TURCK

Industrielle
Automation

FIELDBUS COMPONENTS
excom®

USER MANUAL

How to work with this manual

1 System description *excom*®

2 Safety requirements in explosion hazardous areas

Warning!
Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the mounting instructions (AWA) of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDE 0 105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0 100 Part 410) or HD 384.4.41 S2.

- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross-sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- All shrouds and doors must be kept closed during operation.

How to work with this manual

Introduction

Attention
You should always read this section, because safety in dealing with electrical equipment should not be left to chance.

This manual contains all information pertaining to safe and proper operation of *excom*®products. It specifically addresses trained and qualified staff that have the appropriate technical knowledge.

Correct operation

Warning
The devices described may only be used in applications specified in the context of this manual or in the associated individual technical device descriptions and in conjunction with approved external devices and components.

Correct and safe operation of the devices relies on proper transport and storage, correct installation and setup as well as careful operation and maintenance.

Project engineering guidelines/Product installation

Warning
The relevant safety and accident prevention regulations of the specific application must be observed without fail.

Meaning of the symbols used

Warning

This sign is placed next to a warning indicating the presence of a hazard. This can relate to personal injury as well as to system damage (hardware and software).

The user should interpret this symbol as follows: exercise extreme caution.

Attention

This sign is placed next to a warning indicating a potential hazard.

This can relate to personal injury as well as to system (hardware and software) and equipment damage.

Note

This sign is located next to general hints providing important information on one or several work steps.

These hints may facilitate work and possibly help to avoid additional work resulting from incorrect working procedures.

1 System description *excom*®

Versions and optional uses of *excom*® stations

excom® is an intrinsically safe remote I/O system for use in potentially explosion hazardous areas. The system's specific type of explosion protection allows operation and installation in zones 1 and 2 (in accordance with EN 60079-10). The field circuits are approved for zone 0.

The module rack comes in two different sizes for taking up to 9 or 18 modules. These also have different power supply voltages and terminals. The module racks are fitted with power supply units, gateways, and I/O modules.

In order to configure the *excom*® station for the application, “Digital modules” page 7-1, “Analogue modules” page 8-1 and “Function modules” page 9-1 are available that meet the requirements of field instrumentation in process automation. As the backplane provides the intrinsically safe supply of the I/O modules, these can be removed and fitted during operation without having to disconnect the power supply. This can also be carried out without interrupting any active data communication.

Note

A redundant power supply unit or redundant gateway can be fitted during operation!

Figure of an *excom*® station

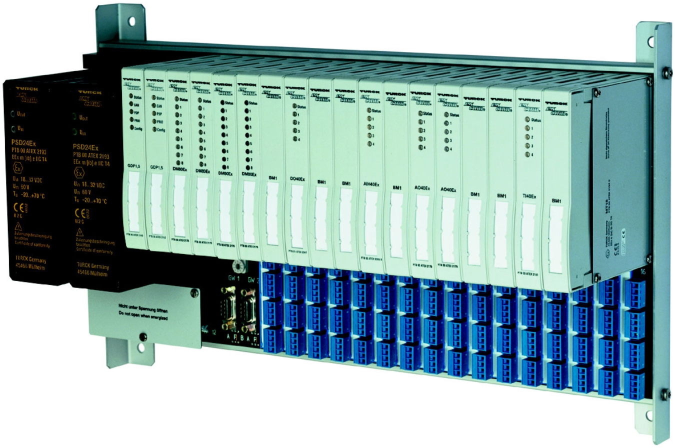


Figure 1:
excom® with the module rack MT18-R024

Module rack versions for different station sizes, supply voltages and terminals

excom® stations are mounted on module racks.

The *excom*® module racks consist of a backplane and the rack system which is mounted in front of it.

The backplane is designed for power and data transfer and incorporates the connection level for the field devices.

The possible size of the station is indicated by the initial characters of the product name:

- **MT18**...:Module rack for taking 2 power supplies, 2 gateways and 16 I/O modules. Up to 128 binary inputs and outputs or 64 analogue inputs and outputs, or any combination thereof can be configured. Redundant gateway and/or power supply units can be installed.
- **MT9**...:Module rack for taking **1** power supply unit, **1** gateway and **8** I/O modules. Up to 64 binary inputs and outputs or 32 analogue inputs and outputs, or any combination thereof can be configured.

The connection level design is indicated in the product name with R or C:

- **R**: Connection is made via plug-in screw terminals
- **C**: Connection is made via spring-loaded terminals

The last three digits of the product indicate the supply voltage:

- **024**: Module rack for 24 VDC supply voltage
- **230**: Module rack for 230/115 VAC supply voltage

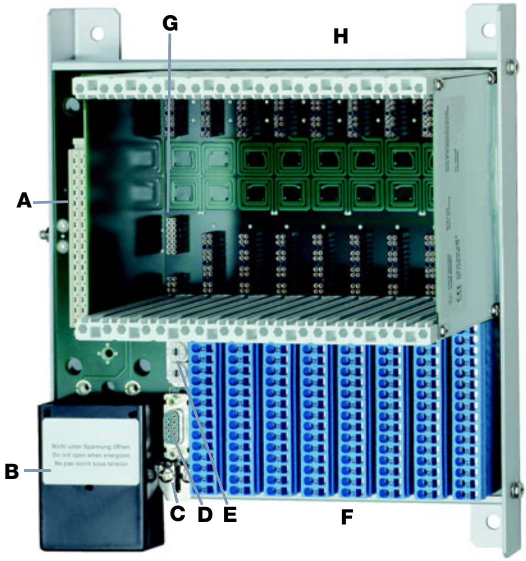
Five different types of module racks are currently available:

- MT9-R024
- MT9-C024
- MT18-R024
- MT18-C024
- MT18-C230

MT9-C024/MT9-R024

The following figure shows the module rack MT9-C024. The only difference between module rack MT9-R024 and the module rack illustrated is that the type of connection terminals used are designed as plug-in MINI COMBICON terminals (F).

Figure: 2
Module rack
MT9-C024

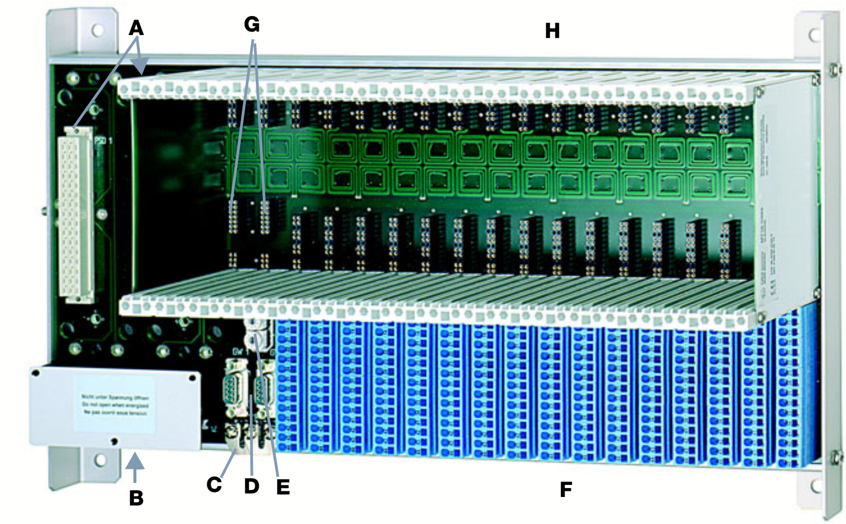


A *Slot for 24 VDC power supply module*
B *EEx e connection area including cover of the EEx e screw terminals for power supply*
C *Link for possible earthing of the cable shield of the data line*
D *9-pole SUB-D connector for PROFIBUS RS485-IS*
E *Rotary coding switches for setting the network address ("PROFIBUS-DP address" page 1-22)*
F *Spring-loaded terminals for connecting the I/O level - the module rack MT9-R024 is provided with plug-in "MINI COMBICON" terminals*
G *Slot for a gateway*
H *Slots for up to 8 I/O modules + gateway*

MT18-C024 / MT18-R024

The following figure shows the module rack MT18-C024. The only difference between module rack MT18-R024 and the module rack illustrated is that the type of connection terminals used are designed as plug-in “MINI COMBICON” terminals (F).

Figure: 3
Module rack
MT18-C024

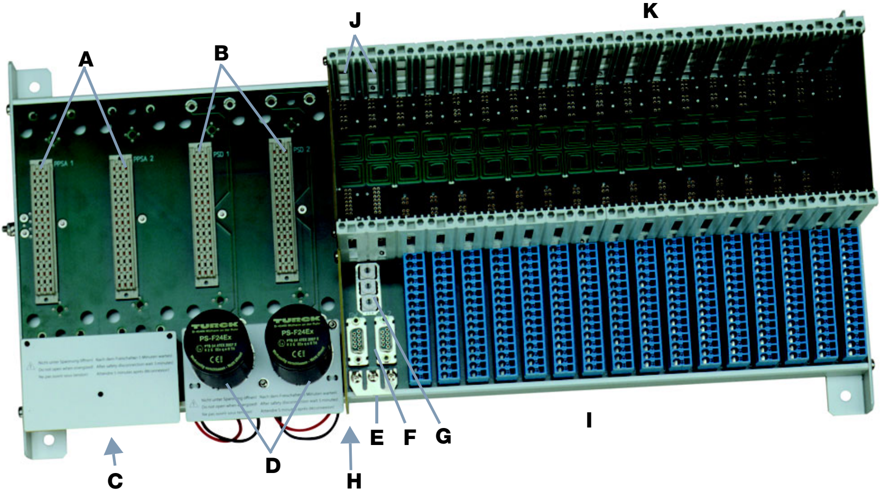


A *Two slots for 24 VDC supply modules*
B *EEx e connection area including cover of the EEx e screw terminals for power supply*
C *Link for possible earthing of the cable shield of the data line*
D *Two 9-pole SUB-D connectors for PROFIBUS RS485-IS (“Increase of fail-safe performance using redundant circuits” page 5-13)*
E *Rotary coding switches for setting the network address (“PROFIBUS-DP address” page 1-22)*
F *Spring-loaded terminals for connecting the I/O level - the module rack MT18-R024 is provided with plug-in “MINI COMBICON” terminals*
G *Slots for two gateways (“Increase of fail-safe performance using redundant circuits” page 5-13)*
H *Slots for up to 16 I/O modules*

MT18-C230

The following figure shows the module rack MT18-**C**230.

Figure: 4
Module rack
MT18-C230



A *Slots for 115/230 VAC AC/DC converters*
B *Slots for 24 VDC supply modules*
C *EEx e connection area including cover of the EEx e screw terminals for power supply*
D *Integrated filter*
E *Link for possible earthing of the cable shield of the data line (* *"Shielding concepts" page 5-8* *)*
F *Two 9-pole SUB-D miniature connectors for PROFIBUS RS485-IS (* *"Increase of fail-safe performance using redundant circuits" page 5-13* *)*
G *Rotary coding switches for setting the network address (* *"PROFIBUS-DP address" page 1-22* *)*
H *Partition for creating a 50 mm spacing between connection elements*
I *Spring-loaded terminals for connecting the I/O level*
J *Slots for two gateways (* *"Increase of fail-safe performance using redundant circuits" page 5-13* *)*
K *Slots for up to 16 I/O modules*

Technical data for all module rack versions

Table 1:
Technical data of the module racks

Type	MT18-C230	MT18-C(R)024	MT9-C(R024)
Connections			
Bus (9-pole miniature SUB-D connector)	2	2	1
AC/DC converters (EEx e dual screw terminals)	6	-	-
Power supply (EEx e dual screw terminal)	6	6	3
– Connection cross section	0.2...4 mm² rigid or 0.2...2.5 mm² with wire ferrule		
Field devices	4 x 4 screw terminals per module		
– Connection cross-section	0.25...1.5 mm² with wire ferrule (without plastic sleeve)		
Mini-Combicon plug-in terminals			
Slots			
Power supply	4	2	1
Gateway	2	2	1
I/O module	16	16	8
Setting options			
Bus address	3 decimally coded rotary switches		
I.S. Approval	PTB 00 ATEX 2194 U		
Marking	II 2 (1) G EEx e ib [ia] IIC		

Table 1: Technical data of the module racks

Type	**MT18-C230**	**MT18-C(R)024**	**MT9-C(R024)**
Power supply connection	EEx e IIC		
AC/DC converter			
– U_{in}	≤ 250VAC		
– I_{in}	≤ 5 A		
– P_{in}	≤ 130VA		
Power supply for station			
– U_{in}	≤ 32 V DC		≤ 40 V
– I_{in}	≤ 11 A		≤ 11 A
– P_{in}	≤ 100 W		≤ 100W
General data			
Protection degree	IP20		
Operating temperature	-20...+70 °C		
Relative humidity	95% at 55 °C acc. to EN 60069-2		
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27		
Dimensions (without mounting bracket)			
– Width (in mm)	544	440	227
– Height (in mm)	260	260	260
– Depth (in mm)	130	130	130

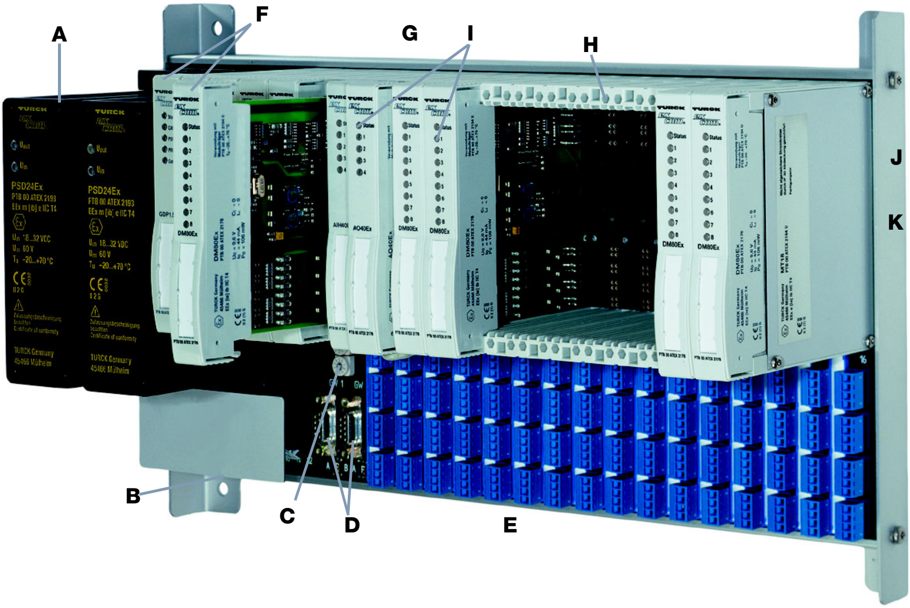
The *excom®* components, their functions and technical data

The *excom®* system consists of power supply units, gateways, I/O modules and module racks to accommodate all components.

All modules can be connected easily: gateways, power supply units and I/O modules are simply plugged into the rack. All internal connections are made in this way so that only the peripheral devices have to be connected.

excom® station components at a glance

Figure: 5
excom® module rack MT18-C(R) 024



A *"Supply modules - Redundancy" page 1-13*
B *"External power supply" page 1-19*
C *"Address switch and addressing" page 1-22*
D *"PROFIBUS-DP connection" page 1-23*
E *"Connections to the field level" page 1-23*
F *"Gateways - Redundancy" page 1-25*
G *"I/O modules - Overview" page 1-25*
H *"Coding pins - exchanging modules during operation" page 1-27*
I *"LEDs and diagnostics" page 1-30*

Supply modules - Redundancy

The power supply units provide a reliable power supply for the entire system.

The module rack used determines the power supply possible for the station:

Table: 2	**MT9-C(R)024**	**MT18-C(R)024**	**MT18-C230**
	PSD24Ex with **18...32 V DC** power supply connection	PSD24Ex with **18...32 V DC** power supply connection	PPSA230Ex with **230 V AC mains voltage** connection or PPSA115Ex with **115 V AC mains voltage** connection The PSD24Ex supply modules are installed downstream
	Redundant modules cannot be fitted!	**Redundant modules can be fitted**!	**Redundant modules can be fitted**!
	1 power supply slot	2 power supply slots	4 power supply slots

A single power supply unit is sufficient for correct system operation.

Redundant power supply units increase availability!

PSD24Ex supply module

- Power supply unit for 24 VDC supply

Figure 6: PSD24Ex

The power supply module PSD24Ex is designed to power all *excom*® components up to a fully assembled system.
The power supply unit is provided with combined type EEx m, EEx e and EEx i protection and is thus suitable for use in zone 1.

The power supply is integrated in a fully encapsulated protective aluminium housing.

The supply voltage of the PSD24Ex is 18...32 VDC.

The external supply is connected via “EEx e” terminals on the module rack.

Attention

The “EEx e” terminals must not be accessed under live conditions.

They are located under a protective cover. They may only be opened after the system power has been securely disconnected and thus turned off.

Technical data PSD24Ex

Table 3: Technical data PSD24Ex

Type	**PSD24Ex**
Supply voltage	
External	18...32 V DC (Ripple W_{pp} < 10 %)
Power output	60 W
I.S. Approval	PTB 00 ATEX 2193
Marking	II 2 G EEx [ib] e IIC T4
– U_m	60 V
LEDs	
Operational readiness	1 x green
Power supply	1 x green
General data	
Galvanic isolation	Complete
Protection degree	IP50
Operating temperature	-20...+70 °C
Relative humidity	95% at 55 °C acc. to EN 60068-2
Vibration and shock testing	According to IEC 68-2-6 and IEC 68-2-27
Mounting	Flange, 4 x M4 screws
Dimensions W x H x D [mm]	45 x 155 x 106

AC/DC converter PPSA230Ex / PPSA115Ex

- For 115 /230 VAC power supply
- AC/DC conversion of mains voltage to DC voltage (24 VDC)
- Use on the module rack MT18-C230
- Can only be used with a downstream power supply module PSD24Ex

Figure 7: PPSA230Ex and PPSA115Ex

The power supply modules PPSA230Ex and PPSA115Ex are used for the converted power supply of the *excom*® systems.

Each PPSA230Ex or PPSA115Ex power supply module has a standard PSD24Ex power supply unit connected behind it.

The external supply is connected via EEx e terminals on the module rack.

Attention

The EEx e terminals must not be accessed under live conditions.

They are located under a protective cover. They may only be opened after the system power has been securely disconnected and thus turned off. To open the cover, the modules must first of all be removed from their slots.

The AC/DC converters feature combined protection, type EEx m and EEx e, and are thus suitable for use in zone 1.

They are integrated in a fully encapsulated protective aluminium housing.

The supply voltage is 230 VAC and 115 VAC.

Technical data PPSA230Ex/PPSA115Ex

Table 4: Technical data PPSA230Ex / PPSA115Ex

Type	**PPSA230Ex**	**PPSA115Ex**
Input voltage (maximum)	230 VAC	115 VAC
Input power (maximum)	75 VA	75 VA
Output voltage (maximum)	32 VDC	32 VDC
Power output (maximum)	60 W	60 W
I.S. Approval	PTB 04 ATEX 2047	
Marking	II 2 G EEx e m IIC T4	
– U_m	250 V	
General data		
Protection degree	IP50	

Operating temperature	-20...+70 °C
Relative humidity	95% at 55 °C acc. to EN 60069-2
Vibration and shock testing	According to IEC 68-2-6 and IEC 68-2-27
Mounting	Flange, 4 x M4 screws
Dimensions W x H x D [mm]	45 x 155 x 106

Power supply cover

Attention

Unused slots for power supply units or AC/DC converters must always be provided with an IP20 cover!

The power supply cover BM-PS is suitable for covering unused power supply module slots.

Figure 8: Power supply cover “BM-PS”

External power supply

The module rack is equipped with EEx e terminals for connecting the power supply. These terminals are located under a cover with IP30 protection.

Figure 9: Protective cover for the power supply

Warning

The cover of the EEx e terminals may not be opened while the system is powered.

Note

Newer module rack versions prevent the cover from being opened before the power supply units and AC/DC converters have been removed from their slots!

The supplied power is sufficient for *excom*® stations with any combination of I/O modules. Apart from this, the only exception is when only DO40Ex modules are used. In this exceptional case, the redundant power supply unit may be used for supplying the missing power.

In this case, check very closely whether you can manage without redundancy!

Refer to “Safety requirements in explosion hazardous areas“ for application specific connection examples for the external power supply:

- “24 VDC power supply - not redundant (MT9)” page 2-13
- “24 VDC power supply - with redundant hardware (MT18)” page 2-14
- “24 VDC power supply - not redundant (MT18)” page 2-15

- "115/230 VAC power supply - hardware redundancy" page 2-17
- "115/230 VAC power supply - redundant" page 2-18
- "115/230 VAC and 24 VDC power supply - redundant" page 2-19

Address switch and addressing

PROFIBUS-DP address

In a PROFIBUS structure, a station (in this case: *excom*® station) is identified by means of a network address.

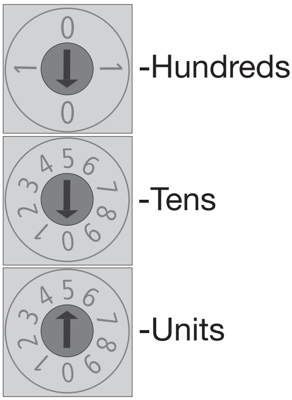
Only the addresses 001 to 125 (125 stations) can be assigned. Bus addresses 000, 126 and 127 must not be used.

Note

Slot 0 is reserved for the gateway

PROFIBUS-DP addresses are set via the three rotary coding switches on the module rack. The three switches represent the value of the three digits of the network address. The figure below shows an example of network address setting “005”.

Figure: 10
Setting network address “005”



Internal module address

The modules are addressed by slot. No settings are therefore required on the individual modules. A module in slot 0 thus automatically has address 0, a module in slot 1 address 1 and so forth.

I/O addresses

Access to the I/O peripheral devices is determined by the system configuration. Access to the different channels depends on the higher-level system used. “Configuration of the excom® station” page 10-6

PROFIBUS-DP connection

Depending on the module rack used, one or two (for redundant configurations) 9-pole SUB-D connectors are provided for connecting the bus (“SUB-D connector assignment for RS485 / RS485-IS” page 5-28).

Either PROFIBUS-DP compliant copper cables or fibre optic cables with suitable external converters can be used as cables. “The coupler system OC11Ex/..” page 5-17 converts the RS485-IS signals to intrinsically safe fibre optic signals. These signals can be transferred over long distances with potential isolation and interference immunity.

excom® can be connected to any system with a PROFIBUS-DP interface (master functionality).

Note

On account of the RS485-IS layer in place, the connection of a DP master to excom®, always requires the use of a DP Ex i segment coupler (such as: TURCK article: SC12Ex) or a fibre optic coupler (TURCK article:OC11Ex/...). (“Physical connection with SC12Ex or OC11Ex/...” page 5-3)
A suitable SUB-D connector must be used for the bus connections in the explosion hazardous area:
SC12Ex and OC11Ex/2G: **D9T-RS485IS**
GDP1,5Ex: **D9T-Ex**
OC11Ex/3G: **D9T-RS485**

Connections to the field level

The module rack provides four 4-pole connectors with two different connection technologies for connecting the field devices:

- Plug-in “MINI COMBICON” terminals
- Spring-loaded terminal

The wiring diagrams for each module type are provided in chapters “Digital modules” page 7-1, “Analogue modules” page 8-1 and “Function modules” page 9-1.

Gateways - Redundancy

The gateways control the internal data bus and function as a slaves on the higher-level fieldbus. The gateways control the entire data communication between the I/O modules and the process control system (PCS). To increase system availability and fail-safe performance, it is possible to use two gateways (redundancy) in conjunction with the module rack MT18.

- "Gateway GDP1,5" page 6-1

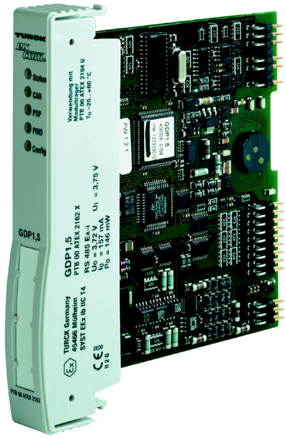


Figure 11: excom® gateway

I/O modules - Overview

The I/O modules are the interface to the periphery. The inputs and outputs allow connection of field devices in protection type EEx ia IIC.

The system can be expanded with a maximum of 16 I/O modules with an MT18 module rack and 8 I/O modules with an MT 9 module rack.

> **Note**
> The backplane provides the intrinsically safe supply of the I/O modules - an additional power supply is not needed.

Figure 12: excom® I/O module

Attention

Unused slots for I/O modules must always be provided with an IP20 cover!

The dummy modules “BM1”(ident no. 6884036) are available for unused slots.

Overview - Digital modules

- “DM80Ex - Digital input/output module, 8-channel” page 7-2
- “DI40Ex4 - digital input module, 4-channel” page 7-13
- “DO40Ex - Digital output module, 4-channel” page 7-20

Overview - Analogue modules

- “AI40Ex - Analogue input module, 4-channel” page 8-3
- “AI41Ex - Analogue input module, 4-channel” page 8-15
- “AO40Ex - Analogue output module, 4-channel” page 8-26
- “AIH40Ex/AIH41Ex - Analogue input modules, 4-channels” page 8-33
- “AOH40Ex - Analogue output module, 4-channel” page 8-61
- “TI40Ex - Temperature module, 4-channel” page 8-73

Counter module

- "DF20Ex - Digital frequency/counter module" page 9-2

HART® compatible field devices

Type AIH... and AOH... analogue modules are equipped with an integrated HART® controller. This considerably simplifies the use of HART® compatible field devices, so that HART® variables, for example, can be transmitted cyclically to the PCS. It is also possible to parameterise HART® field devices on the fieldbus by means of acyclic communication.

Coding pins - exchanging modules during operation

All modules can be plugged into or removed from the rack during operation, even when mounted in zone 1 (hot swapping). Thus it is also possible to replace defective devices during operation.

After a module is replaced, the system automatically checks whether the new module has been inserted into the correct slot. Newly fitted modules are configured and assigned parameters automatically.

Mechanical coding:

The user can code the module rack in such a way that a module can only be replaced by a module of the same type. The coding is implemented with hexagonal coding pins that are fitted in the corresponding recesses on the module rack. Each slot is provided with 4 recesses. Each module is factory coded by means of two fixed coding pins (two other coding pins can be fitted by the user).

Figure: 13 Coding pin positions on the module

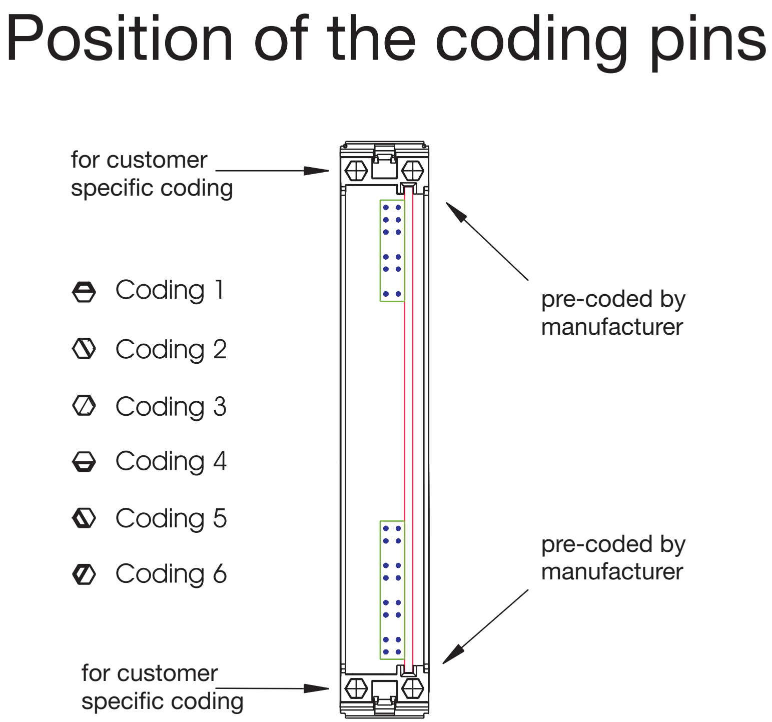


Table: 5
Mechanical coding of the I/O modules

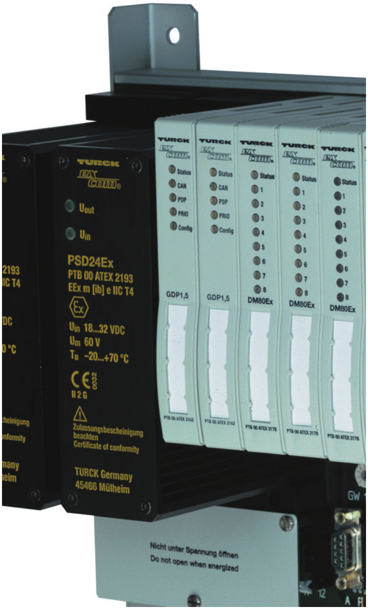
	Module coding (on the right, factory coding)	Coding to be carried out by user on the module rack
GDP1,5	1 1	4 4
DM80Ex	1 3	4 6
DI40Ex	2 3	5 6
DO40Ex	2 2	5 5
AI40Ex	1 5	4 2
AI41Ex	2 4	5 1
AO40Ex	1 2	4 5
AIH40Ex	2 5	5 2
AIH41Ex	3 4	6 1
AOH40Ex	3 2	6 5
TI40Ex	1 4	4 1
DF20Ex	1 3	4 6

LEDs and diagnostics

The modules are provided with LEDs for direct error analysis at the station. Each I/O module also provides LEDs for direct diagnostics and I/O status indication. All indications comply with NAMUR NE 44 or DIN EN 60073, i.e.:

- Green = operational readiness (power on)
- Red = error
- Yellow = switching status of the binary inputs/outputs

Figure 14: LEDs on gateways and modules



PROFIBUS-DP diagnostics

The gateway provides extended PROFIBUS-DP diagnostics functions, so that the user has access to an extensive scope of diagnostics data, which even includes channel specific error indications.

Transmission rate/Cycle time

The PROFIBUS-DP master determines the system's transmission rate. Baud rates of 9.6 up to 1,500 kBaud are admissible.

The internal cycle time for processing binary signals is 5 ms and for analogue signals 20 ms.

The cycle time of the higher-level bus and the process control system have to be added to the response time of the entire system.

Generally, the following formula applies:

$$\mathbf{T_R = 2 \times (T_I + T_B + T_{PCS})}$$

T_R = response time

T_I = internal cycle time of the Ex link

T_B = cycle time of the higher-level bus

T_{PCS} = cycle time of the process control system

Overview - Field housings

Housings for the *excom*® system come in two different sizes and three different versions. The following list provides an overview. A detailed description is provided in chapter "Housings for the *excom*® stations" page 3-1

Housings of size EG-VA6555 for **one** system of size MT18 or **two** systems of size MT9:

- EG-VA6555/BLD-U
- EG-VA6555/M16-K
- EG-VA6555/M20-K

Housings of size EG-VA4055 for **one** system of size MT9:

- EG-VA4055/BLD-U
- EG-VA4055/M16-K
- EG-VA4055/M20-K

Overview - Field housings with integrated module rack

These products consist of a stainless steel housing of protection type increased safety "e", in which a size MT18 or MT9 module rack can be installed and fitted with different modules. One or two filters are also integrated. As the fieldbus housings with an integrated module rack already have system approval, the user does not have to apply for individual approval of the assembled components. All components have been tested and certified by separate approvals.

The system is assembled and mounted at the factory to ensure compliance with the required creepage and clearance distances.

Products with a general approval for the module rack MT18-C230 are available on request.

The product designation is based on the "Ordering code for the systems approved as a whole" page 2-43.

The following products for size **MT18** module racks are provided with **spring-loaded terminals** for the signal connection level:

- EG-VA6555/BV680211
- EG-VA6555/BV680212
- EG-VA6555/BV680221
- EG-VA6555/BV680222

The following products are provided with **Mini-Combicon terminals** for the signal connection level:

- EG-VA6555/BV680122
- EG-VA6555/BV680121
- EG-VA6555/BV680112
- EG-VA6555/BV680111

The following products for size **MT9** module racks are provided with **spring-loaded terminals** for the signal connection level:

- EG-VA4055/BV681211
- EG-VA4055/BV681212

The following products are provided with **Mini-Combicon terminals** for the signal connection level:

- EG-VA4055/BV681111
- EG-VA4055/BV681112

A detailed description of the housings is provided in chapter "Housings for the *excom®* stations" page 3-1

A detailed description of the module racks:

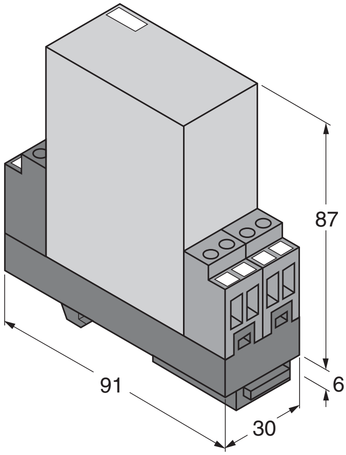
"Module rack versions for different station sizes, supply voltages and terminals" page 1-4.

Accessories without a slot on the module rack

MODEX filter

The MODEX filter (ident no.6884062) is recommended for improving the startup behaviour and increasing operational reliability. This filter must be fitted separately on a C rail. (“External power supply” page 1-19)

Figure: 15



2 Safety requirements in explosion hazardous areas

Attention

The applicable national and international regulations and directives concerning the correct setup and operation of the device in explosion hazardous areas must be observed and followed without fail. This is the responsibility of the system operator.

excom® provides at the terminals marked in blue intrinsically safe circuits for explosion protection in potentially explosive gas and dust atmospheres in compliance with EN 50020.

The intrinsically safe circuits have been certified by authorised bodies and approved for use in the respective countries.

Note

Correct and safe operation of the *excom*® systems requires that it is transported, stored, installed and set up properly; operated in an error-free and undamaged condition; and handled and maintained with great care in accordance with the governing regulations.

Correct operation

The components of the *excom*® system are manufactured and tested according to IEC 61010-1 and are shipped in a technically safe and perfect condition.

excom® is suitable for installation in zones 1 and 2, as well as zones 21 and 22, when mounted into an appropriate protective housing.

Warning

Installations in zone 0 or 20 are not permitted!

The protection type printed on the *excom*® components and the particular conditions specified in the module descriptions of the manual must be observed.

Warning

Structural modifications, alterations and repairs to the device are **not** permitted.

Attention

All foreign matter must be removed from the device and the protective cover prior to initial setup.

Compliance with relevant standards

This explosion protected equipment meets the requirements of EN 50014, EN 50019, EN 50020 and EN 50028 and the EC directives “Equipment and protective systems intended for use in potentially explosive atmospheres” (94/9/EC) and “Electromagnetic compatibility” (89/336/EC).

Note

The EC conformity certificates are enclosed with the instruction leaflets of the components.

Installation guidelines

excom® is a remote I/O system suitable for installation in zones 1 and 2, as well as zones 21 and 22. The intrinsically safe field circuits are approved for zone 0 and zone 20.

Connection to the PCS or PLC

The connection to the PCS or PLC is implemented using the PROFIBUS-DP.

Either copper cables with suitable external segment couplers or fibre optic cables (with a suitable external converter) can be used. "The coupler system OC11Ex/.." page 5-17 converts the RS485-IS signals to intrinsically safe fibre optic signals.
Two gateways can be installed for redundant system operation if required. This is only possible in conjunction with the module rack MT18.

Note
The gateways can be exchanged under live conditions.

The external power supply is connected via EEx e terminals (increased safety) located on the module rack and fed to the internal 24 VDC power supply units.

Attention
Please observe the usual safety regulations for terminal connections.

24 VDC power supply units can also be exchanged in an energised state in zone 1 and zone 21. Two power supply units can be installed for redundant system operation if required.

When using the MT18 module rack, two power supply units or two AC/DC converters with two downstream power supply units can be used for redundant system operation.

Connection of peripheral field devices

The peripheral field components, i.e. sensors and actuators located in the explosion hazardous area, are connected via terminals on the module rack.

The modules feature protection type “intrinsic safety” and provide safe galvanic isolation. The modules, sensors and actuators can therefore be exchanged during operation (hot-swapping).

Provisions for usage in zones 1 and 2

If the system is installed in zone 1 or zone 21, it must be mounted in a specially approved EEx e field housing with protection rating IP54 or higher. An EEx e type housing is not mandatory in zone 2 and only a housing with IP54 protection is required. The customer is responsible for enclosing the system in an appropriate housing, as specified in this manual and in compliance with EN 50014. In both cases the effects of temperature rise within the housing must be taken into account.

Alternatively, it is possible to order a factory-assembled system in a series EG-VA... protective field housing to ensure that the required precautionary measures are fulfilled (“Housings for the *excom*® stations” page 3-1).

All modules, the gateway to the higher-level fieldbus and the power supply are covered by separate approvals. They may only be used in conjunction with the module racks.

Mounting guidelines

The power supply units, the bus coupler and the I/O modules are plugged into the designated slots in the module rack. They must clearly snap into the retaining clamps.

The power supplies are screw mounted.

Note

Power supply units, bus couplers and the I/O modules may be exchanged during operation, even in zone 1 or zone 21.

Warning

230/115 VAC power supply units can only be exchanged after the power supply is disconnected. A waiting time of at least 5 minutes must be observed for this.

Warning

Please also note that once intrinsically safe components have been connected to non-intrinsically safe circuits, these **must no** longer be used later as intrinsically safe equipment.

Warning

Defective components or components suspected of being defective **must not** be used. These kinds of components must be marked accordingly and Ex markings removed.

Prior to initial setup or after any modification of the interconnection assembly it must be ensured that the relevant regulations, directives and general requirements have been observed, that operation is error-free and that all safety regulations are fulfilled.

Mounting and connection of the device should only be carried out by qualified and trained staff familiar with the relevant national and international regulations of explosion protection.

The electrical equipment can be installed as a category II 2 D device in zone 21 and zone 22. However the requirements of EN 50281-1-2, in relation to dust deposits and temperature must be observed by the system installer.

Power supply

The external power supply may only be connected to the designated terminals located under a special cover with IP30 protection.

Warning

The terminal cover may only be opened in a de-energised condition.

The power cable may thus only be disconnected in zone 1 21 locations after power has been disconnected or if a special permission has been obtained for this purpose.

If the system is mounted in zone 2 or in the safe area, this restriction does not apply.

The terminal cover must be securely fastened after the connection work has been completed.

Warning

The system may only be operated when the terminal cover is properly closed!

Cable connections

All cables must be routed via the EEx e cable and line entry fittings and stripped to length. Only fixed cables must be routed through the cable gland. The cables must be connected according to the terminal markings. Intrinsically safe circuits must be separated from non-safe circuits. They must be marked and wired to the terminals according to the wiring diagrams of the I/O modules.
Unused cable entries must be replaced by approved EEx e sealing plugs. The strain relief devices of the EEx e bushings must be closed.

Attention

Prior to initial operation the wiring and functionality of the *excom*® system must be tested; this particularly applies to the wiring and marking of the intrinsically safe circuits. According to EN 60079-14, the installer is required to certify the “intrinsic safety” of these circuits.

Connecting the power supply to the PPSA230Ex and PPSA115Ex

All power supply components of the *excom*® system must be installed in compliance with the requirements of explosion protection type “e” (increased safety according to EN 50019).

- Rigid cables 4 mm^2, flexible cables 2.5 mm^2.

The auxiliary power supply should be short-circuit protected by means of a fuse with 10 A max.

The requirements of EN 60079-14 (VDE 0165 part 1), in particular chapter 11 (additional requirements of explosion protection type “e” – increased safety) must be observed.

The terminals are located under an IP30 cover.

Attention

The cover must only be opened in a de-energised state after a waiting period of 5 minutes.
The system must only be operated with the cover closed.

Attention

Prior to applying the auxiliary power supply, the user must test and ensure conformance of the auxiliary supply voltage to the admissible voltage of the internal power supply modules.

The space between the AC power supply and the housing wall is specified with a clearance of min. 5 mm and a creepage distance of min. 8 mm. The mounting space for cable connection must have a side clearance of 20 mm.

The PS-F24Ex power supply filter must be used with an AC power supply. The connection should be carried out as described in “Example wiring diagrams for the power supply” page 2-13.

Direct connection of the power supply to the PSD24Ex

All power supply components of the *excom*® system must be installed in compliance with the requirements of explosion protection type “e” (increased safety according to EN 50019).

The power supply should only be connected directly to the PSD24Ex if the slot for the associated PPSA230Ex PPSA115Ex AC AC/DC converter is empty.

The power supply is directly connected to the terminals 1, 2 (+) and 3, 4 (-). Terminals 5, 6 (PE) can be used if required to connect an protective conductor (routed together) or a low-noise protective earth conductor. The protective conductor is terminated at this point and is not used further internally. Terminals 1...6 are assigned to the first power supply unit; terminals 7, 8 (+) and 9, 10 (-) and terminals 11, 12 (PE) are allocated to the second (redundant) power supply unit.

The admissible max. cable cross-section is defined as follows:

- Rigid cables 4 mm^2, flexible cables 2.5 mm^2.

The auxiliary power supply should be short-circuit protected by means of a fuse with 10 A max.

The requirements of EN 60079-14 (VDE 0165 part 1), in particular chapter 11 (additional requirements of explosion protection type “e” – increased safety) must be observed.

The terminals are located under an IP30 cover.

Attention

This terminal cover may only be opened in a de-energised condition after a waiting time of at least 30 seconds.
The system must only be operated with the cover closed.

Attention

Prior to applying the auxiliary power supply, the user must test and ensure conformance of the auxiliary supply voltage to the admissible voltage of the internal power supply modules.

The space between the 24VDC power supply and the housing wall is specified with a clearance of min. 5 mm and a creepage distance of min. 8 mm. The mounting space for cable connection must have a side clearance of 20 mm.

Connection of the power supply via a MODEX filter

When using a MODEX filter, the power supply is connected directly to the MODEX filter. When using a TURCK filter, the power supply is connected directly as described in “Direct connection of the power supply to the PSD24Ex” page 2-10. The requirements of chapter “Example wiring diagrams for the power supply” page 2-13 must be observed.

