Device Manual

IO-Link Master with PROFINET Interface
CabinetLine
8 Ports
IP 20

AL1900

HW Revision: AB
Firmware: 2.3.x
LR DEVICE: 1.5.0.x

English

Contents

1 Preliminary note

Content

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1.1 Legal and copyright information

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1.2 Purpose of the document

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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   Explanation of Symbols

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 0x123 0b010	Decimal number Hexadecimal number Binary number
[...]	Designation of pushbuttons, buttons or indications

1.4   Modification history

Version	Topic	Date
00	New creation of document	04 / 2019
01	Correction: Technical data - Max. current load per output	05 / 2019

2 Safety instructions

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2.1 General

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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

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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

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General warning
Observe instructions in chapter "Electrical connection" (→ **Electrical connection** (→ S. 14))!

2.4   IT safety

NOTICE!

If the device is operated in an unprotected network environment.

> Unauthorised read or write access to data is possible.
> Unauthorised manipulation of the device function is possible.
► Check and restrict access options to the device:
  ▪ Restrict access to authorised persons.
  ▪ Do not connect the device to open networks or the internet.

If access from the internet is inevitable:

► choose a safe method to connect with the device (e. g. VPN).
► Use encrypted data transmission (e. g. https / TLS).

2.5   Tampering with the unit

WARNING!

Tampering with the unit.

> In case of non-compliance:
  ▪ Possible affects on safety of operators and machinery
  ▪ Expiration of liability and warranty
► Do not open the devices!
► Do not insert any objects into the devices!
► Prevent metal foreign bodies from penetrating!

3   Intended use

Content

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3.1   Permitted use

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

3.2   Prohibited use

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The device may not be used beyond the limits of the technical data (→ **Technical data** (→ S. 73))!

4 Function

Content

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4.1 Communication, parameter setting, evaluation

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4.1.1 IO-Link

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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

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The device offers the following PROFINET functions:

- Profinet RT Device (Class B)
- 2 port switch for access to the PROFINET interface; integrated switch is RT   and IRT conform according to PROFINET V2.3
- Gateway for transmission of the process and parameter data between the connected IO-Link devices and the higher-level PROFINET controller
- Supported protocols: SNMP, LLDP, MRP, DCP, RTA, RTC Class 1 (nicht synchronisiert)
- PROFINET features: FSU, I&M0 - 4 read/write
- Device description: GSDML file

4.1.3 Internet of Things (IoT)

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The device offers the following IoT functions:

- Gateway for the transmission of process, parameter and monitoring data between IO-Linkmaster / IO-Link devices and the IT network level
- REST-API to access process and parameter data
- Supported protocols: TCP/IP JSON, MQTT

4.1.4 Security mode

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The IoT interface offers the following optional sercurity functions:

- Secure data transfer via encrypted connection (Secure Layer Transport - TLS)
- Access protection via authentification

4.1.5 Parameter setting

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)

4.1.6 Visual indication

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

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

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

Content

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5.1 Install the device

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| ! | ► 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

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6.1 Notes

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> [!] The unit must be connected by a qualified electrician.
> ► The national and international regulations for the installation of electrical equipment must be adhered to.
>
> The unit is only suitable for operation using SELV/PELV voltages.
> ► Observe the information concerning IO-Link circuits!
>
> The IP rating of the overall system depends on the protection ratings of the individual devices and the applied connection elements.
>
> For UL applications:
> ► To connect the IO-Link master, only use cables with AWG 26 to 12 and a minimum temperature range of 75 °C.
>
> Wiring: → **Technical data** (→ S. 73)

The circuits are separated from each other and from device surfaces that could be touched by means of basic insulation according to EN61010-1 (secondary circuit with 30 V DC maximum, supplied from mains circuit up to 300 V of overvoltage category II).

The communication interfaces are separated from each other and from device surfaces that could be touched by means of basic insulation according to EN61010-1 (secondary circuit with 30 V DC maximum, supplied from mains circuit up to 300 V of overvoltage category II). They are designed for network environment 0 according to IEC TR62102.

6.2   PROFINET ports

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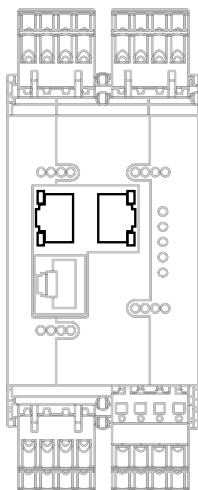
► Connect the unit via the sockets X21 and/or X22 to the PROFINET network.
► To connect the devices, use connectors with protection rating IP 20 or higher (→ **Accessories** (→ S. 71)).

6.3   IoT port

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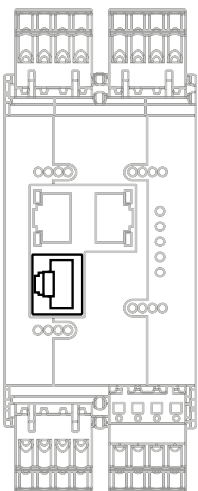
► Connect the device via the socket X23 to the IT network (e.g. laptop/PC with LR DEVICE parameter setting software, laptop/PC with LR SMARTOBSERVER monitoring software, laptop/PC with http request enabled software).
► To connect the devices, use connectors with protection rating IP 20 or higher (→ **Accessories** (→ S. 71)).

6.4 IO-Link ports

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

► Please note the information concerning IO-Link wiring!

⚠️ **WARNING!**

Supply of energy to the IO-Link ports of the IO-Link master

> Risk of fire!

► Prevent supply and feedback of energy to the IO-Link ports.

► Before set-up check the correct connection of the supply cables.

6.4.1 Connect IO-Link devices for Class A operation

Wiring information:

• The connected IO-Link devices must be supplied exclusively via the IO-Link master.

• The additional digital inputs of the IO-Link ports X01...X08 (clamp 2) have a type 2 behaviour according to the standard EN61131-2. The connected electronics must be electrically suited for this.
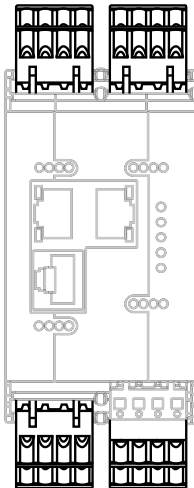
► Connect IO-Link devices to the ports X01...X08.
  ▪ Maximum cable length per IO-Link port: 20 m
► To connect the devices, only use cables with protection rating IP 20 or higher.

6.4.2   Connect IO-Link devices for Class B operation

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Wiring information:

- For the Class B operation, the IO-Link device must be supplied with an additional auxiliary voltage UA.
- Wiring diagram:
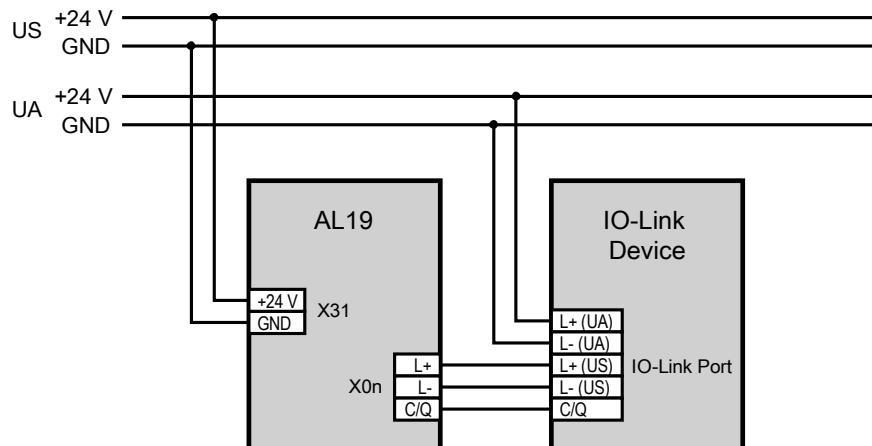
- Permitted maximum current intensity for UA: 4A

⚠️ **WARNING!**

Non-compliance with the electrical separation of the circuits

> Risk of fire!

