DREHMO
VALVE ACTUATORS

Profinet interface
for i-matic actuators
Electric version iMC

Supplementary operation instructions
for devices with Profinet interface

Operation instructions
Assembly and commissioning

Note:
These operation instructions are only valid in combination with the operation instructions pertaining to the actuator.
Safely store these operation instructions for future use.

Table of contents

1 Safety

1.1 Prerequisites for the safe handling of the product

Standards/directives

The end user or the contractor must ensure that all legal requirements, directives, guidelines, national regulations and recommendations with respect to assembly, electrical connection, commissioning and operation are met at the place of installation.

Depending on the device version, this includes:

- Standards and directives such as IEC 60079:
  Part 14: Electrical installations design, selection and erection.
  Part 17: Electrical installations inspection and maintenance.
- Configuration guidelines for the respective fieldbus or network applications

Safety instructions/warnings

All personnel working with this device must be familiar with the safety and warning instructions in this manual and heed the instructions given. Safety instructions and warning signs on the device must be observed to avoid personal injury or property damage.

Qualification of staff

Assembly, electrical connection, commissioning, operation, and maintenance must be carried out by suitably qualified personnel authorised by the end user or contractor of the plant only.

Prior to working on this product, the staff must have thoroughly read and understood these instructions and, furthermore, know and observe officially recognised rules regarding occupational health and safety.

Work performed in potentially explosive atmospheres is subject to special regulations which have to be observed. The end user or contractor of the plant is responsible for respect and control of these regulations, standards, and laws.

Electrostatic charge

Highly efficient charge generating processes (processes more efficient than manual friction) on the device surface must be excluded at any time. Highly efficient charge generating processes will lead to propagating brush discharges and therefore to ignition of a potentially explosive atmosphere. This safety instruction also applies to fireproof coatings or covers available as an option.

When using a stem protection tube, any type of charge generating processes must be excluded at its protective cap as well as the V-seal (e.g. only wipe with a damp cloth). Otherwise, ignitable electrostatic discharges might occur.

Ignition hazards

Gearings were subjected to an ignition hazard assessment in compliance with the currently applicable standard according to ISO 80079-36/ -37. Hot surfaces, mechanically generated sparks as well as static electricity and stray electric currents were identified and assessed as major potential ignition sources. Protective measures to prevent the likelihood that ignition sources arise were applied to the gearboxes. This includes in particular lubrication of the gearbox, the protection level of enclosure protection and the warnings and notes contained in these operation instructions.

Commissioning

Prior to commissioning, imperatively check that all settings meet the requirements of the application. Incorrect settings might present a danger to the application, e.g. cause damage to the valve or the installation. The manufacturer will not be held liable for any consequential damage. Such risk lies entirely with the user.

Operation

Prerequisites for safe and smooth operation:

- Correct transport, proper storage, mounting and installation, as well as careful commissioning.

- Only operate the device if it is in perfect condition while observing these instructions.
- Immediately report any faults and damage and allow for corrective measures.
- Heed recognised rules for occupational health and safety.
- Heed national regulations.
- During operation, the housing warms up and surface temperatures > 60 °C may occur. To prevent possible burns, we recommend checking the surface temperature using an appropriate thermometer and wearing protective gloves, prior to working on the device.

Protective measures

The end user or the contractor are responsible for implementing required protective measures on site, such as enclosures, barriers, or personal protective equipment for the staff.

Maintenance

To ensure safe device operation, the maintenance instructions included in this manual must be observed.

Maintenance and service actions must be exclusively performed by appropriately trained and authorised staff.

Any device modification requires prior written consent of the manufacturer.

1.2 Range of application

DREHMO actuator are designed for the operation of industrial valves, e.g. globe valves, gate valves, butterfly valves and ball valves.

For other applications, please contact the manufacturer. The manufacturer is not liable for any possible damage resulting from use in other than the designated applications. Such risk lies entirely with the user. For appropriate usage, obey the operation instructions pertaining to the actuator as well as the present supplementary operation instructions.

The described interface board is designed for connecting the actuator via Profinet to the DCS.

1.3 Commissioning (electrical connection)

During electrical operation, certain parts inevitably carry hazardous voltages. Work on the electrical system or equipment must only be carried out by a skilled electrician themselves or by specially instructed personnel under the control and supervision of such an electrician and in accordance with the applicable electrical engineering rules.

1.4 Warnings and notes

The following warnings draw special attention to safety-relevant procedures in these operation instructions, each marked by the appropriate signal word (DANGER, WARNING, CAUTION, NOTICE).

⚠DANGER **Indicates an imminently hazardous situation with a high level of risk. Failure to observe this warning results in death or serious injury.**

⚠WARNING **Indicates a potentially hazardous situation with a medium level of risk. Failure to observe this warning could result in death or serious injury.**

⚠CAUTION **Indicates a potentially hazardous situation with a low level of risk. Failure to observe this warning could result in minor or moderate injury. May also be used with property damage.**

NOTICE

Potentially hazardous situation. Failure to observe this warning could result in property damage. Is not used for personal injury.

The ⚠ safety symbol warns of a potential personal injury hazard.

The signal word (here: DANGER) indicates the level of hazard.

2 General information

2.1 General information on Profinet

Profinet I/O is a communication protocol for industrial automation engineering based on Ethernet and standardised by the PROFIBUS Nutzerorganisation e.V. (PNO) worldwide. Profinet enables real time communication (RT) with short cycle times as well as acyclic communication (non RT) for configuration and diagnostics.

As communication network for field devices, Profinet reserves many advantages across the total lifecycle of a site. Advantages include economy in cable connections and system components as well as simplification of processes within the overall business environment.

Some of the advantageous Profinet features are:

- Virtually unlimited number of participants within the network
- Flexible topologies (line, star, tree, ring, …)
- Topologies can easily be scaled and expanded
- Network topology can be planned and programmed offline
- Large network expansion by cascading via switches
- High performance (cycle times within the range of 1 – 8 ms and high throughput), in particular for large data volumes (diagnostics, file transfer, etc.)
- Easy device replacement without requirement of new bus configuration
- Simple maintenance
- Use of the existing network and IT know-how
- Seamless and vertical integration of process and production data from field level into the cross-functional information systems
- Simple access to device data on field level without proprietary gateways
- Integration of web servers or universal interfaces such as OPC UA within the device
- Multitude of network components, software tools and safety technologies available
- Combination of various transmission media like copper cables, fibre optic cables or WLAN

Based on Ethernet and IT protocols, Profinet automatically benefits from the continuous development thanks to a large number of market competitors. Consequently, Profinet is a future-proof device communication and protects long-term investments.

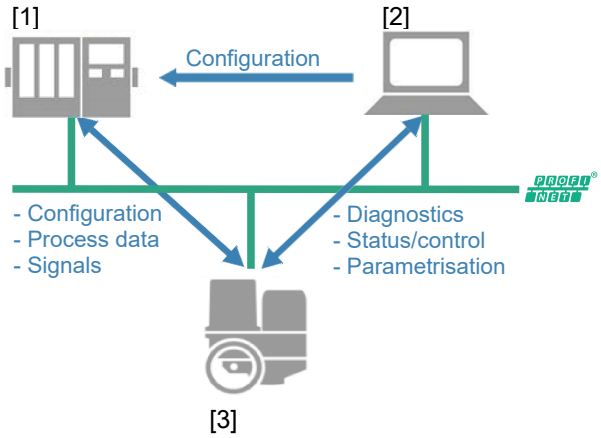
2.2 Basic characteristics

Profinet defines the technical and functional features of a communication system based on Industrial Ethernet, used for interconnecting distributed digital automation devices.

Profinet makes the distinction between I/O controller (master) and I/O devices (slave). Profinet is designed for fast data exchange on field level. Here, central control devices (PLC or PC) communicate via a fast network with peripheral field devices such as input devices, output devices, valves and actuators.

Data exchange among these field devices is based on cyclic communication. The necessary communication functions are defined by the basic Profinet functions according to IEC 61158 and IEC 61784.

Figure 1: Profinet network



[1] I/O controller (PLC)
[2] I/O supervisor (programming device)
[3] I/O device (field device)

A Profinet network comprises at least one I/O controller and one or several I/O devices. As an option, an I/O device can exchange data with several I/O controllers (shared input and shared device function). An I/O supervisor is often only available on a temporary basis for commissioning and programming. In turn, for continuous diagnostics and status monitoring the I/O supervisor is integral part of a Profinet installation.

2.3 Profinet basic functions

An I/O controller reads the input information in cyclic intervals from the I/O devices and writes the output information to the I/O devices. In addition to this cyclic data transfer of the process representation, Profinet also provides powerful functions for diagnostic and commissioning as well as event based alarm treatment in real time. Data transfer is monitored via the monitoring function at I/O controller and I/O device level.

2.4 Communication technology

- Full duplex, 100 Mbit/s switched Ethernet (100BASE-TX) IEEE 802.3
- Wiring according to IEC 61784-5-3. Cable with twisted wire pairs for each direction RX and TX
- Simultaneous communication into both send and receive direction
- Ethernet switches coordinate data transmission and prevent collisions on the cable

2.5 Bus access

- Switched Ethernet with flexible priority control, no collision domains, no coordination of the network access required – all participants have simultaneous access.
- Data exchange in compliance with provider-consumer model: The provider (I/O device) supplies process data to one or several consumers (I/O controllers).
- The maximum number of Profinet I/O devices per network depends on the I/O controller implemented.

2.6 Topology – Profinet device network configuration

Profinet is characterised by the virtually free topology implementation. If the required response times of messages for the automation application are exceeded, the maximum network depth – the number of cascaded Profinet participants – have been

reached. The maximum distance between two network participants is 100 metres. When using switches with fibre optic cable communication, distances can be increased.