Connecting the PS-F24Ex

When using a TURCK filter, the power supply is connected directly as described in “Connecting the power supply to the PPSA230Ex and PPSA115Ex” page 2-10 and “Direct connection of the power supply to the PSD24Ex” page 2-10. The requirements of chapter “Example wiring diagrams for the power supply” page 2-13 must be observed.

The red cable (+) of the PS-F24Ex must only be connected to terminals 1,2 or 7,8, and the black cable (-) only to terminals 3,4 or 9,10.

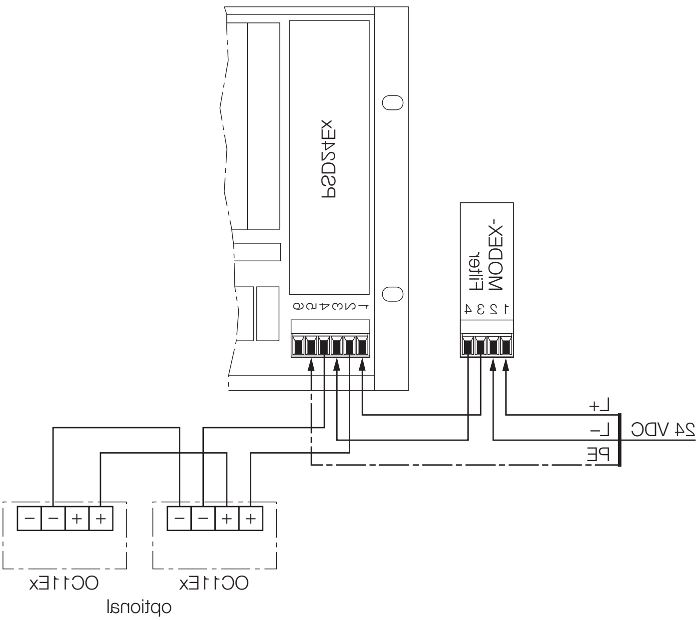
Example wiring diagrams for the power supply

24 VDC power supply - not redundant (MT9)

The following example illustrates a circuit with a separate capacitor (Modex filter) for improving the startup behaviour and increasing operational reliability. The power supply is not redundant. The two segment couplers are also powered here (“The coupler system OC11Ex/..” page 5-17). The following components are required:

- “MT9-C024/MT9-R024” page 1-6
- 1 x “PSD24Ex supply module” page 1-14
- 1 x “MODEX filter” page 1-33

Figure: 16 Connection on the module rack MT9-C(R)024.

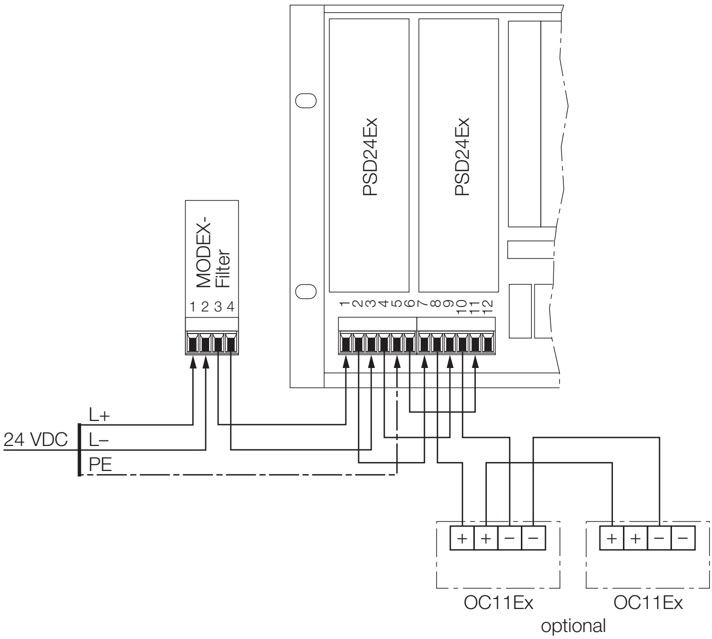


24 VDC power supply - with redundant hardware (MT18)

The following example illustrates a circuit **with** a separate capacitor (MODEX filter) for improving the startup behaviour and increasing operational reliability. The power supply is redundant. The two segment couplers are also powered here ("The coupler system OC11Ex/.." page 5-17). The following components are required:

- "MT18-C024 / MT18-R024" page 1-7
- 2 x "PSD24Ex supply module" page 1-14
- 1 x "MODEX filter" page 1-33

Figure: 17 Connection on the module rack MT18-C(R)024. Hardware redundancy with one power source.

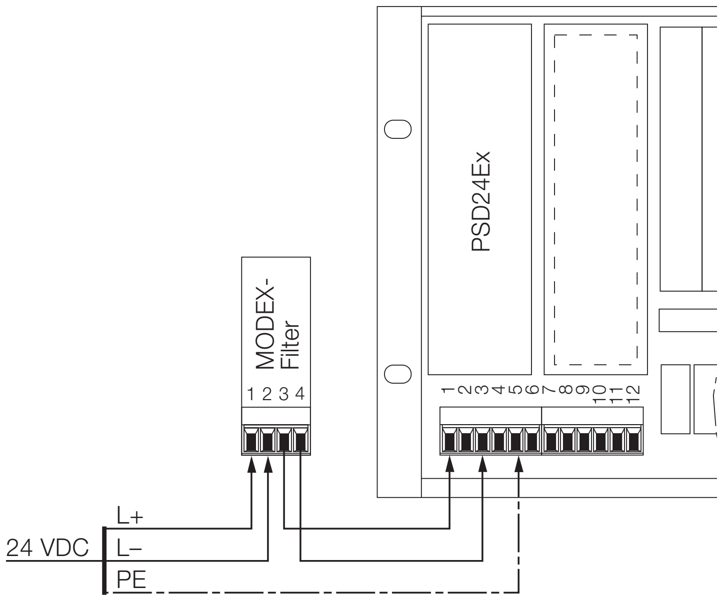


24 VDC power supply - not redundant (MT18)

The following example illustrates a circuit **with** a separate capacitor (MODEX filter) for improving the startup behaviour and increasing operational reliability. The power supply is not redundant. The following components are required:

- "MT18-C024 / MT18-R024" page 1-7
- 1 x "PSD24Ex supply module" page 1-14
- 1 x "MODEX filter" page 1-33

Figure 18: Wiring diagram MT18 with MODEX filter

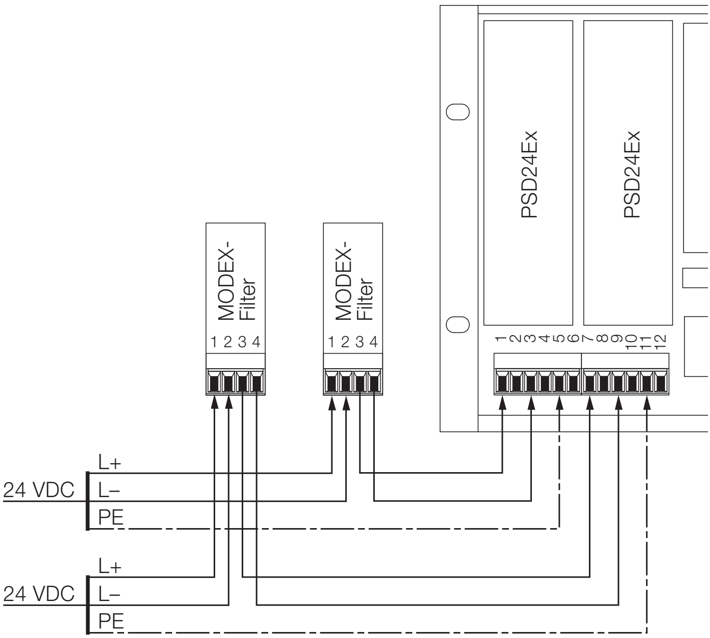


24 VDC power supply - redundant (MT18)

The following example illustrates a circuit **with two** separate capacitors (MODEX filters) for improving the startup behaviour and increasing operational reliability. The power supply is redundant. The following components are required:

- "MT18-C024 / MT18-R024" page 1-7
- 2 x "PSD24Ex supply module" page 1-14
- 2 x "MODEX filter" page 1-33

Figure: 19 Connection on the module rack MT18-C(R)024. Redundancy with two power sources.

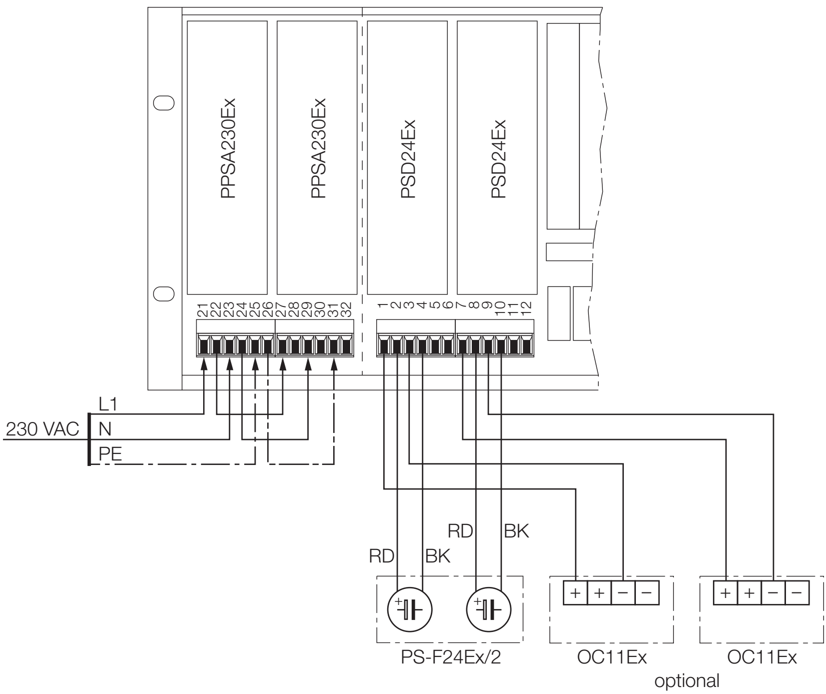


115/230 VAC power supply - hardware redundancy

The following example illustrates a circuit on the MT18-C230 rack with two power supply filters (PS-F24Ex/). The filters are factory fitted on the MT18-C230 rack. Redundant power supply modules are provided and connected to the AC/DC converters. The two segment couplers are also powered here ("The coupler system OC11Ex/.." page 5-17). The following components are required:

- "MT18-C230" page 1-8
- 2 x "AC/DC converter PPSA230Ex / PPSA115Ex" page 1-16
- 2 x "PSD24Ex supply module" page 1-14

Figure: 20
Connection on the module rack MT18-C230 .

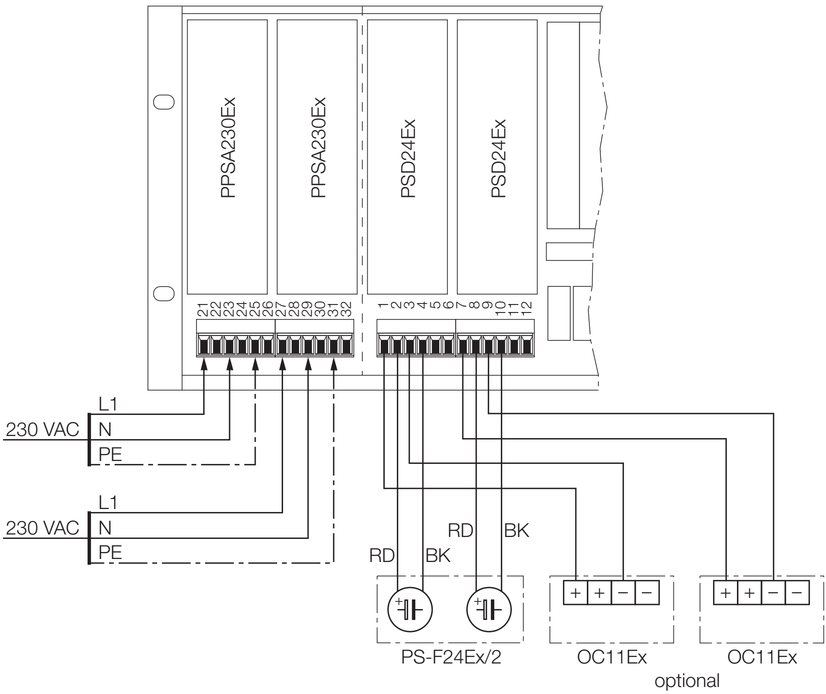


115/230 VAC power supply - redundant

The following example illustrates a circuit on the MT18-C230 rack with two power supply filters (PS-F24Ex/). The filters are factory fitted on the MT18-C230 rack. The two AC/DC converters are connected to two separate voltage sources for redundant operation. The two segment couplers are also powered (“The coupler system OC11Ex/..” page 5-17). The following components are required:

- “MT18-C230” page 1-8
- 2 x “AC/DC converter PPSA230Ex / PPSA115Ex” page 1-16
- 2 x “PSD24Ex supply module” page 1-14

Figure: 21 Connection on the module rack MT18-C230 .

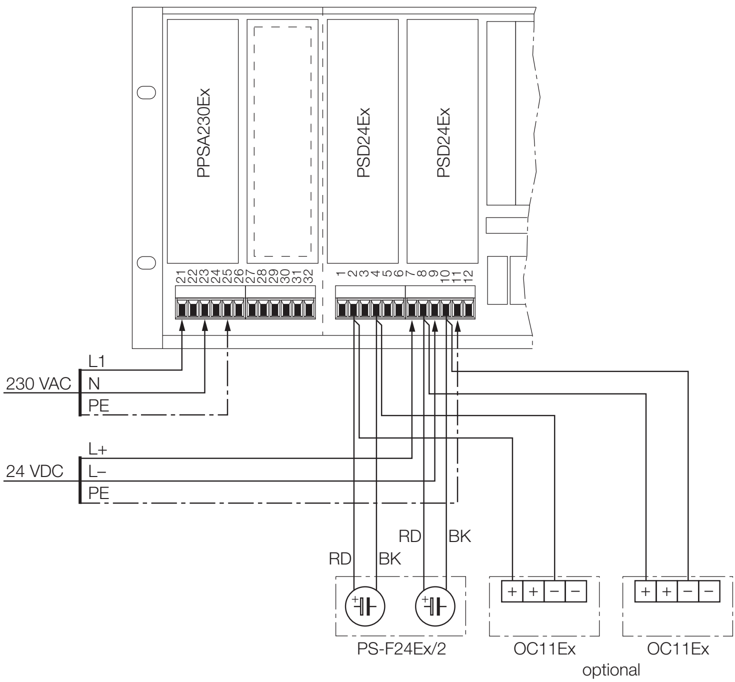


115/230 VAC and 24 VDC power supply - redundant

The following example illustrates a circuit on the MT18-C230 rack with two power supply filters (PS-F24Ex/). The filters are factory fitted on the MT18-C230 rack. A 230 VAC voltage source is connected to the AC/DC converter and a 24 VDC power supply directly to a PSD24EX power supply unit. Two segment couplers are also powered here (“The coupler system OC11Ex/..” page 5-17). The following components are required:

- “MT18-C230” page 1-8
- 1 x “AC/DC converter PPSA230Ex / PPSA115Ex” page 1-16
- 2 x “PSD24Ex supply module” page 1-14

Figure: 22 Connection on the module rack MT18-C230 .



Attention

When implementing the power supply connection examples shown, observe the requirements stated in:
“Connecting the power supply to the PPSA230Ex and PPSA115Ex” page 2-10
“Direct connection of the power supply to the PSD24Ex” page 2-10

The auxiliary power supply should be short-circuit protected by means of a fuse with 10 A max. The requirements of EN 60079-14 (VDE 0165 part 1), in particular chapter 11 (additional requirements of explosion protection type “e” – increased safety) must be observed.
The terminals are located under an IP30 cover.

Attention

This terminal cover may only be opened in a de-energised condition after a waiting time of at least 30 seconds.

The system must only be operated with the cover closed.

Attention

Prior to applying the auxiliary power supply, the user must test and ensure conformance of the auxiliary supply voltage to the admissible voltage of the internal power supply modules.

The space between the 24VDC power supply and the housing wall is specified with a clearance of min. 5 mm and a creepage distance of min. 8 mm.

The mounting space for cable connection must have a side clearance of 20 mm.

Installing the *excom*® stations in a mounting cabinet

The following four drawings show the minimum clearances when installing the *excom*® stations in a mounting cabinet.

Figure 23: MT18-C230 with FO via the coupler OC11Ex/2G

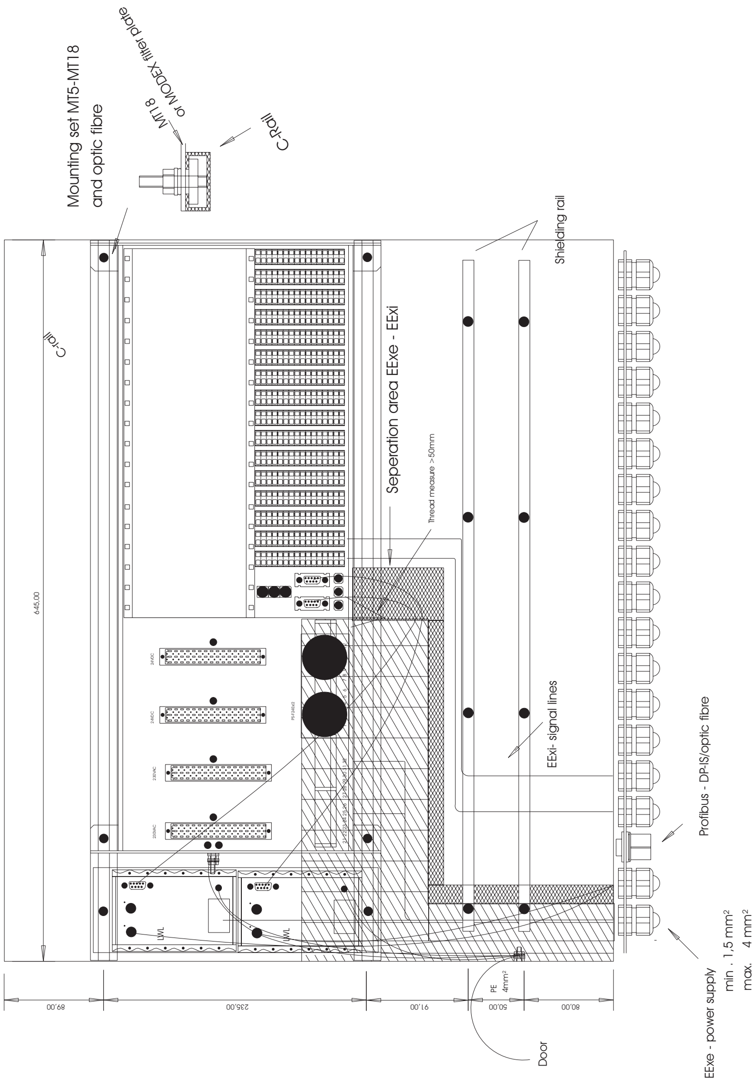


Figure 24: MT18 with 1 MODEX filter

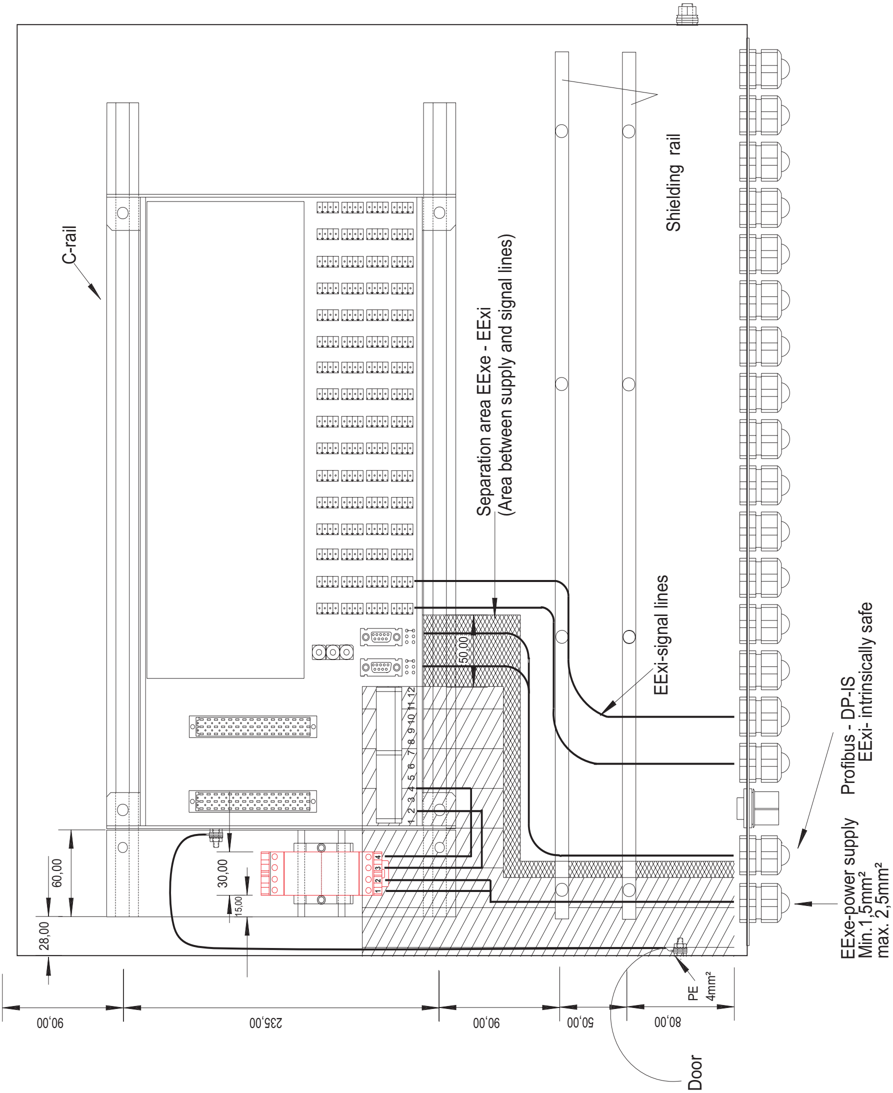


Figure 25:
MT18 with two
MODEX filters

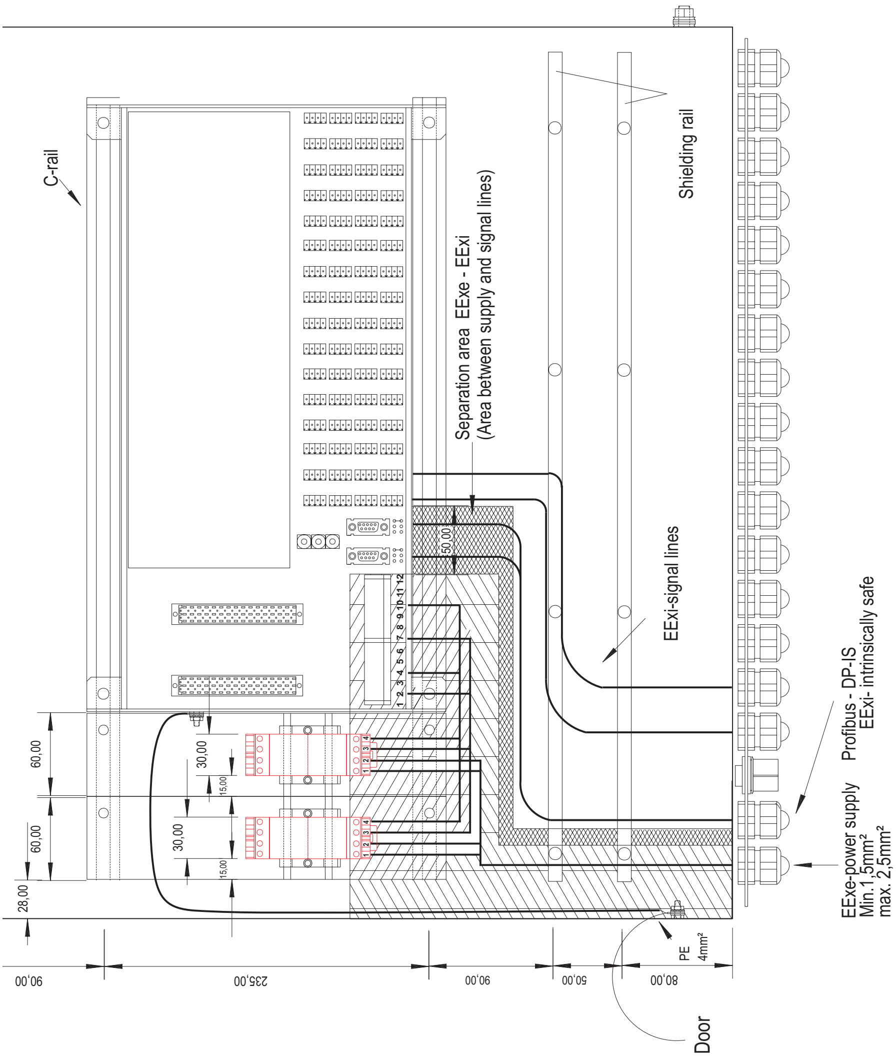
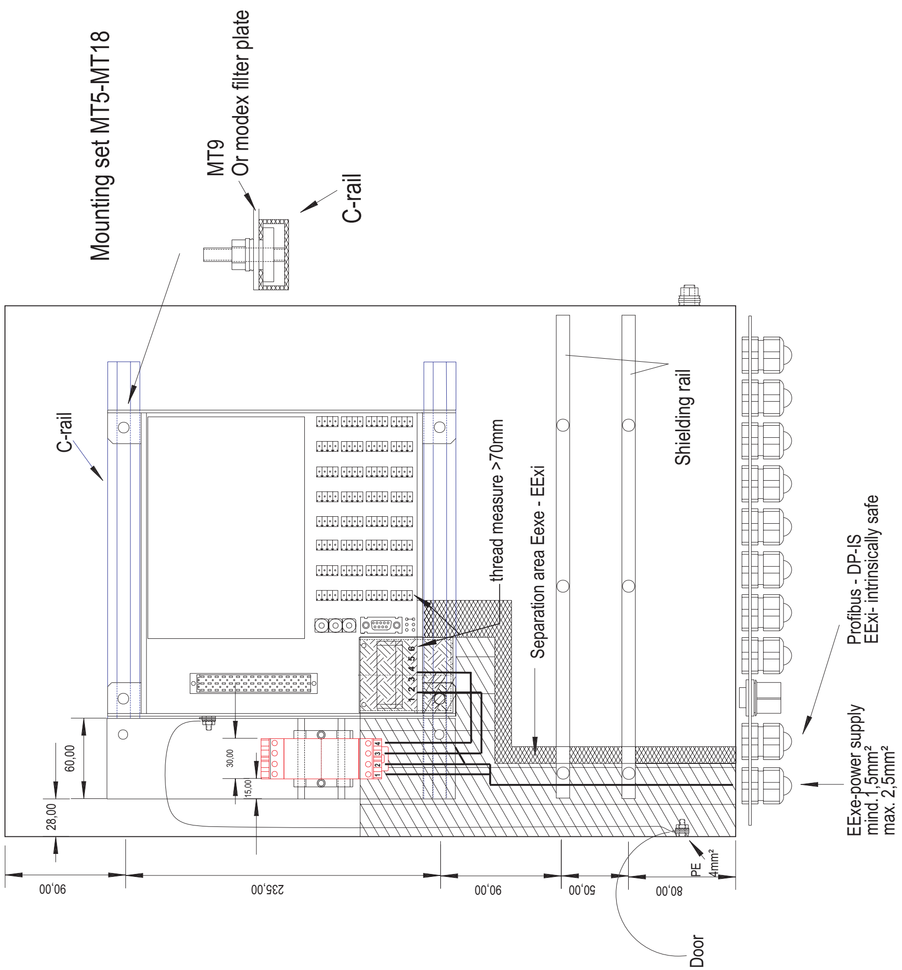


Figure 26: MT9 with one MODEX filter



Potential equalisation and shielding of the field circuits

excom® fulfills the EMC requirements for industrial applications.

Compliance with the applicable regulations is clearly documented by the CE mark and the EC declaration of conformity.*excom*® additionally fulfils the NAMUR recommendation NE21.

Potential equalisation must be provided along all system parts in accordance with EN 60079-14. The *excom*® module rack and the stainless steel field housing are directly connected electrically at the factory via an equipotential bonding conductor and are part of the equipotential bonding system.

The *excom*®module rack must always be connected to the equipotential bonding system with a conductor cross-section of min. 4 mm^2.

If shielded field circuit cables are used, it is possible to establish a single shield connection to the shielding bar integrated in the *excom*® module rack.

This must be integrated in the equipotential bonding system via a bonding conductor with a cross-section of min. 4 mm^2.

Attention

For earthing and shielding in zones 0, 1, 2, 21 and 22 the relevant installation regulations in accordance with EN 60079-14 must be observed!

Earthing of the field device shield depends on the specific requirements of the respective field device.

If a shield connection at both ends is required, the equipotential bonding system already in place must be taken into account.

Warning

On no account must a direct shield connection at both ends be implemented in explosion hazardous areas without appropriate potential equalisation.

In such cases, a capacitive shield connection can contribute to increased electromagnetic compatibility.

Fieldbus connection

Notes on the system approval of the RS485-IS (Ex-i) layer

The gateway GDP1.5 establishes the connection to the external fieldbus system via the connectors GW1 and GW2.

Note

To obtain gateway functionality a segment coupler is always required irrespective of the system used.

Attention

If *excom*® is used as an intrinsically safe system in the explosion hazardous area, the segment coupler used must be approved and the operator is responsible for the “verification and certification of intrinsic safety”.

In this context, it is relatively difficult to apply the classical approach to verifying and certifying intrinsic safety.

Each bus station can either be an input or an output.

For this reason, an “intrinsically safe RS485 fieldbus system” has been defined for approval.

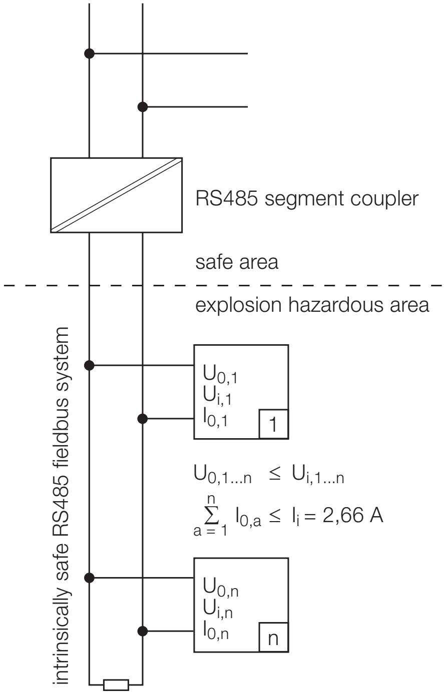
Within the framework of this definition, the values specified in point 15 IV of the gateway approval PTB 00 ATEX 2162 apply to all bus stations:

- Max. value per terminal pair $U_i = 4.2$ V
- Accumulated value of all terminal pairs $I_i = 2.66$ A

All bus stations are wired in parallel to the bus. Voltage accumulation of the individual output voltages U_0 of the bus stations is thus excluded. At no time should the output voltage (U_0) of a bus station be greater than the permissible input value (U_i) of a bus station.

The maximum current of the bus system is permanently defined at the value $I_i = 2.66$ A However, each bus station can only provide the maximum certified current specified by the value I_0. The sum of the I_0 values of the bus stations in place must therefore be less than I_i 2.66 A.
This also determines the theoretical number of bus stations within the bus system.

Figure 27: U/I considerations when interconnecting intrinsically safe bus nodes At no time should the output voltage (U_0) of a bus station be greater than the permissible input value (U_i 4.2 V) of a bus station! The sum of the I_0 values of the bus stations in place must therefore be less than I_i (2.66 A).



EN 50039 specifies cable types A and B, featuring the following specific inductances and capacitances:

- L/R ratio: ≤ 15 µH/W
- Capacitance: ≤ 250 nF/km

Warning
Cables other than those specified must not be used!

When using flexible cables, the litz wire cross-section must be at least 0.2 mm. The cable ends must be protected against splicing by means of ferrules.

Based on the “intrinsically safe RS485 fieldbus system”, each bus station is individually approved within the scope of the system approval.

In this context, there is no reference to an individual approval of a separate system.

Each bus station approvals merely refers to the “RS485 fieldbus system” with the marking SYST EEx ib IIC/IIB. In order to verify intrinsic safety it is only necessary to ensure that all bus stations use the same bus system with the defined cables, that the total current does not exceed the certified value of $I_i = 2.66$ A, and that the specified voltages of $U_0 \leq U_i$ are observed.

Shielding concepts of the fieldbus system

The RS485-IS (Ex-i) fieldbus cables must be protected against interference by means of a suitable shielding concept that is adapted to the overall system. The following requirements must be fulfilled in all cases:

Warning

There should be no equalising currents across the shield cable!

4 shielding concepts are available:

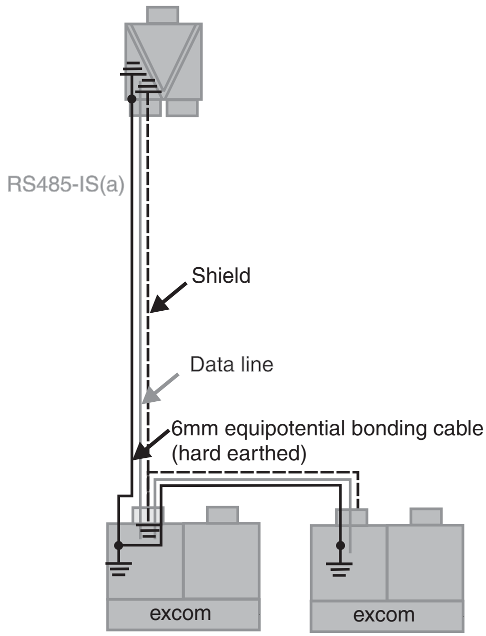
- 1. The connections are hard earthed with the earthing potential at both ends.

To prevent equalising currents over the cable shield, a separate equipotential bond conductor is required. This must be a cable with a minimum conductor cross-section of 6 mm² routed in parallel to the fieldbus cable. The equipotential bonding conductor must be routed both between the supplying device and the first bus station, as well as between all other bus stations. In order to minimise the active shield area, the equipotential bonding conductor must be installed as close to the shielded cable as possible. The shield must also be connected to the PROFIBUS connector body.

If you wish to save the equipotential bonding cable, check whether shielding concept 2 (Seite 2-30) will meet your requirements!

Observe the "General requirements for equipotential bonding" page 2-33.

Figure 28: "Hard" earthing at both ends



- 2.The connection at the supplying device is “hard earthed”, the terminals of all bus stations in the segment have a capacitive earth.

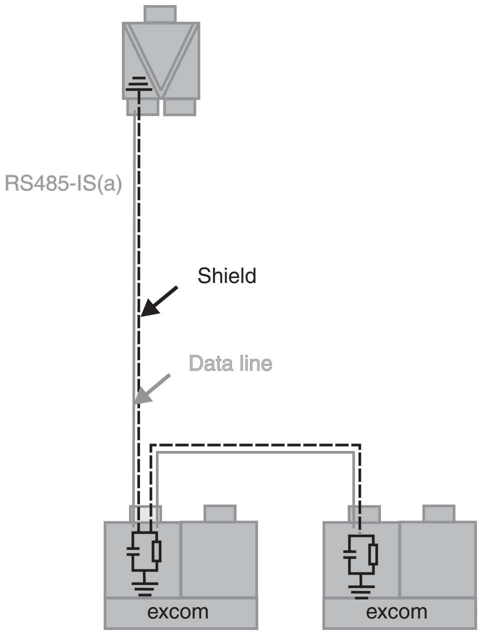
An equipotential bonding conductor parallel to the fieldbus is not necessary.

The shield must also be connected to the PROFIBUS connector body.

This shielding concept meets most requirements to a high degree.

Observe the “General requirements for equipotential bonding” page 2-33.

Figure 29: “Hard” earthing on the supplying device - capacitive earthing of all bus stations



- 3. The connection at the supplying device has a capacitive earth, the connections of all bus stations in the segment have a “hard” earth.

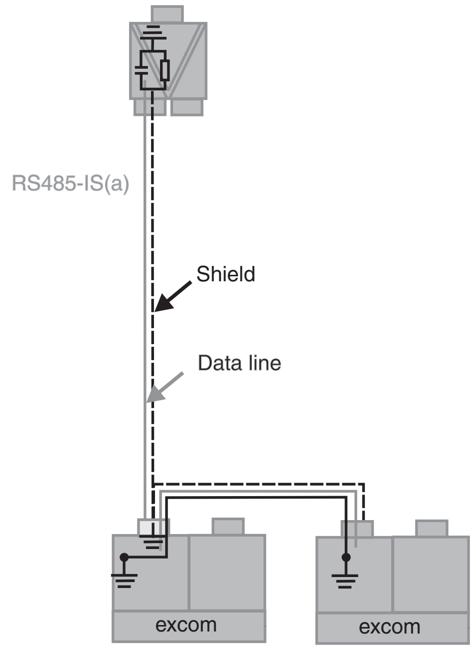
An equipotential bonding conductor parallel to the fieldbus between the supplying device and the first bus station is not necessary.

All other bus stations must be provided with an interconnected equipotential bonding conductor that is routed parallel to the fieldbus to prevent equalising currents from occurring on the shield cable.

This shielding concept only meets a few requirements and must be checked very closely!

Observe the “General requirements for equipotential bonding” page 2-33.

Figure 30: Capacitive earthing on the supplying device -“hard” earthing of all bus stations



- 4. The connection at the supplying device has a capacitive earth, the connections of all bus stations in the segment likewise have a capacitive earth.

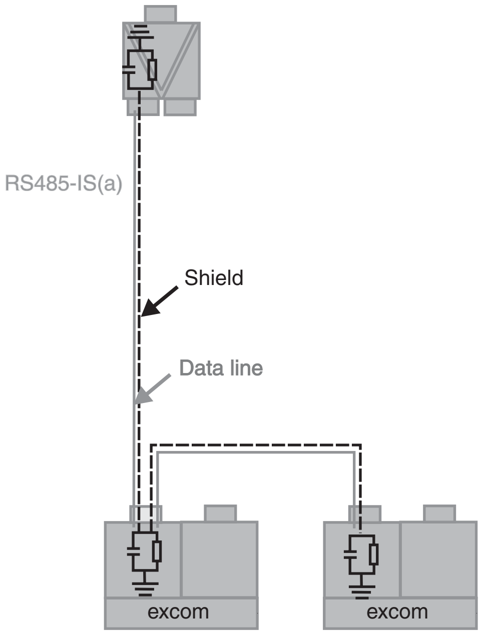
An equipotential bonding conductor parallel to the fieldbus between the supplying device and the first bus station is not necessary. An equipotential bonding conductor is also not required between the bus stations.

The earthing capacity of capacitive earthing at both ends is very low. High frequency interference signals are well earthed.

Check whether these features are suitable for your application and compare it with shield concept 2 (Seite 2-30)!

Observe the "General requirements for equipotential bonding" page 2-33.

Figure 31: Capacitive earthing on the supplying device - capacitive earthing of all bus stations



General requirements for equipotential bonding

- The *excom*® **system** (module rack) and the **field housing** are permanently connected electrically. The field housing is part of the equipotential bonding system. The field housings must be connected to the equipotential bonding system via a bonding conductor with a cross-section of at least 6 mm² . If non-conductive field housings are used, the *excom* ® module rack must be connected directly to the equipotential bonding system.
- If the cable shield is connected directly to the integrated **shielding bar of the** *excom*® **module rack**, the shielding bar must be connected with the equipotential bonding system (cross-section min. 4 mm²).
- **Insulated shielding busbars** are used for routing the shield and the equipotential bonding conductor separately. The insulated shielding busbars may not be connected with the field housing and thus with the equipotential bonding system.
- The **shield for the fieldbus cables** is connected at one end to the existing shielding busbars (if shielded field cables are used).
- The **shield for the fieldbus cable** is connected in the control room to a central point which also serves as the connection for the equipotential bonding system (separate routing of shield and equipotential bonding from this point on).
- **Power supply and fieldbus cables** must be routed separately; alternatively it is possible to install shielded power cables observing a minimum distance of 30 cm from the field bus cable.
- Equipotential bonding must be provided between the **control room and the field installation**.

Figure 32: Separate equipotential bonding

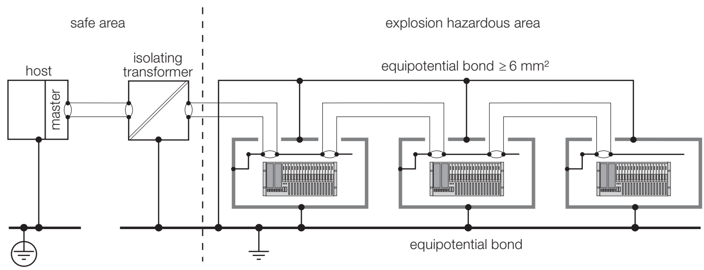
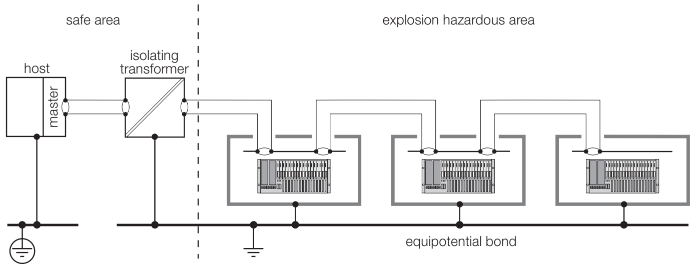


Figure 33: Without separate equipotential bonding



Connection of intrinsically safe field circuits

The field circuit connections located on the module racks MT18... and MT9 of the *excom*® system must be installed in compliance with the regulations of intrinsic protection, type “i”. The regulations of the EN 60079-14 (VDE 0165 part 1), in particular chapter 12 (additional requirements of explosion protection type “i” – intrinsic safety) must be observed.

