DREHMO
VALVE ACTUATORS

# Profibus interface
# for i-matic actuators
# Electric version iMC

Supplementary operation instructions
for devices with Profibus interface

PROFIBUS®

**Operation instructions**
Assembly and commissioning

**Note:**

These operation instructions are only valid in combination with the following instructions:

- Operation instructions pertaining to the actuator 383899 or 383905 (Ex)
- Instruction of actuator controls iMC 383352

Safely store these operation instructions for future use.

# Table of contents


**1 Safety ... 4**

1.1 Prerequisites for the safe handling of the product ... 4

1.2 Range of application ... 5

1.3 Commissioning (electrical connection) ... 5

1.4 Warnings and notes ... 5

**2 Structure of the Profibus interface ... 6**

2.1 Base board with interface board ... 6

2.2 Base board with Profibus functionality ... 6

2.3 Addressing ... 6

**3 Data interface ... 7**

3.1 Cyclic driver interface ... 7

3.1.1 Cyclic driver interface for PP1 and PP2 modules ... 7

3.1.2 Cyclic driver interface for PP3 and PP4 modules ... 14

3.1.3 Cyclic driver interface for PP5 and PP6 modules ... 18

3.1.4 Cyclic driver interface for PP7 and PP8 modules ... 24

3.1.5 Fail safe function ... 31

3.1.6 Fault indications ... 31

3.2 Acyclic driver interface ... 31

**4 Electrical connection ... 32**

4.1 Mains connection ... 32

4.2 Fieldbus connection outside the explosive atmosphere ... 32

4.2.1 Connection in copper ... 32

4.2.2 Shield connection ... 33

4.2.3 Active bus termination ... 33

4.2.4 Connection of FOC systems ... 33

4.3 Fieldbus connection in potentially explosive atmospheres ... 33

4.3.1 Terminal box Ex e with connection terminals on top head rail ... 33

4.3.2 KP/KPH electrical connection ... 35

4.3.3 KT/KM electrical connection ... 39

4.3.4 Parking frame ... 45

**5 Troubleshooting and diagnostics ... 46**

5.1 Troubleshooting ... 46

5.2 Connection status diagnostics at the LCD ... 46

5.3 Status diagnostics DP-V0 connection establishment ... 47

**6 Additional conventional inputs ... 48**

**7 Technical data of the fieldbus interface ... 49**

**8 Sizing guidelines ... 50**

8.1 Cable system ... 50

8.2 Optical fibre systems ... 50

8.3 Bus topology with segmentation ... 50

8.4 Termination resistors ..... 51
8.5 Shield connection of bus cables for copper cables ..... 51
8.6 Overvoltage protection ..... 51
8.7 Device Master Data (GSD) ..... 52
**9 Literature ..... 53**
**Index ..... 54**

# 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 charging**

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.

Any device modification requires prior written consent of the manufacturer.

## 1.2 Range of application

DREHMO actuators 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 used to connect the actuator to the DCS via Profibus DP based on RS-485 bus physics.

## 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 Structure of the Profibus interface

## 2.1 Base board with interface board

On the iMC01 base board of the actuator controls, the Profibus interface is installed as separate interface board. The interface board can be equipped with two different variants:

- Single channel version: with just one ASIC and respective galvanically isolated RS-485 bus connection.
- Redundant version: with two ASICS and respective galvanically isolated RS-485 bus connections.

The Profibus sub-assembly is equipped with an own 32 bit µ-controller. It includes Profibus protocol handling of ASICs and manages the interaction of Profibus connections in redundant version. The data interface to the microcontroller of the base board is made via CAN.

## 2.2 Base board with Profibus functionality

The Profibus functionality is an integral part of the iMC11 base board. The microprocessor of the iMC11 base board directly takes over the protocol handling of ASICs. Only the redundant equipment variant is available. The availability of the redundant channel must be enabled by means of the device key.

## 2.3 Addressing

As standard, the actuators are supplied with address 126. Changing the address settings is made as follows:

- Via menu navigation on the device.
- Menu navigation via PC or via the mobile app in combination with the local Bluetooth interface respectively under the following menu item "Parameters > DCS > Add on board > Profibus".
- Via the SetSlaveAddress Profibus service.

The preset address is saved in non-volatile memory on the base board within the EEPROM.

# 3 Data interface

Besides the basic cyclic DP-V0 protocol, the Profibus board also supports extended services of Profibus DP-V1 and DP-V2 protocols. Besides the classic cyclic data for transmission of operation commands and actuator signals, additional information can be requested from or sent to the actuator with these enhanced protocols during acyclic operation. This includes for example parametrisation data, operational and diagnostic data or the electronic device ID.

The availability of these extended services must be enabled via the device key of actuator controls. Enabling can be made retrospectively by loading the respective device key if this was not done at the time of delivery. Enabling DP-V1 or DP-V2 can be read on the device via “Actual values/diagnostics > Add on board > Profibus > Bus profile” (DP-V2 includes DP-V1, DP-V1 includes DP-V0).

For Profibus functions, various parameters are available in menu item ”Parameters > DCS > Add on board > Profibus“ to adapt the signal behaviour. Please refer to the operation instructions pertaining to the actuators controls for further details.

## 3.1 Cyclic driver interface

Cyclic data are available in different data models comprising respectively two different modules. The modules with identical data module only differ with regard to the data consistency specified in the GSD file. Modules with odd numbers are consistent across their overall length. Modules with event numbers are specified as byte consistent. With regard to consistency treatment, observe the operation instructions of the automation system used.

The position value status specified in the subsequent tables is coded as follows:

*Table 1:* Coding status – according to PA profile

| Quality | | Sub status | | | | Thresholds | | Description |
|---|---|---|---|---|---|---|---|---|
| $2^7$ | $2^6$ | $2^5$ | $2^4$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ | |
| 0 | 0 | | | | | | | Rejected |
| 0 | 1 | | | | | | | Unsafe |
| 1 | 0 | | | | | | | Good (not cascaded) |
| 1 | 1 | | | | | | | Good (cascaded) |

### 3.1.1 Cyclic driver interface for PP1 and PP2 modules

*Table 2:* Process representations 1, 2 – Inputs (PRI) → Status data (10 bytes)

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 0 | all | Actual position value (high byte) | Current actual actuator position within the range of 0 – 1 000 ppt, scaled between the learnt end positions CLOSED and OPEN. |
| 1 | all | Actual position value (low byte) | |
| 2 | all | Actual position value status | Status according to PA profile Cyclic driver interface [▶ 7] |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 3 | 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 | Phase failure | Occurrence of a least one of the signals Phase 1 Phase 2 or Phase 3 failure. |
| | 3 | 24 V internal failure | The AC voltage required for the generation of the internally required AC 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. |
| | 4 | 24 V external failure | The external 24 V DC supply is not available. |
| | 5 | Torque OPEN | Torque sensing provides a value that exceeds the programmed tripping torque OPEN. The signal will be sent irrespective of further parametrisation. |
| | 6 | Torque CLOSE | Torque sensing provides a value that exceeds the programmed tripping torque CLOSE. The signal will be sent irrespective of further parametrisation. |
| | 7 | 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. |
| 4 | 0 | Actuator runs OPEN | The power unit of the actuator is controlled in direction OPEN. |
| | 1 | Actuator runs CLOSE | The power unit of the actuator is controlled in direction CLOSE. |
| | 2 | Final position OPEN | The actuator is at a position outside the operating range at or beyond the learnt position OPEN. |
| | 3 | Final position CLOSED | The actuator is at a position outside the operating range at or beyond the learnt position CLOSED. |
| | 4 | Torque fault OPEN | The torque sensing provides a value that exceeds the programmed tripping torque OPEN and the actuator is in a position outside the operating range at or beyond the learnt position OPEN. |
| | 5 | Torque fault CLOSE | The torque sensing provides a value that exceeds the programmed tripping torque CLOSE and the actuator is in a position outside the operating range at or beyond the learnt position CLOSED. |
| | 6 | Thermal overload tripping | 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. |
| | 7 | REMOTE mode | The actuator is in operation mode REMOTE and can be operated from Remote. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 5 | 0 | LOCAL mode | The actuator is in operation mode LOCAL. The actuator can be operated locally. Local operation can be disabled from Remote by an enabling mechanism. For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 1 | Running LOCAL | The actuator is in LOCAL mode and the power unit is being controlled. |
| | 2 | Activation of discrete commands | Actuator can be operated via Profibus by means of “Operation command OPEN” or "Operation command CLOSE” (output bit “AUTOMATIC” = 0). |
| | 3 | Operation mode LEARN | The actuator is in operation mode LEARN. The actuator can be operated locally. The self-retaining, if parametrised, of the local operation command is deactivated in this operation mode. The sensor calibration can be made for limit and torque sensing. Local operation can be disabled from Remote by an enabling mechanism. Fail safe and ESD mechanisms are not available in this operation mode! Different access rights apply for this operation mode. |
| | 4 | | always 0, reserved for future extensions. |
| | 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 | Torque bypass in end position OPEN | Torque bypass in end position OPEN is parametrised. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 6 | 0 | Torque bypass in end position CLOSED | Torque bypass in end position CLOSED is parametrised. |
| | 1 | Operation mode not REMOTE | The actuator is not in operation mode REMOTE. Operation via Remote is not possible. CAUTION: For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 2 | 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. |
| | 3 | Fail safe behaviour | Parameter setting fail safe behaviour: 0 = stop actuator, 1 = approach fail safe |
| | 4 | 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. |
| | 5 | Intermediate pos. 1 | Indication of the intermediate position according to the set signalling behaviour. |
| | 6 | Intermediate pos. 2 | Indication of the intermediate position according to the set signalling behaviour. |
| | 7 | Actuator start monitoring | Despite controlling the power unit, the actuator controls do not detect an output drive movement. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 7 | 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 warning torque CLOSE. The signal will be sent irrespective of further parametrisation. |
| | 2 | No setpoint signal | No valid setpoint is available for the internal positioner. |
| | 3 | Hardware fault | A fault during detection or current test of hardware components has occurred and the hardware was therefore considered as defective. |
| | 4 | 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. |
| | 5 | 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.<br>• The fault signal can be reset from REMOTE in connection with a Profibus 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.<br>• The fault signal can be reset at the device using the System > Reset function or by an On-Off switching cycle. The fault type can be viewed in the local menu System entry under Actual values/ diagnosis.<br>• 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. |
| | 6 | 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:<br>• Accum. valve stroke for open-close actuators<br>• Accum. operation cycles<br>• Thermal ageing<br>• Mechanical ageing |
| | 7 | | always 0, reserved for future extensions. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 8 | 0 | Running time monitoring | OR operation for the two individual signals “Op.time monit. OPEN “ and “Op.time monit. CLOSE”. |
| | 1 | | always 0, reserved for future extensions. |
| | 2 | Handwheel operation | An output drive movement without electronic control is present. |
| | 3 | Rotary direction monitoring | When controlling the power unit, the actuator controls detect an output drive movement into the wrong direction of rotation. |
| | 4 | Data traffic on channel 1 | Valid data traffic has been detected on channel 1 of the connected fieldbus system (baud rate found). |
| | 5 | Data traffic on channel 2 | Valid data traffic has been detected on channel 2 of the connected fieldbus system (baud rate found). |
| | 6 | 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. |
| | 7 | 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. |
| 9 | all | Actual torque value | Output of the current torque value at output drive. Indication of the value in percent of the actuator nominal torque (0 % – 100 %). |