► Ensure that the external supply UA is galvanically separated from the circuit of the IO-Link Master by assuring basic insulation (according to IEC 61010-1, secondary circuit with 30 V DC maximum, supplied from mains circuit up to 300 V of overvoltage category II).

► Ensure that the IO-Link devices and the connection technology support the galvanic separation.
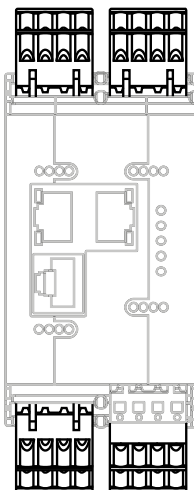
► Connect the IO-Link devices to the ports X01 ... X08.
- Maximum cable length per IO-Link port: 20 m
► Connect the IO-Link devices to UA with 24 V DC (20...30 V SELV/PELV).
► To connect the IO-Link devices, only use cables with protection rating IP 20 or higher.

6.5 Connect the device

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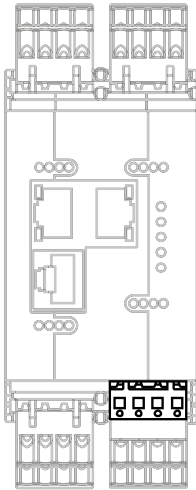
► Disconnect power.
► Connect the IO-Link master via port X31 to 24 V DC
(20...30 V SELV/PELV; according to EN61010-1, secondary circuit
with maximum 30 V DC supplied by mains circuit up to 300 V of
overvoltage category II).

  ▪ 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

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7.1 Overview

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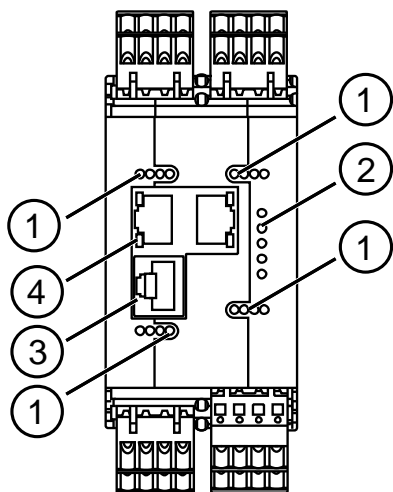
(1) IOL and DI status-LEDs of the IO-Link port (X01...X08 (→ **IO-Link ports (Class A)** (→ S. 21))

(2) PWR status LED of the voltage supply (X31) (→ **Power supply** (→ S. 21)

RDY, BF and SF Status LEDs (→**Status LEDs** (→ S. 20)

IoT status LED of the IoT port (X23) (→ **IoT port** (→ S. 21))

(3) LNK status LED of the IoT port (X23) (→ **IoT port** (→ S. 21))

(4) LNK and ACT status LEDs of the PROFINET ports 1 (X21) and 2 (X22) (→ **Ethernet interface** (→ S. 20))

7.2　LED indicators

The device only has the following LED indicators:

7.2.1　Status LEDs

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	Status: OK
		flashes 5 Hz	Status: Error
		flashes (200 ms on, 800 ms off)	Status: Firmware update is running
		off	Status: Gateway not running or gateway booting
BF	red	on	Bus error
		flashes 1 Hz	No connection to the PROFINET controller
		off	error-free
SF	red	on	▪ 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

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

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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

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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)

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

Status LED			Description
IOL	yellow	off	Port configured as DI / DO: clamp 4 (C/Q) = OFF
		on	Port configured as DI / DO: clamp 4 (C/Q) =ON
	green	flashes 1 Hz	Port configured as IO-Link: no IO-Link device detected
		flashes 2 Hz	Port configured as IO-Link: PROOPERATE state
		on	Port configured as IO-Link: OPERATE state
	red	flashes 2 Hz	Port configuration error or short circuit or overload (US)
		on	Transmission error
DI	yellow	off	Digital input : clamp 2 (DI) = OFF
		on	Digital input: clamp 2 (DI) = ON

8   Set-up

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When the supply voltage is switched on, the AL1900 starts with the factory settings. The display elements signal the current operating mode (→ **Operating and display elements** (→ S. 19)).

To enable parameter setting of the AL1900, the IoT interface and / or the fieldbus interface must be configured according to the network environment.

► Configure IoT interface (LR DEVICE: → **IoT: Configure IP settings** (→ S. 27) or → **Configure IoT interface** (→ S. 38)).

► Configure fieldbus interface (LR DEVICE: → **Fieldbus: Configure IP settings** (→ S. 31) or IoT: → **Configure the fieldbus interface** (→ S. 42)).

> IoT / fieldbus interface has valid IP settings.

> User can set the parameters of the AL1900.

Further steps:

• Optional: Update firmware of AL1900 (→ **Update firmware** (→ S. 68)).

• Set the parameters of the AL1900 (→ **Configuration** (→ S. 24)).

8.1   Read device and diagnostic information

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 ▪ 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 Configuration

Content

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9.1   LR DEVICE

Content

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On delivery, the AL1900 is configured with the factory settings (→ **Factory settings** (→ S.)).

Required software: LR DEVICE (1.5.0.x or higher) (art.-no.: QA0011/QA0012)

9.1.1 Remarks

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Offline parameter setting

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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

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> 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.

9.1.2   IoT: Configure IP settings

34049

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** (→ S. 70)).

To configure the IP settings of the IoT interface:

► 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.

9.1.3   IoT: Configure security mode

54680

The IoT interface of the IO-Link offers a security mode. It enables secure data transmission via transport encryption and restriction of the access to IO-Link masters and IO-Link devices via user authentication.

To configure the security mode:

► Select [IoT] menu.

> The menu page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values	
[Security mode HTTPS]	Set the security mode	[Disabled]	Security mode disabled
		[Enabled]	Security mode enabled
[Security password]	Password Note: The set password is not displayed.		

► Save changed values on the device.

The security mode only protects the access to the device via the IoT interface.

The user name "administrator" cannot be changed.

The security mode can be enabled without setting the password. During the attempt to write to the device, LR DEVICE requires to enter and confirm the password.

After entering the password, the user has unrestricted access to IO-Link masters and connected IO-Link devices. The password will only be requested again if the current LR DEVICE session is over (e. g. after rebooting the LR DEVICE).

To change the set password:

► Sign in with a valid password.

► Enter the new password in the field [Security password].

► Write changes to the device.

> The new password is set.

> LR DEVICE requires entering the new password to be able to access to the IO-Link master.

9.1.4 IoT: Configure access rights

34046

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]	▪ 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)]	▪ 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]	▪ 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.

> [!] If the parameter [Access rights] is set to [PROFINET + IoT] via IoT and PROFINET projection, then the parameter values set in the PROFINET projection software apply.
>
> If the parameter [Access rights] is set to [IoT only] via IoT, then set the parameter [Access rights] to [Keep settings] in the PROFINET projection software.
>
> Changes of the parameter [Access Rights] are only effective after restarting the device (→ **Firmware: Reboot the device** (→ S. 34))

9.1.5   IoT: Configure the interface to LR AGENT or LR SMARTOBSERVER

34048

To enable transfer of process data from the IO-Link master to LR AGENT or LR SMARTOBSERVER, the interface has to be configured accordingly.

► Select [IoT] menu.

> The menu page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values	
[IP address LR Agent or SMARTOBSERVER]	IP address of LR AGENT or LR SMARTOBSERVER	Factory setting: 255.255.255.255	
[Port LR Agent or SMARTOBSERVER]	Port number that is used to send process data to LR AGENT or LR SMARTOBSERVER	0 ... 65535	Factory setting:: 35100
[Interval LR Agent or SMARTOBSERVER]	Cycle time for the transfer of the process data to LR AGENT or 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 LR AGENT or LR SMARTOBSERVER (String32)	Factory setting: AL1900	

> ! After changing the parameter [Port LR Agent or 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 changing the the parameter.