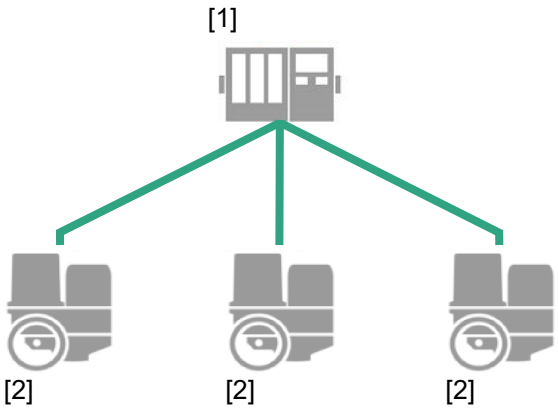
Only use industrial switches certified for Profinet and logically separate the Profinet based automation network from the remaining IT infrastructure. In general, hubs may not be used since this could lead to network collision. Based on existing network load by office applications, uncoordinated mixing of office network and automation network can lead to unpredictable problems with the Profinet application. For Profinet networks as of conformity class CC-B, both points specified are binding.

The following topologies and combinations are possible using Profinet:

Point-to-point or star topology

Devices in this topology only have one connection to the DCS (point-to-point) or to the Ethernet switch (star).

Figure 2: Point-to-point or star topology

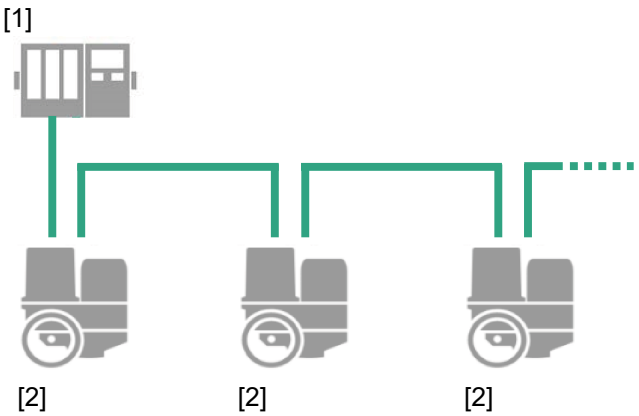


[1] I/O controller (PLC) [2] I/O device (field device)

Line topology

With this topology, devices and DCS are interconnected in series. To connect the devices, no additional Ethernet switch is required.

Figure 3: Line topology



[1] I/O controller (PLC) [2] I/O device (field device)

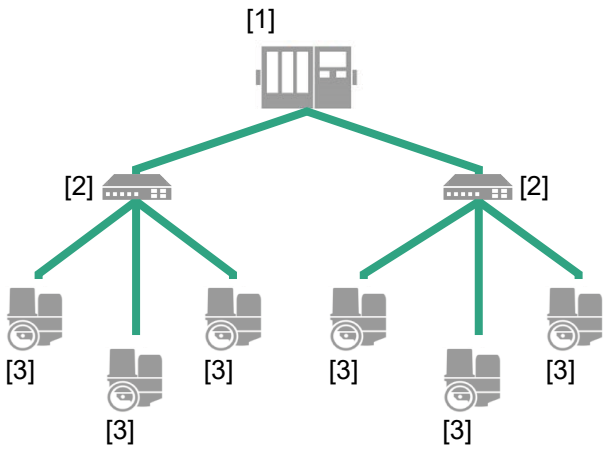
Information

For Ethernet networks, this topology is not recommended. If one participant or network switch fails, the other participants along the line are no longer accessible. Therefore, it is advised to use ring topology (refer to Topology – Profinet device network configuration [▶ 10]).

Tree topology

If you interconnect several star structures, you obtain a tree network topology. Any combination is possible.

Figure 4: Tree topology



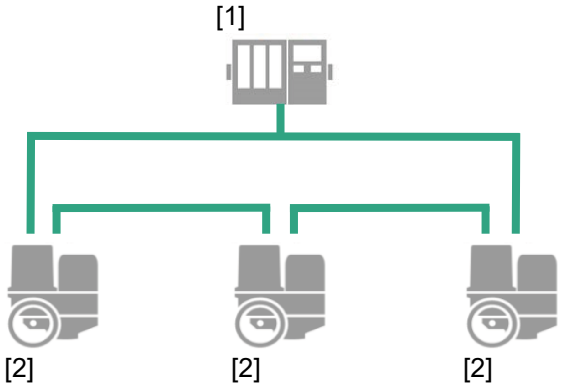
[1] I/O controller (PLC) [2] Switch
[3] I/O device (field device)

Ring topology

When applying this topology, the devices and the DCS are connected in series. The major difference to line topology is that both the first and the last device are connected to the DCS.

The ring topology is recommended when redundancy structures are required. However, make sure that this topology is supported by the DCS.

Figure 5: Ring topology



[1] I/O controller (PLC) [2] I/O device (field device)

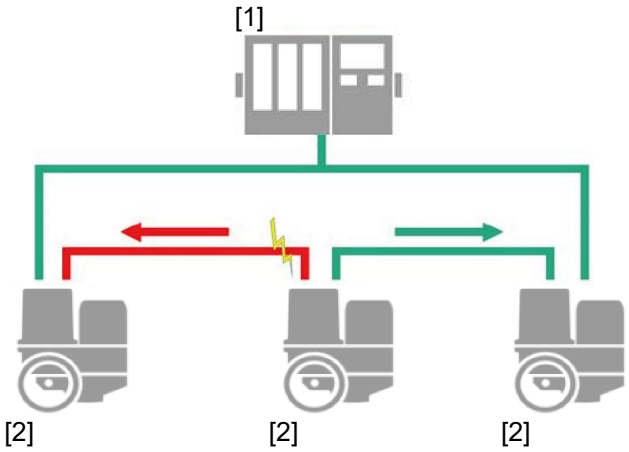
2.7 Redundancy

Media redundancy (ring)

The media redundancy available for Profinet warrants for high availability within the plant. The actuator is equipped with two physically isolated communication ports to the host controller and can be connected within a simple ring topology. If the first channel fails, e.g on the basis of line interruption, the second communication channel is automatically used. For this, the Media Redundancy Protocol as defined in the Profinet Standard is used. It allows the establishment of a redundant and protocol-independent ring topology whereby the change-over time is less than 50 ms. MRP is defined in the IEC 62439 standard.

This deals with a redundancy of the transmission medium. The Profinet interface of the device is not available twice.

Figure 6: Media redundancy



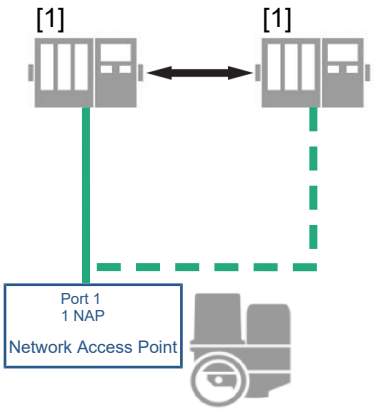
[1] I/O controller (PLC) [2] I/O device (field device)

S2 system redundancy (S2 single NAP)

Profinet system redundancy allows for redundant operation of several controllers or CPUs within one network. By this, failure or replacement of one controller during operation of the site is possible without interruption. Several variants of Profinet system redundancy are available. The S2 system redundancy (Single NAP) function enables redundant communication between a Profinet interface in the actuator and two Profinet actuator controls/CPUs (I/O controllers). Only one Profinet hardware is available in the DREHMO actuator, the system has two controllers. The system redundancy allows application relations (AR) between the device and several controllers. Profinet designation: S2 Single NAP.

The Profinet interface of the device is not available in double but keeps up communication relationships to both controllers. For S2 system redundancy, a cable connection via a network port at the actuator is sufficient.

Figure 7: System redundancy



[1] I/O controller (PLC)

2.8 Profinet communication cable

According to IEC 61156-6, CAT 5 cables are specified as minimum requirement for Profinet. However using CAT 5e and CAT 6 cables is recommended. For further references regarding planning an installation of Profinet networks, the PROFIBUS User Organisation (PNO) (www.profibus.com) provides suitable guidelines.

The following tables list the available cable types Profinet types A through C with regard to the respective application:

Table 1: Cable types

Cable types for dual pair Profinet cables			
Cable types	**Application type A**	**Application type B**	**Application type C**
Version	Dual pair data cable	Dual pair data cable	Dual pair data cable
Type of installation	Fixed installation, immobile after installation	Flexible installation, occasional movement, vibration or twisting after installation	Special applications (e. g. for continuous movement, vibration or torsion)
Cable parameter			
Designation (minimum)	“PROFINET type A“	“PROFINET type B“	“PROFINET type C“
Cross section	AWG 22/1 ≥ 0.610 mm²	AWG 22/7 ≥ 0.318 mm²	AWG 22/.. ≥ 0.318 mm²
Outer cable diameter	5.5 – 8.0 mm		depending on the application
Wire diameter	1.4 ± 0.2 mm		depending on the application
Colour of sheath	Green RAL6018		depending on the application
Colour of wire insulation	Pair 1: white, blue Pair 2: yellow, orange		
Number of wires	4		
Cable design	Dual pair or star quad		
Shield	Aluminium foil + copper braid		depending on the application
Communication requirements			
Applicable standards	ISO/IEC 11801 Edition 2.0 IEC 61140-1 IEC 61156-5 (minimum device group 5)		ISO/IEC 11801 Edition 2.0 IEC 61140-1 IEC 61156-6 (minimum device group 5)
Delay	≤20 ns/100 m		
Coupling attenuation	≥80 dB at 30 – 100 MHz ”Channel Class-D“ according to EN 50174-2		

Minimum spacing

The minimum spacing (according to IEC 61918) required between laying Profinet cables and other cables must be respected. They are shown in the table below.

