ifm electronic

Operating Instructions
IO-Link Master with EtherNet/IP interface
PowerLine
4 Ports
IP 65 / IP 67

AL1220

ifm firmware: 1.1.22 or higher
LR DEVICE: 1.1.0.87 or higher
IO-Link: 1.1.2

English

7391114_00_UK 2017-06-02

Contents

1 Preliminary note

Contents

14801

1.1 Legal and copyright information

1631

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1.2 Purpose of the document

22044

This document is only for device types "IO-Link master - EtherNet/IP gateway (PowerLine) 4 port IP 65 / IP 67" (art. no.: AL1220).

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

13839

...	Instructions
> ...	Reaction, result
→ ...	Cross-reference or internet link
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	02.06.2017

2 Safety instructions

Contents

213

2.1 General

22068

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

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

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

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

2.2 Required background knowledge

22046

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

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

2.3 Warnings used

13685

⚠ WARNING

Designation of pushbuttons, buttons or indications

⚠ CAUTION

Slight reversible injuries may result.

NOTICE

Property damage is to be expected or may result.

Important note
Non-compliance may result in malfunction or interference.

Information
Supplementary note.

2.4 Safety symbols on the device

15021

General warning
When this symbol is shown, consult the corresponding section in the operating instructions.

2.5 Tampering with the unit

11242

⚠ WARNING

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

Tampering with the units is not allowed.
In case of non-compliance our liability and warranty expire.

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

3 Functions and features

Contents

18761

3.1 Permitted use

22052

The device has been designed for use without a control cabinet in plant construction.

3.2 Prohibited use

22053

The device may not be used beyond the limits of the technical data (→ **Technical data** (→ p. 61))!

4 Function

Contents

7482

4.1 Communication, parameter setting, evaluation

Contents

7485

4.1.1 IO-Link

7773

The device offers the following IO-Link functions:

- IO-Link master for connection of up to 4 IO-Link devices (sensors, actuators) according to IO-Link standard 1.0 and 1.1.
- Provision of process data of the connected IO-Link devices for LR SmartObserver monitoring software (→ www.ifm-datalink.com)

4.1.2 EtherNet/IP

2259

The device offers the following EtherNet/IP functions:

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

4.1.3 Parameter setting

7771

The device provides the following configuration options:

- Parameter setting of the IO-Link master of the AL1220 with parameter setting software LR DEVICE and/or EtherNet/IP projection software
- Parameter setting of the connected IO-Link devices (sensors, actuators) with parameter setting software LR DEVICE and/or EtherNet/IP projection software
- Storage of parameter sets of the connected IO-Link devices for automatic recovery (data storage)

4.1.4 Visual indication

7772

The device has the following visual indicators:

- Status and error indication of the gateway, of the EtherNet/IP 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 4 digital inputs (type 2 according to EN 61131-2).
The digital inputs are on pin 2 of the IO-Link ports X01 ... X04.
All inputs refer to the potential of the device supply (pin 3).

4.3 IO-Link supply

7623

The device has 4 supplies for IO-Link devices (sensors, actuators).
The IO-Link ports X01...X04 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).

4.4 Voltage output

8522

The device has a voltage output (X32) for the supply of an additional device. That means that several devices of type AL12nn can be supplied via one singe voltage source (daisy chain). Max. 9 A may be taken from US and max. 9 A from UA.

5 Mounting

Contents

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5.1 Mount the device

15540

- ► Disconnect the system from power before installation.
- ► For installation choose a flat mounting surface.
- ► Please observe the maximum tightening torque.

► Fix the unit to the mounting surface using 2 M5 mounting screws and washers.
  - Tightening torque: 1.8 Nm

► Ground the unit via the two mounting screws of the upper mounting lugs.

6 Electrical connection

Contents

22017

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. 19))!

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

► Observe the required safety measures against electrostatic discharge!

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

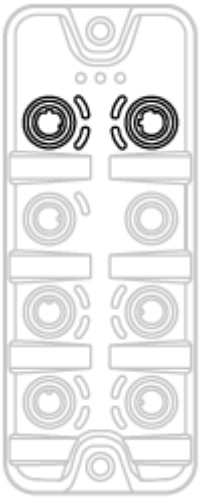
► For UL applications: For connecting the device and the IO-Link devices use UL certificated cables of category CYJV or PVVA.

Wiring: → **Electrical connection**

6.1 Ethernet ports

22683

Notes on connection possibilities: → **Connection possibilities** (→ p. 27)



- ► Connect the unit via the M12 socket X21 and/or X22 with the EtherNet/IP network (e.g. EtherNet/IP PLC, additional EtherNet/IP device)
  - Tightening torque: 0.6...0.8 Nm
- ► Connect the unit via the M12 socket X21 and/or X22 to the industrial Ethernet network
  (e.g. laptop/PC with installed parameter setting software LR DEVICE, laptop/PC with installed monitoring software LR SmartObserver)
  - Tightening torque: 0.6...0.8 Nm
- ► For the connection, use M12 connectors with protection rating IP 65 / IP 67 or higher (e.g. E12492).
- ► Cover the unused sockets with M12 protective caps (art. no.: E73004).
  - Tightening torque 0.6...0.8 Nm

6.2 IO-Link ports

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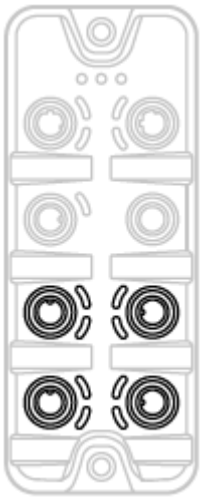


Ports X01...X04: For use as IO-Link port class A:

► Connect the connector of the IO-Link devices with the M12 sockets X01 ... X04.
- Tightening torque: 0.6...0.8 Nm
- Maximum cable length per IO-Link interface: 20 m

► For the connection, use M12 connectors with protection rating IP 65 / IP 67 or higher (z.B. EVC493).

► Cover the unused sockets with M12 protective caps (art. no.: E73004).
- Tightening torque 0.6...0.8 Nm

6.2.1 Input circuit

18629

The inputs of the M12 sockets 4 (pin 2) provide a type 2 behaviour according to standard EN61131-2, the connected electronics must be rated for this electrically.

6.2.2 IO-Link circuits

1863

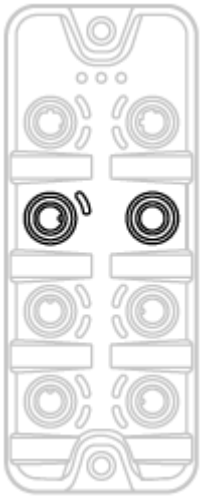
The IO-Link ports of the device meet the requirements of the IO-Link specification 1.0 bis 1.1.2.

The power supply of the connected IO-Link devices may only take place via the AL1220.

Further information: → **Technical data** (→ p. 61)

6.3 Connect the device

8577



► Disconnect power.

If voltage is supplied via a separate power supply:

► Connect device via the M12 socket X31 to 24 V DC (20 ... 30 V SELV/PELV; according to IEC 61010-1, secondary circuit with maximum 30 V DC, supplied from mains circuit up to 300 V of overvoltage category II).
- Tightening torque: 0.6...0.8 Nm.
- Maximum cable length: 25 m

► To connect the device, use M12 connectors with protection rating IP 65 / IP 67 or higher (e.g. E12430).

If voltage is supplied via additional AL12nn (daisy chain):

► Connect device via the M12 socket X31 to M12 socket of the voltage output X32 of the requested AL12nn.
- Tightening torque: 0.6...0.8 Nm
- Maximum cable length: 25 m

► To connect the device, use T-coded M12 connectors with protection rating IP 65 / IP 67 or higher (e. g. E12425)

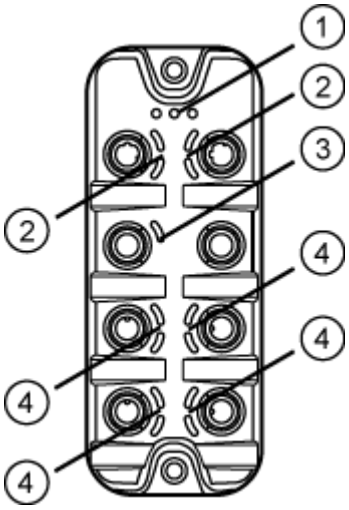
7 Operating and display elements

Contents

5440

7.1 Overview

23700



1. Status LEDs RDY, NET und MOD
   → **Status LEDs** (→ p. 23)
2. Status LEDs LNK and ACT of the EtherNet/IP interfaces 1 (X21) and 2 (X22)
   → **Ethernet interface** (→ p. 23)
3. Status LED US of the voltage supply (X31/X32)
   → **Voltage supply** (→ p. 24)
4. Status-LEDs IOL and DI of the IO-Link port Class A (X01...X04)
   → **IO-Link ports (Class A)** (→ p. 24)

7.2 LED indicators

22024

The device only has the following LED indicators:

7.2.1 Status LEDs

7707

The RDY LED indicates the status of the gateway.
The NET LED (Network Status) indicates the status of the network.
The MOD LED (Module Status) indicates the status of the EtherNet/IP module.

Status LED			Description
RDY	green	on	Gateway functions properly
		flashes 1 Hz	Error
		flashes 5 Hz	Firmware update
		off	Gateway does not function; Device reboots
NET	green	on	Connection with the EtherNet/IP PLC
		off	No IP address
	red	on	IP address is used twice
		flashes	No connection with the EtherNet/IP PLC
MOD	green	on	No error
		off	Voltage too low
	red	on	Module failed
		flashes	Configuration of the module has been changed

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 Voltage supply

22026

The interface for voltage supply (X31) has the LED that is marked as US. The LED indicates the status of the voltage supply.

Status LED			Description
US	green	on	The supply voltage Us is applied.
		off	No supply voltage is applied or the applied supply voltage is too low.

7.2.4 IO-Link ports (Class A)

22029

Each IO-Link port Class A (X01 ... X04) 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: Pin 4 (C/Q) =ON
		off	Interface configured as DI/DO: Pin 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: Pin 2 (DI) = ON
		off	Digital input : Pin 2 (DI) = OFF

8 Configuration

Contents

22367

8.1 Remarks

Contents

22369

8.1.1 Supported configuration options

1989

The AL1220 can be configured using the following options:

- Parameter setting software LR DEVICE (version 1.1.0.87 or higher) (art. no.: QA0011/QA0012)
- EtherNet/IP projection software

8.1.2 Connection possibilities

12742

Via the two EtherNet/IP interfaces X21 and X22, the AL1220 can be simultaneously connected with the EtherNet/IP control level (PLC) and the IT infrastructure level (monitoring/parameter setting). The following connection possibilities exist:

Operation without EtherNet/IP connection

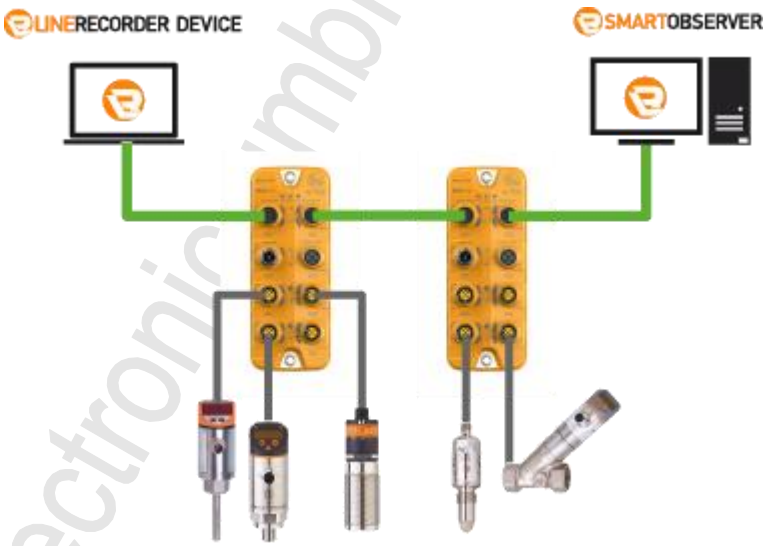
4364

Operation as independent IO-Link master with connected IO-Link devices. As an option, several IO-Link masters can be coupled via the EtherNet/IP interfaces. If necessary, the IO-Link masters can be coupled with the IT infrastructure via industrial Ethernet in order to enable monitoring of the process data of the connected IO-Link devices.