► Save changed values on the device.

9.1.6   Fieldbus: Configure IP settings

34527

The PROFINET interface (ports X21/X22) have to be configured in order to acces the IO-Link master via the PROFINET.

To set the IP properties of the fieldbus interface:

► 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.

9.1.7   IO-Link ports: Activate data transfer to LR AGENT or LR SMARTOBSERVER

33690

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

To transfer process data the interface to the LR AGENT or LR SMARTOBSERVER has to be correctly configured (→ **IoT: Configure the interface to LR AGENT or LR SMARTOBSERVER** (→ S. 30)).

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 Agent or SMARTOBSERVER]	Transfer of process data of the connected IO-Link device to LR AGENT oder LR SMARTOBSERVER	[Disabled]	Transfer process data
		[Enabled]	Don't transfer process data

► Save changed values on the device.

9.1.8   IO-Link ports: Configure operating mode

33694

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 ... 132800	1 microsecond ... 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.

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

33697

The user can choose how the IO-Link ports are to behave with regard to the device validation and the storage / recovery of parameter data of the connected IO-Link device.

The following options are available:

Option	Validation of the IO-Link device	Storage of the parameter values	Recovery of the parameter values
[No check and clear]	no	no	no
[Type compatible V1.0 device]	yes, test the compatibility with IO-Link standard V1.0	no	no
[Type compatible V1.1 device]	yes, test the compatibility with IO-Link standard V1.1	no	no
[Type compatible V1.1 device with Backup + Restore]	yes, test the compatibility with IO-Link standard V1.1 and identity of design (vendor ID and device ID)	yes, automatic storage of the parameter values; changes of the current parameter values will be stored	yes, recovery of the parameter values when connecting an identical IO-Link device with factory settings
[Type compatible V1.1 device with Restore]	yes, test the compatibility with IO-Link standard V1.1 and identity of design (vendor ID and device ID)	no, there is no automatic storage changes of the current parameter values will not be stored	yes, recovery of the parameter values when connecting an identical IO-Link device with factory settings

> [!] The options only apply if the IO-Link port is in the operating mode "IO-Link".
>
> For options [Type compatible V1.1 device with Backup + Restore] and [Type compatible V1.1 device with Restore]: If the vendor ID and device ID are changed in the online mode, the data memory will be deleted and a new backup of the parameter values of the connected IO-Link device will be created in the IO-Link master.

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 IO-Link master when connecting a new IO-Link device at port x (x = 1...8)	[No check and clear]	
		[Type compatible V1.0 device]	
		[Type compatible V1.1 device]	
		[Type compatible V1.1 device with Backup + Restore]	
		[Type compatible V1.1 device with Restore]	
[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.

9.1.10 Info: Show device information

To read the general information of the ifm IO-Link master:

► Select [Info] menu.

> The menu page shows the current settings.

Name	Description	Possible values
[Product code]	Article number of the IO-Link master	AL1900
[Device family]	Device family of the IO-Link master	IO-Link master
[Vendor]	Vendor	ifm electronic gmbh
[SW-Revision]	Firmware of the IO-Link master	
[HW revision]	Hardware version of the IO-Link master	
[Bootloader revision]	Bootloader version of the IO-Link master	
[Serial number]	Serial number	

9.1.11 Firmware: Reset device to factory settings

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.

9.1.12 Firmware: Reboot the device

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.

9.1.13   Configure IO-Link devices

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** (→ S. 32)).

> IoT has write access rights to the IO-Link master (→ **IoT: Configure access rights** (→ S. 29)).

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).
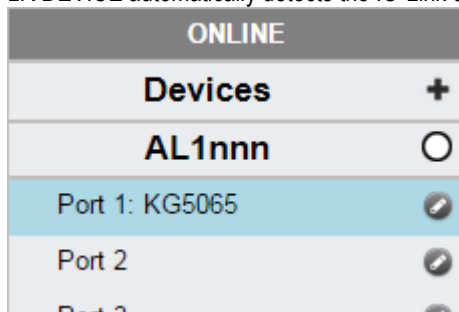
3   Configure IO-Link device

► 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.

9.2 ifm IoT Core

Content

52244

General notes on the ifm IoT Core: → **Programmers' notes** (→ S. 56)

9.2.1 First steps

52245

To read the device description of the AL1900:

► Send the following POST request to the AL1900:
  `{"code":"request","cid":-1,"adr":"gettree"}`

> AL1900 returns the device description as structured JSON object.

► Identify all substructures and the data points contained therein in the tree structure of the JSON object.

► Identify the applicable services for the access to substructures and the data points contained therein.

9.2.2   General functions

The AL1900 is of type device (→ **Overview: IoT types** (→ S. 92)).

Besides gettree, the following services can be applied to the root element of type device.

Service	Description
../getidentity	Read device information
../getdatamulti	Read several parameter values sequentially
../getelementinfo	Read the uid of the AL1900
../setelementinfo	Write the uid of the AL1900

Depending on the read and write access rights, the following services can be applied to elements of type data:

Service	Description
../getdata	Read the value of the element
../setdata	Write the value of the element

9.2.3 Configure IoT interface

Via the IoT interface the AL1900 wil be integrated in the IT network.

Substructure: iotsetup

Avalable data points:

Name	Description	Access
../accessrights	Access rights to the IO-Link master	rw
../smobip	IP address of the LR SMARTOBSERVER	rw
../smobport	Port number of the LR SMARTOBSERVER	rw
../smobinterval	Cycle time for data transmission to LR SMARTOBERVER (value in milliseconds)	rw
../network/dhcp	Configuration of the IP settings of the IoT port	rw
../network/ipaddress	IP address of the IoT port	rw
../network/subnetmask	Subnet mask of the network segment	rw
../network/ipdefaultgateway	IP address of the network gateway	rw

rw ... read and write

Applicable services:

Name	Description
../network/setblock	Write all values of the substructure at once

> If the parameter [Access rights] is set to [PROFINET + IoT] using IoT and PROFINET projection, then the parameter values set in the PROFINET projection software apply.
>
> If the parameter [Access rights] is set to [IoT only] via IoT, then set the parameter [Access rights] to [Keep settings] in the PROFINET projection software.
>
> Changes of the parameter [Access Rights] are only effective after restarting the device (→ **Firmware: Reboot the device** (→ S. 34))

9.2.4   IoT interface: Configure security mode

<div align="right">54683</div>

The access to the IoT interface of the IO-Link master can be protected with a security mode:

Sub-structure: `iotsetup`

Available data points:

Name	Description	Access
../security/securitymode	active security mode	rw
../security/password	Password for authentication (Base64 coded)	w

rw ... read and write
w ... write only

> ℹ️ Valid character set for the Base64 coding / decoding of the password: UTF-8
>
> Online tool for coding / decoding: → www.base64encode.org

Note: Security mode

<div align="right">54684</div>

The security mode enables restricting access to the IO-Link master and the connected IO-Link devices from the IT network. In the activated security mode, the following restrictions apply:

- Access only with authentication (password-protected user account)
- Access only via secure https connection (Transport Layer Security - TLS)

> ⚠️ The security mode only protects the access to the device via the IoT interface.
>
> The standard value for users is: administrator
>
> The set password cannot be read with getdata.

The current status of the security function can be read with the getidentity service (→ **Service: getidentity** (→ S. 96)).

For the authentication, the user must additionally provide the POST requests with a valid user name and password in the field "auth". The user name and the password will be shown as Base64-coded character strings (→ **Example: Request with authentication** (→ S. 41)).