Table 2: Minimum cable spacing

Minimum spacing for Profinet cables			
	Spacing to Profinet cable		
	Without or with non-metal cutoff bridge	Aluminium cutoff bridge	Steel cutoff bridge
Signal transmission cable			
For example other Profinet cables, Profibus cables, data cables for PCs, programming devices, shielded analogue inputs	0 mm	0 mm	0 mm
Power supply cables			
Unshielded power supply cables	200 mm	100 mm	50 mm
Unshielded power cables	0 mm	0 mm	0 mm

Further notes
Available Profinet recommendations, particularly planning, assembly and commissioning guidelines of the PROFIBUS User Organisation (PNO) (www.profibus.com) must be met.

2.9 Profinet conformance classes

To simply the application of Profinet, various conformance classes are defined which specify required properties of the Profinet components and ensure their interoperability by certifications.

The main properties of the conformance classes are shown in the table below:

Table 3: Profinet conformance classes

CC-A (unsynchronised)	CC-B (unsynchronised), CC-A plus	CC-C (synchronised communication – IRT) CC-B plus
• Basic functions for Profinet I/O with RT communication • Standard Ethernet IEEE • 802.3 Switches • Cable based • Wireless data transmission possible • TCP/IP communication (acyclic services)	• Certified Profinet Switches • Network diagnostics via IT mechanism (SNMP) • Simple device replacement • Neighbourhood topology detection (LLDP with LLDP-MIB) • Offline topology configuration possible • Optional system redundancy CC-B (PA)	• Hardware supported bandwidth utilisation (IRT communication) • Synchronisation • Basis for time synchronised applications (cycle times >1ms)

2.10 Supported functionality

Switch functionality

- Two Ethernet ports 100BASE-TX with integral Ethernet switch suitable for industrial applications
- Conformance class CC-C RT class 2, without application synchronisation (RT class 3)
- Managed Switch Services, SNMP …
- Auto negotiation, auto crossover and auto polarity exchange
- Autonomous switch function in case of maintenance requirement. When connecting an additional 24 V power supply, the switch function is maintained even if the electrical connection is disconnected from the device. For this, insert the electrical connection into an appropriate parking frame.
- Port deactivation

Device functionality

- Profinet I/O conformance class CC-B(PA) RT class 1
- DCP and DHCP for IP address assignment
- Web server for network configuration and diagnostics
- Acyclic communication: Diagnostic & parametrisation via FDI package
- Support of two simultaneous cyclic communication relations
- Extended device identification in compliance with I&M 1-3
- Profinet I/O version 2.4
- GSDML version 2.4
- Redundancy according to MRP – ring topology supported
- S2 system redundancy

Unsupported functions

- Redundancy according to MRRT or MRPD
- Shared input and shared device

2.11 Protective functions

- Response monitoring (watchdog)
- Access protection for inputs/outputs (sync and freeze)
- Process data exchange (DATA EX) monitoring with configurable timer interval at controller
- Adjustable failure behaviour at actuator in case of Profinet communication loss

Port deactivation for unused network ports
Unused Ethernet ports can be deactivated to prevent unauthorised and above all undetected access to the network in the field. Therefore, it is no longer necessary to protect unused ports mechanically against access.

Switching off the integrated web server
The web server integrated within actuator controls can locally be switched off via local controls..

Switching off the integrated FTP server
The FTP server integrated within actuator controls can locally be switched off via local controls..

2.12 Device types

- **I/O controller:** e.g. central automation devices such as PLC
- **I/O supervisor:** e.g. programming devices or configuration tools (PC)
- **I/O device:** devices with binary or analogue inputs/outputs e.g. actuators, valves
- **Network components:** e. g. switches, access points, routers

3 Commissioning

3.1 Introduction

Only few steps are required to integrate an DREHMO actuator into a Profinet environment. At first, a standardised device description (GSDML file) is linked to the DCS. The device name assignment for the actuator using the DCS system tools is the next step. On the basis of the device name, the actuator is identified within the Profinet system. The IP address is automatically assigned by the automation system.

Afterwards, the user can configure and parametrise the device via the programming software of the used DCS. This information is then stored in the actuator controls (I/O controller) and sent to the actuators (I/O devices) each time cyclic communication is started.

The process representation input and output bytes are used to control the actuator and to supply the feedback signals. If a configuration with consistent data is selected, certain controllers require special function blocks for controlling the Profinet I/O devices.

An integrated DREHMO web server additionally allows swift and easy performance of connection tests, status requests and fault diagnostic by means of a web browser.

Certification

DREHMO actuators with Profinet are certified by the PROFIBUS User Organisation (PNO).

Ident number (device type)

Each Profinet I/O device and each I/O controller has an individual identification number. The ID number is required for the I/O controller to identify the type of device connected without signification protocol overhead. The controller compares the ID numbers of the connected I/O devices to the ID number in the specified configuration data. The process data transfer will only be started if the correct device types with the correct device addresses were connected to the network. This ensures a high security against configuration errors. The PNO manages the ID numbers together with the device master data (GSDML). DREHMO actuators with IMC actuator controls are listed with the PNO with the following device type number:

- Ident no.: 0x2205, manufacturer ID 0x0131

Device Master Data (GSD/GSDML)

For Profinet, the performance features of the devices are documented by the manufacturer and made available to the users as device data sheet and a General Station Description in XML format. Structure, contents and coding of the General Station Description (GSDML) are standardised. They enable comfortable integration of any I/O device into different engineering tools of different manufacturers.

For DREHMO actuators equipped with actuator controls, the following GSD files are available:

- GSDML-V2.4-DREHMO GmbH-DREHMO Actuators-20210520.xml (supports S2 system redundancy)
- Profinet I/O version 2.4
- Manufacturer-ID 0x0131 = 305 = DREHMO GmbH
- Device ID 0x2205 = 8709 = DREHMO IMC with PROFINET
- DAP: 0x80010000

Information
GSD or GSDML files can be downloaded from our website www.drehmo.com

3.2 Mains connection (default)

DANGER

Hazardous voltage!

Death or serious injury!

→ Work on the electrical system or equipment and electrical installation work on actuators must only be carried out by skilled electricians themselves or by specially instructed personnel under the control and supervision of such an electrician and in accordance with the applicable electrical engineering rules.

→ Wiring is made in compliance with the terminal plan attached.

→ Cable protection for internal wiring of the actuator must be provided for at the customer's.

→ The sizing values are specified on the terminal plan or the name plate.

→ Thoroughly obey the correctness of the PE connection (refer to terminal plan). Electrical protection is only ensured once all covers are closed.

3.3 Profinet addressing – device name assignment

The device name is assigned to the device during device name assignment. The acyclic communication is IP based and allows the use of known IT mechanisms via protocols such as UDP or TCP/IP. Cyclic Profinet real-time data as well as event-based alarms are exclusively based on the most widely used network technology, Ethernet with MAC addressing and message prioritisation. The MAC address is inseparably linked to the device and globally unambiguous. Using the DCP protocol (Discovery) and the device name, the controller will identify the network devices and will assign their IP addresses. As an alternative, the IP address may also be assigned manually.

Profinet participants are therefore addressed by means of the parameters below:

- Unique MAC address
- Assigned device names
- Assigned IP address

Device name and, as an option, also the IP address, is assigned by the software used for configuration of the network topology, e.g. Siemens Step7/TIA or Proneta. The described address parameters can be read via local display, using the i-matic explorer service software or any other (e.g. FDI based) configuration and diagnostic system.

3.4 Configuration of Profinet interface

Configuration of cyclic data transfer is exclusively made via the Profinet controller which sends the configuration when establishing the cyclic data transfer to the device. The devices receives the configuration, checks for validity and adapts itself to the new configuration, provided that it is valid. No settings are made within the device itself. The configuration procedure depends on the implemented tool.

The number of input and output bytes sent or received by the I/O devices to and from the controller are predefined within actuator controls. Accordingly, once the controller starts cyclic communication, the required communication relations are negotiated with the I/O device.

3.4.1 Parameters of Profinet interface

Various parameters relevant for the Profinet interface are nevertheless set via the actuator controls, either via the local controls menu or the i-matic explorer.

The parameters relevant for the Profinet interface can be found under Menu > Parameters > DCS > Interface > Profinet

NOTICE

Note

Changing a parameter will result in renewed parametrisation and restart of the Profinet communication module. Thus, the communication for the controller will be lost for a short time. The possibly used bridge functionality of the connection sub-assembly will then be lost.

Table 4: Parameters of Profinet interface

Parameters	Signification
Ethernet port 1	Activates or deactivates port 1 on the connection board. Unused ports can be activated for security reasons to prevent manipulation of the overall system by attackers. Setting options: Deactivated/activated
Ethernet port 2	Activates or deactivates port 2 on the connection board. Unused ports can be activated for security reasons to prevent manipulation of the overall system by attackers. Setting options: Deactivated/activated
System redundancy	Activates or deactivates S2 system redundancy. Setting options: Deactivated/activated
Web sever	Activates or deactivates the integral web server. The web server can be deactivated for security reasons. Setting options: Deactivated/activated
FTP server	Activates or deactivates the integral FTP server. The FTP server can be deactivated for security reasons. Setting options: Deactivated/activated
Admin mode	Activates or deactivates the Admin mode of the sub-assembly. If user data have been created for the FTP server, access to the FTP server can nevertheless be activated, e.g. if you have forgotten your user credentials. For this, the Admin mode must first be activated. When restarting the actuator controls, the Admin mode will be deactivated. Setting options: Deactivated/activated

3.5 Communication start

After successful device name assignment, the communication channels between I/O controller and I/O devices are established. The I/O controller creates so-called Application Relations (AR) between the participants. Communication Relations (CR) with different properties are defined via these AR:

- Record Data CR for the acyclic parameter transfer
- I/O Data CR for the cyclic process data exchange
- Alarm CR for signalling alarms in real time

With this, all relevant parameters and times for system start-up as well as transmission rates of cyclic I/O data from the I/O controller are transferred to the I/O devices.

