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

AL1940

IO-Link: 1.1.2
ifm firmware: 2.1.19 or higher
LR DEVICE: 1.3.0.131 or higher

English

7391167 / 00 04 / 2018

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1 Preliminary note

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1.1 Legal and copyright information

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1.2 Purpose of the document

22044

This document is only for device types "IO-Link master - Modbus TCP gateway (CabinetLine) 8 port IP 20" (art. no.: AL1940).

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

► Read this document before using the device.

► Keep this document during the service life of the device.

1.3 Symbols and styles used

15989

⚠ WARNING

Death or serious irreversible injuries may result.

⚠ CAUTION

Slight reversible injuries may result.

NOTICE

Property damage is to be expected or may result.

Important note
Non-compliance can result in malfunction or interference

Information
Supplementary note

► ... Request for action

> ... Reaction, result

→ ... "see"

abc Cross-reference

123 Decimal number
0x123 Hexadecimal number
0b010 Binary number

[...] Designation of pushbuttons, buttons or indications

1.4 Modification history

21676

Version	Topic	Date
00	New creation of document	04 / 2018

2 Safety instructions

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2.1 General

22068

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

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

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

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

2.2 Required background knowledge

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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

15021

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

2.4 Tampering with the unit

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WARNING

Tampering with the units can affect the safety of operators and machinery!
Tampering with the units is not allowed.
In case of non-compliance our liability and warranty expire.

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

3 Intended use

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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 fieldbus. 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** (→ p. 68))!

4 Function

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4.1 Communication, parameter setting, evaluation

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7485

4.1.1 IO-Link

7773

The device offers the following IO-Link functions:

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

4.1.2 Modbus TCP

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The device offers the following Modbus TCP functions:

- Provision of the functions of a Modbus TCP Slave
- 2 port switch for access to the Modbus TCP interface (X21/X22)
- Gateway for transmission of the process and parameter data between the connected IO-Link devices and the higher-level Modbus TCP controller

4.1.3 Internet of Things (IoT)

8355

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

4.1.4 Parameter setting

7284

The device provides the following configuration options:

- Parameter setting of the IO-Link master of the AL1940 with LR DEVICE parameter setting software, Modbus TCP projection software or ifm IoT-Core services.
- Parameter setting of the connected IO-Link devices (sensors, actuators) with LR DEVICE parameter setting software, Modbus TCP projection software or ifm IoT-Core services
- Storage of parameter sets of the connected IO-Link devices for automatic recovery (data storage)

4.1.5 Visual indication

7772

The device has the following visual indicators:

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

4.2 Digital inputs

7584

The device has 8 additional digital inputs (type 2 according to EN 61131-2).
The digital inputs are on clamp 2 of the IO-Link ports X01 ... X08.
All inputs refer to the potential of the device supply (clamp 3).

4.3 IO-Link supply

7623

The device has 8 supplies for IO-Link devices.
The IO-Link ports X01...X08 are ports class A.
Every supply provides short circuit monitoring.
The device ensures fire protection for the connected IO-Link devices by providing a power-restricted circuit at the IO-Link ports (according to IEC61010-1 and Class 2 according to UL1310).

5 Mounting

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5.1 Install the device

16676

► Disconnect power before installation.

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

► When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD).

► Only operate the device when mounted on a grounded DIN rail.

► Install the device in a control cabinet of protection rating IP 54 or higher. The control cabinet has to be installed in accordance with local and national regulations.

► Fix the device vertically onto a 35 mm raised rail.

► Leave enough space between the unit and the top or bottom of the control cabinet as well as to adjacent devices to enable air circulation and to avoid inadmissible heating.

6 Electrical connection

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22017

6.1 Remarks

23709

A qualified electrician must connect the unit.

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

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

► Observe the information concerning IO-Link circuits (→ **IO-Link circuits** (→ p. 17))!

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

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

Wiring: → **Technical data** (→ p. 68)

6.2 Modbus TCP ports

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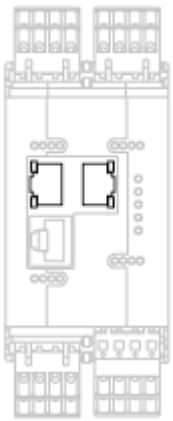

► Connect the unit via the sockets X21 and/or X22 to the Modbus TCP network.

► To connect the devices, use connectors with protection rating IP 20 or higher (→ **Accessories** (→ p. 66)).

6.3 IoT port

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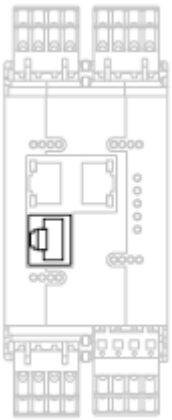

- ► Connect the device via the socket "IoT" (X23) to the IT network (e.g. laptop/PC with the installed LR DEVICE parameter setting software, laptop/PC with installed LR SMARTOBSERVER monitoring software).
- ► To connect the devices, use connectors with protection rating IP 20 or higher (→ **Accessories** (→ p. 66)).

6.4 IO-Link ports

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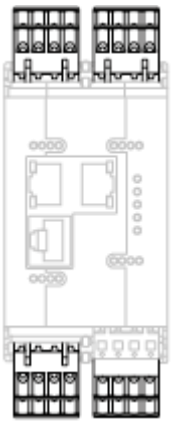

- ► Connect the IO-Link devices to the terminals X01 ... X08.
  - Wiring: → **Technical data** (→ p. 68)
  - Maximum cable length per IO-Link port: 20 m
- ► To connect the devices, use cables with protection rating IP 20 or higher.

If operating as IO-Link port class B:

- ► Observe notes regarding IO-Link circuits (→ **IO-Link circuits** (→ p. 17))!

6.4.1 Input circuit

17863

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

6.4.2 IO-Link circuits

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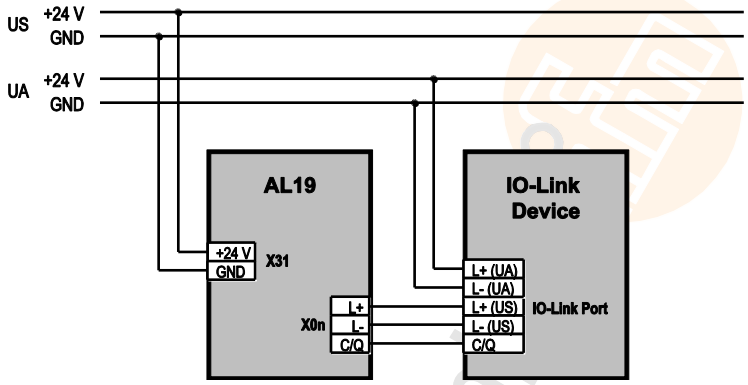
The IO-Link ports of the device meet the requirements of the IO-Link specification 1.0 bis 1.1.2.

The power supply of the connected IO-Link devices may only take place via the AL1940.
Exception: Connection of IO-Link devices with additonal external power supply to ports X01...X08 for port class B operation

Wiring:



Maximum admissible current for UA: 4 A

The external supply for port class B operation must be galvanically separeted from the circuit of the AL1940 by assuring basic isolation (according to EN61010-1, secondary circuit with maximum 30 V DC derived from applied voltage up to 300 V of overvoltage category II)!

NOTICE

Risk of material damage

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

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

Further information: → **Technical data** (→ p. 68)

6.5 Connect the device

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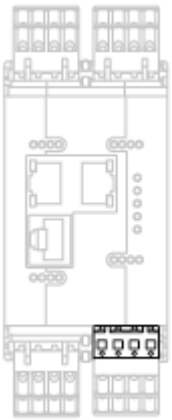

- ► Disconnect power.
- ► Connect the IO-Link master via port X31 to 24 V DC (20...30 V SELV/PELV; according to IEC 61010-1, secondary circuit with max. 30 V DC, supplied from main circuit up to 300 V of overvoltage category II).
  - Wiring: → **Technical data** (→ p. 68)
  - Recommended maximum cable 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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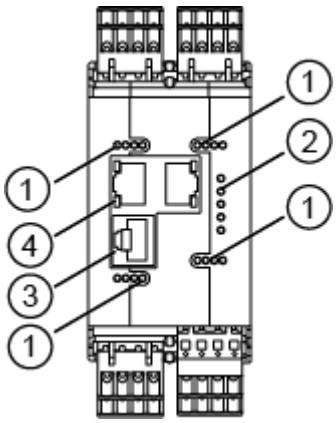

1. IOL and DI status-LEDs of the IO-Link port (X01...X0<IOL_AnzPort (→ **IO-Link ports (Class A)** (→ p. 22))
2. PWR status LED of the voltage supply (X31) (→ **Power supply** (→ p. 21))
   <IOL_StatusLED (→ status LEDs **Status LEDs** (→ p. 20))
   IoT status LED of the IoT port (X23) (→ **IoT port** (→ p. 21))
3. LNK status LED of the IoT port (X23) (→ **IoT port** (→ p. 21))
4. LNK and ACT status LEDs of the Modbus TCP ports 1 (X21) and 2 (X22) (→ **Ethernet interface** (→ p. 21))

7.2 LED indicators

22024

The device only has the following LED indicators:

7.2.1 Status LEDs

11748

The RDY LED indicates the status of the gateway.
The RUN LED indicates the current state of the Modbus TCP state machine.
The ERR LED indicates occurring errors.

Status LED			Description
RDY	green	on	gateway functions properly
		flashing 1 Hz	error
		flashing 5 Hz	firmware update
		off	gateway does not function; device reboots
ERR	red	on	error in application controller
		flashes (10 Hz)	boot error
		flashes (200 ms on, 200 ms off, 200 ms on, 1000 ms off)	watchdog error (Modbus TCP or process data)
		flashes (200 ms on, 1000 ms off)	local error
		flashes (2.5 Hz)	invalid configuration
		off	no error
RUN	green	on	connection established
		flashes (1 Hz)	ready, but not yet configured
		flashes (5 Hz)	waiting for connection
		off	not ready

7.2.2 Ethernet interface

22027

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

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

7.2.3 IoT port

7722

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

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

7.2.4 Power supply

17856

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

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

7.2.5 IO-Link ports (Class A)

22029

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

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

8 Configuration

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8.1 LR DEVICE

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22822

On delivery, the AL1940 is configured with the factory settings (→ **Factory settings** (→ p. 65)).