*Table 3:* Process representations 1, 2 – outputs (PRO) → control data (4 bytes)

| Byte | Bit | Signal | Signification |
|---|---|---|---|
| 0 | all | Position setpoint (high byte) | Setpoint 0 – 1,000 ppt, scaled between end positions CLOSED and OPEN. |
| 1 | all | Position setpoint (low byte) | |
| 2 | 0 | Acknowledge failure | Alternative reset mechanism from REMOTE for selected stored failures:<br>• Acknowledgement command for a Torque OPEN or Torque CLOSE exceed fault instead of acknowledgement via an operation command into the opposite direction.<br>• Acknowledgement command for a triggered actuator start monitoring fault instead of a renewed edge in the operation command.<br>• Acknowledgement command for a triggered phase1, phase 2 or phase 3 failure if the phase failure monitoring was not parametrised with automatic reset. |

| Byte | Bit | Signal | Signification |
|---|---|---|---|
| 3 | 0 | AUTOMATIC | Activates the integral 3-point positioner and thus enables setpoint operation if the “Internal positioner” parameter within the electronic name plate of the actuator controls is set to Enabled V005. |
| | 1 | 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 “Internal positioner” parameter within the electronic name plate of the actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 2 | 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 actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 3 | 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 actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 4 | Emergency shutdown (ESD) | Activates the Emergency shutdown (ESD) of the actuator provided it has not 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 the push-to-run operation, even if self-retaining has been programmed. For the ESD command, the Edge detection remote is inactive, is spite of possibly having been set to “activated”. When changing operation modes, this might cause deviating behaviour as for operation commands OPEN or CLOSE. |
| | 5 | Stepping mode | Activates the stepping mode for operating time extension if the process parameter “Step. mode pulse source” is programmed to External. |
| | 6 | Enabling local controls | Actuator operation via the local controls is enabled via this signal in case of a programmed block of the control unit. |
| | 7 | Fieldbus channel change | Changes the active channel in case of an available redundant fieldbus circuit for an edge from logic 0 to logic 1, should no valid data exchange be available on the further channel. |

### 3.1.2 Cyclic driver interface for PP3 and PP4 modules

*Table 4:* Process representations 3, 4 – Inputs (PRI) → Status data (8 bytes)

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 0 | 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 | | |
| | 3 | | |
| | 4 | Actuator runs OPEN | The power unit of the actuator is controlled in direction OPEN. |
| | 5 | Actuator runs CLOSE | The power unit of the actuator is controlled in direction CLOSE. |
| | 6 | 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. |
| | 7 | 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 | 0 | Thermal overload tripping | 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. |
| | 1 | D/S: Collective fault 1<br>A: Phase failure[1)] | D/S: 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.<br>A: Occurrence of a least one of the signals Phase 1 Phase 2 or Phase 3 failure. |
| | 2 | REMOTE mode | The actuator is in operation mode REMOTE and can be operated from Remote. |
| | 3 | LOCAL mode | The actuator is in operation mode LOCAL. The actuator can be operated locally. Local operation can be disabled from Remote by an enabling mechanism. For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 4 | End position OPEN signal | Signals end position OPEN according to the End position indication parameter. Options: “Position” or “acc. to type of seating”. |
| | 5 | End position CLOSED signal | Signals end position CLOSED according to the End position indication parameter. Options: “Position” or “acc. to type of seating”. |
| | 6 | Torque warning OPEN | Torque sensing provides a value that exceeds the programmed warning torque OPEN. The signal will be sent irrespective of further parametrisation. |
| | 7 | Torque warning CLOSE | Torque sensing provides a value that exceeds the programmed warning torque CLOSE. The signal will be sent irrespective of further parametrisation. |
| 2 | all | Actual position value (high byte) | Current actual actuator position within the range of 0 – 1 000 ppt, scaled between the learnt end positions CLOSED and OPEN. |
| 3 | all | Actual position value (low byte) | |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 4 | 0 | | |
| | 1 | Operation mode not REMOTE | The actuator is not in operation mode REMOTE. Operation via Remote is not possible. CAUTION: For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 2 | Thermal overload tripping | 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. |
| | 3 | Phase failure | Occurrence of a least one of the signals Phase 1 Phase 2 or Phase 3 failure. |
| | 4 | Torque signal OPEN | Torque sensing provides a value that exceeds the programmed tripping torque OPEN. This signal will always occur in intermediate positions; however, in the end position, it will only occur if the “Torque indication” parameter has been set to Ind. in end position. |
| | 5 | Torque signal CLOSE | Torque sensing provides a value that exceeds the programmed tripping torque CLOSE. This signal will always occur in intermediate positions; however, in the end position, it will only occur if the “Torque indication” parameter has been set to Ind. in end position. |
| | 6 | CLEAR active channel | All host outputs of the active fieldbus channel are reset in the device (slave) – GlobalControlClear. |
| | 7 | | |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 5 | 0 | | |
| | 1 | 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. |
| | 2 | 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. |
| | 3 | Sensor fault | |
| | 4 | 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.<br>• The fault signal can be reset from REMOTE in connection with a Profibus 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.<br>• The fault signal can be reset at the device using the System > Reset function or by an On-Off switching cycle. The fault type can be viewed in the local menu System entry under Actual values/ diagnosis.<br>• 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. |
| | 5 | | |
| | 6 | Handwheel operation | An output drive movement without electronic control is present. |
| | 7 | Running time monitoring | OR operation for the two individual signals “Op.time monit. OPEN “ and “Op.time monit. CLOSE”. |
| 6 | 0 – 3 | | |
| | 4 | Actuator runs OPEN | The power unit of the actuator is controlled in direction OPEN. |
| | 5 | Actuator runs CLOSE | The power unit of the actuator is controlled in direction CLOSE. |
| | 6 | Running LOCAL OPEN | The actuator is in LOCAL mode and the power unit is controlled in direction OPEN. |
| | 7 | Running LOCAL CLOSE | The actuator is in LOCAL mode and the power unit is controlled in direction CLOSE. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 7 | 0 | D/S: Collective fault 2<br>A: DigIn 1[1)] | D/S: 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.<br>A: Status of digital input 1. |
| | 1 | Dig. input 2 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 2 | Dig. input 3 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 3 | Dig. input 4 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 4 | Dig. input 1 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 5 – 6 | | |
| | 7 | 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:<br>• Accum. valve stroke for open-close actuators<br>• Accum. operation cycles<br>• Thermal ageing<br>• Mechanical ageing |

1) Signal content depends on used GSD file:
D/S → DREHMO/Sipos
A → AUMA

*Table 5:* Process representations 3, 4 – outputs (PRO) → control data (4 bytes)

| Byte | Bit | Signal | Signification |
|---|---|---|---|
| 0 | 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 actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control 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 actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 2 | AUTOMATIC | Activates the integral 3-point positioner and thus enables setpoint operation if the “Internal positioner” parameter within the electronic name plate of the actuator controls is set to Enabled V005. |
| | 3 | Acknowledge failure | Alternative reset mechanism from REMOTE for selected stored failures:<br>• Acknowledgement command for a Torque OPEN or Torque CLOSE exceed fault instead of acknowledgement via an operation command into the opposite direction.<br>• Acknowledgement command for a triggered actuator start monitoring fault instead of a renewed edge in the operation command.<br>• Acknowledgement command for a triggered phase1, phase 2 or phase 3 failure if the phase failure monitoring was not parametrised with automatic reset. |
| | 4 – 7 | | |
| 1 | 0 – 7 | | |
| 2 | all | Position setpoint (high byte) | Setpoint 0 – 1,000 ppt, scaled between end positions CLOSED and OPEN. |
| 3 | all | Position setpoint (low byte) | |

### 3.1.3 Cyclic driver interface for PP5 and PP6 modules

*Table 6:* Process representations 5, 6 – Inputs (PRI) → Status data (15 bytes)