After successful establishment of application relations and their communication relations, the network participants start productive operation.

The Internet Protocol (IP) is used for connection setup and acyclic services. The Address Resolution Protocol (ARP) is enhanced with the detection of duplicate IP addresses. Using the Discovery and basic Configuration Protocol (DCP) is mandatory IP address assignment. As an option, DHCP may also be used.

3.6 Communication monitoring

3.6.1 Connection monitoring of Profinet communication

The active Profinet communication is continuously monitored. In case of failure, a failure behaviour is initiated which can be defined as requested.

3.6.2 Communication status

Correct Profinet communication to the actuator can be checked via local controls display or via the i-matic explorer service software. The relevant information can be found in the menu: Actual values/diagnosis > Interface > Profinet > Status

- "Setup", "Network init", "Wait Process", "Idle I/O", "Process Active I/O", "Error", "Exception"

The status of the Ethernet port can also be viewed on the display of the i-matic actuator. Should both ports of the Profinet interface be activated, two symbols each are displayed whereby the upper symbol indicates the status of port 1 and the lower symbol the status of port 2.

Figure 8: Fieldbus status indication in the basic display of the LC

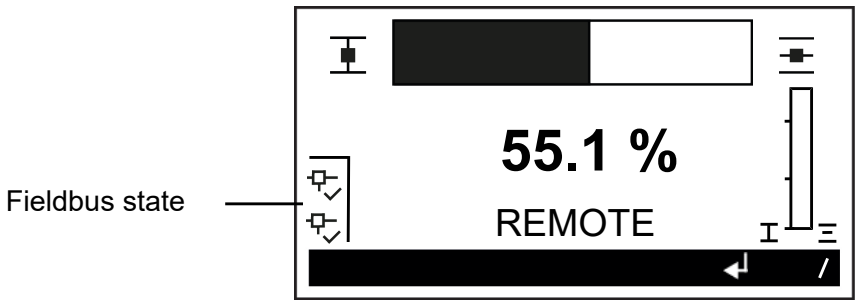


Table 5: Communication status

Symbol	Signification
	No Ethernet network connection and no data communication on port 1 or 2
	Port 1 or 2 are correctly connected to the Ethernet network, however without active data communication
	Bus OK, the participant is directly addressed by the master via this channel. DataEx describes, whether the device can correctly communicate using one of the two ports and whether the Profinet data has directly been sent via the device address. A Profinet user relation to I/O controller or I/O supervisor is available.

3.7 I & M functions

The actuator controls support the I & M function according to PNO guideline 3.502.

With the term Identification & Maintenance (I & M) functions, the PROFIBUS User Organisation (PNO) introduced a new functionality for all Profibus and Profinet devices with acyclic communication channel that may prove very useful for plant operators. The I & M functions define how certain device-describing data (according to name plate) is to be uniformly stored in the Profinet devices. Engineering tools may then read and interpret the data according to a code which can be accessed on the PNO server. This provides uniform and powerful access to all important and current device data. This is a significant requirement for Asset Management.

Part of the device-specific I & M information is the unambiguous (asset) identification using a manufacturer ID (MANUFACTURER_ID, for DREHMO actuators = 305), the order number (ORDER_ID) of the actuator as well as the individual serial number (SERIAL_NUMBER). Further data supplements the asset information.

Table 6: Supported I&M functions

Record	Content	Size	Description
I&M0	MANUFACTURER_ID	2 bytes	PROFINET I/O Object (F6h), attribute #2 (‘Vendor ID/ I&M Vendor ID’)
	ORDER_ID	20 bytes	PROFINET I/O Object (F6h), attribute #8 (‘I&M Order ID’)
	SERIAL_NUMBER	16 bytes	PROFINET I/O Object (F6h), attribute #9 (‘I&M Serial Number’)
	HARDWARE_REVISION	2 bytes	PROFINET I/O Object (F6h), attribute #10 (‘I&M Hard- ware revision’)
	SOFTWARE_REVISION	4 bytes	PROFINET I/O Object (F6h), attribute #11 (‘I&M Soft- ware revision’)
	REVISION_COUNTER	2 bytes	PROFINET I/O Object (F6h), attribute #12 (‘I&M Revi- sion counter’)
	PROFILE_ID	2 bytes	PROFINET I/O Object (F6h), attribute #13 (‘I&M Profile ID’)
	PROFILE_SPE- CIFIC_TY- PE	2 bytes	PROFINET I/O Object (F6h), attribute #14 (‘I&M Profile specific type’)
	IM_VERSION	2 bytes	0101h (Internal, constant value)
	IM_SUPPORTED	2 bytes	001Eh (Internal, constant value)
I&M1	TAG_FUNCTION	32 bytes	Default: All bytes set to blanks (‘ ‘)
	TAG_LOCATION	22 bytes	Default: All bytes set to blanks (‘ ‘)
I&M2	INSTALLATION_DATE	16 bytes	Default: All bytes set to blanks (‘ ‘)
I&M3	DESCRIPTOR	54 bytes	Default: All bytes set to blanks (‘ ‘)
I&M4	SIGNATURE	54 bytes	Default: All bytes set to zero (00h)

4 Data interface

4.1 General information

Cyclic data

Configuration of cyclic data transfer only performed in Profinet controller. Selection of input/channel or respective input and/or output date is performed via slot/subslot configuration used to program a Profinet controller.

All I/O data are supplied in slot 1, subslot 1. Data are structured in various blocks with different properties. The following sub-sections comprise explanations about the different blocks.

Process interface

Data structure is described on the basis of the automation system:

- Input data: Are sent by the field device to the automation system
- Output data: Are sent by the automation system to the field device

4.2 Input data (process representation input) – signals

The process representation input allows the consumer (controller) to read the state of the provider (actuator).

4.2.1 Process representation input (default process representation)

Module definition

- Module ID="ID_MODULE_INPUT_ADI32768”
- ModuleIdentNumber="0x00008000"
- ModuleInfo CategoryRef=”CAT_REF_IN_MODULES”
- Name TextId="T_ID_INFO_TEXT_ADI"
- InfoText TextId="Process representation Input Data"

Sub-module definition

- VirtualSubmoduleItem ID="ID_SUBMOD_ADI_PAIN_0"
- SubmoduleIdentNumber="0x00002200"
- API="0"
- FixedInSubslots="1"
- Name TextId="Inputs"
- InfoText TextId="Process representation Input Data"

I/O data definition in sub module

- IOData IOPS_Length="1"
- IOCS_Length="1"
- Input Consistency="All items consistency"

Table 7: Process representation input

Byte	Bit	Feedback	Signification
0			**Types of duty**
	0	OFF mode	The actuator is in operation mode OFF and can neither be operated from REMOTE nor from LOCAL.
	1	LOCAL mode	The actuator is in operation mode LOCAL and can be operated via the local controls.
	2	REMOTE mode	The actuator is in operation mode REMOTE and can be operated via the DCS interface.
	3	Operation mode not REMOTE	The actuator is not in operation mode REMOTE.
	4	Operation mode LEARN	The actuator is in LEARN mode and is being commissioned.
	5-7	Reserve	
1			**Running indications**
	0	Actuator runs	Actuator is motor-operated in direction OPEN or CLOSE
	1	Actuator runs OPEN	Actuator is motor-operated in direction OPEN
	2	Actuator runs CLOSE	Actuator is motor-operated in direction CLOSE
	3	Stepping mode active	It is signalled that stepping mode in direction OPEN or CLOSE has been programmed and that the following condition is additionally met: The process parameter Step.mode pulse source is set to internal or the process parameter Step.mode pulse source is set to external and the stepping mode active remote command is present.
	4	Actuator in stepping mode range	The actuator is within the range for which internal stepping mode is active.
	5	Stepping pause active	Actuator at standstill during active stepping mode.
	6	Setpoint position reached	The specified setpoint has been reached.
	7	Reserve	
2			**Position indications**
	0	Final position OPEN	The actuator is at a position outside the operating range at or beyond the learnt position OPEN.
	1	Final position CLOSED	The actuator is at a position outside the operating range at or beyond the learnt position CLOSED.
	2	Final position reached	OR operation of the individual signals “Final position OPEN” and “Final position CLOSED”.
	3	End position OPEN signal	Signals end position OPEN according to the End position indication parameter. Options: “Position” or “acc. to type of seating”.
	4	End position CLOSED signal	Signals end position CLOSED according to the End position indication parameter. Options: “Position” or “acc. to type of seating”.
	5	End position OPEN acc. to type of seating	End position signal for OPEN, depending to the programmed type of seating in direction OPEN. In case of programmed limit seating, this signal will immediately be sent when exceeding the end position. In case of programmed torque seating, the signal will only be sent after exceeding the end position once the tripping torque in direction OPEN has also been exceeded.
	6	End position CLOSED acc. to type of seating	End position signal for CLOSED, depending to the programmed type of seating in direction CLOSED. In case of programmed limit seating, this signal will immediately be sent when exceeding the end position. In case of programmed torque seating, the signal will only be sent after exceeding the end position once the tripping torque in direction CLOSE has also been exceeded.
	7	Reserve	