Required software: LR DEVICE (1.3.0.131 or higher) (art.-no.: QA0011/QA0012)

8.1.1 Remarks

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22369

Offline parameter setting

22405

The AL1940 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 AL1940 (OFFLINE mode). The configuration created in this way can be stored as a file (*.lrp) and loaded to the AL1940 and activated at a later date.

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

Parameter setting with LR DEVICE

10924

Parameter setting of the AL1940 with the LR DEVICE is only possible via the IoT interface X23.

8.1.2 IoT: Configure access rights

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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	[Modbus TCP + IoT]	▪ Modbus TCP and IoT Core have read and write access rights to parameters and process data ▪ Modbus TCP and <IoT Core> have read access rights to events/alarms
		[Modbus TCP + IoT (read-only)]	▪ Modbus TCP has read and write access rights to parameters and process data ▪ Modbus TCP 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 ▪ Modbus TCP has no access rights

► Save changed values on the device.

Parameter [Access Rights]:
Different parameter settings in the Modbus TCP projection software and the IoT applications can result in undesired system behaviour. The set values of the Modbus TCP projection software apply.

Changes of the parameter [Access Rights] are only effective after restarting the device.
To activate the changed access rights:

► **Firmware: Reboot the device** (→ p. 34)

8.1.3 IoT: Configure IP settings

17713

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

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

To configure the IP settings of the IoT port:

► Select [IoT] menu.

> The menu page shows the current settings.

► Set the following parameters as required:

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

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

► Save changed values on the device.

8.1.4 IoT: Configure the interface to the LR SMARTOBSERVER

16552

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

► Select [IoT] menu.

> The menu page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values	
[IP address LR SMARTOBSERVER]	IP address of the PC on which the LR SMARTOBSERVER is installed.	Factory setting: 255.255.255.255	
[Port LR SMARTOBSERVER]	Port number that is used to send process data to the LR SMARTOBSERVER	0 ... 65535	Factory setting:: 35100
[Interval LR SMARTOBSERVER]	Cycle time for the transfer of the process data to the LR SMARTOBSERVER (value in milliseconds)	[Off]	no transfer
		500 ... 2147483647	500 ms ... 2147483647 ms
[Application Tag]	Source identifier of the IO-Link master in the structure of the LR SMARTOBSERVER (String32)	Factory setting: AL1940	

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

To prevent the delay:

► Reboot the device after the parameter change.

► Save changed values on the device.

8.1.5 Fieldbus: configure Modbus TCP port

12284

The configuration of the IP settings of the fieldbus port is only possible via LR DEVICE.

To configure the fieldbus port:

► Select [Fieldbus] 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 parameters are set by the user
		[DHCP]	IP parameters are set by a DHCP server in the network.
		[BOOTP]	IP parameters are set via the Bootstrap Protocol (BOOTP)
[IP address]*	IP address of the Modbus TCP port	Factory setting: 192.168.1.250	
[Subnet mask]*	Subnet mask of the IP network	Factory setting: 255.255.255.0	
[Default gateway IP address]*	IP address of the gateway	Factory setting: 0.0.0.0	
[MAC address]	MAC address of the Modbus TCP interface	The value is firmly set.	
[Fieldbus firmware]	Firmware version of the Modbus TCP stack	e.g. 2.6.0.5	
[Process data length]	Length of the process input data and process output data per IO-Link port	2 bytes input 2 bytes output	2 bytes input data, 2 bytes output data
		4 bytes input 4 bytes output	4 bytes input data, 4 bytes output data
		8 bytes input 8 bytes output	8 bytes input data, 8 bytes output data
		16 bytes input 16 bytes output	16 bytes input data, 16 bytes output data
		32 bytes input 32 bytes output	32 bytes input data, 32 bytes output data
[Swap]	Sequence of bytes in the data word	off	as Array of Bytes
		on	as integer16 value; when process data is updated, bytes will be exchanged

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

► Save changed values on the device.

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

16551

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

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

To activate / deactivate data transfer:

► Select [Port x] menu (x = 1...8).

> The menu page shows the current settings.

► Set the following parameters as required:

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

► Save changed values on the device.

8.1.7 IO-Link ports: Configure operating mode

17439

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

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

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

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

► Select [Port x] menu (x = 1...8).

> The menu page shows the current settings.

► Set the following parameters as required:

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

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

17945

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

To configure the device validation and the data storage:

► Select [Port x] menu (x = 1...8).

> The menu page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values	
[Validation / Data Storage]	Supported IO-Link standard and behaviour of the device during connection of a new IO-Link device on port x (x = 1...8)	[No check and clear]	▪ 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 saved (observe the note!) ▪ When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.
		[Type compatible V1.1 device with Restore]	▪ IO-Link device is compatible with the V1.1 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ The IO-Link master saves the parameter values of the connected IO-Link device once. ▪ When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.
[Vendor ID]	ID of the manufacturer that is to be validated	0 ... 65535	Factory setting: 0 ifm electronic: 310
[Device ID]	ID of the IO-Link device that is to be validated	0 ... 16777215	Factory setting: 0

► Save changed values on the device.

8.1.9 IO-Link ports: set fail-safe values

11752

In case the Modbus TCP connection is interrupted, fail-safe values can be assigned to the outputs of the IO-Link ports.

To set the fail-safe values of the IO-Link ports:

► select [Port x] menu (x = 1...8).

> The menu page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values	
[Fail-safe digital out]	Fail-safe values for output (operating mode "DO")	Reset	Reset value (LOW)
		Old	hold old value
		Set	Set value (HIGH)
[Fail-safe IO-Link]	Fail-safe value for output (operating mode "IO-Link")	Off	no fail-safe value
		Reset	reset value
		Old	hold old value
		Pattern	provide sample

► Save changed values on the device.

8.1.10 Info: Show device information

12218

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	AL1940
[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	

8.1.11 Firmware: Reset device to factory settings

7209

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

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

8.1.12 Firmware: Reboot the device

18105

When rebooting the device, all settings are kept.
To restart the AL1940:

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

8.1.13 Configure IO-Link devices

11033

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

Requirements:

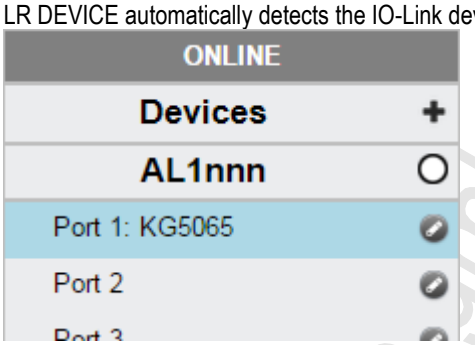
> IO-Link master is correctly installed and connected to the LR DEVICE parameter setting software.
> The IO-Link device is correctly connected to the AL1940.
> Operating mode of the IO-Link port is "IO-Link" (→ **IO-Link ports: Configure operating mode** (→ p. 31)).
> IoT has write access rights to the IO-Link master (→ **IoT: Configure access rights** (→ p. 26)).

1 Select IO-Link master

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

2 Add IO-Link device

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



3 Configure IO-Link device

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

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

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

8.2 IoT Core

Contents

17302

The user can access the IoT Core only via IoT port X23 of the ifm IO-Link master.
General notes on the ifm IoT Core: → **Programmers' notes** (→ p. 46)

The AL1940 is of type `device` (→ **Overview: IoT types** (→ p. 106)).
It has the following sub-structures:

Structure	Contents
processdatamaster	▪ Diagnostic data (temperature, voltage, current) ▪ Status of the current / voltage supply
deviceinfo	Device identification
timer[1]	Subscribe to data
timer[2]	Subscribe to data
iotsetup	Parameters of the IoT port (access rights, IP settings, IP settings of the LR SMARTOBSERVER)
fieldbussetup	Parameters of the fieldbus port (IP settings, device identification in fieldbus projection software)
iolinkmaster/port[n]	▪ Parameters of the IO-Link port (operating mode, transmission rate, cycle time, validation and data storage) ▪ Digital input data (clamp 2) ▪ Port event
iolinkmaster/port[n]/iolinkdevice	▪ Status information IO-Link devices on the IO-Link port ▪ Device information of the IO-Link device ▪ Process data on input/output ▪ Application-specific identification
firmware	▪ Firmware of the device ▪ Reset devices ▪ Reboot the device

The user can request the available data points and services in the substructures with `gettree`(→ **Service: gettree** (→ p. 107)). The service returns the device description as tree structure. It shows the services supported by a data point: In the sub-element "subs" each data point lists all services that can be applied to it.

8.2.1 Configure IoT port

16540

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

Name	Description	Access
iotsetup/accessrights	Access rights to the IO-Link master ▪ 0 = Modbus TCP + IoT ▪ 1 = Modbus TCP + IoT (read only) ▪ 2 = IoT only	rw
iotsetup/smobip	IP address of the LR SMARTOBSERVER	rw
iotsetup/smobport	Port number of the LR SMARTOBSERVER	rw
iotsetup/smobinterval	Cycle time for (value in milliseconds)	rw
iotsetup/network/dhcp	Configuration of the IP settings of the IoT port ▪ 0 = STATIC_IP/OFF ▪ 1 = DHCP/ON	rw
iotsetup/network/ipaddress	IP address of the IoT port	rw
iotsetup/network/subnetmask	Subnet mask of the network segment	rw
iotsetup/network/ipdefaultgateway	IP address of the network gateway	rw

rw ... read and write

Data point [iotsetup/accessrights]:
Different parameter settings in the Modbus TCP projection software and the IoT applications can result in undesired system behaviour. The set values of the Modbus TCP projection software apply.