The installer is required to certify the intrinsic safety of the field circuits in accordance with EN 60079-14. The connection must be carried out according to the relevant wiring diagram for the modules (“Digital modules” page 7-1, “Analogue modules” page 8-1, “Function modules” page 9-1).

Servicing and maintenance

If all mounting instructions are observed and if the system is operated correctly within the specified ambient conditions, regular maintenance is not necessary.

Attention

The operator of electrical systems in explosion hazardous areas is required to have these inspected regularly by a qualified electrician who shall verify that the equipment is free of defects, such as cracks in the housing, damage or discolouration of modules as a result of excessive temperatures and damage, defective seals and the secure fit of terminals and sealing plugs.

The electrical equipment must be disconnected from the power supply prior to exchanging or dismantling non-pluggable components. The use parts other than genuine TURCK components is not permitted!

Attention

If maintenance is performed on part of the *excom*® system on which explosion protection depends, operation must not be resumed until the electrical equipment has been inspected by an expert for compliance with explosion protection regulations, issued applicable certification of this or until the control mark of this expert has been attached to the apparatus.

Inspection by an expert is unnecessary if the manufacturer performs a maintenance test on the equipment and certifies successful testing by attaching the inspection mark prior to resuming operation.

Note

The approval expires if the device is repaired, modified or opened by a person other than the manufacturer or an expert, unless the device-specific instruction manual explicitly permits such interventions.

Marking

All *excom*® components are marked as follows:

- Approval number of the EC type examination certificate
- Important safety relevant connection values
- CE mark
- Manufacturer marking

Field housings

If the system is installed in zone 1, it must be mounted in a specially approved EEx e field housing with protection rating IP54 or higher.

Note

In zone 2, an EEx e type housing is not mandatory so that it is sufficient to integrate the system into an IP54 field housing meeting the requirements of EN 60079-15.

It is the customer's responsibility to enclose the system as stated in the manual in an appropriate housing meeting the requirements of EN 50014.

Alternatively, it is possible to order a factory-assembled system in an appropriate field housing to ensure that protection type IP54 is fulfilled.

The module rack MT9 is integrated into the field housing, type EG-VA4055/... whereas the module rack MT18 is enclosed in the field housing EG-VA6555/... .

The field housings EG-VA4055/... and EG-VA6555/... come with differently punched flange plates.

The holes are suitable for cable glands supplied by Hummel and venting pipes from TBK.
The following components are used:

Table 6: Approved cable entry fittings

	Type	Approval
Cable entry fitting	HSK-K-Ex (Hummel)	DMT 02 ATEX E047 X
Sealing plugs	HSK-V-Ex (Hummel)	BVS 03 ATEX E 298 X
Venting pipes	DBEL0112 (TPK Kapfer)	PTB 00 ATEX 3109 X

Alternatively:

	Type	Approval
Cable entry fitting	ECDEP - EExi II (RST)	LCIE 97 ATEX 6007 X
Cable entry fitting	ECDEP - EEx e II (RST)	LCIE 97 ATEX 6007 X
Sealing plugs	ECDEP (RST)	LCIE 98 ATEX 0001 U
Screwed sealing plugs	EEx e II (RST)	LCIE 98 ATEX 0001 U
Cable entry fitting	U59 (Pflitsch)	PTB 02 ATEX 1115 X

Ambient conditions

The admissible ambient temperature ratings of the *excom*® modules and components can be taken from the individual device conformity certificates. It must be ensured that the admissible ambient temperature rating of the modules and components used is not exceeded by the ambient temperature in the field housing occurring under normal operating conditions. In this respect, the power loss within the field housing must be taken into account.

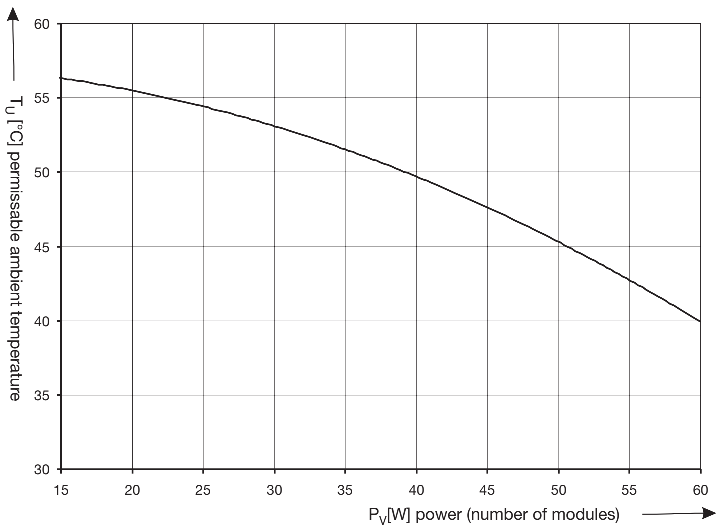
Assessment of temperature compliance

Attention

Remember that increasing the number of modules in an *excom*® system increases the total output and thus decreases the permissible ambient temperature.
If necessary, carry out measures to reduce the ambient temperature. Avoid direct sunlight! In the event of exposure to direct sunlight, the ambient temperature must be reduced.

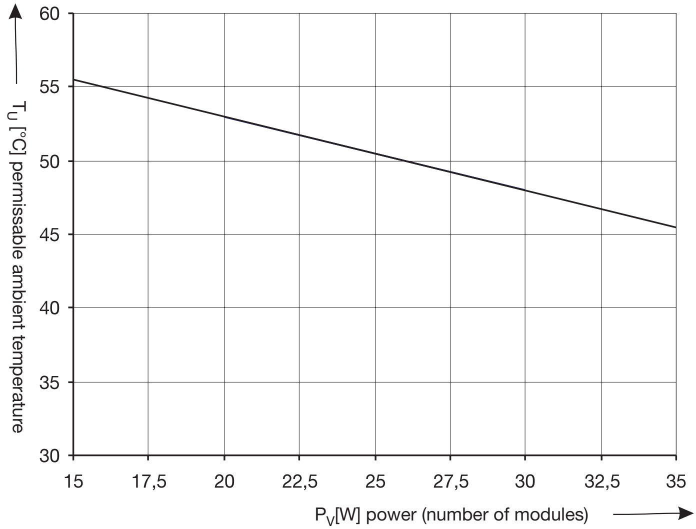
Temperature curve of the housing EG-VA6555/... with the module rack MT18

Figure 34: Temperature curve EG-VA6555/...



Temperature curve of the housing EG-VA4055/... with the module rack MT9:

Figure 35: Temperature curve EG-VA4055/...



Note

The power loss indicated in the curve is the sum of the individual module ratings (internal power input).

The additional power loss of the supply unit/units has been taken into account. External heat sources such as sunlight have not been considered.

If other components are installed in the housings in addition to the *excom*® system, their thermal power loss values must also be calculated and certified by means of an individual acceptance test.

Notes on explosion protection certificates

This section is primarily addressed to those responsible for explosion protection and contains information for a better understanding of the different sorts of EC type examination certificates and admissible combinations.

Understanding “U” type approvals

Each module, module rack and the housing of the *excom*® system have separate EC type examination approvals certifying compliance with explosion protection. This does not involve any disadvantages for the plant operator because the authorised testing bodies have taken this into account and ensured that approvals are carefully coordinated within the system.

The module rack is provided with a different type of approval than the modules. It is designated by the letter “U” in the approval, which is given for “incomplete” items of electrical equipment. This definition in accordance with EN 50014:1997 (paragraph 3.23 and 3.25) covers “Ex components” as opposed to the term “equipment”.

These incomplete items of electrical equipment may not be used in explosion hazardous areas on their own and require a separate approval when integrated in electrical equipment.

The first paragraph in section 15 of the module rack approval PTB 00 ATEX 2194 U stipulates exclusive application of the module rack in combination with the *excom*® system. In turn, section 15 of the individual module approvals describes each module as a component of the *excom*® system and explicitly states approval of the module rack.

An additional approval or document is thus not needed due to this integral approach. This therefore ensures the approval of the collective operation of all individually approved components of the *excom*® system.

It is not necessary to “verify and certify intrinsic safety” for the internal connection of the individual modules via the module rack. With section 15 of the individual certificates, the entire assembly is approved by the authorised bodies. The power supply concept is separately assessed by approval PTB 00 ATEX 2193 covering the power supply module PSD24EX and by approval PTB 00 ATEX 2194 U covering the internal CAN bus. All components of the *excom*® system may therefore be operated without an additional approval by the user.

System approval of *excom*® field housings

In order to save the user the trouble of having to apply for individual approval of the assembled components, TURCK has obtained a system approval covering the stainless steel field housings with integrated module rack.

With this approval, the components (housing, module rack and line filter) are combined under a “U” type approval.

The I/O fieldbus system consists of a stainless steel housing with protection type EEx e and an integrated module rack. This rack is designed to incorporate various modules.

It is also possible to integrate a line filter and various other prewired terminals within the scope of this approval.
All components of the *excom*® system have been tested and certified by separate approvals. The system is factory-assembled and mounted at TURCK to ensure compliance with the required creepages and clearances.

In order not to exceed the maximum temperature specification of temperature class T4, the maximum permissible ambient temperature is reduced according to the power of the modules installed (see also the temperature curves, “Assessment of temperature compliance” page 2-39).

Table 7: Max. admissible ambient temperature

Basic housing	P_{in} (power of the installed modules)	Max. admissible ambient temperature
EG-VA6555	< 59 W	-20 ... +40 °C
	< 50 W	-20 ... +45 °C
	< 40 W	-20 ... +50 °C
	< 30 W	-20 ... +53 °C
EG-VA4055	< 30 W	-20 ... +48 °C
	< 20 W	-20 ... +53 °C

Ordering code for the systems approved as a whole

An approved complete system can be ordered using the following ordering code:

Figure 36: Ordering code

EG-VA xxxx /BV 68 x x x x Meaning

	Meaning
1	M16-K
2	M20-K
5	customer-specific version
0	No installation of MODEX filter
1	installation of 1 MODEX filter
2	installation of 2 MODEX filter
3	installation of PS-F24Ex/1 filter
4	installation of PS-F24Ex/2 filter
0 1	MT18-R024 (for 24-VDC-power supply; pluggable terminals)
0 2	MT18-C024 (for 24-VDC-power supply; cage clamp terminals)
0 5	MT18-C230 (for 230/115-VAC-AC/DC converter; cage clamp terminals)
1 1	MT9-R024 (for 24-VDC-power supply; pluggable terminals)
1 2	MT9-C024 (for 24-VDC-power supply; cage clamp terminals)
4055	field housing (400 mm x 550 mm x 210 mm)
6555	field housing (650 mm x 550 mm x 210 mm)

3 Housings for the *excom*® stations

Stainless steel field housings - EEx e

General information

The explosion protected stainless steel housings are approved for installation in explosion hazardous areas (zone 1). They are also suitable for use in hostile and corrosive environments.

Note

It should also be remembered that stainless steel housings with integrated module racks and a corresponding system approval are available! "Overview - Field housings with integrated module rack" page 1-31

Note

For outdoor applications ventilation should be ensured in order to avoid a buildup of condensation water within the housing.

Observe the requirements stated in "Assessment of temperature compliance" page 2-39 !

Ventilation

Condensation water can accumulate, especially in housings mounted outdoors, due to the temperature differences present (inside/outside the housing). This may impair functionality (corrosion, short-circuits).

Ventilation will remedy this effect by ensuring sufficient air circulation and thus counteracting the buildup of condensation. Furthermore, condensation water which may accumulate at the bottom of the housing in extreme conditions, can drain off.

For this the venting pipe ELST-M20Ex must be mounted at the bottom of the housing. The labyrinth construction prevents water from penetrating through the ventilation, whilst still ensuring sufficient ventilation.

A porous plastic plate is used for dust protection.

Attention

A venting pipe “ELST-M20EX” page Appendix-65 must be used without fail in the dust area. This meets the requirements of protection class IP65 and higher.

Attention

Use of a venting pipe reduces the protection rating of the whole system against the ingress of water to IP54 acc. to EN 60529. The venting pipe is mounted using the drill hole provided.

Technical specifications

Table 8: Stainless steel field housing

Approval	PTB 00 ATEX 1101U
Material	Stainless steel 1.4404
Material thickness	1.5 mm
Protection degree	IP65, EN 60529
Flange plate	2.0 mm stainless steel plate with mounting holes and drill holes for cable glands, part of the base housing.
Cover (door)	Attached to the base housing via interior hinges, inspection window made of safety glass and with double ward lock The M6 earthing studs are welded onto the inside.
Inspection window	ESG safety glass with seal
Inspection window seal	Acrylic seal, temperature resistant up to +90°C
Housing seal	Housing cover silicone seal, temperature range -20 to +130°C
Flange seal	CR cellular caoutchouc, temperature range -30 up to +120°C
C-rail	Section rail, 25 x 10 mm, material thick-ness 1.5 mm
Shielding busbar	CU rail, nickel-plated, 10 x 3 mm

EG-VA6555/... (650 x 550 x 210 mm)

The EEx e IIC stainless steel housing with a hinged cover and inspection window (visible area 570 x 80 mm) is designed for insertion of the *excom*® module rack.

Table 9: Stainless steel field housing types

Optional assemblies:	one MT18 rack two MT9 module racks The EEx e and EEx i circuits must be installed in conformity with the applicable regulations. The relevant guidelines must be observed if cables cross inside the housing.
Version 1: Housing with flange plate M16, incl. screw connections (EG-VA6555/M16-K)	Mounting holes for cable glands, incl. screw connections: – 4 x M20 for supply voltage (EEx e IIC), black – 4 x M16 for bus cables (EEx e IIC), blue – 1 x M20 for venting pipe – 64 x M16 for signal lines (EEx e IIC), blue
Version 2: Housing with flange plate M20, incl. screw connections (EG-VA6555/M20-K)	Mounting holes for cable glands, incl. screw connections: – 4 x M20 for supply voltage (EEx e IIC), black – 4 x M20 for bus cables (EEx e IIC), blue – 1 x M20 for venting pipe – 64 x M20 for signal lines (EEx e IIC), blue
Version 3: Housing with blanking plate, empty (EG-VA6555/BLD-U)	Mounting holes for cable glands can be positioned as required by the customer

Dimension drawings EG-VA/6555...

Figure 37: EG-VA6555/... View into the housing from the bottom

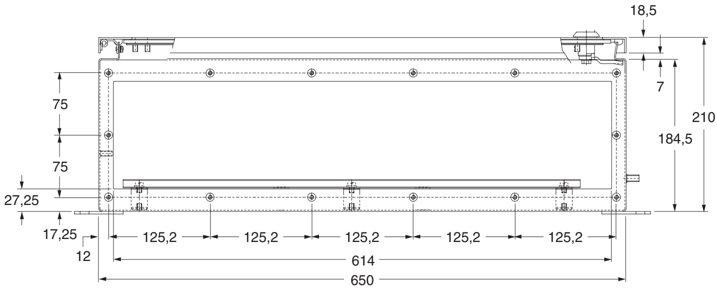


Figure 38: EG-VA6555/... Front view without door

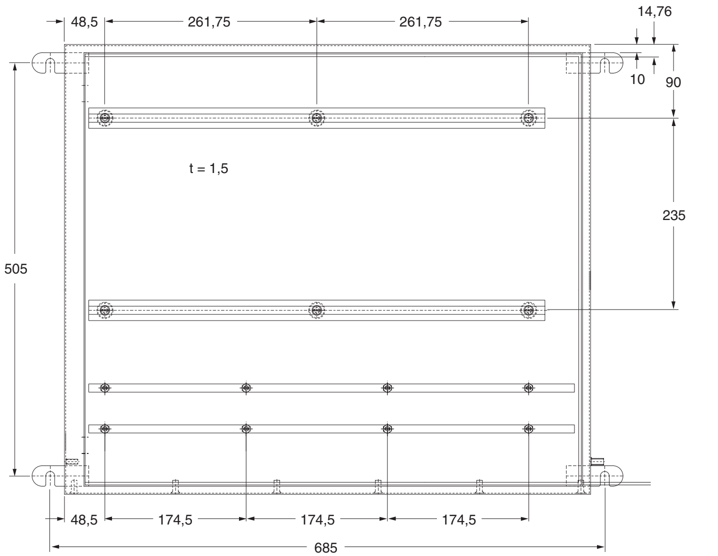
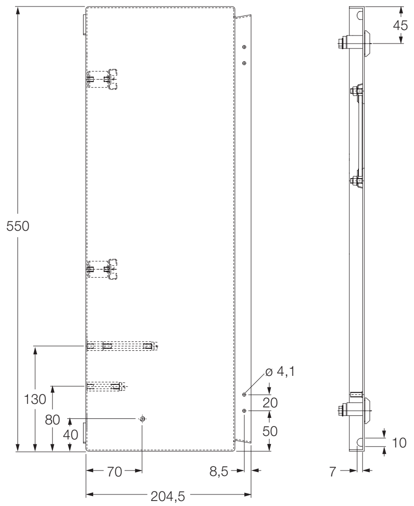
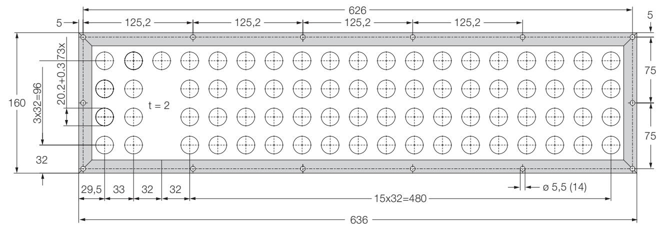


Figure 39: EG-VA6555/... Side view with door



Flange plate for EG-VA6555/...

Figure 40: Flange plate for EG-VA6555/...



- Base part with drain, 4 welded clips on the outside
- 2 mounting rails (C-rails) on rubber padding for mounting of module racks
- 2 CU rails (nickel-plated) as shielding bus for termination of cable shields
- M6 earthing studs welded to the inside, M8 earthing studs welded to the outside
- The (outer) M8 earthing stud must be connected to the equipotential bonding system of the installation using a cable with sufficient cross-section (min. 6 mm²)
- The flange plate and front cover are supplied with the base

EG-VA4055/... (400 x 550 x 210 mm)

EEx e IIC stainless steel housing with a hinged cover and inspection window (visible area 300 x 80 mm) designed to incorporate the *excom*® module rack.

Table 10: Stainless steel field housing types

Optional assemblies:	one MT9 rack The EEx e and EEx i circuits must be installed in conformity with the applicable regulations. The relevant guidelines must be observed if cables cross inside the housing.
Version 1: Housing with flange plate M16, incl. screw connections (EG-VA4055/M16-K)	Mounting holes for cable glands, incl. screw connections: – 4 x M20 for voltage supply (EEx e IIC), black – 4 x M16 for bus cables (EEx e IIC), blue – 1 x M20 for venting pipe – 32 x M16 for signal lines (EEx e IIC), blue
Version 2: Housing with flange plate M20, incl. screw connections (EG-VA4055/M20-K)	Mounting holes for cable glands, incl. screw connections: – 4 x M20 for voltage supply (EEx e IIC), black – 4 x M20 for bus cables (EEx e IIC), blue – 1 x M20 for venting pipe – 32 x M20 for signal lines (EEx e IIC), blue
Version 3: Housing with blanking plate, empty (EG-VA4055/BLD-U)	Mounting holes for cable glands can be positioned as required by the customer

Dimension drawings EG-VA/4055/...

Figure 41: EG-VA4055/... View into the housing from the bottom

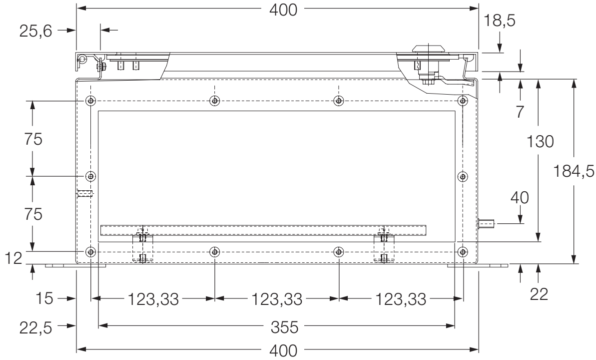
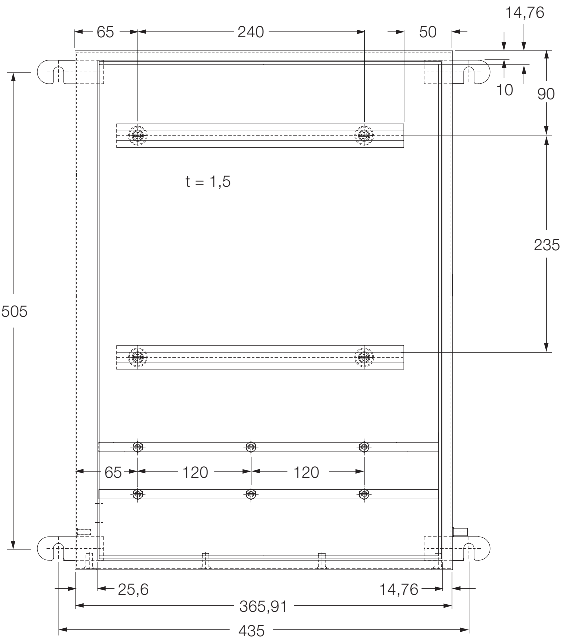


Figure 42: EG-VA4055/... Front view without door



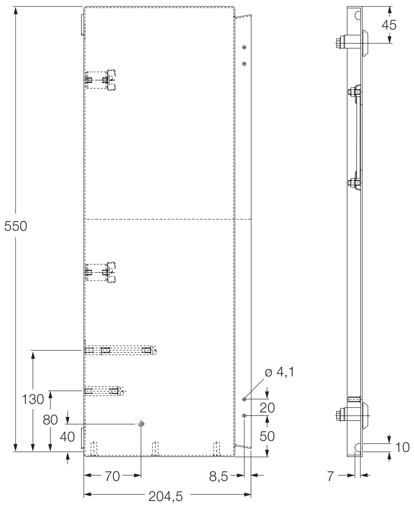


Figure 43: EG-VA4055/... Side view with door

Flange plate for the EG-VA4055/...

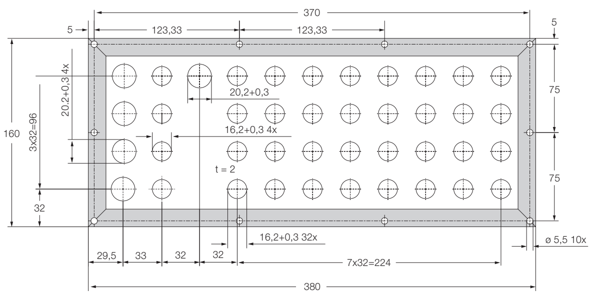


Figure 44: Flange plate for the EG-VA4055/...

- Base with drain, 4 welded clips on the outside
- 2 mounting rails (C-rails) on rubber padding for mounting of module racks
- 2 CU rails (nickel-plated) as shielding bus for termination of cable shields
- M6 earthing studs welded to the inside, M8 earthing studs welded to the outside

- The (outer) M8 earthing stud must be connected to the equipotential bonding system of the installation using a cable with sufficient cross-section (min. 6 mm^2)
- The flange plate and front cover are supplied with the base

4 Mounting and mounting instructions

Observation of safety requirements in explosion hazardous areas

Warning

Chapter "Safety requirements in explosion hazardous areas" page 2-1 must be read in all cases.

The safety instructions as well as the mounting and wiring guidelines for explosion hazardous areas described in the chapter must be observed without fail, otherwise correct and safe system operation cannot be guaranteed.

Mounting the module racks

The rack system is made of extruded aluminium sections. This provides the system with enhanced stability and ensures optimum shielding. The module racks are suitable for wall mounting and 19” rail mounting.

Warning

The EEx e and EEx i circuits are located on the backplane. The module rack must only be transported and stored in its original packaging.

Damaged or improperly handled devices, which are no longer in their original factory condition, must not be mounted.

Module rack MT9

The module rack MT9 is designed to accommodate up to 8 I/O modules, 1 gateway and 1 power supply.

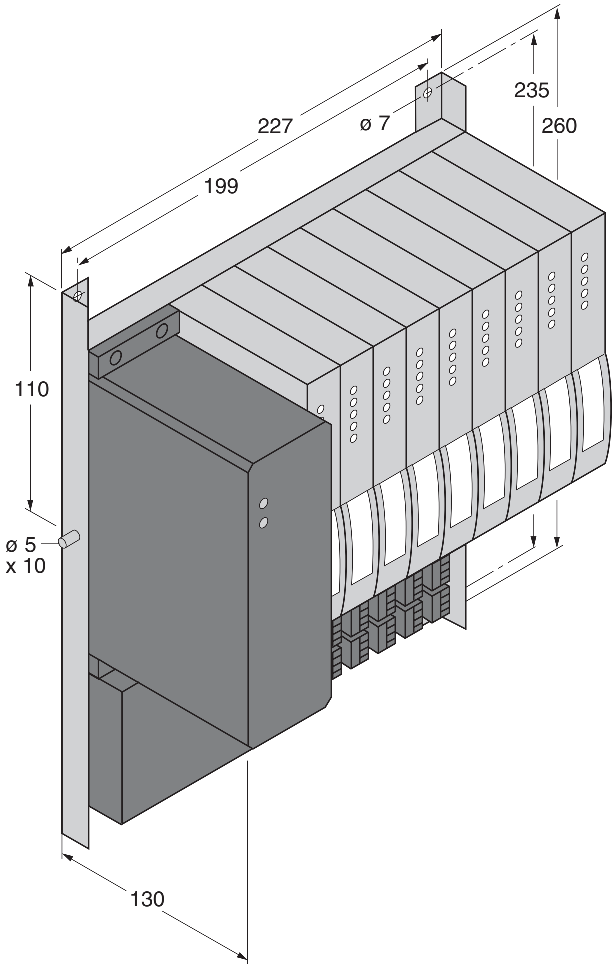
It is mounted via M6 screws or bolts.

Attention

Special type GM306 slide nuts and type GS406 threaded bolts must be used in conjunction with M6 nuts in accordance with DIN 934 for mounting in stainless steel housings EG-VA4055/... or EG-VA6555/ ... .

Dimension drawing for the module rack MT9-C(R)024

Figure: 45
Module rack
MT9-C(R)024



Module rack MT18

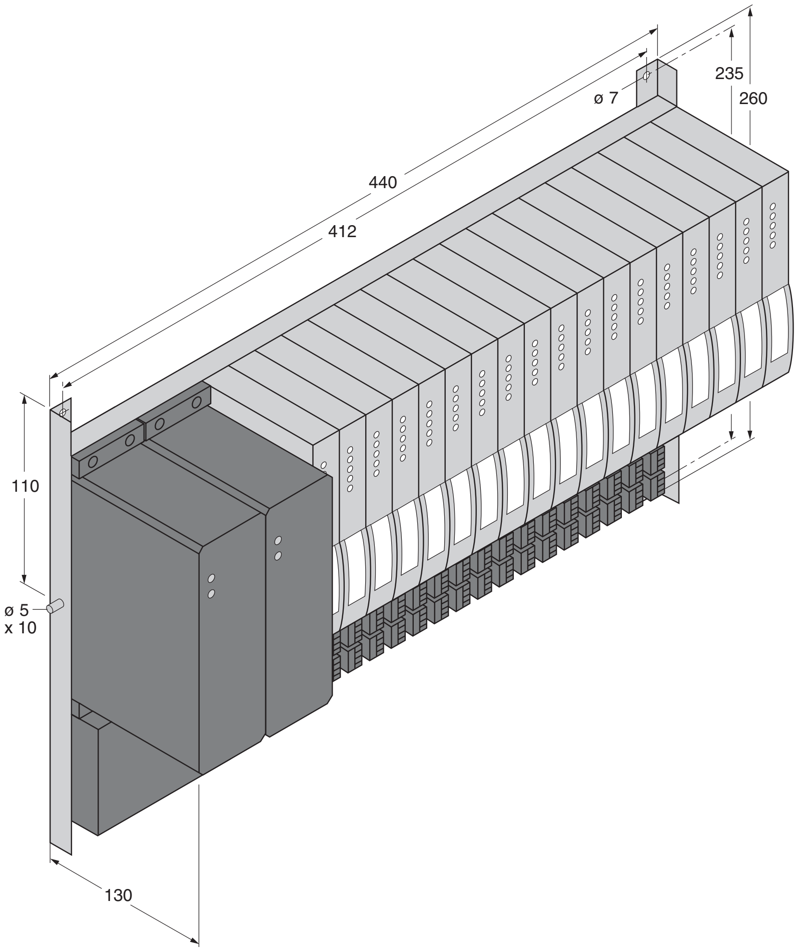
The module rack MT18 is designed for taking 16 I/O modules, 2 gateways and 2 power supply units (MT18-C(R)024) or 2 power supply units with 2 AC/DC converters for 115/230 VAC (MT18-C230).
It is mounted using M6 screws or bolts.

Attention

Special type GM306 slide nuts and type GS406 threaded bolts must be used in conjunction with M6 nuts in accordance with DIN 934 for mounting in stainless steel housings EG-VA4055/... or EG-VA6555/... .

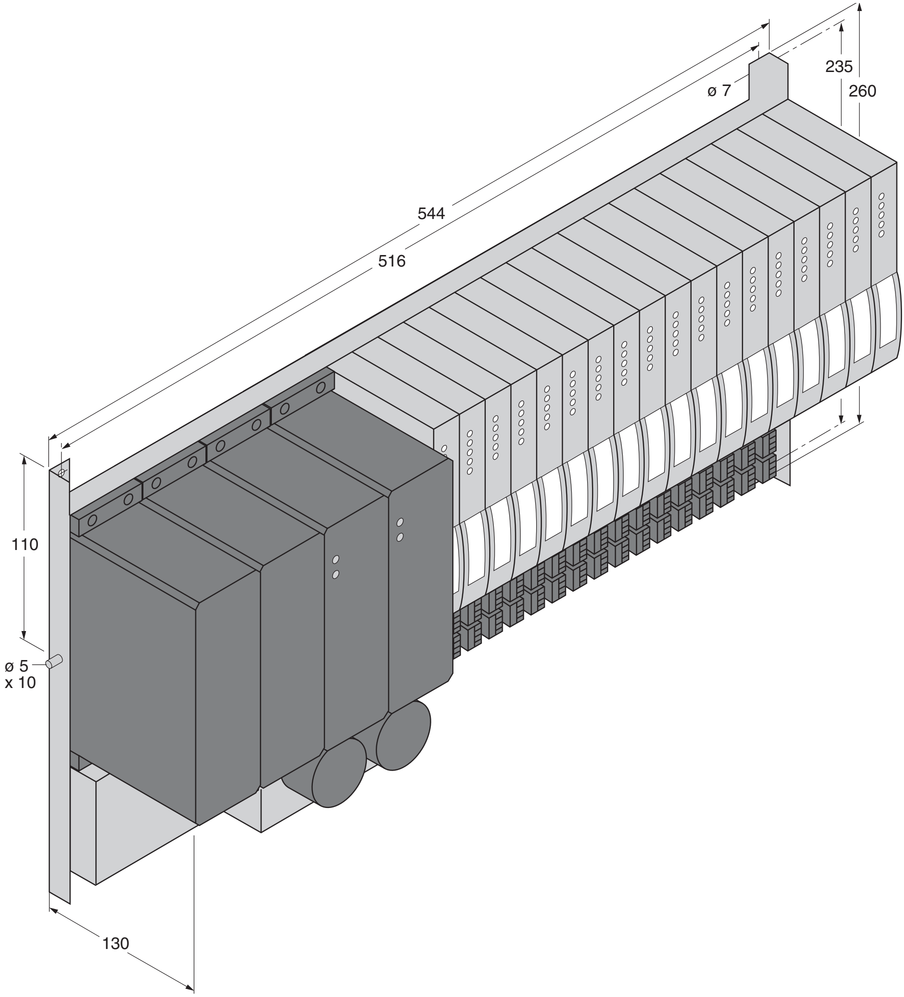
Dimension drawing for the module rack MT18-C(R)024

Figure: 46
Module rack
MT18-C(R)024



Dimension drawing for the module rack MT18-C230

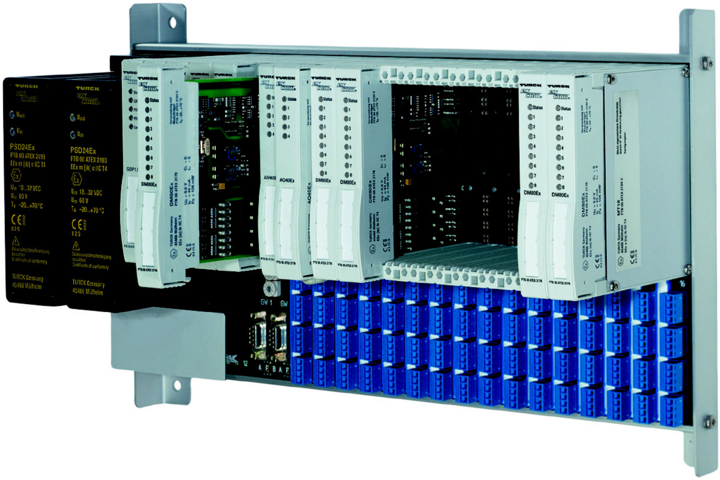
Figure: 47
Module rack
MT18-C230



Mounting the power supply units, gateways and I/O modules

The power supplies, gateways and the I/O modules are plugged into the designated slots in the module rack. They must clearly snap into the retaining clamps. The power supply units must be screw fastened appropriately.

Figure 48: excom®



Note

Power supply units, bus couplers and the I/O modules may be exchanged during operation, even in zone 1.

Warning

The use defective components or components suspected of being defective is not permitted.

Mounting of the stainless steel field housing

When mounting the stainless steel field housing, please observe the following guidelines:

- The housings must be mounted in such a way that the cable glands are located on the underside.
- The field housings are designed to incorporate a fully assembled rack comprising the maximum number of I/O modules and power supply units.
- To ensure correct operation, the inspection window of the field housing must not be damaged.

Ambient temperature

- Direct exposure to sunlight and high ambient temperatures must be avoided.
- Ensure sufficient ventilation around the housing.

Compliance with protection degree IP54

- The operator must ensure that at least protection degree IP54 is achieved when installing the cables.

Additional temperature verification

- When using valve control modules, an additional temperature verification must be completed as the specified temperature characteristics are no longer valid (“Assessment of temperature compliance” page 2-39).

Connecting and wiring the *excom*® stations

The *excom*® stations must be connected and wired as described in the following. Otherwise correct operation cannot be guaranteed.

Warning
System installation, modification, extensions and all work on the module rack or in the housing must be carried out by qualified staff in compliance with the applicable national standards.

- The EEx e connections are protected by covers with IP30 protection.
- Before removing the covers, the circuits must be disconnected.
- The EEx e cables must be routed via the cable glands designated for this purpose.
- Crossings of the EEx e and EEx i circuit cables should be avoided. Should this not be possible, the installation regulations must be observed.
- The cables must be connected according to the terminal markings provided.

System extension or replacement of modules

- Only TURCK original parts should be used for spares or extensions.

Attention

excom® components must only be transported and stored in the original TURCK packaging.

5 PROFIBUS-DP interface

Physical connection with SC12Ex or OC11Ex/...

The maintenance and possible exchange of electrical equipment during operation is one of the features required in the field of process automation. The PROFIBUS interface for *excom*® therefore has an intrinsically safe design in order to meet this requirement. A conversion from RS 485 to intrinsically safe RS 485 is therefore required between PROFIBUS master and *excom*®. These kinds of converters are normally known as segment couplers.

TURCK offers two different types of segment couplers, the SC12 and the OC11. The SC12 uses copper as the transmission medium and provides two intrinsically safe RS485-IS lines. These lines can be used, for example, for line redundancy. The OC11, on the other hand, converts non-intrinsically safe RS485 signals into optical signals that are transferred to the explosion hazardous area via fibre optic cables. A second OC11 normally converts these back into electrical signals in the field, normally at the first *excom*® station. From this point the networking is continued using copper media in accordance with RS485-IS.

Attention

Due to the special characteristics of the RS485-Ex-i layer, *excom*® must only be operated with these segment couplers connected in front!

The two TURCK couplers described below provide a regenerated (“Repeater functionality” page 5-26) and signal transmission that is adapted to the explosion hazardous area (“Converting the RS485 signal into the RS485 IS(-Ex-i) signal” page 5-10):

- SC12Ex
- OC11Ex

The following sections provide a detailed description of the segment couplers and the different features required for application-specific use.

Segment coupler SC12Ex

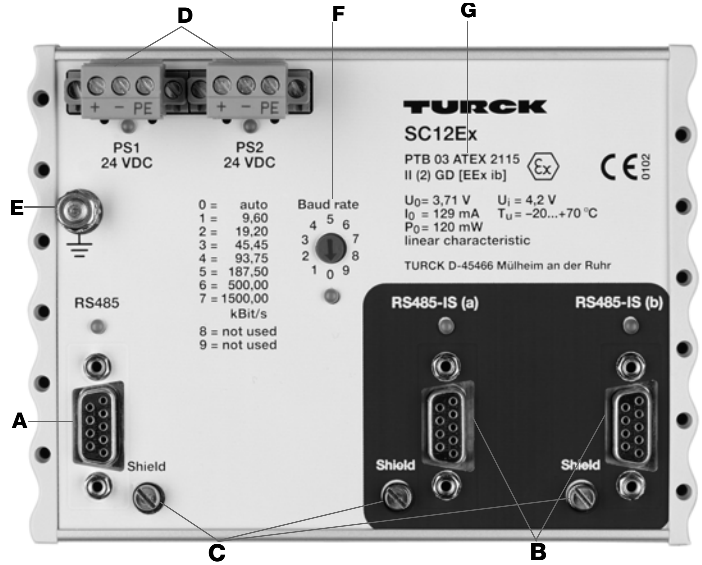


Figure 49: Front view of the SC12Ex

A *Terminal for the PROFIBUS standard interface (“SUB-D connector assignment for RS485 / RS485-IS” page 5-28)*

B *Two terminals for intrinsically safe PROFIBUS interfaces (to RS485-IS)*

C *Shield connection, capacitive or direct earthing (“Shielding concepts of the fieldbus system” page 2-28)*

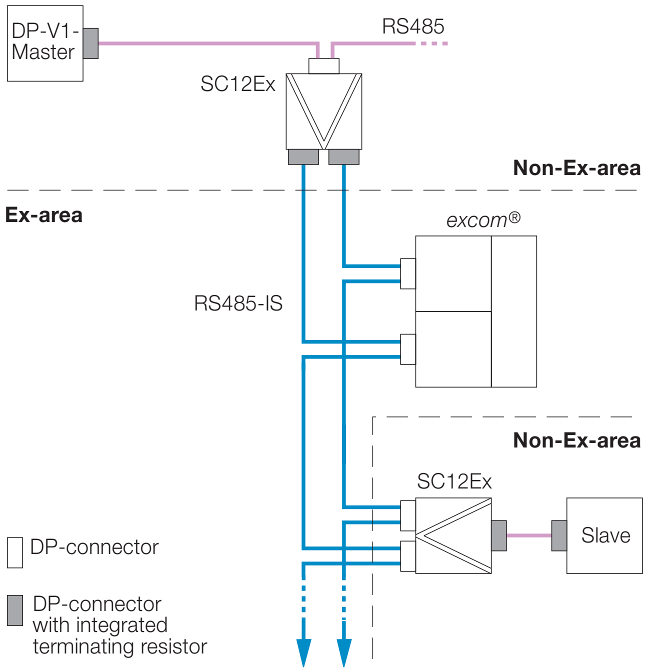
D *Two three-pole COMBICON screw connectors for connecting the power supply*

E *Earthing bolt with M5 thread*

F *Rotary switch for selecting a baud rate or selecting ‘Baud rate detection’ mode (“Automatic baud rate detection/baud rate setting” page 5-29)*

G *Test certificate number as well as explosion protection group:*
Test certificate number: PTB 03 ATEX 2115
Explosion protection group: II (2) GD [EEx ib]
II: All areas except mining
(2): The round brackets indicate the ‘apparatus group’
The 2 stands for “high level of safety”.
G: Explosion protection for gas, vapour, mist
D: Explosion protection for dusts
[ ]: “apparatus group”
EEx: complies with European standard
ib: Intrinsic safety in the event of ***one*** *fault*
The documentation “D200412” provides further information on categories and relevant standards for explosion protection.

Figure 50: System design with segment coupler SC12Ex



Redundant interfaces and power supply

This coupler provides a standard RS485-PROFIBUS interface and **two intrinsically safe RS485-IS PROFIBUS interfaces**. "Line redundancy (flying redundancy) - hardware" page 5-38 can be implemented with one device. The communication channels have equal parity in each segment. If no redundancy is required, two segments (with 32 stations each) can be connected to one coupler.

The coupler can be provided with a redundant power supply. The two operating voltage inputs are decoupled with diodes. The load separation depends on the operating voltage. The operating voltage range is 18…32 VDC. A power supply unit with UM < 60 VDC must be used.

The SC12Ex allows transmission distances of up to 1.2 km depending on the transmission speed used.

Table: 11

Baud rate	Transmission distance
9.6 kBaud	1,200 m
19.2 kBaud	1,200 m
45.45 kBaud	1,200 m
187.5 kBaud	1,000 m
500 kBaud	400 m
1.5 MBaud	200 m

One of the "Shielding concepts" page 5-8 must be used in the installation.

Other features

- The "Repeater functionality" page 5-26 ensures that the amplitude and phase of the signal is regenerated, thus preventing any loss in signal strength and quality.
- Cable faults (wire break/short-circuit) are not transferred from one segment to another. In this way the fault-free operation of all segments independently of each other is ensured.
- The coupler is provided with 6 "LEDs" page 5-11
- The "Automatic baud rate detection/baud rate setting" page 5-29 function enables the baud rate to be detected automatically by the coupler when the rotary switch is set to "0". The baud rate can be set to a fixed value using switch positions "1" to "7".

Connectors and bus termination

Standard PROFIBUS connectors can be used on the RS485 terminal. These normally have a switchable and integrated resistor combination for active bus termination. For example, D9T-RS485, Ident no. 6890942.