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 0 | all | Actual position value (high byte) | Current actual actuator position within the range of 0 – 1 000 ppt, scaled between the learnt end positions CLOSED and OPEN. |
| 1 | all | Actual position value (low byte) | |
| 2 | all | Actual position value status | Status according to PA profile Cyclic driver interface [▶ 7] |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 3 | 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 | Phase failure | Occurrence of a least one of the signals Phase 1 Phase 2 or Phase 3 failure. |
| | 3 | 24 V internal failure | The AC voltage required for the generation of the internally required AC 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. |
| | 4 | 24 V external failure | The external 24 V DC supply is not available. |
| | 5 | Torque OPEN | Torque sensing provides a value that exceeds the programmed tripping torque OPEN. The signal will be sent irrespective of further parametrisation. |
| | 6 | Torque CLOSE | Torque sensing provides a value that exceeds the programmed tripping torque CLOSE. The signal will be sent irrespective of further parametrisation. |
| | 7 | 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. |
| 4 | 0 | Actuator runs OPEN | The power unit of the actuator is controlled in direction OPEN. |
| | 1 | Actuator runs CLOSE | The power unit of the actuator is controlled in direction CLOSE. |
| | 2 | Final position OPEN | The actuator is at a position outside the operating range at or beyond the learnt position OPEN. |
| | 3 | Final position CLOSED | The actuator is at a position outside the operating range at or beyond the learnt position CLOSED. |
| | 4 | Torque fault OPEN | The torque sensing provides a value that exceeds the programmed “Tripping torque OPEN” and the actuator is in a position outside the operating range at or beyond the learnt position OPEN. |
| | 5 | Torque fault CLOSE | The torque sensing provides a value that exceeds the programmed “Tripping torque CLOSE” and the actuator is in a position outside the operating range at or beyond the learnt position CLOSED. |
| | 6 | Thermal overload tripping | 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. |
| | 7 | REMOTE mode | The actuator is in operation mode REMOTE and can be operated from Remote. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 5 | 0 | LOCAL mode | The actuator is in operation mode LOCAL. The actuator can be operated locally. Local operation can be disabled from Remote by an enabling mechanism. For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 1 | Running LOCAL | The actuator is in LOCAL mode and the power unit is being controlled. |
| | 2 | Activation of discrete commands | Actuator can be operated via Profibus by means of “Operation command OPEN” or "Operation command CLOSE” (output bit “AUTOMATIC” = 0). |
| | 3 | Operation mode LEARN | The actuator is in operation mode LEARN. The actuator can be operated locally. The self-retaining, if parametrised, of the local operation command is deactivated in this operation mode. The sensor calibration can be made for limit and torque sensing. Local operation can be disabled from Remote by an enabling mechanism. Fail safe and ESD mechanisms are not available in this operation mode! Different access rights apply for this operation mode. |
| | 4 | | always 0, reserved for future extensions. |
| | 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 | Torque bypass in end position OPEN | Torque bypass in end position OPEN is parametrised. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 6 | 0 | Torque bypass in end position CLOSED | Torque bypass in end position CLOSED is parametrised. |
| | 1 | Operation mode not REMOTE | The actuator is not in operation mode REMOTE. Operation via Remote is not possible. CAUTION: For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 2 | 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. |
| | 3 | Fail safe behaviour | Parameter setting fail safe behaviour:<br>0 = stop actuator, 1 = approach fail safe |
| | 4 | 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. |
| | 5 | Intermediate pos. 1 | Indication of the intermediate position according to the set signalling behaviour. |
| | 6 | Intermediate pos. 2 | Indication of the intermediate position according to the set signalling behaviour. |
| | 7 | Actuator start monitoring | Despite controlling the power unit, the actuator controls do not detect an output drive movement. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 7 | 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 warning torque CLOSE. The signal will be sent irrespective of further parametrisation. |
| | 2 | No setpoint signal | No valid setpoint is available for the internal positioner. |
| | 3 | Hardware fault | A fault during detection or current test of hardware components has occurred and the hardware was therefore considered as defective. |
| | 4 | 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. |
| | 5 | 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.<br>• The fault signal can be reset from REMOTE in connection with a Profibus 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.<br>• The fault signal can be reset at the device using the System > Reset function or by an On-Off switching cycle. The fault type can be viewed in the local menu System entry under Actual values/ diagnosis.<br>• 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. |
| | 6 | 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:<br>• Accum. valve stroke for open-close actuators<br>• Accum. operation cycles<br>• Thermal ageing<br>• Mechanical ageing |
| | 7 | | |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 8 | 0 | Running time monitoring | OR operation for the two individual signals “Op.time monit. OPEN “ and “Op.time monit. CLOSE”. |
| | 1 | | always 0, reserved for future extensions. |
| | 2 | Handwheel operation | An output drive movement without electronic control is present. |
| | 3 | Rotary direction monitoring | When controlling the power unit, the actuator controls detect an output drive movement into the wrong direction of rotation. |
| | 4 | Data traffic on channel 1 | Valid data traffic has been detected on channel 1 of the connected fieldbus system (baud rate found). |
| | 5 | Data traffic on channel 2 | Valid data traffic has been detected on channel 2 of the connected fieldbus system (baud rate found). |
| | 6 | 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. |
| | 7 | 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. |
| 9 | all | Actual torque value | Output of the current torque value at output drive. Indication of the value in percent of the actuator nominal torque (0 % – 100 %). |
| 10 | all | Analogue input 1 (high byte) | 0...1000 ppt of analogue input 1, scaled between 4 – 20 mA (high byte). |
| 11 | all | Analogue input 1 (low byte) | 0...1000 ppt of analogue input 1, scaled between 4 – 20 mA (low byte). |
| 12 | all | Analogue input 2 (high byte) | 0...1000 ppt of analogue input 2, scaled between 4 – 20 mA (high byte). |
| 13 | all | Analogue input 2 (low byte) | 0...1000 ppt of analogue input 2, scaled between 4 – 20 mA (low byte). |
| 14 | 0 | Dig. input 1 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 1 | Dig. input 2 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 2 | Dig. input 3 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 3 | Dig. input 4 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 4 – 7 | | |

*Table 7:* Process representations 5, 6 – outputs (PRO) → control data (4 bytes)

| Byte | Bit | Signal | Signification |
|---|---|---|---|
| 0 | all | Position setpoint (high byte) | Setpoint 0 – 1,000 ppt, scaled between end positions CLOSED and OPEN. |
| 1 | all | Position setpoint (low byte) | |
| 2 | 0 | Acknowledge failure | Alternative reset mechanism from REMOTE for selected stored failures:<br>• Acknowledgement command for a Torque OPEN or Torque CLOSE exceed fault instead of acknowledgement via an operation command into the opposite direction.<br>• Acknowledgement command for a triggered actuator start monitoring fault instead of a renewed edge in the operation command.<br>• Acknowledgement command for a triggered phase1, phase 2 or phase 3 failure if the phase failure monitoring was not parametrised with automatic reset. |

| Byte | Bit | Signal | Signification |
|---|---|---|---|
| 3 | 0 | AUTOMATIC | Activates the integral 3-point positioner and thus enables setpoint operation if the “Internal positioner” parameter within the electronic name plate of the actuator controls is set to Enabled V005. |
| | 1 | 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 “Internal positioner” parameter within the electronic name plate of the actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 2 | 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 actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 3 | 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 actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 4 | Emergency shutdown (ESD) | Activates the Emergency shutdown (ESD) of the actuator provided it has not 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 the push-to-run operation, even if self-retaining has been programmed. For the ESD command, the Edge detection remote is inactive, is spite of possibly having been set to “activated”. When changing operation modes, this might cause deviating behaviour as for operation commands OPEN or CLOSE. |
| | 5 | Stepping mode | Activates the stepping mode for operating time extension if the process parameter “Step. mode pulse source” is programmed to External. |
| | 6 | Enabling local controls | Actuator operation via the local controls is enabled via this signal in case of a programmed block of the control unit. |
| | 7 | Fieldbus channel change | Changes the active channel in case of an available redundant fieldbus circuit for an edge from logic 0 to logic 1, should no valid data exchange be available on the further channel. |

### 3.1.4 Cyclic driver interface for PP7 and PP8 modules

*Table 8:* Process representations 7, 8 – Inputs (PRI) → Status data (11 bytes)

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 0 | all | Actual position value (high byte) | Current actual actuator position within the range of 0 – 1 000 ppt, scaled between the learnt end positions CLOSED and OPEN. |
| 1 | all | Actual position value (low byte) | |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 2 | all | Actual torque value (high byte) | Output of the current torque value at output drive. Indication of the value in percent of the actuator nominal torque (0 % – 100 %). |
| 3 | all | Actual torque value (low byte) | |
| 4 | all | Maintenance consumption variable (high byte) | 0 – 100 % consumption of dynamic maintenance collective of the dynamic maintenance indication: This variable indicates the highest relative consumption with regard to the respective limit value of thermal ageing or mechanical ageing. |
| 5 | all | Maintenance consumption variable (low byte) | |
| 6 | 0 | REMOTE mode | The actuator is in operation mode REMOTE and can be operated from Remote. |
| | 1 | OFF mode | The actuator is in operation mode OFF. The actuator cannot be driven by the motor. CAUTION: For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 2 | LOCAL mode | The actuator is in operation mode LOCAL. The actuator can be operated locally. Local operation can be disabled from Remote by an enabling mechanism. For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 3 | Operation mode not REMOTE | The actuator is not in operation mode REMOTE. Operation via Remote is not possible. CAUTION: For the fail safe and ESD functions, special procedures can be parametrised if required! |
| | 4 | Operation mode LEARN | The actuator is in operation mode LEARN. The actuator can be operated locally. The self-retaining, if parametrised, of the local operation command is deactivated in this operation mode. The sensor calibration can be made for limit and torque sensing. Local operation can be disabled from Remote by an enabling mechanism. Fail safe and ESD mechanisms are not available in this operation mode! Different access rights apply for this operation mode. |
| | 5 | | always 0, reserved for future extensions. |
| | 6 | | |
| | 7 | Handwheel operation | An output drive movement without electronic control is present. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 7 | 0 | Actuator runs OPEN | The power unit of the actuator is controlled in direction OPEN. |
| | 1 | Actuator runs CLOSE | The power unit of the actuator is controlled in direction CLOSE. |
| | 2 | Final position OPEN | The actuator is at a position outside the operating range at or beyond the learnt position OPEN. |
| | 3 | Final position CLOSED | The actuator is at a position outside the operating range at or beyond the learnt position CLOSED. |
| | 4 | Torque OPEN | Torque sensing provides a value that exceeds the programmed tripping torque OPEN. The signal will be sent irrespective of further parametrisation. |
| | 5 | Torque CLOSE | Torque sensing provides a value that exceeds the programmed tripping torque CLOSE. The signal will be sent irrespective of further parametrisation. |
| | 6 | 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. |
| | 7 | 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. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 8 | 0 | Hardware fault | A fault during detection or current test of hardware components has occurred and the hardware was therefore considered as defective. |
| | 1 | 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. |
| | 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.<br>• The fault signal can be reset from REMOTE in connection with a Profibus 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.<br>• The fault signal can be reset at the device using the System > Reset function or by an On-Off switching cycle. The fault type can be viewed in the local menu System entry under Actual values/diagnosis.<br>• 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 | Thermal overload tripping | 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. |
| | 4 | Phase failure | Occurrence of a least one of the signals Phase 1 Phase 2 or Phase 3 failure. |
| | 5 | Phase correction failure | A phase sequence cannot be automatically detected. |
| | 6 | 24 V internal failure | The AC voltage required for the generation of the internally required AC 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 | 24 V external failure | The external 24 V DC supply is not available. |

| Byte | Bit | Feedback | Signification |
|---|---|---|---|
| 9 | 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 | Torque warning OPEN | Torque sensing provides a value that exceeds the programmed warning torque OPEN. The signal will be sent irrespective of further parametrisation. |
| | 3 | Torque warning CLOSE | Torque sensing provides a value that exceeds the programmed warning torque CLOSE. The signal will be sent irrespective of further parametrisation. |
| | 4 | Actuator start monitoring | Despite controlling the power unit, the actuator controls do not detect an output drive movement. |
| | 5 | Rotary direction monitoring | When controlling the power unit, the actuator controls detect an output drive movement into the wrong direction of rotation. |
| | 6 | 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:<br>• Accum. valve stroke for open-close actuators<br>• Accum. operation cycles<br>• Thermal ageing<br>• Mechanical ageing |
| | 7 | | always 0, reserved for future extensions. |
| 10 | 0 | Data traffic on channel 1 | Valid data traffic has been detected on channel 1 of the connected fieldbus system (baud rate found). |
| | 1 | Data traffic on channel 2 | Valid data traffic has been detected on channel 2 of the connected fieldbus system (baud rate found). |
| | 2 | 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. |
| | 3 | 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. |
| | 4 | Dig. input 1 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 5 | Dig. input 2 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 6 | Dig. input 3 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |
| | 7 | Dig. input 4 | Status of the specific digital input. The availability of the input depends on the electronic equipment of the actuator. |