8.2.2 Configure the fieldbus port

11747

The parameters of the fieldbus port X21/X22 are saved in the `fieldbussetup` substructure. The user can access the following data points:

Last name	Description	Access
fieldbussetup/fieldbusfirmware	Firmware version of the IO-Link master	r
fieldbussetup/network/macaddress	MAC address of the fieldbus port	r
fieldbussetup/network/ipaddress	IP address of the fieldbus port	rw
fieldbussetup/network/subnetmask	Subnet mask of the network segment	rw
fieldbussetup/network/ipdefaultgateway	IP address of the network gateway	rw
fieldbussetup/network/dhcp	Activate/deactivate the DHCP client of the device	rw
fieldbussetup/connectionstatus	Status of the connection to the Modbus TCP network	r
fieldbussetup/independentmode/ processdataconfiguration	Length of the process input data and process output data	rw
fieldbussetup/independentmode/swap	Arrangement of the bytes	r/w
fieldbussetup/independentmode/port[n]/ failsafedigital	Fail-safe value for the digital output - Pin 4 (DO)	r/w
fieldbussetup/independentmode/port[n]/ failsafeiolink	Fail-safe value for output data IO-Link	r/w

n ... 1...8
r = read only
rw ... read and write

8.2.3 Configure IO-Link ports

16454

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

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

n ... 1...8)
r = read only
rw ... read and write
* ... only available if Modbus TCP PLC is separated from the device

8.2.4 Set application identification

16580

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

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

rw ... read and write

8.2.5 Read / write cyclic process data

10994

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

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

n ... 1...8
r = read only
rw ... read and write
* ... only available if Modbus TCP PLC is separated from the device

8.2.6 Read diagnostic data

16571

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

Name	Description	Access
processdatamaster/temperature	Temperature of the IO-Link master (value in °C)	r
processdatamaster/voltage	Voltage applied (value in V)	r
processdatamaster/current	Current (value in A)	r
processdatamaster/supervisionstatus	Diagnostic information of the device supply ▪ 0 = no error ▪ 1 = short circuit ▪ 2 = overload ▪ 3 = undervoltage	r

r = read only

8.2.7 Read device information

17133

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

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

r = read only

Additional information about the AL1940 can be read with the `getidentity` service (→ **Service: getidentity** (→ p. 110)).

8.2.8 Read information about IO-Link devices

16553

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

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

n ... 1...8
r ... read only
rw ... read and write

8.2.9 Configure IO-Link devices

11002

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

The user can use the following services:

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

n ... 1...8
r = read only
rw ... read and write

8.2.10 Control IO-Link master

17963

The device can be controlled via the following services:

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

r = read only
rw ... read and write

8.2.11 Examples

Contents

16577

Example: Read process data of an IO-Link device

16574

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

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

- **Request object:**

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

- **Return object:**

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

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

0x03C9 = 0b**1111001**001

Temperature value: 0b11110010 = 242

Therefore: The current temperature value is 24.2 °C.

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

17310

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

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

- **Request object:**

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

- **Return object:**

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

Example: Change name of the IO-Link master

10987

Task: Set the name of the IO-Link master for the representation in the LR SMARTOBSERVER to AL1940.

Solution: Change the parameter [Application Tag] with the setdata service to the value [AL1940].

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

- **Request object:**

```
{
"code":10,
"cid":4711,
"adr":"/devicetag/applicationtag/setdata",
"data":{"newvalue":"AL1940"}
}
```

- **Return object:**

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

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

16546

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

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

- **Request object:**

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

- **Return object:**

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

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

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

16578

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

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

- **Request object:**

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

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

- **Response object:**

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

Example: Subscribe to event

17946

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

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

- **Request object:**

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

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

- **Request object:**

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

- **Response object**

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

8.2.12 Programmers' notes

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10989

ifm IoT Core: General information

16576

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

The IoT Core provides the user with the following functions:

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

Device description

14411

The IoT Core creates a device description on the AL1940. This device description is a structured, machine-readable data object in JSON format. All current values of parameters, diagnostic data and device information are mapped in this data object. The user can access this data object from IT networks.

The complete device description can be read using the gettree (→ service **Service: gettree** (→ p. 107)).

Access ifm-IoT Core

17561

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

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

GET method

21300

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

```
ip/datapoint/service
```

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

The syntax of the return of the IoT Core is:

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

parameter	Description
id	Correlation ID for the assignment of request and return
resp_data	Value of the data point; depending on the data type of the data point
err_code	Error code (→ **IoT Core: Diagnostic codes** (→ p. 49))

Example:
Request (via browser): `192.168.0.250/devicetag/applicationtag/getdata`
Return: `{"cid":-1,"data":{"value":"AL1940"}, "code":200}`

POST method

16548

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

The syntax of the request to the IoT Core is:

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

Parameter	Description	
code_id	ID of the service class	
	10	Request
	11	Transaction
	80	Event
id	Correlation ID for the assignment of request and return	
data_point	Data point which is to be accessed	
service	Service to be performed (→ **Overview: IoT services** (→ p. 107))	
req_data	Data to be transferred to the IoT Core (e.g. new values); indication optional (depending on the service)	

The syntax of the return of the IoT Core is:

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

Parameter	Description
id	Correlation ID for the assignment of request and return
resp_data	Value of the data point; depending on the data type of the data point
err_code	Error code (→ **IoT Core: Diagnostic codes** (→ p. 49))

Example:

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

Return: `{"cid":4711,"data":{"value":"AL1940"}, "code":200}`

IoT Core: Diagnostic codes

17437

The ifm IoT Core uses the following diagnostic codes:

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

8.3 Modbus TCP

Contents

11614

On the field bus side, the device can be configured with any Modbus TCP compatible projection software.

8.3.1 Integrate the AL1940 into the Modbus project

11754

The AL1940 provides the functionality of a Modbus-TCP slave. The user can integrate the IO-Link master via the profile of a generic Modbus-TCP slave to a fieldbus project.

The IO-Link master, the IO-Link Ports and the process data are configured via the Modbus register of the AL1940.

Example: Integrate IO-Link master in a CODESYS project

9612

Familiarise yourself with the following CODESYS functions!

- Modbus master:
  → Online help > Fieldbus support >Modbus configurator >Modbus master
- Modbus slave device:
  → Online help > Fieldbus support > Modbus configurator > Modbus slave device

Task: Integrate IO-Link master in a CODESYS project

Hardware:

- AC14 DL as Modbus-TCP master
- AL1940 as Modbus-TCP slave

Solution:

Preparation:

► Create CODESYS project with AC14 DL.

1 Create Modbus-TCP master

► In the device tree: Right-click on X8

> Context menu appears.

► In the context menu: Select [Add Device...].

> Dialogue window appears.

► Select the following settings:
1. [Vendor]: Select [ifm electronic].
2. [Device]: Select [Modbus_TCP_Master].
3. [Name]: Enter a unique name.

► Click on [Add Device].

> Device tree shows Modbus-TCP master as sub-node of the interface X8.

2 Create Modbus-TCP slave (AL1940)

► In the device tree: Right-click on the node of the added Modbus-TCP master

► In the context menu: Select [Add Device...].

> Dialogue window appears.

► Select the following settings:
1. [Vendor]: Select [ifm electronic].
2. [Device]: Select [Modbus_TCP_Slave].
3. [Name]: Enter a unique name

► Click on [Add Device].

> Device tree shows AL1940 as sub-node of the Modbus-TCP master.

3 Configure Modbus-TCP slave

► In the following tabs, set the parameters as required:
1. [General]
2. [ModbusTCPSlave Parameters]

8.3.2 Set IO-Link master and IO-Link ports

10928

Register area for the access to the configuration of the IO-Link master: → **Configuration Area** (→ p. 74)
The area contains the following data:

- Access rights to the IO-Link master
- Data length of the IO-Link input and output data of all IO-Link ports
- Alignment of the bytes in a data word
- Port configuration of the IO-Link ports

► Observe the general rules for access to the Modbus registers (→ **Rules for accessing the Modbus register** (→ p. 59))!

Several connected register areas can be written with one write command.

► When writing the registers, ensure that the transferred parameter data has the correct length!

Register area		Contents	Access
Start address	Length (words)		
8998	1	Access Rights; Process Data Length	r/w
8999	1	Byte swap	r/w
9000	6	Port X01: Port Configuration	r/w
9006	6	Port X02: Port Configuration	r/w
9012	6	Port X03: Port Configuration	r/w
9018	6	Port X04: Port Configuration	r/w
9024	6	Port X05: Port Configuration	r/w
9030	6	Port X06: Port Configuration	r/w
9036	6	Port X07: Port Configuration	r/w
9042	6	Port X08: Port Configuration	r/w

r/w = read and write

In addition, the user can set the IO-Link ports of the AL1940 via the following acyclic commands:

- "Set Mode": → **Command 0x10 – set mode** (→ p. 91)
- "Set Validation ID / Data Storage": → **Command 0x20 – set validation ID / data storage** (→ p. 93)
- "Set Fail-safe Data Pattern": → **Command 0x30 – set fail-safe data pattern** (→ p. 95)

The commands use the process mechanisms of the acyclic command channel (→ **Use acyclic services** (→ p. 60)).

8.3.3 read input data of several IO-Link ports

8702

Register area for compact access to the input data of the IO-Link ports X01…X04 and X05...X08: → **Input Data** (→ p. 79)

The area contains the following data:

- Combined digital inputs - clamp 2 / clamp 4 (DI) of the IO-Link ports X01...X04 and X05...X08
- Status information of the IO-Link ports X01...X04 and X05...X08
- Status information of the IO-Link devices on IO-Link ports X01...X04 and X05...X08
- Combined input data - IO-Link of the IO-Link ports X01...X04 and X05...X08

Observe the general rules for access to the Modbus registers (→ **Rules for accessing the Modbus register** (→ p. 59))!

The parameter "Invalid Data" indicates whether the read IO-Link input data is valid.

► Together with the input data, also read and evaluate the corresponding status information of the IO-Link devices!