The following requests can be done if the security mode is enabled, also without authentication:

- /getidentity
- /deviceinfo/vendor/getdata
- /deviceinfo/productcode/getdata

Example: Activate security mode

Task: Activate the security mode of the IO-Link interface of the IO-Link master. Set the password "password" (Base64 coded: cGFzc3dvcmQ=)

Solution: The activation sonsists of 2 steps:

1   Activate security mode

Use service setdata with datapoint iotsetup/security/securitymode to activate the security mode.

- Request:

```
{
"code":"request",
"cid":-1,
"adr":"/iotsetup/security/securitymode/setdata",
"data":{"newvalue":"1"}
}
```

- Response:

```
{
"cid":-1,
"code":200
}
```

2   Set required password

Use service setdata with data point iotsetup/security/password to set the required password.

- Request:

```
{
"code":"request",
"cid":-1,
"adr":"/iotsetup/security/password/setdata",
"data":{"newvalue":"cGFzc3dvcmQ="}
}
```

- Response:

```
{
"cid":-1,
"code":200
}
```

Example: Request with authentication

Task: The temperature of the IO-Link master is to be read. The security function is enabled (current password: password).

Solution: Read the data point processdatamaster/temperature with the getdata service. The request must be sent using https. The user name and the password are transferred as a Base64-coded character string ("administrator" = "YWRtaW5pc3RyYXRvcg==", "password" = "cGFzc3dvcmQ=")

- Request:

```
{
"code":"request",
"cid":-1,
"adr":"processdatamaster/temperature/getdata",
"auth":{"user":"YWRtaW5pc3RyYXRvcg==","passwd":"cGFzc3dvcmQ="}
}
```

- Response:

```
{
"cid":-1,
"data":{"value":37},
"code":200
}
```

Example: reset password

Task: The existing password is to be reset.

Solution: To reset a password, disable the security mode. To disable it, enter the user name and the password (the fields "user" and "passwd").

- Request:

```
{
"code":"request",
"cid":-1,
"adr":"iotsetup/security/securitymode/setdata",
"data":{"newvalue":0},
"auth":{"user":"YWRtaW5pc3RyYXRvcg==","passwd":"SW9UNGlmbQ=="}
}
```

- Response:

```
{
"cid":-1,
"code":200
}
```

9.2.5   Configure the fieldbus interface

34523

Via the fieldbus interface (ports X21 / X22) the AL1900 will be integrated in the PROFINET network.

Substructure: `fieldbussetup`

Avalable data points:

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

r ... read only
rw ... read and write
* ... parameter only editable, if connection to PROFINET plc is interupted

Applicable services:

Name	Description
../network/setblock	Write all values of the substructure at once

9.2.6   Configure IO-Link ports

52248

The user can configure the IO-Link ports X01...X08 separately.

Substructure: `iolinkmaster/port[n]` (n = 1...8).

Available data points:

Name	Description	Access
../senddatatosmob	Send process data to LR SMARTOBSERVER	rw*
../mastercycletime_preset	Cycle time of the data transfer at the IO-Link port (value in microseconds)	rw
../mastercycletime_actual	Current cycle time of the data transfer at the IO-Link port (value in microseconds)	r
../portevent	Activity display	rw
../mode	Operating mode of the IO-Link port	rw*
../comspeed	Data transfer rate of the IO-Link port	rw
../validation_datastorage_mode	Response of the IO-Link port when a new IO-Link device is connected	rw*
../validation_vendorid	IO-Link ID of the manufacturer that is to be validated	rw*
../validation_deviceid	IO-Link ID of the device that is to be validated	rw*
../datastorage	Data storage area of the port	rw
../datastorage/maxsize	Maximum size of the data storage area (in bytes)	r
../datastorage/chunksize	Size of a data segment (in bytes)	r
../datastorage/size	Size of the data storage area (in bytes)	r

r ... read only
rw ... read and write
* ... parameter only editable, if connection to the PROFINET plc is interupted

Applicable services:

Service	Description
../validation_useconnecteddevice	Validate the IO-Link device connected to the IO-Link port
../datastorage/getblobdata	Read the content of the data storage area
../datastorage/stream_set	Transfer an individual data segment
../datastorage/start_stream_set	Start sequential transmission of several data segments

Example: Clone the Data Storage of an IO-Link port

52344

Task: Save the Data Storage of IO-Link port X02 of IO-Link master 1 and restore the data at IO-Link master 2.

Solution: The cloning process consists of 2 steps. In the first step, the Data Storage of the IO-Link port of IO-Link master 1 is saved. In the second step, the saved data is restored at the Data Storage of port IO-Link port of IO-Link master 2.

Save Data Storage:

1   Preparations

► Read size of segments of Data Storage (h = number of bytes):
{"code":"request", "cid": -1,"adr":"/iolinkmaster/port[2]/datastorage/chunksize/getdata"}
Example: h = 256

► Read total size of Data Storage area (g = number of bytes):
{"code": "request", "cid": -1, "adr": "/iolinkmaster/port[2]/datastorage/size/getdata"}
Example: g = 550

► Calculate the number of reading steps n: n = first integer value to which the following applies: $g < n*h$
Example: n= 3, because $550 < 3*256$

2   Read Data Storage of IO-Link port

► Read Data Storage segment by segment ("pos" is the byte offset, at which the reading process with length "length" starts).
{"code": "request", "cid": -1, "adr": "/iolinkmaster/port[2]/datastorage/getblobdata", "data": {"pos": 0, "length": h}}
{"code": "request", "cid": -1, "adr": "/iolinkmaster/port[2]/datastorage/getblobdata", "data": {"pos": h, "length": h}}
{"code": "request", "cid": -1, "adr": "/iolinkmaster/port[2]/datastorage/getblobdata", "data": {"pos": 2*h, "length": h}}
...
{"code": "request", "cid": -1, "adr": "/iolinkmaster/port[2]/datastorage/getblobdata", "data": {"pos": n*h, "length": h}}
Example:
1st read request: pos = 0, length = 256
2nd read resquest: pos = 256, length =256
3rd read request: pos = 512, length = 256

> Each segment value will be returned as BASE64 coded string.

► Join segments.

Restore Data Storage:

1   Preparations

► Determine the size of the saved Data Storage value (n = number of bytes).
Example: n = 550

► Read size of segments (s = number of bytes):
{"code":"request", "cid": -1,"adr":"/iolinkmaster/port[1]/datastorage/chunksize/getdata"}
Example: s = 256

2   Transfer Data Storage strings

► Start transfer of Data Storage string ("size" = size of Data Storage string):
{"code":"request", "cid": -1, "adr":"/iolinkmaster/port[1]/datastorage/start_stream_set", "data": {"size": n}}
Example: size = 550

► Transfer Data Storage string segment by segment ("value" = string value of length s):
{"code": "request", "cid": -1, "adr": "/iolinkmaster/port[1]/datastorage/stream_set", "data": {"value": "aWZtfgIAAABBTDF4NXhfY25faXRfdDIuMi43Nw..."}}

9.2.7   Configure IO-Link devices

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).