*Table 9:* Process representations 7, 8 – outputs (PRO) → control data (4 bytes)

| Byte | Bit | Signal | Signification |
|---|---|---|---|
| 0 | all | Position setpoint (high byte) | Setpoint 0 – 1,000 ppt, scaled between end positions CLOSED and OPEN. |
| 1 | all | Position setpoint (low byte) | |

| Byte | Bit | Signal | Signification |
|---|---|---|---|
| 2 | 0 | Acknowledge failure | Alternative reset mechanism from REMOTE for selected stored failures:<br>• Acknowledgement command for a Torque OPEN or Torque CLOSE exceed fault instead of acknowledgement via an operation command into the opposite direction.<br>• Acknowledgement command for a triggered actuator start monitoring fault instead of a renewed edge in the operation command.<br>• Acknowledgement command for a triggered phase1, phase 2 or phase 3 failure if the phase failure monitoring was not parametrised with automatic reset. |

| Byte | Bit | Signal | Signification |
|---|---|---|---|
| 3 | 0 | AUTOMATIC | Activates the integral 3-point positioner and thus enables setpoint operation if the “Internal positioner” parameter within the electronic name plate of the actuator controls is set to Enabled V005. |
| | 1 | 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 “Internal positioner” parameter within the electronic name plate of the actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 2 | 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 actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 3 | 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 actuator controls is set to Enabled V005, the “AUTOMATIC” bit must be inactive. The signal behaviour can be influenced via further DCS parameters in the Control category. |
| | 4 | Emergency shutdown (ESD) | Activates the Emergency shutdown (ESD) of the actuator provided it has not 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 the push-to-run operation, even if self-retaining has been programmed. For the ESD command, the Edge detection remote is inactive, is spite of possibly having been set to “activated”. When changing operation modes, this might cause deviating behaviour as for operation commands OPEN or CLOSE. |
| | 5 | Stepping mode | Activates the stepping mode for operating time extension if the process parameter “Step. mode pulse source” is programmed to External. |
| | 6 | Enabling local controls | Actuator operation via the local controls is enabled via this signal in case of a programmed block of the control unit. |
| | 7 | Fieldbus channel change | Changes the active channel in case of an available redundant fieldbus circuit for an edge from logic 0 to logic 1, should no valid data exchange be available on the further channel. |

### 3.1.5 Fail safe function

Once the bus failure time predefined by the master has elapsed, the Profibus ASIC issues a fault signal to the main processor. Following the delay time specified for fail safe, this fault signal triggers the fail safe state. Thereafter, the actuator performs the actions in compliance with fail safe settings which can also be parametrised (refer to operation instructions of actuator controls, Fail safe parameters).

### 3.1.6 Fault indications

Resetting fault signals can be made according to the fault in addition to the acknowledgement facility via the acknowledgement bit within the process representation:

- By an operation command in opposite direction: Torque excess, rotary direction monitoring.
- Automatic when fault origin is remedied: all other faults, e.g. motor excess temperature trigger.

## 3.2 Acyclic driver interface

Acyclic parameters can be changed via the MSAC1 and MSAC2 DP-V1 services. The file types used are defined in conformity with Profibus PA.

A list of acyclic data models becomes obsolete since the access via the automation system is typically made either via a device specific EDD (Electronic Device Description) or via a DTM (Device Type Manager - device driver for the FDT Field Device Tool).

EDD and DTM can either be downloaded from the DREHMO website http://www.drehmo.com or requested with the DREHMO Service.

# 4 Electrical connection

## 4.1 Mains connection

**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.

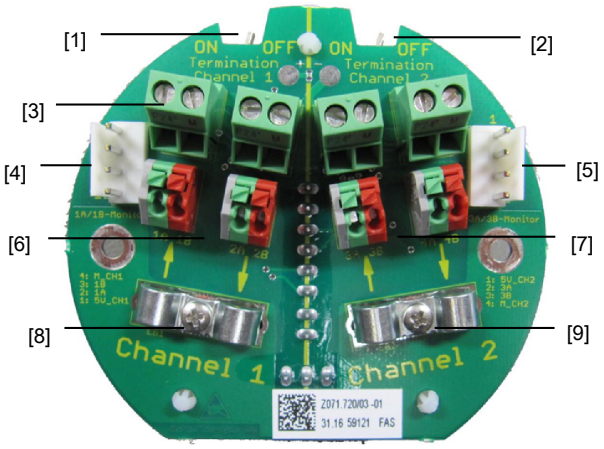
## 4.2 Fieldbus connection outside the explosive atmosphere

The control connection outside the explosive atmosphere affects the electrical versions iMCX0X, iMCX2X, iMCX5X or iMCX7X.

### 4.2.1 Connection in copper

Wiring is made in compliance with the terminal plan attached to the actuator. Connection is made via the bus connection board in the connector. Position of the connection terminals is shown on the figure below.

*Figure 1:* Fieldbus connection board




| | | | |
|---|---|---|---|
| [1] | Bus termination channel 1 | [2] | Bus termination channel 2 |
| [3] | 24 V DC terminals | [4] | Diagnostic channel 1 |
| [5] | Diagnostic channel 2 | [6] | Channel 1 |
| [7] | Channel 2 | [8] | Strain relief terminal channel 1 |
| [9] | Strain relief terminal channel 2 | | |

*Table 10:* Connection data of printed circuit terminals

| **24 V DC terminals** | |
|---|---|
| Type of connection | Screw type connection M3 |
| Tightening torque | 0.5 Nm – 0.6 Nm |
| Dismantling length | 11 mm |

| | |
|---|---|
| Cross section (solid) | 0.14 $mm^2$ – 2.5 $mm^2$ |
| Cross section (stranded) | 0.14 $mm^2$ – 2.5 $mm^2$ |
| Cross section (stranded with wire end sleeve without plastic sleeve) | 0.25 $mm^2$ – 2.5 $mm^2$ |
| **Bus connection terminals** | |
| Type of connection | Spring clamp terminal |
| Dismantling length | 9 mm |
| Cross section (solid) | 0.2 $mm^2$ – 1.5 $mm^2$ |
| Cross section (stranded) | 0.2 $mm^2$ – 1.5 $mm^2$ |
| Cross section (stranded with wire end sleeve without plastic sleeve) | 0.25 $mm^2$ – 1 $mm^2$ |

**NOTICE**

**Electrostatic discharge ESD!**

Electronic components may be damaged.

→ Earth both persons and devices.

### 4.2.2 Shield connection

The strain relief gripper clamps can be used as cable shield support instead of the preferred use of EMC glands.

### 4.2.3 Active bus termination

RS-485 segments must be equipped on both sides with termination resistors to condition bus signals and avoid reflections. Respective wiring with a termination resistor of 220 Ohm is available on the connection board. For the respective devices, switch 1 for channel 1 and switch 2 for channel 2 must be set to “ON” (termination resistor is switched on). If the respective terminator is activated, the respective bus output is isolated from the input to ensure that possibly subsequent bus participants are separated from the master. For subsequent bus participants, the termination switch channel 1 or channel 2 must be set to “OFF” (termination resistor is switched off).

Active conditioning of bus signals for switched on bus termination resistor is only available if the actuator electronics is supplied by means of the power supply or the optional external 24 V supply.

### 4.2.4 Connection of FOC systems

The electrical connection can optionally be designed as FOC connection unit. For this, obey the separately available operation instructions.

## 4.3 Fieldbus connection in potentially explosive atmospheres

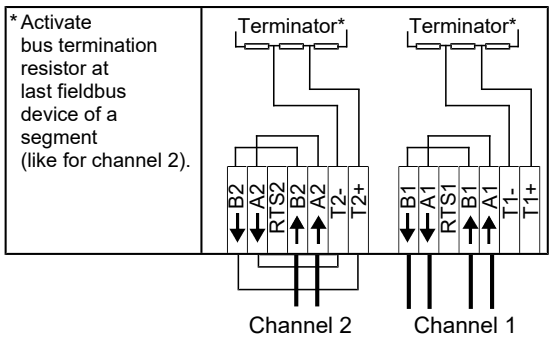
The control connection in the potentially explosive atmosphere concerns the electrical versions iMCX1X or iMCX6X.

### 4.3.1 Terminal box Ex e with connection terminals on top head rail

#### 4.3.1.1 Connection in copper

The connection of Profibus signal cables (A, B) is made in the terminal compartment of the actuator by means of Ex terminals mounted on top head rails. In combination with a terminal box, a T-piece might be required to extend the strand by electrically interconnected double terminals (A1-A1, B1-B1, A2-A2, B2-B2).

*Figure 2:* Connection principle of two Profibus systems to an i-matic actuator




Channel 1 leading to the next device
Channel 2 last device within segment (terminator activated)

By using appropriate cable bridges within the terminal compartment, it is possible to terminate the incoming bus cable instead of a strand extension. The terminator of the respective channel x is activated (refer to Figure 2: Channel 2 [▶ 34]), by connecting terminal Tx+ with Bx, and Tx- with Ax (x is used as variable for the channel number).

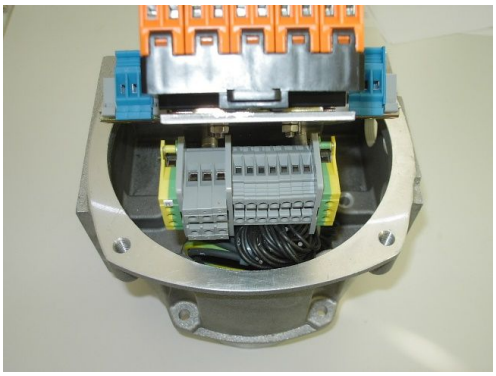
Devices of device category 2 G/D with terminal box have a spur length of up to approx. 40 cm.

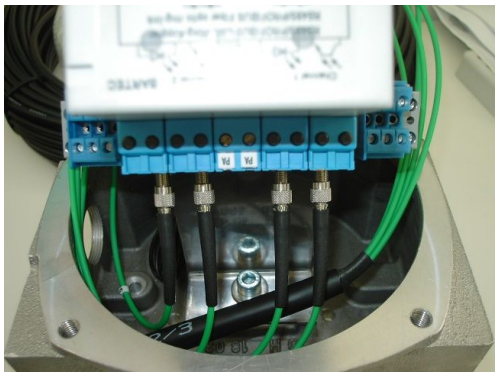
- **Observe the maximum spur length within a Profibus segment!**

### 4.3.1.2 Connection of FOC systems

For actuators of device category 2 G/D for FOC systems, connection is made exclusively within the terminal box by means of terminal blocks. The FOC coupler is housed within the terminal compartment as flameproof enclosure, intrinsically safe component for optical side and is supplied by the electronics. The devices are available for simple fibre optic systems (star, line topology) as well as for redundant systems (FO ring). The divider has to be respectively housed within the terminal compartment. Therefore, observe that the fibre optic cable can be lead through a cable entry of size M20. As standard, the connection is made via F-SMA plug/socket connectors. The following illustrations show the layout of the terminal connection compartment.