Byte	Bit	Feedback	Signification
3			**Torque exceeding**
	0	Torque exceed OPEN	Torque sensing provides a value that exceeds the programmed tripping torque OPEN. The signal will be sent irrespective of further parametrisation.
	1	Torque exceed CLOSED	Torque sensing provides a value that exceeds the programmed tripping torque CLOSE. The signal will be sent irrespective of further parametrisation.
	2	Torque indication OPEN	Torque sensing provides a value that exceeds the programmed tripping torque OPEN. This signal will always occur in intermediate positions; in the end position, it will only occur if the “Torque indication” parameter has been set to “Ind. in end position”.
	3	Torque indication CLOSE	Torque sensing provides a value that exceeds the programmed tripping torque CLOSE. This signal will always occur in intermediate positions; in the end position, it will only occur if the “Torque indication” parameter has been set to “Ind. in end position”.
	4	Torque indication OPEN or CLOSE	OR operation for the two “Torque indication OPEN” and “Torque indication CLOSE” signals.
	5	Torque fault OPEN	Torque sensing provides a value that exceeds the programmed tripping torque OPEN. This signal will always occur in intermediate positions; in the end position, it will only occur if the “Seating mode” parameter for end position OPEN has been set to “Final position limit sw.”.
	6	Torque fault CLOSE	Torque sensing provides a value that exceeds the programmed tripping torque OPEN. This signal will always occur in intermediate positions; in the end position, it will only occur if the “Seating mode” parameter for end position OPEN has been set to “Final position limit sw.”.
	7	Torque fault OPEN or CLOSE	OR operation for the two signals “Torque fault OPEN” and “Torque fault CLOSE”.
4			**Torque warnings**
	0	Torque warning OPEN	Torque sensing provides a value that exceeds the programmed warning torque OPEN. The signal will be sent irrespective of further parametrisation.
	1	Torque warning CLOSE	Torque sensing provides a value that exceeds the programmed tripping torque CLOSE. The signal will be sent irrespective of further parametrisation.
	2	Torque warning OPEN or CLOSE	OR operation for the two “Torque warning OPEN” and “Torque warning CLOSE” signals.
	3	Torque warning signal OPEN	Torque sensing provides a value that exceeds the programmed warning torque OPEN. This signal will always occur in intermediate positions; in the end position, it will only occur if the “Seating mode” parameter has been set to “Ind. in end position”.
	4	Torque warning signal OPEN	Torque sensing provides a value that exceeds the programmed tripping torque CLOSE. This signal will always occur in intermediate positions; in the end position, it will only occur if the “Seating mode” parameter has been set to “Ind. in end position”.
	5	Torque warning signal OPEN or CLOSE	Torque sensing provides a value that exceeds the programmed warning torque for OPEN or CLOSE. This signal will always occur in intermediate positions; in the end position, it will only occur if the “Seating mode” parameter for the respective direction has been set to “Final position limit sw.”.
	6-7	Reserve	

Byte	Bit	Feedback	Signification
5			**Device status 1**
	0	Reserve	
	1	Emergency shutdown (ESD)	An extremal ESD command is present and the currently programmed ESD action active; however the execution of the ESD action is neither blocked by a possibly excluding operation mode nor by a possibly excluding motor over temperature.
	2	Fail safe active	The actuator is in the internally generated fail safe state. This state is exclusively set in REMOTE mode when falling below the limit value of the external setpoint or if fieldbus communication fails.
	3	EMERGENCY STOP	External EMERGENCY STOP is present.
	4	Int. positioner disabled	The actuator can only be operated from REMOTE via the connected discrete commands. For activating the internal positioner and the setpoint, the AUTOMATIC output bit must be active (see output B0.3). A local fault signal H1 (entry in the error log) will only be generated if the signal is mapped in collective failure.
	5	Interlock LOCAL active	One of the signals “Enable LOCAL”, “Enable LOCAL OPEN” or “Enable LOCAL CLOSE” has been assigned to a command input and is inactive. Operation of the actuator in LOCAL mode is thus restricted.
	6	Interlock REMOTE active	One of the signals “Enable REMOTE”, “Enable REMOTE OPEN” or “Enable REMOTE CLOSE” has been assigned to a command input and is inactive. Operation of the actuator in REMOTE mode is thus restricted.
	7	Handwheel operation	An output drive movement without electronic control is present.
6			**Device status 2**
	0	Actuator in local control	The actuator is in LOCAL mode and the power unit is being controlled.
	1	Actuator in local control OPEN	The actuator is in LOCAL mode and the power unit is controlled in direction OPEN.
	2	Actuator in local control CLOSE	The actuator is in LOCAL mode and the power unit is controlled in direction CLOSE.
	3	Actuator is operated from REMOTE	The actuator is in REMOTE mode and is operated.
	4-7	Reserve	
7			**Intermediate position**
	0	Intermediate pos. 1	Indication of the intermediate position according to the set signalling behaviour.
	1	Intermediate pos. 2	Indication of the intermediate position according to the set signalling behaviour.
	2	Intermediate pos. 3	Indication of the intermediate position according to the set signalling behaviour.
	3	Intermediate pos. 4	Indication of the intermediate position according to the set signalling behaviour.
	4	Intermediate pos. 5	Indication of the intermediate position according to the set signalling behaviour.
	5	Intermediate pos. 6	Indication of the intermediate position according to the set signalling behaviour.
	6	Intermediate pos. 7	Indication of the intermediate position according to the set signalling behaviour.
	7	Intermediate pos. 8	Indication of the intermediate position according to the set signalling behaviour.
8	**All**	Position value high byte	0...1000 ppt actual position value, scaled between end positions OPEN and CLOSED
9	**All**	Position value low byte	
10	**All**	Torque value	0...100% of torque value at output drive

Byte	Bit	Feedback	Signification
11		**Actuator fault indications**	
	0	Actuator start monitoring	Despite controlling the power unit, the actuator controls do not detect an output drive movement.
	1	Rotary direction monitoring	When controlling the power unit, the actuator controls detect an output drive movement into the wrong direction of rotation.
	2	Running time monitoring	OR operation for the two individual signals “Op.time monit. OPEN “ and “Op.time monit. CLOSE”.
	3	Op.time monit. OPEN	The operating data value for the current running time of the actuator in direction OPEN exceeds the programmed limit value for the running time in direction OPEN.
	4	Op.time monit. CLOSE	The operating data value for the current running time of the actuator in direction CLOSE exceeds the programmed limit value for the running time in direction CLOSE.
	5	Motor overtemperature	Motor protection trips due to motor overtemperature. Tripping may be delayed due to the “Thermal failure delay” actuator parameter. The resetting behaviour of the signal can be defined via the “Thermal failure reset” actuator parametrisation.
	6-7	Reserve	
12		**General fault indications**	
	0	Collective failure 1	Collective failure 1 can be compiled out of various signals by means of parametrisation with logic OR operations. The fault is indicated at the device by means of the bell symbol and the fault indication light. The fault signal is automatically reset.
	1	Collective failure 2	Collective failure 2 can be compiled out of various signals by means of parametrisation with logic OR operations. The fault is indicated at the device by means of an exclamation mark as warning symbol. The fault signal is automatically reset.
	2	Operation command rejected	Will occur if e.g. an OPEN/CLOSE command for operation with internal positioner and a setpoint with set Automatic bit are present.
	3	Reserve	
	4	RTC failure	The optional RTC has failed
	5	RTC invalid	The time setting of the optional RTC is invalid or has not yet been done
	6	RTC battery low	The battery of the optional RTC is empty
	7	Reserve	

Byte	Bit	Feedback	Signification
13	**Electronics fault indications 1**		
	0	Configuration invalid	One or several of the following parametrisations are invalid. • The device key in the electronic name plate of the actuator controls is invalid. • The torques defined for the actuator via the device key are not plausible. • The tripping torque OPEN parametrised for the valve exceeds the maximum input torque OPEN for the valve according to electronic name plate. • The tripping torque CLOSE parametrised for the valve exceeds the maximum input torque CLOSE for the valve according to electronic name plate. • The tripping torques OPEN and CLOSE parametrised for the valve exceed the parametrised maximum input torque for gearbox/thrust unit. • For a Profibus interface, the system redundancy has been parametrised according to DPV2 for the redundancy concept, although the required DPV2 functionality has not been enabled via the device key.
	1	Device key invalid	The parametrised device key in the electronic name plate of the actuator controls is invalid.
	2	Discrepancy error	There is discrepancy with regard to the electric signals within the control and the read in signals in the hardware monitoring of the power unit.
	3	Wrong power unit	Due to the evaluation of an existing hardware coding a power unit other than specified in the parametrisation was detected.
	4	Reserve	
	5	Parametrisation error Gearbox input torque	The parametrised tripping torque OPEN or tripping torque CLOSE of the valve exceeds the permissible gearbox input torque.
	6	Parametrisation error Valve torque OPEN	The parametrised tripping torque OPEN of the valve exceeds the maximum permissible torque of the valve in direction OPEN.
	7	Parametrisation error Valve torque CLOSE	The parametrised tripping torque CLOSE of the valve exceeds the maximum permissible torque of the valve in direction CLOSE.

