO-Link device has been recognised and if the device is in the "preoperate" or in the "operate" state

FALSE	no device
TRUE	device detected
- [DE] Device Error: shows if an error or a warning occurred; Note: The user needs to determine the cause of the fault separately via acyclic services.

FALSE	no error
TRUE	error detected
- [PQ] Port Qualifier: shows if IO data is valid

FALSE	invalid
TRUE	valid

13.2.3 Acyclic data

Contents	
I&M datasets.....	74
Diagnostic and alarms.....	76

22427

I&M datasets

22778

The AL1900 supports the following I&M datasets (I&M = Identification & Maintenance):

I&M0 (Slot 0)

22779

Variable	Description	Access*	Size
Vendor ID	IO-Link ID of the manufacturer	r	2
OrderID	Order number of the device (numbers are separated by blanks)	r	20
Serial number	Serial number of the device (numbers separated by blanks)	r	16
Hardware revision	Hardware revision of the device	r	2
Software revision prefix	Prefix of the software revision of the device (V, R, P, U or T)	r	1
Software Revision	Software revision (numbers separated by blanks, e.g. x y z in "Vx.y.z")	r	3
Revision Counter	Revision counter; is incremented with each parameter change	r	2
Profile ID	ID of sub-module profile (Slot 0: 0x0000)	r	2
Profile Specific Type	additional value for profile ID; 0, if not used	r	2
IMVersion	I&M version (default value: 0x0101)	r	2
IMSupported	Supported I&M datasets (0x1110 for I&M1-3)	r	2

* ... r = only read

I&M1 (Slot 0)

22765

Variable	Description	Access*	Size
TagFunction of submodule	function of the device (ASCII, padded with spaces)	r/w	32
TagLocation of submodule	Location of the device in the plant (ASCII, padded with spaces)	r/w	22

* ... r/w = read and write

I&M2 (Slot 0)

22780

Variable	Description	Access*	Size
Installation_Date	Installation date of the device (ASCII, padded with spaces)	r/w	16
	reserved	r/w	38

* ... r/w = read and write

I&M3 (Slot 0)

22781

Variable	Description	Access*	Size
Descriptor	Description of the device (ASCII, padded with spaces)	r/w	54

* ... r/w = read and write

I&M0 (Slot 1)

22782

Variable	Description	Access*	Size
Vendor ID	IO-Link ID of the manufacturer	r	2
OrderID	Order number of the device (numbers are separated by blanks)	r	20
Serial number	Serial number of the device (numbers separated by blanks)	r	16
Hardware revision	Hardware revision of the device	r	2
Software revision prefix	Prefix of the software revision of the device (V, R, P, U or T)	r	1
SOFTWARE_REVISION	Software revision (numbers separated by blanks, e.g. x y z in "Vx.y.z")	r	3
REVISION_COUNTER	Revision counter; is incremented with each parameter change	r	2
Profile ID	ID of the sub-module profile (Slot 1: 0x4E01 = IO-Link)	r	2
Profile Specific Type	additional value for profile ID; 0, if not used	r	2
IMVersion	I&M version (default value: 0x0101)	r	2
IMSupported	Supported I&M datasets (0x0E for I&M1-3)	r	2

* ... r = only read

Diagnostic and alarms

22784

ECD code	Name	Description	Type
0x02	EVNT_CODE_M_PDU_CHECK	Receive frame with CRC error	Alarm
0x1B	EVNT_CODE_S_RETRY	Repetitions detected	Alarm
0x1E	EVNT_CODE_P_SHORT	Short circuit on C/Q cable detected	Diagnostics
0x1F	EVNT_CODE_P_SENSOR	Error in the sensor supply	Diagnostics
0x20	EVNT_CODE_P_ACTOR	Error in the actuator supply	Diagnostics
0x21	EVNT_CODE_P_POWER	Error in the power supply of the IO-Link master	Diagnostics
0x28	EVNT_CODE_DSREADY_NOACTION	Data storage completed, but no action, since CRC was correct	Alarm
0x29	DS_FAULT_IDENT	Sensor does not match the content of the data memory	Alarm
0x2A	DS_FAULT_SIZE	Sensor parameters too large for data memory	Alarm
0x2B	DS_FAULT_UPLOAD	Error during data memory transmission from the sensor	Alarm
0x2C	DS_FAULT_DOWNLOAD	Error during data memory transmission to the sensor	Alarm
0x2F	DS_FAULT_DEVICE_LOCKED	Error during data storage because the device is blocked	Alarm
0x32	EVNT_CODES_DSREADY_DOWNLOAD	Parameter transmission to the sensor finished	Alarm
0x33	EVNT_CODE_DSREADY_UPLOAD	Parameter transmission from the sensor finished	Diagnostics