Parameter setting
- IO-Link master: LR DEVICE
- IO-Link device: LR DEVICE

Monitoring (optional): LR SmartObserver

Topology (example):



Operation with EtherNet/IP connection (without LR DEVICE)

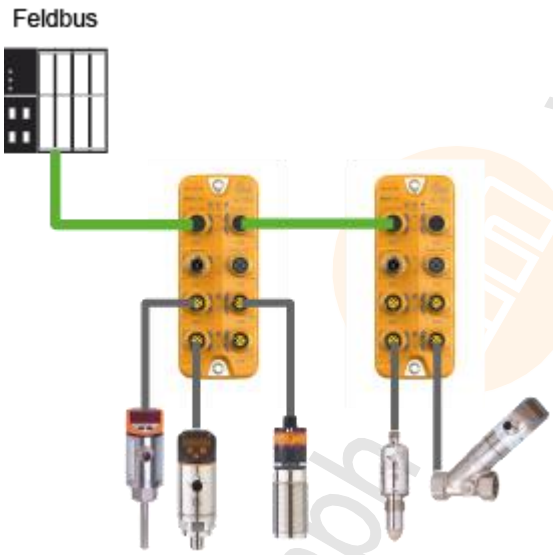
7396

Operation of the IO master as EtherNet/IP IO device. As an option, several IO-Link masters can be coupled via the Ethernet interfaces X21 and X22. The complete monitoring of the process data and processing of alarms takes place via EtherNet/IP mechanisms.

Parameter setting
- IO-Link master: EtherNet/IP projection software
- IO-Link device: EtherNet/IP projection software (acyclic services)

Monitoring: EtherNet/IP projection software

Topology (example):



Operation with EtherNet/IP connection and LR DEVICE/LR SmartObserver

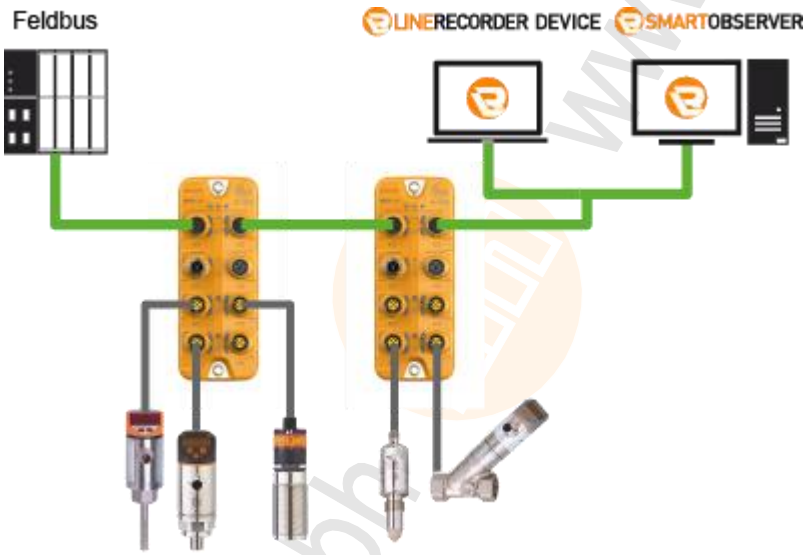
7398

The AL1220 can be connected via the two Ethernet interfaces X21 and X22 simultaneously with the EtherNet/IP control level (PLC) and the IT infrastructure level (monitoring/parameter setting).

Parameter setting
- IO-Link master: LR DEVICE and/or EtherNet/IP projection software
- IO-Link device: LR DEVICE and/or EtherNet/IP projection software

Monitoring: LR SmartObserver and/or EtherNet/IP projection software

Topology (example):



8.1.3 Offline parameter setting

SYS_OBJECTID>

The AL1220 supports the offline parameter setting. In this context, the user creates and stores a configuration for the unit and the connected IO-Link devices without being connected to the AL1220. The configuration created in this way can be stored as a file (*.lrp) and loaded to the device and activated at a later date.

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

8.1.4 VPN connection

22762

An active VPN connection blocks the access of the parameter setting software LR DEVICE to the EtherNet/IP interface of the AL1220.

► Deactivate the VPN connection in order to be able to access the AL1220 with the LR DEVICE.

8.2 LR DEVICE: Configure the device

Contents

7948

On delivery, the AL1220 is configured with the → **Factory Settings** (→ p. 59) configured.

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

► Use the help function of the parameter setting software LR DEVICE!

Requirements

> The device is properly connected with the LR DEVICE laptop/PC via the EtherNet/IP interface.

> LR DEVICE is correctly installed (→ Software manual LR DEVICE).

1 Start LR DEVICE.

► Start LR DEVICE.

> Web browser shows LR DEVICE user interface.

2 Scan network

► Scan network for new IO-Link masters.

> Under [ONLINE], the article number and the IP address of the device appear.

3 Set network parameters

► Under [ONLINE]: Click on the AL1220.

> LR DEVICE shows the following sections:

Section	Functions
[Alle]	all available functions
[Network]	→ **Configure the Ethernet interface** (→ p. 32)
[LineRecorder]	→ **Configure communication profile** (→ p. 33) → **Configure the interface to the SmartObserver** (→ p. 34)
[Port x]*	→ **Set the operating mode of the IO-Link ports** (→ p. 35) → **Set device validation and data storage** (→ p. 36)
[Setup]	→ **LR DEVICE: Read device information** (→ p. 54) → **Reset IO-Link master to factory settings** (→ p. 38) → **Reboot the device** (→ p. 55)

* ... x = 1...4

8.2.1 Configure the Ethernet interface

8000

To set the parameters of the Ethernet interface (X21/X22):

► Select the [Network] menu.

► The page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values
[IP address]	IP address of the device	e.g. 172.18.65.50
[Subnet mask]	Subnet mask of the IP network	e.g. 255.255.255.0
[IP gateway address]	IP address of the gateway	e.g. 172.18.65.1
[Host name]	Name of the device in the EtherNet/IP network	e.g. al1xxx
[MAC address]	MAC address of the device	The value is fixed

► Store changed values on the device.

8.2.2 Configure communication profile

22061

In order to copy the access rights to the device:

► Select the [LineRecorder] menu.

> The page shows the current settings.

► Set the following parameter as required:

Parameter	Description	Possible values	
[Communication Profile]	Access rights to the parameter data, process data and event/diagnostic messages of the IO-Link master and the connected IO-Link devices	EtherNet/IP + LineRecorder	▪ EtherNet/IP and LR DEVICE have read and write access rights to parameters and process data ▪ EtherNet/IP and LR DEVICE have read access rights to events/alarms
		EtherNet/IP + LineRecorder (ro)	▪ EtherNet/IP has read and write access rights to parameters and process data ▪ EtherNet/IP has read access rights to events/alarms ▪ LR DEVICE only has read access rights to parameters, process data and events/alarms
		LineRecorder only	▪ LR DEVICE has read and write access rights to parameters to parameters and process data ▪ LR DEVICE has read access rights to events/alarms ▪ EtherNet/IP has no access rights
		keep setting	Previous settings are valid

► Store changed values on the device.

If parameter [Communication Profile] = EtherNet/IP + LineRecorder:
Different parameter settings in the EtherNet/IP projection software and the LR DEVICE may cause undesired system behaviour. Parameter settings applied by the EtherNet/IP projection software always overrule the settings applied by LR DEVICE.

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

► → **Reboot the device** (→ p. 55)

8.2.3 Configure the interface to the SmartObserver

12743

In order to set the parameters of the interface to the SmartObserver:

► Select the [LineRecorder] menu.

> The page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values	
[IP address SmartObserver]	IP address of the laptop/PC where the SmartObserver is installed	e.g. 192.168.0.100	
[Port SmartObserver]	Port address that is used to send process data to the SmartObserver	1 ... 65535	Default value: 35100
[Source ID SmartObserver]	Source identifier with which the process data of the device is indicated in the SmartObserver (String32)		
[Port x. LR events]	Operating mode of the IO-Link port (x = 1...4)	Disabled	Cyclic transfer of the process data
		Enabled	Event-based transfer of the process data
[Port x. LR cycle time (ms)]*	Cycle time of the IO-Link interface for cyclic transmission of the process data between the IO-Link master and the SmartObserver (x = 1...4)	Disabled	no data transmission
		1000 ... 60000	1000 ms ... 60000 ms

* ... parameter only valid if parameter [PortX. LR events] = Disabled

After changing the parameter [Port SmartObserver] or [Source ID SmartObserver], it can take 120 seconds before the device establishes a new TCP connection.

To prevent the delay:

► Reboot the device after the parameter change.

► Store changed values on the device.

8.2.4 Set the operating mode of the IO-Link ports

8714

The IO-Link ports X01...X04 of the device support the following operating types:

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

The user can set the operating mode of each IO-Link port separately at any time.

► Select [Port x] menu.

> The page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values	
[Port x mode]	Operating mode of the IO-Link port (x = 1...4)	IO-Link	Operation as IO-Link interface
		DI	Operation as digital input
		DO	Operation as digital output
		Disabled	Interface deactivated
[Port x IO-Link. Cycle time]*	Cycle time of the data transmission between the IO-Link master and the IO-Link device	As fast as possible	The device automatically sets the fastest possible cycle time
		2.0 ms ... 128.0 ms	2 milliseconds ... 128 milliseconds

* ... Parameter only available, if [Port x mode] = IO-Link

> Store the changed values on the AL1220.

8.2.5 Set device validation and data storage

7165

In operating mode "IO-Link" the user can set the behaviour of the IO-Link ports regarding device validation and backup/restore of parameter data of the connected IO-Link devices.

To configure the device validation and data storage settings:

► Select [Port x] menu.

> The page shows the current settings.

► Set the following parameters as required:

Name	Description	Possible values	
[Port x IO-Link Validation / Data Storage]	Supported IO-Link standard and behaviour of the device when a new IO-Link device is connected to IO-Link port x (x = 1...4)	No check and clear	▪ No verification of the vendor ID and device ID ▪ No data storage
		Type compatible V1.0 device	▪ IO-Link device is compatible with the V1.0 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ No data storage
		Type compatible V1.1 device	▪ IO-Link device is compatible with the V1.1 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ no data storage
		Type compatible V1.1 device with Backup + Restore	▪ IO-Link device is compatible with the V1.1 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ The IO-Link master saves the parameter values of the connected IO-Link device; modifications of the parameter values are also stored (observe the note!) ▪ When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.

Name	Description	Possible values	
		Type compatible V1.1 device with Restore	▪ IO-Link device is compatible with the V1.1 IO-Link standard ▪ Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) ▪ The IO-Link master 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.
[Port x IO-Link. Vendor ID]	ID of the manufacturer that is to be validated	0 ... 65535	ID of the manufacturer of the IO-Link device (ifm electronic: 310)
[Port x IO-Link. Device ID]	ID of the IO-Link device that is to be validated	0 ... 16777215	ID of the IO-Link device

► Store the changed values on the AL1220.

8.2.6 Reset IO-Link master to factory settings

12740

When resetting the AL1220, all parameters are reset to the → **Factory Settings** (→ p. 59)

To reset the device to factory settings:

► Select [Setup] menu.

> The page shows the current settings.

► Click on [Factory Reset] to reset the AL1220.