The PROFIBUS connector D9T-RS485IS, Ident no. 6890944, must be used on the intrinsically safe RS485-IS terminal.

The connector D9T-Ex, Ident no. 6890938, must be used on the PROFIBUS terminal of the *excom*® station.

Both connectors are provided with a switchable terminating resistor for terminating the network at the first and last bus stations.

Attention

The PROFIBUS RS485-IS connector must not be used on non-intrinsically safe PROFIBUS terminals and on the *excom*® gateway GDP1,5EX, Ident no. 6884008. This may cause the destruction of the interface drivers inside the device!

Shielding concepts

The PROFIBUS cable must routed and connected with appropriate shielding measures in order to prevent the effects of interference on the data transfer. It should be taken into account in this respect that electrical fields can be effectively suppressed by earthing the shielding at one end. However, more frequently occurring magnetic fields are often only effectively protected by earthing the shielding at both ends.

When the shielding is earthed at both ends, however, it must be ensured that no equalising currents flow along the shield due to potential differences from one connection point to the other. Capacitive earthing is one possible remedy for this. In this, the shield is not connected directly with the equipotential bonding conductor but via a capacitor.

The shielding concept must be adapted to the overall concept. Four shielding concepts can be used and are supported by using variable shield terminals.

Observe the requirements stated in "Shielding concepts of the fieldbus system" page 2-28. This also provides the relevant terminal designations and the "General requirements for equipotential bonding" page 2-33.

The following concepts can be implemented:

"1. The connections are hard earthed with the earthing potential at both ends." page 2-29

"2.The connection at the supplying device is "hard earthed", the terminals of all bus stations in the segment have a capacitive earth." page 2-30

"3. The connection at the supplying device has a capacitive earth, the connections of all bus stations in the segment have a "hard" earth." page 2-31

"4. The connection at the supplying device has a capacitive earth, the connections of all bus stations in the segment likewise have a capacitive earth." page 2-32

At the RS485-IS line terminal on the SC12Ex the shield always has a capacitor connection to the earth potential (factory setting). For direct earthing, the insulation washer under the screw marked "Shield" must be removed ("Front view of the SC12Ex" page 5-4).

The *excom*® system is factory shipped with the shield terminal connected directly with earth. The shield can also be connected to earth via an integrated RC combination. For this, the jumper that bridges factory fitted RC combination must be removed. (older *excom*® systems do not have this jumper. The shield terminal is always directly connected to the earth potential.)

Converting the RS485 signal into the RS485 IS(-Ex-i) signal

The PROFIBUS interface in the hazardous area must meet the requirements of "intrinsic safety". The **RS485-IS(-Ex-i) layer** is used as *excom*® is required for operation in zone 1 and the gateway must be isolated from the bus during operation.

The interface is designed in accordance with guidelines of the PNO RS485-IS working group. The transmission routes of both areas must be galvanically isolated, and this is ensured with the SC12Ex.

The data received at the RS485 interface is transferred simultaneously to the RS485-IS (a) interface and/or the RS485-IS(b) interface. The delay is 11 bit times.

The data received at the RS485-IS(a) and/or the RS485-IS(b) interfaces is transferred to the RS 485 interface. The intrinsically safe interface that first received valid telegrams relays this on via the standard PROFIBUS interface to the master.

During the transmission to the master, the adjacent intrinsically safe interface is disabled for further data traffic.

Figure 51:

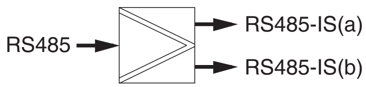
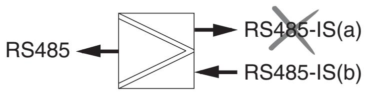


Figure 52:



LEDs

The coupler is provided with three status LEDs for the three PROFIBUS segments, 2 operation LEDs for the two power supplies and one status LED for the automatic baud rate detection.

Operating voltage

Table 12:

PS1/PS2 24 VDC	Meaning
Green	Input voltage o.k.
OFF	Input voltage too low

PROFIBUS interfaces

Table 13:

RS485/ RS485-IS(2x)	Meaning
Red	Invalid data traffic
Yellow	Valid data received
OFF	No data traffic

Baud rate detection/baud rate setting

Table 14:

Baud rate	Meaning
Continuous yellow	Baud rate detected
Yellow flashing	Baud rate detection active
OFF	Baud rate setting via rotary switch

Increase of fail-safe performance using redundant circuits

The following circuits (SC12Ex - version 1 and version 2) increase fail-safe performance by means of redundant controls, transmission routes and gateways.

A master (e.g. master 1) handles the controller functions. The neighbouring master (in this case 2) is in standby mode. Version 1 provides gateway and line redundancy. Version 2 on the other hand provides comprehensive redundancy from the control system to the gateway, preventing the possibility of any data loss on account of a fault.

Figure 53: gateway and line redundancy with SC12 Ex Version 1

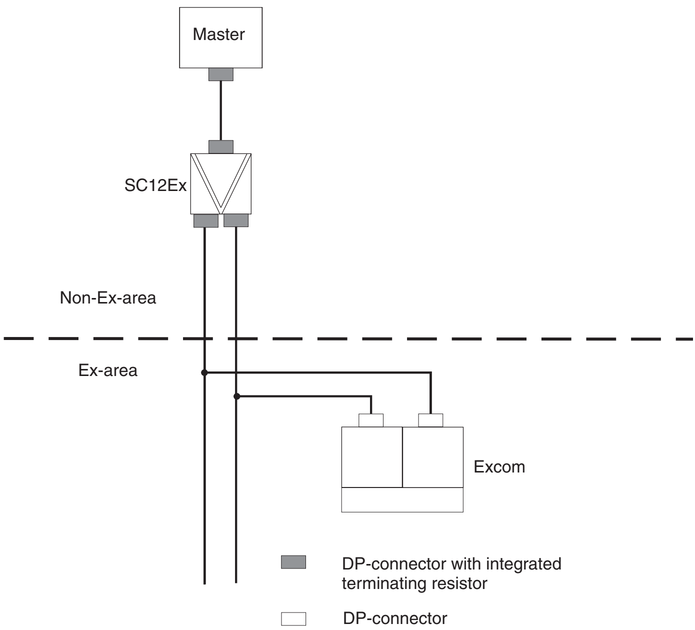
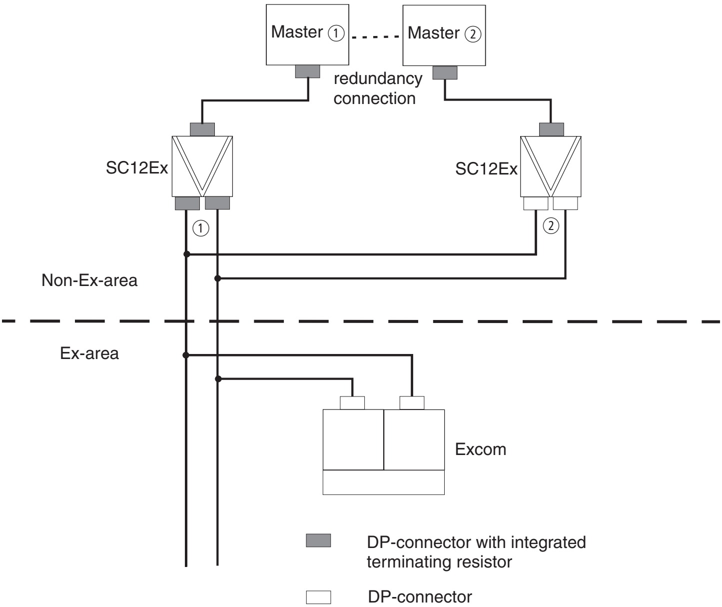


Figure 54: comprehensive redundancy with SC12Ex Version 2



The following errors can occur. The system remains functional:

- A wire break at any point in the system.
- Failure of a segment coupler - the adjacent master detects the failure and takes over the control function.
- A master fails - the adjacent master detects the failure and takes over the control function.
- If a gateway of the *excom*® station fails, the redundant gateway takes over the function.

Technical data SC12Ex

Table: 15
Technical data

Type	SC12Ex
Ident no.	6884047
Operating voltage	18...32 VDC
Current consumption	< 200 mA
Transmission rate	9.6 kBit/s...1.5 Mbit/s (automatic detection)
Galvanic isolation	
Between PROFIBUS and supply voltage (to EN 50020)	250 V
Between intrinsically safe PROFIBUS and PROFIBUS (to EN 50020)	60 V
Between intrinsically safe PROFIBUS and supply voltage (to EN 50020)	60 V
Between the two intrinsically safe PROFIBUS segments (to EN 50020)	10 V
Ex marking of the device	[EEx ib] IIC
Ex limit values in accordance with PNO working group “RS485-IS”	U_0 = 4.2 V; I_0 = 4.8 A
Housing	
Dimensions (mm)	142 x 105 x 32
Housing material	Anodized aluminium

Cover material	FR4, grey/blue
Protection degree	IP20
Ambient temperature	-20...+70 °C

The coupler system OC11Ex/..

Figure 55: The OC11Ex/.. coupler system- with a fibre optic cable connection

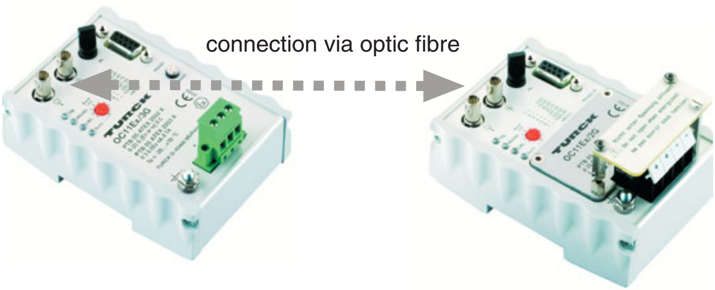
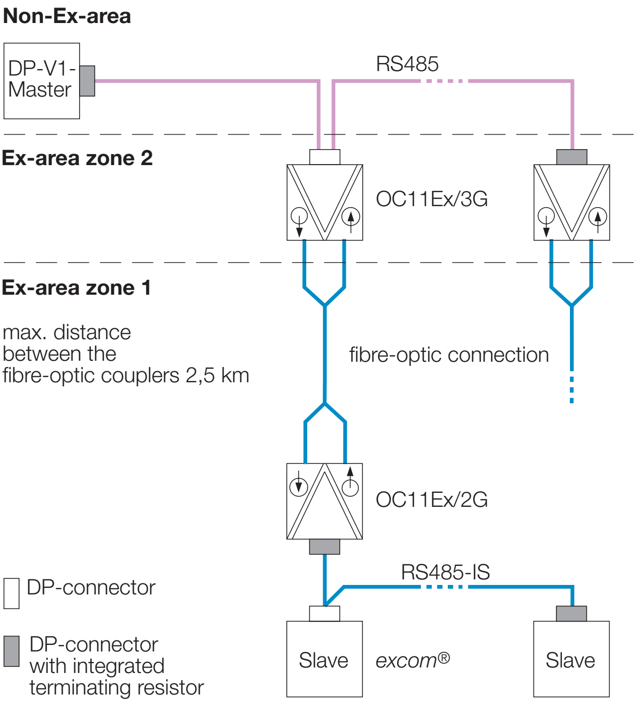


Figure 56: Fibre optic cable for transmission



Fibre optic cable for transmission

The coupler system transfers the bus signals via **fibre optic cable** from a safe area to a hazardous area. In the safe area, the **OC11Ex/3G** receives PROFIBUS-DP signals on a standard RS485 interface and outputs them on an intrinsically safe fibre optic cable. The **OC12Ex/2G** communication partner can be installed in zone 1. This converts the signals of the fibre optic cable to the intrinsically safe RS485-IS data format. This transmission is isolated and noise-immune and can cover **distances up to 2500 m**.

"2-wire fibre optic cable with pre-assembled ST connectors" page Appendix-61 are available in the following lengths: 2.5 m, 5 m, 10 m, 25 m, 50 m, 100 m, 250 m, 1000 m, 2500 m.

Other features

- The "Repeater functionality" ensures that the amplitude and phase of the signal is regenerated, so that an entire network segment can be connected to the coupler.
- An additional connection option enables the direct connection of two OC11Ex/3G or two OC11Ex/2G devices. In this way, an "Increase of fail-safe performance using redundant circuits" page 5-22 or a new segment can be implemented.
- Cable faults (wire break/short-circuit) are not transferred from one segment to another. In this way the fault-free operation of all segments independently of each other is ensured.
- A coupler is provided with 4 LEDs: one status LED for the connected PROFIBUS segment, one status LED for the connected fibre optic cable, one operation LED for the power supply and one status LED for the automatic baud rate detection.
- The "Automatic baud rate detection/baud rate setting" page 5-29 function enables the baud rate to be detected automatically by the coupler when the rotary switch is set to "0". The baud rate can be set to a fixed value using switch positions "1" to "7".

Connectors and bus termination

Standard PROFIBUS connectors can be used on the RS485 terminal. These normally have a switchable and integrated resistor combination for active bus termination. For example, D9T-RS485, Ident no. 6890942.

The PROFIBUS connector D9T-RS485IS, Ident no. 6890944, must be used on the intrinsically safe RS485-IS terminal.

The connector D9T-Ex, Ident no. 6890938, must be used on the PROFIBUS terminal of the *excom*® station.

Both connectors are provided with a switchable terminating resistor for terminating the network at the first and last bus stations.

Shielding concepts

The PROFIBUS cable must routed and connected with appropriate shielding measures in order to prevent the effects of interference on the data transfer. It should be taken into account in this respect that electrical fields can be effectively suppressed by earthing the shielding at one end. However, more frequently occurring magnetic fields are often only effectively protected by earthing the shielding at both ends.

When the shielding is earthed at both ends, however, it must be ensured that no equalising currents flow along the shield due to potential differences from one connection point to the other. Capacitive earthing is one possible remedy for this. In this, the shield is not connected directly with the equipotential bonding conductor but via a capacitor.

The shielding concept must be adapted to the overall concept. Two shielding concepts can be used and are supported by the OC11Ex/.. coupler system as well as by the actual rack by using variable shield terminals.

Observe the instructions stated in “Shielding concepts of the fieldbus system” page 2-28. This also provides the relevant terminal designations and the “General requirements for equipotential bonding” page 2-33.

The following concepts can be implemented:

“3. The connection at the supplying device has a capacitive earth, the connections of all bus stations in the segment have a “hard” earth.” page 2-31

“4. The connection at the supplying device has a capacitive earth, the connections of all bus stations in the segment likewise have a capacitive earth.” page 2-32

At the RS485-IS line terminal on the OC11Ex/2G the shield always has a capacitor connection to the earth potential (factory setting).

The *excom*® system is factory shipped with the shield terminal connected directly with earth. The shield can also be connected to earth via an integrated RC combination. For this, the jumper that bridges factory fitted RC combination must be removed. (older *excom*® systems do not have this jumper. The shield terminal is always directly connected to the earth potential.)

LEDs

Operating voltage

Table 16:

U_B	Meaning
Green	Input voltage o.k.
OFF	Input voltage too low

PROFIBUS interfaces

Table 17:

RS485/ FO	Meaning
Red	Error in the PROFIBUS/FO segment
Yellow	Valid data received
OFF	No data traffic

Baud rate detection/baud rate setting

Table 18:

Auto (Baud rate)	Meaning
Continuous yellow	Baud rate detected
Yellow flashing	Baud rate detection active
OFF	Baud rate setting via rotary switch

Increase of fail-safe performance using redundant circuits

The OC11Ex/3G and OC11Ex/2G devices are provided with an 8 mm snap-in connector in addition to the PROFIBUS SUB-D terminal. This is used for providing a redundant connection to a second OC11 with the same redundancy concept as for the SC12Ex.

The description below shows how the interface can be used for creating a redundancy circuit:

Figure: 57 Redundancy circuit with OC11/.. Version 1

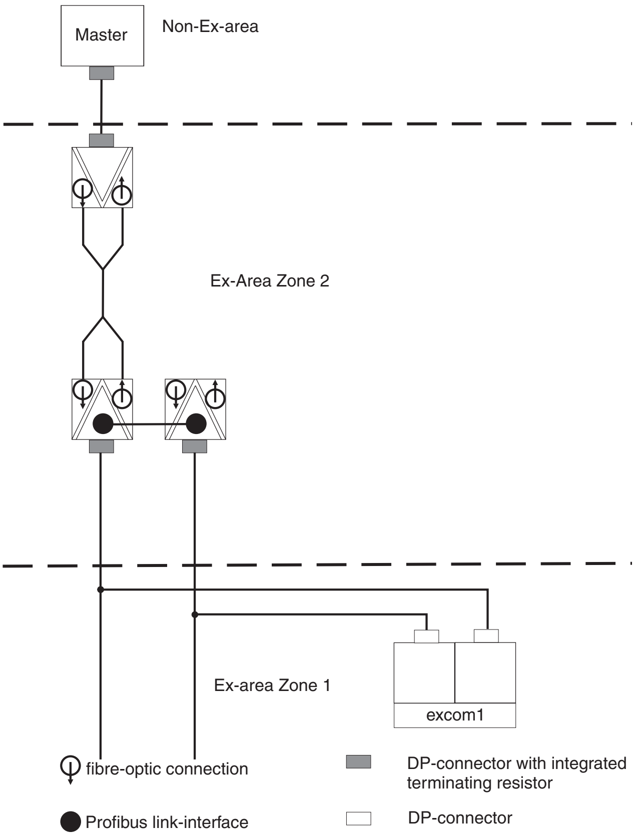
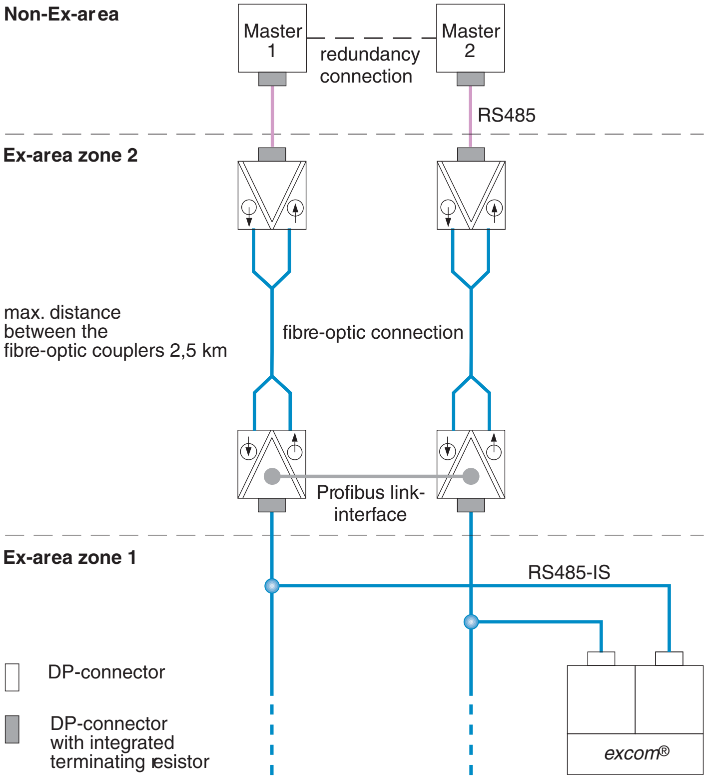


*Figure: 58
Redundancy circuit with OC11/..
Version 2*



Technical data OC11Ex/2G and OC11Ex/3G

Table 19: Technical data

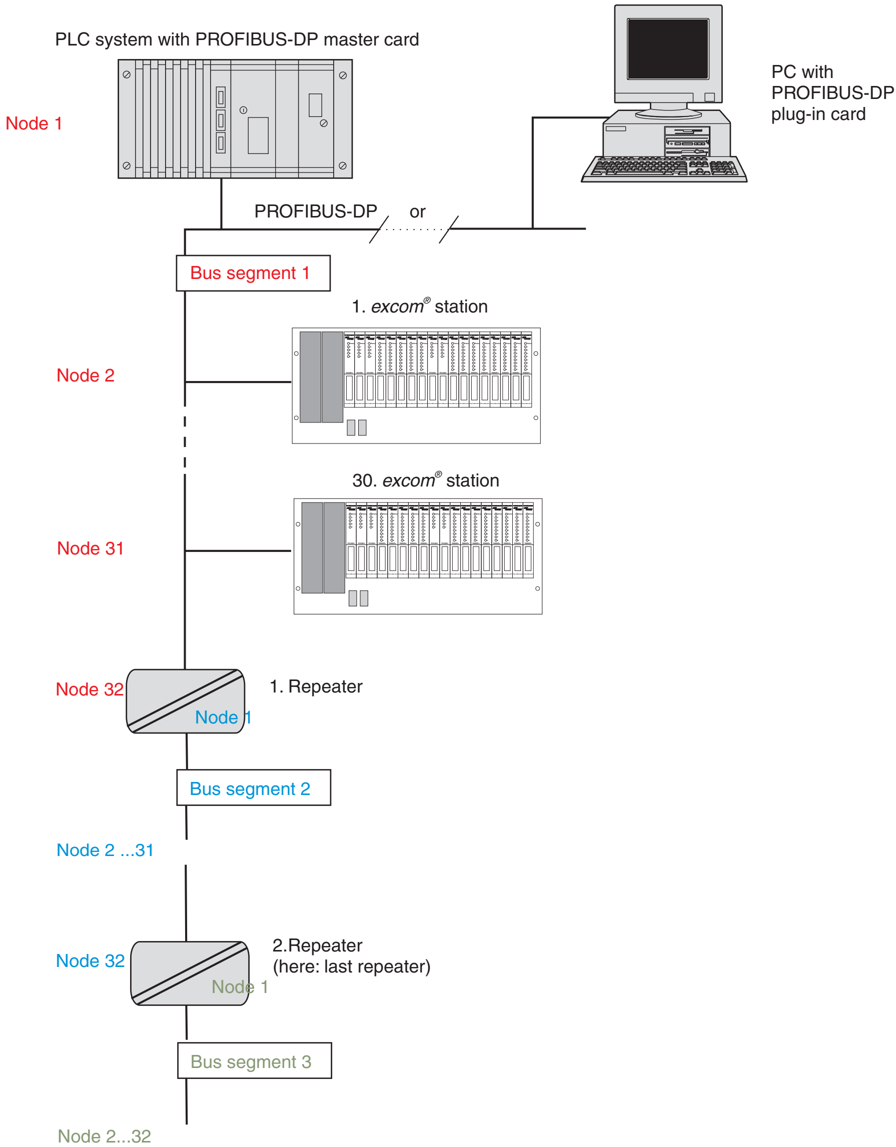
Type	OC11Ex/2G	OC11Ex/3G
Ident no.	6890423	6890424
Operating voltage	18...32 VDC	18...32 VDC
Current consumption	< 100 mA	< 100 mA
Transmission rate	9.6 kBit/s...1.5 Mbit/s (automatic detection)	
Galvanic isolation		
Between PROFIBUS and supply voltage (to EN 50020)	60 V	60 V
Ex marking of the device	PTB 05 ATEX 2051 X/ EEx e mb ib [ib opis] IIC T4	PTB 05 ATEX 2052 X/ [Ex opis] IIC PTB 05 ATEX 2053 X/ EEx nA II T4
Ex limit values in accordance with PNO working group “RS485-IS”	U_0 = 4.2 V; I_0 = 4.8 A	

Housing	
Dimensions (mm)	75 x 105 x 32
Housing material	Anodized aluminium
Cover material	FR4, grey
Protection degree	IP20
Ambient temperature	-20...+70 °C

Repeater functionality

If a network consists of more than 32 stations, one or several repeaters must be used. Repeaters physically condition the signal by regenerating the signal amplitude and phase. Repeaters divide up the network into individual segments. One network can only take 32 stations.

Repeaters, with the exception of diagnostics repeaters, do not have their own bus address. Although SC12Ex and OC11Ex/... belong to these so-called “transparent” bus stations, they each represent a physical station that must be included when calculating the total number of bus stations.



Segmentation of a PROFIBUS network - example

SUB-D connector assignment for RS485 / RS485-IS

The PROFIBUS interfaces are connected to 9-pole SUB-D female connectors with the assignment as specified by the PROFIBUS standard.

Figure: 59
View of a SUB-D female and male connector.

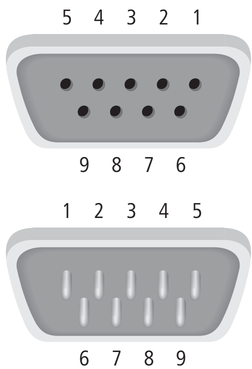


Table: 20
Assignment of the SUB-D poles

Pol no.	RS485	RS485-IS	Meaning
1	n. c.	n. c.	
2	n. c.	n. c.	
3	RxD/TxD-P	RxD/TxD-P	Receive data/Send data of the non-inverted line
4	n. c.	n. c.	
5	DGND	ISGND	Bus termination minus
6	DP	ISP	Bus termination plus
7	n. c.	n. c.	
8	RxD/TxD-N	RxD/TxD-N	Receive data/Send data of the inverted line
9	n. c.	n. c.	

Automatic baud rate detection/baud rate setting

The start delimiter of the PROFIBUS telegrams is evaluated for "automatic baud rate detection". Three valid start delimiters must be received in succession before detection is activated. All received telegrams undergo a plausibility check by means of the start delimiter. The baud rate detection complies with the state machine described in EN 50170 and is started after a reset. A reset is executed and the baud rate is detected again if no more telegrams are received at the interfaces for 1.7 s. Alternatively, the baud rate used can be set permanently via a rotary switch.

Table 21:

Rotary switch position	Baud rate
Position 0	Automatic baud rate detection
Position 1	9.6 kBaud
Position 2	19.2 kBaud
Position 3	45.45 kBaud
Position 4	93.75 kBaud
Position 5	187.5 kBaud
Position 6	500 kBaud
Position 7	1.5 MBaud
Position 8	not used
Position 9	not used

Length of the bus cable depending on the baud rate

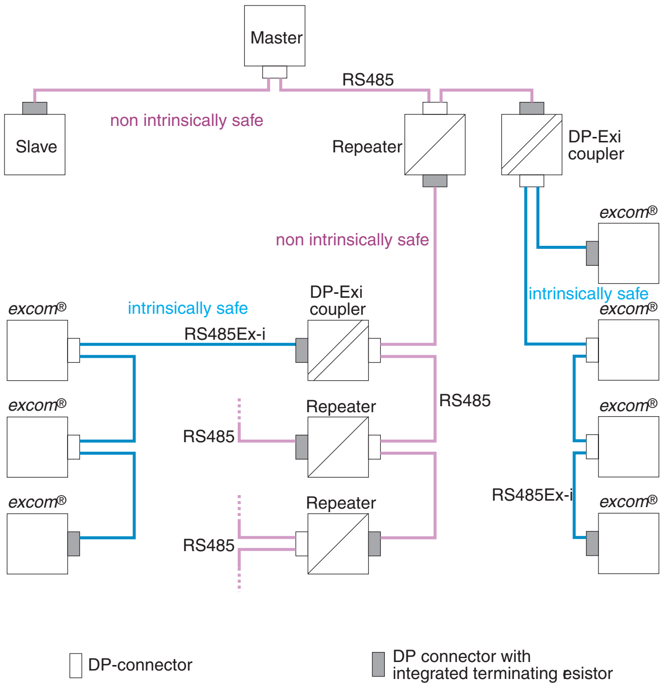
The following table shows the maximum length of the bus cable or the bus segment in relation to the baud rate:

Table 22: Baud rate and bus length

Baud rate	Bus segment (length of bus cable)
9.6 kbps	1,200 m
19.2 kbps	1,200 m
45.45 kbps	1,200 m
93.75 kbps	1,200 m
187.5 kbps	1,000 m
500 kbps	400 m
1.5 Mbps (most frequent type)	200 m

System schematic

Figure 60: Structure of the excom® system



Note

Segment couplers and repeaters represent a physical load on the bus due to their emitter/receiver circuitry. When the segment is designed, these must therefore always be included as bus stations.

GSD files

GSD files describe the entire configuration contents and the communication characteristics of a PROFIBUS station. Characteristics such as transmission speed, timing features, configuration data, parameters, diagnostics data etc. are described in the file by means of key words.
The respective configuration software of the host system interprets these GSD files and normally displays the configuration and parameter data of the stations textually.

excom® may be parameterised by channel or by module. Module-specific parameterisation ensures simple and quick configuration and setting.
Channel-specific parameterisation provides more setting options and is accordingly more complex.
Therefore *excom*® works with two different kinds of GSD files: Mode 1 GSD files for module-specific parameterisation and mode 2 GSD files for channel-specific parameterisation.

Table 23: GSD files for excom®

Name of GSD file	Mode	Language	Parameterisation
trk1ff9f.gsd	1	English (Default)	By module
trckff9f.gsd	2	English (Default)	By channel
trk1ff9f.gsg	1	German	By module
trckff9f.gsd	2	German	By channel

Module-specific parameterisation requires one parameter byte per module.

Channel-specific parameterisation requires 4 or 5 parameter bytes per module. This not only results in a larger variety of available parameters but also in a larger variety in selectable module configurations.

Data throughput

The following table shows the differences between the module versions. The amount of input and output data is also shown.

Table 24: Data throughput with different *"GSD files" page 5-32*

Mode 1 with trk1ff9t.gsd (g)	Mode 2 with trckff9t.gsd (g)	Input data	Output data
GDP1,5Ex	GDP1,5Ex	-	-
GDP1,5Ex D	-	-	-
GDP1,5Ex CD	-	1 word	1 word
-	GDP1,5Ex C	1 word	1 word
DM80Ex	DM80Ex	1 byte	1 byte
DM80Ex S	DM80Ex S	2 bytes	1 byte
DM80Ex 8I	DM80Ex 8I	1 byte	-
DM80Ex S 8I	DM80Ex S 8I	2 bytes	-
DI40Ex	DI40Ex	1 byte	-
DO40Ex	DO40Ex	-	1 byte
AI40Ex	AI40Ex	4 words	
AI41Ex	AI41Ex	4 words	
AO40Ex	AO40Ex	-	4 words
AIH40Ex	AIH40Ex	4 words	-
-	AIH40Ex 1H	6 words	-
AIH40Ex 4H	AIH40Ex 4H	12 words	-
-	AIH40Ex 8H	20 words	-
AIH41Ex	AIH41Ex	4 words	-
-	AIH41Ex 1H	6 words	-

Table 24: Data throughput with different *"GSD files" page 5-32*

Mode 1 with trk1ff9t.gsd (g)	Mode 2 with trckff9t.gsd (g)	Input data	Output data
AIH41Ex 4H	AIH41Ex 4H	12 words	-
-	AIH41Ex 8H	20 words	-
AOH40Ex	AOH40Ex	-	4 words
-	AOH40Ex 1H	2 words	4 words
AOH40Ex 4H	AOH40Ex 4H	8 words	4 words
-	AOH40Ex 8H	16 words	4 words
TI40Ex R	TI40Ex R	4 words	-
TI40Ex T	TI40Ex T	4 words	-
DF20 Ex P	DF20 Ex P	8 bytes	2 bytes
DF20Ex F	DF20Ex F	8 bytes	2 bytes

Configuration of the gateway

Depending on the network configurator setting of the host software, the gateway (GDP1,5Ex) may be equipped with additional functions. These additional functions are indicated with the suffix “C” and “D” in the product name.

D:
This function enables the separate **deactivation of data traffic on individual channels** of the connected modules. As diagnostics messages are also not sent, as well as the process data, this prevents possible wire-break indications from modules with unused outputs.This configuration version is only in module-specific parameterisation, as the error messages cannot be suppressed for unused channels.

C:
In this configuration the gateway provides an input and an output word. The input data word and the output data word are used as status and control registers of the gateway.
This status information is used, for example, in a redundancy circuit to display which of the two gateways is currently “active” and “passive”. If one gateway fails, this status information can be detected, and the neighbouring gateway activated in response by means of the output data word.

The following configurations are possible:

Table 25: Gateway configuration options

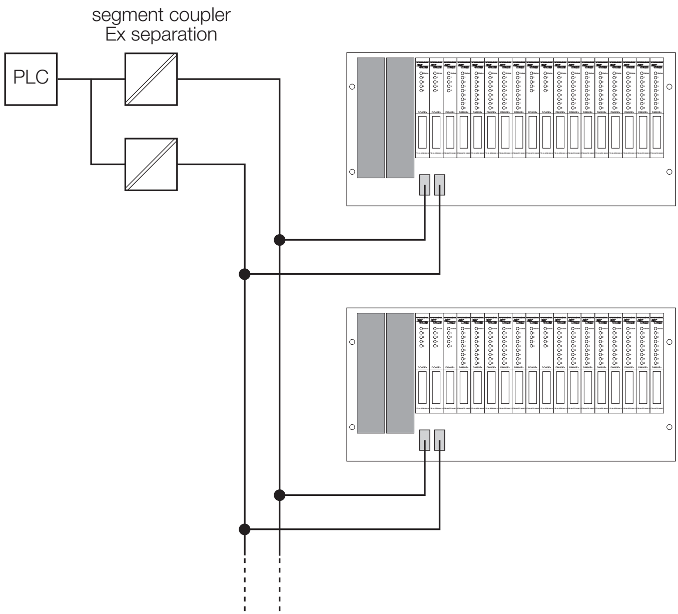
Gateway designation in the GSD file Trk1ff9f	Additional function	Input bytes	Output bytes
GDP1,5Ex		0	0
GDP1,5Ex **D**	Deactivation	0	0
GDP1,5Ex **CD**	Deactivation Cyclic data	2	2
Gateway designation in the GSD file Trckff9f			
GDP1,5Ex		0	0
GDP1,5Ex **C**	Cyclic data	2	2

Gateway redundancy

The use of two gateways and two bus lines ensures error-free and continuous communication if one of the gateways or bus lines fails.

If one of the gateways fails, the other immediately takes over. Redundant operation of *excom*® stations is only possible in conjunction with the module rack MT18. The MT9 module racks do not have the space to accommodate a second gateway.

Figure 61: Redundancy



Recommended connection components (“Ordering details” page Appendix-60)

- PROFIBUS-DP cable (type: CABLE 451B)
- Connector (type: D9T-Ex)

excom® supports 2 redundancy concepts:

“Line redundancy (flying redundancy) - hardware” page 5-38.

“System redundancy - hardware and software” page 5-39

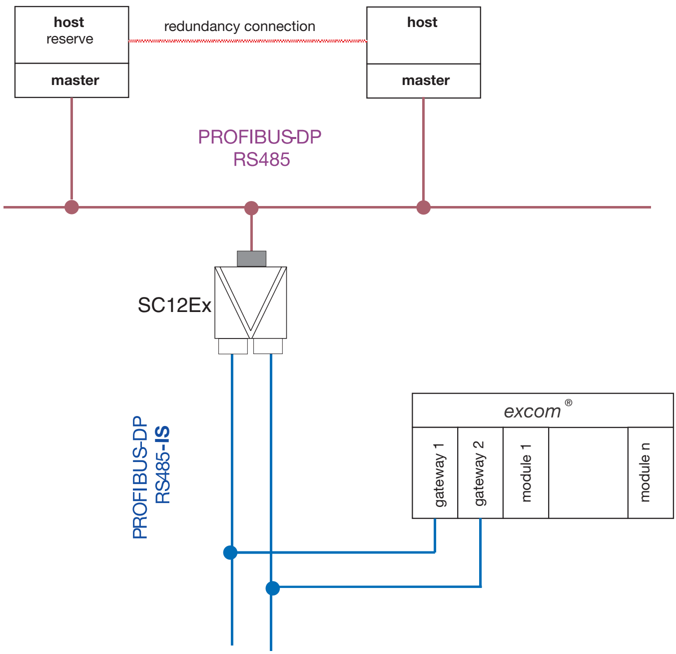
Line redundancy (flying redundancy) - hardware

Line redundancy is implemented with only one single active master. A second redundant master may only be installed for hot standby purposes.

With line redundancy, the bus line is split close to the master into two redundant bus lines. Two segment couplers or one SC12Ex are used for this. The *excom*® station must incorporate two gateways for this purpose. Each gateway is then connected to one of the two redundant bus lines. One of the gateways is active, the other is in its standby mode.

In the following hardware circuit, the gateway parameters are correctly defined with "excom® - parameters for line redundancy" page 5-61.

Figure 62: Line redundancy



System redundancy - hardware and software

Note

System redundancy is supported by *excom*® from firmware version 1.6.2 of the gateway.

With system redundancy , two separately operating PROFIBUS masters work with one *excom*® station. Also with this concept, the *excom*® station is connected via segment couplers ("Physical connection with SC12Ex or OC11Ex/..." page 5-3).

SC12Ex:

"Increase of fail-safe performance using redundant circuits" page 5-13

OC11Ex/2G and OC11Ex/3G:

"Increase of fail-safe performance using redundant circuits" page 5-22

The *excom*® station has two gateways which are activated into cyclic data exchange by their respective masters. On both masters, the configuration and parameters of the redundant slave must be absolutely identical.

One of the two gateways works as the primary device, whilst the other gateway operates as the secondary device. The primary device receives the output data transferred from the master and sends it to the output modules. It also supplies the actual input values. The secondary gateway ignores the received output data. It only supplies the actual input values. In this way, both masters always receive the actual status of the inputs.

With system redundancy, either the gateway or the master can be the trigger to switch systems. In this case, the function of sending the output data to the output modules is switched from the one gateway to the other.

Configuration for system redundancy:

One gateway must be configured with the name suffix "C":

- GDP 1,5 C (with GSD file Trckff9f)
- GDP 1,5 CD (with GSD file Trk1ff9f)

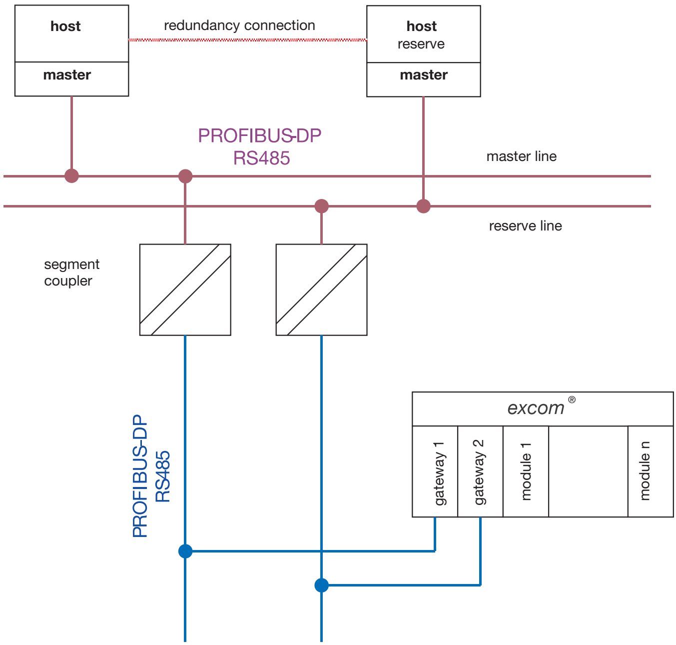
Parameterisation of the gateway:

Table: 26

Parameter name	Parameter value as text	Parameter value as binary value
Redundancy mode	Mode 3[A)]	11
Address offset	OFF	0
Address offset value	0	0000000

A *"Diagnostics with redundancy mode 1 and mode 3" page 5-62*

Figure 63: System redundancy



The triggering of a switchover by the gateway is automatic. An automatic switchover by the gateway is executed if communication is dropped on the primary line (watchdog timeout) or if the primary gateway is removed. The masters can also force a switchover. This is carried out via the cyclic data of the gateway

The cyclic data of the gateway can be used to indicate its status and to set a new status via the master.

Input word for actual gateway status

With system redundancy configured, one gateway communicates with the master assigned to it.

Table 27: Structure of the input word

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	**not used**							
Byte 1	**not used**						**Slot**	**active/ passive**

Table: 28 Possible status indications via the input word

Slot	**active/ passive**	**Meaning**
0	0	Gateway on the right slot is passive
0	1	Gateway on the right slot is active
1	0	Gateway on the left slot is passive
1	1	Gateway on the left slot is active

Output word for forcing redundancy switchover

Bits 0 - 2 control the redundancy switchover. The redundancy switchover is only activated if bits 0 and 1 change status from 11->01 or 11-10. Bit 2 sets the reaction to an edge change. If “Bit 2 = 0”, a redundancy switchover is initiated regardless of the position of the gateway. If “Bit 2 = 1”, the left or right gateway is activated as required.

Bit 2 can be set statically. It is re-evaluated with every edge change.

Table 29: Structure of the input word

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0							**not used**	
Byte 1						**Control bit**	**Control bits for edge change**	

Bit 2 = 0:

Table: 30 Status change with bit 2= 0

Bit 1 0	**Meaning**
11 -> 01	Receiver is the passive gateway. The passive gateway requests control from the active one and is activated.
11 -> 10	Receiver is the active gateway. The active gateway gives control to the passive one and is passive.

Bit 2 = 1:

Table: 31 Possible status change with switch function B

Bit 2	**Meaning**
11 -> 01	Receiver is the left gateway. The left gateway requests control from the right one and is activated.
11 -> 10	Receiver is the active gateway. The right gateway requests control from the left one and is activated.

Data formats

PROFIBUS is primarily byte oriented. I/O modules can be configured for byte or word processing. With *excom*® the values of the digital modules are organised bytewise, whilst the values of the analogue modules are organised wordwise.

Digital modules

With the digital modules, every channel is assigned one bit in the data byte. Channel 0 is assigned Bit 0, channel 2 Bit 1 and so forth. The modules can also be configured with status information. This assigns an input bit to a channel status. The assignment of the information is shown in the following tables.

For example:

DI40Ex

Table 32:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Status channel 1-4				Data Channel 4	Data Channel 3	Data Channel 2	Data Channel 1

DM80Ex

The 8-channel module DM80Ex has 1 or 2 input bytes and 1 output byte depending on the configuration.