Register area		Contents	Access
Start address	Length (words)		
197	1	Port X01…X04: Digital Input - Pin 2 / Pin 4 (DI)	r
198	1	Port X01…X04: Status Information IO-Link Ports	r
199	1	Port X01…X04: Status Information IO-Link Devices	r
	2n	Port X01…X04: Compact Input Data - IO-Link (4n bytes)	r
297	1	Port X05…X08: Digital Input - Pin 2 / Pin 4 (DI)	r
298	1	Port X05…X08: Status Information IO-Link Ports	r
299	1	Port X05...X08: Status Information IO-Link Devices	r
	2n	Port X05…X08: Compact Input Data - IO-Link (4n bytes)	r

r = read only
n = [2,4,8,16,32]; is determined by parameters [Process Data Length] (→ **Configuration Area** (→ p. 74))

8.3.4 Read input data of individual IO-Link ports

23072

Register area for separate access to input data of the individual IO-Link ports: → **Single Port Access** (→ p. 84)

The area contains the following data for each IO-Link port X01...X08:

- Digital input data at clamp 2 / clamp 4 (DI)
- Diagnostic and status information of the connected IO-Link devices
- Input data IO-Link

Observe the general rules for access to the Modbus registers (→ **Rules for accessing the Modbus register** (→ p. 59))!

The parameter "Invalid Data" indicates whether the read IO-Link input data is valid.

► Also read and evaluate the corresponding diagnostic information!

Register area		Contents	Access
Start address	Length (words)		
1000	1	Port X01: Digital Input - Pin 2 / Pin 4 (DI)	r
1001	1	Port X01: Diagnostic data	r
	n/2	Port X01: Input Data - IO-Link (n bytes)	r
2000	1	Port X02: Digital Input - Pin 2 / Pin 4 (DI)	r
2001	1	Port X02: Diagnostic data	r
	n/2	Port X02: Input Data - IO-Link (n bytes)	r
3000	1	Port X03: Digital Input - Pin 2 / Pin 4 (DI)	r
3001	1	Port X03: Diagnostic data	r
	n/2	Port X03: Input Data - IO-Link (n bytes)	r
4000	1	Port X04: Digital Input - Pin 2 / Pin 4 (DI)	r
4001	1	Port X04: Diagnostic data	r
	n/2	Port X04: Input Data - IO-Link (n bytes)	r
5000	1	Port X05: Digital Input - Pin 2 / Pin 4 (DI)	r
5001	1	Port X05: Diagnostic data	r
	n/2	Port X05: Input Data IO-Link (n bytes)	r
6000	1	Port X06: Digital Input - Pin 2 / Pin 4 (DI)	r
6001	1	Port X06: Diagnostic data	r
	n/2	Port X06: Input Data - IO-Link (n bytes)	r
7000	1	Port X07: Digital Input - Pin 2 / Pin 4 (DI)	r
7001	1	Port X07: Diagnostic data	r
	n/2	Port X07: Input Data - IO-Link (n bytes)	r
8000	1	Port X08: Digital Input - Pin 2 / Pin 4 (DI)	r
8001	1	Port X08: Diagnostic data	r
	n/2	Port X08: Input Data - IO-Link (n bytes)	r

r .. read only
n = [2,4,8,16,32]; is determined by parameters [Process Data Length] (→ **Configuration Area** (→ p. 74))

8.3.5 Write output data of several IO-Link ports

9633

Register area for compact access to the output data of the IO-Link ports X01…X04 and X05...X08: → **Output Data** (→ p. 83)

The area contains the following data:

- Digital output data at clamp 2 of the IO-Link ports X01...X04
- IO-Link output data of the IO-Link ports X01...X04
- Digital output data at clamp 2 of the IO-Link ports X05...X08
- IO-Link output data of the IO-Link ports X05...X08

► Observe the general rules for access to the Modbus registers (→ **Rules for accessing the Modbus register** (→ p. 59))!

Several connected register areas can be written with one write command.

The IO-Link master writes only the outputs in "Compact Output Data" that are completely covered by the transferred output data.

Example: The configured process data length is 4 bytes. If all in all 5 words have been transferred to register 600, the IO-Link master writes the outputs X01 (words 1+2) and X02 (words 3+4). Output X03 is not written.

► When writing the IO-Link outputs, ensure that the output data has the correct length!

The output data is invalid in the following situations:

- no Ethernet cable connected
- PLC has terminated the connection
- Connection to the PLC has a timeout

Register area		Contents	Access
Start address	Length (words)		
599	1	Port X01...X04: Digital Output - Pin 4 (DO)	r/w
600	2n	Port X01...X04: Compact Output Data IO-Link (4n bytes)	r/w
699	1	Port X05...X08: Digital Output - Pin 4 (DO)	r/w
700	2n	Port X05...X08: Compact Output Data IO-Link (4n bytes)	r/w

r/w = read and write
n = [2,4,8,16,32]; is determined by parameters [Process Data Length] (→ **Configuration Area** (→ p. 74))

8.3.6 Write output data of individual IO-Link ports

23016

Register area for separate access to output data of individual IO-Link ports: → **Single Port Access** (→ p. 84)

The area contains the following data for each IO-Link port X01...X08:

- Digital output data at clamp 2
- Digital output data at clamp 4 (DO)
- IO-Link output data

► Observe the general rules for access to the Modbus registers (→ **Rules for accessing the Modbus register** (→ p. 59))!

With one write command, several connected register areas of a IO-Link port can be written (e. g. registers 1100 and 1101).

► When writing outputs, ensure that the length of the transferred output data corresponds with the configured process data length.

The output data is invalid in the following situations:

- no Ethernet cable connected
- PLC has terminated the connection
- Connection to the PLC has a timeout

Register area		Contents	Access
Start address	Length (words)		
1100	1	Port X01: Digital Output - Pin 4 (DO)	r/w
1101	n/2	Port X01: Output Data IO-Link (n bytes)	r/w
2100	1	Port X02: Digital Output - Pin 4 (DO)	r/w
2101	n/2	Port X02: Output Data IO-Link (n bytes)	r/w
3100	1	Port X03: Digital Output - Pin 4 (DO)	r/w
3101	n/2	Port X03: Output Data IO-Link (n bytes)	r/w
4100	1	Port X04: Digital Output - Pin 4 (DO)	r/w
4101	n/2	Port X04: Output Data IO-Link (n bytes)	r/w
5100	1	Port X05: Digital Output - Pin 4 (DO)	r/w
5101	n/2	Port X05: Output Data IO-Link (n bytes)	r/w
6100	1	Port X06: Digital Output - Pin 4 (DO)	r/w
6101	n/2	Port X06: Output Data IO-Link (n bytes)	r/w
7100	1	Port X07: Digital Output - Pin 4 (DO)	r/w
7101	n/2	Port X07: Output Data IO-Link (n bytes)	r/w
8100	1	Port X08: Digital Output - Pin 4 (DO)	r/w
8101	n/2	Port X08: Output Data IO-Link (n bytes)	r/w

r/w = read and write
n = [2,4,8,16,32]; is determined by parameters [Process Data Length] (→ **Configuration Area** (→ p. 74))

8.3.7 Read diagnostic information and events

11048

Register area for the access to diagnostic information of the IO-Link ports X01…X08:→ **Diagnostic data** (→ p. 76)

The area contains the following data:

- Status/error flags for port configuration
- Vendor ID / device ID of the connected IO-Link devices
- Events and corresponding event codes

► Observe the general rules for access to the Modbus registers (→ **Rules for accessing the Modbus register** (→ p. 59))!

A maximum of 3 events per IO-Link port are displayed.

One-time events will be deleted after a minimum of 10 s (Event Single Shot).

Occurring events indicate the time of the error occurrence (event appears). If the error cause disappears, this is indicated by a further event (event disappears). Both event type always occur in pairs.

Register area		Contents	Access
Start address	Length (words)		
30	10	Port X01: Diagnostic Data	r
40	10	Port X02: Diagnostic Data	r
50	10	Port X03: Diagnostic Data	r
60	10	Port X04: Diagnostic Data	r
70	10	Port X05: Diagnostic Data	r
80	10	Port X06: Diagnostic Data	r
90	10	Port X07: Diagnostic Data	r
100	10	Port X08: Diagnostic Data	r

r = read only

Additional diagnostic and status details are provided in the following register areas:

- "Input Data" area: → **read input data of several IO-Link ports** (→ p. 53)
- "Single Port Access" area: → **read input data of several IO-Link ports** (→ p. 53)

8.3.8 Read device information

11039

The user can read device information using the FC43.
The AL1940 supports the following data records ("Read Device ID code"):

- Basic Device Identification (0x01): contained data objects: → Modbus TCP specification
- Regular Device Identification (0x02): contained data objects: → Modbus TCP specification
- Specific Device Identification (0x04): contained data objects:

Object ID	Object name / description	Data type	Possible values
0x00	VendorName	ASCII string	ifm electronic
0x01	ProductCode	ASCII string	AL1940
0x02	MajorMinorRevision	ASCII string	e.g. V1.001
0x03	VendorURL	ASCII string	www.ifm.com
0x04	ProductName	ASCII string	IO-Link Master DL MOD 8P IP20
0x05	ModelName	ASCII string	1940
0x06	UserApplicationName	ASCII string	MODBUS IO-Link master

8.3.9 Control IO-Link master

23382

The user can control the IO-Link master using the following acyclic commands:

- "Reboot": → **Command 0x40 – Reboot** (→ p. 97)
- "Factory Reset": → **command 0x50 – Factory Reset** (→ p. 99)

The commands use the process mechanisms of the acyclic command channel (→ **Use acyclic services** (→ p. 60)).

8.3.10 Configure IO-Link devices

9031

The IO-Link master supports the configuration of the connected IO-Link devices from the Modbus TCP projection software. The parameters of an IO-Link device are set via IO-Link index and subindex. The number of the configurable parameters depends on the connected IO-Link device.

Available parameters of the IO-Link devices: → IO Device Description (IODD) of the IO-Link device

The user can read and write IO-Link index and subindex using the following methods:

- Acyclic communication: → **Use acyclic services** (→ p. 60)

8.3.11 Modbus TCP: Programmers' notes

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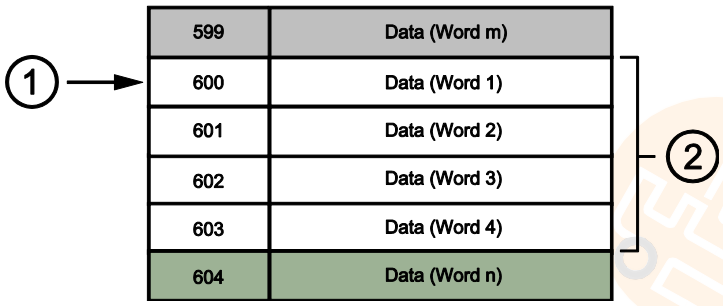
17965

Rules for accessing the Modbus register

13916

The Modbus table of the AL1940 is subdivided into areas.