> LR DEVICE sets the AL1220 factory settings.

8.3 LR DEVICE: Configure IO-Link devices

22403

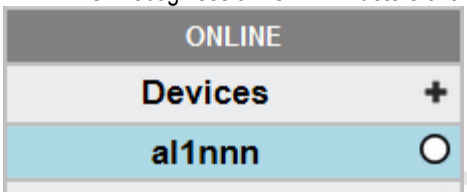
In order to configure the IO-Link devices connected to the AL1220 using the parameter setting software LR DEVICE:

Requirements:

> AL1220 is correctly installed and connected to the LR DEVICE software via the EtherNet/IP interface (X21/X22).
> The IO-Link device is connected correctly with the AL1220.
> The operating mode of the IO-Link interface is "IO-Link" (parameter [Port x mode] = IO-Link)
> Parameter [Access rights] is configured with one of the following values:
– EtherNet/IP + LineRecorder
– LineRecorder only

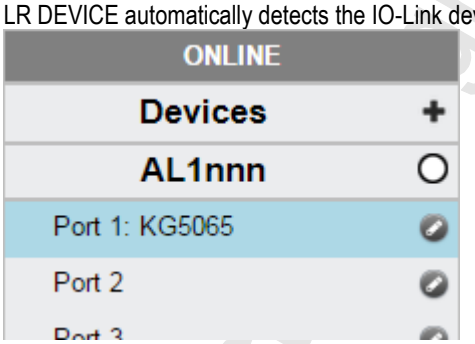
1 Select IO-Link master

► Start LR DEVICE.
► Update IODD file library
OR:
Import IODD file of the IO-Link device manually.
► Scan network for devices.
> LR DEVICE recognises all IO-Link masters of the EtherNet/IP network.



2 Add IO-Link device

► Under [ONLINE]: Click on the required AL1220.
> LR DEVICE automatically detects the IO-Link devices connected to the AL1220 (e.g. ifm Sensor KG5065).



3 Configure IO-Link device

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

Information about the available parameters of the IO-Link device: → Operating instructions of the IO-Link device

► Store changed configuration on the IO-Link device.

8.3.1 Offline parameter setting: Add IO-Link devices manually

22817

The AL1220 supports the automatic recognition of IO-Link devices that are connected to the IO-Link interfaces. In addition to the automatic recognition of IO-Link devices in the online mode, the user can also manually add IO-Link devices to the device configuration (e.g. → **Offline parameter setting** (→ p. 30)).

1 Set up offline configuration

► Start LR DEVICE.

► Add AL1220 to an offline configuration.

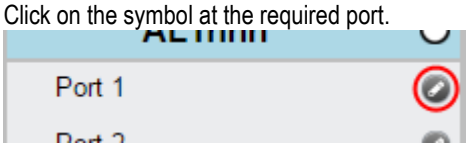
> LR DEVICE shows AL1220 in [OFFLINE] section.

2 Add IO-Link device to configuration.

► Under [OFFLINE]: Click on [AL1220].

> LR DEVICE shows the available parameters of the AL1220.

► Click on the symbol at the required port.



> The dialogue window [Gerät auswählen] appears.

► Select the required IO-link device from the list.

► Click on [OK] to add the selected IO-Link device to the device configuration.

> IO-Link device appears at the selected port.

3 Configure IO-Link device

► Mouse click on the port to which the IO-Link device is connected.

> LR DEVICE shows the available parameters of the IO-Link device.

► Configure IO-Link device.

Information about the available parameters of the IO-Link device: → Operating instructions of the IO-Link device

► Store changed configuration on the IO-Link device.

► Click on [AL1220].

8.4 EtherNet/IP: Configure the device

Contents

1987

On the field bus side, the device can be configured with any EtherNet/IP compatible projection software.

The information in the following sections refers to the EtherNet/IP projection software RSLogix 5000.

8.4.1 Registration of the EDS file

1979

ifm provides an EDS file to integrate the AL1220 in a EtherNet/IP projection software. The user can download the EDS file from the ifm website (→ the EDS file, all parameters, process data, and their valid value ranges are defined.

To add the AL1220 to the device catalogue of RSLogix5000:

► Download the EDS file of the AL1220 from the ifm website.
► Start RSLogix5000.
► Select [Tools] > [EDS Hardware Installation Tool].
> EDS Wizard appears.
► Register the downloaded EDS file of the AL1220 with the EDS Wizard.
> EDS Wizard installs the EDS file and adds the AL1220 to the device catalogue.

8.4.2 Integrate the AL1220 into the EtherNet/IP network

8015

The device is integrated as module of an I/O scanner in the EtherNet/IP network.

Requirements:

> The EDS file of the AL1220 is installed (→ **Registration of the EDS file** (→ p. 42)).

1 Create/open EtherNet/IP project

► Start RSLogix 5000.
► Create new EtherNet/IP project.
OR
Open an existing EtherNet/IP project.

2 Configure EtherNet/IP PLC and IO scanner

► Select and configure EtherNet/IP controller and IO scanner.
> EtherNet/IP project includes a EtherNet/IP controller and an IO scanner.

3 Integrate AL1220 in project

► In the Controller Organizer: Right mouse click on the IO scanner.
> Context menu appears.
► In the context menu: Select [New Module...].
> The window [Select Module Type] appears.
► Select AL1220 and click on [Create].
> The [New Module] window appears.
► Enter name and IP address of the AL1220.
► Click on [OK] to adopt the entered values.
> RSLogix 5000 adds AL1220 as sub-element of the IO scanner to the project.

4 Save the project

► Save EtherNet/IP project

8.4.3 Configure AL1220

8019

The AL1220 is configured via the controller tags.

Requirements:

> AL1220 is correctly integrated in the EtherNet/IP project (→ **Integrate the AL1220 into the EtherNet/IP network** (→ p. 42)).

1 Open controller tags

► In the Controller Organizer: Double click on [Controller Name_of_Project] > [Controller Tags]

> [Controller Tags] window appears.

► In the tree view: Click on [AL1220:C].

> Controller tags for the configuration of the device appear.

2 Configure AL1220

► Set the following controller tags as required:

Name	Description	Possible values	
[AL1220:C.Communication_Profile]	The access rights to the parameter data, process data and events/diagnostic messages of the IO-Link master and the connected IO-Link devices	0x00	<Feldsbus> + LineRecorder ▪ EtherNet/IP and LR DEVICE have read and write access rights to parameters and process data ▪ EtherNet/IP and LR DEVICE have read access rights to events/alarms
		0x01	EtherNet/IP + LineRecorder (ro) ▪ EtherNet/IP has read and write access rights to parameters and process data ▪ EtherNet/IP has read access rights to events/alarms ▪ LR DEVICE only has read access rights to parameters, process data and events/alarms
		0x02	EtherNet/IP only ▪ EtherNet/IP has read and write access rights to parameters and process data ▪ EtherNet/IP has read access rights to events/alarms ▪ LR DEVICE has no access rights (parameters, process data, events/alarms, web interface, firmware update)
		0x03	Continue in Use Case previous setting is valid
[AL1220:C.Port_Process_Data_Size]	Length of the process input data and process output data	0x00	2 bytes input, 2 bytes output
		0x01	4 bytes input, 4 bytes output
		0x02	8 bytes input, 8 bytes output
		0x03	16 bytes input, 16 bytes output
		0x04	32 bytes input, 32 bytes output

► Save EtherNet/IP project

8.4.4 Configure IO-Link ports

11810

The IO-Link ports are configured via the controller tags. The user can configure each IO-Link port separately.

To configure the IO-Link ports:

Requirements:

> AL1220 is correctly integrated in the EtherNet/IP project (→ **Integrate the AL1220 into the EtherNet/IP network** (→ p. 42)).

1 Open controller tags

► In the Controller Organizer: Double click on [Controller Name_of_Project] > [Controller Tags]

> [Controller Tags] window appears.

► In the tree view: Click on [AL1220:C].

> Controller tags for the configuration of the device appear.

2 Configure IO-Link ports

► Configure the following tags for each IO-Link port at will:

Name	Description	Possible values	
[AL1220:C.Port_Mode_Port_x]	Operating mode of the IO-Link port	0x00	Interface deactivated
		0x01	Operation as digital input (DI)
		0x02	Operation as digital output (DO)
		0x03	Operation as IO-Link interface
[AL1220:C.Port_Cycle_Time_Port_x]	Cycle time of the data transmission between the IO-Link master and the IO-Link device	0x00	The device automatically sets the fastest possible cycle time
		0x01	2 milliseconds
		0x02	4 milliseconds
		0x03	8 milliseconds
		0x04	16 milliseconds
		0x05	32 milliseconds
		0x06	64 milliseconds
		0x07	128 milliseconds
[AL1220:C.Swap_Port_x]	Visualisation of the process data (EtherNet/IP uses Little Endian Format (Intel), IO-Link uses Big Endian Format (Motorola))	0x00	Byte swapping for IO-Linkdata deactivated
		0x01	Byte swapping for IO-Linkdata activated
[AL1220:C.Validation_Data_Storage_Port_x]	Supported IO-Link standard and behaviour of the IO-Link master when connecting new IO-Link devices to the IO-Link port	0x00	No validation
		0x01	Type compatible V1.0 device
		0x02	Type compatible V1.1 device
		0x03	Type compatible V1.1 device with Backup + Restore
		0x04	Type compatible V1.1 device with Restore
[AL1220:C.Vendor_ID_Port_x]	Vendor ID of the manufacturer of the device on the IO-Link port	0x0000...0xFFFF ifm electronic: 0x136	

Name	Description	Possible values	
[AL1220:C.Device_ID_Port_x]	Device ID of the device on the IO-Link port	0x000000...0xFFFFFF	
[AL1220:C.Fail_Safe_Mode_Port_x]	Fail-safe mode for output data when the EtherNet/IP connection is interrupted	0x00	No Failsafe
		0x01	Failsafe Reset Value
		0x02	Failsafe Old Value
		0x03	Failsafe with Pattern
[AL1220:C.Fail_Safe_Value_DO_Port_x]	Fail-safe value for the operating mode "digital output (DO)"	0x00	Failsafe Reset Value
		0x01	Failsafe Old Value
		0x02	Failsafe Set Value

x = 1...4

► <Save EtherNet/IP project.

8.5 EtherNet/IP: Configure IO-Link devices

23106

The AL1220 supports the configuration of the connected IO-Link devices from the EtherNet/IP projection software. For this, ifm offers the EtherNet/IP object "IO-Link Request" (→ **IO-Link requests (object class: 0x80)** (→ p. 96)). The object enables direct read and write access to IO-Link objects of the IO-Link device. The extent of the configurable parameters depends on the IO-Link device.

The following services are available:

Name	Description	Reference
Read request	Send a request to read an IO-Link object	→ **Read_ISDU** (→ p. 97)
Write request	Send a request to write an IO-Link object	→ **Write_ISDU** (→ p. 100)

Information for the execution of acyclic commands: → **Execute acyclic commands** (→ p. 48)
Available parameters of the IO-Link devices: → Operating instructions of the IO-Link device

8.6 EtherNet/IP: Programmers' notes

12761

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

- Read device information of the AL1220
- Read diagnostics and alarms
- Set parameters of the connected IO-Link devices

The following sections show the available options.

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

8.6.1 Read cyclic input data

8518

The user can access the cyclic input data of the connected sensors and IO-Link devices via the controller tags of the AL1220.

To access the input data:

► Starting RSLogix5000.
► Open a EtherNet/IP project.
► In the project tree: Mouse click on [Controller Tags] > [AL1220.I]
> The window shows the data structure with cyclic input data ([AL1220.I:Data])

Mapping of the inputs on the data structure [AL1220.I:Data]: → **Input assembly** (→ p. 71))

8.6.2 Write cyclic output data

8570

The user can access the cyclic output data of the connected actuators and IO-Link devices via the controller tags of the AL1220.