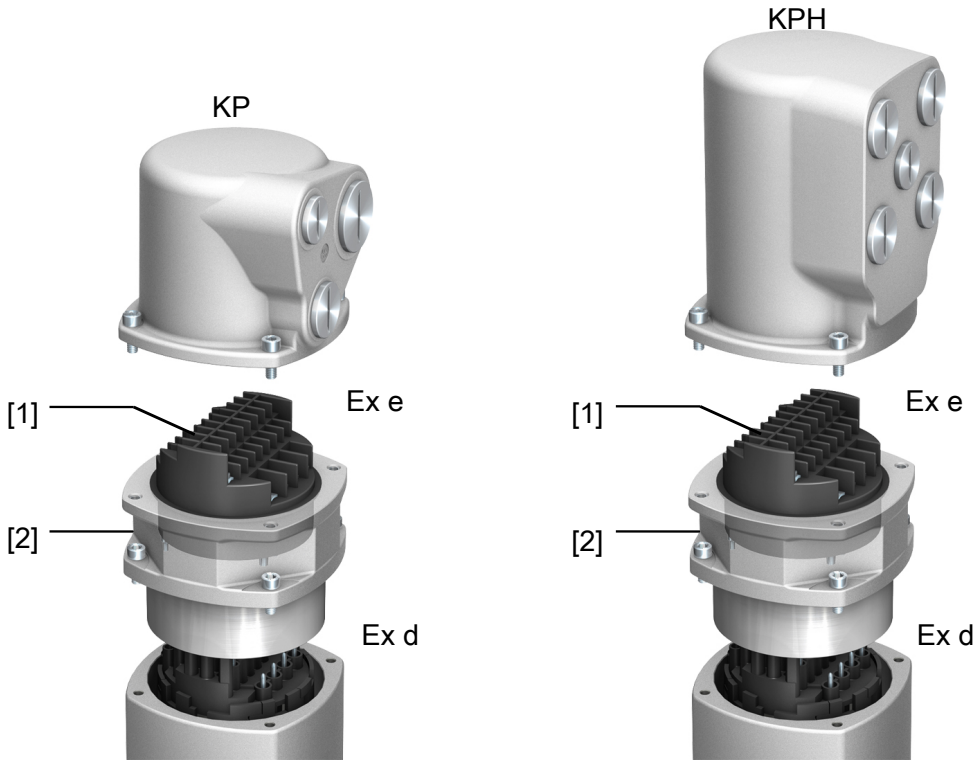
*Figure 3:* FOC connection in terminal box – Detailed view of device terminals and fibre optics





## 4.3.2 KP/KPH electrical connection

*Figure 4:* KP and KPH electrical connection




[1] Screw-type terminals [2] Plug-in frame (flameproof)

Short description

KP/KPH plug-in electrical connection with screw-type terminals for pins for motors and pins for controls. KP version (standard) with three cable entries. KPH version (enlarged) with additional cable entries. Cable entries via the cover.

The terminal compartment (with screw-type terminals) is designed in protection type Ex e (increased safety). Plug-in connection is made via the frame. Removing the cover is sufficient for connecting the cables. The flameproof frame remains connected to the device. The flameproof interior of the connected devices remains sealed.

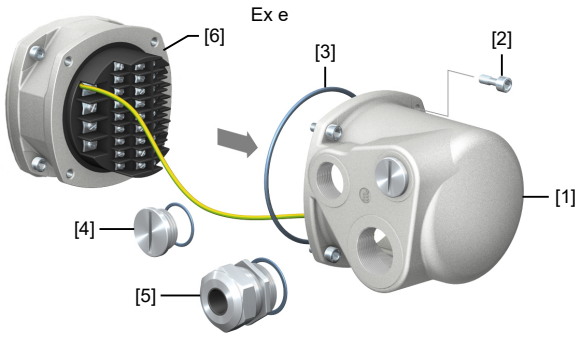
Technical data

*Table 11:* KP/KPH electrical connection

| | Power contacts | Control contacts |
|---|---|---|
| No. of contacts max. | 3 + protective earth conductor (PE) | 38 pins/sockets + protective earth conductor (PE) |
| Designations | U1, V1, W1, ⏚ (PE) | 1 to 24, 31 to 40, 47 to 50, PE |
| Connection voltage max. | 525 V | 250 V |
| Nominal current max. | 25 A | 10 A |
| Type of customer connection | Screw connection | Screw connection |
| Connection diameter max. | 6 $mm^2$ | 1.5 $mm^2$ |

### 4.3.2.1 Open terminal compartment

*Figure 5:* Open terminal compartment




| | | | |
|---|---|---|---|
| [1] | Cover (figure shows KP version) | [2] | Screws for cover |
| [3] | O-ring | [4] | Blanking plug |
| [5] | Cable gland (example) | [6] | Flameproof frame |

**DANGER**

**Electric shock due to presence of hazardous voltage!**

Death or serious injury.

→ Disconnect device from the mains before opening.

How to proceed

1. Loosen screws [2] and remove cover [1].

**Information:** The terminal compartment is designed in protection type Ex e (increased safety). The flameproof interior of the connected device remains closed when removing the cover [1].

2. Insert cable glands [5] suitable for connecting cables.

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

**Information:** For shielded cables: Use EMC cable glands.

3. Seal unused cable entries with approved blanking plugs [4] suitable for the required protection type.
4. Tighten cable glands [5] and blanking plugs [4] at the housing. Consider torques according to manufacturer's details.

### 4.3.2.2 Cable connection

*Table 12:* Terminal cross sections and terminal tightening torques

| Designation | Terminal cross sections | Tightening torques |
|---|---|---|
| Power contacts (U1, V1, W1) | With small clamp washers: 1.5 – 4.0 $mm^2$ (flexible or solid) | 0.9 – 1.1 Nm |
| PE connection | With large clamp washers: 2.5 – 6.0 $mm^2$ (flexible or solid) | |
| Control contacts (1 to 24, 31 to 40, 47 to 50, PE) | 0.75 – 1.5 $mm^2$ (flexible or solid) | 0.5 – 0.7 Nm |

**WARNING**

**In case of a fault: Hazardous voltage while protective earth conductor is NOT connected!**

Electrical shock, risk of severe injury or death.

→ Connect all protective earth conductors.

→ Connect PE connection to external protective earth conductor of connection cable.

→ Power the device only once the protective earth conductor has been connected.

How to proceed

1. Remove cable sheathing in a length of 120 – 140 mm.
2. Insert the wires into the cable glands.
3. Fasten cable glands with the specified torque to ensure required enclosure protection.

**Information:** For shielded cables: Link the cable shield end via the cable gland to the housing (earthing).

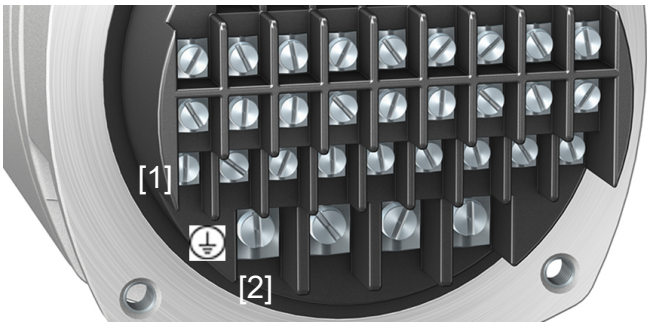
4. Strip wires: Controls 6 – 8 mm, motor 10 – 12 mm
5. For flexible cables: Use wire end sleeves according to DIN 46228. To connect cables with smaller wire cross section as of 0.34 mm², it is permitted to cut the wire to length using a wire end sleeve according to DIN 46228 version A. Use appropriate auto-adjusting crimping pliers (e.g. Knipex 975308) to ensure safe clamping.
6. Connect cables according to order-related wiring diagram.

**Information:** Two wires for each connection permitted. When using motor cables with a wire cross section of 1.5 mm²: Use small clamp washers for connection to terminals U1, V1, W1 and PE (the small clamp washers are in the cover of electrical connection upon delivery).

**WARNING! In case of fault: Hazardous voltage while protective earth conductor is NOT connected!**

7. Firmly tighten protective earth to PE connection.

*Figure 6:* Protective earth connection

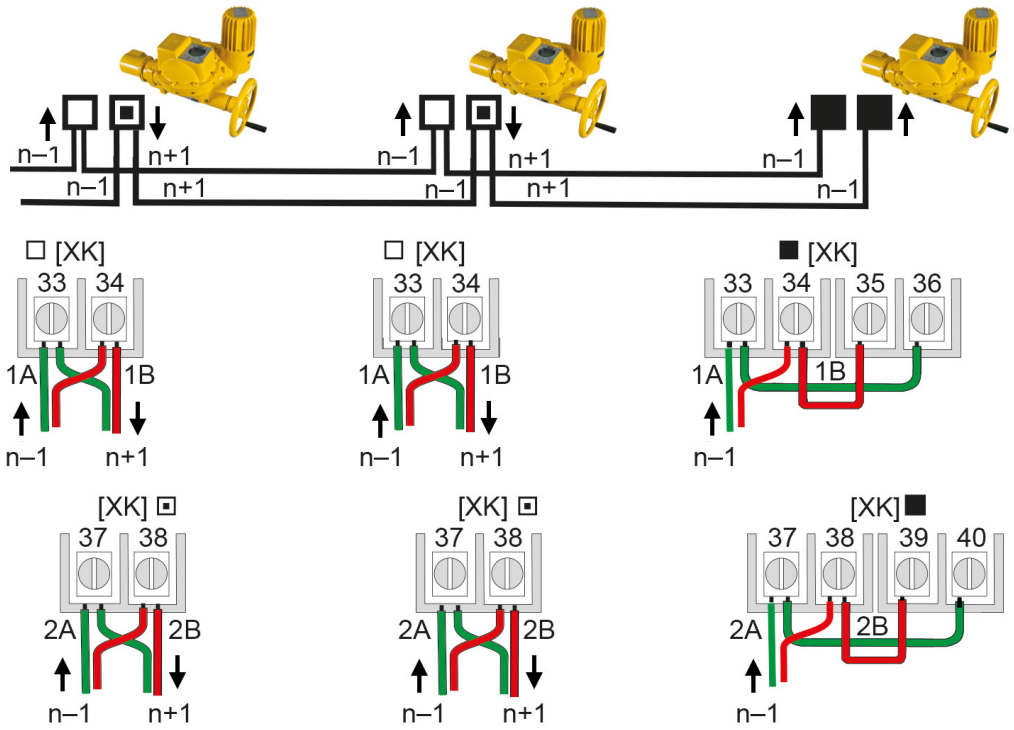



[1] PE connection, control cable

[2] PE connection, motor cable

### 4.3.2.3 Connect fieldbus cables

*Figure 7:* Terminal assignment for line topology (1-channel or2-channel)



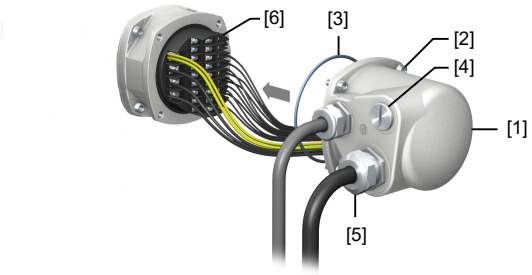

| | |
|---|---|
| ☐ | Channel 1: Further fieldbus devices will follow (standard) |
| ■ | Channel 2: Further fieldbus devices will follow (for redundancy) |
| ■ | Last fieldbus device |
| n–1 | Fieldbus cable from previous device (input) |
| n+1 | Fieldbus cable to next device (output) |
| [XK] | Terminal assignment according to wiring diagram (customer connection):<br>Channel 1: Terminals 33, 34 and 35, 36<br>Channel 2: Terminals 37, 38 and 39, 40 (redundancy only) |

How to proceed

1. Connect bus cables.
   ⇨ Always link A connections to green wire and B connections to red wire.
2. If the actuator is the final device in the fieldbus segment (line topology only):
   ⇨ Connect termination resistor for channel 1 through linking the terminals 34 - 35 and 33 - 36 (standard)
   ⇨ For redundancy: Connect termination resistor for channel 2 through linking the terminals 38 - 39 and 37 - 40.