The following configurations are possible:

Table 33: Configuration of the DM80Ex

Input bytes	Output bytes	Type	Configuration
1	1	DM80Ex	Bi-directional DM80Ex without status byte
2	1	DM80 Ex S	Bi-directional DM80 Ex with status byte
1	0	DM80 Ex 8E	DM80Ex as a pure input module without status byte
2	0	DM80 Ex S8E	DM80Ex as a pure input module with status byte

The assignment of the individual bits of the three data bytes (input, output and status byte) can be taken from the following tables:

Table 34: Bit assignment of data bytes

	Bit position							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input byte n (data byte inputs)	Ch. 8	Ch. 7	Ch. 6	Ch. 5	Ch. 4	Ch. 3	Ch. 2	Ch. 1
Input byte n+1 (status byte inputs/ outputs)	Ch. 8	Ch. 7	Ch. 6	Ch. 5	Ch. 4	Ch. 3	Ch. 2	Ch. 1
Output byte	Ch. 8	Ch. 7	Ch. 6	Ch. 5	Ch. 4	Ch. 3	Ch. 2	Ch. 1

Analogue modules

The analogue modules have 2 data bytes.

In addition to the measuring value, the analogue input modules can send a status bit which is set in the event of an error.

Table 35: Measuring value representation

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
Status bit	Measuring value														

The status bit is left-justified, right-justified or not incorporated in the process value at all, depending on the gateway parameter "Analogue data format" page Appendix-3" selected.

The resolution of the measuring value is module-specific, whereas the non-linearised value representation on the PROFIBUS is always the same.

- 0... 21 mA corresponds to 0...21000
- 0...10.5 V corresponds to 0...10500

HART® variables

Analog modules with an integrated HART® controller can also include HART® variables of the field devices in the cyclic PROFIBUS communication. For example, check back signal from position actuators. HART® variables are Floating point variable and thus 4 bytes in length. Invalid values are designated as "Not A Number". Their hexadecimal value is 7F A0 00 00.

Access to any HART® variables in different channels is possible as required. The following parameter values can be selected depending on the configuration of the module concerned:

Primary: Primary variable represents the measured value 4-20 mA

SV1: 1st secondary variable (normally the process value

SV2. 2nd secondary variable (device specific)

SV3. 3rd secondary variable (device specific)

SV4. 4th secondary variable (device specific)

HART® variables are always arranged in the cyclic data behind the analogue values of the module. Different channels of a module are selected depending on the defined access to the HART® variables.

Ascending order is used starting with channel 1SV1 and ending with channel 4 SV4.

If more variables are selected with a GSD based configuration than the module configuration specifies, only the first variables are transferred according to the order described above.

For example:

Configuration:

AIH40 4H (analogue input module with 4 HART® variables)

Parameters:

Channel 1 SV1 and SV2

Channel 2 SV1

Channel 3 SV1 and SV2

Channel 4 SV1 and SV2

The following are transferred:

Channel 1 SV1 and SV2

Channel 2 SV1

Channel 3 SV1

Note

There is no indication of implausible parameters.

Gateway diagnostics according to EN50170-2

Principle

A slave informs the master of its status using a diagnostics telegram. In this way, the master can detect during the startup whether the slave is ready for data exchange or whether there is an initialisation error. In DataExchange status, a PROFIBUS slave then sends diagnostics data when the diagnostics buffer is changed. For example, due to a wire break in the peripheral components. The *excom*® gateway sends the master messages on incoming and outgoing errors.

Structure

The structure of the diagnostics message complies with the PROFIBUS-DP specification with extensions DPV1. Alarm messages are not supported. Device-specific diagnostics according to DPV0 is replaced by status diagnostics according to DPV1.

The slave sends the master its status information in the header during startup and during cyclic data exchange. It is normally 6 bytes in length. The first 3 bytes contain status information, byte 4 shows the address of the relevant master. Bytes 5 and 6 supply the PROFIBUS identifier. The area starting from Byte 7 is for extended diagnostics.

Table 36: Structure of the diagnostics message

Byte 1…6	Byte 7…15	Byte 16…19	Byte 20…
"Header"	"Alarm/ status diagnostics" page 5-51	"Slot-specific diagnostics" page 5-54	"Channel-specific diagnostics" page 5-55

Header

The following tables provide an exact specification of the individual diagnostics bytes of the header:

- "Bit assignment in Header Byte 1 Station_status_1" page 5-48

- "Bit assignment in Header Byte 2 Station_status_2" page 5-49
- "Bit assignment in Header Byte 3 Station_status_3" page 5-50
- "Header Byte 4 Diag.Master Add" page 5-51
- "Header Bytes 5 and 6 Ident_Number" page 5-51

Table 37: Bit assignment in Header Byte 1 ***Station_status_1***

Bit no.	Name	Meaning
0	Diag.Station_Non_ Existent	This bit is set by the DP master if the respective slave cannot be addressed.
1	Diag.Station_Not_ Ready	This bit is set by the DP slave if it is not yet ready for data transfer.
2	Diag.Cfg_Fault	This bit is set by the DP slave if the configuration data last sent by the master differs from the data defined in the slave.
3	Diag.Ext_Diag	This bit is set by the DP slave. If it is set to 1, extended diagnostics data are present in the slave-specific diagnostics area (Ext_Diag_Data). If it is set to 0, it is possible that slave-specific data may be present (Ext_Diag_Data). With this mechanism, *excom*® sends its status in accordance with DP-V1 and the ID-related diagnostics.
4	Diag.Not_Supported	This bit is set by the slave on receiving a request that is not supported.
5	Diag.Invalid_Slave_ Response	This bit is set by the DP master if it receives a faulty or implausible response by an addressed slave. The DP slave resets this bit to 0.

Table 37: Bit assignment in Header Byte 1 ***Station_status_1***

Bit no.	Name	Meaning
6	Diag.Prm_Fault	This bit is set by the DP slave upon receipt of a faulty parameter message (e.g.: wrong message length, wrong ident-number, invalid parameters).
7	DIAG.Master_Lock	The DP slave has been parameter-ised by another master. This bit is set by the DP master (class 1) if the address in byte 4 does not match address 255 and differs from the master's own address. The DP slave sets this bit to 0.

Table 38: Bit assignment in Header Byte 2 ***Station_status_2***

Bit no.	Name	Meaning
0[A)]	Diag.Prm_Req	The slave must be assigned param-eters again.
1[A)]	Diag.Stat_Diag (static diagnostics)	The DP slave sets this bit to indicate that the master is to collect diag-nostics information from the respective slave until it resets the bit. For example, the DP slave sets this bit if it is not capable of transmitting valid user data.
2	This bit is set by the DP slave to 1.	
3	Diag.WD_On (Watchdog on)	This bit is set by the DP slave, as soon as the watchdog control func-tion has been activated.

Table 38:
Bit assignment in Header Byte 2
Station_status_2

Bit no.	Name	Meaning
4	Diag.Freeze_Mode	This bit is set by the DP slave upon receipt of a "Freeze control" command.
5	Diag.Sync_Mode	This bit is set by the DP slave upon receipt of a "Sync control" command.
6	reserved (0)	-
7	Diag.Deactivated	This bit is set by the DP master if the DP slave has been registered as inactive within the slave parameter set and no longer participates in cyclic data transfer. This bit is always reset to 0 by the DP slave.

A *If bit 1 and bit 0 are set, bit 0 has the higher priority*

Table 39:
Bit assignment in Header Byte 3
Station_status_3

Bit no.	Name	Meaning
0-6	reserved	
7	Diag.Ext_Diag_ Overflow	If this bit is set, there is more diagnostics data present than specified in the Ext_Diag_Data. The DP slave sets this bit if the number of channel diagnostics messages exceeds the capacity of the DP slave's send buffer.

Table 40: Header Byte 4 ***Diag.Master Add***

Name	Meaning
Diag.Master_Add	This byte contains the address of the master which has parameterised the slave. If none of the masters in the network has parameterised the slave, the slave will enter address 255 into this byte.

Table 41: Header Bytes 5 and 6 ***Ident_Number***

Name	Meaning
Ident_Number (unsigned16)	This word contains the PROFIBUS ident no. of this device. This ident number can be used for verification purposes or for exact identification of the slave.

Alarm/status diagnostics

Bytes 6 to 14 of the diagnostics message contain the device's status diagnostics.

The module status is indicated by two bits per slot (module). Channel errors are not considered.

Table 42: Status diagnostics

Byte no.	Bit no.	Name	Meaning
6	0 to 5	**Length**	Length of status diagnostics incl. header (fixed at: 001001 = 9)
	6 to 7	**Header**	Code for status diagnostics (fixed at: 00)
7	0 to 7	**Status_Type**	Diagnostics block contains module status. (fixed at: 0x82)

Table 42: Status diagnostics

Byte no.	Bit no.	Name	Meaning
8	0 to 7	**Slot number**	fixed at 0 (Gateway
9	1 to 0	**Status_specifier**	00: No further distinction 01: Status coming 10. Status going 11. reserved
	2 to 7	**reserved**	-

Table 42: Status diagnostics

Byte no.	Bit no.	Name	Meaning
10	0 and 1	**Comm. interface**	-
	2 and 3	**I/O module 1**	00: data valid 01: data invalid due to module error 10: data invalid, wrong module inserted 11: data invalid, module not inserted
	4 and 5	**I/O module 2**	see I/O module 1
	6 and 7	**I/O module 3**	see I/O module 1
11	0 and 1	**I/O module 4**	see I/O module 1
	2 and 3	**I/O module 5**	see I/O module 1
	4 and 5	**I/O module 6**	see I/O module 1
	6 and 7	**I/O module 7**	see I/O module 1
12	0 and 1	**I/O module 8**	see I/O module 1
	2 and 3	**I/O module 9**	see I/O module 1
	4 and 5	**I/O module 10**	see I/O module 1
	6 and 7	**I/O module 11**	see I/O module 1
13	0 and 1	**I/O module 12**	see I/O module 1
	2 and 3	**I/O module 13**	see I/O module 1
	4 and 5	**I/O module 14**	see I/O module 1
	6 and 7	**I/O module 15**	see I/O module 1
14	0 and 1	**I/O module 16**	00: valid 01: invalid, module error 10: invalid, wrong module 11: invalid, module missing
	2 to 7	not used	-

Slot-specific diagnostics

Bytes 15 to 18 of the diagnostics message contain the slot-specific diagnostics.

1 bit per slot (module slot) indicates whether there are diagnostics messages present for the respective slot.

If the appropriate bit is set, a diagnostics entry is present for the respective slot.

Table 43: Slot-specific diagnostics

Byte no.	Bit no.	Contents/slot
15	0 to 5	Length (incl. header) (fixed at: 000100 = 4)
	6 and 7	Header (fixed at: 01)
16	0 to 7	Slot 7 to slot 0 (one slot per bit)
17	0 to 7	Slot 15 to 8 (one slot per bit)
18	0	Slot 16
	1 to 7	reserved

Channel-specific diagnostics

For each channel error three bytes are generated.
If a single channel is affected by more than one error, e.g. overflow and
HART® status, both are transferred successively.

Table 44: Channel-specific diagnostics

Byte no.	Bit no.	Name	Meaning
1	0 to 5	Slot	Slot number of module (0... 16)
	6 and 7	Header	(fixed at: 10
2	0 to 5	Channel	Contains the number of the channel to which the channel-specific diagnostics message refers. Module errors (incl. gateway) are transferred as diagnostics messages to channel 0.
	6 and 7	Coding Input/output	00: reserved 01: input 10: output 11: input/output
3	0 to 4	Error codes	The list of "Error codes according to PROFIBUS-DP standard" is provided in the following table. The list of "Manufacturer-specific error codes" comes after it.
	5 to 7	Channel type	000: reserved 001: 1 bit 010: 2 bits 011: 4 bits 100: 1 byte 101: 1 word 110: 2 words 111: reserved

Error codes according to PROFIBUS-DP standard

The following error codes are in accordance with the definitions of the PROFIBUS-DP standard:

Table 45: Error codes

Code	Meaning
0	reserved
1	Short-circuit
2	Underrange U < 1.8 V (I < 3.6 mA)
3	Overrange U > 10.5 V (I > 21 mA)
4	Overload
5	Excess temperature
6	Wire-break
7	Upper limit exceeded
8	Below lower limit
9	Error
10 to 15	reserved
16 to 31	Manufacturer-specific (*excom*®)

Manufacturer-specific error codes

Within a modular slave system, the meaning of every error code transferred can vary in principle with every slot, i.e. according to the type of module type used.

With *excom*®, the meaning of the error codes of the gateway and all I/O modules are different:

Table 46: Error codes of the gateway

Code no.	Meaning
16	ROM error
17	RAM error
18	EEPROM error
19 to 21	reserved
22	No CAN communication
23	Redundant CAN not available
24	Error power supply unit 1
25	Error power supply unit 2
26	Re-initialisation following a watchdog reset
27	Redundancy switchover
28	Redundant GDP missing
29	Redundant GDP not available
30	Redundant GDP error
31	Redundant GDP w/o DP comm.

Table 47: Error codes for the I/O modules

Code no.	Meaning
19	Module type (desired configuration) not known
20	Module type (actual configuration) not known
21	reserved
22	Parameter not plausible (inconsistent)
23 to 29	reserved
30	HART® status error
31	HART® error

Diagnostics of analogue modules

The diagnostics messages of the *excom*® analogue modules depend on the parameterised measuring range of the modules.

Table 48: Diagnostics Analogue modules

	Measuring range	Short-circuit	Wire break	Under-range	Over-range
Table 49:	0 to 20 mA or 0 to 10 V	X (to be turned off separately)	-	-	X
Table 50:	4 to 20 mA or 2 to 10 V	X (to be turned off separately)	X (to be turned off separately)	X	X

Module behaviour in the event of an error

The modules basically behave as defined in the substitute value strategy.
The inverting of binary signals also results in inverting of the Min/Max values, because the substitute value represents the required status of the instrumentation and not the status of the periphery.

The following tables show the module behaviour in the event of an error:

Table 51: Substitute value strategy Analogue modules

Substitute value strategy	**Type AI** **Numerical value**	**Type AO** **Physical value**
Min. value		
0 to 20 mA 0 to 10 V	0 0	0 mA
4 to 20 mA 2 to 10 V	3600 1800	3.6 mA
Max. value		
0 to 20 mA/4 to 20 mA and 0 to 10 V/2 to 10 V	22000 and 10500	22 mA
Last valid value	XXXXX	XX.XXX

Table 52: Substitute value strategy Digital modules

Substitute value strategy	**Type DI**	**Type DO**	**Type DI**	**Type DO**
	Normal		**Inverse**	
Min. value	**0**	**0**	**1**	**1**
Max. value	**1**	**1**	**0**	**0**
Last valid value	**0/1**	**0/1**	**1/0**	**1/0**

Note

In the event of an error, the status bit if existent or enabled, is set to "1"

The following errors will lead to the setting of substitute values:

Input modules
(substitute value is transferred to the host system)

- Wire-break
- Short-circuit
- Measuring value underrange
- Measuring value overrange
- Missing module
- Removed module
- Internal communication interrupt (CAN)

Output modules

(substitute value is transferred to the periphery)

- External communication interrupt (PROFIBUS)
- Internal communication interrupt (CAN)
- Removed gateway

excom® - parameters for line redundancy

excom® is set to redundant operation via the gateway parameters "Redundancy mode", "Address offset" and "Address offset value".

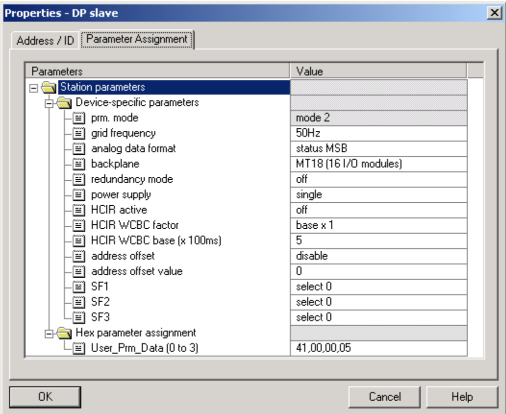


Figure 64: Redundancy parameters

Redundancy mode "OFF"

If the parameter "Redundancy mode" is deactivated ("off"), *excom*® will operate in the line redundancy mode without monitoring function. If communication between the master and the primary gateway is interrupted, the redundant gateway of the *excom*® system takes over communication.

Note

The communication capability of the redundant gateway is not verified on switchover. Additional diagnostics data is not generated.

Redundancy mode “mode 1”

If the parameter “Redundancy mode” is set to (“mode 1”), *excom®* will also operate in the line redundancy mode. If communication between the master and the primary gateway is interrupted, the redundant gateway of the *excom®* system takes over communication.

In this mode, however, the communication capability of the redundant gateway is verified on switchover.

By enabling the parameter “Address offset” (“ON”) and by entering an “Address offset value” other than “0”, the redundant gateway is assigned to an *excom®* internal virtual bus address (basic address of the *excom®* station + “Address offset value”).

Due to the virtual bus address set, the redundant gateway will react to the polling of all unconfigured slaves in the network by the PROFIBUS master and sends a receipt acknowledgement.

Based on this acknowledgement the communication ability of the redundant gateway is verified.

Diagnostics with redundancy mode 1 and mode 3

The different redundancy conditions, i.e. normal operation or error conditions, are indicated via the status diagnostics, the “Channel-specific diagnostics” page 5-55 (slot 0 channel 0) and the LEDs of the two gateways.
The following conditions can occur:

1 R_SWITCH_OVER:
Redundancy switchover has taken place (is reset after 10 s).

Table 53: Redundancy status R_SWITCH_OVER

Active gateway	Passive gateway	Error code (active gateway)
PRIO-LED OFF	PRIO-LED flashes shortly	27

2 R_GW_MISSING:
The redundant gateway is missing.

Table 54: Redundancy status R_GW_MISSING

Active gateway	Passive gateway	Error code (active gateway)
PRIO-LED flashes	-	28

3 R_NOT_READY:
The redundant gateway is not ready.

Table 55: Redundancy status R_NOT_READY

Active gateway	Passive gateway	Error code (active gateway)
PRIO-LED flashes	PDP LED red	29

4 R_GW_ERROR:
The redundant gateway is present, but there is an error.

Table 56: Redundancy status R_GW_ERROR

Active gateway	Passive gateway	Error code (active gateway)
PRIO-LED flashes	PDP LED red	30

5 R_NO_DP:
The redundant gateway cannot communicate with PROFIBUS; possible reasons are: HSA (Highest Station Address) too low, physical connection defective etc.

Table 57: Redundancy status R_GW_ERROR

Active gateway	Passive gateway	Error code (active gateway)
PRIO-LED flashes	PDP LED red	31

6 Gateway GDP1,5

Gateway GDP1,5

Figure 65: Gateway GDP1,5

The *excom*® gateway GDP1,5 is an intrinsically safe gateway for PROFIBUS-DPV1. It connects the *excom*® station to the higher-level fieldbus system and is in charge of the entire data transfer. The gateway provides all PROFIBUS diagnostics data up to channel-related diagnostics. Additional manufacturer-specific error codes are also generated by the gateway. These include HART® communication errors, power supply and commissioning errors, as well as information about simulators, internal communication, redundancy switchover etc..

Connection to higher-level systems

Connections to the PROFIBUS-DP network can either be established by fibre optic or copper cables. When using fibre optic cables, a suitable converter for converting fibre optic signals to RS 485-IS signals must be selected. “The coupler system OC11Ex/..” page 5-17 converts RS485-IS signals to intrinsically safe fibre optic signals.
When using copper cables a suitable segment such as the “Segment coupler SC12Ex” page 5-4 (RS485-IS coupler) must be used in order to ensure explosion protection.

The gateway can be operated up to a maximum transmission speed of 1,500 kBaud. A standard SUB-D connector on the module rack is used to connect the bus.

excom® can be connected to any host system with a PROFIBUS master class 1 via its PROFIBUS interface in accordance with EN 50170.

Compliance with PROFIBUS standards ensures that configuration, parameterisation and diagnostics as well as cyclic data transfer between master and *excom*® are correct. In order to process acyclic services via PROFIBUS, the DPV1 extensions have been implemented in *excom*®.

The GSD files TRK1FF9F.GSx and TRCKFF9F.GSx fully describe the behaviour of *excom*® on the PROFIBUS. Furthermore, they store the configuration and parameters of the individual modules.

To configure *excom*® the GSD file must be integrated into the respective hardware configurator of the host system. This ensures that the PROFIBUS master is supplied with *excom*® specific information and data records.

Note

The configuration may be changed during operation, provided a suitable host system is used.

Technical data

Table 58: Technical data

Type	**GDP1,5**
Operating voltage	From central power supply unit via module rack
Internal power consumption	< 3 W
Connections	
PROFIBUS-DP	9-pole SUB-D connector on module rack
Power supply	Via connectors on the module rack
I.S. Approval	PTB 00 ATEX 2162
Marking	II 2 G SYST EEx ib IIC T4
RS485 fieldbus connection (terminal pair) I	
Explosion protection type	EEx ib IIC/IIB
Max. values	
– No-load voltage U_0	3.72 V
– Short-circuit current I_0	157 mA
– Max. power P_0	146 mW
– Typical curve	Linear
– U_i	4.2 V
External RS485 fieldbus system	
Explosion protection type	SYST EEx ib IIC/IIB

Max. values per terminal pair	
– U_i	4.2 V
Max. total value of terminal pairs	
– I_i	2.66 A
Cables: Cable type A or B (according to EN 50039)	
L'/R':	≤ 28.5 µH/Ω (loop resistance)
C'	≤ 250nF/km
Litz wire diameter	≤ 0.2 mm Lumped inductances and capacitances within the fieldbus system are not admissible
General data	
Galvanic isolation	To PROFIBUS-DP according to EN 50020 (U_m = 60 V)
Protection degree	IP20
Operating temperature	-20 to +60 °C range

Gateway parameters

The different parameters depend on the "Configuration of the gateway" page 5-35. They are marked by a suffix on the product name
(C/D):

Note

Refer to the following for the bit assignment for mode 1:
"GDP1,5Ex" page Appendix-3
"GDP1,5Ex D/ GDP1,5Ex CD" page Appendix-5
Mode 2:
"GDP1,5Ex/ GDP1,5Ex C" page Appendix-22

Mode 1 and mode 2

GDP1,5Ex/ GDP1,5Ex D/ GDP1,5Ex CD/ GDP1,5Ex C

Table 59: Parameters for GDP1,5Ex (Mode1)

Parameter name	Meaning
SF1/ SF2/ SF3	reserved
module rack	(without function)
Analogue data format	Status MSB: Status bit on bit position 2^{15} Status LSB: Status bit on 2^0 No status: Measuring value without status bit
Line frequency	50 Hz or 60 Hz filter to suppress power supply line related interference on signal lines
Prm.Mode	Parameterisation mode: set via the GSD file constantly to mode 1

Table 59: Parameters for GDP1,5Ex (Mode1)

Parameter name	Meaning
Power supply	When there is a redundant supply via two power supply modules PSD24Ex, the power supply diagnostics are activated via the setting “redundant”.
Redundancy mode	Selection of the redundancy type: – OFF Redundancy without monitoring function – Mode 1: Flying redundancy – Mode 3: System redundancy (“Redundancy” page 5-37)
Address offset	Activation of the address offset in the “flying redundancy” mode
Offset value	Address offset in order to generate a virtual address. The redundant gateway is polled under the slave address + address offset.
HCIR active	Enable online configuration
HCIR WCBC factor	Factor to generate the maximum conversion time between old and new configuration.
HCIR WCBC Basis (x 100ms)	Determines the basis of the conversion time

This parameter is valid only for the gateway configuration with a suffix “C**”** on the product name.

Table 59: Parameters for GDP1,5Ex (Mode1)

Parameter name	Meaning
Cyclic data	The default value of this parameter is “0” and must not be changed.

These parameters are valid only for the gateway configuration with a suffix “D**”** on the product name. This configuration is only possible in **mode 1** !

Unused channels slot 1	Deactivation of individual channels on slot 1 by setting a bit at the appropriate location of the byte corresponding to the channel number. Each slot is assigned one byte, i.e. a maximum of 8 channels. When defining the parameter, the value must often be entered in decimal format. e.g.: The channel 8 is deactivated with 1000 0000 (binary). This is 128 in decimal format. The channel 4 is deactivated with 0000 1000 (binary). This is 8 in decimal format. Channel:1,2,3,4,5,6,7,8 corresponds to decimal: 1,2,4,8,16,32,64,128
:	:
Unused channels slot 16	Deactivation of individual channels on slot 16 (see “Unused channels Slot”)

Function of the LEDs

Table 60: LED functions

LED	Behaviour	Function
Status	Green	Operational readiness
	OFF	Not ready for operation (now power supply)
CAN	Yellow	Internal communication o.k.
	Red	No communication possible via the backplane
PDP	Yellow flashing	Invalid PROFIBUS address (0,126,127)
	Red	No data exchange with PROFIBUS master
PRIO (redun-dancy status)	OFF	Gateway is passive
	Yellow	Gateway is active
Config	OFF	Configuration o.k.
	Red flashing	Configuration errors (missing or incorrectly fitted modules)

7 Digital modules

Digital input modules

DM80Ex - Digital input/output module, 8-channel

Figure 66: DM80Ex

The input/output module DM80Ex is designed for connection of NAMUR sensors (EN 60 947-5-6) and actuators. If mechanical contacts are connected and the wire-break or short-circuit monitoring function is activated, a resistor circuitry (WM1, ident no. 0912101) must be implemented.

The 8 channels of the module are programmable as 8I, 8O, 4I/4O and 5I/3O in parameterisation mode 1. In parameterisation mode 2, groups of 2 channels can be freely configured as inputs or outputs. Module-specific parameter assignment with mode 1 or channel-specific parameter assignment with mode 2 is possible by selecting the suitable “GSD files” page 5-32.
The module is provided with protection type EEx ib IIC and may thus be used in combination with *excom*® in zone 1. The explosion protection type of the inputs/outputs is EEx ia IIC.

Note

All inputs and output are on a common potential, i.e. the channels are not isolated galvanically from each other.
Only the input and output block, the bus and power supply are galvanically isolated.

The input/output behaviour is parameterised via the PROFIBUS-DP master. Possible parameters are: switching behaviour, input delay, substitute value strategy, wire-break and short-circuit monitoring.

Configuration/data throughput

Different data throughputs are possible depending on the configuration.

The following configurations are possible:

Table 61: Configuration of the DM80Ex

Input bytes	Output bytes	Type	Configuration
1	1	DM80Ex	Bi-directional DM80Ex without status
2	1	DM80Ex S	Bi-directional DM80 Ex with status indications
1	0	DM80Ex 8I	DM80Ex as a pure input module without status indications
2	0	DM80Ex S 8I	DM80Ex as a pure input module with status indications

The following table shows the assignment of the bits of the three data bytes (input, output and status byte):

Table 62: Bit assignment of data bytes

	Bit position							
	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Input byte n	Ch. 8	Ch. 7	Ch. 6	Ch. 5	Ch. 4	Ch. 3	Ch. 2	Ch. 1
Status byte (Input byte n+1)	Ch. 8	Ch. 7	Ch. 6	Ch. 5	Ch. 4	Ch. 3	Ch. 2	Ch. 1
Output byte	Ch. 8	Ch. 7	Ch. 6	Ch. 5	Ch. 4	Ch. 3	Ch. 2	Ch. 1

Note

In parameterisation mode 1 combined with a mixed operation, the low order channels are inputs and the high order channels are outputs,

For example:

- 5 inputs / 3 outputs:

Bits 0-4 in the input byte n are the inputs of channels 1-5.

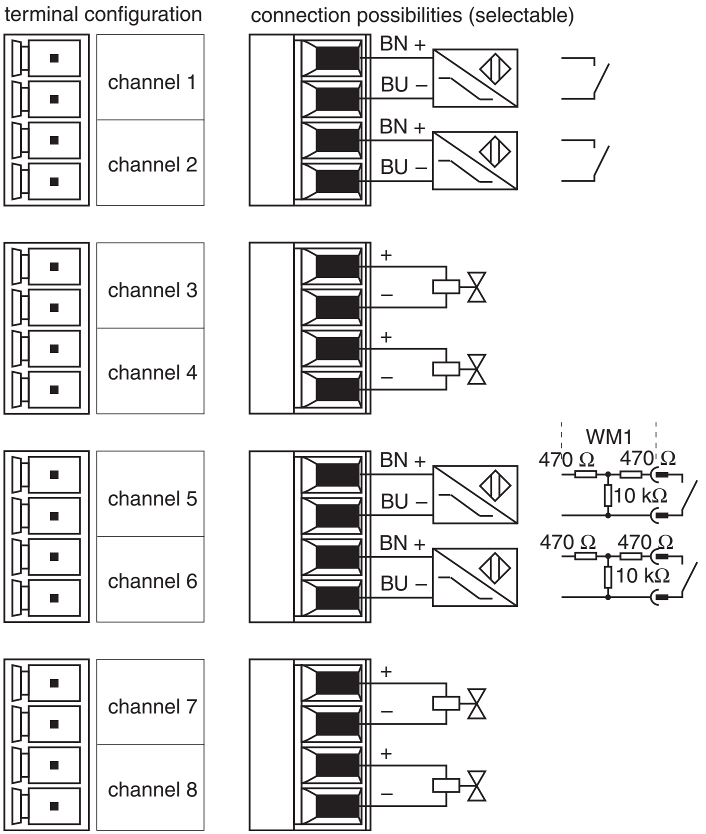
Bits 5-7 in the output byte are the outputs of channels 6-8.

Note

The status byte is configured in the same manner.

Wiring diagrams

Figure 67: Terminal assignment DM80Ex



Technical data

DM80Ex

Table 63: Technical data of the digital module DM80Ex

Type	DM80Ex
Operating voltage	Via central power supply unit via module rack
Internal power consumption	< 2 W
Inputs	8 sensors according to NAMUR (EN 60947-5-6)
No-load voltage	8 V DC
Short-circuit current	Approx. 4 mA per input
Switching threshold OFF/ON	1.7 mA / 1.5 mA
Switching frequency	< 100 Hz
Short-circuit	$R_a < 367\ \Omega$ (4.1 mA)
Wire-break	< 0.1 mA
Outputs	8 actuators
No-load voltage	8 V DC
Nominal current	Approx. 4 mA per output
Internal resistance	320 W
Switching frequency	< 100 Hz
Short-circuit	R_a < 367 W
Wire-break	< 0.2 mA
I.S. Approval	PTB 00 ATEX 2178
Marking	II 2 (1) G EEx ib [ia] IIC T4
Max. values (field circuits)	EEx ia IIC/IIB

No-load voltage U_0	$\leq$ 9.6 V
Short-circuit current I_0	$\leq$ 44 mA
Max. power P_0	$\leq$ 106 mW
Typical curve	Linear
Max. internal inductance L_I	Negligible
Max. internal capacitance C_I	Negligible
Max. external inductance L_0	("max. L_0 and max. C_0 for DM80Ex" page 7-9)
Max. external capacitance C_0	("max. L_0 and max. C_0 for DM80Ex" page 7-9)
General data	
Galvanic isolation	To bus and to supply
Protection degree	IP20
Operating temperature	-20...+60 °C
Relative humidity	95 % at 55 °C according to EN60069-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Refer to the following table for the max. external inductance L_0 and max. external capacitance C_0 values for the *excom*® module DM80Ex.

Table 64: max. L_0 and max. C_0 for DM80Ex

Max. external inductance L_0 (mH)	**Max. external capacitance C_0 (mF)**	
	IIC	IIB
2	0.9	5.1
1	1.1	6.1
0.5	1.3	7.3
0.2	1.7	8.6

Module parameters

Note

Refer to the following for the bit assignment for mode 1:
"DM80Ex/ DM80Ex S" page Appendix-7
"DM80Ex 8I/ DM80Ex S 8I" page Appendix-8.
Mode 2:
"DM80Ex/ DM80Ex S/ DM80Ex 8I/ DM80Ex S 8I" page Appendix-24

Mode 1

In mode 1, the module has 1 parameter byte.

Table 65: DM80Ex... (mode 1)

Parameter name	**Meaning**
Short-circuit monitoring	Short-circuit monitoring is activated/deactivated for all 8 channels of the module.

Table 65: DM80Ex... (mode 1)

Parameter name	Meaning
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 8 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Debouncing	In order to debounce the mechanical contacts an additional attenuation of the input signals is activated.
Polarity	Activation or deactivation of signal inverting.
Effective direction	Depending on the set parameters, the module's channels are either configured as inputs or as outputs.

Mode 2

In mode 2, the module has 5 parameter bytes.

In mode 2, module parameterisation is always effective for two channels.

Table 66: DM80Ex... (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.
Effective direction	Depending on the set parameters, the module's channels are either configured as inputs or as outputs.
Polarity	Activation or deactivation of signal inverting.
Debouncing	In order to debounce the mechanical contacts an additional attenuation of the input signals is activated.
Channel 1	Activation/deactivation of channel 1.
:	:
Channel 8	Activation/deactivation of channel 8.

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

In addition to the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the module DM80Ex supports the following channel status indications (channel-specific diagnostics):

Table 67: Error codes

Error code	No.	Meaning
Standard	1	Short-circuit
	6	Wire-break
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Functions of the LEDs

Table 68:

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
	Flashing green rapidly	The gateway has not sent any output data. The master is not yet in data_exchange after configuration.
Channel	Yellow	Channel switched
	Red	Channel error (wire-break, short-circuit)

DI40Ex4 - digital input module, 4-channel

Figure 68: DI40Ex

The input module DI40Ex is designed for connection of up to 4 sensors according to NAMUR (EN 60947-5-6) or mechanical contacts. If mechanical contacts are connected and the wire-break or short-circuit monitoring function is activated, a suitable resistor circuitry (WM1, ident no. 0912101) must be implemented.

The module is provided with protection type EEx ib IIC and can thus be used in combination with *excom*® in zone 1. The explosion protection type of the inputs is EEx ia IIC. The field devices can therefore be operated in zone 0.

Note

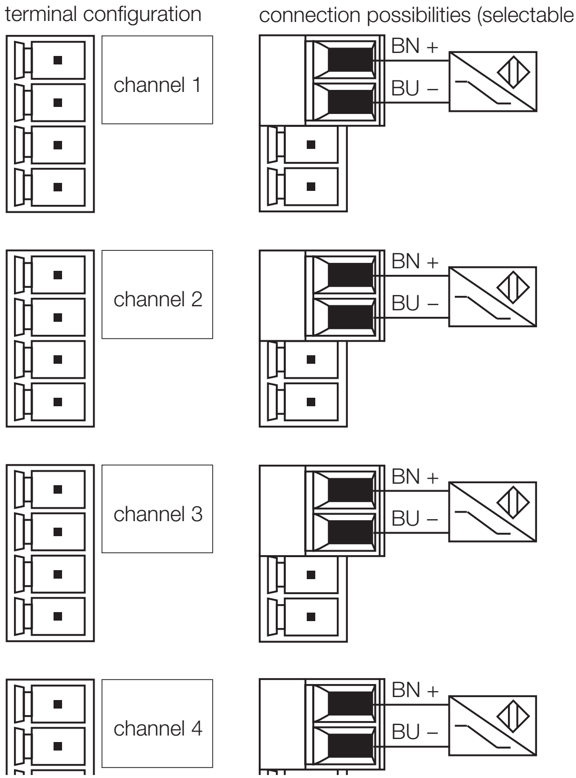
The fieldbus, the power supply and the channels are galvanically isolated.

Parameterisation

The input behaviour is parameterised via the PROFIBUS-DP master. Possible parameters are: switching behaviour, input delay, substitute value strategy, wire-break and short-circuit monitoring.

Wiring diagrams

Figure 69: Terminal assignment DI40Ex



Technical data

DI40Ex

Table 69: Technical data DI40Ex

Type	**DI40Ex**
Operating voltage	Via central power supply unit via module rack
Internal power consumption	< 2 W
Inputs	4 sensors according to NAMUR (EN 60947-5-6)
No-load voltage	8 V DC
Short-circuit current	Approx. 4 mA per input
Switching threshold OFF/ON	1.8 mA / 1.3 mA
Switching frequency (binary input)	< 50 Hz
Short-circuit	R_a < 367 W
Wire-break	< 0.1 mA
I.S. Approval	PTB 00 ATEX (pending)
Marking	II 2 (1) G EEx ib [ia] IIC T4
Max. values (field circuits)	EEx ia IIC/IIB
No-load voltage U_0	$\leq$ 8.7 V
Short-circuit current I_0	$\leq$ 8.8 mA
Max. power P_0	$\leq$ 106 mW
Typical curve	Linear
Max. internal inductance L_I	Negligible

Max. internal capacitance C_I	Negligible
Max. external inductance L_0	("max. L_0 and max. C_0 for DI40Ex" page 7-16)
Max. external capacitance C_0	("max. L_0 and max. C_0 for DI40Ex" page 7-16)
General data	
Galvanic isolation	complete
Protection degree	IP20
Operating temperature	-20...+70 °C
Relative humidity	95 % at 55 °C according to EN60068-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Refer to the following table for the max. external inductance L_0 and max. external capacitance C_0 values for the *excom*® module DI40Ex.

Table 70: max. L_0 and max. C_0 for DI40Ex

Max. external inductance L_0 (mH)	Max. external capacitance C_0 (mF)	
	IIC	IIB
2	0.9	5.1
1	1.1	6.1
0.5	1.3	7.3
0.2	1.7	8.6

Module parameters

Note

Refer to the following for the bit assignment for mode 1:
"DI40Ex" page Appendix-8.
Mode 2:
"DI40Ex" page Appendix-25

Mode 1

In mode 1, the module has 1 parameter byte.

Table 71: DI40Ex (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Debouncing	In order to debounce the mechanical contacts an additional attenuation of the input signals is activated.
Polarity	Activation or deactivation of signal inverting.
reserved	-

Mode 2

In mode 1, the module has 4 parameter bytes (1 byte per channel).

Note

The parameters in mode 2 for the module DI40Ex are the same as those of mode 1.

However, parameterisation in mode 2 always applies to a single channel and not to the entire module.

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

In addition to the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the module DI40Ex supports the following channel status indications (channel-specific diagnostics):

Table 72: Error codes

Error code	No.	Meaning
Standard	1	Short-circuit
	6	Wire-break
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Function of the LEDs

Table 73: LED functions

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
channel (1-4)	Yellow	Channel switched
	Red	Channel error (wire-break, short-circuit)

Digital output module for standard Exi valves

DO40Ex - Digital output module, 4-channel

Figure 70: DO40Ex

The output module D040Ex is designed for connection of intrinsically safe actuators such as valves (with the two states “open” and “closed”) or indicators.

It is provided with protection type EEx ib IIC and may thus be used in combination with *excom*® in zone 1. The explosion protection type of the outputs is EEX ia IIC.

Note
The outputs are galvanically isolated from each other.

One actuator may be connected per channel. Each channel has two intrinsically safe circuits with different I.S. data.

Diagnostics

The module is provided with short-circuit and wire-break monitoring when the output is switched.

Valve control

The values for valve actuation are shown in the load curve (see “Load curve of the DO40Ex” page 7-25).

The admissible limit values can be taken from the respective I.S. certificates of the valve manufacturers.

Valves that require a higher output than the “maximum power” on the output must be actuated via valve control modules. Suitable control modules can be connected directly to the outputs of the DO40Ex module.

Note

Each channel has two connections. These connections have different no-load voltage values and can only be used individually and never together.
If a connection is used, the neighbouring connection for the same channel loses its functionality.

The following variations are possible, for example, for **connection 1**:

Table: 74 Power specifications for connection 1

Voltage and maximum current with a no-load voltage of 24 VDC	Maximum power at output
24 V/6 mA	144 mW
18 V/ 25 mA	450 mW

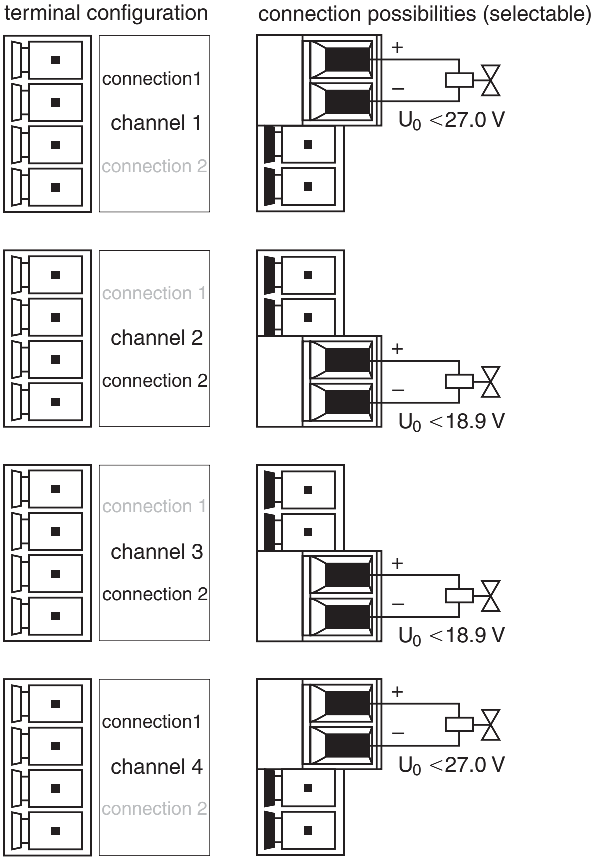
The following variations are possible, for example, for **connection 2**:

Table: 75Power specifications for connection 2

Voltage and maximum current with a no-load voltage of 16 VDC	Maximum power at output
15 V/35 mA	525 mW
12 V/ 45 mA	540 mW

Wiring diagrams

Figure 71: Terminal assignment DO40Ex



Technical data

DO40Ex

Table 76: Technical data of the digital output module DO40Ex

Type	**DO40Ex**	
Operating voltage	Via central power supply unit via module rack	
Internal power consumption	< 2 W	
Outputs	4 actuators	
No-load voltage	16 V DC	24 V DC
Nominal current	15 V/35 mA; 12 V/ 45 mA	24 V/6 mA; 18 V/ 25 mA
Internal resistance	300 W	
Switching frequency	< 100 Hz	
Short-circuit (pulsed)	100 W	
Wire-break	< 1 mA	
I.S. Approval	PTB 00 ATEX 2047	
Marking	II 2 (1) G EEx ib [ia] IIC T4	
Max. I.S. values (field circuits)	EEx ia IIC/IIB	
No-load voltage U_0	$\leq$ 18.9 V	$\leq$ 27 V
Short-circuit current I_0	$\leq$ 100 mA	
Max. power P_0	$\leq$ 675 mW	
Typical curve	Trapezoidal	Linear
Max. internal inductance L_I	24 nF	

Max. internal capacitance C_I	Negligible
Max. external inductance L_0	"max. L_0 and max. C_0 for DO40Ex with 16 V DC actuators" page 7-25 and "max. L_0 and max. C_0 for DO40Ex with 24 V DC actuators" page 7-26
Max. external capacitance C_0	"max. L_0 and max. C_0 for DO40Ex with 16 V DC actuators" page 7-25 and "max. L_0 and max. C_0 for DO40Ex with 24 V DC actuators" page 7-26
General data	
Galvanic isolation	complete
Protection degree	IP20
Operating temperature	-20...+60 °C
Relative humidity	95 % at 55 °C according to EN60069-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Load curve

Table 77: Load curve of the DO40Ex

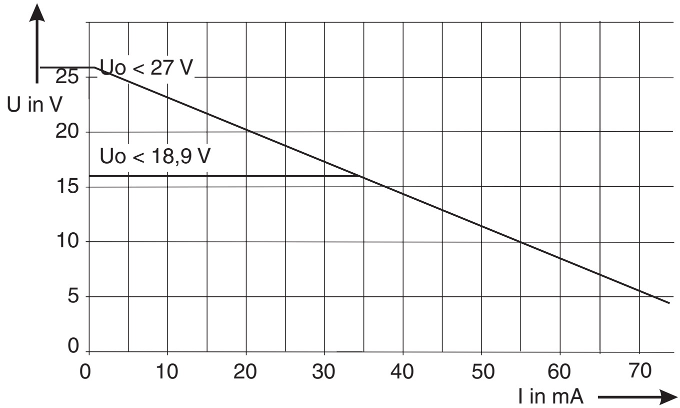


Table 78: max. L_0 and max. C_0 for DO40Ex with 16 V DC actuators

Max. external inductance L_0	**Max. external capacitance C_0 (mF)**	
	IIC	IIB
2	-	976
1	86	976
0.5	106	976
0.2	156	1176

Table 79: max. L_0 and max. C_0 for DO40Ex with 24 V DC actuators

Max. external inductance L_0	Max. external capacitance C_0 (mF)	
	IIC	IIB
2	0.10	1
1	0.10	1
0.5	0.12	1
0.2	0.15	1.17

Module parameters

Note

Refer to the following for the bit assignment for mode 1:
"DO40Ex" page Appendix-9.
Mode 2:
"DO40Ex" page Appendix-26.