13.3 ifm IoT Core

Contents

Overview: IoT profile.....	78
Overview: IoT types.....	81
Overview: IoT services.....	82

8988



13.3.1 Overview: IoT profile

Contents	
Profile: deviceinfo	78
Profile: devicetag	79
Profile: iolinkmaster	79
Profile: parameter	80
Profile: processdata	80
Profile: service	80
Profile: software	80
Profile: timer	80

17111

Profile: deviceinfo

17135

Element (identifier)	Properties	mandatory	Comments
deviceinfo	<ul style="list-style-type: none"> ▪ type = structure ▪ profiles = deviceinfo 		characterises the element as device information
deviceinfo/devicename	type = data	optional	
deviceinfo/devicefamily	type = data	optional	
deviceinfo/devicevariant	type = data	optional	
deviceinfo/devicesymbol	type = data	optional	
deviceinfo/deviceicon	type = data	optional	
deviceinfo/serialnumber	type = data	mandatory	
deviceinfo/productid	type = data	optional	
deviceinfo/productname	type = data	optional	
deviceinfo/productcode	type = data	mandatory	
deviceinfo/producttext	type = data	optional	
deviceinfo/ordernumber	type = data	optional	
deviceinfo/productiondate	type = data	optional	
deviceinfo/productioncode	type = data	optional	
deviceinfo/hwrevision	type = data	mandatory	
deviceinfo/swrevision	type = data	mandatory	
deviceinfo/bootloaderrevision	type = data	optional	
deviceinfo/vendor	type = data	optional	
deviceinfo/vendortext	type = data	optional	
deviceinfo/vendorurl	type = data	optional	
deviceinfo/vendorlogo	type = data	optional	
deviceinfo/productwebsite	type = data	optional	
deviceinfo/supportcontact	type = data	optional	
deviceinfo/icon	type = data	optional	
deviceinfo/image	type = data	optional	
deviceinfo/standards	type = data	optional	

Profile: devicetag

17438

Element (identifier)	Properties	mandatory	Comments
devicetag	<ul style="list-style-type: none"> ▪ type = structure ▪ profiles = devicetag 		
devicetag/applicationtag	type = data	mandatory	
devicetag/applicationgroup	type = data	optional	
devicetag/machinecode	type = data	optional	
devicetag/tenant	type = data	optional	

Profile: iolinkmaster

14997

Element (identifier)	Properties	mandatory	Comments
masterport	<ul style="list-style-type: none"> ▪ type = structure ▪ profiles = iolinkmaster 		Executable service
masterport/mode	<ul style="list-style-type: none"> ▪ type = data ▪ profile = parameter 	mandatory	
masterport/comspeed	<ul style="list-style-type: none"> ▪ type = data ▪ profile = parameter 	mandatory	
masterport/mastercycletime_actual	<ul style="list-style-type: none"> ▪ type = data ▪ profile = parameter 	mandatory	
masterport/mastercycletime_preset	<ul style="list-style-type: none"> ▪ type = data ▪ profile = parameter 	mandatory	
masterport/validation_datastorage_mode	<ul style="list-style-type: none"> ▪ type = data ▪ profile = parameter 	mandatory	
masterport/validation_vendorid	<ul style="list-style-type: none"> ▪ type = data ▪ profile = parameter 	mandatory	
masterport/validation_deviceid	<ul style="list-style-type: none"> ▪ type = data ▪ profile = parameter 	mandatory	
masterport/additionalpins_in	<ul style="list-style-type: none"> ▪ type = data ▪ profile = processdata 	optional	
masterport/additionalpins_out	<ul style="list-style-type: none"> ▪ type = data ▪ profile = processdata 	optional	
masterport/portevent	<ul style="list-style-type: none"> ▪ type = data 	mandatory	
masterport/iolinkdevice	<ul style="list-style-type: none"> ▪ type = structure ▪ profile = iolinkdevice_full 	mandatory	

Profile: parameter

16545

The profile is used to mark the elements of type data as parameters (acyclic data). The profile defines no substructure.