### 4.3.2.4 Close terminal compartment

*Figure 8:* Close terminal compartment



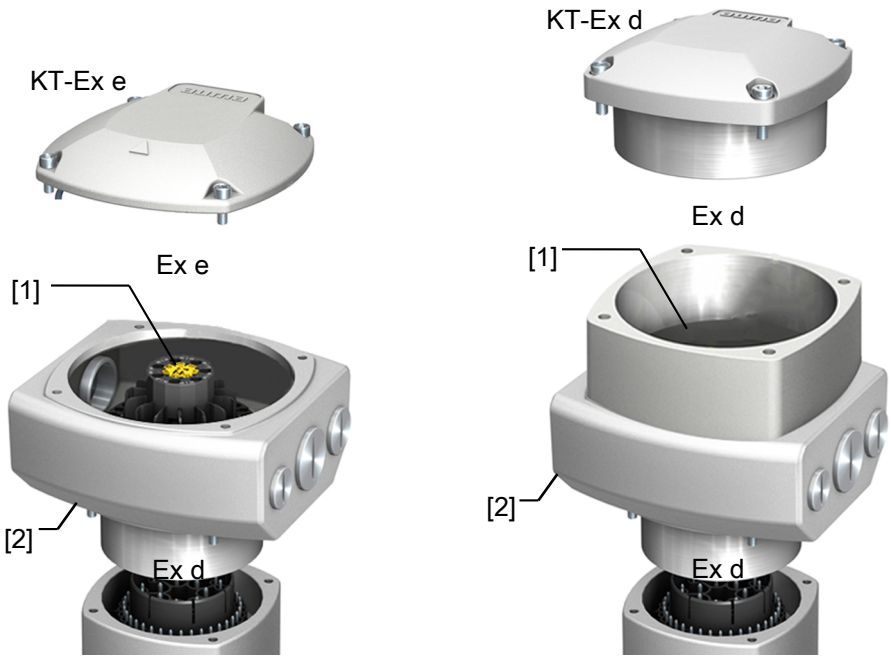

| | | | |
|---|---|---|---|
| [1] | Cover (figure shows KP version) | [2] | Screws for cover |
| [3] | O-ring | [4] | Blanking plug |
| [5] | Cable gland | [6] | Flameproof frame |

How to proceed

1. Clean sealing faces of cover [1] and frame [6].
2. Check whether O-ring [3] is in good condition, replace if damaged.
3. Slightly grease the O-ring with acid-free grease (e.g. petroleum jelly) and insert them correctly.
4. Fit cover [1] and fasten screws [2] evenly crosswise.
5. Fasten cable glands [5] and blanking plugs [4] applying the specified torque to ensure the required enclosure protection.

### 4.3.3 KT/KM electrical connection

*Figure 9:* Electrical connection for KT/KM (figure shows KT version)




| | | | |
|---|---|---|---|
| [1] | Terminal carrier with screw-type/spring clamp terminals | [2] | Connection frame |

Short description

KT plug-in electrical connection with screw-type terminals for power connection and spring clamp terminals for control contacts.

KM version with additional support terminals (terminal blocks) via terminal carrier.

Both versions (KT and KM) are available with terminal compartment in protection type Ex e (increased safety) as well as in protection type Ex d.

Plug-in connection is made via the connection frame. Removing the cover is sufficient for connecting the cables. Thereby, the connection frame with the cable entries remains at the device. The flameproof interior of the connected devices remains sealed.

Technical data

*Table 13:* KT/KM electrical connection

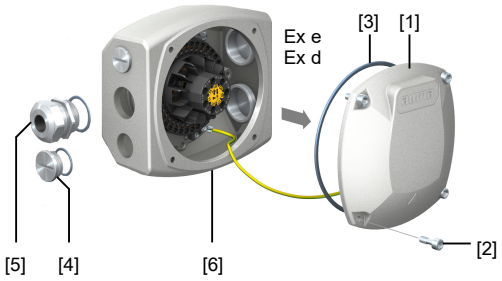
| | Power contacts | Control contacts |
|---|---|---|
| No. of contacts max. | 6 + PE conductor[1)] | 50 |
| Designations | U1, V1, W1, U2, V2, W2, ⏚ | 1 to 36, 37 to 50 |
| Support terminals max. | 3 | 12 |
| Connection voltage max. | 1,000 V | 250 V |
| Nominal current max. | 25 A | 5 A[2)] |
| Type of customer connection | Screw connection<br>PE = Ring lug/U-bracket | Spring clamp terminals |
| Connection diameter max. | 10 $mm^2$ | 2.5 $mm^2$ |

1) Four protective earth connections within frame

2) The sum of the currents of all control contacts must not exceed 50 A.

### 4.3.3.1 Open terminal compartment

*Figure 10:* Open terminal compartment




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

**DANGER**

**Electric shock due to presence of hazardous voltage!**

Death or serious injury.

→ Disconnect device from the mains before opening.

**WARNING**

**Risk of explosion in case of non-respect of the protection type!**

Risk of death or serious injury!

→ During commissioning, replace supplied blanking plugs with cable glands or blanking plugs with Ex approval, suitable for the type of protection. Thread types and thread sizes are specified on the name plate.

**NOTICE**

**Corrosion by ingress of humidity when using unsuitable cable glands/ blanking plugs!**

→ Use suitable cable glands/screw plugs according to the IP enclosure protection specified on the name plate.

For shielded cables: Use EMC cable glands.

How to proceed

1. Loosen screws [2] and remove cover [1].
2. Insert cable glands [5] suitable for connecting cables.
3. Seal unused cable entries with approved blanking plugs [4] suitable for the required protection type.
4. Tighten cable glands [5] and blanking plugs [4] at the housing. Consider torques according to manufacturer's details.

### 4.3.3.2 Cable connection

*Table 14:* Customising the cables

| Terminal designation | Type | Wires per terminal | Terminal cross sections | Dismantling length[1] | | Type of connection and (tightening torque) |
|---|---|---|---|---|---|---|
| | | | | Without wire end sleeve | With wire end sleeve according to DIN 46228; length of wire end sleeve insulated (without insulation) | |
| Power contacts (U1, V1, W1, U2, V2, W2) PE connection | solid | 1 | 0.25 – 10.0 $mm^2$ | 12 mm | Not permissible | Screw-type terminals[2] (M = 1.2 – 1.5 Nm) |
| | flexible | 1 | up to 2.5 $mm^2$<br>up to 4 $mm^2$<br>up to 10 $mm^2$ | Not permissible | 8 (8) mm<br>10 (10) mm<br>12 (12) mm | |
| | flexible | 2[3] | 0.25 – 6 $mm^2$ | Not permissible | 12 (12) mm | |
| Control contacts (1 to 36, 37 to 50) | solid | 1 | 0.25 – 2.5 $mm^2$ | 10 mm | Not permissible | Spring clamp terminals[4] |
| | flexible | 1 | 0.25 – 1.0 $mm^2$<br>up to 1.5 $mm^2$<br>up to 2.5 $mm^2$ | 10 mm | 10 (6) mm<br>10 (7) mm<br>10 (10) mm | |
| | flexible | 2[3] | 0.25 – 0.75 $mm^2$ | Not permissible | 10 (10) mm | |
| Protective earth connections within frame (customer connection) | solid | 2 | 1.5 $mm^2$ – 10 $mm^2$ | 10 mm | Not permissible | U-bracket (M = 3 – 4 Nm) |
| | flexible | 2 | 1.5 $mm^2$ – 10 $mm^2$ | Not permissible | 10 (10) mm with M6 ring lug as an alternative[1] | |

1) For dismantling length, refer to manufacturer's specifications for wire end sleeve or ring lug
2) Flexible cables for screw-type terminals with wire end sleeves
3) For two wires per terminal, a twin wire end sleeve must be used
4) Flexible cables for spring clamp terminals permissible even without wire end sleeves. Dismantling: 10 mm

**⚠WARNING**

**In case of a fault: Hazardous voltage while protective earth conductor is NOT connected!**

Electrical shock, risk of severe injury or death.

→ Connect all protective earth conductors.

→ Connect PE connection to external protective earth conductor of connection cable.

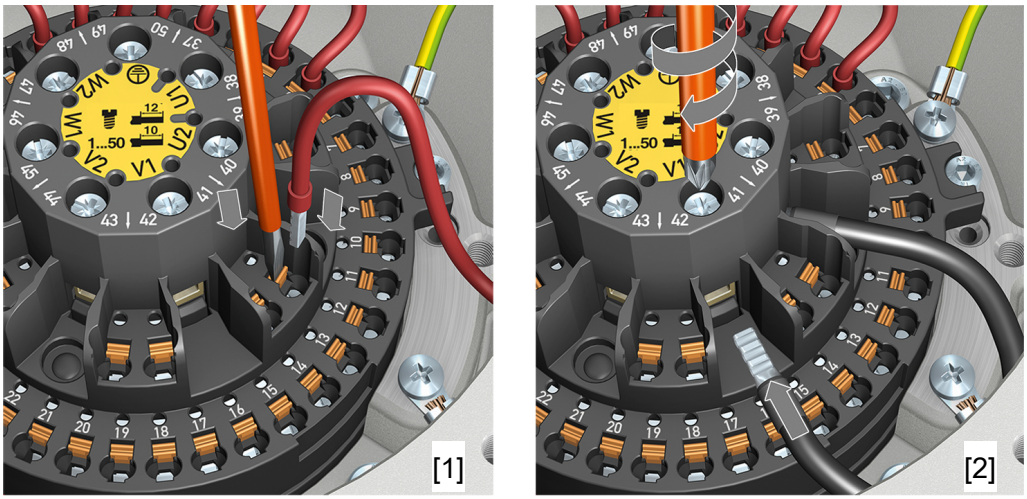
→ Power the device only once the protective earth conductor has been connected.