Substructure: `iolinkmaster/port[n]/iolinkdevice` (n = 1...8)

Applicable services:

Service	Description
../iolreadacyclic	Read a parameter of an IO-Link device (acyclic)
../iolwriteacyclic	Write a parameter of an IO-Link device (acyclic)

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

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:**

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

- **Return:**

```
{
"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

33844

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:

```
{
"code":"request",
"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:

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

9.2.8   Set application identification

The user can set the application name of the IO-Link master:

Substructure: `devicetag`

Available data points:

Name	Description	Access
../applicationtag	Name of the IO-Link master (application tag)	rw

rw ... read and write

Example: Change name of the IO-Link master

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:

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

* Response:

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

9.2.9 Read / write cyclic process data

To access the cyclic process data of the IO-Link ports X01...X08:

Substructure: `iolinkmaster/port[n]` (n = 1...8)

Available data points:

Name	Description	Access
../pin2in	Value of the digital input on clamp 2 of the IO-Link port	r
../iolinkdevice/pdin	Value of the IO-Link input on clamp 4 of the IO-Link port	r
../iolinkdevice/pdout	Value of the IO-Link output on clamp 4 of the IO-Link port	rw*

r = only read
rw = read and write
* = only changeable, if not connected to fieldbus PLC

Example: Read process data of an IO-Link device

Task: Read the current measured value of the ifm temperature sensor TN2531 at IO-Link port X02

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

- Request:

```
{
"code":"request",
"cid":4711,
"adr":"/iolinkmaster/port[2]/iolinkdevice/pdin/getdata"
}
```

- Response:

```
{
"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 = 0b**11110010**01

Temperature value: 0b11110010 = 242

Therefore: The current temperature value is 24.2 °C.

9.2.10 Control IO-Link master

Different services and management functions can be carried out on the IO-Link master.

Substructure: `firmware`

Available data points:

Name	Description	Access
../version	Software version	r
../type	Software type	r
../container	Area for updating the firmware	w
../container/maxsize	Maximum size of the container area (in bytes)	r
../container/chunksize	Size of a data segment (in bytes)	r
../container/size	Size of the container area (in bytes)	r

r = only read
w = write only

Applicable services:

Name	Description
../factoryreset	Reset IO-Link master to factory settings
../reboot	Reboot IO-Link master
../signal	Trigger the flashing of the status LED
../install	Install firmware transferred to the IO-Link master
../container/stream_set	Transfer an individual data segment
../container/start_stream_set	Start sequential transmission of several data segments

Example: Update firmware

52252

Task:

Update the firmware of the device; size of the firmware file: 356676 bytes

Solution:

The firmware is transferred to the device in fragments (chunks). The size of the fragments depends on the size of the flash memory of the IO-Link master. To transfer the firmware, the firmware file must be converted into a character string using BASE64.

1   Preparations

    ► Determine the size of the fragments (g = number of bytes):
       {"code":"request", "cid": -1, "adr":"/firmware/container/chunksize/getdata"}

    ► Convert the firmware file into a BASE64 string.

2   Start the transfer of the firmware

    ► Start the transfer of the firmware via the service start_stream_set (parameter "size": size of the firmware file):
       {"code":"request", "cid": -1, "adr":"/firmware/container/start_stream_set", "data":{"size":356676}}

3   Load the firmware into the flash memory of the IO-Link master

    ► Send the BASE64 string of the firmware file to the IO-Link master fragment by fragment (value = string value with length g).
       {"code": "request", "cid": -1, "adr": "/firmware/container/stream_set", "cid": -1, "data": {"value": "aWZtfgIAAABBTDF4NXhfY25faXRfdDIuMi43Nw..."}

    ► Repeat step 3 until all fragments of the firmware file have been sent to the IO-Link master.

    > IO-Link master stores the segments received in the container area.

4   Install firmware

    ► Start the installation of the transmitted firmware.
       {"code": "request", "cid": -1, "adr": "/firmware/install", "data": {}}

9.2.11   Read diagnostic data of the AL1900

52253

The user can read diagnostic data of the status   of the IO-Link masters.

Substructure: `processdatamaster`

Available data points:

Name	Description	Access
../temperature	Temperature of the IO-Link master (value in °C)	r
../voltage	Voltage applied (value in V)	r
../current	Current (value in A)	r
../supervisionstatus	Diagnostic information of the device supply	r

r ... read only

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

33840

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:

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

- Response:

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

9.2.12   Read device information of the IO-Link master

To read the device information of the AL1900:

Substructure: `deviceinfo`

Available data points:

Name	Description	Access
../productcode	Article number	r
../vendor	Producer	r
../devicefamily	Device family	r
../hwrevision	Hardware revision	r
../serialnumber	Serial number	r
../swrevision	Firmware version	r
../bootloaderrevision	Bootloader version	r
../extensionrevisions	Firmware and bootloader version	r
../fieldbustype	Fieldbus	r

r ... read only

Additional information about the AL1900 can be read with the `getidentity` service (→ **Service: getidentity** (→ S. 96)).

9.2.13   Read information about IO-Link devices

The user can obtain information about the IO-Link devices connected to the IO-Link ports.

Substructure: `iolinkmaster/port[n]/iolinkdevice` (n = 1...8)

Available data points:

Name	Description	Access
../status	Status of the connected IO-Link device	r
../vendorid	IO-Link ID of the vendor	r
../deviceid	IO-Link ID of the IO-Link device	r
../productname	Product name of the IO-Link device	r
../serial	Serial number of the IO-Link device	r
../applicationspecifictag	Device-specific identification (application tag)	rw

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

9.2.14 Subscribe to events

If a data point has the subelement datachanged, the user can subscribe to events.

Available data points:

Name	Description	Access
timer[n]/counter	Current value that can be subscribed to	r
timer[n]/interval	Cycle time of the update of the subscribed values	rw
iolinkmaster/port[n]/portevent	Display of the following events on IO-Link port n: ▪ IO-Link device connected ▪ IO-Link device disconnected ▪ Operating mode of the IO-Link port changed	r
iolinkmaster/port[n]/iolinkdevice/iolinkevent	Display of IO-Link events	r

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

Applicable services:

Name	Description
../datachanged/subscribe	Subscribe to an event message
../datachanged/unsubsribe	Unsubscribe from an event message
../datachanged/getsubscriptioninfo	Show information about event messages

Example: Subscribe to event

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:

```
{
"code":"request",
"cid":4711,
"adr":"/timer[1]/counter/datachanged/subscribe",
"data":{"callback":"http://192.168.0.44:80/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:

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

- Response:

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

9.2.15   MQTT support

The AL1900 can operate as a client in a MQTT-based communication environment. By using the subscribe service it is possible to send messages to a MQTT broker (PUBLISH).

Example: Publish the temperature to an MQTT broker

Task: Publish the temperature of an IO-Link master to an MQTT broker (IP address MQTT broker: 192.168.82.100, port: 1883, Topic:abc).

Solution:

- Request:

```
{
"code":"request",
"cid":-1,
"adr":"iolinkmaster/port[1]/portevent/datachanged/subscribe",
"data":{
"callback":"mqtt://192.168.82.100:1883/abc",
"datatosend":["processdatamaster/temperature"}
}
```

- Response:

```
{
"cid":-1,
"code":200
}
```

9.2.16 Programmers' notes

Content

34229

IoT Core: General information

52256

The CabinetLine device family has an IoT Core. The IoT Core allows the user to address the AL1900 from IT networks via a REST API and to integrate it into Internet-of-Things applications.

A device description is stored on the AL1900. This device description is a structured, machine-readable data object in JSON format. All current values of parameters, process data, diagnostic data and device information are mapped in this data object. These data values can be read and changed by means of services.

Access the ifm IoT Core

The user can access the ifm IoT Core via HTTP requests. The following request methods are available.

GET request

Using the GET method the user has read access to a data point.
The syntax of the request to the IoT Core is:

```
http://ip/datapoint/service
```

Parameter	Description
ip	IP address of the IoT interface
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":diag_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
diag_code	Diagnostic code (→ **IoT Core: Diagnostic codes** (→ S. 59))

Example: GET request

Request (via browser):

```
http://192.168.0.250/devicetag/applicationtag/getdata
```

Response:

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

POST request

54700

Using a POST request the user has read and write access to a data point.