To access the cyclic output data:

► Starting RSLogix5000.
► Open a EtherNet/IP project.
► In the project tree: Mouse click on [Controller Tags] > [AL1220.O]
> The window shows the data structure with cyclic input data ([AL1220.O:Data])

Mapping of the outputs on the data structure [AL1220.C:O]: → **Output assembly** (→ p. 75)).

8.6.3 Execute acyclic commands

22633

The AL1220 offers the following options to execute acyclic commands:

Command channels in cyclic process data

16384

Within the cyclic input and output data, special areas are available for the acyclic data transmission. Both read and write access can be implemented via the areas.

Principle of the command channels

9002

A cyclic command consists of a request and a response. The command request is transmitted in the Output Assembly. The command response of the IO-Link master is transmitted in the Input Assembly.

The following table shows the general process of an acyclic communication via the acyclic command channel.

Step	Output assembly	Input assembly
1	► [Trigger] = 0 > The data in the request area is invalid.	--
2	► Write the data of the request area: - Port (bytes 4 and 5) - Index (bytes 6 and 7) - Sub-index (bytes 8 and 9) - Command (byte 10) - Data (11...43)	--
3	► [Trigger] = 1 > Command is transmitted	> [Handshake] = 0
4	--	► Read [Handshake]. If [Handshake] = 0x0: > The data in the response area is invalid. ► Continue with step 4 If [Handshake] = 0x1: > The data in the response area is valid. ► Continue with step 5
5	--	► Read [Result] byte (byte 11) If [Result] = 0x00 > Command has been processed without errors If [Result] = 0x01: > An error occurred during the processing of the command. ► Read diagnostic codes (byte 13) ► Eliminate the error and repeat the execution of the command

Acyclic port commands

12063

For the acyclic access to the configuration of the IO-Link ports of the AL1220, the following commands are available:

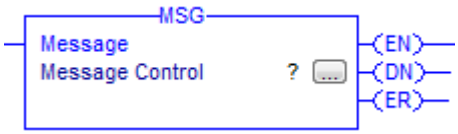
Command	Description	Reference
Set mode	Set the operating type of the IO-Link port	→ **Command 0x10 – set mode** (→ p. 81)
Set Validation ID / Data Storage	Adjust the supported IO-Link standard and the behaviour of the IO-Link master when connecting a new IO-Link device to the IO-Link port	→ **Command 0x20 – set validation ID / data storage** (→ p. 83)
Set fail-safe data pattern	Behaviour of the outputs when the EtherNet/IP connection is interrupted and setting of the corresponding fail-safe values	→ **Command 0x30 – set fail-safe data pattern** (→ p. 85)

The port commands use the same mechanisms as the acyclic command channel (→ **Acyclic command channel** (→ p. 76)).

EtherNet/IP mechanisms for acyclic commands

7102

Acyclic commands can be executed with the EtherNet/IP command `Message (MSG)`.



Parameters of the available field bus objects: → **Field bus objects** (→ p. 87)

For detailed information about the `Message (MSG)` command: → Operating instructions RSLogix 5000

8.6.4 Read diagnostic and status information

10235

Diagnostic and status information is a part of the cyclically transmitted process data (mapping: → **Input assembly** (→ p. 71)). the input assembly includes the following diagnostic information of the IO-Link ports and the status information of the transmitted data:

Byte	Content
2	Indication of short circuit/overload of the IO-Link ports X01...X04
3	Status indication of the voltage supply of the device
43	Status information IO-Link port X01
58	Status information IO-Link port X02
73	Status information IO-Link port X03
88	Status information IO-Link port X04

To access the cyclically transmitted diagnostic and status information:

► Starting RSLogix5000.
► Open a EtherNet/IP project.
► In the project tree: Mouse click on [Controller Tags] > [AL1220.I]
> The window shows cyclic input data (Input Assembly).
► Link diagnostic and status information with variables.

9 Operation

Contents

22368

9.1 Read device information

12741

In order to get information about the current status of the hardware and software components of the device, the user can use the following possibilities:

- **Web interface: Read device and diagnostic information** (→ p. 53)
- **LR DEVICE: Read device information** (→ p. 54)
- **EtherNet/IP: Read device information** (→ p. 54)

9.1.1 Web interface: Read device and diagnostic information

12744

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

► Connect laptop/PC and AL1220 via the Ethernet internet.

► Start web browser.

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

> Web browser shows the web interface of the device.

> The page shows the following data:

- Table with connected IO-Link devices

Name	Description
[Port]	Number of the IO-Link interface
[Mode]	Operating mode of the IO-Link interface
[Comm. Mode]	Baud rate of the IO-Link interface
[MasterCycleTime]	Cycle time
[Vendor ID]	ID of the manufacturer of the IO-Link device
[Device ID]	ID of the IO-Link device
[Name]	Article number of the IO-Link device ▪ For ifm articles: This article number is stored along with a link to the produkt page on the ifm website.
[Serial]	Serial number of the IO-Link device
[LR Interval]	Cycle time for the communication with the SmartObserver

- Version information of the installed firmware components

Name	Description
[Firmware version]	Firmware version
[FirmwareCN Version]	Version of the firmware container
[Bootloader Version]	Version of the boot loader
[NETX Firmware Version]	Version of the EtherNet/IP firmware

- Diagnostic information of the device

Name	Description
[Current]	Current (in mA)
[Voltage]	Voltage (in mV)
[Short Circuit]	Number of detected short circuits
[Temperature]	Device temperature (in °C)

The page of the device is constantly updated. This is why the data is always up-to-date.

9.1.2 LR DEVICE: Read device information

11614

To show information about the AL1220:

► Start LR DEVICE.

► Scan network for devices.

> LR DEVICE shows recognised AL1220.

► Mouse click on AL1220

> The header shows the following information:

Name	Description	Possible values	
Device name	Article number of the device	AL1220	
Manufacturer	Manufacturer of the device	ifm electronic gmbh	
Device ID	IO-Link ID of the device		
Serial number	Serial number of the device		
Revision	Hardware revision / software revision of the unit		
Type of unit	Name of the device	IO-Link master PowerLine EtherNet/IP 4 ports IP 65 / IP 67	
Device status	Current status of the slave		no information about the condition
			OK: no errors, no warning, no information
			OK: no errors, no warning, information
			Warning
			Error

9.1.3 EtherNet/IP: Read device information

7639

The user can read information about the device via the field bus object "Identity Object" (→ **Field bus objects** (→ p. 87)).

9.2 Reboot the device

12760

When restarting the device, all settings are kept.
To restart the AL1220:

► Start LR DEVICE.
► Scan the network for devices.
> LR DEVICE recognises the AL1220.
► Under [ONLINE]: Click on [AL1220]
► Select the [Setup] section.
> LR DEVICE shows available parameters.
► Click on [Restart] to restart the device.
> LR DEVICE restarts the AL1220.

9.3 Error detection and elimination

20926

In order to recognise and eliminate errors, the user can use the following resource:

- Status LED of the unit (→ **LED indicators** (→ p. 23))
- Cyclic diagnostic and status information (→ **Input assembly** (→ p. 71))

9.4 Firmware update

22425

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

If the firmware update is not successful, deactivate all connections to the EtherNet/IP PLC, LR SmartObserver and LR DEVICE and repeat the process.

- ► Stop EtherNet/IP PLC.
- ► Set the parameter [IP address SmartObserver] to 255.255.255.255 (→ **Configure the interface to the SmartObserver** (→ p. 34)).
- ► Stop the LRAgent.LRDevice service in the Windows task manager.

To install a new firmware version on the device:

Requirements

> File with new firmware has been downloaded.

> 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-Adresse des Geräts>/update`

> Web browser shows the [Firmware Update] page.

2 Load new firmware to AL1220

- ► Click on [Datei auswählen].

> Dialogue window appears.

- ► Select the firmware file and click on [Öffnen] 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.

9.5 Exchange IO-Link device

7775

To exchange 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 / Data Storage] = Type compatible V1.1 device with Restore
OR
[Port x IO-Link Validation / Data Storage] = Type compatible V1.1 device with Restore

► Save changes.

2 Exchange IO-Link device

► Disconnect old IO-Link device from AL1220.

► Connect new IO-Link device with the same IO-Link port of the AL1220.

> 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

23489

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

Parameter	Factory setting
[IP address]	192.168.1.250
[Subnet mask]	255.255.255.0
[IP gateway address]	0.0.0.0
[Host name]	blank
Data memory (Data Storage)	blank

12 Appendix

Contents

7156

12.1 Technical data

Contents

9011

12.1.1 Application

23710

Application	
Application	I/O modules for field applications
Daisy-chain function	Voltage supply; communication interface

12.1.2 Electrical data

22819

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

12.1.3 Inputs / outputs

23711

Inputs / outputs	
Total number of inputs and outputs	8; (configurable)

12.1.4 Inputs

22820

Inputs	
Number of digital inputs	8; (IO-Link Port Class A: 4 x 2)
Switching level high [V]	11...30 DC
Switching level low [V]	0...5 DC
Digital inputs protected against short circuits	yes

12.1.5 Outputs

22821

Outputs (digital)	
Output function	4; (IO-Link Port Class A: 4 x 1)
Max. current load per output [mA]	200
Short-circuit protection	yes

12.1.6 Interfaces

22630

Interfaces	
Communication interface	Ethernet; IO-Link
Communication interface	IO-Link; TCP/IP; PROFINET IO
Ethernet	
Transmission standard	10Base-T; 100Base-TX
Transmission rate	10; 100
Protocol	TCP/IP; PROFINET IO
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	
Transmission type	COM 1 / COM 2 / COM 3
IO-Link revision	V1.1
Number of ports class A	4

12.1.7 Operating conditions

22823

Operating conditions	
Applications	Indoor use
Ambient temperature [°C]	-25...60
Storage temperature [°C]	-25...85
Max. perm. relative air humidity [%]	90
Max. height above sea level [m]	2000
Protection rating	IP 65; IP 67
Pollution Degree	2

12.1.8 Approvals / tests

22824

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

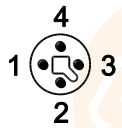
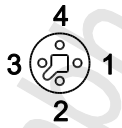
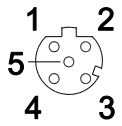
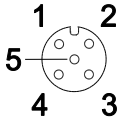
12.1.9 Mechanical data

22825

Mechanical data	
Weight [g]	272
Materials	Housing: PA; socket: brass nickel-plated

12.1.10 Electrical connection

7637

Voltage supply IN X31	
Connector	M12
Wiring	 1: + 24 V DC (US) 2: GND (UA) 3: GND (US) 4: +24 V DC (UA)
Voltage supply OUT X32	
Connector	M12
Wiring	 1: + 24 V DC (US) 2: GND (UA) 3: GND (US) 4: +24 V DC (UA)
Ethernet IN / OUT X21, X22	
Connector	M12
Wiring	 1: TX + 2: RX + 3: TX - 4: RX - 5: -
Process connection IO-Link Ports Class A X01...X04	
Connector	M12
Wiring	 1: + 24 V DC (US) 2: DI 3: GND (US) 4: C/Q IO-Link 5: -

12.2 EtherNet/IP

Contents

22433

12.2.1 Parameter data

Contents

Configuration Assembly

10233

The values of the Configuration Assembly are set in RSLogix 5000 via the controller tags of the EtherNet/IP project.