How to proceed

1. Remove cable sheathing in a length of 250 – 300 mm.
2. Insert the wires into the cable glands.
3. Fasten cable glands with the specified torque to ensure required enclosure protection.
   **Information:** For shielded cables: Link the cable shield end via the cable gland to the housing (earthing).
4. Strip wires.
   For dismantling length, refer to Cable connection [▶ 41].
5. Connect cables according to order-related wiring diagram.
   **Information:** Each spring clamp terminal is equipped with a test contact for service purposes which is located above the numbering.

**Information:** For flexible cables: for screw-type terminals, use wire end sleeves according to DIN 46228. For spring clamp terminals, connection is possible without wire end sleeves.

*Figure 11:* Connect cables to terminal carrier.

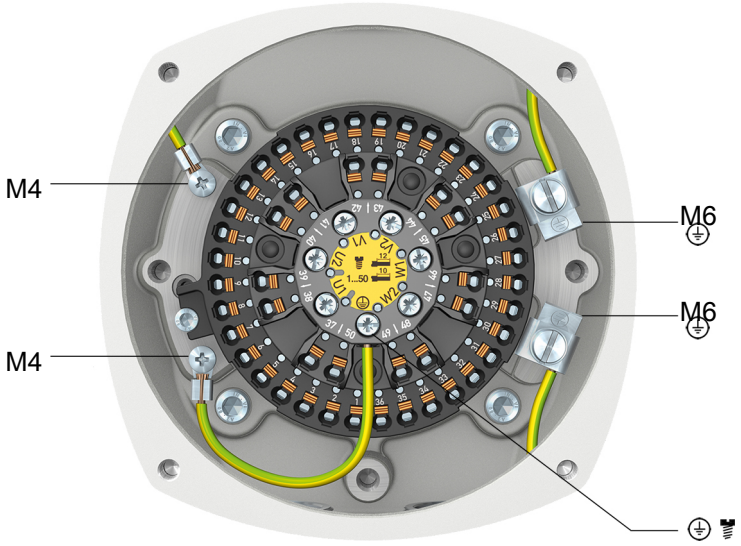



[1] Fitting control cables into spring clamp terminals

[2] Tightening power terminals

6. Firmly tighten protective earth to PE connection (M6 ⏚).
   **WARNING! In case of fault: Hazardous voltage while protective earth conductor is NOT connected!**

*Figure 12:* Protective earth connections within connection frame



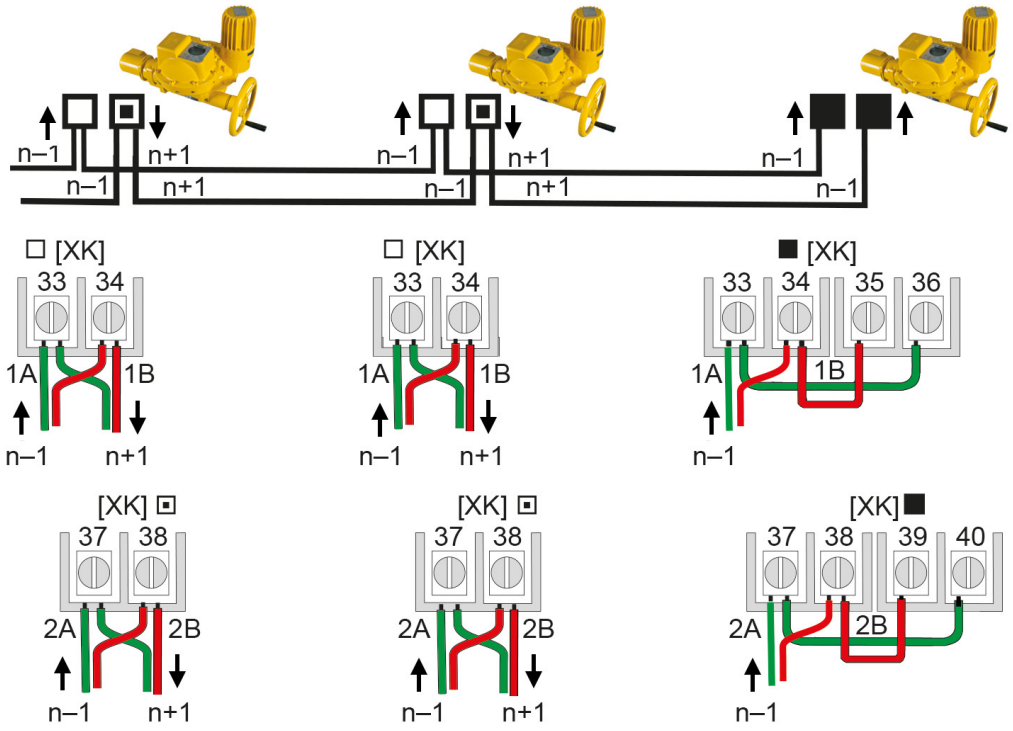

M6 Customer protective earth connection for M6 ring lug or with U-bracket for up to two wires.

M4 Internal protective earth connections via M4 ring lug (to cover and terminal carrier) connected in the factory

⏚ Protective earth connection to terminal carrier (power terminals); connected in the factory.

### 4.3.3.3 Connect fieldbus cables

*Figure 13:* Terminal assignment for line topology (1-channel or2-channel)



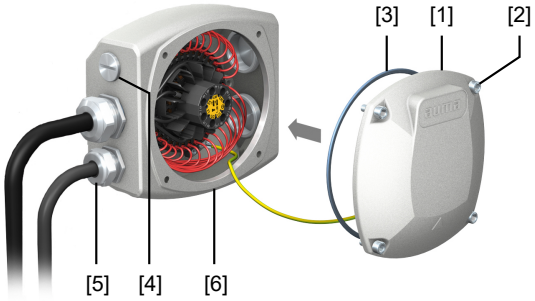

| | |
|---|---|
| □ | Channel 1: Further fieldbus devices will follow (standard) |
| ■ | Channel 2: Further fieldbus devices will follow (for redundancy) |
| ■ | Last fieldbus device |
| n–1 | Fieldbus cable from previous device (input) |
| n+1 | Fieldbus cable to next device (output) |
| [XK] | Terminal assignment according to wiring diagram (customer connection):<br>Channel 1: Terminals 33, 34 and 35, 36<br>Channel 2: Terminals 37, 38 and 39, 40 (redundancy only) |

How to proceed

1. Connect bus cables.
   ⇨ Always link A connections to green wire and B connections to red wire.
2. If the actuator is the final device in the fieldbus segment (line topology only):
   ⇨ Connect termination resistor for channel 1 through linking the terminals 34 - 35 and 33 - 36 (standard)
   ⇨ For redundancy: Connect termination resistor for channel 2 through linking the terminals 38 - 39 and 37 - 40.

### 4.3.3.4 Close terminal compartment

*Figure 14:* Close terminal compartment




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

For version in flameproof enclosure (Ex d), heed the following:

**⚠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 [6].
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.
   **WARNING! Risk of explosion in case of damage to flameproof enclosure!**
6. Fasten cable glands [5] and blanking plugs [4] applying the specified torque to ensure the required enclosure protection.

### 4.3.4 Parking frame

*Figure 15:* Parking frame, example with Ex plug/socket connector and cover

Application Parking frame for safe storage of a disconnected plug or cover. For protection against touching the bare contacts and against environmental influences.

**⚠WARNING**

**Explosion hazard!**

Risk of death or serious injury.

→ Prior to opening the device (removing the plug) ensure that the device is free of gas and voltage!

→ Do NOT switch on voltage in potentially explosive atmospheres.

# 5 Troubleshooting and diagnostics

## 5.1 Troubleshooting

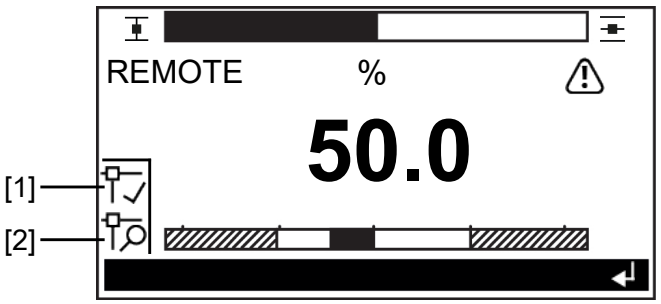
Hereafter, possibly occurring faults and the respective questions for fault delimitation are given:

- *The actuator does not contact the bus:*
  Were correct terminals used? Have wires A and B been mixed up?
  Is the power supply OK?
  Has the station address been assigned only once?
  Is the station address higher than the “Highest Station Address” (HSA) of the already working stations?
- *When switching on, the actuator interferes with other stations:*
  Were correct terminals used? Have wires A and B been mixed up?
  Are the values for $minT_{SDR}$ and $maxT_{SDR}$ adapted to the other stations?
- *The actuator does not connect to the DCS:*
  (If possible, analyse fault signal)
  Has a connection to another station already been established?
  Are the address parameters correct?

## 5.2 Connection status diagnostics at the LCD

A status indication is shown on the *i-matic* display regarding the status of communication of the bus connections. For a single-channel bus connection, only one symbol is displayed. For a two-channel bus connection, respectively two symbols are displayed whereby the upper symbol shows the status of channel 1 and the lower symbol the status of channel 2. The active channel (channel whose control signals are used for actuator controls) is shown as inverted.

*Figure 16:* Diagnostic options at the LCD




[1] Fieldbus status channel 1 [2] Fieldbus status channel 2

*Table 15:* Symbols for connection status diagnostics at the LCD

| Symbol | Signification |
|---|---|
|  | The slave is in baud rate search state. No valid Profibus telegrams are detected. Either the master is inactive or wiring problems have occurred. |
|  | A valid baud rate has been detected. However, the slave is not parametrised by the master or parametrisation is faulty. |
|  | The slave is in data exchange state (DP-V0). |
|  | Slave watchdog expired. The actuator is in fail safe state if this has been parametrised. |
|  | The slave has received a global Control Clear from the master. Generally, the master PLC or the interface sub-assembly are in Stop state. |

## 5.3 Status diagnostics DP-V0 connection establishment

If a DP-V0 connection cannot be established caused by faults within the parametrisation telegram, the menu item “Actual value/diagnostics > Add on board > Profibus > Param. error code” allows for detailed diagnostics:

*Table 16:* Parametrisation error code for status diagnostics

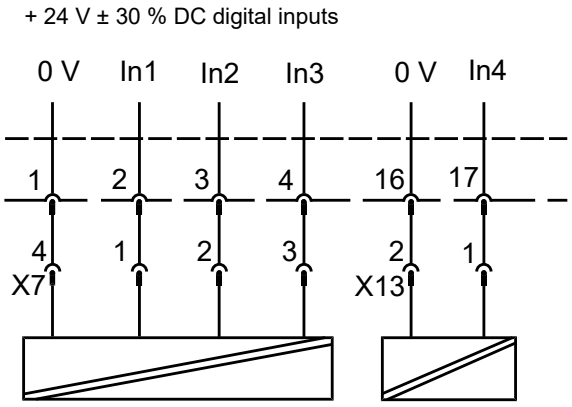
| Value | Description |
|---|---|
| 0 | No error present. |
| 1 | An invalid bit in one of the 3 DP-V1 bytes of the parameter telegram is set. |
| 2 | The parameter frame has an invalid length. |
| 3 | The PRM_CMD part for parametrisation of DP-V2 redundancy is invalid. |
| 4 | The PRM_CMD part has an invalid length or the actuator has no DP-V2 functionality. |
| 5 | The TIME_AR part for the timestamp and distribution parameter is invalid. |
| 6 | The TIME_AR part for the timestamp and distribution parameter has an invalid length or the actuator has no DP-V2 functionality. |
| 9 | Within the expanded parameters, there is one block with an unsupported block ID. |
| 10 | Within the expanded parameters, the lengths of the blocks are inconsistent. |

# 6 Additional conventional inputs

As an option, *i-matic* type actuators and integral iMC controls family may by equipped with conventional inputs in addition to the Profibus interface. Four digital inputs - 24 V DC galvanically isolated from the electronics via opto-isolator and an analogue input for a 4 – 20 mA signal are available. The digital inputs are arranged in two different potential groups and partly electrically interconnected. For each digital input, an input current of approx. 12 mA is present if 24 V DC is applied. Digital inputs can be assigned to different functions by means of the actuator parametrisation. The reciprocity interaction of this function with the Profibus interface commands can be influenced by the specifying a remote priority. Please refer to the operation instructions pertaining to the actuators controls for further instructions. The signal logic of the four digital inputs is shown in modules PP5 and PP6.