Byte	Bit	Feedback	Signification
14		**Electronics fault indications 2**	
	0	Hardware fault	A fault during detection or current test of hardware components has occurred and the hardware was therefore considered as defective.
	1	Hardware fault in the interface card	A fault during detection or current test of of the used interface sub-assembly has occurred and sub-assembly was therefore considered as defective.
	2	System test fault	During the automatic testing of the hardware and software, the actuator controls have detected a fault and have then performed a system reset. • The fault signal can be reset from REMOTE in connection with a Profinet interface and via the acyclic bit “Reset system test fault“ slot 1 index 240”. The fault type can be read out via the acyclic services “System test fault code” in slot 1 index 195. • In LOCAL mode, the fault signal can be reset using the System > Reset function or by means of an Off-On switching cycle. The fault type can be viewed in the local menu System entry under Actual values/diagnosis. • This signal is particularly relevant for safety-related systems if the site has to be put into a safe state once a fault has occurred.
	3	Sensor fault	At detection and self diagnostic of the combined sensor for limit and torque sensing, a fault has been detected and the combined sensor was considered as being unfit to operate. Actuator operation is not possible and will be aborted if required. A new hardware configuration of the sensor by controls is used to remedy the fault. The signal will be present until fault has been remedied and will then be automatically reset.
	4	Sensor range overflow	For more than 1,490 revolutions of the hollow shaft, this signal occurs.
	5	Sensor position illegal	Appears if the sensor position is below -50 % or exceeds +150 %.
	6	Position calibration fault	Fault during calibration of the combined sensor.
	7	Torque calibration fault	Fault during calibration of the combined sensor.
15		**Electronics fault indications 3**	
	0	Electronics overtemp.	The temperature measured on the baseboard of the electronics exceeds the “max. electr. temp.” indicated in the electronic name plate under Controls -> Basics.
	1	Battery backup failure	There is a failure in the optional battery module. More detailed information can be found under Actual values/diagnosis> “Battery backup”.
	2	NV memory fault	A fault during access to the internal non-volatile memory.
	3-7	Reserve	
16		**Electronics fault indications 4**	
	0	Phase failure	Occurrence of a least one of the signals “Phase 1 failure”,”Phase 2 failure” or “Phase 3 failure”.
	1	Phase 1 failure	Phase 1 of mains power input failed.
	2	Phase 2 failure	Phase 2 of mains power input failed.
	3	Phase 3 failure	Phase 3 of mains power input failed.
	4	Phase correction failure	A phase sequence cannot be automatically detected.
	5	Reserve	
	6	24V DC internal failure	The AC voltage required for the generation of the internally required DC voltage is not available on the secondary part of the mains transformer. As an alternative, the actuator controls can be externally supplied. Control of reversing contactor units as power unit is not possible due to the existing failure.
	7	24V DC external failure	The external 24 V DC is not available.

Byte	Bit	Feedback	Signification
17	**Maintenance indications**		
	0	Maintenance required	Collective signal of various operating data counters and the maintenance signals. This signal is active if one of the following limit values has been exceeded: • Accum. valve stroke for open-close actuators • Accum. operation cycles • Thermal ageing • Mechanical ageing
	1	Limit valve stroke exceeded	The value of the “Valve stroke” counter exceeds the pertaining programmable limit “Limit valve stroke”.
	2	Accum. op. cycles exceeded	The value of the “Operating cycle” counter exceeds the pertaining programmable limit “Limit valve stroke”.
	3	Actual cycles/hour too high	The value of the “Operation cycle” counter exceeds the pertaining programmable limit “Limit valve stroke”.
	4	Dynamic maint. ind.	OR operation of the two “Mechanical ageing” and “Thermal ageing” indications.
	5	Mechanical ageing	The value for mechanical ageing exceeds the pertaining limit value for mechanical ageing and thus initiates this dynamic maintenance indication.
	6	Thermal ageing	The value for thermal ageing exceeds the pertaining limit value for thermal ageing and thus initiates this dynamic maintenance indication.
	7	Reserve	
18	**All**	Dynamic maintenance consumption variable	0...100 % consumption of dynamic maintenance collective. This variable indicates the highest relative consumption with regard to the respective limit value of thermal ageing or mechanical ageing.
19	**Out of specification**		
	All	Reserve	
20	**Fieldbus communication**		
	0	Data traffic on channel 1	Valid data traffic has been detected on channel 1 of the connected fieldbus system (baud rate found, link).
	1	Data traffic on channel 2	Valid data traffic has been detected on channel 2 of the connected fieldbus system (baud rate found, link).
	2	Data exchange via channel 1	Validated data exchange with the host is taking place on channel 1 of the connected fieldbus system (data exchange).
	3	Data exchange via channel 2	Validated data exchange with the host is taking place on channel 2 of the connected fieldbus system (data exchange).
	4	Channel 1 is active channel	Channel 1 of the connected fieldbus system is the active channel. Signals of this channel are used for remote control of the actuator.
	5	Channel 2 is active channel	Channel 2 of the connected fieldbus system is the active channel. Signals of this channel are used for remote control of the actuator.
	6	Clear channel 1	All outputs of the host in fieldbus channel 1 of the device (slave) are reset (GlobalControlClear).
	7	Clear channel 2	All outputs of the host in fieldbus channel 2 of the device (slave) are reset (GlobalControlClear).
21	**All**	Analogue input 1 high byte	0...1000 ppt of analogue input 1,scaled between 4...20 mA
22	**All**	Analogue input 1 low byte	
23	**All**	Reserve	
24	**All**	Reserve	
25	**All**	Reserve	
26	**Digital inputs**		
	0	Digital input 1	Status of digital input 1.
	1	Digital input 2	Status of digital input 2.
	2	Digital input 3	Status of digital input 3.
	3	Digital input 4	Status of digital input 4.
	4-7	Reserve	

Byte	Bit	Feedback	Signification
27		**Diagnostics**	
	0	Actual value valid	
	1	Analogue value 1 valid	
	2	Reserve	
	3	No setpoint signal	
	4-7	Reserve	
28		**Partial Valve Stroke Test**	
	0	PVST active	Future Use - Partial Stroke Mode
	1	PVST abort	Future Use
	2	PVST warning	Future Use
	3	Deblocking	Future Use
	4-7	Reserve	
29		Reserve	
30		Reserve	
31		Reserve	

4.3 Output data (process representation output) – Commands

The consumer (controller) can control the provider (actuator) via the process representation output.

4.3.1 Process representation output (default process representation)

Information

The actuator must be in operation mode REMOTE to be able to perform remote operation.

Module definition

- Module ID=" ID_MODULE_OUTPUT_ADI33024"
- ModuleIdentNumber="0x00008100"
- ModuleInfo CategoryRef= “CAT_REF_OUT_MODULES”
- Name TextId=" T_ID_MODULE_NAME_OUTPUT_ADI33024"
- InfoText TextId="Process representation Output Data"

Sub-module definition

- VirtualSubmoduleItem ID="ID_SUBMOD_OUTPUT_ADI33024_GROUP1"
- SubmoduleIdentNumber="0x10001000"
- API="0"
- FixedInSubslots="1"
- Name TextId="Outputs"
- InfoText TextId="Process representation Output Data"

I/O data definition in sub module

- IOData IOPS_Length="1"
- IOCS_Length="1"
- Output Consistency="All items consistency"

Table 8: Process representation output

Byte	Bit	Signal	Signification
0	**Commands**		
	0	Operation command OPEN	Operates the actuator in direction OPEN if control via discrete commands from remote has been enabled. Operation mode REMOTE must be active. If the “Internal positioner” parameter within the electronic name plate of the controls is set to “Enabled V005”, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the “Controls” category.
	1	Operation command CLOSE	Operates the actuator in direction CLOSE if control via discrete commands from remote has been enabled. Operation mode REMOTE must be active. If the “Internal positioner” parameter within the electronic name plate of the controls is set to “Enabled V005”, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the “Controls” category.
	2	STOP command	Stops the actuator for control via discrete operation commands. Not effective during active setpoint operation. Operation mode REMOTE must be active. If the “Int. positioner” parameter within the electronic name plate of the controls is set to “Enabled V005”, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the “Controls” category.
	3	AUTOMATIC	Activates the integral 3-point positioner and thus enables setpoint operation if the “Int positioner” parameter within the electronic name plate of the controls is set to “Enabled V005”.
	4	Stepping mode	Activates the stepping mode for operating time extension if the process parameter “Step. mode pulse source” is programmed to “external”.
	5	Emergency shutdown (ESD)	Activates the ESD of the actuator unless it has been deactivated via the DCS parameter “Emergency shutdown (ESD)”. This command can also be activated for operation mode LOCAL or OFF by programming the respective parameters. The actuator behaviour in combination with potential torque or motor overtemperature tripping can also be parametrised for this command. The control type for this command is always “push-to-run operation”, even if “self-retaining” has been programmed. For the ESD command, the “Edge detection remote” which has possibly been set to “activated” is inactive. When changing operation modes, this might cause deviating behaviour as for operation commands OPEN, CLOSE.
	6	Reserve	
	7	EMERGENCY STOP	Activates the EMERGENCY STOP function.

Byte	Bit	Signal	Signification
1	**Operation blocks**		
	0	Local controls disabled	Actuator operation via the local controls is disabled via this signal in case of a programmed block of the control unit.
	1	Block for LOCAL in OPEN	Actuator operation via the local controls for an operation in direction OPEN is disabled via this signal in case of a programmed block of the control unit.
	2	Block for LOCAL in CLOSE	Actuator operation via the local controls is disabled for an operation in direction CLOSE via this signal in case of a programmed block of the control unit.
	3	Block for REMOTE in OPEN or CLOSE	Actuator operation from REMOTE is disabled via this signal.
	4	Block for REMOTE in OPEN	Actuator operation from REMOTE in direction OPEN is disabled via this signal.
	5	Block for REMOTE in CLOSE	Actuator operation from REMOTE in direction CLOSE is disabled via this signal.
	6-7	Reserve	
2	**Additional commands**		
	0	Acknowledge failure	Alternative reset mechanism from REMOTE for selected stored failures: • Acknowledgement command for a Torque OPEN or Torque CLOSE exceed fault instead of acknowledgement via an operation command into the opposite direction. • Acknowledgement command for a triggered actuator start monitoring fault instead of a renewed edge in the operation command. • Acknowledgement command for a triggered Phase1, phase 2 or phase 3 failure if the phase failure monitoring was not parametrised with automatic reset.
	1-3	Reserve	
	4	Force LOCAL	This signal enables an alternative REMOTE operation in a special operation mode “Force LOCAL” via additional discrete commands “Force LOCAL STOP”, “Force LOCAL CLOSE” and “Force LOCAL OPEN”. This signal will only become effective if the actuator is in operation mode REMOTE during activation and if local operation has not been disabled. Due to the available signal, the operation mode changes under these conditions to “Force LOCAL”. Control via the discrete operation commands OPEN, CLOSE or via setpoint are not possible from REMOTE as long as this signal is active.
	5	Force LOCAL STOP	Stops the actuator if control via the “Force LOCAL CLOSE” or “Force LOCAL OPEN” is active in operation mode “Force LOCAL”.
	6	Force LOCAL CLOSE	Operates the actuator in operation mode “Force LOCAL” in direction CLOSE. The command is normally executed in push-to-run operation. As soon as a command input has be parametrised with the “Force LOCAL STOP” command, the command will be effective with self-retaining.
	7	Force LOCAL OPEN	Operates the actuator in operation mode “Force LOCAL” in direction OPEN. The command is normally executed in push-to-run operation. As soon as a command input has be parametrised with the “Force LOCAL STOP” command, the command will be effective with self-retaining.