Byte	Content
0	Communication profile (→ **Communication profile** (→ p. 68))
1	Process data length (→ **Process data length** (→ p. 68))
2	X01: Operating mode (→ **Port configuration** (→ p. 69))
3	X01: Cycle time IO-Link master - IO-Link device (→ **Port configuration** (→ p. 69))
4	X01: Byte swap (→ **Port configuration** (→ p. 69))
5	X01: Data storage and validation (→ **Port configuration** (→ p. 69))
6	X01: Vendor ID (LSB) (→ **Port configuration** (→ p. 69))
7	X01: Vendor ID (MSB) (→ **Port configuration** (→ p. 69))
8	X01: Device ID (LSB) (→ **Port configuration** (→ p. 69))
9	X01: Device ID (→ **Port configuration** (→ p. 69))
10	X01: Device ID (MSB) (→ **Port configuration** (→ p. 69))
11	X01: reserved
12	X01: Fail safe mode (→ **Port configuration** (→ p. 69))
13	X01: Fail safe value of DO (pin 4) (→ **Port configuration** (→ p. 69))
14...25	X02: Parameters of the IO-Link ports (→ lines 2...13)
26...37	X03: Parameters of the IO-Link port (→ lines 2...13)
38...49	X04: Parameters of the IO-Link port (→ lines 2...13)

Communication profile

23072

name	Description	Possible values	
[Communication profile]	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.	0x00	EtherNet/IP + LineRecorder
		0x01	EtherNet/IP + LineRecorder (ro)
		0x02	EtherNet/IP only
		0x03	Continue in Use Case

Process data length

23016

Name	Description	Possible values	
[Process data length]	Length of the process input data and process output data Controller Tag: []	0x00	2 bytes input data, 2 bytes output data ▪ Input assembly: 126 bytes ▪ Output assembly: 54 bytes
		0x01	4 bytes input data, 4 bytes output data ▪ Input assembly: 134 bytes ▪ Output assembly: 62 bytes
		0x02	8 bytes input data, 8 bytes output data ▪ Input assembly: 150 bytes ▪ Output assembly: 78 bytes
		0x03	16 bytes input data, 16 bytes output data ▪ Input assembly: 182 bytes ▪ Output assembly: 110 bytes
		0x04	32 bytes input data, 32 bytes output data ▪ Input assembly: 246 bytes ▪ Output assembly: 172 bytes

Port configuration

7423

Name	Description	Possible values	
[X0n: Port Mode]	Operating mode of the IO-Link port	0x00	Interface deactivated
		0x01	Operation as digital input (DI)
		0x02	Operation as digital output (DO)
		0x03	Operation as IO-Link interface
[X0n: Master Cycle Time]	Cycle time of the data transmission between the IO-Link master and the IO-Link device	0x00	The device automatically sets the fastest possible cycle time
		0x01	2 milliseconds
		0x02	4 milliseconds
		0x03	8 milliseconds
		0x04	16 milliseconds
		0x05	32 milliseconds
		0x06	64 milliseconds
		0x07	128 milliseconds
[X0n: Byte Swap]	Visualisation of the process data (EtherNet/IP uses Little Endian Format (Intel), IO-Link uses Big Endian Format (Motorola))	0x00	Byte swapping for IO-Link process data deactivated
		0x01	Byte swapping for IO-Link process data activated
[X0n: Validation ID]	Supported IO-Link standard and behaviour of the IO-Link master when connecting new IO-Link devices to the IO-Link port	0x00	No validation
		0x01	Type compatible V1.0 device
		0x02	Type compatible V1.1 device
		0x03	Type compatible V1.1 device with Backup + Restore
		0x04	Type compatibe V1.1 device with Backup
[X0n: VID (LSB)]	Vendor ID of the manufacturer of the device on the IO-Link port	per byte: 0x00...0xFF 0xYYZZ - YY = VID (MSB) - ZZ = VID (LSB)	
[X0n: VID (MSB)]			
[X0n: DID (LSB)]	Device ID of the device on the IO-Link port	per byte: 0x00...0xFF 0xXXYYZZ - XX = DID (MSB) - YY = DID - ZZ = DID (LSB)	
[X0n: DID]			
[X0n: DID (MSB)]			
[X0n: Fail-safe Mode]	Fail-safe mode for output data when the EtherNet/IP connection is interrupted	0x00	No Failsafe
		0x01	Failsafe Reset Value
		0x02	Failsafe Old Value
		0x03	Failsafe with Pattern
[X0n: Fail-safe Value of DO Pin 4]	Fail-safe value for the operating mode "digital output (DO)"	0x00	Failsafe Reset Value
		0x01	Failsafe Old Value
		0x02	Failsafe Set Value

12.2.2 Cyclic data

Contents

22429

Input assembly

11135

Byte	Content
0	Digital inputs of the IO-Link ports in the DI operating mode (→ **Mapping: digital input data (DI)** (→ p. 72))
1	
2	Status information (→ **Mapping: Status information** (→ p. 72))
3	
4...45	Acyclic command area: Response channel (→ **Response channel** (→ p. 78))
46...63	Port X01: Diagnostic, vendor ID, device ID, events (→ **Mapping: IO-Link port information** (→ p. 73))
64...81	Port X02: Diagnostic, vendor ID, device ID, results (→ **Mapping: IO-Link port information** (→ p. 73))
82...99	Port X03: Diagnostic, vendor ID, device ID, events (→ **Mapping: IO-Link port information** (→ p. 73))
100...117	Port X04: Diagnostic, vendor ID, device ID, events (→ **Mapping: IO-Link port information** (→ p. 73))
118	Port X01: Cyclic input data (n bytes)
118+n	Port X02: Cyclic input data (n bytes)
118+2n	Port X03: Cyclic input data (n bytes)
118+3n	Port X04: Cyclic input data (n bytes)

Legend:
n = [2,4,8,16,32]; is determined by the parameter [Prozess_Data_Length] (→ **Process data length** (→ p. 68))

Mapping: digital input data (DI)

23008

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	reserved	reserved	reserved	X04: Pin 4	X03: Pin 4	X02: Pin 4	X01: Pin 4
reserved	reserved	reserved	reserved	X04: Pin 2	X03: Pin 2	X02: Pin 2	X01: Pin 2

Legend:

X0n: Pin 4	Signal level on pin 4 of the IO-Link port	1 bit	0x0 = OFF 0x1 = ON
X0n: Pin 2	Signal level on pin 2 of the IO-Link port	1 bit	0x0 = OFF 0x1 = ON

Mapping: Status information

23006

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	reserved	reserved	reserved	X04: Short / OL	X03: Short / OL	X02: Short / OL	X01: Short / OL
reserved	reserved	reserved	reserved	reserved	reserved	Sensor PWR	AUX PWR

Legend:

X0n: Short / OL	Occurrence of a short circuit or of an overvoltage on the IO-Link port	1 bit	0x0 = without errors 0x1 = short circuit or overvoltage detected
Sensor PWR	Status of the supply voltage US	1 bit	0x0 = supply voltage US not available 0x1 = supply voltage US available
AUX power	Status of the supply voltage UA	1 bit	0x0 = supply voltage UA not available 0x1 = supply voltage UA not available

Mapping: IO-Link port information

23465

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	Wrong PD Output Length	Wrong PD Input Length	Wrong Cycle Time	Wrong VID / DID	Invalid Data Bit	Device Conn	IOL Mode
reserved							
VID (LSB)							
VID (MSB)							
DID (LSB)							
DID							
DID (MSB)							
reserved							
Event Mode		Event Type		Event Source	Event Instance		
Event Code 1							
Event Code 2							
Event Mode		Event Type		Event Source	Event Instance		
Event Code 1							
Event Code 2							
Event Mode		Event Type		Event Source	Event Instance		
Event Code 1							
Event Code 2							
reserved							

Legend:

IOL mode	Operating mode of the IO-Link port	1 bit	0x0 = IO-Link inactive 0x1 = IO-Link active
Device Conn	Connection of the device	1 bit	0x0 = not available 0x1 = available
Invalid Data Bit	Status of the process input data on the IO-Link port	1 bit	0x0 = data valid 0x1 = data invalid
Wrong VID / DID	Status of the vendor ID / device ID	1 bit	0x0 = VID / DID are correct 0x1 = wrong VID or DID
Wrong Cycle Time	Status of the cycle time	1 bit	0x0 = cycle time is correct 0x1 = wrong cycle time
Wrong PD Input Length	Status of the length of the process input data	1 bit	0x0 = length is correct 0x1 = configuration of the length of the input data is wrong
Wrong PD Output Length	Status of the length of the process output data	1 bit	0x0 = length is correct 0x1 = configuration of the length of the output data is wrong
VID	Vendor ID of the connected IO-Link device	16 bits	0x0000...0xFFFF 0xXXYY - XX = VID (MSB) - YY = VID (LSB)
DID	Device ID of the connected IO-Link device	24 bits	0x000000...0xFFFFFF 0xXXYYZZ - XX = DID (MSB) - YY = DID - ZZ = DID (LSB)

Event Mode	Event mode	2 bits	depends on the device (→ operating instructions of the IO-Link device)
Event Type	Event type	2 bits	
Event Source	Evens source	1 bit	
Event Instance	Event instance	3 bits	
Event Code 1	Event code	8 bits	
Event Code 2	Event code	8 bits	

Output assembly

11126

Byte	Content
0	Digital output data of the IO-Link ports in the DO operating mode (→ **Mapping: Digital output data (DO)** (→ p. 75))
1	reserved
2	reserved
3	reserved
4...45	Acyclic command area: Request channel (→ **Request channel** (→ p. 77))
46	Port X01: Acyclic output data (n bytes)
46+n	Port X02: Acyclic output data (n bytes)
46+2n	Port X03: Acyclic output data (n bytes)
46+3n	Port X04: Acyclic output data (n bytes)

Legend:
n = [2,4,8,16,32]; is determined by the parameter [Prozess_Data_Length] (→ **Process data length** (→ p. 68))

Mapping: Digital output data (DO)

23005

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reserved	reserved	reserved	reserved	X04: Pin 4	X03: Pin 4	X02: Pin 4	X01: Pin 4

Legend:

X0n: Pin 4	Signal level on pin 4 of the IO-Link port	1 bit	0x0 = OFF 0x1 = ON

12.2.3 Acyclic data

22427

Acyclic command channel

10236

In the cyclic process data, command channels for the transmission of acyclic data is available.

Object	Contents	Bytes	Access
Output assembly	Request channel (field bus PLC >>> IO-Link master) → **Request channel** (→ p. 77)	4...45	r/w
Input assembly	Response channel (IO-Link master >>> fieldbus PLC) → **Response channel** (→ p. 78)	4...45	r

Legend:

r = only read access rights
r/w = read and write access rights

Request channel

17657

Byte	Content	
4	Port no. (LSB)	
5	Port no. (MSB)	
6	Index (LSB)	
7	Index (MSB)	
8	Sub-index (LSB)	
9	Sub-index (MSB)	
10	Trigger	Command
11	Length of the user data (number of bytes)	
12	Data (byte 0)	
13	Data (byte 1)	
..	...	
43	Data (byte 31)	
44	reserved	
45	reserved	

Legend:

Port no. (LSB)	Number of the IO-Link port (low byte) ▪ Port no. = 0xXX**YY** ▪ Port no. (LSB) = 0x**YY**	8 bits	0x01 = port X01 0x02 = port X02 ... 0x04 = port X04
Port no. (MSB)	Number of the IO-Link port (high byte) ▪ Port no. = 0x**XX**YY ▪ Port no. (MSB) = 0x**XX**	8 bits	0x00
Index (LSB)	Index of the IO-Link object (low byte) ▪ Index = 0xXX**YY** ▪ Index (LSB) = 0x**YY**	8 bits	0x00...0xFF
Index (MSB)	Index of the IO-Link object (high byte) ▪ Index = 0x**XX**YY ▪ Index (MSB) = 0x**XX**	8 bits	0x00...0xFF
Sub-index (LSB)	Sub-index of the IO-Link object (low byte) ▪ Sub-index = 0xXX**YY** ▪ Sub-index (LSB) = 0x**YY**	8 bits	0x00...0xFF
Sub-index (MSB)	Sub-index of the IO-Link object (high byte) ▪ Sub-index = 0x**XX**YY ▪ Sub-index (MSB) = 0x**XX**	8 bits	0x00...0xFF
Trigger	Control of the command execution	1 bit	0x0 = do not process command 0x1 = execute command
Command	Command number	7 bits	0x01 = read 0x02 = write
Length of the user data	Number of bytes that contain relevant user data	8 bits	0x00 = 0 bytes ... 0x20 = 32 bytes
Data (byte n)	User data	8 bits	0x00...0xFF