1 A register area has one start address.

2 A register area consists of one or several registers (length/number of words)

The following general rules apply for access to the Modbus registers:

- ► Only read or write Modbus registers word by word.
- ► Only use the valid function codes to read or write Modbus registers (→ **Supported function codes** (→ p. 60)).
- ► Only implement read and write access via valid start addresses. Access via an invalid start address generates an error.

Example:

Task: Write IO-Link output data of the IO-Link port X02 (process data length n = 2 bytes)

Solutions:

Right:

- Version 1: "Output Data" area (→ **Output Data** (→ p. 83))
  - ► In the Compact Output Block of the ports X01…X04, read the registers 600…603 (FC03, start address: 600, length: 4 words)
  - ► Change read values of the register 601.
  - ► In the Compact Output Block of the ports X01…X04, write the registers 600…603 (FC16, start address: 600, length: 4 words)
- Version 2: "Single Port Access" area (→ **Single Port Access** (→ p. 84))
  - ► Write the required value into register 2101 (FC06, start address: 2101)

Wrong:

- ► In the Compact Output Block of the ports X01…X04, write the register 601 (FC06, start address: 601, length: 1 word)

Supported function codes

13676

The AL1940 supports the following function codes for read and/or write access to the Modbus register:

Function code	Function name / description
3 (0x03)	Read Multiple Registers
4 (0x04)	Read Input Register
6 (0x06)	Write Single Register
16 (0x10)	Write Multiple Registers
23 (0x17)	Read/Write Multiple Registers
43 (0x2B)	Read Device Identification

Detailed information about the function codes: → MODBUS-TCP specification

Use acyclic services

11046

The AL1940 has a command interface to execute acyclic commands. A cyclic command consists of a request and a response.

Register area		Contents	Access
Start address	Length (words)		
500	22	Command Request Channel (Fieldbus PLC >>> IO-Link Master)	r/w
0	22	Command Response Channel (IO-Link Master >>> Fieldbus PLC)	r

Structure of the acyclic command channel: → **Acyclic Command Channel** (→ p. 86)

General procedure of the acyclic communication:

1 Write Command Request

► In the request channel: Write required data (except for [User ID]).
> Write required [User ID].
> Changed [User ID] signals a new command.
> In the response channel: registers are reset to 0.
> Acyclic command channel is blocked.
> Processing of the command is started.

2 Check status

► In the response channel: Check [Command Status] register.
> If [Command Status] <> 0: continue with step 3
> If [Command Status] == 0: repeat step 2.

3 Read Command Response

► In the response channel: read returned user data.
> Acyclic command channel is released.

9 Operation

Contents

22368

9.1 Identify device

16568

In the online mode, the user can identify the device using the RDY and IoT status LEDs.

► Start LR DEVICE.
► Scan network for devices.
> LR DEVICE recognises the IO-Link master.
► Click on the selection field next to the device name.
> The RDY and IoT status LEDs are flashing.

9.2 Firmware update

16582

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

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

- ► Stop Modbus TCP PLC.
- ► Set the parameter [IP address SmartObserver] to 255.255.255.255 (→ **IoT: Configure the interface to the LR SMARTOBSERVER** (→ p. 28)).
- ► Stop the LRAgent.LRDevice service in the Windows task manager.

To install a new firmware version on the device:

Requirements

> Zip file with new firmware has been downloaded and unpacked.

> Ethernet connection between laptop/PC and device is established.

1 Call up web interface

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

> Web browser shows the [Firmware Update] page.

2 Load new firmware to AL1940

- ► Click on [Search...].

> Dialogue window appears.

- ► Select the firmware file (.bin) and click on [Open] in order to adopt the file.
- ► Click on [Submit] to start the firmware update.

> Firmware is being loaded to the device.

> After successful storage, the success message is displayed.

3 Restart the device

- ► Click on [Restart device now] to restart the device.

> The status LED RDY flashes quickly.

> Firmware is updating.

- ► Follow the instructions in the browser.

9.3 Replace IO-Link device

7775

To replace an IO-Link device:

Requirement:

> IO-Link device is with factory settings.

> IO-Link device supports IO-Link standard 1.1 or higher.

1 Set data storage

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

► Save changes.

2 Replace IO-Link device

► Disconnect old IO-Link device from IO-Link master.

► Connect new IO-Link device with the same IO-Link port of the AL1940.

> IO-Link master copies parameter values from the data memory to the new IO-Link device.

10 Maintenance

21577

The operation of the unit is maintenance-free.

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

11 Factory settings

16542

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

Parameter	Factory setting
[IP address] (Modbus TCP)	192.168.1.250
[Subnet mask] (Modbus TCP)	255.255.255.0
[IP gateway address] (Modbus TCP)	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
[Modbus TCP name]	blank
Data memory (Data Storage)	blank

12 Accessories

17853

List of accessories of AL1940: → www.ifm.com > Product page > Accessories

13 Appendix

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7156

13.1 Technical data

Contents

9011

13.1.1 Application

23710

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

13.1.2 Electrical data

22819

Electrical data	
Operating voltage [V]	20...30 DC; (US; to SELV/PELV; cULus: max. 24 DC)
Current Consumption [mA]	300...3900; (US)
Protection class	III
Sensor supply US	
Max. current load total [A]	3.6

13.1.3 Inputs / outputs

23711

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

13.1.4 Inputs

22820

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

13.1.5 Outputs

22821

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

13.1.6 Interfaces

10921

Interfaces	
Communication interface	Ethernet; IO-Link
Communication interface	IO-Link; TCP/IP; Modbus TCP
Ethernet	
Transmission standard	10Base-T; 100Base-TX
Transmission rate [MBit/s]	10; 100
Protocol	TCP/IP; Modbus TCP
Factory settings	▪ IP address: 192.168.1.250 ▪ Subnet mask: 255.255.255.0 ▪ 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

17862

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

13.1.8 Approvals / tests

22824

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

13.1.9 Mechanical data

22825

Mechanical data	
Weight [g]	329.6
Materials	Housing: PA

13.1.10 Electrical connection

11030

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

13.2 Modbus TCP

Contents

22433

13.2.1 Register

Contents

18637

The AL1940 saves the configuration data, process data and status/diagnostic data in Modbus registers.

Configuration Area

8912

Register	Content	
	Bits 8-15	Bits 0-7
8998*	Access Rights	Process Data Length
8999*	reserved	Byte Swap
9000*	Port X01: Port Configuration (→ **Mapping: port configuration** (→ p. 75))	
9006*	Port X02: Port Configuration (→ **Mapping: port configuration** (→ p. 75))	
9012*	Port X03: Port Configuration (→ **Mapping: port configuration** (→ p. 75))	
9018*	Port X04: Port Configuration (→ **Mapping: port configuration** (→ p. 75))	
9024*	Port X05: Port Configuration (→ **Mapping: port configuration** (→ p. 75))	
9030*	Port X06: Port Configuration (→ **Mapping: port configuration** (→ p. 75))	
9036*	Port X07: Port Configuration (→ **Mapping: port configuration** (→ p. 75))	
9042*	Port X08: Port Configuration (→ **Mapping: port configuration** (→ p. 75))	

* ... valid start address for accessing the register area (→ **Rules for accessing the Modbus register** (→ p. 59))

Legend:

- [Access Rights] — The access rights to the parameter data, process data and the events/diagnostic messages of the IO-Link master as well as the connected IO-Link devices. — 1 byte
  - 0x00: Modbus TCP + IoT
  - 0x01: Modbus TCP + IoT (ro)
  - 0x02: Modbus TCP only
  - 0x03: Keep setting (default)
- [Process Data Length] — Length of the process input data and process output data — 1 byte
  - 0x01: 2 bytes input / 2 bytes output data
    - Input Data: 14 Words
    - Output Data: 10 Words
  - 0x02: 4 bytes input / 4 bytes output data
    - Input Data: 22 Words
    - Output Data: 18 Words
  - 0x04: 8 bytes input / 8 bytes output data
    - Input Data: 38 Words
    - Output Data: 34 Words
  - 0x08: 16 bytes input / 16 bytes output data
    - Input Data: 70 Words
    - Output Data: 66 Words
  - 0x16: 32 bytes input / 32 bytes output data
    - Input Data: 134 Words
    - Output Data: 130 Words
- [Byte Swap] — Sequence of bytes in the data word — 1 byte
  - 0x00: as Array of Bytes
  - 0x01: as integer16 value; when process data is updated, bytes will be exchanged
- [Port Configuration] — Configuration of the IO-Link port — 12 bytes — → **Mapping: port configuration** (→ p. 75)

Mapping: port configuration

18639

Bits 8-15	Bits 0-7
Port Mode	Master Cycle Time
reserved	Validation ID
Vendor ID	
reserved	Device ID (MSB)
Device ID	Device ID (LSB)
Failsafe Mode -- IO-Link	Failsafe Mode -- Pin 4 (DO)

Legend:

▪ [Port Mode]	Operating mode of the IO-Link port	1 byte	0x00	deactivated
			0x01	Digital input (DI)
			0x02	Digital output (DO)
			0x03	IO-Link
▪ [Master Cycle Time]	Cycle time of the data transmission between the IO-Link master and the IO-Link device	1 byte	0x00	As fast as possible
			0x01	2 milliseconds
			0x02	4 milliseconds
			0x03	8 milliseconds
			0x04	16 milliseconds
			0x05	32 milliseconds
			0x06	64 milliseconds
			0x07	128 milliseconds
▪ [Validation ID]	Supported IO-Link standard and behaviour of the IO-Link master when connecting new IO-Link devices to the IO-Link port	1 byte	0x00	No validation
			0x01	V1.0 device
			0x02	V1.1 device
			0x03	V1.1 device with Backup + Restore
			0x04	V1.1 device with Backup
▪ [Vendor ID]	Vendor ID of the manufacturer of the device on the IO-Link port	2 bytes	0x0000...0xFFFF	
▪ [Device ID]	Device ID of the device on the IO-Link port Device ID = 0x123456 ▪ Device ID (MSB) = 0x12 ▪ Device ID = 0x34 ▪ Device ID (LSB) = 0x56	3 bytes	pro Byte: 0x00...0xFF	
▪ [Failsafe Mode -- IO-Link]	Fail-safe mode for output data when the Modbus TCP connection is interrupted	1 byte	0x00	No Failsafe
			0x01	Failsafe Reset Value
			0x02	Failsafe Old Value
			0x03	Failsafe with Pattern
▪ [Failsafe Mode -- Pin 4 (DO)]	Fail-safe value for the operating mode "digital output (DO)	1 byte	0x00	Failsafe Reset Value
			0x01	Failsafe Old Value
			0x02	Failsafe Set Value

Diagnostic data

11746

Register	Contents	
	Bits 8-15	Bits 0-7
30*	reserved	Port X01: → **Mapping: Diagnostics** (→ p. 77)
31	Port X01: Vendor ID	
32	reserved	Port X01: Device ID (MSB)
33	Port X01: Device ID	Port X01: Device ID (LSB)
34...39	Port X01: Events (→ **Mapping: events** (→ p. 78))	
40*	Port X02: Diagnostic data (Mapping: → Port X01 - register 30...39)	
50*	Port X03: Diagnostic data (Mapping: → Port X01 - register 30...39)	
60*	Port X04: Diagnostic data (Mapping: → Port X01 - register 30...39)	
70*	Port X05: Diagnostic data (Mapping: → Port X01 - register 30...39)	
80*	Port X06: Diagnostic data (Mapping: → Port X01 - register 30...39)	
90*	Port X07: Diagnostic data (Mapping: → Port X01 - register 30...39)	
100*	Port X08: Diagnostic data (Mapping: → Port X01 - register 30...39)	

* ... valid start address for accessing the register area (→ **Rules for accessing the Modbus register** (→ p. 59))

Legend:

- [Vendor ID] Vendor ID of the manufacturer of the device on the IO-Link port — 2 bytes — 0x0000...0xFFFF
- [Device ID] Device ID of the device on the IO-Link port — 3 bytes — per byte: 0x00...0xFF
  Device ID = 0x123456
  - Device ID (MSB) = 0x12
  - Device ID = 0x34
  - Device ID (LSB) = 0x56

Mapping: Diagnostics

17305

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	Wrong Length PD OUT	Wrong Length PD IN	Cycle time	Wrong Vendor ID/ Device ID	reserved	reserved	IOL mode

Legend:

▪ [IOL Mode]	Operating type of the IO-Link port	1 bit	0x0	Other
			0x1	IO-Link
▪ [Wrong Vendor ID/ Device ID]	Verification if the current and configured vendor ID and device ID are identical	1 bit	0x0	OK
			0x1	No match
▪ [Wrong Cycle Time]	Verification if the current and configured cycle time are identical	1 bit	0x0	OK
			0x1	No match
▪ [Wrong Length PD IN]	Verification if the size of the received input data are identical with the configured size	1 bit	0x0	OK
			0x1	Configured size too small
▪ [Wrong Length PD OUT]	Verification if the size of the sent output data is identical with the size expected by the IO-Link device	1 bit	0x0	OK
			0x1	Configured size too small

Mapping: events

13674

Bit															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
reserved								Event 1: Mode		Event 1: Type		Event 1: Src	Event 1: Instance		
Event 1: Code															
reserved								Event 2: Mode		Event 2: Type		Event 2: Src	Event 2: Instance		
Event 2: Code															
reserved								Event 3: Mode		Event 3: Type		Event 3: Src	Event 3: Instance		
Event 3: Code															

Legend:

- [Event m: Mode] Mode: mode of the event — 2 bits
  - 0x0 reserved
  - 0x1 One-time event
  - 0x2 Event has disappeared
  - 0x3 Event has appeared
- [Event m: Type] Type: category of the event — 2 bits
  - 0x0 reserved
  - 0x1 Notification
  - 0x2 Warning
  - 0x3 Error
- [Event m: Src] Source: source of the event — 1 bit
  - 0x0 IO-Link Device
  - 0x1 IO-Link Master
- [Event m: Instance] Type: trigger of the event — 2 bits
  - 0x0 unknown
  - 0x1...0x3 reserved
  - 0x4 Application
  - 0x5...0x7 reserved
- [Event m: Code] Code: event code; depends on the device — 2 bytes — → IODD description of the IO-Link device

Input Data

17312

Register	Contents	
	Bits 8-15	Bits 0-7
197*	Port X01...X04: Digital Input - Pin 2 / Pin 4 (DI) (→ **Mapping: digital input data** (→ p. 80))	
198*	Port X01...X04: Diagnostic Information (→ **Mapping: diagnostic information** (→ p. 81))	
199*	Port X01...X04: Status Information IO-Link Ports (→ **Mapping: Status information IO-Link ports** (→ p. 82))	
200	Port X01...X04: Compact Input Block (4n bytes)	
297*	Port X05...X08: Digital Input - Pin 2 / Pin 4 (DI) (→ **Mapping: digital input data** (→ p. 80))	
298*	Port X05...X08: Diagnostic Information (→ **Mapping: diagnostic information** (→ p. 81))	
299*	Port X05...X08: Status Information IO-Link Ports (→ **Mapping: Status information IO-Link ports** (→ p. 82))	
300	Port X05...X08: Compact Input Block (4n bytes)	

* ... valid start address for accessing the register area (→ **Rules for accessing the Modbus register** (→ p. 59))

Legend:

- [Digital Input - Pin 2 / Pin 4 (DI)] Digital input data Pin 2 / Pin 4 (operating mode DO) of 4 IO-Link ports — 2 bytes
- [Diagnostic Information] Diagnostic information — 2 bytes
- [Status Information IO-Link Ports] Status information of the IO-Link ports — 2 bytes
- [Compact Input Block (4n Bytes)] Input data (operating mode IO-Link) of 4 IO-Link ports; n = [2,4,8,16,32]; is determined by parameters [Process Data Length] (→ **Configuration Area** (→ p. 74)) — 4n byte — per byte: 0x00...0xFF

Mapping: digital input data

11098

Register 197:

Bit															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
res.	res.	res.	res.	X04: clamp 2	X03: clamp 2	X02: clamp 2	X01: clamp 2	res.	res.	res.	res.	X04: clamp 4	X03: clamp 4	X02: clamp 4	X01: clamp 4

Register 297:

Bit															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
res.	res.	res.	res.	X08: clamp 2	X07: clamp 2	X06: clamp 2	X05: clamp 2	res.	res.	res.	res.	X08: clamp 4	X07: clamp 4	X06: clamp 4	X05: clamp 4

Legend:

- [clamp 4] Signal level on clamp 4 of the IO-Link port (DI) 1 bit 0x0 LOW
  0x1 HIGH
- [clamp 2] Signal level on clamp 2 of the IO-Link ports (if used) 1 bit 0x0 LOW
  0x1 HIGH

Mapping: diagnostic information

7265

Register 198:

Bit															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
res.	res.	res.	res.	X04: SC/ OL	X03: SC/ OL	X02: SC/ OL	X01: SC/ OL	res.	res.	res.	res.	res.	res.	SENS PWR	AUX PWR

Register 298:

Bit															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
res.	res.	res.	res.	X08: SC/ OL	X07: SC/ OL	X06: SC/ OL	X05: SC/ OL	res.	res.	res.	res.	res.	res.	SENS PWR	AUX PWR

Legend:

▪ [SC/OL]	Short Circuit / Overload: indicates the occurrence of a short-circuit or overvoltage on the IO-Link port	1 bit	0x0	error-free
			0x1	Short-circuit or overvoltage
▪ [SENS PWR]	Sensor Power: indicates the status of the supply voltage US	1 bit	0x0	US not available
			0x1	US available
▪ [AUX PWR]	Auxiliary Power: indicates the supply voltage UA	1 bit	0x0	UA not available
			0x1	UA available

Mapping: Status information IO-Link ports

16455

Register 199:

Bit															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
res.	res.	res.	res.	X04: Data invalid	X03: Data invalid	X02: Data Invalid	X01: Data invalid	res.	res.	res.	res.	X04: Dev Conn	X03: Dev Conn	X02: Dev Conn	X01: Dev Conn

Register 299:

Bit															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
res.	res.	res.	res.	X08: Data invalid	X07: Data invalid	X06: Data Invalid	X05: Data invalid	res.	res.	res.	sres.	X08: Dev Conn	X07: Dev Conn	X06: Dev Conn	X05: Dev Conn

Legend:

▪ [Data invalid]	indicates the status of the process input data on the IO-Link port	1 bit	0x0	data valid
			0x1	data invalid
▪ [Dev Conn]	Device Connected: indicates the connection to the device on the IO-Link port	1 bit	0x0	Available
			0x1	not available

Output Data

11407

Register	Contents	
	Bits 8-15	Bits 0-7
599*	Port X01...X04: Digital Output - Pin 4 (DO) (→ **Mapping: Digital output data** (→ p. 83))	
600*	Port X01...X04: Compact Output Block (4n bytes)	
699*	Port X05...X08: Digital Output - Pin 4 (DO) (→ **Mapping: Digital output data** (→ p. 83))	
700*	Port X05...X08: Compact Output Block (4n bytes)	

* ... valid start address for accessing the register area (→ **Rules for accessing the Modbus register** (→ p. 59))

Legend:

- [Digital Output - Pin 4 (DO)] Digital output data - pin 4 (operating mode DO) of 4 IO-Link ports 2 bytes
- [Compact Output Block (4n Bytes)] Output data (operating mode IO-Link) of 4 IO-Link ports 4n bytes per byte: 0x00...0xFF
  n = [2,4,8,16,32]; is determined by parameters [Process Data Length] (→ **Configuration Area** (→ p. 74))

Mapping: Digital output data

7264

Register 599:

Bit															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	X04: Pin 4	0X03: Pin 4	X02: Pin 4	X01: Pin 4

Register 699:

Bit															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	X04: Pin 4	0X03: Pin 4	X02: Pin 4	X01: Pin 4

Legend:

- [Pin4] Signal level on pin 4 of the IO-Link port (DO) 1 bit 0x0 LOW
  0x1 HIGH

Single Port Access

11408

Register	Contents	
	Bits 8-15	Bits 0-7
1000*	Port X01: Digital Data - Pin 2	Port X01: Digital Input - Pin 4 (DI)
1001*	reserved	Port X01: → **Mapping: PQI**
1002	Port X01: Input Data IO-Link (n bytes)	
1100*	reserved	Port X01: Digital Output - Pin 4 (DO)
1101*	Port X01: Output Data IO-Link (n bytes)	
2000*	Port X02: Single Port Access (Mapping: → Port X01 - register 1000...1101)	
3000*	Port X03: Single Port Access (Mapping: → Port X01 - register 1000...1101)	
4000*	Port X04: Single Port Access (Mapping: → Port X01 - register 1000...1101)	
5000*	Port X05: Single Port Access (Mapping: → Port X01 - register 1000...1101)	
6000*	Port X06: Single Port Access (Mapping: → Port X01 - register 1000...1101)	
7000*	Port X07: Single Port Access (Mapping: → Port X01 - register 1000...1101)	
8000*	Port X08: Single Port Access (Mapping: → Port X01 - register 1000...1101)	

* ... valid start address for accessing the register area (→ **Rules for accessing the Modbus register** (→ p. 59))

Legend:

- [Digital Input - Pin 2] — Pin 2 signal level (if used) — 1 byte — 0x00 LOW; 0x01 HIGH
- [Digital Input - Pin 4 (DI)] — Pin 4 signal level (operating mode DI) — 1 byte — 0x00 LOW; 0x01 HIGH
- [Input Data IO-Link (n Bytes)] — Input data (operating mode IO-Link) (n bytes) n = [2,4,8,16,32]; is determined by parameters [Process Data Length] (→ **Configuration Area** (→ p. 74)) — n byte — per byte: 0x00...0xFF
- [Digital Output - Pin 4(DO)] — Pin4 signal level (operating mode DO) — 1 byte — 0x00 LOW; 0x01 HIGH
- [Output Data IO-Link (n Bytes) — Output data (operating mode IO-Link) (n bytes) n = [2,4,8,16,32]; is determined by parameters [Process Data Length] (→ **Configuration Area** (→ p. 74)) — n byte — per byte: 0x00...0xFF

Mapping: PQI

21509

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	Wrong Length PD OUT	Wrong Length PD IN	Wrong Cycle Time	Wrong VID/DID	Invalid Data	Dev Conn	IOL Mode

Legend:

▪ [IOL Mode]	Operating type of the IO-Link port	1 bit	0x0	Other
			0x1	IO-Link
▪ [Dev Conn]	Connection between IO-Link Device and IO-Link port	1 bit	0x0	not connected.
			0x1	connected
▪ [Invalid Data]	Status of the process input data on the IO-Link port	1 bit	0x0	valid data
			0x1	invalid data
▪ [Wrong VID/DID]	Verification whether the current and configured vendor ID and device ID are identical	1 bit	0x0	OK
			0x1	no match
▪ [Wrong Cycle Time]	Verification whether the current and configured cycle time are identical	1 bit	0x0	OK
			0x1	no match
▪ [Wrong Length PD IN]	Verification whether the size of the received input data are identical with the configured size	1 bit	0x0	OK
			0x1	Configured size too small
▪ [Wrong Length PD OUT]	Verification whether the size of the sent output data is identical with the size expected by the IO-Link device	1 bit	0x0	OK
			0x1	Configured size too small

Acyclic Command Channel

17311

The following Modbus registers are available for acyclic data transmission:

Register	Contents	
	Bits 8-15	Bits 0-7
500*	Command Request Channel (→ **Request channel** (→ p. 87))	
0*	Command Response Channel (→ **Response channel** (→ p. 88))	

* ... valid start address for accessing the register area (→ **Rules for accessing the Modbus register** (→ p. 59))

Legend:

- [Command Request Channel] Area for transmission of command request (fieldbus PLC >>> IO-Link master) 44 bytes
- [Command Response Channel] Area for transmission of command response (IO-Link master >>> fieldbus PLC) 44 bytes

Request channel

10893

Register	Contents	
	Bits 8-15	Bits 0-7
500	Port No.	
501	Index	
502	Subindex	
503	Command	User ID
504	Data Length (Number of Bytes)	
505	Data (byte 1)	Data (byte 0)
...	...	...
521	Data (byte 33)	Data (byte 32)

Legend:

▪ [Port No.]	Number of the IO-Link port	1 Word	0x0001	Port X01
			0x0002	Port X02
			...	...
			0x0008	Port X08
▪ [Index]	Index of the IO-Link object	1 Word	0x0000...0xFFFF	
▪ [Subindex]	Subindex of the IO-Link object	1 Word	0x0000...0xFFFF	
▪ [Command]	Command number	1 byte	0x01	Read
			0x02	Write
▪ [User ID]	ID to identify the command	1 byte	0x00...0xFF	
▪ [Data Length (Number of Bytes)]	Number of bytes that contain relevant user data (is only evaluated for Command = 0x02)	1 Word	0x0000	0 bytes
			...	...
			0x0022	34 bytes
▪ [Data (Byte n)]	user data	n bytes	per byte: 0x00 ... 0xFF	

Response channel

6916

Register	Contents	
	Bits 8-15	Bits 0-7
0	Port No.	
1	Index	
2	Subindex	
3	Command	User ID
4	Result	
5	Data Length (Number of Bytes)	
6	Data (byte 1) / Error Code	Data (byte 0) / Error
...	...	...
21	Data (byte 31)	Data (byte 30)

Legend:

▪ [Port No.]	Number of the IO-Link port	1 Word	0x0001	Port X01
			0x0002	Port X02
			...	...
			0x0008	Port X08
▪ [Index]	Index of the IO-Link object	1 Word	0x0000...0xFFFF	
▪ [Subindex]	Subindex of the IO-Link object	1 Word	0x0000...0xFFFF	
▪ [Command]	Command number	1 byte	0x01	Read
			0x02	Write
▪ [User ID]	reflected User ID from request channel	1 byte	0x00...0xFF	
▪ [Result]	Status of the command processing	1 Word	0x0000	OK
			0x000F	OK, but data length too long (only with [Command] = 0x02)
			0x00FF	Error
▪ [Data Length (Number of Bytes)]	Number of bytes that contain relevant user data	1 Word	0x0000	0 bytes
			...	....
			0x0020	32 bytes
▪ [Error]	Error ID	1 byte	→ **Error codes** (→ p. 89)	
▪ [Error Code]	additional error codes	1 byte	depends on the IO-Link device	
▪ [Data (Byte n)]	User data (byte n)	n bytes	per byte: 0x00...0xFF	

Error codes

15475

Error code	Description
0x71	Service not available (unknown command has been sent to the IO-Link port)
0x72	Port blocked (another cyclic process accesses the IO-Link port)
0x74	Invalid data (wrong parameter has been sent in the command)
0x76	Wrong port (wrong port number)
0x77	Wrong port function (wrong port function or wrong parameter has been sent to the device)
0x78	Invalid length (set length is > 0x20)
0x80	Error in the device application; observe add. error codes (error codes: → description of IODD of the IO-Link device)

13.2.2 Acyclic commands

Contents

22631

Command 0x10 – set mode

23461

The command changes the operating mode of an IO-Link port of the AL1940.

Corresponding parameter: [Port Mode] (→ **Mapping: port configuration** (→ p. 75))

Command request

12221

Register	Contents	
	Bits 8-15	Bits 0-7
500	Port No.	
501	reserved	
502	reserved	
503	0x10	User ID
504	reserved	
505	Target Mode	
506 ... 521	reserved	

Legend:

- [Port No.] Number of the IO-Link port — 1 word
  - 0x0001 Port X01
  - 0x0002 Port X02
  - ... ...
  - 0x0008 Port X08
- [User ID] ID to identify the command — 1 byte — 0x00 .. 0xFF
- [Target Mode] Operating type of the IO-Link port — 1 word
  - 0x0000 deactivated
  - 0x0001 digital input (DI)
  - 0x0002 digital output (DO)
  - 0x0003 IO-Link

Command response

14273

Register	Contents	
	Bits 8-15	Bits 0-7
0	Port No.	
1	reserved	
2	reserved	
3	0x10	User ID
4	Result	
5	Data Length (Number of Bytes)	
6	reserved / Error code	Target Mode / Error
7 ... 21	reserved	

Legend:

▪ [Port No.]	Number of the IO-Link port	1 word	0x0001	Port X01
			0x0002	Port X02
			...	...
			0x0008	Port X08
▪ [User ID]	reflected User ID from request channel	1 byte	0x00 .. 0xFF	
▪ [Result]	Status of the command processing	1 byte	0x00	OK
			0xFF	Error
▪ [Data Length (Number of Bytes)]	Number of bytes that contain relevant user data	1 word	0x0001	1 byte
			0x0002	2 bytes
▪ [Target Mode]	Operating type of the IO-Link port	1 byte	0x00	deactivated
			0x01	digital input (DI)
			0x02	digital output (DO)
			0x03	IO-Link
▪ [Error]	Error ID	1 byte	→ **Error codes** (→ p. 89)	
▪ [Error Code]	additional error codes	1 byte	depends on the IO-Link device	

Command 0x20 – set validation ID / data storage

23462

The command sets the behaviour of the IO-Link master when connecting a new IO-Link device to an IO-Linkport of the device.