The syntax of the request to the IoT Core is:

```
{
"code":"code_id",
"cid":id,
"adr":"data_point/service",
"data":{req_data},
"auth":{"user":"usr_id","passwd":"password"}
}
```

Field	Parameter	Description	
code	code_id	Service class	
		▪ request	Request
		▪ transaction	Transaction
		▪ event	Event
cid	id	Correlation ID for the assignment of request and response; vom Nutzer frei vergebbare Kennung	
adr	data_point	Data point of the element tree which is to be accessed	
	service	Service to be performed (→ **Overview: IoT services** (→ S. 93))	
data*	req_data	Data to be transferred to the IoT Core (e.g. new values); syntax depending on the service	
auth**	usr_id	user name (base64 coded); default value: administrator	
	password	password (base64 coded)	

* = optional; only required for services, that submit data to the IoT core (e. g. setdata)
** = optional; only required, if security mode is activated

The syntax of the return of the IoT Core is:

```
{
"cid":id,
"data":{resp_data},
"code":diag_code
}
```

Field	Parameter	Description
cid	id	Correlation ID for the assignment of request and response (see request)
data*	resp_data	Value of the data point; syntax depending on the service
code	diag_code	Diagnostic code (→ **IoT Core: Diagnostic codes** (→ S. 59))

* = optional; only required for services, that receive data from the IoT core (e.g. gettdata)

Example: POST request

Request:

```
{
"code":"request",
"cid":4711,
"adr":"devicetag/applicationtag/getdata"
}
```

Response:

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

IoT Core: Diagnostic codes

Code	Text	Description
200	OK	Request successfully processed
230	OK but needs reboot	Request successfully processed; IO-Link master must be restarted
231	OK but block request not finished	Request successfully processed; blockwise request, but not yet finished
232	Data has been accepted, but internally modified	New values have been accepted, but were adjusted by the IO-Link master
233	IP settings of the IoT core changed; application has to reboot the device; Wait for min. 1 second before the device is rebooted	IP settings have been successfully changed, IO-Link master will be restarted; wait for at least 1 second
400	Bad request	Invalid request
401	Unauthorized	Non authorised request
403	Forbidden	Forbidden request
500	Internal Server Error	Internal fault
503	Service Unavailable	The service is not available (e. g. IO-Link port in wrong operating mode; no IO-Link device at IO-Link port)
530	The requested data is invalid	Invalid process data
531	IO-Link error	Error in IO-Link master / device
532	PLC connected Error	Error: The IO-Link master is still connected with the fieldbus PLC

9.3   PROFINET

Content

34541

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!

9.3.1 Install GSD Files

ifm provides a GSD file to integrate the AL1900 in the PROFINET projection software. All parameters, process data and their valid value ranges are defined in the GSD file. The user can download the GSD file from the ifm website (→ www.ifm.com).

To add the IO-Link master to the hardware catalogue of the PROFINET projection software:

► Download the GSD file of the AL1900 from the ifm website.

► Launch the PROFINET projection software.

► Install the GSD file of the AL1900.

Once the GSD file is installed, the AL1900 is in the hardware catalogue in the following folder:

> [PROFINET IO] > [Addiotional Field Devices] > [IO] > [ifm electronic]

1	AL1900
2	IO-Link ports
3	PROFINET modules
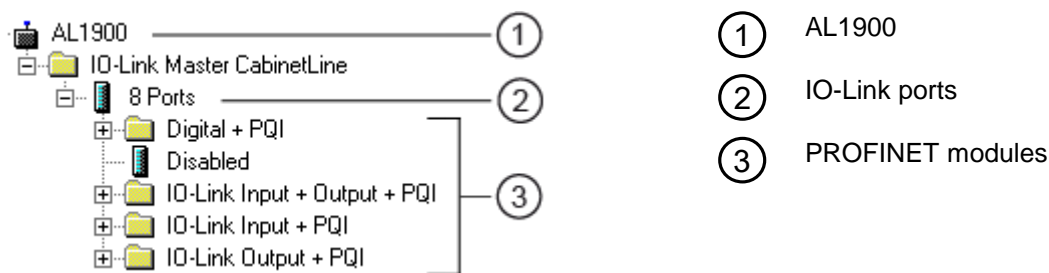
9.3.2 Integrate the IO-Link master in the project

The AL1900 can be integrated from the hardware catalogue into the project.

► Create new project /open project

► Create and configure PROFINET controller and coupling units.

► Create and configure PROFINET connection.

► Drag the [AL1900] node from the hardware catalogue and drop it on the PROFINET connection.

> The AL1900 is displayed as part of the PROFINET network.

To integrate the AL1900 in the network infrastructure, the fieldbus interface must be configured correspondingly.

► Double click on slot 0 to open the configuration of the AL1900.

► Configure the Ethernet interface of the IO-Link master.

► Drag the [8 Ports] node from the hardware catalogue and drop it on slot 1 of the IO-Link master.

► Save the project.

The IO-Link master is integrated in the project and can be configured.

9.3.3   Configure the IO-Link master

52480

You can access the configuration of the IO-Link master via slot 1.1 of the AL1900.

The parameter [Access Rights] determines which controller instance may have read and write access to the data of the IO-Link master.

To set the parameters of the IO-Link master:

► In the project: Double click on slot 1.1 of the AL1900.

► Set parameters [Access Rights] as required (→ **Parameter of the IO-Link master** (→ S. 78)).

► Save the project.

> If the parameter [Access Rights] = [PROFINET + IoT] in LR DEVICE and the PROFINET projection software, the parameter values set in the PROFINET projection software will always apply.
>
> If the parameter [Access Rights] = [IoT only] in LR DEVICE, set the parameter [Access Rights] = [Keep settings] in the projection software.
>
> Changes of the parameter [Access Rights] will only be effective after restarting the IO-Link master (→ **Firmware: Reboot the device** (→ S. 34)).

9.3.4 Configure IO-Link ports

52481

You can access the configuration of the IO-Link ports via the slots 1.2 ... 1.9 of the AL1900. The following assignment applies

Slot	IO-Link port of the AL1900
1.2	Port X01
1.3	Port X02
...	...
1.9	Port X08

The available PROFINET modules are defined in the GSD file (→ **PROFINET modules** (→ S. 81)). A PROFINET module determines the following properties of an IO-Link port:

- Operating mode (IO-Link, DI, DO, deactivated)
- Type and length of the process data
- Optional data (fail-safe values, device validation, data storage, cycle time, events)

The following table shows the available parameters depending on the selected operating mode:

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

-- = not available
X = available

To configure an IO-Link port of the AL1900:
- ► Drag the required PROFINET module from the hardware catalogue and drop it on the slot of the IO-Link port.
- ► Double click on the slot of the IO-Link port
- ► Set the parameters as required (→ **Parameters of the IO-Link ports** (→ S. 79)).
- ► Configure unused IO-Link ports with PROFINET module "Deactivated".
- ► Repeat the steps to configure further IO-Link ports.
- ► Save the project.

9.3.5   Configure IO-Link devices

52482

The AL1900 supports the configuration of the connected IO-Link devices via the PROFINET application. The configurable parameters depend on the IO-Link device that is used.

> Configurable parameters of the IO-Link devices: → IO Device Description (IODD) of the IO-Link Devices

The following options are available:

Symbol (function block)	Description	Notes
IO_LINK_DEVICE (FB5001)	Acyclic access to the parameters of an IO-Link device	Input parameter: • CAP: Access point for function AL1900: AL1900: 0xB400 • PORT: Slot/sub-slot of the IO-Link interface of the connected IO-Link device Port X01: 1 Port X02: 2 ... Port X08: 8 • IOL_INDEX and IOL_SUBINDEX: Index and sub-index of the parameter (depends on the IO-Link device: → IO Device Description (IODD))
IOL_CALL (FB1)	Acyclic access to the parameters of an IO-Link devices (obsolete)	→ IO_LINK_DEVICE (FB5001)

9.3.6 Read and write cyclic process data

52483

While the IO-Link ports are being configured, IEC addresses are generated automatically for inputs and outputs as well as the PQI byte. To enable access to the cyclic process data in the application, the user must couple the IEC addresses with symbolic variables. This can be done in global lists of variables (STEP 7: [Symbols]; TIA portal: [PLC tags]).