Response channel

8468

Byte	Content	
4	Port no. (LSB)	
5	Port no. (MSB)	
6	Index (LSB)	
7	Index (MSB)	
8	Sub-index (LSB)	
9	Sub-index (MSB)	
10	Handshake	Command
11	Result	
12	Length of the response data (number of bytes)	
13	Data (byte 0) or diagnostic data	
14	Data (byte 1)	
...	...	
44	Data (byte 31)	
45	reserved	

Legend:

Port no. (LSB)	Number of the IO-Link port (low byte) ▪ Port no. = 0xXXYY ▪ Port no. (LSB) = 0xYY	8 bits	0x01 = port X01 0x02 = port X02 ... 0x04 = Port X04
Port no. (MSB)	Number of the IO-Link port (high byte) ▪ Port no. = 0xXXYY ▪ Port no. (MSB) = 0xXX	8 bits	0x00
Index (LSB)	Index of the IO-Link object (low byte) ▪ Index = 0xXXYY ▪ Index (LSB) = 0xYY	8 bits	0x00...0xFF
Index (MSB)	Index of the IO-Link object (high byte) ▪ Index = 0xXXYY ▪ Index (MSB) = 0xXX	8 bits	0x00...0xFF
Sub-index (LSB)	Sub-index of the IO-Link object (low byte) ▪ Sub-index = 0xXXYY ▪ Sub-index (LSB) = 0xYY	8 bits	0x00...0xFF
Sub-index (MSB)	Sub-index of the IO-Link object (high byte) ▪ Sub-index = 0xXXYY ▪ Sub-index (MSB) = 0xXX	8 bits	0x00...0xFF
Handshake	Validity of the response data	1 bit	0x0 = invalid data 0x1 = data is invalid
Command	Command number	7 bits	0x01 = read 0x02 = write
Result	Status of the command processing	8 bits	0x00 = command processed without errors 0x01 = errors occurred
Length of the response data	Number of bytes that contain relevant user data	8 bits	0x00 = 0 bytes ... 0x20 = 32 bytes

Data (byte 0) or diagnostic data	User data (byte 0) or error codes	8 bits	User data: 0x00...0xFF Error codes: → **Failure codes** (→ p. 79)
Data (byte n)	User data (byte n)	8 bits	0x00...0xFF

Failure 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

Acyclic commands

Contents

22631

Command 0x10 – set mode

23461

The command changes the operating mode of an IO-Link port of the AL1220.

Corresponding parameter: [Port Mode] (→ **Port configuration** (→ p. 69))

Command request

22990

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port no. (LSB)							
5	Port no. (MSB)							
6	reserved							
7	reserved							
8	reserved							
9	reserved							
10	Trigger	0x10						
11	Target mode							
12...45	reserved							

Legend:

Port no. (LSB)	Number of the IO-Link port (low byte) Port no. = 0xXX**YY** ▪ Port no. (LSB) = 0x**YY**	8 bits	0x01 = port X01 0x02 = port X02 ... 0x04 = port X04
Port no. (MSB)	Number of the IO-Link port (high byte) Port no. = 0x**XX**YY ▪ Port no. (MSB) = 0x**XX**	8 bits	0x00
Trigger	Control of the command execution	1 bit	0x0 = do not process command 0x1 = execute command
Target mode	Operating type of the IO-Link port	8 bits	0x00 = deactivated 0x01 = operation as digital input (DI) 0x02 = operation as digital output (DO) 0x03 = operation as IO-Link intervals

Command response

8039

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port no. (LSB)							
5	Port no. (MSB)							
6	reserved							
7	reserved							
8	reserved							
9	reserved							
10	Handshake	0x10						
11	Result							
12	Target Mode							
13...45	reserved							

Legend:

Port no. (LSB)	Number of the IO-Link port (low byte) Port no. = 0xXX**YY** ▪ Port no. (LSB) = 0x**YY**	8 bits	0x01 = port X01 0x02 = port X02 ... 0x04 = Port X04
Port no. (MSB)	Number of the IO-Link port (high byte) Port no. = 0x**XX**YY ▪ Port no. (MSB) = 0x**XX**	8 bits	0x00
Handshake	Status of the execution of the command	1 bit	0x0 = command is executed 0x1 = execution of the command was successful
Result	Error indication	8 bits	0x00 = no errors 0x01 = errors occurred
Target mode	Operating type of the IO-Link port	8 bits	0x00 = deactivated 0x01 = operation as digital input (DI) 0x02 = operation as digital output (DO) 0x03 = operation as IO-Link intervals

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] (→ **Port configuration** (→ p. 69))

Command request

7337

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port no. (LSB)							
5	Port no. (MSB)							
6	reserved							
7	reserved							
8	reserved							
9	reserved							
10	Trigger	0x20						
11	Validation ID							
9...42	reserved							

Legend:

Port no. (LSB)	Number of the IO-Link port (low byte) Port no. = 0xXX**YY** ▪ Port no. (LSB) = 0x**YY**	8 bit	0x01 = port X01 0x02 = port X02 ... 0x04 = port X04
Port no. (MSB)	Number of the IO-Link port (high byte) Port no. = 0x**XX**YY ▪ Port no. (MSB) = 0x**XX**	8 bits	0x00
Trigger	Control command execution	1 bit	0x0 = do not process command 0x1 = execute command
Validation ID	Behaviour of the IO-Link master when connecting an IO-Link device to the IO-Link port	8 bits	0x00 = No check 0x01 = Type compatible V1.0 device 0x02 = Type compatible V1.1 device 0x03 = Type compatible V1.1 device with Backup + Restore 0x04 = Type compatible V1.1 device with Restore

Command response

20764

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port no. (LSB)							
5	Port no. (MB)							
6	reserved							
7	reserved							
8	reserved							
9	reserved							
10	Handshake	0x20						
11	Result							
12	Validation ID							
13..45	reserved							

Legend:

Port no. (LSB)	Number of the IO-Link port (low byte) Port no. = 0xXX**YY** ▪ Port no. (LSB) = 0x**YY**	8 bits	0x01 = port X01 0x02 = port X02 ... 0x04 = port X04
Port no. (MSB)	Number of the IO-Link port (high byte) Port no. = 0x**XX**YY ▪ Port no. (MSB) = 0x**XX**	8 bits	0x00
Handshake	Status of the execution of the command	1 bit	0x0 = command is executed 0x1 = execution of the command was successful
Result	Error indication	8 bits	0x00 = no errors 0x01 = errors occurred
Validation ID	Behaviour of the IO-Link master when connecting an IO-Link device to the IO-Link port	8 bits	0x00 = No check 0x01 = Type compatible V1.0 Device 0x02 = Type compatible V1.1 Device 0x03 = Type compatible V1.1 Device with Backup + Restore 0x04 = Type compatible V1.1 Device with Restore

Command 0x30 – set fail-safe data pattern

23464

The command sets the behaviour of the outputs when the EtherNet/IP connection and the corresponding fail-safe values are interrupted.

Corresponding parameter: [Fail-safe Mode] (→ **Port configuration** (→ p. 69))
The number of the required fail-safe values results from the size of the output data (→ **Process data length** (→ p. 68)).

Command request

23527

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port no. (LSB)							
5	Port no. (MSB)							
6	reserved							
7	reserved							
8	reserved							
9	reserved							
10	Trigger	0x30						
11	Fail-safe mode							
12	Byte Length N							
13	Fail-safe data (byte 0)							
...	...							
44	Fail-safe data (byte 31)							
45	reserved							

Legend:

Port no. (LSB)	Number of the IO-Link port (low byte) Port no. = 0xXX**YY** ▪ Port no. (LSB) = 0x**YY**	8 bits	0x01 = port X01 0x02 = port X02 ... 0x04 = port X04
Port no. (MSB)	Number of the IO-Link port (high byte) Port no. = 0x**XX**YY ▪ Port no. (MSB) = 0x**XX**	8 bits	0x00
Fail-safe mode	Behaviour of the outputs when the EtherNet/IP connection is interrupted and setting of the corresponding fail-safe values	8 bits	0x00 = No Fail-safe 0x01 = Fail-safe Reset Value 0x02 = Fail-safe Old Value 0x03 = Fail-safe with Pattern
Trigger	Control command execution	1 bit	0x0 = do not process command 0x1 = execute command
Byte Length N	Number of the bytes that contain fail-safe values	8 bits	0x00 = 0 bytes ... 0x20 = 32 bytes
Fail-safe data (byte n)	Fail-Safe value n (n = 0...31)	8 bits	0x00...0xFF

Command response

23529

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port no. (LSB)							
5	Port no. (MSB)							
6	reserved							
7	reserved							
8	reserved							
9	reserved							
10	Handshake	0x30						
11	Result							
12	Fail-safe mode							
13...45	reserved							

Legend:

Port no. (LSB)	Number of the IO-Link port (low byte) Port no. = 0xXX**YY** ▪ Port no. (LSB) = 0x**YY**	8 bits	0x01 = port X01 0x02 = port X02 ... 0x04 = port X04
Port no. (MSB)	Number of the IO-Link port (high byte) Port no. = 0x**XX**YY ▪ Port no. (MSB) = 0x**XX**	8 bits	0x00
Handshake	Status of the execution of the command	1 bit	0x0 = command is executed 0x1 = execution of the command was successful
Result	Error indication	8 bits	0x00 = no errors 0x01 = errors occurred
Fail-safe mode	Behaviour of the outputs when the EtherNet/IP connection is interrupted	8 bits	0x00 = No Fail-safe 0x01 = Fail-safe Reset Value 0x02 = Fail-safe Old Value 0x03 = Fail-safe with Pattern

Field bus objects

Contents

22640

CIP class services

23651

The device supports the following class and instance services:

Class code		Service	Description
dec	hex		
01	01	Get Attribute All	Read all attribute values of the class or instance
02	02	Set Attribute All	Change all attribute values of the class or instance
05	05	Reset	Reset
09	09	Delete	Delete
14	0E	Get Attribute Single	Read single attribute value of the class or instance
16	10	Set Attribute Single	Change single attribute value of the class or instance
75	4B	Read ISDU	Read ISDU
76	4C	Write ISDU	Write ISDU
78	4E	Forward Close	Close connection
84	54	Forward Open	Open new connection

CIP object classes

23652

The device supports the following CIP object classes:

Class code		Object type	Reference
dec	hex		
01	01	Identity Object	→ **Identity Object (object class: 0x01)** (→ p. 89)
02	02	Message Router Object	→ **Message Router Object (object class: 0x02)** (→ p. 91)
04	04	Assembly Object	→ **Assembly Object (object class: 0x04)** (→ p. 92)
06	06	Connection Manager Object	→ **Connection Manager Object (object class: 0x06)** (→ p. 93)
71	47	Device Level Ring Object	→ **Device Level Ring Object (object class: 0x47)** (→ p. 94)
72	48	Quality of Service	→ **Quality of Service (object class: 0x48)** (→ p. 95)
128	80	IO-Link Requests	→ **IO-Link requests (object class: 0x80)** (→ p. 96)
245	F5	TCP/IP Object	→ **TCP/IP object (object class: 0xF5)** (→ p. 103)
246	F6	Ethernet Link Object	→ **Ethernet Link Object (object class: 0xF6)** (→ p. 105)

Identity Object (object class: 0x01)

23119

The Identity Object contains the general information about the device.