The illustration below is an extract of the terminal plan and shows the set-up of the four digital inputs.

*Figure 17:* Digital inputs




As standard, the analogue input is galvanically connected to the electronics. As an option, galvanic isolation is possible. The illustrations below show the representations on the wiring diagram:

*Figure 18:* Non potential-free analogue input

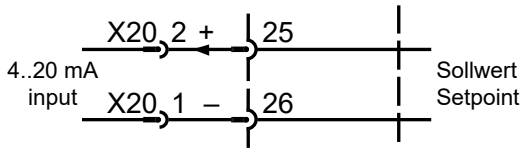
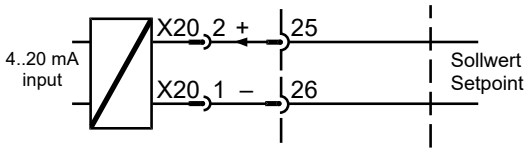



*Figure 19:* Analogue input galvanically isolated




The current value of the analogue input is shown as analogue input signal 1 in modules PP5 and PP6.

# 7 Technical data of the fieldbus interface

*Table 17:* Technical characteristics of the fieldbus interface

| | |
|---|---|
| **Identification number** | 0x0824 for master slave redundant systems<br>0x0825 for other DP or DP-V1 actuators |
| **Baud rate** | Is specified by the master and amounts to max. 1.5 MBaud |
| **Protocol** | According to IEC 61158 and IEC 61784-1 |
| **Bus system** | RS-485 |

# 8 Sizing guidelines

The currently valid guidelines of the Profibus User Organisation as well as the content of IEC 61158 have to be obeyed as standard. Hereafter, the main points are listed as an overview.

## 8.1 Cable system

Specified according to IEC 61158:

*Table 18:* Cable specification

| | Cable type A IEC 61158 part 2 (DP) |
|---|---|
| Impedance | 135 – 165 Ohm |
| Capacity | < 30 pF/m |
| Loop resistance | < 110 Ohm/km |
| Wire diameter | > 0.64 mm |
| Cross section | > 0.34 $mm^2$ |

On the basis of these cable parameters, the following permissible lengths of cable segments apply:

*Table 19:* Segment lengths

| Baud rate | 9.6 | 19.2 | 93.75 | 187.5 | 500 | 1,500 | kbit/s |
|---|---|---|---|---|---|---|---|
| Cable type A | 1,200 | 1,200 | 1,200 | 1,000 | 400 | 200 | m |

For data rates up to 500 kbit/s, the spurs within a segment should not add up to more than 6.6 m (compare references of PNO, also refer to Literature [▶ 53]).).

For actuators of device category 2 G/D, the spur length is about 40 cm. The maximum permissible number of actuators within a segment for 500 kbit/s is consequently 16.

For cable installation, obey the applicable conditions for signal cables:

a) do not install in direct proximity of power cables

b) minimum bent radii of cables used must be obeyed to prevent the risk of damage to shield or wires.

## 8.2 Optical fibre systems

Optical fibre cables may add up to a maximum length between two Matic actuators up to 1,400 m (50 µm FOC) or 2,600 m (62.5 m FOC).

The maximum number of devices with FOC connection within a segment is listed in the following table:

*Table 20:* Number of devices for FOC connection

| Baud rate | max. number of FOC actuators |
|---|---|
| 9.6 kBd | 124 |
| 19.2 kBd | 124 |
| 93.75 kBd | 32 |
| 187.5 kBd | 16 |
| 500 kBd | 6 |
| 1.5 MBd | 2 |

## 8.3 Bus topology with segmentation

Based on the RS-485 transmission technology, a limitation of maximum 32 stations per cable segment applies. If more stations or longer cable distances are required, the segments can be coupled via repeaters, irrespective of the segment addresses. Thus, several segments can be coupled within one strand.

*Figure 20:* Example of a strand consisting of several segments

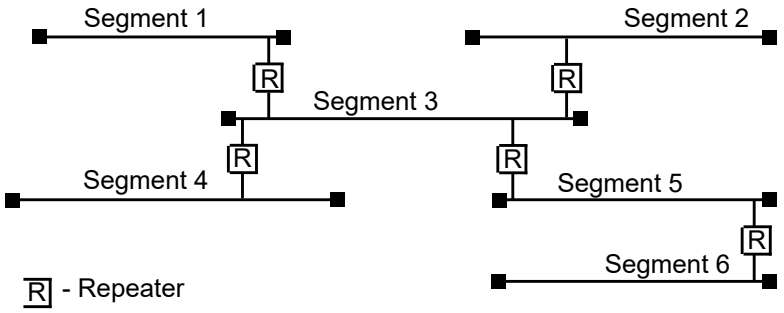
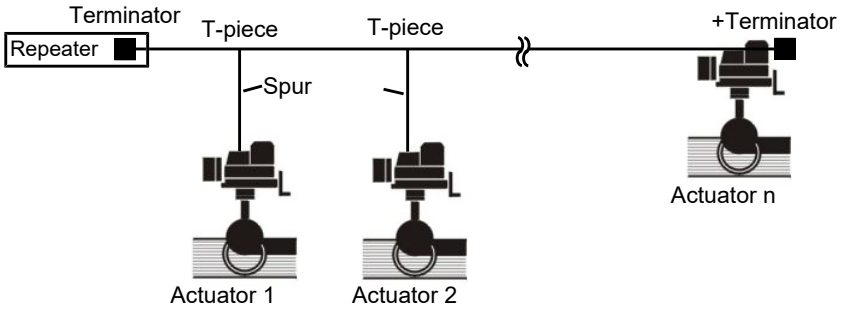


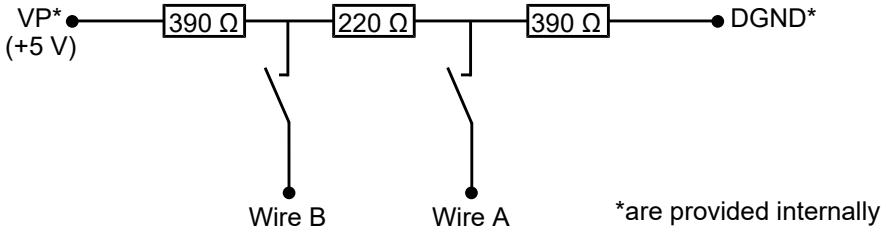

*Figure 21:* Example of a bus segment




## 8.4 Termination resistors

Special importance is attached to both termination resistors at both segment ends. They terminate the cable with the impedance and the idle level is defined.

*Figure 22:* Termination resistor




The terminators are to be added at both ends of a segment. Other terminations can cause most varied errors (individual telegram error right through to the complete segment failure) within the Profibus system.

## 8.5 Shield connection of bus cables for copper cables

Typically, the shields of incoming and outgoing cables are to be connected via EMC cable glands, directly at the housing potential, to ensure highest possible EMC protection.

As an alternative, there is the possibility for non Ex devices to connect the shield via the fieldbus cables by means of the respective strain relief gripper clamps on the Profibus connection board.

## 8.6 Overvoltage protection

When installing bus cables or signal cables outside of buildings, obey the following:

- Use of standard transmission cables in metal pipes, earthed on both sides and interconnected. The metal pipes must integrated into the available equipotential bonding when entering the building.
- Use of cables with shield capable of bearing lightning currents.

Any other overvoltage protection modules for bus signals can be deployed as an option and act as additional protection according to the terminal plan.

## 8.7 Device Master Data (GSD)

The current GSD files can be downloaded at http://www.drehmo.com > Downloads > Software.

# 9 Literature

- PROFIBUS- DP/DP-V1. Basics, tips and tricks for users
  by Manfred Popp
  ISBN: 3-7785-2781-9
  Hüthig publishing company, Heidelberg
- Links of potential interest:
  www.profibus.com
  Website in English with comprehensive hints for projecting Profibus systems, exceeding the information in these operation instructions.
- Description of FOC coupler for potentially explosive atmospheres:
  www.bartec.de
  RS 485/PROFIBUS FOC coupler
  07-7311-97WP/

# Index


## A

Acyclic driver interface 31
Addressing 6
Analogue inputs 48

## B

Base board 6
Baud rate 49
Bus system 49
Bus termination 33

## C

Cable system 50
Coding status 7
Commissioning 4
Connection diagnostics 46
Connection establishment 47
Cyclic driver interface 7

## D

Data interface 7
Device Master Data (GSD) 52
Digital inputs 48
Directives 4
Driver interface 7, 31
DTM 31

## E

EDD 31
Electrical connection 32

## F

FOC systems 33, 34

## I

Identification number 49
Ignition hazards 4

## K

KP/KPH electrical connection 35
KT/KM electrical connection 39

## L

Literature 53

## M

Mains connection 32
Maintenance 5

## O

Operation 4
Optical fibre systems 50
Overvoltage protection 51

## P

Protective measures 5
Protocol 49

## Q

Qualification of staff 4

## R

Range of application 5

## S

Safety 4
Safety instructions/warnings 4
Shield connection 33
Sizing guideline 50
Spur 34
Standards 4

## T

Technical data 49
Terminal box Ex e 33
Topology 38, 43, 50
Troubleshooting 46

DREHMO
VALVE ACTUATORS

DREHMO GmbH
Zum Eichstruck 10
57482 Wenden
Germany

Service
Tel +49 2762 9850-206
Fax +49 2762 9850-205
service.ww@drehmo.com
www.drehmo.com

386393/003/en/02

For detailed information on DREHMO products, refer to the Internet: www.drehmo.com