Profile: processdata

16569

The profile is used to mark the elements of type data as process data (cyclic data). The profile does not define a substructure.

Profile: service

16575

Element (identifier)	Properties	mandatory	Comments
service	<ul style="list-style-type: none"> ▪ type = service ▪ profiles = service 		Executable service

Profile: software

10999

Element (identifier)	Properties	mandatory	Comments
software	<ul style="list-style-type: none"> ▪ type = structure ▪ profiles = software 		characterises the element as software
software/version	type = data	mandatory	
software/reboot	type = service	optional	
software/factoryreset	type = service	optional	
software/status	type = structure	optional	
software/diag	type = structure	optional	

Profile: timer

10997

Element (identifier)	Properties	mandatory	Comments
timer	<ul style="list-style-type: none"> ▪ type = structure ▪ profiles = timer 		Executable service
timer/interval	<ul style="list-style-type: none"> ▪ type = data ▪ profile = parameter 	optional	

13.3.2 Overview: IoT types

16547

The ifm IoT Core uses the following element types:

Name	Description
structure	Element is a structure element (like a folder in a file system)
service	Element is a service that can be addressed from the network
event	Element is an event that can be started by the firmware and sends messages.
data	Element is a data point
device	Root element a device represents

13.3.3 Overview: IoT services

Contents	
Service: factoryreset	82
Service: gettree	82
Service: getdata	83
Service: getdatamulti	83
Service: getidentity	84
Service: getsubscriptioninfo	84
Service: iolreadacyclic	85
Service: iolwriteacyclic	85
Service: reboot	85
Service: setblock	86
Service: setdata	86
Service: setelementinfo	87
Service: signal	87
Service: subscribe	88
Service: unsubscribe	88

17708

Service: factoryreset

12188

Name: factoryreset

Description: The service sets the parameters of the device to the factory settings.

Applicable to: different objects

Request data: none

Return data (data): none

Service: gettree

17435

Name: gettree

Description: The service reads the complete device description of the AL1900 and provides it as JSON object.

Applicable to: Objects of the device type

Request data: none

Return data (data):

Data field	Required field	Data type	Default	Description
Identifier	mandatory	STRING		Identifier of the root element
type	mandatory	STRING		Type of the element
format	optional	JSON object	empty	Format of the data content
uid	optional	STRING	empty	
profiles	optional	JSON array	empty	
subs	mandatory	JSON array		Subelements
hash	optional	STRING		

Service: getdata

12223

Name: getdata**Description:** Service reads the value of a data point and provides it.**Applicable to:** Objects of the data type**Request data:** none**Return data (data):**

Data field	Required field	Data type	Default	Description
value	mandatory	STRING		Value of the element/data point

Example: {"code":10,"cid":4711,"adr":"devicetag/applicationtag/getdata"}

Service: getdatamulti

17964

Name: getdatamulti**Description:** The service sequentially reads the values of several data points and provides them. The value and the diagnostic code are provided for each data point.**Applicable to:** Objects of the data type**Request data:**

Data field	Required field	Data type	Default	Description
datatosend	mandatory	ARRAY OF STRINGS		List of data points to be requested; data points must support the service getdata
consistent	optional	BOOL	false	

Return data (data): for each requested data point

Data field	Required field	Data type	Default	Description
Data point	mandatory	STRING		Data point request
code	mandatory	INT		Diagnostic code of the request
data	mandatory	STRING		Value of the data point

Service: getidentity

17134

Name: getidentity**Description:** The service reads the complete device description of the AL1900 and provides it as JSON object.**Applicable to:** Objects of the device type**Request data:** none**Return data (data):**

Data field	Required field	Data type	Default	Description
iot		device		Device description as JSON object
iot.name	mandatory	STRING		
iot.uid	optional	STRING		
iot.version	mandatory	STRING		
iot.catalogue	optional	ARRAY OF OBJECTS		
iot.deviceclass	optional	ARRAY OF STRING		
iot.serverlist		ARRAY OF OBJECTS		
device	optional			AL1900
device.serialnumber	optional			Serial number
device.hwrevision	optional			Hardware version
device.swrevision	optional			Software version
device.custom	optional			