Mode 1

In mode 1, the module has 1 parameter byte.

Table 80: DO40Ex (mode 1 and 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.

Table 80: DO40Ex (mode 1 and 2)

Parameter name	Meaning
Polarity	Activation or deactivation of signal inverting.

Mode 2

In mode 2, the module has 4 parameter bytes.

Note

The parameters in mode 2 for the module DI40Ex are the same as those of mode 1.

However, parameterisation in mode 2 always applies to a single channel and not to the entire module.

Bit configuration of the output byte

The values for the 4 channels of the module are assigned to bits 0 to 3 of the output byte. Bits 4 to 7 are not assigned.

Table 81: Bit configuration of the A bytes

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output byte	-	-	-	-	Ch. 4	Ch. 3	Ch. 2	Ch. 1

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

Alongside the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the module DO40Ex supports the following channel status indications (channel-specific diagnostics):

Table 82: Error codes

Error code	No.	Meaning
Standard	1	Short-circuit
	6	Wire-break
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Function of the LEDs

Table 83: Function of the LEDs

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
	Flashing green rapidly	The gateway has not sent any output data. The master is not yet in data_exchange after configuration.
Channel	Yellow	Channel switched
	Red	Channel error (wire-break, short-circuit)

8 Analogue modules

AI40Ex - Analogue input module, 4-channel

Figure 72: Analogue input module AI40Ex

The input module AI40Ex is designed for connection of 2-wire transducers (active input = source mode / passive transducer).

The module is provided with protection type EEx ib IIC and can thus be used in combination with *excom*® in zone 1. The explosion protection type of the inputs is EEX ia IIC.

Channel-wise parameterisation

Note
The inputs are galvanically isolated from each other.

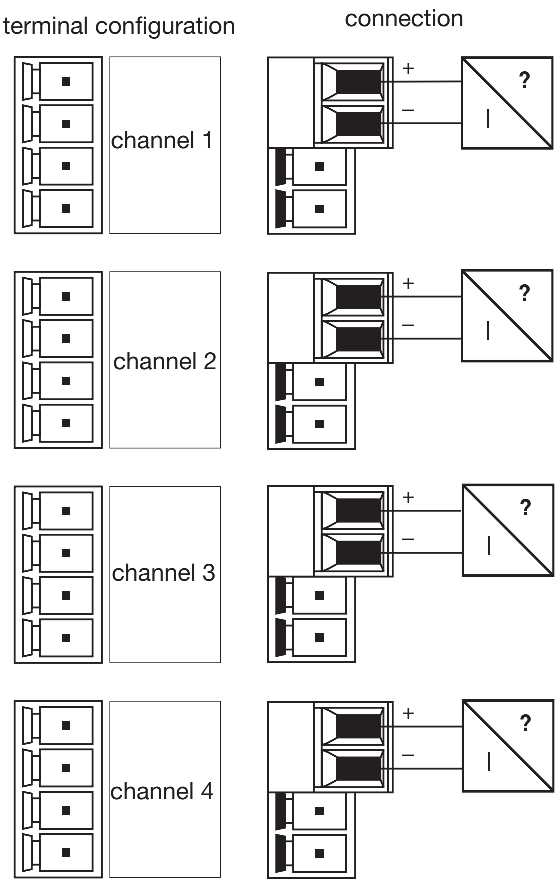
Parameters, such as wire-break monitoring, short-circuit monitoring, substitute value strategy etc. can be set separately for each channel and are initiated exclusively by the PROFIBUS master.

Wiring diagrams

The input module AI40Ex can be connected as an **active** input to a two-wire transducer or as a **passive** input to a four-wire transducer with an external power supply.

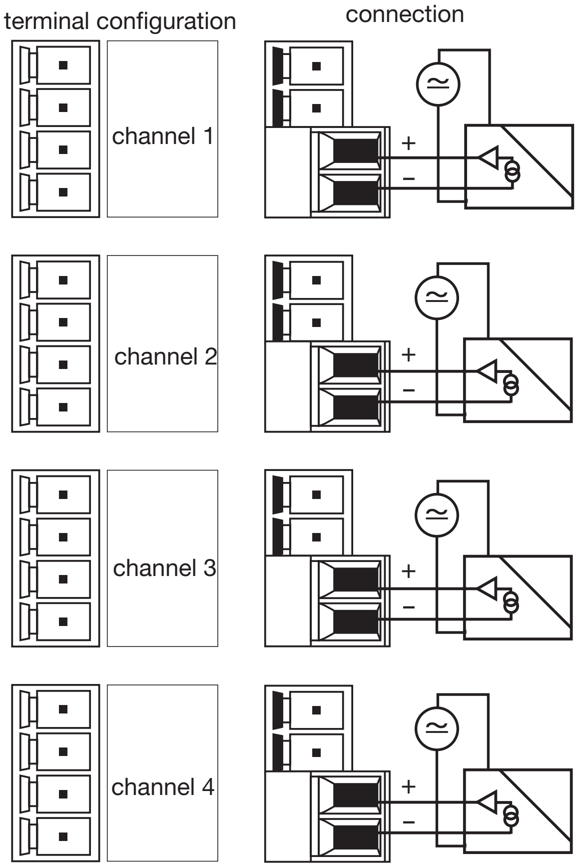
The following wiring diagram shows the analog input in “active” mode, i.e. the connected two-wire measuring transducer is powered via the signal cable. The “Connection“ parameter (discribed on page 8-9) must be parameterised as “active“.

Figure: 73
The analogue input is “active”



The following wiring diagram shows the analog input in “passive” mode, i.e. the connected four-wire measuring transducer is powered via an external power source. The “Connection“ parameter (discribed on page 8-9) must be parameterised as “passive“.

Figure: 74
The analogue input is “passive”



Technical data

AI40Ex

Table 84: Technical data AI40Ex

Type	**AI40Ex**
Operating voltage	Via central power supply unit via module rack
Internal power consumption	< 3.5 W
Inputs	4 analogue sensors
Input voltage	> 15 V DC at 22 mA (at the transmitter)
Input current	0/4...20 mA per input
Overrange	> 22 mA
Short-circuit	< 5 V (in “live zero” mode only)
Underrange	2...3.6 mA
Wire-break	< 2 mA (in “live zero” mode only)
Resolution	14 bits
Linearity tolerance	< 0.1 % (of final value)
Temperature drift	< 50 ppm/K
Rise/release time	< 50 ms (10...90 %)
I.S. Approval	PTB 03 ATEX 2217
Marking	II 2 (1GD) G EEx ib [ia] IIC T4
Max. values (field circuits)	EEx ia IIC/IIB
No-load voltage U_0	≤ 19.1 V
Short-circuit current I_0	≤ 90 mA
Max. power P_0	≤ 800 mW

Typical curve	Trapezoidal
U_Q	23.3 V
R	134 Ω
Max. internal inductances L_I	Negligible
Max. internal capacitances C_I	≤ 24.2 nF
Max. external inductances L_0	"Maximum external inductance and capacitance" page 8-7
Max. external capacitances C_0	"Maximum external inductance and capacitance" page 8-7
General data	
Galvanic isolation	to bus and to supply
Protection degree	IP20
Operating temperature	-20...+70 °C
Relative humidity	95 % at 55 °C according to EN60068-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Refer to the following table for the max. external inductance and capacitance values for the module AI40Ex:

Table 85: Maximum external inductance and capacitance

	EEx ia + EEx ib	
	IIC	IIB
L_0	0.2 mH	1.0 mH
C_0	125 nF	870 nF

Module parameters

Note

Refer to the following for the bit assignment for mode 1:
"AI40Ex" page Appendix-10
Mode 2:
"AI40Ex" page Appendix-27

Mode 1

Two types of GSD files are available. If you wish to parameterise your *excom*® station in mode 1, select the GSD file "Trk**1**ff9f". This provides only one byte of parameter data per module. All channels of a module are assigned the same parameters.

In mode 1, the module has 1 parameter byte.

Table 86: AI40Ex (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Filter (PT1)	Activation of a software filter for generating an average value.
Measuring range	Depending on the parameterisation, the measuring range is either set to 0...20 mA or 4...20 mA.

Table 86: AI40Ex (mode 1)

Parameter name	Meaning
Connection	With this parameter, the type of trans-ducer supply must be indicated. The parameter must indicate **active** if the transducer supply is provided via the input terminal of the *excom*® station! The parameter must indicate **passive** if the transducer power supply is provided externally! "Wiring diagrams" page 8-4

Mode 2

Two types of GSD files are available. If you wish to parameterise your *excom*® station in mode 2, select the GSD file “Trckff9f”.

In mode 2, the module has 4 parameter bytes (1 byte per channel).

The channel number is at the beginning of the parameter name, e.g. “C1:Replacement value strategy” for parameterising the replacement value strategy of the first channel.

Note

The parameters in mode 2 for the module AI40Ex are the same as those of mode 1.

However, parameterisation in mode 2 always applies to a single channel and not to the entire module.

Measured value representation

The resolution is 14 bits, i.e. the analogue value of 0...25 mA is digitised as a number between 0 and 16383. To simplify representation the digitised value is spread over a range from 0...25000 and transferred to the host system. The representation depends on the gateway parameter “Analogue data format” page Appendix-3. Three formats can be set for the measured value in the process input data.

Table 87: Measuring value representation

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
MSB															LSB
SB*	0 -25000 corresponds to 0 - 25 mA														
0 -25000 corresponds to 0 - 25 mA															SB*
	0 -25000 corresponds to 0 - 25 mA														

* SB =Status bit
The status bit is set if there is an error that triggers a diagnostics indication.
The status bit is left-justified, right-justified or not incorporated in the process value at all, depending on the gateway parameter “Analogue data format” page Appendix-3 selected.

Table 88: Substitute values for the AO40Ex

Measuring range	**Substitute values**
0 to 20 mA	Min.: 0 mA Max: 22 mA
4 to 20 mA	Min: 3.6 mA Max: 22 mA

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

Alongside the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the module AIH40Ex supports the following channel status indications (channel-specific diagnostics):

The channel-specific status indications depend on the module parameters.

The "Short-circuit monitoring" page 8-8" and " "Wire break monitoring" page 8-8 parameters can be used to disable the corresponding diagnostics indications.

Four different parameter settings must be taken into account:

*Table 89: Parameterisation: "Measuring range" page 8-8 to **"4...20 mA"** "Connection" page 8-9 to **"active"***

Error code	No.	Meaning
Standard	1	Short-circuit
	6	Wire-break
	2	Underrange
	3	Overrange
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Table 90: Parameterisation: *"Measuring range" page 8-8* *to **"0...20 mA"*** *"Connection" page 8-9* *to **"active"***

Error code	No.	Meaning
Standard	1	Short-circuit
	3	Overrange
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Table 91: Parameterisation: *"Measuring range" page 8-8* *to **"4...20 mA"*** *"Connection" page 8-9* *to **passive"***

Error code	No.	Meaning
Standard	1/6	Line errors
	2	Underrange
	3	Overrange
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Table 92: Parameterisation: *"Measuring range" page 8-8* *to* ***"0...20 mA"*** *"Connection" page 8-9* *to* ***"passive"***

Error code	No.	Meaning
Standard	1/6	Line errors
	2	Underrange
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Function of the LEDs

Table 93: LED functions

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
	Flashing green rapidly	The module has been configured. The gateway has not sent any output data. The master is not yet in data_exchange after configuration.
channel (1-4)	Yellow	
	Red	Channel error (wire-break, short-circuit etc.)

AI41Ex - Analogue input module, 4-channel

Figure 75: Analogue input module AI41Ex

The input module AIH41Ex is designed for connection of 4-wire transducers (passive input = non-source mode / active transducer).

The module is provided with protection type EEx ib IIC and can thus be used in combination with *excom*® in zone 1. The explosion protection type of the inputs is EEX ia IIC.

Note
The inputs are galvanically isolated from each other.

Channel-wise parameterisation

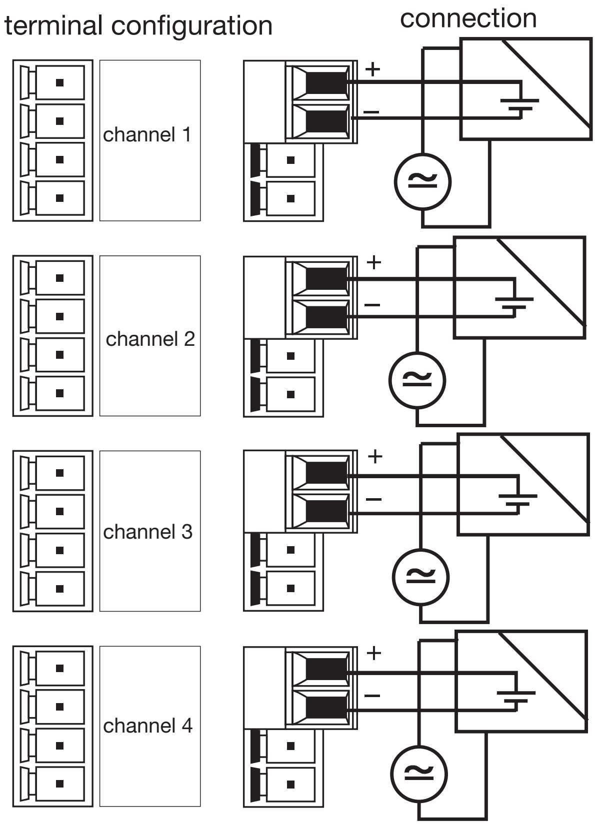
Parameters, such as line monitoring, substitute value strategy etc. can be set separately for each channel; parameterisation is initiated exclusively by the PROFIBUS master.

Wiring diagrams

The input module AI41Ex can be connected as a **passive** input to a four-wire measuring transducer. The power supply must be provided externally.

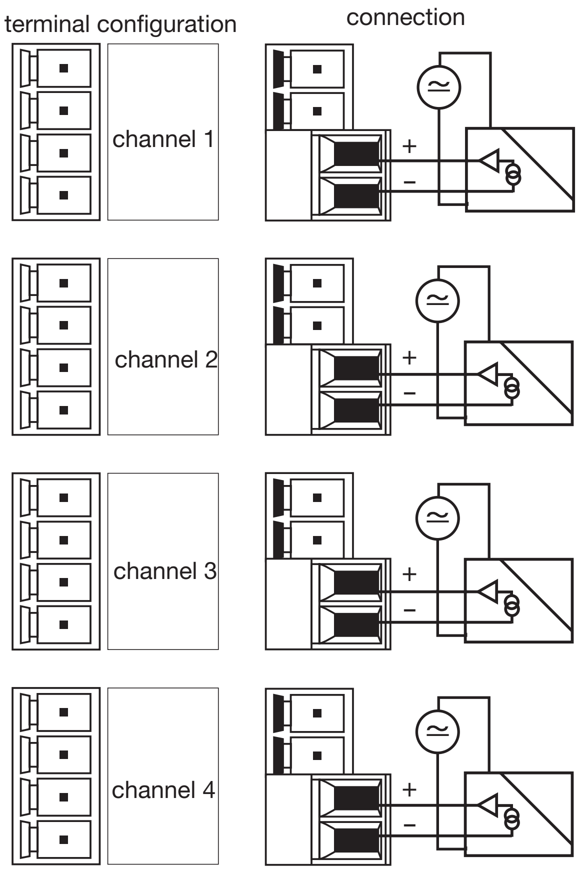
The following wiring diagram shows the analogue voltage input with an external power supply for the measuring transducer:

Figure: 76
The analogue voltage input is passive



The following wiring diagram shows the analogue current input with an external power supply for the measuring transducer:

Figure: 77
The analogue current input is passive



Technical data

AI41Ex

Table 94: Technical data AI41Ex

Type	**AI41Ex**
Operating voltage	Via central power supply unit via module rack
Internal power consumption	< 2 W
Inputs	4 analogue sensors
Input current	0/4...20 mA per input
Overrange	> 22 mA
Short-circuit	< 5 V (in “live zero” mode only)
Underrange	2...3.6 mA
Wire-break	< 2 mA (in “live zero” mode only)
Resolution	14 bits
Linearity tolerance	< 0.1 % (of final value)
Temperature drift	< 50 ppm/K
Rise/release time	< 50 ms (10...90 %)
I.S. Approval	PTB 03 ATEX 2217
Marking	II 2 (1GD) G EEx ib [ia] IIC T4
Max. values (field circuits)	EEx ia IIC/IIB
No-load voltage U_0	$\leq$ 6.6 V
Short-circuit current I_0	$\leq$ 2.1 mA
Max. power P_0	$\leq$ 3.5 mW
Typical curve	Linear
R	134 Ω

Max. internal inductances L_I	Negligible
Max. internal capacitances C_I	Negligible
Max. external inductances L_0	“Maximum external inductance and capacitance” page 8-19
Max. external capacitances C_0	“Maximum external inductance and capacitance” page 8-19
General data	
Galvanic isolation	to bus and to supply
Protection degree	IP20
Operating temperature	-20...+70 °C
Relative humidity	95% at 55 °C acc. to EN 60068-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Refer to the following table for the max. external inductance and capacitance values for the module AI41Ex:

Table 95: Maximum external inductance and capacitance

	IIC	**IIB**
L_0 (mH)	**C_0 (µF)**	**C_0 (µF)**
2	2.0	11
1	2.3	12
0.5	2.7	15
0.2	3.3	19

Module parameters

Note

Refer to the following for the bit assignment for mode 1:
"AI41Ex" page Appendix-11
Mode 2:
"AI41Ex" page Appendix-28

Mode 1

Two types of GSD files are available. If you wish to parameterise your *excom*® station in mode 1, select the GSD file "Trk**1**ff9f". This provides only one byte of parameter data per module. All channels of a module are assigned the same parameters.

In mode 1, the module has 1 parameter byte.

Table 96: AI40Ex (mode 1)

Parameter name	Meaning
Line monitoring	Line monitoring is activated or deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Filter (PT1)	Activation of a software filter for generating an average value.
Measuring range	Depending on the parameterisation, the measuring range is either set to 0 to 20 mA, 4 to 20 mA, 0 to 10 V or 2 to 10 V.

Mode 2

Two types of GSD files are available. If you wish to parameterise your *excom*® station in mode 2, select the GSD file “Trckff9f”.

In mode 2, the module has 4 parameter bytes (1 byte per channel).

The channel number is at the beginning of the parameter name, e.g. “C1:Replacement value strategy” for parameterising the replacement value strategy of the first channel.

Note

The parameters in mode 2 for the module AI41Ex are the same as those of mode 1.

However, parameterisation in mode 2 always applies to a single channel and not to the entire module.

Measured value representation

The resolution is 14 bits, i.e. the analogue value of 0...25 mA or 0...10 VDC is digitised as a number between 0 and 16383. To simplify representation, the digitised value is spread over a range from 0...25000 for the current value and transferred to the host system. The voltage value is represented in the range from 0 to 1000 for transferring to the host system. The representation depends on the gateway parameter “Analogue data format” page Appendix-3. Three formats can be set for the measured value in the process input data.

Table 97: Measuring value representation

2^{15}	2^{14} 2^{13} 2^{12} 2^{11} 2^{10} 2^{9} 2^{8} 2^{7} 2^{6} 2^{5} 2^{4} 2^{3} 2^{2} 2^{1}	2^{0}
MSB		LSB
SB*	0 -25000 corresponds to 0 - 25 mA	
SB*	0-10000 corresponds to 0 to 10 V	
	0 -25000 corresponds to 0 - 25 mA	SB*
	0-10000 corresponds to 0 to 10 V	SB*
	0 -25000 corresponds to 0 - 25 mA	
	0-10000 corresponds to 0 to 10 V	

* SB =Status bit
The status bit is set if there is an error that triggers a diagnostics indication.
The status bit is left-justified, right-justified or not incorporated in the process value at all, depending on the gateway parameter “Analogue data format” page Appendix-3 selected.

Table 98: Substitute values for AI41Ex

Measuring range	Substitute values
0 to 20 mA	Min: 0 mA Max: 22 mA
4 to 20 mA	Min: 3.6 mA Max: 22 mA
0 to 10 V	Min: 0 V Max: 10.5 V
2 to 10 V	Min: 1.8 V Max: 10.5 V

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

Alongside the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the module AI41Ex supports the following channel status indications (channel-specific diagnostics):

The channel-specific status indications depend on the module parameters.

The "Line monitoring" page 8-20 parameter can be used to disable the corresponding diagnostics indications.

Two different parameter settings must be taken into account:

*Table 99: Parameterisation: "Measuring range" page 8-8 to **"4...20 mA" or "2..10 V"***

Error code	No.	Meaning
Standard	1/6	Line errors
	2	Underrange
	3	Overrange
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Table 100: Parameterisation: *"Measuring range" page 8-8* *to **"0...20 mA" or "0..10 V"***

Error code	No.	Meaning
Standard	1/6	Line errors
	3	Overrange
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Function of the LEDs

Table 101: LED functions

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
	Flashing green rapidly	The module has been configured. The gateway has not sent any output data. The master is not yet in data_exchange after configuration.
channel (1-4)	Yellow	
	Red	Channel error (wire-break, short-circuit etc.)

AO40Ex - Analogue output module, 4-channel

Figure 78: Analogue output module AO40Ex

The output module AO40Ex is designed for connection of intrinsically safe actuators such as control valves or process indicators.

The module is provided with protection type EEx ib IIC and can thus be used in combination with *excom*® in zone 1. The explosion protection type of the outputs is EEX ia IIC.

Note

The outputs are galvanically isolated from each other.

HART® compatibility

The module is suitable for connection of HART® compatible actuators. Thus the module can be parameterised directly via the connection level of the module rack via an approved modem.

HART® compatibility means it is possible to connect to the terminals of the transmitter with an FSK modem. (the corresponding load is inverted in the module.)

Measured value representation

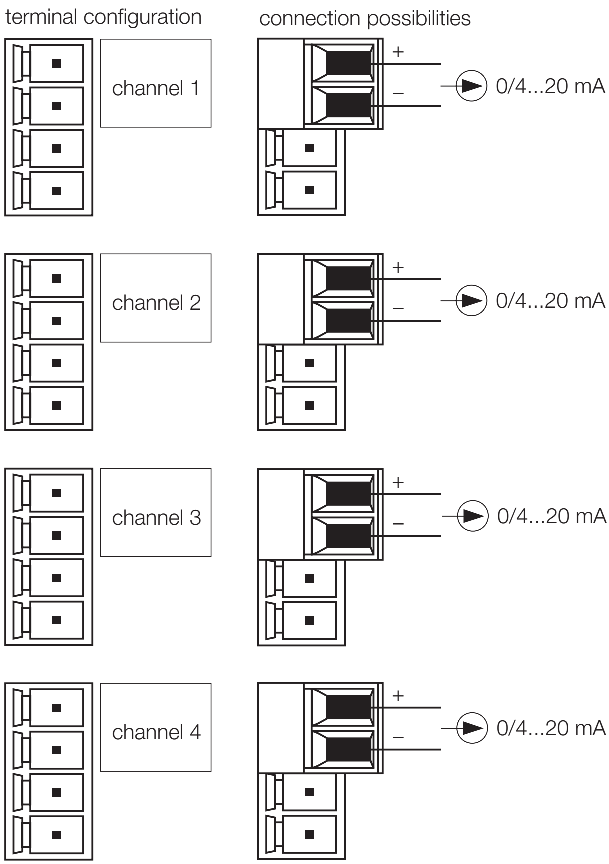
The resolution is 13 bits, i.e. the analogue value of 0...25 mA is reproduced as a number between 0 and 8191. In order to simplify value representation, the host system operates with the value range of 0...25000.

Channel-wise parameterisation

Parameters, such as line monitoring, substitute value strategy etc. can be set separately for each channel; parameterisation is initiated exclusively by the PROFIBUS master.

Wiring diagrams

Figure 79: Terminal assignment AO40Ex



Technical data

AO40Ex

Table 102: Technical data AO40Ex

Type	**AO40Ex**
Operating voltage	Via central power supply unit via module rack
Internal power consumption	< 3.5 W
Outputs	4 analogue actuators
No-load voltage	< 16 V DC
Output current	0/4...20 mA per output
External load	< 600 W
HART® impedance	> 240 W
Short-circuit	< 100 W (in “live zero” mode only)
Wire-break	< 2 mA (in “live zero” mode only)
Resolution	13 bits
Linearity tolerance	< 0.1 % (of final value)
Temperature drift	< 50 ppm/K
Rise/release time	< 50 ms (10...90 %)
I.S. Approval	PTB 00 ATEX 2179
Marking	II 2 (1) G EEx ib [ia] IIC T4
Max. values (field circuits)	EEx ia IIC/IIB
No-load voltage U_0	≤ 18.9 V
Short-circuit current I_0	≤ 80 mA
Max. power P_0	≤ 510 mW

Typical curve	Trapezoidal
Max. internal inductances L_I	Negligible
Max. internal capacitances C_I	25 nF
Max. external inductances L_0	"max. L_0 and max. C_0 for AO40Ex" page 8-29
Max. external capacitances C_0	"max. L_0 and max. C_0 for AO40Ex" page 8-29
General data	
Galvanic isolation	complete
Protection degree	IP20
Operating temperature	-20...+60 °C
Relative humidity	95 % at 55 °C according to EN60069-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Refer to the following table for the max. external inductance and capacitance values for the module AO40Ex:

Table 103: max. L_0 and max. C_0 for AO40Ex

Max. external inductance L_0	Max. external capacitance C_0 (mF)	
	IIC	IIB
2	0.10	1
1	0.10	1
0.5	0.12	1
0.2	0.15	1.17

Module parameters

Note

Refer to the following for the bit assignment for mode 1:
"AO40Ex" page Appendix-11
Mode 2:
"AO40Ex" page Appendix-29

Mode 1

In mode 1, the module has 1 parameter byte.

Table 104: AO40Ex (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Measuring range	Depending on the parameterisation, the measuring range is either set to 0...20 mA or 4...20 mA.

Mode 2

In mode 2, the module has 4 parameter bytes (1 byte per channel).

Note

The parameters in mode 2 for the module AO40Ex are the same as those of mode 1.

However, parameterisation in mode 2 always applies to a single channel and not to the entire module.

Measured value representation

Table 105: Measuring value representation

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
0 -25000 corresponds to 0 - 25 mA															

Table 106: Substitute values for the AO40Ex

Measuring range	Substitute values
0 to 20 mA	Min: 0 mA Max: 22 mA
4 to 20 mA	Min: 3.6 mA Max: 22 mA

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

Alongside the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the module AO40Ex supports the following channel status indications (channel-specific diagnostics):

Table 107: Error codes

Error code	No.	Meaning
Standard	1	Short-circuit

Table 107: Error codes

Error code	No.	Meaning
	6	Wire-break
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Function of the LEDs

Table 108: LED functions

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
	Flashing green rapidly	The module has been configured. The gateway has not sent any output data. The master is not yet in data_exchange after configuration.
channel (1-4)	Yellow	
	Red	Channel error (wire-break, short-circuit etc.)

AIH40Ex/AIH41Ex - Analogue input modules, 4-channels

Figure 80: Analogue input modules

The analogue input modules of the *excom*® system are intrinsically safe modules for connection of up to four transmitters.

The input module AIH40Ex is designed for connection of 2-wire transducers (active input = source mode / passive transducer).

The input module AIH41Ex is designed for connection of 4-wire transducers (passive input = non-source mode / active transducer). The module is provided with protection type EEx ib IIC and can thus be used in combination with *excom*® in zone 1. The explosion protection type of the inputs is EEX ia IIC.

Note

The inputs are not galvanically isolated from each other. When connecting the field devices, it must be taken into account that all inputs are on a common potential.

The resolution is 14 bits, i.e. the analogue value of 0...25 mA is digitised as a number between 0 and 16383. To simplify representation the digitised value is transformed into 1mA/digit and transferred to the host system.

HART® compatibility of the modules

The module is suitable for connection of HART® compatible sensors which communicate directly with the integrated HART® controller. Up to 8 HART® variables (max. 4 per channel) can be read via the cyclic user data transfer of the PROFIBUS. Bi-directional variable exchange between the host system and the HART® transmitter is accomplished by PROFIBUS-DPV1 services.

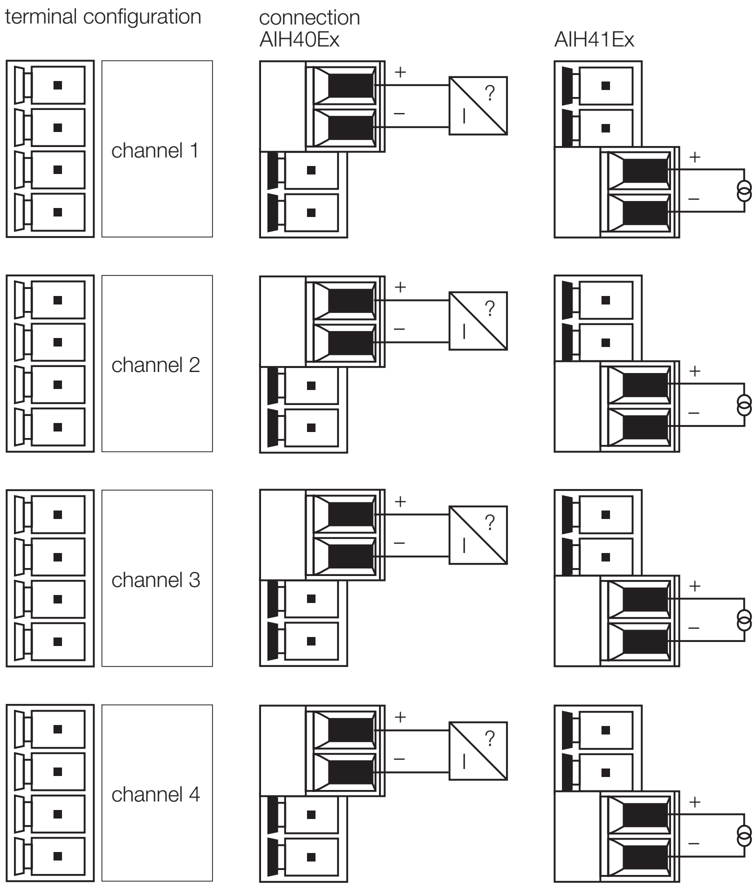
Channel-wise parameterisation

Parameters, such as wire-break/short-circuit monitoring, measuring range, HART® communication etc. can be set separately for each channel; parameterisation is initiated exclusively by the PROFIBUS master.

8

Wiring diagrams

Figure 81: Terminal assignment AI40Ex/ AI41Ex



Technical data

Table 109: Technical data of the analogue input modules

Type	**AIH40Ex active**	**AIH41Ex passive**
Operating voltage	Via central power supply unit via module rack	
Internal power consumption	< 3.5 W	
Inputs	4 analogue sensors	
Input voltage	> 15.0 V DC at 22 mA (at the transmitter)	
Input current	0/4...20 mA per input	
HART® impedance	> 240 W	
Overrange	> 22 mA	
Short-circuit	< 5 V (in “live zero” mode only)	
Underrange	2...3.6 mA	
Wire-break	< 2 mA (in “live zero” mode only)	
Resolution	14 bits	
Linearity tolerance	< 0.1 % (of final value)	
Temperature drift	< 50 ppm/K	
Rise/release time	< 50 ms (10...90 %)	
I.S. Approval	PTB 00 ATEX 2059 X	
Marking	II 2 (1) G EEx [ia] ib IIC T4	
Max. values (field circuits)	EEx ia IIC/IIB	
No-load voltage U_0	≤ 22.1 V	≤ 7.2 V

Table 109: Technical data of the analogue input modules

Type	AIH40Ex active	AIH41Ex passive
Short-circuit current I_0	≤ 93 mA	≤ 16 mA
Max. power P_0	≤ 640 mW	≤ 29 mW
Typical curve	Trapezoidal	Linear
U_Q	27.54 V	-
R	298 W	-
Max. internal inductance L_I	≤ 0.22 mH	≤ 0.11 mH
Max. internal capacitance C_I	≤ 1.1 nF	≤ 1.1 nF

Table 109: Technical data of the analogue input modules

Type	AIH40Ex active	AIH41Ex passive
Max. external inductance L_0	"max. L_0 and max. C_0 for AIH40Ex" page 8-39	"Transmitter with linear output curve" page 8-39 "Transmitter with trapezoidal output curve" page 8-40 "Transmitter with rectangular or trapezoidal output curve" page 8-40
Max. external capacitance C_0	"max. L_0 and max. C_0 for AIH40Ex" page 8-39	"Transmitter with linear output curve" page 8-39 "Transmitter with trapezoidal output curve" page 8-40 "Transmitter with rectangular or trapezoidal output curve" page 8-40
General data		
Galvanic isolation	to bus and to supply	
Protection degree	IP20	
Operating temperature	-20...+70 °C	
Relative humidity	95 % at 55 °C according to EN60069-2	
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27	

Refer to the following tables for the max. external inductance L_0 and max. external capacitance C_0 values for the *excom*® modules AIH40Ex and AIH41Ex.

The following values apply to the module AIH40Ex which is suitable for passive transmitters:

Table 110: max. L_0 and max. C_0 for AIH40Ex

EEx ia + EEx ib	Max. external inductance L_0	Max. external capacitance C_0
IIC	1.78 mH	1.78 mH
IIB	100 nF	500 nF

The following values apply to the module AIH41Ex, which is suitable for connection of active intrinsically safe transmitters, depending on the output curve of the connected transmitter (linear, trapezoidal, rectangular):

- for active intrinsically safe transmitters with linear output curve at (I_i = 100 mA) (“Transmitter with linear output curve” page 8-39 Table 111:)
- for active intrinsically safe transmitters with trapezoidal output curve (“Transmitter with trapezoidal output curve” page 8-40)
- for active intrinsically safe transmitters with rectangular or trapezoidal output curve (“Transmitter with rectangular or trapezoidal output curve” page 8-40)

Table 111: Transmitter with linear output curve

Max. values	EEx ia + EEx ib IIC		EEx ia + EEx ib IIB	
U_i	L_0	C_0	L_0	C_0
2 V	2.4 mH	4.2** mF	9.8 mH	33 mF
5 V	2.4 mH	1.3 mF	9.8 mH	8.3 mF
10 V	2.4 mH	358 nF	9.8 mH	2.1 mF
15 V	2.4 mH	158 nF	9.8 mH	1.1 mF
16.5 V	2.4 mH	126 nF	9.8 mH	950 nF
20 V	2.4 mH	87 nF	9.8 mH	688 nF

Table 111: Transmitter with linear output curve

Max. values	EEx ia + EEx ib IIC		EEx ia + EEx ib IIB	
22 V	2.4 mH	71 nF	9.8 mH	594 nF
25 V	2.0 mH	54 nF	9.0 mH	465 nF
30 V	2.0 mH	37 nF	9.0 mH	345 nF

Table 112: Transmitter with trapezoidal output curve

Max. values		EEx ia + EEx ib IIC		EEx ia + EEx ib IIB	
U_i	I_i	L_0	C_0	L_0	C_0
22.1 V	93 mA	0.5 mH	60 nF	2 mH	25 nF

Table 113: Transmitter with rectangular or trapezoidal output curve

Max. values		EEx ia + EEx ib IIC		EEx ia + EEx ib IIB	
U_i	I_i	L_0	C_0	L_0	C_0
2 V	100 mA	1.99 mH	500 nF	4.89 mH	3 mF
5 V	100 mA	1.99 mH	300 nF	4.89 mH	1.5 mF
10 V	90 mA	1.99 mH	200 nF	4.89 mH	1 mF
15 V	56 mA	0.99 mH	100 nF	4.89 mH	500 nF
16.5 V	49 mA	0.99 mH	100 nF	4.89 mH	500 nF
20 V	35 mA	0.99 mH	70 nF	4.89 mH	300 nF
16.5 V	97 mA	-	-	1.99 mH	400 nF
20 V	80 mA	-	-	0.99 mH	300 nF
22 V	65 mA	-	-	0.99 mH	300 nF
25 V	50 mH	-	-	0.99 mH	250 nF

Module parameters

Note

Refer to the following for the **bit assignment** for mode 1:

"AIH40Ex" page Appendix-12
"AIH40Ex 4H (with 4 HART® variables)" page Appendix-13
"AIH41Ex" page Appendix-14
"AIH41Ex 4H (with 4 HART® variables)" page Appendix-15

Mode 2:

"AIH40Ex" page Appendix-30
"AIH40EX 4H" page Appendix-31
"AIH40Ex 1H" page Appendix-33
"AIH40Ex 8H" page Appendix-35
"AIH41Ex" page Appendix-37
"AIH41Ex 4H" page Appendix-38
"AIH41Ex 1H" page Appendix-40
"AIH41Ex 8H" page Appendix-42

Mode 1

In mode 1, the module has 1 parameter byte.

AIH40Ex

Table 114: AIH40Ex (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/ deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Filter (PT1)	Activation of a software filter

Table 114: AIH40Ex (mode 1)

Parameter name	Meaning
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break and measuring range underrange monitoring are not active. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break and measuring range underrange monitoring are active. Gateway sends “Min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break and measuring range underrange monitoring are active. Gateway sends “Min. value” 3.6 mA as substitute value to host.

AIH40Ex 4H

In this configuration, the module adds 4 HART® variables to the cyclic data transfer.

Table 115: AIH40Ex 4H (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/ deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Filter (PT1)	Activation of a software filter
HART® status / variables	The “auto” HART® status means, that only those channels, which are actually required to send variables, will provide HART® status data. An “ON” HART® status means that all four channels will provide HART® status data.

AIH41Ex

Table 116: AIH41Ex (mode 1)

Parameter name	Meaning
Line monitoring	Line monitoring is activated or deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Filter (PT1)	Activation of a software filter
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break and measuring range underrange monitoring are not active. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host.

AIH41Ex 4H

Table 117: AIH41Ex 4H (mode 1)

Parameter name	Meaning
Line monitoring	Line monitoring is activated or deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Filter (PT1)	Activation of a software filter
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break and measuring range underrange monitoring are not active. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host.

Mode 2

In mode 2, the module has 5 parameter byte.

AIH40Ex

Table 118: AIH40Ex (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.
Filter (PT1)	Activation of a software filter
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break and measuring range underrange monitoring are not active. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host.

AIH40EX 4H

In this configuration, the module adds 4 HART® variables to the cyclic data transfer.

Table 119: AIH40Ex 4H (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.
SVn (channel m)	Activation/deactivation of the secondary variable n of channel m
Filter (PT1)	Activation of a software filter

AIH40Ex 1H

In this configuration, the module adds 1 HART® variable to the cyclic data transfer.

Table 120: AIH40Ex 1H (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break and measuring range underrange monitoring are not active. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host.
Filter (PT1)	Activation of a software filter
HART® variable	Selection of HART® variables

Table 120: AIH40Ex 1H (mode 2)

Parameter name	Meaning
HART® variable of channel	Selection of the channel number corresponding to the HART® variable

AIH40Ex 8H

In this configuration, the module adds 8 HART® variables to the cyclic data transfer.

Table 121: AIH40Ex 8H (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.
SVn (channel m)	Activation/deactivation of the secondary variable n of channel m
Filter (PT1)	Activation of a software filter

AIH41Ex

Table 122: AIH41Ex (mode 2)

Parameter name	Parameter value
Line monitoring	Line monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.

Table 122: AIH41Ex (mode 2)

Parameter name	Parameter value
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break and measuring range underrange monitoring are not active. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host.
Filter (PT1)	Activation of a software filter

AIH41Ex 4H

In this configuration, the module adds 4 HART® variables to the cyclic data transfer

Table 123: AIH41Ex 4H (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.
SVn (channel m)	Activation/deactivation of the secondary variable n of channel m
Filter (PT1)	Activation of a software filter

AIH41Ex 1H

In this configuration, the module adds 1 HART® variable to the cyclic data transfer.