Class attributes

23648

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instance	UINT	Max. number of instances of the object	1
6	Get	Maximum ID Number Class Attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID Number Instance Attributes	UINT	ID of the last instance attribute	9

Instance attributes

23649

Attr. ID	Access	Name	Data type	Description	Preset
1	Get	Vendor ID	UINT	Manufacturer ID	322
2	Get	Device type	UINT	Type of unit	12
3	Get	Product code	UINT	Identification of a particular product of a vendor	AL1220
4	Get	Revision	STRUCT	Revision of the article that is represented by the Identity Object	1.1
		▪ Major revision	USINT	Main revision (1...127)	1
		▪ Minor revision	USINT	Side revision (3 digits, if necessary with zeros in the beginning)	1
5	Get	Status	WORD	Status of the device	
6	Get	Serial number	UDINT	Serial number of the device	
7	Get	Product Name	SHORT STRING	Readable device designation (max. 32 ASCII characters)	IO-Link Master PL EIP 4P IP67
8	Get	State	USINT	Current status of the device (according to status transition diagram)	
				0 Nonexistent	
				1 Device Self Testing	
				2 Standby	
				3 Operational	
				4 Major Recoverable Fault	
				5 Major Unrecoverable Fault	
				6...254 Reserved	
				255 Default for Get_Attributes_All service	
9	Get	Configuration Consistency Value	UINT	The content shows the configuration of the device	0

Supported services

23667

Service code		Name	Class	Attribute	Description
dec	hex				
01	01	Get_Attribute_All	yes	yes	Read all attributes
05	05	Reset	yes	yes	Reset
14	0E	Get_Attribute_Single	yes	yes	Read single attribute
16	10	Set_Attribute_Single	yes	yes	Change single attribute

If an Identity Object receives a reset request, it carries out the following actions:

- It checks if it supports the requested reset type.
- It responds to the request.
- It tries to execute the requested reset type.

Supported reset types:

- 0 Reboot the device (obligatory for all EtherNet/IP devices).
- 1 Restore factory settings and reboot the device.

Message Router Object (object class: 0x02)

23694

The Message Router Object provides an access with which an EtherNet/IP client can address a service to any object class or instance in the physical device.

Class attributes

23695

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instance	UINT	Max. number of instances of the object	1
3	Get	Number of Instances	UINT	Number of instances	1
6	Get	Maximum ID Number Class Attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID Number Instance Attributes	UINT	ID of the last instance attribute	0

Instance attributes

23696

The object has no instance attributes.

Supported services

23697

Service code		Name	Class	Attribute	Description
dec	hex				
14	0E	Get_Attribute_Single	yes	no	Read single attribute value

Assembly Object (object class: 0x04)

23690

The Assembly Object combines attributes of several objects to allow data to be sent to or received from each object via one connection.

Class attributes

23691

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	2
2	Get	Max instance	UINT	Max. number of instances of the object	0x00C7
3	Get	Number of Instances	UINT	Number of instances	3
6	Get	Maximum ID Number Class Attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID Number Instance Attributes	UINT	ID of the last instance attribute	4

Instance attributes

23692

Attr. ID	Access	Name	Data type	Description	Preset
100	Get	Input assembly	STRUCT	Cyclic input data (→ **Input assembly** (→ p. 71))	--
150	Get, Set	Output assembly	STRUCT	Cyclic output data (→ **Output assembly** (→ p. 75))	--
199	Get, Set	Configuration assembly	STRUCT	Configuration data (→ **Configuration Assembly** (→ p. 67))	--

Supported services

23693

Service code		Name	Class	Attribute	Description
dec	hex				
14	0E	Get_Attribute_Single	yes	yes	Read attribute value
16	10	Set_Attribute_Single	no	yes	Change attribute value

Connection Manager Object (object class: 0x06)

23698

The Connection Manager Object structures and manages the internal resources that are used for the connection.

Class attributes

23699

Attr ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instance	UINT	Max. number of instances of the object	1
3	Get	Number of Instances	UINT	Number of instances	3
6	Get	Maximum ID Number Class Attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID Number Instance Attributes	UINT	ID of the last instance attribute	0

Instance attributes

23696

The object has no instance attributes.

Supported services

23701

Service code		Name	Class	Attribute	Description
dec	hex				
14	0E	Get_Attribute_Single	yes	yes	Read single attribute
16	10	Set_Attribute_Single	no	yes	Change single attribute
78	4E	Forward_Close	yes	no	Close connection
84	54	Forward_Open	yes	no	Open new connection

Device Level Ring Object (object class: 0x47)

23657

The Device Level Ring (DLR) Object represents the interface for configuration and status information.

Class attributes

23658

Attr ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	3
2	Get	Max instance	UINT	Max. number of instances of the object	1
6	Get	Maximum ID Number Class Attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID Number Instance Attributes	UINT	ID of the last instance attribute	12

Instance attributes

23659

Attr. ID	Access	Name	Data type	Description		Preset
1	Get	Network Topology	USINT	current network topology		0
2	Get	Network status	USINT	current network status		0
10	Get	Active Supervisor	STRUCT of	Identification of the supervisor		0
			▪ UDINT	IP address of the supervisor		
			▪ ARRAY of 6 USINTs	MAC address of the supervisor		
12	Get	Capability Flags	DWORD	DLR functions of the device		0x82
				Bit 0	Announced-based ring node	0
				Bit 1	Beacon-based ring node	1
				Bit 2...4	reserved	--
				Bit 5	Supervisor capable	0
				Bit 6	Redundant Gateway capable	0
				Bit 7	Flush_Table frame capable	1
				Bit 8..31	reserved	--

Supported services

23660

Service code		Name	Class	Attribute	Description
dec	hex				
1	01	Get_Attribute_All	no	yes	Read all attribute values
14	0E	Get_Attribute_Single	yes	yes	Read single attribute value

Quality of Service (object class: 0x48)

23661

Quality of Service (QoS) enables prioritising of Ethernet frames. The priorities of the Ethernet frames can be influenced with the attributes "Differentiate Service Code Points" (DSCP) or "802.1Q Tag".

Class attributes

23662

Attr ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	3
2	Get	Max instance	UINT	Max. number of instances of the object	1
6	Get	Maximum ID Number Class Attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID Number Instance Attributes	UINT	ID of the last instance attribute	8

Instance attributes

23663

Attr ID	Access	Name	Data type	Description	Value
1	Get	802.1Q tagRevision	USINT	Current network topology	0
2	Get, Set	DSCP PTP Event	USINT	DSCP value for PTP event frames	59
3	Get, Set	DSCP PTP general	USINT	DSCP value for PTP general frames	47
4	Get, Set	DSCP PTP Urgent	USINT	DSCP value for implicit messages with "urgent" priority	55
5	Get, Set	DSCP Scheduled	USINT	DSCP value for implicit messages with "scheduled" priority	47
6	Get, Set	DSCP High	USINT	DSCP value for implicit messages with "high" priority	43
7	Get, Set	DSCP Low	USINT	DSCP value for implicit messages with "low" priority	31
8	Get, Set	DSCP explicit	USINT	DSCP value for explicit messages with "scheduled" priority	27

Supported services

23664

Service code		Name	Class	Attribute	Description
dec	hex				
01	01	Get_Attribute_All	yes	yes	Read all attribute values
14	0E	Get_Attribute_Single	no	yes	Read single attribute value

IO-Link requests (object class: 0x80)

23121

The manufacturer-specific object "IO-Link Requests" enables read and write access to the IO-Link objects of an IO-Link device connected to a AL1220 via ISDU (Index Service Data Unit). The object projects the mechanisms of the CIP addressing on the IO-Link protocol.

Class attributes

23668

Attr ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max instance	UINT	Max. number of instances of the object	2
6	Get	Maximum ID Number Class Attributes	UINT	Number of instances of the object	8

Instance attributes

23669

The required IO-Link port of the device is addressed via the instance attribute.

Supported services

23670

Service code		Name	Class	Attribute	Description
dec	hex				
75	4B	→ Read_ISDU (→ p. 97)	no	yes	Read ISDU
76	4C	→ Write_ISDU (→ p. 100)	no	yes	Read ISDU

Read_ISDU

23118

With Read_ISDU, parameters of a connected IO-Link device can be read.

Read Request

23702

Attribute determines the IO-Link port to which the IO-Link device is connected. The area "User Specific Service Data" contains the IO-Link index and the IO-Link sub-index of the IO-Link object whose value is to be read:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x01...0x08	Port number
Service code ID	USINT	0x4B	Read Request (ISDU_Read)
User specific service data	UINT	Index	IO-Link ISDU object index
	USINT	Subindex	IO-Link ISDU object sub-index

Read response

23114

- **Positive response**

If the service has been executed successfully (Error Code = 0), the read data are returned bit by bit (User Specific Service Data). The answer has the following format:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	1	IO-Link master
Attributes	USINT	1...8	Port number
Service code ID	USINT	0x4C	Read response
Error code	USINT	0	--
Extended error code	USINT	0	--
User specific service data	USINT	e.g. 0xAB	Data (byte 0)
	USINT	e.g. 0xCD	Data (byte 1)
	...		...
	USINT	e.g. 0xEF	Data (byte n)

The read data is in the IO-Link format. If necessary, the user needs to adapt the byte arrangement of the read data to the CIP format.

- **Negative response**

If an error occurs while executing the service (Error Code <> 0), an extended error code is transmitted. The answer has the following format:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	128	IO-Link acyclic access
Instance ID	UINT	1	IO-Link master
Service code ID	USINT	0x4B	Read response
Attributes	USINT	1...8	port number
Error code	USINT	<> 0	--
Extended error code	USINT	0	--
User specific service data	USINT		IO-Link error code (if error code = 0x1E)
	USINT		Additional code (if error code = 0x1E)

Error code:

Code	Description
0x02	Resource not available: The IO-Link port is busy processing another acyclic service.
0x05	Invalid class ID or instance ID
0x08	Wrong service ID: only service code 0x4B or 0x4C is permitted
0x09	Wrong attribute ID: wrong port number
0x20	Invalid parameter value (e.g. invalid length)
0x1E	Embedded service, error: Error occurred during an IO-Link service. Byte 0 and byte 1 of the User Specific Service Data contain the IO-Link error code and an additional code that are returned by the IO-Link master (see below).

IO-Link error code:

Code	Description
0x00	RESULT_SUCCESS
0x01	RESULT_STATE_CONFLICT
0x02	RESULT_NOT_SUPPORTED
0x03	RESULT_SERVICE_PENDING
0x04	RESULT_WRONG_PARAMETER
0x05	RESULT_NO_COMMUNICATION
0x06	RESULT_MIN_CYCLE_TIME
0x07	RESULT_NO_RESOURCES
0x08	RESULT_ABORT
0x1E	RESULT_UNKNOWN_COMMAND
0x1F	RESULT_NOT_CONNECTED
0x20	RESULT_NOT_ALLOWED
0x21	RESULT_WRONG_LENGTH
0x22	RESULT_WRONG_TYPE

Example: reading the parameter value of anIO-Link device

23110

Task: reading the value of the parameter X of an IO-Link device

- IO-Link device in the port: 0x02
- Parameter X in the object directory of an IO-Link device: Index: 90, sub-index 3

From this, the following results for the configuration of the EtherNet/IP command Message (MSG):

CIP format	Data type	MSG Config	Description
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x02	Port number
Service code ID	USINT	0x4B	Service "ISDU_Read"
User specific service data	UINT	0x005A	IO-Link ISDU object index
	USINT	0x03	IO-Link ISDU object sub-index

After successful execution of the request, the response area has the following content:

CIP format	Data type	MSG Config	Description
Class ID	UINT	0x80	Object class "IO-Link Requests"
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x02	Port number
Service code ID	USINT	0x4B	Service "ISDU_Read"
Error code	USINT	0x00	Request processed successfully
Extended error code	USINT	0x00	--
User specific service data	USINT	e.g. 0x12	Parameter value that has been read (byte 0)
	USINT	e.g. 0x34	Parameter value that has been read (byte 1)

If an error occurs while the request is executed, the response area has the following content:

CIP format	Data type	MSG Config	Description
Class ID	UINT	0x80	Object class "IO-Link Requests"
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x02	Port number
Service code ID	USINT	0x4B	Service "ISDU_Read"
Error code	USINT	9x1E	Error code: Embedded service error
Extended error code	USINT	0x00	--
User specific service data	USINT	e.g. 0x04	IO-Link error code: wrong parameter
	USINT	e.g. 0x27	Additional code

Write_ISDU

23111

With Write_ISDU, the parameters of a connected IO-Link device can be changed.