Service: getsubscriptioninfo

17436

Name: getsubscriptioninfo**Description:** The service provides information about an existing subscription (subscribe).**Applicable to:** Objects of the event type**Request data:**

Data field	Required field	Data type	Default	Description
subscriptionid	mandatory	INT		ID of the subscription

Return data (data): none

Service: iolreadacyclic

12222

Name: iolreadacyclic**Description:** The service acyclically reads the parameter value of an IO-Link device. It is accessed via IO-Link index and subindex.**Applicable to:** IO-Link specific objects**Request data:**

Data field	Required field	Data type	Default	Description
index	mandatory	NUMBER		IO-Link index of the parameter
subindex	mandatory	NUMBER		IO-Link subindex of the parameter

Return data (data):

Data field	Required field	Data type	Default	Description
value	mandatory	STRING		Value of the parameter; Value in hexadecimal format

Service: iolwriteacyclic

11035

Name: iolwriteacyclic**Description:** The service acyclically writes the parameter value of an IO-Link device. It is accessed via IO-Link index and subindex.**Applicable to:** IO-Link specific objects**Request data:**

Data field	Required field	Data type	Default	Description
index	mandatory	NUMBER		IO-Link index of the parameter
subindex	mandatory	NUMBER		IO-Link subindex of the parameter
value	mandatory	STRING		New value of the parameter; Value in hexadecimal format

Return data (data): none**Service: reboot**

10986

Name: reboot**Description:** The service reboots the device.**Applicable to:** different objects**Request data:** none**Return data (data):** none

Service: setblock

12224

Name: setblock**Description:** The service simultaneously sets the values of several data points of a structure.**Applicable to:** Objects of the data type**Request data:**

Data field	Required field	Data type	Default	Description
datatosend	mandatory	ARRAY OF (STRINGS)		List of data points and their new values; data points must support the service setdata
consistent	optional	BOOL	false	

Return data (data): none

Example:

```
{
  "code":10,
  "cid":4711,
  "adr":"/iotsetup/network/setblock",
  "data":{"consistent":true,"datatosend":["ipadresse":"192.168.0.6","ipdefaultgateway":"192.168.0.250"]}
}
```

Service: setdata

11036

Name: setdata**Description:** The service sets the value of the data point.**Applicable to:** Objects of the data type**Request data:**

Data field	Required field	Data type	Default	Description
newvalue	mandatory	STRING		New value of the element/data point

Return data (data): none

Example:

```
{
  "code":10,
  "cid":4711,
  "adr":"devicetag/applicationtag/setdata",
  "data":{"newvalue":"ifm IO-Link master"}
}
```

Service: setelementinfo

7159

Name: setelementinfo**Description:** The service sets the uid of an element.**Applicable to:** Objects of the device type**Request data:**

Data field	Required field	Data type	Default	Description
url	mandatory	STRING		URL of the element to be changed
uid	optional	STRING		UID to be set
profiles	optional	JSON array		
format	optional	JSON object		

Return data (data):

Data field	Required field	Data type	Default	Description
identifier	mandatory	STRING		Identifier of the element
type	mandatory	STRING		Type of the element
format	optional	JSON object	blank	Format of the data or the service content
uid	optional	STRING	blank	
profiles	optional	JSON array	blank	
hash	optional	STRING	--	

Service: signal

25406

Name: signal**Description:** Der Dienst löst das Blinken der Status-LEDs des AL1900 aus.**Applicable to:** various objects**Request data (data):** none**Return data (data):** none

Service: subscribe

10920

Name: subscribe**Description:** The service subscribes to the values of data points. The data points to be subscribed are transferred as a list. The IO-Link master sends changes to the data drain defined in callback.**Applicable to:** Objects of the event type**Request data:**

Data field	Required field	Data type	Default	Description
callback	mandatory	STRING		Address to which IoT Core event notifications are to be sent; complete URL: http://ipaddress:port/path
datatosend	mandatory	ARRAY OF STRINGS		List from URLs of data elements; elements have to support getdata

Return data (data): none**Service: unsubscribe**

16567

Name: unsubscribe**Description:** The service deletes an existing subscription. unsubscribe is successful if cid and the callback address are registered for a subscription (subscribe). If the STRING "DELETE" is provided in callback, the IO-Link master deletes all active subscriptions.**Applicable to:** Objects of the event type**Request data:**