Table 124: AIH41Ex 1H (mode 2)

Parameter name	Meaning
Line monitoring	Line monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break and measuring range underrange monitoring are not active. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break and measuring range underrange monitoring are active. Gateway sends “min. value” 3.6 mA as substitute value to host.
Filter (PT1)	Activation of a software filter
HART® variable	Selection of HART® variables
HART® variable of channel	Selection of the channel number corresponding to the HART® variable

AIH41Ex 8H

In this configuration, the module adds 8 HART® variables to the cyclic data transfer.

Table 125: AIH41Ex 8H (mode 2)

Parameter name	Parameter value
Line monitoring	Line monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set separately for each channel.
SVn (channel m)	Activation/deactivation of the secondary variable n of channel m
Filter (PT1)	Activation of a software filter

Data throughput

Depending on the configuration, there are different data throughputs. Following configurations are possible:

Table 126: Number of input words

Input words	Configuration
4	AIH40Ex without cyclic HART® data
6	AIH40Ex with 1 cyclic HART® variable
12	AIH40Ex with 4 cyclic HART® variables
20	AIH40Ex with 8 cyclic HART® variables

Input data mapping

The module input data and the HART® variables are mapped as follows. This example is based on a module with 8 cyclic HART® variables:

Table 127: Input data mapping

Word no. (1 Word = 2 Bytes)	Data byte no.	Contents
0	0	MSB of input channel 1
	1	LSB of input channel 1
1	2	MSB of input channel 2
	3	LSB of input channel 2
2	4	MSB of input channel 3
	5	LSB of input channel 3
3	6	MSB of input channel 4
	7	LSB of input channel 4
4 / 5		HART® variable 1[A)]
6 / 7		HART® variable 2[A)]
8 / 9		HART® variable 3[A)]
10 / 11		HART® variable 4[A)]
12 / 13		HART® variable 5[A)]
14 / 15		HART® variable 6[A)]
16 / 17		HART® variable 7[A)]
18 / 19		HART® variable 8[A)]

A *The HART® variables are presented in the REAL data format.*

Note

All secondary variables that were activated with the parameterisation are assigned a location in the mapped input data. This also applies if the corresponding channels are not connected to a HART®-compatible device.

Measured value representation

Table 128: Measuring value representation

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
Status bit	0 - 21000 corresponds to 0 - 21 mA														

Error indication via the status bit of the data message

Note

In the event of an error the module provides an error indication via the status bit of the data message, depending on the set measuring range (0 to 20 mA, 4 to 20 mA).

The status bit is set if there is a measuring range violation or a line error. Thus the measuring value can be evaluated for errors consistently.

Measuring ranges

Table 129: Measuring range table - analogue input

Measuring value	Transferred value	
	Decimal	Hexadecimal
21 mA	21000	5208
:	:	:
20 mA	20000	4E20
:	:	:
4 mA	4000	0FA0
:	:	:
0 mA	0	0

In addition to the status bit, the diagnostics message provides detailed and differentiated channel-specific diagnostics.

Table 130: Error codes AIH40Ex/ AIH41Ex

Measuring value	AIH40Ex		AIH41Ex	
	Error code	**Message text**	**Error code**	**Message text**
0mA < I < 2mA	6	Wire-break	16	Line errors
2mA < I < 3.6	8	Below lower limit	8	Below lower limit
3.6mA < I < 20 mA	Within range			
20 mA < I < 25 mA	7	Upper limit exceeded	7	Upper limit exceeded
I > 25mA	1	Short-circuit	7	Upper limit exceeded

Table 131: Substitute values for AIH40Ex/ AIH41Ex

Measuring range	Substitute values
0 to 20 mA	Min: 0 mA Max: 22 mA
4 to 20 mA	Min: 3.6 mA Max: 22 mA

Floating point format of the HART® variables

The HART® variables are presented as follows:

Table 132: Floating point format

Byte	Meaning							
n	Sign	Exponent						
	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1
n + 1	Exponent	Mantissa						
	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}
n + 2	Mantissa							
	2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}
n + 3	Mantissa							
	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

Alongside the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the AIH4...devices support the following channel status indications (channel-specific diagnostics):

Table 133: Error codes

Error code	No.	Meaning
Standard	1	Short-circuit
	6	Wire-break
	7	Upper limit exceeded
	8	Below lower limit
	16	ROM error
Specific	19	Module type (desired configuration) not known

Table 133: Error codes

Error code	No.	Meaning
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)
	30	HART® status error
	31	HART® error

Function of the LEDs

Table 134: LED functions

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
channel (1-4)	Yellow	-
	Red	Channel error (wire-break, short-circuit, over-range, underrange etc.)

AOH40Ex - Analogue output module, 4-channel

Figure 82: Analogue output module AOH40Ex

The output module AOH40Ex is designed for connection of intrinsically safe actuators such as control valves or process indicators.

The module is provided with protection type EEx ib IIC and can thus be used in combination with *excom*® in zone 1. The explosion protection type of the outputs is EEX ia IIC.

Note

The channels are not galvanically isolated from each other. All outputs are on a common earth potential.

HART® compatibility

The module is suitable for connection of HART® compatible actuators. These communicate directly with the integrated HART® controller.

Measured value representation

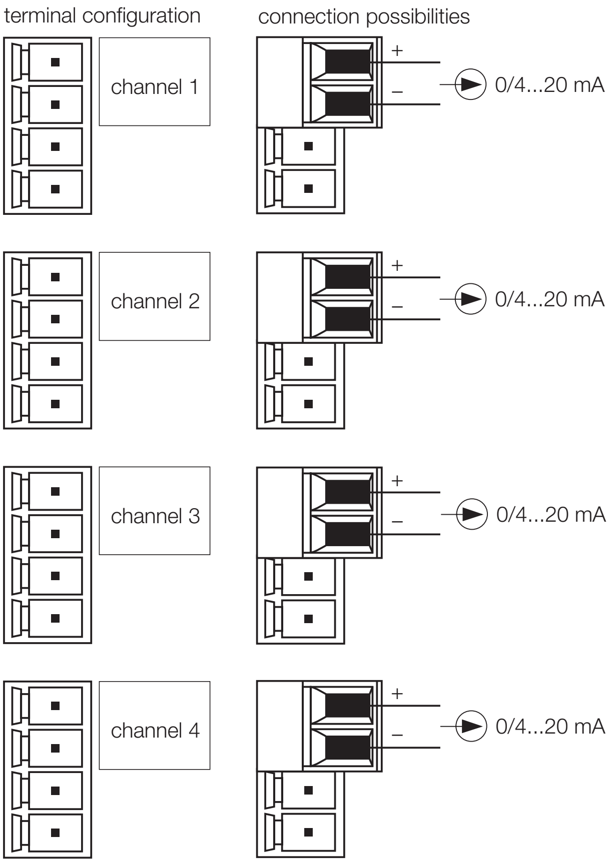
The resolution is 12 bits, i.e. the analogue value of 0...25 mA is reproduced as a number between 0 and 4095. In order to simplify value representation, the host system operates with the value range of 0...25000.

Channel-wise parameterisation

Parameters, such as line monitoring, substitute value strategy etc. can be set separately for each channel; parameterisation is initiated exclusively by the PROFIBUS master.

Wiring diagrams

Figure 83: Terminal assignment AOH40Ex



Technical data

Table 135: Technical data AO40Ex

Type	**AOH40Ex**
Operating voltage	Via central power supply unit via module rack
Internal power consumption	< 3.5 W
Outputs	4 analogue actuators
No-load voltage	< 16 V DC
Output current	0/4...20 mA per output
External load	< 600 W
HART® impedance	> 240 W
Short-circuit	< 50 W (in “live zero” mode only)
Wire-break	< 15 V (in “live zero” mode only)
Resolution	12 bits
Linearity tolerance	< 0.1 % (of final value)
Temperature drift	< 50 ppm/K
Rise/release time	< 50 ms (10...90 %)
I.S. Approval	PTB 00 ATEX 2051
Marking	II 2 (1) G EEx ib [ia] IIC T4
Max. values (field circuits)	EEx ia IIC/IIB
No-load voltage U_0	≤ 22.1 V
Short-circuit current I_0	≤ 93 mA
Max. power P_0	≤ 640 mW
Typical curve	Trapezoidal

Max. internal inductances L_I	$\leq$ 0.22 mH
Max. internal capacitances C_I	$\leq$ 1.1 nF
Max. external inductances L_0	"max. L_0 and max. C_0 for AOH40Ex" page 8-64
Max. external capacitances C_0	"max. L_0 and max. C_0 for AOH40Ex" page 8-64
General data	
Galvanic isolation	to bus and to supply
Protection degree	IP20
Operating temperature	-20...+70 °C
Relative humidity	95 % at 55 °C according to EN60068-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Refer to the following table for the max. external inductance and capacitance values for the module AO40Ex:

Table 136: max. L_0 and max. C_0 for AOH40Ex

EEx ia + EEx ib	Max. external inductance L_0	Max. external capacitance C_0
IIC	1.78 mH	1.78 mH
IIB	100 nF	500 nF

Module parameters

Note

Refer to the following for the **bit assignment** for mode 1:
"AOH40Ex" page Appendix-16
"AOH40Ex 4H (with 4 HART® variables)" page Appendix-17
Mode 2:
"AOH40Ex" page Appendix-44
"AOH40Ex 4H" page Appendix-45
"AOH40Ex 1H" page Appendix-47
"AOH40Ex 8H" page Appendix-48

Mode 1

AOH40

In mode 1, the module has 1 parameter byte.

Table 137: AOH40Ex (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/ deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.

Table 137: AOH40Ex (mode 1)

Parameter name	Meaning
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break monitoring is inactive. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break monitoring is active. Gateway sends “min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break monitoring is inactive. Gateway sends “min. value” 3.6 mA as substitute value to host.

AOH40 4H

In this configuration, the module adds 4 HART® variables to the cyclic data transfer

Table 138: AOH40Ex (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/ deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Filter (PT1)	Activation of the filter.

Table 138: AOH40Ex (mode 1)

Parameter name	Meaning
HART® status / variables	The “auto” HART® status means, that only those channels, which are actually required to send variables, will provide HART® status data. An “ON” HART® status means that all four channels will provide HART® status data.

Mode 2

AOH40Ex

In mode 2, the module has 4 parameter bytes (1 byte per channel).

These 4 parameter bytes are transferred during the initialisation on startup.

Note

The parameters in mode 2 for the module AOH40Ex are the same as those of mode 1.

However, parameterisation in mode 2 always applies to a single channel and not to the entire module.

AOH40Ex 4H

In this configuration the module also provides 4 HART® variables for cyclic data transfer and the standard 8 bytes for channels 1 to 4.

Table 139: AOH40Ex 4H (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
SVn (channel m)	Activation/deactivation of the secondary variable n of channel m
Filter (PT1)	Setting the filter.

AOH40Ex 1H

In this configuration, the module adds 1 HART® variable to the cyclic data transfer.

Table 140: AOH40Ex 1H (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
HART® status / measuring range	– OFF / 0-20 mA: Dead zero without HART® status request. Wire-break monitoring is inactive. Gateway sends “Min. value” 0 as substitute value to host. – OFF / 4-20 mA: Live zero without HART® status request. Wire-break monitoring is active. Gateway sends “min. value” 3.6 mA as substitute value to host. – ON/4-20 mA: Live zero with HART® status request (HART® diagnostics active). Wire-break monitoring is inactive. Gateway sends “min. value” 3.6 mA as substitute value to host.
Filter (PT1)	Activation of a software filter
HART® variable	Selection of HART® variables
HART® variable of channel	Selection of the channel number corresponding to the HART® variable

AOH40Ex 8H

In this configuration, the module adds 8 HART® variables to the cyclic data transfer.

Table 141: AOH40Ex 8H (mode 2)

Parameter name	Parameter value
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
SVn (channel m)	Activation/deactivation of the secondary variable n of channel m
Filter (PT1)	Setting the filter

Measured value representation

Table 142: Measuring value representation

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
0 -25000 corresponds to 0 - 25 mA															

Table 143: Substitute values for AOH40Ex

Measuring range	Substitute values
0 to 20 mA	Min: 0 mA Max: 22 mA
4 to 20 mA	Min: 3.6 mA Max: 22 mA

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

Alongside the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the module AOH40Ex supports the following channel status indications (channel-specific diagnostics):

Table 144: Error codes

Error code	No.	Meaning
Standard	1	Short-circuit
	6	Wire-break
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)
	30	HART® status error
	31	HART® error

Function of the LEDs

Table 145: LED functions

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
	Flashing green rapidly	The module has been configured. The gateway has not sent any output data. The master is not yet in data_exchange after configuration.
channel (1-4)	Yellow	-
	Red	Channel error (wire-break, short-circuit etc.)

TI40Ex - Temperature module, 4-channel

Figure 84: TI40Ex

The temperature module TI40Ex is designed for connection of 2, 3 and 4-wire temperature detectors, type Pt100, Pt200, Pt400, Pt1000, Ni100 and Cu100 as well as thermoelements, types B, E, D, J, K, L, N, R, S, T and U.

It can also be used for low voltage (-75...+75 mV, -1.2...+1.2 V) and for resistance measurements (0...30 W, 0...300 W, 0...3 kW).

The module is provided with protection type EEx ib IIC and can thus be used in combination with *excom*® in zone 1. The explosion protection type

of the inputs is EEX ia IIC.

Note

The channels are galvanically isolated from each other.

Line compensation / cold junction compensation

When connecting 2-wire temperature resistors, line compensation is accomplished by means of fixed resistance values during parameterisation.

When using thermoelements, the external cold junction compensation is accomplished separately for each channel by connecting a Pt100 resistor to the two unused terminals. However, if internal cold junction compensation is selected, it is effective for all channels via an integrated Pt100 resistor.

Measured value representation

The resolution is 16 bits, i.e. the analogue value is presented as a number between 0 and 65536.

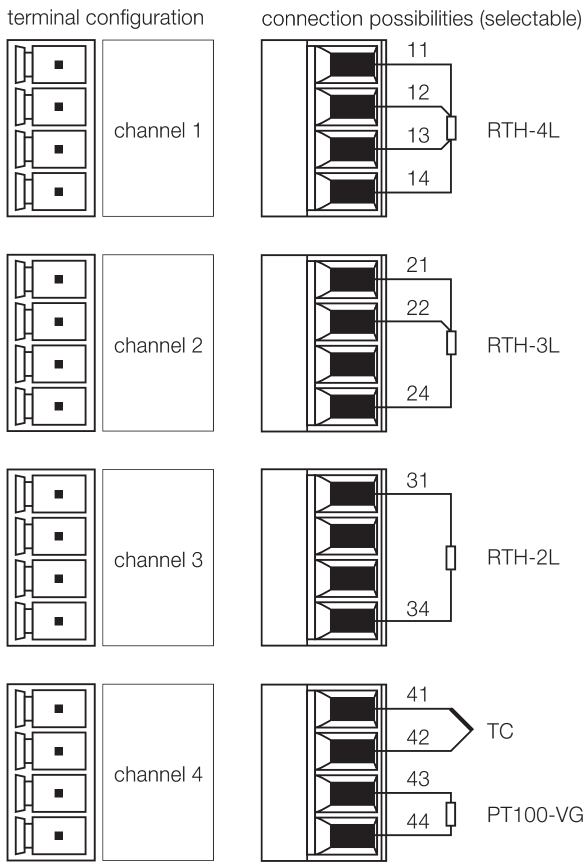
The temperature is reproduced as a value in 1/10 Kelvin. An offset of 273.2 must be allowed for conversion into °C.

Channel-wise parameterisation

Parameters, such as line monitoring, substitute value strategy and damping etc. can be set separately for each channel; parameterisation is initiated exclusively by the PROFIBUS master.

Wiring diagrams

Figure 85: Terminal assignment TI40Ex



Technical data

TI40Ex

Table 146: Technical data TI40Ex

Type	**TI40Ex**
Operating voltage	Via central power supply unit via module rack
Internal power consumption	< 3 W
Inputs	4 x 2, 3 or 4-wire resistance temperature detectors
Input (resistance temperature detector)	Pt100, Pt200, Pt400, Pt1000, Ni100, Cu100
Line resistance	
– 4-wire	< 50 W
– 3-wire	< 10 W
– 2-wire	< 5 W
Resolution	16 bits
Short-circuit	< 5 W
Wire-break	> 500 W
Input (thermoelement)	Types B, E, J, K, L, N, R, S, T and U
Wire-break	< 100nA / > 150 mV
Resolution	16 bits
Linearity tolerance	< 0.05 % (of final value)
Temperature drift	< 50 ppm/K
Rise/release time	< 200 ms (10...90 %)
I.S. Approval	PTB 00 ATEX 2181

8

Marking	II 2 (1) G EEx ib [ia] IIC T4	
Max. values (field circuits)	EEx ia IIC/IIB	
	Connection to passive field device (e.g. measuring resistors)	Connection to active field device (e.g. thermoelements)
No-load voltage U_0	≤ 5.5 V	≤ 1.2 V
Short-circuit current I_0	≤ 25 mA	≤ 50 mA
Max. power P_0	≤ 35 mW	≤ 60 mW
Typical curve	Linear	
Max. internal inductances L_I	Negligible	
Max. internal capacitances C_I	60 nF	Negligible
Max. external inductances L_0 / Max. external capacitances C_0	"max. L_0 and max. C_0 when connecting passive field devices" page 8-78	"max. L_0 and max. C_0 when connecting active field devices" page 8-78
General data		
Galvanic isolation	complete	
Protection degree	IP20	
Operating temperature	-20...+70 °C	
Relative humidity	95 % at 55 °C according to EN60069-2	
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27	

The max. external inductances or capacitances can be taken from the following tables.

Table 147: max. L_0 and max. C_0 when connecting passive field devices

Max. external inductance L_0 (mH)	**Max. external capacitance C_0 (mF)**	
	IIC	IIB
2	2.6	15
1	2.9	17
0.5	3.6	21
0.2	4.5	27

Table 148: max. L_0 and max. C_0 when connecting active field devices

Max. external inductance L_0 (mH)	**Max. external capacitance C_0 (mF)**	
	IIC	IIB
2	1.6	9.8
1	1.9	12
0.5	2.3	14
0.2	3.0	19

Module parameters

Note

Refer to the following for the bit assignment for mode 1:
"TI40Ex R" page Appendix-18
Mode 2:
"TI40Ex R" page Appendix-50

Mode 1

TI40Ex R (connection of resistance temperature detectors)

Table 149: TI40Ex R (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated/deactivated for all 4 channels of the module.
Wire break monitoring	Wire-break monitoring is activated/deactivated for all 4 channels of the module.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Filter (PT1)	Activation of the filter
Sensor type	Setting the sensor type

Note

In case of 2-wire technology, the line resistance falsifies the result of linearisation

TI40Ex T

In mode 1, the parameters of the module TI40Ex **T** are the same as those of the module TI40Ex **R**.

The module, however, does use the “short-circuit monitoring” parameter.

Note

The parameter “Sensor type” of the TI40Ex **T** is used to set the type of thermoelement.

Mode 2

TI40Ex R

Table 150: TI40Ex R (mode 2)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated separately for each channel.
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Line resistance	Setting the line resistance. With 2-wire technology, the line resistance + basis are subtracted prior to linearisation.
Connection	Connection technology (2-wire, 3-wire etc.)
Filter (PT1)	Activation of the filter
Sensor type	Setting the sensor type

TI40Ex T

Table 151: TI40Ex T (mode 2)

Parameter name	Meaning
Wire break monitoring	Wire-break monitoring is activated and deactivated separately for each channel.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Reference temperature	Setting of the reference temperature for the external thermostat.
Reference point	– None: Cold junction compensation is not carried out – Internal: Cold junction compensation is carried out by Pt100 on the module – Pt100 at terminal: Cold junction compensation is carried out by Pt100 at terminal on the module rack – External (thermostat): Cold junction compensation is carried out by thermostat onsite
Filter (PT1)	Activation of the filter
Sensor type	Setting the type of thermoelement

Measured value representation

Table 152: Measuring value representation

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
Status bit	Numerical value 0 to 30000														

The numerical value: 0 - 30000 corresponds to 0 to 3000 K (Kelvin)

The following general formula must be used for converting to degrees Celsius (°C):

0 °C = - 273.15K

The temperature can be calculated from the numerical value into degrees Celsius (°C) using the following formula:

$$\text{temperature in } ^\circ\text{C} = \frac{\text{numerical value} - 2732}{10}\,^\circ\text{C}$$

Error indication via the status bit of the data message

Note

In the event of an error, the module provides an error indication via the status bit of the data message.

The status bit is set if there is a measuring range violation or a line error.
Thus the error can be evaluated consistently with regard to the measuring value.

Measuring ranges

Table 153: Scaling the analogue values

Measuring range	Value representation	Resolution	Not valid in case of measuring range violation		Substitute value in case of invalid measuring value	
			Over-range	Under-range	Min.	Max.
-75 ... +75 mV	0 ... 30000	5 mV	-75 mV	+75 mV	0	32767
-1200 ... +1200 mV	3000... 27000	100 mF	-1200 mV	+1200 mV	0	32767
0... 3000 K	0... 30000	0.1 K	Sensor-specific		0	32767
0... 30 W	0... 30000	1 W	0 W	30 W	0	32767
0... 300 W	0... 30000	10 W	0 W	300 W	0	32767
0... 3000 W	0... 30000	100 W	0 W	3000 W	0	32767

Table 154: Measuring range of the temperature sensors

Sensor	Underrange		Overrange	
	In K	In °C	In K	In °C
Pt100	73	- 200	1123	850
Pt200	73	- 200	1123	850
Pt400	73	- 200	1123	850
Pt1000	73	- 200	1123	850
Ni100	213	- 60	523	250
Cu100	213	- 60	1123	850
Type B	273	0	2093	1820
Type C	273	0	2588	2315
Type D	273	0	2588	2315
Type E	3	- 270	1273	1000
Type J	63	210	1473	1200
Type K	3	- 270	1645	1372
Type L	73	- 200	1173	900
Type N	3	- 270	1573	1300
Type R	223	- 50	2041	1768
Type S	223	- 50	2041	1768
Type T	3	- 270	673	400
Type U	73	- 200	873	800

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

Alongside the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the TI40Ex devices support the following channel status indications (channel-specific diagnostics):

Table 155: Error codes

Error code	No.	Meaning
Standard	1	Short-circuit
	6	Wire-break
	7	Upper limit exceeded
	8	Below lower limit
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Function of the LEDs

Table 156: LED functions

LED	Behaviour	Function
Status	Red flashing	Module is not configured for this slot.
	Green flashing	The module has not yet been configured by the gateway
channel (1-4)	Yellow	-
	Red	Channel error (wire-break, short-circuit, over-range, underrange etc.)

9 Function modules

DF20Ex - Digital frequency/counter module

Frequency or counter module

Figure 86: DF20Ex

The input module DF20Ex is equipped with 8 channels, which are combined in two function blocks.
The inputs are suitable for the connection of NAMUR sensors or mechanical contacts.
The output provides 4 mA at 8 VDC.
There is one frequency input and three control inputs/outputs per block.

The function blocks are referred to as “A” and “B”; the related signal lines are referred to as “A1”, “A2”, “A3” and “A4” as well as “B1”, “B2”, “B3” and “B4”.

The module is provided with protection type EEx ib IIC and can thus be used in combination with *excom*® in zone 1. The explosion protection type of the inputs/outputs is EEx ia IIC.

Attention

When connecting the field devices, it must be taken into account that all inputs/outputs are on a common potential.

Counting and frequency function

The module can be operated in the modes “Counter” and “Frequency input”: It is thus either suitable for pulse counting or frequency measurement of binary pulse sequences.

The counting direction (up/down) can be set either externally via a control input or internally via control bit programming. The control inputs are suitable for direction discrimination as reset or enable input.

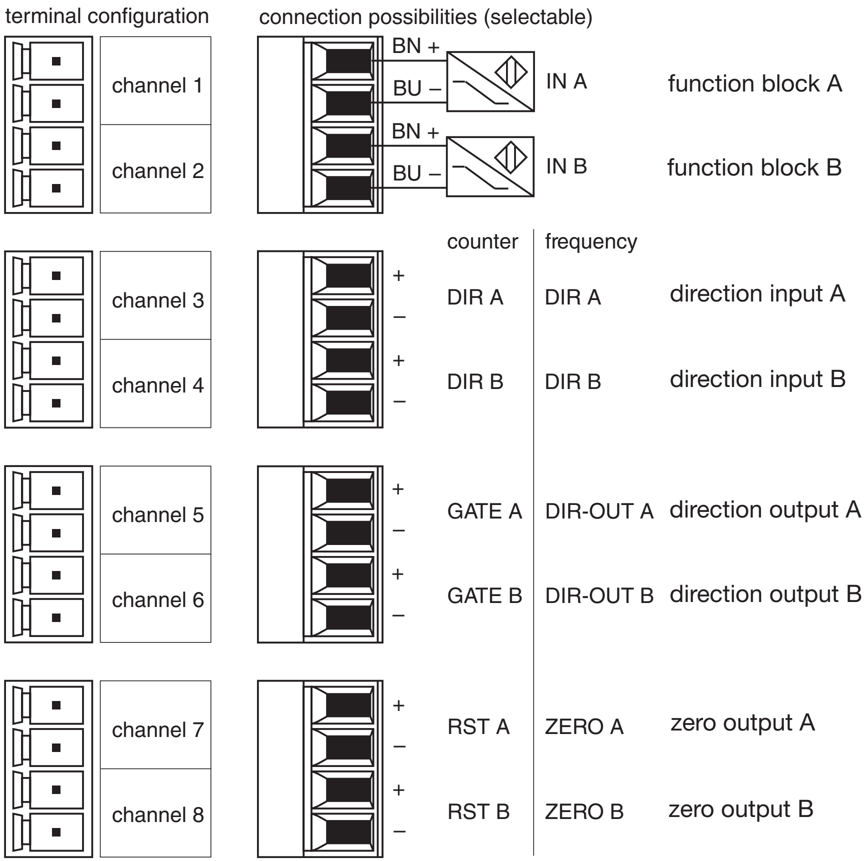
The max. measuring frequency of the DF20Ex is 4 kHz, even when both function blocks are used simultaneously.
If automatic direction detection is parameterised for one of the function blocks, $f < 1.25$ kHz applies to both function blocks.

Parameterisation

The input/output behaviour is parameterised via the PROFIBUS-DP master. Each channel is equipped with an adjustable wire-break and short-circuit monitoring function.

Wiring diagrams

Figure: 87
Terminal assignment DF20Ex



Technical data

Table 157: Technical data DF20Ex

Type	**DF20Ex**
Operating voltage	Via central power supply unit via module rack
Internal power consumption	< 1.5 W
Inputs/outputs	8 channels according to NAMUR (DIN EN 60 947-5-6)
No-load voltage	8 V DC
Short-circuit current	Approx. 4 mA per input
Switching threshold OFF/ ON	1.8 mA / 1.4 mA
Internal channel resistance	320 W
Min. switching frequency	> 0.1 Hz
Max. switching frequency	> 4 kHz/2 kHz
Switching frequency	< 100 Hz
Pulse length (maximum)	5 ms
Short-circuit	R_a < 367 W
Wire-break	< 0.2 mA
I.S. Approval	PTB 00 ATEX 2178
Marking	II 2 (1) G EEx ib [ia] IIC T4
Max. values (field circuits)	EEx ia IIC/IIB
No-load voltage U_0	≤ 9.6 V
Short-circuit current I_0	≤ 44 mA

Max. power P_0	$\leq$ 106 mW
Typical curve	Linear
Max. internal inductance L_I	Negligible
Max. internal capacitance C_I	Negligible
Max. external inductance L_0	("max. L_0 and max. C_0 for DF20Ex" page 9-6)
Max. external capacitance C_0	("max. L_0 and max. C_0 for DF20Ex" page 9-6)
General data	
Galvanic isolation	to bus and to supply
Protection degree	IP20
Operating temperature	-20...+60 °C
Relative humidity	95 % at 55 °C according to EN60068-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Refer to the following table for the max. external inductance L_0 and max. external capacitance C_0 values for the *excom*® module DF20Ex.

Table 158: max. L_0 and max. C_0 for DF20Ex

Max. external inductance L_0 (mH)	**Max. external capacitance C_0 (mF)**	
	IIC	IIB
2	0.9	5.1
1	1.1	6.1
0.5	1.3	7.3
0.2	1.7	8.6

Frequency module

DF20Ex F

In this configuration, the module provides a double word with measuring value and status per function block.

Note

The max. measuring frequency of the DF20Ex is 4 kHz, even when both function blocks are used simultaneously. If automatic direction detection is parameterised for one of the function blocks, f < 1.25 kHz applies to both function blocks.

Measuring input

The non-linearised value is a LONG INTEGER value, the resolution per digit is 0.1 mHz.
For conversion into Hz, the status bits have to be masked and the non-linearised value converted to REAL must be divided by 10000. This results in a fixed support digit with four decimal places.

The following table shows the non-linearised values for the function block A.

Table 159: Non-linearised values block A

Byte	Bit	7	6	5	4	3	2	1	0
1	Significance	2^{31}	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}
	Meaning	S	0	VZ	Measuring value				
2	Significance	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}
	Meaning	Measuring value							
3	Significance	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}
	Meaning	Measuring value							
4	Significance	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
	Meaning	Measuring value							

- **S = measuring value status**
  0 = valid measuring value
  1 = invalid measuring value
- **VZ = sign**
  0 = positive measuring value
  1 = negative measuring value

Note
This also applies to function block B. In this case, bytes 5 to 8 are assigned.

Input for rotation direction discrimination

In addition to the measuring input, there is an input available for detection of the rotary direction.

Depending on the parameters set via the host system, rotation direction detection is either static or dynamic. In the dynamic detection mode, the maximum measuring frequency is 1.25 kHz.

Static evaluation

If static detection of the input signal is selected, logic 0 stands for forward motion and logic 1 stands for reverse motion.

Dynamic evaluation

If dynamic detection is selected, the rotation direction is detected by means of the phase relation between the measuring input and the input for rotation direction detection.

The following drawing shows the principle:

Figure 88: Dynamic detection of rotation direction; IN leading

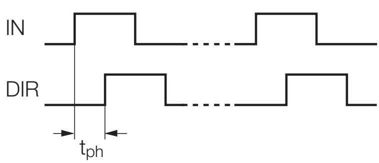
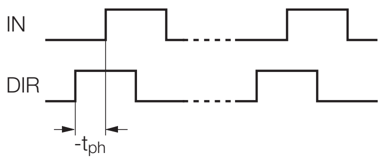


Figure 89: Dynamic detection of rotation direction; IN trailing



Further, it is possible to preset the direction detection via the host system. In that case, the DIR input is inactive. The control byte of the DF20EX P is structured as follows:

Table 160: Output byte 0 of the DF20Ex F for function block A

Bit	7	6	5	4	3	2	1	0
Meaning	-	-	-	-	Up/ down	-	-	-

Output byte 1 is analogue and controls function block B.

- up/down = 0 positive frequency
- up/down = 1 negative frequency

Contact configuration

The 16 contacts of each module on the rack are configured as follows:

Table 161: Contact assignment DF20Ex F

Contact no.		Assignment	
1	+	Frequency input Function block A	IN A
2	-		
3	+	Frequency input Function block B	IN B
4	-		
5	+	Direction detection input Function block A	DIR A
6	-		
7	+	Direction detection input Function block B	DIR B
8	-		
9	+	Direction output Function block A	DIR_OUT A
10	-		
11	+	Direction output Function block B	DIR_OUT B
12	-		
13	+	Zero output Function block A	ZERO A
14	-		
15	+	Zero output Function block B	ZERO B
16	-		

Note

Unused inputs/outputs of an unused function block must be terminated, or the wire-break/short-circuit monitoring function must be deactivated, otherwise the measured value shows the replacement value.

LED indications

Table 162: DF20Ex F - Meaning of the LEDs

LED	Meaning
1	IN A
2	DIR A
3	DIR_OUT A
4	ZERO (f< 0.1 Hz channel A)
5	IN B
6	DIR B
7	DIR_OUT B
8	ZERO (f< 0.1 Hz channel B)

Parameter

Mode 1

Since not all settings are covered by mode 1, the following parameters are pre-set:

- Substitute value programming for inputs and output identical
- Frequency range 0...4 kHz
- Non-inverting inputs and outputs
- Accuracy 0.1% (scanning interval 300 ms)

Table 163: DF20Ex F (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated commonly for all channels.
Wire break monitoring	Wire-break monitoring is activated and deactivated commonly for all channels.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.

Table 163: DF20Ex F (mode 1)

Parameter name	Meaning
Debouncing	Activation/deactivation of the additional damping function of the input signals.
Counting/rotation direction	Parameterisation of the direction discrimination function.
Average value	Number of sampling intervals for floating average forming

Mode 2

Just like with other *excom*® modules, channel-wise parameterisation (here: function block-related) is possible in mode 2.

Since for the DF20Ex there no physical channels but function blocks, the two available function blocks are referred to as “A” and “B” and the related signal lines are referred to as “A1”, “A2”, “A3” and “A4” as well as “B1”, “B2”, “B3” and “B4”.

Table 164: DF20Ex F (mode 2)

Parameter name	Meaning
Line monitoring	Wire-break or short-circuit monitoring is activated and deactivated separately for each channel.
Substitute value input	The input value of the according function block either adopts the value 0, 1 or the last valid value.
Direction detection	Parameterisation of the direction discrimination function.
Debouncing of the control inputs	Activation/deactivation of the additional damping function of the input signals.
Measuring cycle	Setting of the measuring cycle and the accuracy resulting therefrom.
Average value	Number of sampling intervals for floating average forming
Polarity	Activation or deactivation of signal inverting.

Counter module

DF20 Ex P

In this configuration, the module provides a double word with counter value and status per function block.

Counter input

The following table shows the non-linearised values for the function block A.

Table 165: Non-linearised values block A

Byte	Bit	7	6	5	4	3	2	1	0
0	Significance	2^{31}	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}
	Meaning	S	OV	VZ	Counter status				
1	Significance	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}
	Meaning	Counter status							
2	Significance	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}
	Meaning	Counter status							
3	Significance	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
	Meaning	Counter status							

S = measuring value status

- 0: Valid measuring value
- 1: Invalid measuring value

OV = Overflow

- 0: No overflow
- 1: Overrange

Sign

- 0: Positive measuring value
- 1: Negative measuring value

This also applies to function block B. In this case, bytes 4 to 7 are assigned.

Input for counting direction discrimination

In addition to the measuring input, there is an input for detection of the counting direction available.

Depending on the parameters set via the host system, the counting direction detection is either static or dynamic. In the dynamic detection mode, the maximum measuring frequency is 1.25 kHz.

Static evaluation

If static detection is selected, logic 0 stands for upward counting and logic 1 stands for downward counting.

Dynamic evaluation

If dynamic detection is selected, the counting direction is detected by means of the phase relation between the measuring input and the input for counting direction detection.

The following drawing shows the principle:

Figure 90: Dynamic detection of counting direction; IN leading

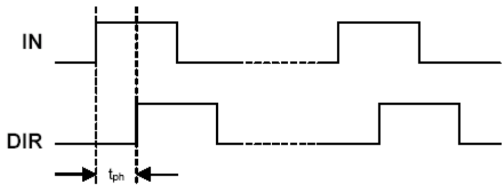
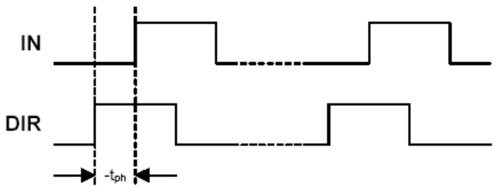


Figure 91: Dynamic detection of counting direction; IN trailing



Further, it is possible to preset the counting direction via the host system. In that case, the DIR input is inactive. The control byte of the DF20EX P is structured as follows:

Table 166: Output byte 0 of the DF20Ex P for function block A

Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Meaning	-	-	-	-	Up/ down	RST OV	MRS	RST

- **Up/down** = counting direction
  0= upwards
  1= downwards
- **RST OV** = Reset of the overrange bit OV
  0 = Overrange bit enabled
  1 = Overrange bit is reset
- **MRS** = In case of host control, the counter is enabled by this
  0 = Counter disabled
  1 = Counter enabled
- **RST** = Counter reset
  0 = Counter enabled
  1 = Counter reset and disabled

Output byte 1 is analogue and controls function block B.

Contact configuration

The 16 contacts of each module on the rack are configured as follows:

Table 167: Contact assignment DF20Ex P

Contact no.		Assignment	
1	+	Counter input Function block A	IN A
2	-		
3	+	Counter input Function block B	IN B
4	-		
5	+	Counting direction (I/O) Function block A	UP/DOWN
6	-		
7	+	Counting direction (I/O) Function block B	UP/DOWN
8	-		
9	+	Counting direction (I/O) Function block A	MRS A
10	-		

11 12	+ -	Counting direction (I/O) Function block B	MRS B
13 14	+ -	Reset (I/O) Function block A	RST A
15 16	+ -	Reset (I/O) Function block B	RST B

LED indications

Table 168: DF20Ex P - Meaning of the LEDs

LED	Meaning
1	IN A
2	UP/DOWN A
3	MRS A
4	RST A
5	IN B
6	UP/DOWN B
7	MRS B
8	RST B

Parameter

Mode 1

Since not all settings are covered by mode 1, the following parameters are pre-set:

- Substitute value programming for inputs and output identical
- Counting of rising edges
- Frequency range 0...4 kHz
- Host-controlled counter
- Non-inverting inputs and outputs

Table 169: DF20 Ex P (mode 1)

Parameter name	Meaning
Short-circuit monitoring	Short-circuit monitoring is activated and deactivated commonly for all channels.
Wire break monitoring	Wire-break monitoring is activated and deactivated commonly for all channels.
Substitute value strategy	Depending on the parameter setting, either the minimum, the maximum or the last valid value is set.
Debouncing	Activation/deactivation of the additional damping function of the input signals.
Counting/rotation direction	Parameterisation of the direction discrimination function.
Reset counter	The counter is either reset by the host or via the terminals.

Mode 2

Just like with other *excom*® modules, channelwise programming (here: function block-related) is possible in mode 2.

Since for the DF20Ex there no physical channels but function blocks, the two available function blocks are referred to as “A” and “B” and the related signal lines are referred to as “A1”, “A2”, “A3” and “A4” as well as “B1”, “B2”, “B3” and “B4”.

Table 170: DF20 Ex P (mode 2)

Parameter name	Meaning
Line monitoring	Wire-break or short-circuit monitoring is activated and deactivated separately for each channel.
Substitute value input	The input value of the according function block either adopts 0, 1 or the last valid value.
Counting direction detection	Parameterisation of the counting direction detection function.
Debouncing of the control inputs	Activation/deactivation of the additional damping function of the input signals.
Reset counter	The counter is either reset by the host or via the terminals.
Edge counting	Parameterisation of the edge counting function. Either only rising or rising and falling edges are counted.
Gate	Parameterisation of counter enabling function. Host controlled or via terminals
Polarity	Activation or deactivation of signal inverting.

Substitute values and validity of measuring values with the DF20Ex

Unlike other *excom*® modules, not all signals are transferred directly by the DF20Ex, but are pre-processed internally.

Consequently, not the substitute signal values but a derivation of the resulting function are provided as substitute values.

If substitute value programming is set to “Last valid value”, the substitute frequency value is set to zero if there is a wire-break or short-circuit at the frequency input, because this error can occur at any time during the measurement.

The following substitute values are formed depending on type of error and parameterisation.

Table 171: Substitute value forming

Error	Parameter Substitute value of input	Substitute value A)
Wire-break or short-circuit on A1...A4 or B1...B4	Min. value	16 # 80 00 00 00
	Max. value	7.26 kg 9F FF FF FF
	Last valid value	16 # 80 00 00 00
Module removed	Min. value	16 # 80 00 00 00
	Max. value	7.26 kg 9F FF FF FF
	Last valid value	16 # 8x xx xx xx

A *Applies to both rotary directions*

Substitute output values only refer to the output of the rotation direction if the parameter value “host-controlled (f < 4kHz)” is set. The output will then accept the set substitute value.

Channel-specific module diagnostics

Diagnostics data is structured according to EN 50170 part 2.

Alongside the module status (device-specific diagnostics) and the status overview (slot-specific diagnostics), the module DF20Ex F supports the following channel status indications (channel-specific diagnostics):

Table 172: Error codes

Error code	No.	Meaning
Standard	1	Short-circuit
	6	Wire-break
Specific	19	Module type (desired configuration) not known
	20	Module type (actual configuration) not known
	22	Parameter not plausible (inconsistent)

Note
The channel-specific diagnostics indications via the LEDs on the module front plate do not correspond to the contact assignment order at the connection level.

Please also refer to the following tables:

- "Contact assignment DF20Ex F" page 9-10Table 161:
- "DF20Ex F - Meaning of the LEDs" page 9-11
- "Contact assignment DF20Ex P" page 9-16Table 161:
- "DF20Ex P - Meaning of the LEDs" page 9-17

10 Configuration

Connection to the Siemens S7 PLC

The “SIMATIC Manager” software package version 5.1.3.0 from Siemens is used in the following configuration example for configuring the connection of an *excom*® gateway to an S7 type Siemens controller.

Reading in the GSD file

If the hardware catalog does not yet include any excom® GSD files or if the installed files have to be updated, the *excom*® specific GSD files (default = English) or GSG files (German) must be read into the software.

This can be carried out in two ways:

Prior to starting the software

- Copy the GSD files for the *excom*® station into the directory “Step7\S7data\GSD”.
- Copy the Icon files (*.bmp) into the registry “Step7\S7data\NSBMP”.
- Start the SIMATIC Manager software.

Once the files are correctly installed, the *excom*® modules will be registered automatically in the hardware overview which can be called up under the menu item ‹Insert Æ Hardware Catalog›.