Take the following actions in global lists of variables of the PROFINET controller:

► Create a symbolic name and select the data type

► Assign an IEC address to the symbolic name

► Save the project.

Using the symbolic name, the user can read the inputs and write the outputs from the application.

> [!] ► To check the validity of the cyclic process data, evaluate the PQI byte (→ **PQI (Port Qualifier Information)** (→ S. 82)).
>
> Even if the fieldbus connection is interrupted, the PQI byte indicates that the process data is valid. This may have an unintended impact on the control process.
>
> ► Take suitable measures to detect an interruption of the fieldbus connection.

Read additional digital input

52549

IO-Link ports X01...X08 have a additional digital input (pin 2). The current value is mapped to the PQI byte (→ **PQI (Port Qualifier Information)** (→ S. 82)).

9.3.7 Read I&M datasets

52484

I&M0 provide the user with device-specific basic information. This ensures reliable identification of the device, the device's hardware and software components as well as 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 by means of the following functions:

Symbol / function block	Description	Notes
GET_IM_DATA	▪ 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: ▪ IM_TYPE = 0
RDREC	Function block for acyclic reading of datasets	Input parameters: ▪ 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: ▪ I&M1: Index = 0xAFF1 ▪ I&M2: Index = 0xAFF2 ▪ I&M3: Index = 0xAFF3

9.3.8 Detect diagnostics and alarms

52485

Available alarms and diagnostic messages: → **Diagnostic and alarms** (→ S. 85)

Symbol	Operational block	Description
I/O_FLT1	OB82	Diagnostic alarms
I/O_FLT2	OB83	Connect/disconnect alarms
RACK_FLT	OB86	Module rack failure

10 Maintenance, repair and disposal

51990

The operation of the unit is maintenance-free.

► Dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations when it is no longer used.

10.1 Cleaning process

51991

► Clean the surface of the unit when necessary.

► Do not use any caustic cleaning agents for this!

10.2   Update firmware

52258

The firmware of the IO-Link master can be updated with the following options:

- IoT Core: → **Example: Update firmware** (→ S. 50)

- Web interface:

> ⚠ If the firmware update is not successful, deactivate all connections to the LR SMARTOBSERVER and LR DEVICE and repeat the process.
>
> ► Deactivate the connection to the PROFINET PLC.
> ► Set the parameter [IP address LR SMARTOBSERVER] to 255.255.255.255 or 0.0.0.0 (→ **IoT: Configure the interface to LR AGENT or LR SMARTOBSERVER** (→ S. 30)).
> ► Stop the LRAgent.LRDevice service in the Windows task manager.
>
> After the firmware update, check the settings of the interface to the LR SMARTOBSERVER!

Prerequisites

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

1   Call up web interface

► Start web browser.

► Enter the following into the address field of the browser and confirm with [ENTER]:
   `http://<IP address of the device>/web/update`

> Web browser shows the [Firmware Update] page.

2   Load new firmware to AL1900

► Click on [Select file].

> Dialogue window appears.

► Select the firmware file (.bin) and click on [Open].

► 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.

10.3   Replace IO-Link device

34182

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.

11 Factory settings

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)	empty

12 Accessories

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

13 Appendix

Content

33879

13.1 Technical data

Content

34188

13.1.1 Application

33878

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

13.1.2 Electrical data

33808

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

34068

Inputs / outputs	
Total number of inputs and outputs	16; (configurable)
Number of Inputs and Outputs	Number of digital inputs: 16; Number of digital outputs: 8

13.1.4 Inputs

34069

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

13.1.5 Outputs

34053

Outputs	
Number of digital outputs	8; (IO-Link Port Class A)
Max. current load per output [mA]	300
Short-circuit protection	yes

13.1.6 Interfaces

34389

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	- 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	- 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

33811

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

33877

Approval / tests	
EMC	▪ EN 61000-6-2 ▪ EN 61000-6-4
MTTF [Years]	90

13.1.9 Mechanical data

34050

Mechanical data	
Weight [g]	330
Materials	Housing: PA

13.1.10 Electrical connection

33807

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...X08			
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

Content

33674

13.2.1   Parameter data

34546

Slot	Subslot	Name	Description
1	1	Master	Parameter data of the IO-Link master (→ **Parameter of the IO-Link master** (→ S. 78))
	2	Port X01	
	3	Port X02	
	4	Port X03	
	5	Port X04	▪ Parameter data of the IO-Link ports (→ **Parameters of the IO-Link ports** (→ S. 79)
	6	Port X05	▪ modules (→ **PROFINET modules** (→ S. 81))
	7	Port X06	
	8	Port X07	
	9	Port X08	

Parameter of the IO-Link master

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 + IoT	• 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 + IoT (ro)	• 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	• 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

34528

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]*	▪ 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	▪ no verification of the vendor ID and device ID ▪ no data storage
		Type compatible V1.0 device	▪ 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	▪ 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	▪ 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	▪ 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	Diabled	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

33814

PROFINET modules

34539

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	Digital input and PQI
DO + PQI		Digital output and PQI
Disabled	deactivated	

PQI (Port Qualifier Information)

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

33868

I&M datasets

34555

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

I&M0 (Slot 0)

34545

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	Suported I&M datasets (0x1110 for I&M1-3)	r	2

* ... r = only read

I&M1 (Slot 0)

34543

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)

34544

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)

34550

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)

34542

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 = IOLink)	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

34533

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

33803

13.3.1 Overview: IoT profile

Content

34054

Profile: blob

52264

Element (identifier)	Characteristics	Mandatory	Comments
blobname	▪ type = data ▪ profiles = blob		Characterises the element as device information
../size	type = data	mandatory	
../chunksize	type = data	mandatory	
../setblobdata	type = service	optional	
../getblobdata	type = service	optional	
../start_stream_set	type = service	optional	
../stream_set	type = service	optional	
../clear	type = service	optional	
../getcrc	type = service	optional	
../getmd5	type = service	optional	
../getdata	type = service	optional	
../setdata	type = service	optional	

Profile: deviceinfo

34207

Element (identifier)	Properties	mandatory	Comments
deviceinfo	▪ type = structure ▪ profile = deviceinfo		characterises the element as device information
../devicename	type = data	optional	
../devicefamiliy	type = data	optional	
../devicevariant	type = data	optional	
../devicesymbol	type = data	optional	
../deviceicon	type = data	optional	
../serialnumber	type = data	mandatory	
../productid	type = data	optional	
../productname	type = data	optional	
../productcode	type = data	mandatory	
../producttext	type = data	optional	
../ordernumber	type = data	optional	
../productiondate	type = data	optional	
../productioncode	type = data	optional	
../hwrevision	type = data	mandatory	
../swrevision	type = data	mandatory	
../bootloaderrevision	type = data	optional	
../vendor	type = data	optional	
../vendortext	type = data	optional	
../vendorurl	type = data	optional	
../vendorlogo	type = data	optional	
../productwebsite	type = data	optional	
../supportcontact	type = data	optional	
../icon	type = data	optional	
../image	type = data	optional	
../standards	type = data	optional	

Profile: devicetag

34206

Element (identifier)	Properties	mandatory	Comments
devicetag	▪ type = structure ▪ profile = devicetag		
../applicationtag	type = data	mandatory	
../applicationgroup	type = data	optional	
../machinecode	type = data	optional	
../tenant	type = data	optional	

Profile: iolinkdevice_full

52265

Element (identifier)	Characteristics	Mandatory	Comments
iolinkdevice	▪ type = structure ▪ profile = iolinkdevice_full		Structure of an IO-Link device
../vendorid	type = data	mandatory	
../deviceid	type = data	mandatory	
../productname	type = data	mandatory	
../serial	type = data	mandatory	
../applicationspecifictag	type = data	mandatory	
../pdin	type = data	mandatory	
../pdout	type = data	mandatory	
../status	type = data	mandatory	
../iolreadacyclic	type = data	mandatory	
../iolwriteacyclic	type = data	mandatory	
../iolinkevent	type = data	mandatory	