Byte	Bit	Signal	Signification
3	Intermediate positions		
	0	Intermediate pos. 1	Approaching of the programmed intermediate position via the internal positioner.
	1	Intermediate pos. 2	Approaching of the programmed intermediate position via the internal positioner.
	2	Intermediate pos. 3	Approaching of the programmed intermediate position via the internal positioner.
	3	Intermediate pos. 4	Approaching of the programmed intermediate position via the internal positioner.
	4	Intermediate pos. 5	Approaching of the programmed intermediate position via the internal positioner.
	5	Intermediate pos. 6	Approaching of the programmed intermediate position via the internal positioner.
	6	Intermediate pos. 7	Approaching of the programmed intermediate position via the internal positioner.
	7	Intermediate pos. 8	Approaching of the programmed intermediate position via the internal positioner.
4	All	Setpoint high byte	Setpoint 0...1000 ppt,, scaled between end positions CLOSED and OPEN
5	All	Setpoint low byte	
6	All	Reserve	
7	All	Reserve	
8	Digital outputs		
	0	Digital output 1	Activates the digital output of the actuator controls.
	1	Digital output 2	Activates the digital output of the actuator controls.
	2	Digital output 3	Activates the digital output of the actuator controls.
	3	Digital output 4	Activates the digital output of the actuator controls.
	4	Digital output 5	Activates the digital output of the actuator controls.
	5	Digital output 6	Activates the digital output of the actuator controls.
	6	Reserve	
	7	Reserve	
9	All	Analogue output 1 high byte	Transmission of a 16 bit value from the DCS for issuing a current signal at the analogue output of the actuator controls. Scaled in 0...1023 for 4...20 mA.
10	All	Analogue output 1 low byte	
11	All	Reserve	
12	All	Reserve	
13	All	Reserve	
14	All	Reserve	
15	All	Reserve	

4.4 Profinet services

Acyclic data

Actuator controls with Profinet grant access to the contents of the device identification data, the operational information, and the most important parameters for setting and the maintenance information. Access to the data of all actuators connected within the Profinet network is therefore enabled for predictive condition-based maintenance or uniform parameter setting. This acyclic data exchange is performed via UDP with lower priority than the process data exchange.

For integrating device-specific information, data and parameters, accessible via Profinet, into the engineering station, either a Device Type Manager (DTM), Electronic Device Description (EDD) or an FDI package is required depending on the control system.

Information

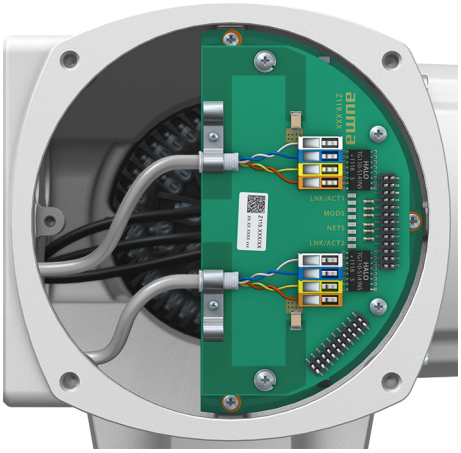
Failure to order actuator controls with this characteristic requires prior enabling and activating the acyclic communication.

5 Profinet functional module

5.1 Weatherproof version

The Profinet functional module is located within the SF electrical connection.

Figure 9: Profinet connection board with connection terminals



DANGER

Electric shock due to presence of hazardous voltage!

Death or serious injury.

→ Disconnect device from the mains before opening.

→ Only replace fuses when not live.

→ Wait for minimum 30 seconds after power cut-off prior to opening the housing.

NOTICE

Electrostatic discharge ESD!

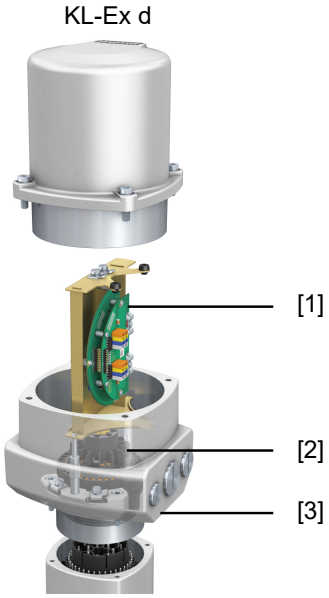
Electronic components may be damaged.

→ Earth both persons and devices.

5.2 Explosion-proof version

The Profinet functional module is located in the terminal compartment of the KL plug-in electrical connection in protection type Ex d.

Figure 10: Profinet connection board with connection terminals within KL-Ex d electrical connection



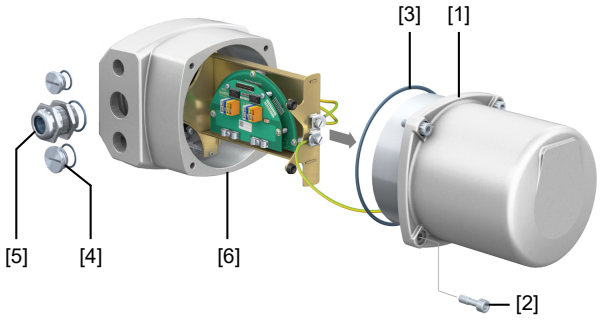
[1]	Mounting frame with connection board	[2]	Terminal carrier with screw-type terminals
[3]	Connection frame		

Short description

KL plug-in electrical connection in protection type Ex d with screw-type terminals for power connection and connection board for control contacts assembled onto a mounting frame. Plug-in connection is made via the connection frame. For cable connection, simply remove the cover. The connection frame with the cable entries remains within the device. The flameproof interior of the connected devices remains sealed.

5.2.1 Open terminal compartment

Figure 11: Open terminal compartment



[1]	Cover (illustration shows KL version in type of protection Ex d)	[2]	Screws for cover
[3]	O-ring	[4]	Blanking plug
[5]	Cable gland (example)	[6]	KL-Ex d connection frame

DANGER

Electric shock due to presence of hazardous voltage!

Death or serious injury.

→ Disconnect device from the mains before opening.

→ Only replace fuses when not live.

→ Wait for minimum 30 seconds after power cut-off prior to opening the housing.

NOTICE

Electrostatic discharge ESD!

Electronic components may be damaged.

→ Earth both persons and devices.

How to proceed

1. Loosen screws [2] and remove cover [1].
2. Insert cable glands suitable for connecting cables.

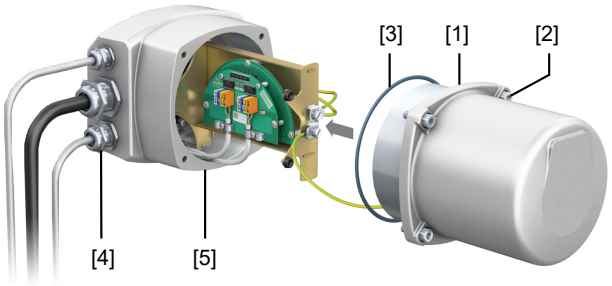
Information: When selecting cable glands observe type of protection with Ex d approval and enclosure protection IP ... (refer to name plate). The IP … enclosure protection stated on the name plate is only ensured if suitable cable glands are used. Thread types and thread sizes are specified on the name plate.

Information: For shielded cables: Use EMC cable glands.

3. Seal unused cable entries with approved plugs suitable for the required protection type Ex d.

5.2.2 Close terminal compartment

Figure 12: Close terminal compartment



[1]	Cover (illustration shows KL version in type of protection Ex d)	[2]	Screws for cover
[3]	O-ring	[4]	Cable gland
[5]	Connection frame		

WARNING

Risk of explosion in case of damage to flameproof enclosure!

Risk of death or serious injury!

→ Handle cover and housing parts with care.

→ Flameproof joints must neither be damaged nor soiled in any way.

→ Do not jam cover during fitting.

How to proceed

1. Clean sealing faces of cover [1] and connection frame [5].

2. For design in flameproof enclosure (Ex d): Preserve joint surfaces with an acid-free corrosion protection agent.
3. Check whether O-ring [3] is in good condition, replace if damaged.
4. Slightly grease the O-ring with acid-free grease (e.g. petroleum jelly) and insert them correctly.
5. Fit cover [1] and fasten screws [2] evenly crosswise. For design in flameproof enclosure (Ex d):

WARNING! Risk of explosion in case of damage to flameproof enclosure!