Write Request

23703

Attribute determines the IO-Link port to which the IO-Link device is connected. The area "User Specific Service Data" contains the IO-Link index, the IO-Link sub-index of the IO-Link object whose value is to be changed. It is followed, bit by bit, by the value that is to be assigned to the parameter.

CIP format	Data type	MSG Config	IO-Link mapping
Class	UINT	0x80	IO-Link acyclic access
Instance	UINT	0x1	IO-Link master
Attribute	USINT	0x01...0x08	Port number
Service code ID	USINT	0x4C	Write Request (ISDU_Write)
User specific service data	UINT	Index	IO-Link ISDU object index
	USINT	Subindex	IO-Link ISDU object sub-index
	USINT	e.g. 0xAB	IO-Link ISDU data (byte 0)
	USINT	e.g. 0xBC	IO-Link ISDU data (byte 1)

Write response

23115

- **Positive response**

If the service has been executed successfully (Error Code = 0), the area "User Specific Data" stays empty The answer has the following format:

CIP format	Data type	MSG Config	IO-Link mapping
Class	UINT	0x80	IO-Link acyclic access
Instance	UINT	0x01	IO-Link master
Attribute	USINT	0x01...0x08	Port number
Service code ID	USINT	0x4C	Service "ISDU_Write"
Error code	USINT	0	--
Extended error code	USINT	0	--

- **Negative response**

If an error occurs while executing the service (Error Code <> 0), an extended error code is transmitted. The answer has the following format:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	128	IO-Link acyclic access
Instance ID	UINT	1	IO-Link master
Service code ID	USINT	0x4B	Read response
Attributes	USINT	1...8	Port number
Error code	USINT	<> 0	--
Extended error code	USINT	0	--
User specific service data	USINT		IO-Link error code (if error code = 0x1E)
	USINT		Additional code (if error code = 0x1E)

Error code:

Code	description
0x02	Resource not available: The IO-Link port is busy processing another acyclic service.
0x05	Invalid class ID or instance ID
0x08	Wrong service ID: only service code 0x4B or 0x4C is permitted
0x09	Wrong attribute ID: wrong port number
0x20	Invalid parameter value (e.g. invalid length)
0x1E	Embedded service, error: Error occurred during an IO-Link service. Byte 0 and byte 1 of the User Specific Service Data contain the IO-Link error code and an additional code that are returned by the IO-Link master (see below).

IO-Link error code:

Code	description
0x00	RESULT_SUCCESS
0x01	RESULT_STATE_CONFLICT
0x02	RESULT_NOT_SUPPORTED
0x03	RESULT_SERVICE_PENDING
0x04	RESULT_WRONG_PARAMETER
0x05	RESULT_NO_COMMUNICATION
0x06	RESULT_MIN_CYCLE_TIME
0x07	RESULT_NO_RESOURCES
0x08	RESULT_ABORT
0x1E	RESULT_UNKNOWN_COMMAND
0x1F	RESULT_NOT_CONNECTED
0x20	RESULT_NOT_ALLOWED
0x21	RESULT_WRONG_LENGTH
0x22	RESULT_WRONG_TYPE

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

23109

Task: changing the parameter X of an IO-Link device

- IO-Link device in the port: 0x03
- Parameter X in the object directory of an IO-Link device: Index: 91, sub-index 5
- new parameter value: 0xABCD

From this, the following results for the configuration of the EtherNet/IP command Message (MSG):

CIP format	Data type	MSG Config	Description
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x03	Port number
Service code ID	USINT	0x4C	Service "ISDU_Write"
User specific service data	UINT	0x005B	IO-Link ISDU object index
	USINT	0x05	IO-Link ISDU object sub-index
	USINT	0xAB	New parameter value (MSB)
	USINT	0xCD	New parameter value (LSB)

After successful execution of the request, the response area has the following content:

CIP format	Data type	MSG Config	Description
Class ID	UINT	0x80	Object class "IO-Link Requests"
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x03	Port number
Service code ID	USINT	0x4B	Service "ISDU_Write"
Error code	USINT	0x00	Request processed successfully
Extended error code	USINT	0x00	--

If an error occurs while the request is executed, the response area has the following content:

CIP format	Data type	MSG Config	Description
Class ID	UINT	0x80	Object class "IO-Link Requests"
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x03	Port number
Service code ID	USINT	0x4B	Service "ISDU_Write"
Error code	USINT	0x1E	Error code: Embedded Service Error
Extended error code	USINT	0x00	--
User specific service data	USINT	e.g. 0x04	IO-Link error code: wrong parameter
	USINT	e.g. 0x27	Additional code

TCP/IP object (object class: 0xF5)

23127

TCP/IP Interface Object enables the configuration of the physical network interface of the device.

Class attributes

23647

Attr ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max instance	UINT	Max. number of instances of the object	1

Instance attributes

23650

Attr. ID	Access	Name	Data type	Description			Preset
1	Get	Status	DWORD	Status of the TCP/IP interface			
				Bit 0...3	Configuration status of the interface		
				Bit 4	Mcast pending (always 0)		
				Bit 5	Interface configuration pending		
				Bit 6	ACD Status		
				Bit 7	ACD Fault		
				Bit 8...31	reserved		
2	Get	Configuration Capability	DWORD	Functions of the interface (flags)			0x95 (BOOTP,DHCP Client,TCP/IP configurable, ACD capable)
				Bit 0	BOOTP Client		
				Bit 1	reserved		
				Bit 2	DHCP Client		
				Bit 3	reserved		
				Bit 4	TCP/IP configurable via EtherNet/IP		
				Bit 5	reserved		
				Bit 6	reserved		
				Bit 7	ACD Capable		
				Bit 8...31	reserved		
3	Get/Set	Configuration Control	DWORD	Interface control (control flags):			0
				Bit 0...3	Start-up configuration		
					0	Static IP configuration	
					1	Configuration via BOOTP	
					2	Configuration via DHCP	
				Bit 4	reserved		
				Bit 5...31	reserved		
4	Get	Physical Link Object path	STRUCT:	Logical path to the physical communication interface: the Ethernet Link object			

Attr. ID	Access	Name	Data type	Description	Preset
		▪ Path Size	▪ UINT	Length (in Little Endian Format as WORD)	02 00
		▪ Path	▪ Padded EPATH	Path	20 F6 24 01
				Class ID = 0xF6 Ethernet Link Object	
				Instance ID = 1	
5	Get/Set	Interface Configuration	STRUCT:	TCP/IP configuration	
		▪ IP Address	▪ UDINT	IP adress	192.168.1.250
		▪ Network mask	▪ UDINT	Subnet mask	255.255.255.0
		▪ Gateway address	▪ UDINT	Default gateway address	0.0.0.0
		▪ Name Server	▪ UDINT	1. Name Server	0.0.0.0
		▪ Name Server 2	▪ UDINT	2. Name Server	0.0.0.0
		▪ Domain Name	▪ STRING	Default domain name	0
6	Get, Set	Host name	STRING	Host name	0
				0 no name configured	
8	Get	TTL value		TTL value	1
9	Get	Mcast Config			0
10	Get/Set	SelectAcd	BOOL	activate ACD	1
				0 deactivate	
				1 activate	
11	Get/Set	Last Conflict Detected	STRUCT:	Structure with information via the latest detected conflict	0
			▪ USINT	Condition of the ACD activity with the latest detected conflict	
				0 Noconflictdetetcted	
				1 Probelpv4Address	
				2 OngoingDetection	
				3 SemiActiveProbe	
			▪ ARRAY of 6 USINT	MAC address	
			▪ ARRAY of 28 USINT	Copy of the data of the ARP PDU in which the conflict was detected	
13	Get/Set	Encapsulation Inactivity Timeout	UINT	Inactivity before the TCP connection is deactivated (in seconds)	120

Supported services

23666

Service code		Name	Class	Attribute	Description
dec	hex				
01	01	Get_Attribute_All	no	yes	Read all attributes
14	0E	Get_Attribute_Single	yes	yes	Read single attribute
16	10	Set_Attribute_Single	no	yes	Change single attribute

Ethernet Link Object (object class: 0xF6)

23129

The Ethernet Link Object contains status information of the Ethernet interface.

Class attributes

23645

Attr ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max Instance	UINT	Max. number of instances of the object	2
3	Get	Number of Instances	UINT	Number of instances of the object	2

Instance attributes

23646

Attr. ID	Access	Name	Data type	Description		Preset
1	Get	Interface Speed	UDINT	Current data rate (in bytes/s) 10 Mbps,100 Mbps.		100
2	Get	Interface Status Flags	DWORD	Status flag of the interface		0x20
				Bit 0	Link status	
				Bit 1	Half/full duplex	
				Bit 2...4	Auto negotiation status	
				Bit 5	Manual setting requires reset	
				Bit 6	Local Hardware Fault	
				Bit 7...31	reserved	
3	Get	Physical Address	ARRAY of 6 USINTS	MAC address		
4	Get	Interface Counters	STRUCT of 11 UDINTs	Interface-specific counter		
5	Get	Media counters	STRUCT of 12 UDINTs	Medium-specific counter		
6	Get, Set	Interface control	STRUCT of	Control bits: Bit 0: Auto negotiate Bit 1: Forced Duplex Mode (full 1, half 0)		0
			▪ WORD	Control bits of the interface		
				Bit 0	0 = auto-negotiation active	
					1 = auto-negotiation inactive	
				Bit 1	0 = Half duplex	
					1 = Full duplex	
				Bit 2..15	reserved	
			▪ UINT	Data rate of the interface		
				10	10 Mbps	
				100	100 Mpbs	
7	Get	Interface Type	USINT	Physical interface type		2

Attr. ID	Access	Name	Data type	Description		Preset
				0	unknown	
				1	Internal interface	
				2	Twisted pair	
				3	Optical fibre	
				4...255	reserved	
8	Get	Interface state	USINT	Current status of the interface		0
				0	unknown	
				1	active; ready for transmission and reception	
				2	not active	
				3	Test mode	
				4...255	reserved	
9	Get	Admin State	USINT	Control of the access to the interface		1
				0	reserved	
				1	Activate interface	
				2	Deactivate interface	
				3...255	reserved	
10	Get	Interface label	SHORT_ STRING	Designation of the interface		"X21" (instance 1) "X22" (instance 2)
11	Get	Interface capability	STRUCT of	Capabilities of the interface		
			▪ DWORD	Transmission rate		
				10	10 Mbps	
				100	100 Mbps	
			▪ DWORD	Duplex mode		
				HD	Half duplex	
				FD	Full duplex	
300	Get, Set	MDIX	???	MDIX configuration		3
				0		
				1	MDI	
				2	MDIX	
				3	autoMDI	
				4...255	reserved	

Supported services

23665

Service code		Name	Class	Attribute	Description
dec	hex				
01	01	Get_Attribute_All	no	yes	Read all attribute values
14	0E	Get_Attribute_Single	yes	yes	Read single attribute value
16	10	Set_Attribute_Single	no	yes	Change single attribute value

13 Index

P

Q

R

S

T

V

W

14 ifm weltweit • ifm worldwide • ifm à l'échelle internationale

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