Profile: iolinkmaster

34205

Element (identifier)	Properties	mandatory	Comments
masterport	▪ type = structure ▪ profile = iolinkmaster		Executable service
../mode	▪ type = data ▪ profile = parameter	mandatory	
../comspeed	▪ type = data ▪ profile = parameter	mandatory	
../mastercycletime_actual	▪ type = data ▪ profile = parameter	mandatory	
../mastercycletime_preset	▪ type = data ▪ profile = parameter	mandatory	
../validation_datastorage_mode	▪ type = data ▪ profile = parameter	mandatory	
../validation_vendorid	▪ type = data ▪ profile = parameter	mandatory	
../validation_deviceid	▪ type = data ▪ profile = parameter	mandatory	
../additionalpins_in	▪ type = data ▪ profile = processdata	optional	
../additionalpins_out	▪ type = data ▪ profile = processdata	optional	
../portevent	▪ type = data	mandatory	
../iolinkdevice	▪ type = structure ▪ profile = iolinkdevice_full	mandatory	

Profile: network

52266

Element (identifier)	Characteristics	Mandatory	Comments
network	• type = structure • profiles = deviceinfo		Characterises the element as device information
../macaddress	• type = data • profile = parameter	mandatory	
../ipaddress	• type = data • profile = parameter	optional	
../ipv6address	• type = data • profile = parameter	mandatory	
../subnetmask	• type = data • profile = parameter	mandatory	
../ipdefaultgateway	• type = data • profile = parameter	mandatory	
../dhcp	• type = data • profile = parameter	optional	
../ipversion	• type = data • profile = parameter	optional	
../hostname	• type = data • profile = parameter	optional	
../autonegotiation	• type = data • profile = parameter	optional	
../portspeed	• type = data • profile = parameter	optional	
../enablenetwork	type = service	optional	
../disablenetwork	type = service	optional	

Profile: parameter

34215

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

Profile: processdata

34225

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

34224

Element (identifier)	Properties	mandatory	Comments
service	• type = service • profile = service		Executable service

Profile: software

34223

Element (identifier)	Properties	mandatory	Comments
software	▪ type = structure ▪ profile = software		characterises the element as software
../version	type = data	mandatory	
../type	type = data	mandatory	
../status	type = structure	optional	
../diag	type = structure	optional	

Profile: software/uploadedablesoftware

52267

Element (identifier)	Characteristics	Mandatory	Comments
software	▪ type = structure ▪ profiles = software/uploadablesoftware		Software that can be loaded to the device via the IoT Core
../lastinstall	type = data	optional	
../installhistory	type = data	optional	
../container	▪ type = data ▪ profile = blob	mandatory	
../preinstall	type = service	optional	
../install	type = service	mandatory	
../postinstall	type = service	optional	
../abortinstall	type = service	optional	
../installstatus	type = data	optional	

Profile: timer

34226

Element (identifier)	Properties	mandatory	Comments
timer	▪ type = structure ▪ profile = timer		Executable service
../counter	▪ type = data ▪ profile = parameter	mandatory	
../interval	▪ type = data ▪ profile = parameter	optional	
../start	type = service	optional	
../stop	type = service	optional	

13.3.2   Overview: IoT types

34055

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

Content

34056

Service: factoryreset

34184

Name: factoryreset

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

Request data (field "data"): none

Response data (field "data"): none

Example:
```
{"code": "request", "cid": 4711, "adr": "/firmware/factoryreset"}
```

Service: gettree

Name: gettree

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

Request data (field "data"): none

Response data (field "data"):

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

Example:
```
{
"code":"request",
"cid":4,
"adr":"/gettree"
}
```

Service: getdata

Name: getdata

Description: Service reads the value of a data point and provides it.

Request data (field "data"): none

Return data (field "data"):

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

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

Service: getdatamulti

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.

Request data (field "data"):

Data field	Required field	Data type	Description
datatosend	mandatory	ARRAY OF STRINGS	List of data points to be requested; data points must support the service getdata ("datatosend":["url1","url2",...,"urlx"])
consistent	optional	BOOL	

Response data (field "data"): for each requested data point

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

Service: getidentity

Name: getidentity

Description: The service reads the device information of the AL1900 and issues it.

Request data ("data" field): none

Return data ("data" field):

Data field	Required field	Data type	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	optional	ARRAY OF OBJECTS		
device	optional		AL1900	
device.serialnumber	optional		Serial number	
device.hwrevision	optional		Hardware version	
device.swrevision	optional		Software version	
device.custom	optional			
Security	optional		Security options	
security.securitymode	optional	ENUM	shows if the security mode is activated	
security.authscheme	optional	ENUM	shows the active authentication scheme	
security.ispasswordset	optional	BOOL	shows whether a password has been set	
security.activeconnection	optional	ENUM	shows the currently used communication interface	
			▪ tcp_if	unencrypted http connection at the IoT interface, port 80
			▪ tls_if	encrypted https connection at the IoT interface, port 443
			▪ fb_if	unencrypted http connection at the fieldbus interface, port 80

Service: getsubscriptioninfo

Name: getsubscriptioninfo

Description: The service provides information about an existing subscription (subscribe).

Request data (field "data"):

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

Response data (field "data"):

Data field	Required field	Data type	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 of subscribed data points

Example:

- **Request:**

```
{
"code":"request",
"cid": 4715,
"adr":"/timer[1]/counter/datachanged/getsubscriptioninfo",
"data":{
"callback":"http://192.168.0.44:80/temp"}
}
```

- **Response:**

```
{
"cid": 4715,
"data":{
"callback":"http://192.168.0.44:80/temp",
"datatosend":[
"/iolinkmaster/port[2]/iolinkdevice/productname",
"/iolinkmaster/port[2]/iolinkdevice/pdin",
"/processdatamaster/temperature"]},
"code":200
}
```

Service: iolreadacyclic

Name: iolreadacyclic

Description: The service acyclically reads the parameter value of an IO-Link device. The parameter is accessed via IO-Link index and subindex.

Request data (field "data"):

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

Response data (field "data"):

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

Service: iolwriteacyclic

Name: iolwriteacyclic

Description: The service acyclically writes the parameter value of an IO-Link device. The parameter is accessed via IO-Link index and subindex.

Request data (field "data"):

Data field	Required field	Data type	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

Response data (field "data"): none

Service: reboot

Name: reboot

Description: The service reboots the device.

Request data (field "data"): none

Return data (field "data"): none

Example:

```
{
"code":"request",
"cid":4,
"adr":"firmware/reboot"
}
```

Service: setblock

Name: setblock

Description: The service simultaneously sets the values of several data points of a structure.

Request data (field "data"):

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

Response data (field "data"): none

Example:
```
{
"code":"request",
"cid":4711,
"adr":"/iotsetup/network/setblock",
"data":{"consistent":true,"datatosend":["ipaddress":"192.168.0.6","ipdefaultgatewa
y":"192.168.0.250"]}
}
```

Service: setdata

Name: setdata

Description: The service sets the value of the data point.

Request data (field "data"):

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

Response data (field "data"): none

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

Service: setelementinfo

Name: setelementinfo
Description: The service sets the uid of an element.
Request data (field "data"):

Data field	Required field	Data type	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	

Response data (field "data"):

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

Service: signal

Name: signal
Description: The service starts the flashing of the status LEDs of the AL1900.
Request data (field "data"): none
Return data (field "data"): none

Example:
```
{
"code":"request",
"cid":4711,
"adr":"firmware/signal"
}
```

Service: subscribe

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.

Request data (field "data"):

Data field	Required field	Data type	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

Response data (field "data"): none

Service: unsubscribe

Name: unsubscribe

Description: The service deletes an existing subscription. unsubcribe 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.

Request data (field "data"):

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

Response data (field "data"): none

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