Corresponding parameter: [Validation ID] (→ **Mapping: port configuration** (→ p. 75))

Command request

14272

Register	Contents	
	Bits 8-15	**Bits 0-7**
500	Port No.	
501	reserved	
502	reserved	
503	0x20	User ID
504	reserved	
505	Validation ID	
506 ... 521	reserved	

Legend:

- [Port No.] Number of the IO-Link port, 1 word
  - 0x0001 Port X01
  - 0x0002 Port X02
  - ... ...
  - 0x0008 Port X08
- [User ID] ID to identify the command, 1 byte, 0x00 .. 0xFF
- [Validation ID] Supported IO-Link standard and behaviour of the IO-Link master when connecting new IO-Link devices to the IO-Link port, 1 word
  - 0x0000 no validation
  - 0x0001 V1.0 device
  - 0x0002 V1.1 device
  - 0x0003 V1.1 device, backup + restore
  - 0x0004 V1.1 device, backup

Command response

10919

Register	Contents	
	Bits 8-15	Bits 0-7
0	Port No.	
1	reserved	
2	reserved	
3	0x10	User ID
4	Result	
5	Data Length (Number of Bytes)	
6	reserved / Error code	Validation ID / Error
7 ... 21	reserved	

Legend:

- [Port No.] Number of the IO-Link port — 1 word
  - 0x0001 Port X01
  - 0x0002 Port X02
  - ... ...
  - 0x0008 Port X08
- [User ID] reflected user ID from request channel — 1 byte — 0x00 .. 0xFF
- [Result] Status of the command processing — 1 byte
  - 0x00 OK
  - 0xFF Error
- [Data Length (Number of Bytes)] Number of bytes that contain relevant user data — 1 word
  - 0x0001 1 byte
  - 0x0002 2 bytes
- [Validation ID] Supported IO-Link standard and behaviour of the IO-Link master when connecting new IO-Link devices to the IO-Link port — 1 byte
  - 0x00 no validation
  - 0x01 V1.0 device
  - 0x02 V1.1 device
  - 0x03 V1.1 device, backup + restore
  - 0x04 V1.1 device, backup
- [Error] Error ID — 1 byte — → Error codes (→ p. 89)
- [Error Code] additional error codes — 1 byte — depends on the IO-Link device

Command 0x30 – set fail-safe data pattern

23464

The command sets the behaviour of the outputs when the Modbus TCP connection and the corresponding fail-safe values are interrupted.

Corresponding parameter: [Fail-safe Mode] (→ **Mapping: port configuration** (→ p. 75))
The number of the required fail-safe values results from the size of the output data (→ **Configuration Area** (→ p. 74)).

Command request

11016

Register	Contents	
	Bits 8-15	**Bits 0-7**
500	Port No.	
501	reserved	
502	reserved	
503	0x30	User ID
504	Byte Length N	
505	Failsafe Mode	
506	reserved / Failsafe Data (Byte 1)	reserved / Failsafe Data (Byte 0)
...	...	...
521	reserved / Failsafe Data (Byte 31)	reserved / Failsafe data (Byte 30)

Legend:

- [Port No.] Number of the IO-Link port — 1 word
  - 0x0001 Port X01
  - 0x0002 Port X02
  - ... ...
  - 0x0008 Port X08
- [User ID] ID to identify the command — 1 byte — 0x00 .. 0xFF
- [Data Length (Number of Bytes)] Number of bytes that contain relevant user data (is only evaluated for Command = 0x02) — 1 word
  - 0x0002 2 bytes
  - ... ...
  - 0x0022 34 bytes
- [Failsafe Mode] Fail-safe mode for the outputs of the IO-Link ports in case of an interruption of the Modbus TCP connection — 1 word
  - 0x0000 No Failsafe
  - 0x0001 Failsafe: Reset Value
  - 0x0002 Failsafe: Old Value
  - 0x0003 Failsafe: with Pattern
- [Failsafe Data (Byte n)] Fail-safe values for the outputs (only with fail-safe mode = 0x0003) — 1 byte — 0x00 .. 0xFF

Command response

10990

Register	Contents	
	Bits 8-15	Bits 0-7
0	Port No.	
1	reserved	
2	reserved	
3	0x30	User ID
4	Result	
5	Data Length (Number of Bytes)	
6	reserved / Error code	Failsafe Mode / Error
7 ... 21	reserved	

Legend:

▪ [Port No.]	Number of the IO-Link port	1 Word	0x0001	Port X01
			0x0002	Port X02
			...	...
			0x0008	Port X08
▪ [User ID]	reflected User ID from request channel	1 byte	0x00...0xFF	
▪ [Result]	Status of the command processing	1 Word	0x0000	OK
			0x00FF	Error
▪ [Data Length (Number of Bytes)]	Number of bytes that contain relevant user data	1 word	0x0001	1 byte
			0x0002	2 bytes

Command 0x40 – Reboot

7639

The command reboots the AL1940.

Command request

21515

Register	Contents	
	Bits 8-15	Bits 0-7
500	reserved	
501	reserved	
502	reserved	
503	0x40	User ID
504	reserved	
505	0x00AA	
506 ... 521	reserved	

Legend:

- [User ID] ID to identify the command 1 byte 0x00 .. 0xFF

Command response

25156

Register	Contents	
	Bits 8-15	Bits 0-7
0	reserved	
1	reserved	
2	reserved	
3	0x40	User ID
4	Result	
5	Data Length (Number of Bytes)	
6	reserved / Error code	0xAA / Error
7 ... 21	reserved	

Legend:

- [User ID] reflected User ID from request channel — 1 byte — 0x00 .. 0xFF
- [Result] Status of the command processing — 1 word — 0x0000 OK; 0x00FF Error
- [Data Length (Number of Bytes)] Number of bytes that contain relevant user data — 1 word — 0x0001 1 byte; 0x0002 2 bytes
- [Error] Error ID — 1 byte — → **Error codes** (→ p. 89)
- [Error Code] Additional error codes — 1 byte — depends on the IO-Link device (→ IODD of the IO-Link devices)

command 0x50 – Factory Reset

7254

The command resets all parameters to the factory settings (→ **Factory settings** (→ p. 65)).

Command request

11060

Register	Contents	
	Bits 8-15	Bits 0-7
500	reserved	
501	reserved	
502	reserved	
503	0x50	User ID
504	reserved	
505	0x0055	
506 ... 520	reserved	

Legend:

- [User ID] ID to identify the command 1 byte 0x00 .. 0xFF

Command response

21514

Register	Contents	
	Bits 8-15	Bits 0-7
0	reserved	
1	reserved	
2	reserved	
3	0x50	User ID
4	Result	
5	Data Length (Number of Bytes)	
6	reserved / Error Code	0x55 / Error
7 ... 21	reserved	

Legend:

- [User ID] reflected User ID from request channel — 1 byte — 0x00 .. 0xFF
- [Result] Status of the command processing — 1 word — 0x0000 OK; 0x00FF Error
- [Data Length (Number of Bytes)] Number of bytes that contain relevant user data — 1 word — 0x0001 1 byte; 0x0002 2 bytes
- [Error] Error ID — 1 byte — → **Error codes** (→ p. 89)
- [Error Code] additional error codes — 1 byte — depends on the IO-Link device

13.3 ifm IoT Core

Contents

8988

13.3.1 Overview: IoT profile

Contents

17711

Profile: deviceinfo

17135

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

Profile: devicetag

17438

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

Profile: iolinkmaster

14997

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

Profile: parameter

16545

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

Profile: processdata

16569

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

Profile: service

16575

Element (identifier)	Properties	mandatory	Comments
service	▪ type = service ▪ profiles = service		Executable service

Profile: software

10999

Element (identifier)	Properties	mandatory	Comments
software	▪ type = structure ▪ profiles = software		characterises the element as software
software/version	type = data	mandatory	
software/reboot	type = service	optional	
software/factoryreset	type = service	optional	
software/status	type = structure	optional	
software/diag	type = structure	optional	

Profile: timer

10997

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

13.3.2 Overview: IoT types

16547

The ifm IoT Core uses the following element types:

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

13.3.3 Overview: IoT services

Contents

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Service: factoryreset

12188

Name: factoryreset

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

Applicable to: different objects

Request data: none

Return data (data): none

Service: gettree

17435

Name: gettree

Description: The service reads the complete device description of the AL1940 and provides it as JSON object.

Applicable to: Objects of the `device` type

Request data: none

Return data (data):

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

Service: getdata

12223

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

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

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

Service: getdatamulti

17964

Name: getdatamulti

Description: The service sequentially reads the values of several data points and provides them. The value and the diagnostic code are provided for each data point.

Applicable to: Objects of the `data` type

Request data:

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

Return data (data): for each requested data point

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

Service: getidentity

17134

Name: getidentity

Description: The service reads the complete device description of the AL1940 and provides it as JSON object.

Applicable to: Objects of the `device` type

Request data: none

Return data (data):

Data field	Required field	Data type	Default	Description
iot		device		Device description as JSON object
iot.name	mandatory	STRING		
iot.uid	optional	STRING		
iot.version	mandatory	STRING		
iot.catalogue	optional	ARRAY OF OBJECTS		
iot.deviceclass	optional	ARRAY OF STRING		
iot.serverlist		ARRAY OF OBJECTS		
device	optional			AL1940
device.serialnumber	optional			Serial number
device.hwrevision	optional			Hardware version
device.swrevision	optional			Software version
device.custom	optional			

Service: getsubscriptioninfo

17436

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

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

Return data (data): none

Service: iolreadacyclic

12222

Name: iolreadacyclic

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

Applicable to: IO-Link specific objects

Request data:

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

Return data (data):

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

Service: iolwriteacyclic

11035

Name: iolwriteacyclic

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

Applicable to: IO-Link specific objects

Request data:

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

Return data (data): none

Service: reboot

10986

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

Service: setblock

12224

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

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

Return data (data): none

Example:

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

Service: setdata

11036

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

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

Return data (data): none
Example:

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

Service: setelementinfo

7159

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

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

Return data (data):

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

Service: subscribe

10920

Name: subscribe

Description: The service subscribes to the values of data points. The data points to be subscribed are transferred as a list. The IO-Link master sends changes to the data drain defined in callback.

Applicable to: Objects of the `event` type

Request data:

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

Return data (data): none

Service: unsubscribe

16567

Name: unsubscribe

Description: The service deletes an existing subscription. 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.

Applicable to: Objects of the `event` type

Request data:

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

Return data (data): none

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