6. Fasten cable glands and blanking plugs applying the specified torque to ensure the required enclosure protection.

5.3 Fieldbus cables: connect

Figure 13: Profinet connection board with connection terminals

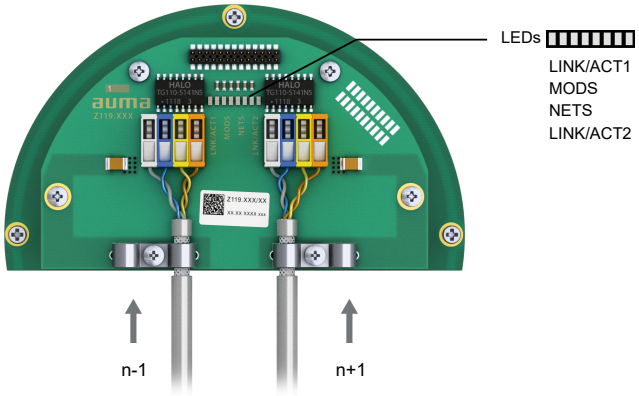
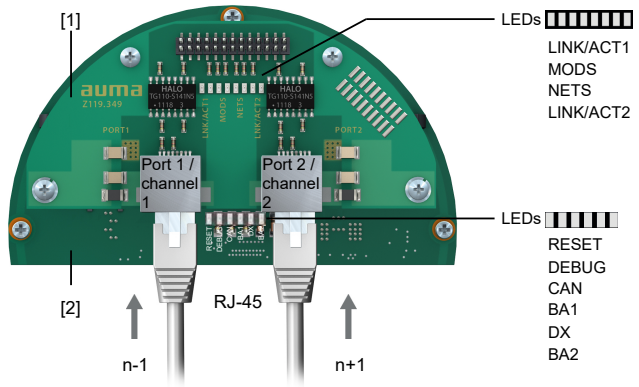


Figure 14: Profinet connection board with RJ-45 connections



[1] Connection board [2] Basic sub-assembly

n–1 Profinet cable from previous device

n+1 Profinet cable to next device

(For line topology or redundant ring/MRP - Media Redundancy Protocol)

Profinet connection is made individually by means of a safe Ethernet-capable insulation displacement connection. The colour coding of connection terminals are matching the Ethernet cable according to Profinet (white/blue/yellow/orange).

Table 9: Connecting data

Connection capacity (single strand)	0.2 mm² – 0.34 mm² / AWG 24 – AWG 22
Connection capacity (stranded)	0.2 mm² – 0.34 mm² / AWG 24 – AWG 22

1. Remove cable sheathing and clamp shield under strain relief.

2. Connect cables to connection terminals. For this, use a small screwdriver to lift or push down the levers.

Table 10: Connection terminal assignment

Signal	Function	Colour of wire insulation
TD +	Transmit Data +	Yellow
TD –	Transmit Data –	Orange
RD +	Receive Data +	White
RD –	Receive Data –	Blue

5.4 Indications (indication and diagnostic LEDs)

Description of LEDs on connection board

Table 11: Signification of the MODS LEDs

MODS (Module status)	Status	Explanation
Red LED: off + Green LED off	Not Initialised	No voltage or module in “SETUP or “NW_INIT “status
Green LED: illuminated	Normal operation	The module has aborted “NW_INIT status
Green LED: 1 brief pulse	Diagnostic events	Diagnostic events available
Red LED illuminated ´+ LED NETS red off	Exception error	Device in “EXCEPTION status“
Red LED off´+ LED NETS illuminated	Fatal event	Internal device error
Green/Red LEDs alternately blinking	Firmware update	Do not cut power supply!

Table 12: Signification of the NETS LEDs

NETS (network status)	Status	Explanation
Red LED: off + Green LED off	Offline	Absence of power supply or no connection to I/O controller
Green LED: illuminated	RUN	Connection to I/O controller available
Green LED: 1 brief pulse	STOP	Connection to I/O controller available. However, I/O controller is in STOP status or I/O data is incorrect.
Green LED: blinking	Blink	Is used by engineering tools to identify the device within the Profinet network
Red LED: illuminated	Fatal event	Internal error, combined with “MODS” LED.
Red LED: 1 brief pulse	Station name error	Device name (station name) not yet set
Red LED: 2 brief pulses	IP address error	IP address not yet set
Red LED: 3 brief pulses	Configuration error	Identification incorrect

Table 13: Signification of the LINK/ACT LEDs

LINK/ACT1, LINK/ACT2 (Link/Activity Port 1 / 2)	Explanation
Red LED: off + Green LED off	No Ethernet network connection and no data communication on port 1 or 2
Green LED: illuminated	Port 1 or 2 are correctly connected to the Ethernet network, however without active data communication
Green LED: blinking	Port 1 or 2 are correctly connected to the Ethernet network and data communication is available
LED: Red	No function

Description of LEDs on basis sub-assembly

Table 14: Signification of the LEDs on the basic sub-assembly

LED	Explanation
LED **RESET**: illuminated	No Reset active, power supply available

LED	Explanation
DEBUG LED: illuminated	Sub-assembly in Reset status
DEBUG LED: 1 brief pulse	Sub-assembly in initialisation status
DEBUG LED: briefly blinking (1 Hz)	Normal status (Profinet application active)
DEBUG LED: slowly blinking (5 Hz)	Sub-assembly in bootloader mode
CAN LED: illuminated	CAN communication to the logic basis sub-assembly OK
BA1 LED or **BA2** LED: is illuminated	Data communication active, network connection via port 1 or port 2
DX LED: illuminated	“Data Exchange” via Profinet

6 Corrective actions

6.1 Diagnostics

Via the local controls menu or the i-matic explorer, various states of the Profinet interface can be checked.

The parameters relevant for the Profinet interface can be found under Menu > Actual values/diagnosis > Interface > Profinet

Table 15: Diagnostic parameters

Indication	Signification	
Status	Profinet communication status/module status of the interface sub-assembly	
	Setup:	Initialisation of Profinet module in progress
	Network init:	Network initialisation of Profinet module in progress
	Wait process:	Device waiting for I/O connection to I/O controller
	Idle I/O:	Connected I/O controller in STOP mode or has not yet sent valid data
	Process active I/O:	Connection to an I/O controller active and valid data received
	Error:	Configuration data is inconsistent or starting parameters faulty
	Exception:	Serious error or unexpected behaviour of Profinet module or Profinet application detected
Device name	Profinet device name. Shows the device name currently assigned to the device.	
IP address	IP address	
Subnet mask	Subnet mask	
Gateway	Gateway	
MAC address module	MAC address of Profinet module	
MAC address port 1	MAC address of Profinet port 1	
MAC address port 2	MAC address of Profinet port 2	
Firmware version module	Profinet firmware version module	

6.2 Troubleshooting

In case of problems with Profinet communication, the actuator controls provide important information on trouble-shooting via the display (menu).

The indication and diagnostic LEDs on the Profinet board can also be used as support. Assumption: Port 1/channel 1 is used as uplink in direction of the I/O controller (no ring topology).

Table 16: Troubleshooting

			Causes and remedies
1	Can the actuator be controlled via Profinet?	Yes	No fault
		No	Continue with step 2

			Causes and remedies
2	Check communication status	Channel 1 DataEx or LED [DX] on Profinet board is illuminated	Valid telegrams to the own address: Connection to I/O controller active and valid data received by I/O controller
			If yes → Continue with 3 If no → Continue with Channel 1 activity
		Channel 1 activity (uplink port) or (LINK/ACT1) LED is blinking on Profinet connection board	Activity of communication interface on channel/port 1: Valid telegrams, however not necessarily sent to the own address
			If yes → Continue with module status If no → Continue with network status
		Channel 2 activity or (LINK/ACT2)LED on Profinet connection board is blinking	Activity of communication interface on channel/port 2: Valid telegrams, however not necessarily sent to the own address
			If yes → Network connection to subsequent device available, If no → Continue with network status
		Network status Link port 1 or (LINK/ACT1) LED on Profinet board is illuminated in green	If yes → Network connection in direction of I/O controller available, no communication → Continue with module status
			If no → No network connection available, check cables and connection
		Network status Link port 2 or (LINK/ACT2) LED on Profinet board is illuminated in green	If yes → Network connection to subsequent device available, no communication
			If no → No network connection available, check cables and connection
		Module status	Wait process: Device waiting for I/O connection to I/O controller → Correct parameter data within I/O controller → Check addressing
			Idle I/O: Connected I/O controller in STOP mode or I/O controller has not yet sent valid data → I/O Check controller configuration
			Process Active I/O → Continue with 3.
			Error: Configuration data is inconsistent or starting parameters faulty → I/O Check controller configuration
			Exception: Serious error or unexpected behaviour of Profinet module or Profinet application detected
3	Operation via push button of the local controls possible?	Yes	• I/O controller does not issue an operation command • I/O controller sends wrong operation command → Check program of DCS
		No	Torque faults, thermal faults or internal faults → Check logic board, motor control and motor

7 Technical data

7.1 Information

The following tables include standard and optional features. For detailed information on the customer-specific version, refer to the order-related data sheet of the respective actuator.

7.2 Profinet interface

Table 17: Troubleshooting

General data of the Profinet interface	
Profinet ident no.	0x013F; 0x0001
DAP (Device Access Point)	0x80010000
Conformance class	CC-B (Conformance Class B) for the Profinet application of the DREHMO actuator controls CC-C (Conformance Class C) for the integral switch function
Netload Class	III
Device diagnostics via Ethernet	Via TCP/IP and integral web server possible Via FDI package & software for diagnostics/commissioning (e.g. Siemens PDM, Emerson AMS)
Device integration	Via GSD (ML) file (available for download at www.drehmo.com)

Table 18: Troubleshooting

Commands and signals of the Profinet interface	
Process representation output (command signals)	OPEN, STOP, CLOSE, position setpoint, RESET, EMERGENCY operation command, enable local controls, Interlock OPEN/CLOSE, PVST
Process representation input (feedback signals)	• End positions OPEN, CLOSED • Actual position value • Actual torque value, requires combined sensor within the actuator • Selector switch in position LOCAL/REMOTE • Running indication (directional) • Torque switches OPEN, CLOSE • Limit switches OPEN, CLOSED • Manual operation by handwheel or via local controls • Analogue (2) and digital (4) customer inputs
Process representation input (fault signals)	• Motor protection tripped • Torque switch tripped in mid-travel, one phase missing • Failure of analogue customer inputs
Behaviour on loss of communication	The behaviour of the actuator is programmable: • Stop in current position • Travel to end position OPEN or CLOSED • Travel to any intermediate position • Execute last received operation command

Index

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