Data field	Required field	Data type	Default	Description
callback	mandatory	STRING		Address to which IoT Core event notifications are to be sent; complete URL: http://ipaddress:port/path

Return data (data): none

14 Index

A

Access ifm-IoT Core	55
Accessories	63
Acyclic data	74
Add the IO-Link master to the PROFINET network	36
Appendix	64
Application	65
Approvals / tests	67

C

CAN standard units	42
Communication, parameter setting, evaluation	11
Configuration	23
Configure access rights	38
Configure IO-Link devices	33, 40, 43, 46
Configure IO-Link ports	39, 46
Configure IoT interface	45
Configure the fieldbus interface	45
Configure the PROFINET port	40
Connect the device	19
Control IO-Link master	48
Cyclic data	72

D

Detect diagnostics and alarms	42
Device description	54
Diagnostic and alarms	76
Digital inputs	12

E

Electrical connection	14, 68
Electrical data	65
Environmental conditions	67
Ethernet interface	21
Example	
Change name of the IO-Link master	51
Change the parameter value of an IO-Link device	52
Read process data of an IO-Link device	50
Read several parameter values of the IO-Link master simultaneously	51
Read the parameter value of an IO-Link device	52
Subscribe to event	53
Examples	50

F

Factory settings	62
Fieldbus	
Configure the PROFINET port	28
Firmware	
Reboot the device	32
Reset device to factory settings	32
Firmware update	58
Function	10

G

General	7
GET method	55

I

I&M datasets	74
I&M0 (Slot 0)	74
I&M0 (Slot 1)	75
I&M1 (Slot 0)	74
I&M2 (Slot 0)	74
I&M3 (Slot 0)	75
ifm IoT Core	77
General information	54
Input circuit	18
Inputs	66
Inputs / outputs	65
Install GSD file	35
Install the device	13
Intended use	9
Interfaces	66
Internet of Things (IoT)	11
IO-Link	11
IO-Link circuits	18
IO-Link ports	17
Activate data transfer to the LR SMARTOBSERVER	28
Configure operating mode	30
Set the device validation and data storage	31
IO-Link ports (Class A)	22
IO-Link supply	12
IoT	
Configure access rights	26
Configure IP settings	27
Configure the interface to the LR SMARTOBSERVER	28
IoT Core	44
Diagnostic codes	57
IoT port	16, 22

L

LED indicators	21
Legal and copyright information	5
LR DEVICE	24

M

Maintenance	61
Mechanical data	67
Modification history	6
Mounting	13

O

Offline parameter setting	25
Operating and display elements	20
Operation	58
Outputs	66
Overview	20
IoT profile	78
IoT services	82
IoT types	81

P

Parameter data	69
Parameter of the IO-Link master	69
Parameter setting	11
Parameters of the IO-Link ports	70

Index

Permitted use.....	9
PI controller.....	5
POST method.....	56
Power supply.....	22
PQI (Port Qualifier Information).....	73
Preliminary note.....	5
Profile	
deviceinfo.....	78
devicetag.....	79
iolinkmaster.....	79
parameter.....	80
processdata.....	80
service.....	80
software.....	80
timer.....	80
PROFINET.....	11, 34, 69
Programmers' notes.....	42
Read & write device information.....	41
PROFINET modules.....	72
PROFINET ports.....	15
Programmers' notes.....	54
Prohibited use.....	9
Purpose of the document.....	5

R

Read / write cyclic process data.....	47
Read and write data cyclically.....	41
Read and write I&M datasets.....	42
Read device information.....	48
Read diagnostic data.....	47
Read information about IO-Link devices.....	49
Remarks.....	15, 25
Replace IO-Link device.....	60
Required background knowledge.....	7

S

Safety instructions.....	7
Safety symbols on the device.....	7
Service	
factoryreset.....	82
getdata.....	83
getdatamulti.....	83
getidentity.....	84
getsubscriptioninfo.....	84
gettree.....	82
iolreadacyclic.....	85
iolwriteacyclic.....	85
reboot.....	85
setblock.....	86
setdata.....	86
setelementinfo.....	87
signal.....	87
subscribe.....	88
unsubscribe.....	88
Set application identification.....	47
Status LEDs.....	21
Symbols and styles used.....	5

T

Tampering with the unit.....	8
Technical data.....	65

V

Visual indication.....	12
VPN connection.....	25

W

Web interface	
Read device and diagnostic information.....	59