After having started the software

If you have already started the software, please proceed as follows to import the above-mentioned files:

- Open a new or an existing project.
- Open the hardware configurator.
- Copy the required GSD files to the software via the menu item ‹Options Install New GSD File...›.

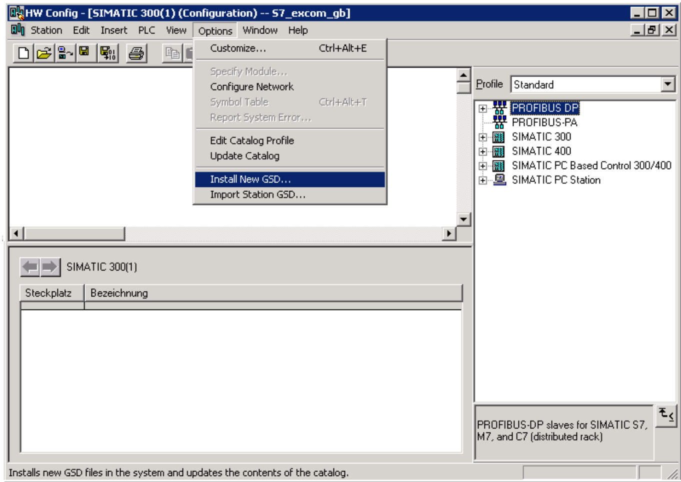
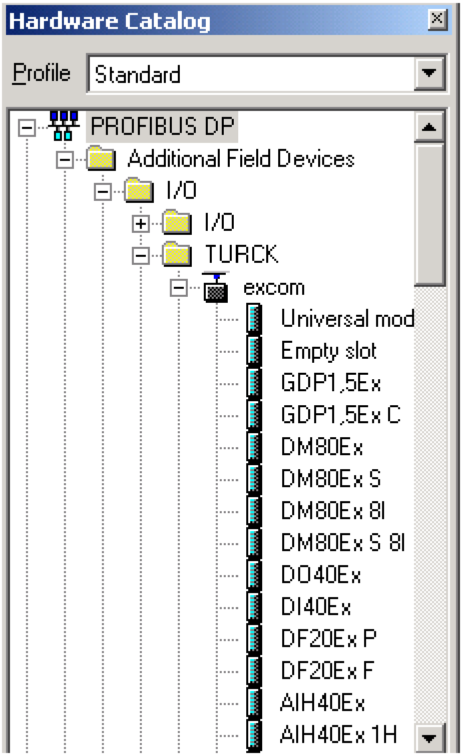


Figure 92: Inserting a GSD file

- Select the required GSD or GSG files from the appropriate source directory.

After the hardware catalog is updated, *excom*® will be listed under “Additional Field Devices → I/O → TURCK → *excom*”.

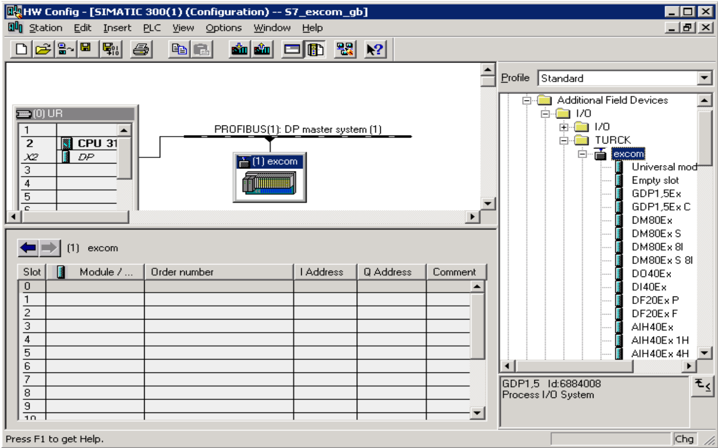
Figure 93: Hardware catalog with excom® modules



Selection of the *excom*® gateway as a slave

To register an excom® station as a slave, select the required entry in the hardware catalog and drag it to the PROFIBUS directory.

Table 173: Inserting an excom® station as a slave



Note that this will only add an empty module rack.

The gateway and the station modules must then be copied separately to the empty module rack.

Configuration of the *excom*® station

To configure an *excom*® station, simply copy the required modules from the hardware catalog to the list of the *excom*® station concerned.

The first module to be registered in the module list is the gateway.

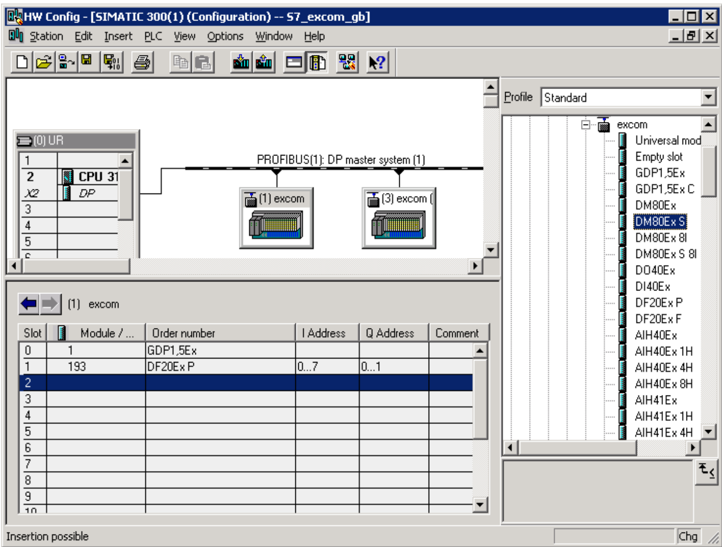
Note

Even if your physical station is configured redundantly, i.e. the station contains two gateways, only a **single** gateway has to be added to the module list.

The redundancy mode, i.e. the gateway performance in the event of an error, is then set as a gateway parameter.

To configure your *excom*® station, simply copy the I/O modules from the hardware catalog to the list of the *excom*® station concerned.

Figure 94: Selection of the excom® modules



Note

When configuring the *excom*® station, ensure that the order of the modules in the software's module list matches the actual order of the modules in the module rack.

Should this not be the case, the gateway will signal the master configuration errors via the PROFIBUS diagnostics; however, data exchange between correctly configured modules and the master is not affected.

Setting the station parameters

To set the module parameters, double-click the relevant *excom*® module. A window will pop up in which you can set the module parameters via the “Parameter Assignment” tab.

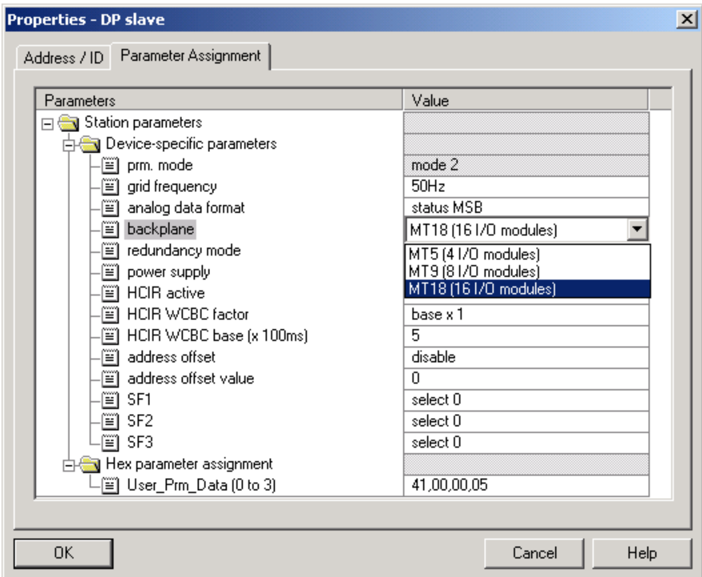


Figure 95: Parameterisation of the excom® gateway

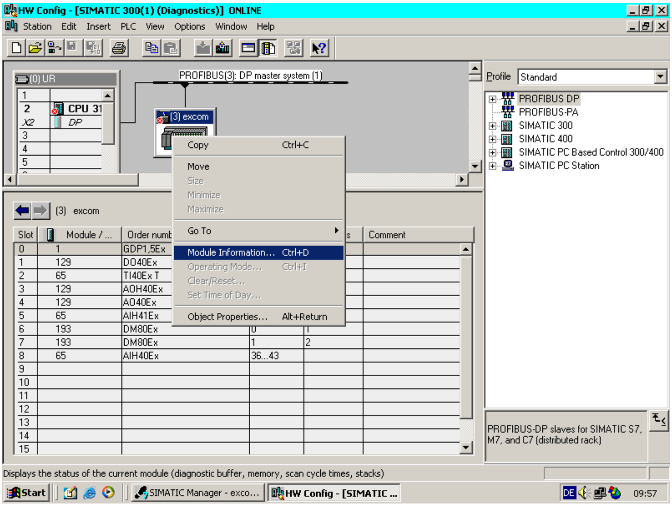
The folder “Device-specific parameters” shows settings in plain text, whereas the folder “Hex parameter assignment” displays the settings in hexadecimal format.

The specific meanings of the module parameters can be taken from the individual module descriptions in chapters 5 to 10 of this manual.

Error diagnostics (station/system diagnostics) when interfaced to an S7 Siemens PLC

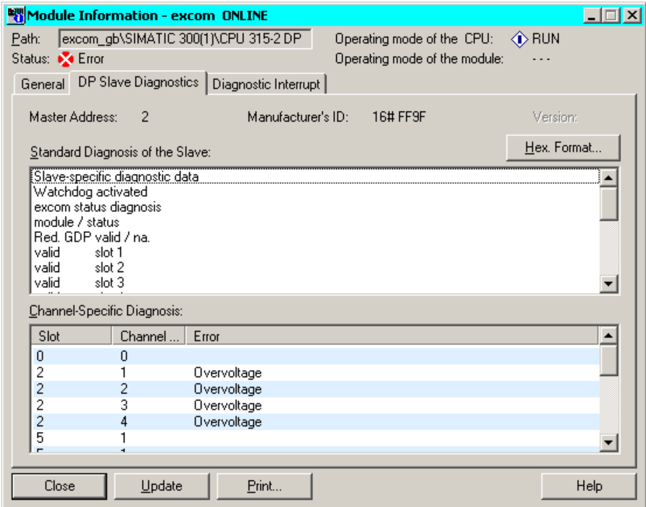
The diagnostics data of the excom® station can be read online during operation.
Open the following menu by right clicking the station:

Figure 96: S7 diagnostics



The menu item “Module Information..." contains the station diagnostics.

Figure 97: Module information of the excom® station



A detailed description of the software's diagnostics functions is contained in the software manual “SIMATIC Manager” published by Siemens.

Information on the diagnostics functions of the individual excom® modules is provided in chapter 5 to 10.

The diagnostics options available for the gateway are described in “PROFIBUS-DP interface“ in the section “Diagnostics” page 5-47.

Connection to ABB AC800F

To configure the *excom*® station in conjunction with an ABB PLC, the configuration software “Control Builder F” V6.2 from ABB is used in our configuration example.

Network configuration

Once the field controller, the power supply, the PROFIBUS module and the master have been selected, the *excom*® station can be added to the network as a slave.

Go to the menu item “Edit → Insert” or right-click the slave and then click “Insert slave”.

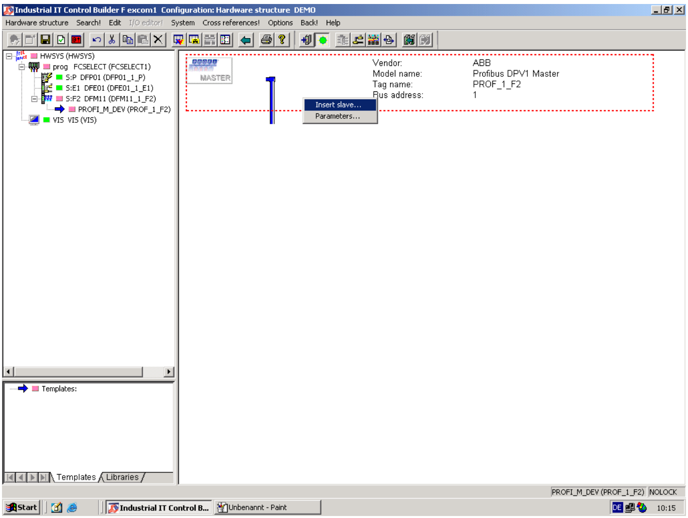
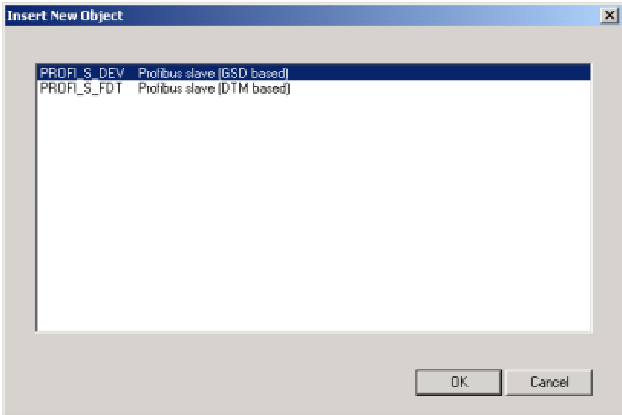


Figure 98: Inserting a slave

In the following window, please select either a GSD-based or a DTM-based slave.

Figure 99: Selection of a GSD-based slave



GSD-based slaves

After entering the station address of the slave, the associated GSD files have to be imported into the configuration software.

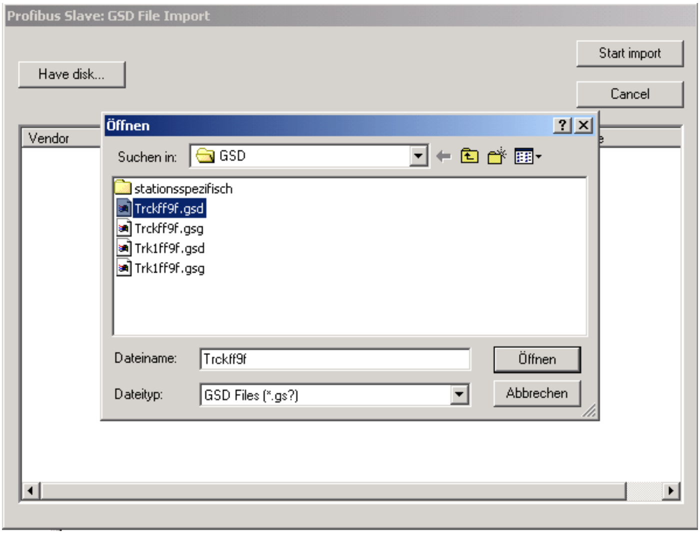


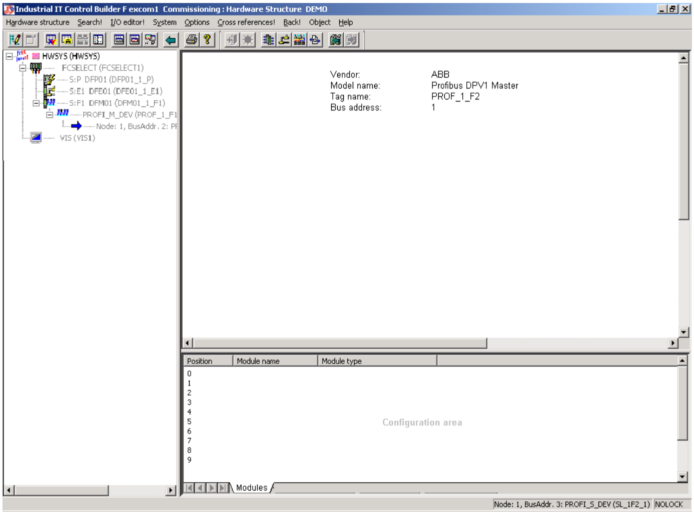
Figure 100: Importing the GSD files

The *excom*® slave may be configured after importing the GSD files.

Configuration of the *excom*® station

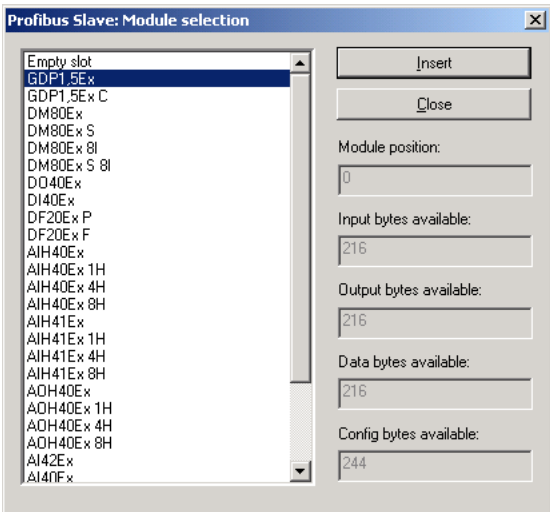
Double-clicking the entry of the slave will open the configuration window.

Figure 101: Slave configuration



Another double-click onto positions 0 to 16 in the lower window section will open the “PROFIBUS slave: module selection” window.

Figure 102: Module selection



Then assign the individual modules to the *excom*® station. Start with the gateway on position 0 and then add all stations according to their actual order in the module rack.

Note

Even if your system is configured redundantly, i.e. the station contains two gateways, only a **single** gateway has to be added to the module list.
The redundancy mode, i.e. the gateway behaviour in the event of an error, is then set as a gateway parameter.

Note

When configuring the *excom*® station, ensure that the order of the modules in the software's module list matches the actual order of the modules in the module rack.

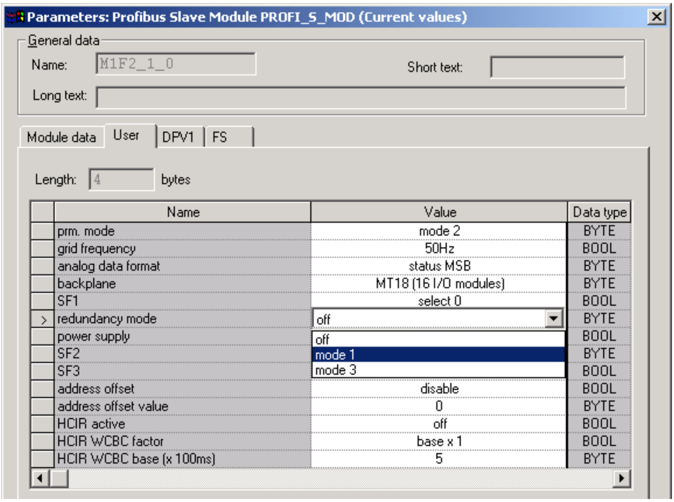
Should this not be the case, the gateway will signal the master configuration errors via the PROFIBUS diagnostics; however, data exchange between correctly configured modules and the master is not affected.

Parameterisation of GSD-based slaves

The slaves are parameterised by double-clicking the respective module.

The module parameters are set via the “User” tab in the window “Parameters: Profibus Slave...”.

Figure 103: Parameterisation of the GSD-based slave

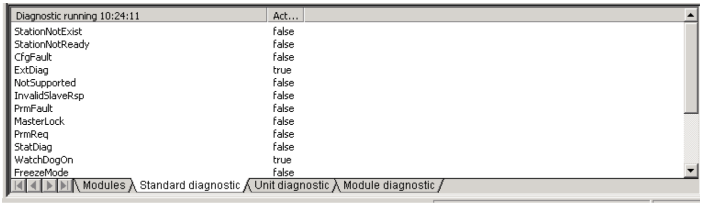


Diagnostics messages of GSD-based slaves

In addition to the general standard station specific diagnostics, the software also provides device-specific status diagnostics (unit diagnostics) and channel-specific diagnostics (module diagnostics) with diagnostics messages in plain text.

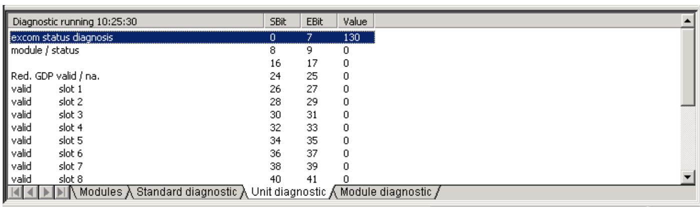
- Extended diagnostics messages are provided.

Figure 104: Standard diagnostics



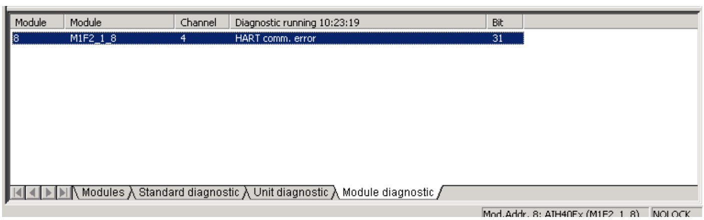
- Status diagnostics

Figure 105: Unit related diagnostics



- Module diagnostics (channel-specific)

Figure 106: Module diagnostics



Appendix

Parameters of the *excom*® modules

The parameters of the *excom*® modules and their bit mapping can be taken from the following tables.

Note
The default parameter settings in the tables are highlighted in bold type.

Parameters in mode 1

GDP1,5Ex

Table 174: Parameters for GDP1,5Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/ 1	Prm. Mode	**00: Mode 1** 01: Mode 2 (Parameterisation mode: determined by the GSD file as a constant parameter)
	2	Line frequency	**0: 50 Hz** 1: 60 Hz
	3/4	Analogue data format	**0 0: Status MSB** 0 1: Status LSB 1 0: No status
	5/6	Module rack	01: MT9 (8 I/O modules) **10: MT18 (16 I/O modules)**
	7	SF1	**0: Selection 0** 1: Selection 1

Table 174: Parameters for GDP1,5Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
1	0/1	Redundancy mode	**0 0: OFF** 0 1: Mode 1 1 1: Mode 3
	2	SF 3	**0: Selection 0** 1: Selection 1
	3	Power supply	**0: Single** 1: Redundant
	4/5	reserved	**0 0**
	6/7	SF2	**0 0: Selection 0** 0 1:Selection 1 1 0: Selection 2 1 1: Selection 3
2	0 to 6	Offset value	**0** to 124
	7	Address offset	**0: OFF** 1: ON
3	0 to 5	HCIR WCBC basis (x 100ms)	**0** to 63
	6	HCIR WCBC factor	**0: Basis x 1** 1: Basis x 16
	7	HCIR active	**0: OFF** 1: ON

Ap-

GDP1,5Ex D/ GDP1,5Ex CD

Table 175: GDP1,5Ex ... (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/ 1	Prm. Mode	**00: Mode 1** 01: Mode 2 (Parameterisation mode: determined by the GSD file as a constant parameter)
	2	Line frequency	**0: 50 Hz** 1: 60 Hz
	3/4	Analogue data format	**00: Status MSB** 01: Status LSB 10: No status
	5/6	Module rack	01: MT9 (8 I/O modules) **10: MT18 (16 I/O modules)**
	7	SF1	**0: Selection 0** 1: Selection 1
1	0/1	Redundancy mode	**00: OFF** 01: Mode 1 11: Mode 3
	2	SF 3	**0: Selection 0** 1: Selection 1
	3	Power supply	**0: Single** 1: Redundant
	4/5	Cyclic data (only GDP1,5Ex CD)	**00: Selection 0** **Default value must not be modified!**
	6/7	SF2	**00: Selection 0** 01: Selection 1 10: Selection 2 11: Selection 3

Table 175: GDP1,5Ex ... (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
2	0 to 6	Offset value	**0** to 124
	7	Address offset	**0: OFF** 1: ON
3	0 to 5	HCIR WCBC Basis (x 100ms)	**0** to 63
	6	HCIR WCBC factor	**0: Basis x 1** 1: Basis x 16
	7	HCIR active	**0: OFF** 1: ON
4		Unused channels slot 1	
5		Unused channels slot 2	
:		:	
18		Unused channels slot 15	
19		Unused channels slot 16	

DM80Ex/ DM80Ex S

Table 176: DM80Ex... (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/1	Effective direction	**00: 8 inputs** 01: 4 inputs / 4 outputs 10: 5 inputs / 3 outputs 11: 8 outputs
	2	Polarity	**0: Normal** 1: Inverse
	3	Debouncing	**0: OFF** 1: 50 ms
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	0**: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

DM80Ex 8I/ DM80Ex S 8I

Table 177: DM80Ex... (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0 to 2	Polarity	**000: Normal** 100: Inverse
	3	Debouncing	**0: OFF** 1: 50 ms
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	0**: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

DI40Ex

Table 178: DI40Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/1	reserved	**00**
	2	Polarity	**0: Normal** 1: Inverse
	3	Debouncing	**0: OFF** 1: 50 ms
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

DO40Ex

Table 179: DO40Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/1	reserved	**00**
	2	Polarity	**0: Normal** 1: Inverse
	3	reserved	**0**
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break moni-toring	**0: ON** 1: OFF
	7	Short-circuit moni-toring	**0: ON** 1: OFF

AI40Ex

Table 180: AI40Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0	Measuring range	0: 0...20 mA **1: 4...20 mA**
	1	Connection	0: Active **1: Passive**
	3	Filter (PT1)	0: OFF **1: 100 ms**
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

AI41Ex

Table 181: AI40Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/1	Measuring range	00:0..10V **01:2..10V** 10:0...20 mA **11:4...20 mA**
	2	reserved	
	3	Filter (PT1)	0:Off **1:100 ms**
	4/5	Substitute value strategy	**00: Min. value** 01:Max. value 10:Last valid value
	6/7	Line monitoring	**00:ON** 11:OFF

AO40Ex

Table 182: AO40Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0	Measuring range	00: 0...20 mA **01: 4...20 mA**
	1 to 3	reserved	**000**
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

AIH40Ex

Table 183: AIH40Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/1	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	2	reserved	**0**
	3	Filter (PT1)	**0: OFF** 1: 100 ms
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

AIH40Ex 4H (with 4 HART® variables)

Table 184: AIH40Ex 4H (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0 to 2	HART® status / sec. variables	**000: ON/ V 1,2,3,4 of C1** 001: Auto/ V 1,2,3,4 of C1 010: ON/ V 1,2 of C1,2 011: Auto/ V 1,2 of C1,2 100: ON/ V 1 of C1,2,3,4 101: ON/ V 2 of C1,2,3,4 110: ON/ V 3 of C1,2,3,4 111: ON/ V 4 of C1,2,3,4
	3	Filter (PT1)	**0: OFF** 1: 100 ms
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

AIH41Ex

Table 185: AIH41Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/1	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	2	reserved	**0**
	3	Filter (PT1)	**0: OFF** 1: 100 ms
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6/7	Line monitoring	**00: ON** 11: OFF

AIH41Ex 4H (with 4 HART® variables)

Table 186: AIH41Ex 4H (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0 to 2	HART® status / sec. variables	**000: ON/ V 1,2,3,4 of C1** 001: Auto/ V 1,2,3,4 of C1 010: ON/ V 1,2 of C1,2 011: Auto/ V 1,2 of C1,2 100: ON/ V 1 of C1,2,3,4 101: ON/ V 2 of C1,2,3,4 110: ON/ V 3 of C1,2,3,4 111: ON/ V 4 of C1,2,3,4
	3	Filter (PT1)	0: OFF 1: 100 ms
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6/7	Line monitoring	**00: ON** 11: OFF

AOH40Ex

Table 187: AOH40Ex (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/1	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	2	reserved	**0**
	3	reserved	**0**
	4/5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

Ap-

AOH40Ex 4H (with 4 HART® variables)

Table 188: AOH40Ex 4H (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	2 to 0	HART® status / sec. variables	**000: ON/ V 1,2,3,4 of C1** 001: Auto/ V 1,2,3,4 of C1 010: ON/ V 1,2 of C1,2 011: Auto/ V 1,2 of C1,2 100: ON/ V 1 of C1,2,3,4 101: ON/ V 2 of C1,2,3,4 110: ON/ V 3 of C1,2,3,4 111: ON/ V 4 of C1,2,3,4
	3	reserved	**0**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

TI40Ex R

Table 189: TI40Ex R (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	2 to 0	Measuring range	000: Pt100 2L (auto) 001: Pt100 3L **010: Pt100 4L** 011: Pt1000 2L (auto) 100: Pt1000 3L 100: Pt1000 4L 110: Ni100 2w 111: Ni100 3w
	3	Filter (PT1)	**0: OFF** 1: 11 s
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

TI40Ex T

Table 190: TI40Ex T (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0 to 2	Measuring range	**000: Type B** 001: Type E 010: Type J 011: Type K1 00: Type N 101: Type R 110: Type S 111: Type T
	3	Filter (PT1)	**0: OFF** 1: 11 s
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	reserved	**0**

DF20 Ex P

Table 191: DF20 Ex P (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0	Reset counter	**0: Host-controlled** 1: Terminal
	1/ 2	Counting/rotation direction	**00: Forwards (f< 4 kHz)** 01: Host-controlled (f < 4k Hz) 00: Terminal (f< 4 kHz) 11: Terminal (auto, f > 1.25 kHz)
	3	Debouncing	**0: OFF** 1: 50 ms
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

DF20Ex F

Table 192: DF20Ex F (mode 1)

Byte no.	Bit no.	Parameter name	Parameter values
0	0	Average value	**0: OFF** 1: 8 values
	1/ 2	Counting/rotation direction	**00: Forwards (f< 4 kHz)** 01: Host-controlled (f < 4 kHz) 00: Terminal (f< 4 kHz) 11: Terminal (auto, f>1.25 kHz)
	3	Debouncing	**0: OFF** 1: 50 ms
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

Parameters in mode 2

GDP1,5Ex/ GDP1,5Ex C

Table 193: Parameters for GDP1,5Ex (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	0/ 1	Prm. Mode	00 Mode 1 **01 Mode 2** (Parameterisation mode: determined by the GSD file as a constant parameter)
	2	Line frequency	**0: 50Hz** 1: 60Hz
	3/ 4	Analogue data format	**00: Status MSB** 01: Status LSB 10: No status
	5/ 6	Module rack	01: MT9 (8 I/O modules) **10: MT18 (16 I/O modules)**
	7	SF1	**0: Selection 0** 1: Selection 1

Table 193: Parameters for GDP1,5Ex (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
1	0/ 1	Redundancy mode	**00: OFF** 01: Mode 1 11: Mode 3
	2	SF 3	**0: Selection 0** 1: Selection 1
	3	Power supply	**0: Single** 1: Redundant
	4/ 5	Cyclic data (only GDP1,5 Ex C)	**00: Selection 0** Default value must not be modified!
	6/ 7	SF2	**00: Selection 0** 01: Selection 1 10: Selection 2 11: Selection 3
2	0 to 6	Offset value	**0** to 124
	7	Address offset	**0: OFF** 1: ON
3	0 to 5	HCIR WCBC Basis (x 100ms)	**0** to 63
	6	HCIR WCBC factor	**0: Basis x 1** 1: Basis x 16
	7	HCIR active	**0: OFF** 1: ON

DM80Ex/ DM80Ex S/ DM80Ex 8I/ DM80Ex S 8I

Table 194: DM80Ex... (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Debouncing	**00: OFF** 01: 10 ms 10: 20 ms 11: 50 ms
	2	Polarity	**0: Normal** 1: Inverse
	3	Effective direction (only DM80Ex/ DM80Ex S)	**0: Input** 1: Output
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Table 194: DM80Ex... (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	Bit 0	Channel 1	**0: Active** 1: deactivated
	Bit 1	Channel 2	**0: Active** 1: deactivated
	:	:	:
	Bit 7	Channel 8	**0: Active** 1: deactivated

DI40Ex

Table 195: DI40Ex (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Debouncing	**00: OFF** 01: 10 ms 10: 20 ms 11: 50 ms
	2	Polarity	**0: Normal** 1: Inverse
	3	reserved	**0**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break moni-toring	**0: ON** 1: OFF
	7	Short-circuit moni-toring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		

Table 195: DI40Ex (mode 2)	Byte no.	Bit no.	Parameter name	Parameter values
	2	Parameters for channel 3 (bit configuration identical to channel 1)		
	3	Parameters for channel 4 (bit configuration identical to channel 1)		
	4	reserved		**00000000**

DO40Ex

Table 196: DO40Ex (mode 2	Byte no.	Bit no.	Parameter name	Parameter values
	0	Parameters for channel 1		
		0/ 1	reserved	**00**
		2	Polarity	**0: Normal** 1: Inverse
		3	reserved	**0**
		4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
		6	Wire break moni-toring	**0: ON** 1: OFF
		7	Short-circuit moni-toring	**0: ON** 1: OFF
	1	Parameters for channel 2 (bit configuration identical to channel 1)		
	2	Parameters for channel 3 (bit configuration identical to channel 1)		
	3	Parameters for channel 4 (bit configuration identical to channel 1)		
	4	reserved		**00000000**

AI40Ex

Table 197: AI40Ex (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	00:OFF **01:0.1s** 10:2.6 s 11:29.2 s
	2	Measuring range	0: 0...20 mA **1: 4...20 mA**
	3	Connection	**0:Active** 1:Passive
	4/ 5	Substitute value strategy	**00:Min. value** 01:Max. value 10:Last valid value
	6	Wire break monitoring	**0:ON** 1:OFF
	7	Short-circuit monitoring	**0:ON** 1:OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	reserved		**00000000**

AI41Ex

Table 198: AI40Ex (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	00:OFF **01:0.1s** 10:2.6 s 11:29.2 s
	2/3	Measuring range	00:0..10V **01:2..10V** 10:0...20 mA **11:4...20 mA**
	4/ 5	Substitute value strategy	**00:Min. value** 01:Max. value 10:Last valid value
	6/7	Line monitoring	**00:ON** 11:OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	reserved		**00000000**

AO40Ex

Table 199: AO40Ex (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	reserved	**00**
	2	Measuring range	0: 0...20 mA **1: 4...20 mA**
	3	reserved	**0**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	reserved		**00000000**

AIH40Ex

Table 200: AIH40Ex (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	**00: OFF** 01: 0.1 s 10: 2.6 s 11: 29.2 s
	2/ 3	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	reserved		**00000000**

AIH40EX 4H

Table 201: AIH40Ex 4H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	**00: OFF** 01: 0.1 s 10: 2.6 s 11: 29.2 s
	2	C1: SV 3	**0: OFF** 1: ON
	3	C1: SV 4	**0: OFF** 1: ON
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Table 201: AIH40Ex 4H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	Parameters for channels 1 to 4		
	Bit 0	C1: SV 1	0: OFF **1: ON**
	Bit 1	C1: SV 2	**0: OFF** 1: ON
	Bit 2	C2: SV1	0: OFF **1: ON**
	Bit 3	C2: SV 2	**0: OFF** 1: ON
	Bit 4	C3: SV 1	0: OFF **1: ON**
	Bit 5	C3: SV 2	**0: OFF** 1: ON
	Bit 6	C4: SV1	0: OFF **1: ON**
	Bit 7	C4: SV 2	**0: OFF** 1: ON

AIH40Ex 1H

Table 202: AIH40Ex 1H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	**00: OFF** 01: 0.1 s 10: 2.6 s 11: 29.2 s
	2/ 3	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Table 202: AIH40Ex 1H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	Parameters for channels 1 to 4		
	Bit 0/ 1	HART® variable of channel	**00: Channel 1** 01: Channel 2 10: Channel 3 11: Channel 4
	Bit 2/ 3/ 4	HART® variable	000: Primary **00: Secondary 1** 010: Secondary 2 011: Secondary 3 100: Secondary 4
	Bit 6/ 7/ 5	reserved	**000**

AIH40Ex 8H

Table 203: AIH40Ex 8H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	**00: OFF** 01: 0.1 s 10: 2.6 s 11: 29.2 s
	2	C1: SV 3	**0: OFF** 1: ON
	3	C1: SV 4	**0: OFF** 1: ON
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	Parameters for channels 1 to 4		
	Bit 0	C1: SV 1	0: OFF **1: ON**
	Bit 1	C1: SV 2	**0: OFF** 1: ON

Table 203: AIH40Ex 8H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
	Bit 2	C2: SV1	0: OFF **1: ON**
	Bit 3	C2: SV 2	**0: OFF** 1: ON
	Bit 4	C3: SV 1	0: OFF **1: ON**
	Bit 5	C3: SV 2	**0: OFF** 1: ON
	Bit 6	C4: SV1	0: OFF **1: ON**
	Bit 7	C4: SV 2	**0: OFF** 1: ON

AIH41Ex

Table 204: AIH41Ex (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	**00: OFF** 01: 0.1 s 10: 2.6 s 11: 29.2 s
	2/ 3	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	7/6	Line monitoring	**00: ON** 01: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	reserved		**00000000**

AIH41Ex 4H

Table 205: AIH41Ex 4H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	**00: OFF** 01: 0.1 s 10: 2.6 s 11: 29.2 s
	2	C1: SV 3	**0: OFF** 1: ON
	3	C1: SV 4	**0: OFF** 1: ON
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6/ 7	Line monitoring	**00: ON** 01: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Table 205: AIH41Ex 4H (mode 2)

Byte no.	**Bit no.**	**Parameter name**	**Parameter values**
4	Parameters for channels 1 to 4		
	Bit 0	C1: SV 1	0: OFF **1: ON**
	Bit 1	C1: SV 2	**0: OFF** 1: ON
	Bit 2	C2: SV1	0: OFF **1: ON**
	Bit 3	C2: SV 2	**0: OFF** 1: ON
	Bit 4	C3: SV 1	0: OFF **1: ON**
	Bit 5	C3: SV 2	**0: OFF** 1: ON
	Bit 6	C4: SV1	0: OFF **1: ON**
	Bit 7	C4: SV 2	**0: OFF** 1: ON

AIH41Ex 1H

Table 206: AIH41Ex 1H (mode 2)

Byte no.	**Bit no.**	**Parameter name**	**Parameter values**
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	**00: OFF** 01: 0.1 s 10: 2.6 s 11: 29.2 s
	2/ 3	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6/ 7	Line monitoring	**00: ON** 11: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Table 206: AIH41Ex 1H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	Parameters for channels 1 to 4		
	Bit 0/ 1	HART® variable of channel	**00: Channel 1** 01: Channel 2 10: Channel 3 11: Channel 4
	Bit 2/ 3/ 4	HART® variable	000: Primary **00: Secondary 1** 010: Secondary 2 011: Secondary 3 100: Secondary 4
	Bit 5/ 6/ 7	reserved	**000**

AIH41Ex 8H

Table 207: AIH41Ex 8H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	Filter (PT1)	**00: OFF** 01: 0.1 s 10: 2.6 s 11: 29.2 s
	2	C1: SV 3	**0: OFF** 1: ON
	3	C1: SV 4	**0: OFF** 1: ON
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6/ 7	Line monitoring	**00: ON** 11: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	Parameters for channels 1 to 4		
	Bit 0	C1: SV 1	0: OFF **1: ON**
	Bit 1	C1: SV 2	**0: OFF** 1: ON
	Bit 2	C2: SV1	0: OFF **1: ON**

Table 207: AIH41Ex 8H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
	Bit 3	C2: SV 2	**0: OFF** 1: ON
	Bit 4	C3: SV 1	0: OFF **1: ON**
	Bit 5	C3: SV 2	**0: OFF** 1: ON
	Bit 6	C4: SV1	0: OFF **1: ON**
	Bit 7	C4: SV 2	**0: OFF** 1: ON

AOH40Ex

Table 208: AOH40Ex (mode 2)

Byte no.	**Bit no.**	**Parameter name**	**Parameter values**
0	Parameters for channel 1		
	0/ 1	reserved	**00**
	2/ 3	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	reserved		**00000000**

AOH40Ex 4H

Table 209: AOH40Ex 4H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0	reserved	**0**
	1	HART® status	0: OFF **1: ON**
	2	C1: SV 3	**0: OFF** 1: ON
	3	C1: SV 4	**0: OFF** 1: ON
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Table 209: AOH40Ex 4H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	Parameters for channels 1 to 4		
	Bit 0	C1: SV 1	0: OFF **1: ON**
	Bit 1	C1: SV 2	**0: OFF** 1: ON
	Bit 2	C2: SV1	0: OFF **1: ON**
	Bit 3	C2: SV 2	**0: OFF** 1: ON
	Bit 4	C3: SV 1	0: OFF **1: ON**
	Bit 5	C3: SV 2	**0: OFF** 1: ON
	Bit 6	C4: SV1	0: OFF **1: ON**
	Bit 7	C4: SV 2	**0: OFF** 1: ON

Ap-

AOH40Ex 1H

Table 210: AOH40Ex 1H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	reserved	**00**
	2/ 3	HART® status / measuring range	00: OFF/ 0...20 mA 01: OFF/ 4...20 mA **10: ON/ 4...20 mA**
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Table 210: AOH40Ex 1H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	Parameters for channels 1 to 4		
	Bit 0/ 1	HART® variable of channel	00: Channel 1 01: Channel 2 10: Channel 3 11: Channel 4
	Bit 2/ 3/ 4	HART® variable	000: Primary 001: Secondary 1 010: Secondary 2 011: Secondary 3 100: Secondary 4
	Bit 5/ 6/ 7	reserved	**000**

AOH40Ex 8H

Table 211: AOH40Ex 8H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0/ 1	reserved	**00**
	2	C1: SV 3	**0: OFF** 1: ON
	3	C1: SV 4	**0: OFF** 1: ON
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF

Table 211: AOH40Ex 8H (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		
4	Parameters for channels 1 to 4		
	Bit 0	C1: SV 1	0: OFF **1: ON**
	Bit 1	C1: SV 2	**0: OFF** 1: ON
	Bit 2	C2: SV1	0: OFF **1: ON**
	Bit 3	C2: SV 2	**0: OFF** 1: ON
	Bit 4	C3: SV 1	0: OFF **1: ON**
	Bit 5	C3: SV 2	**0: OFF** 1: ON
	Bit 6	C4: SV1	0: OFF **1: ON**
	Bit 7	C4: SV 2	**0: OFF** 1: ON

TI40Ex R

Table 212: TI40Ex R (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0 to 3	Line resistance	**0000: Basis + 0 Ohm** 0001: Basis + 0.5 Ohm 0010: Basis + 1.0 Ohm 0011: Basis + 1.5 Ohm 0100: Basis + 2.0 Ohm 0101: Basis + 2.5 Ohm 0110: Basis + 3.0 Ohm 0111: Basis + 3.5 Ohm 1000: Basis + 4.0 Ohm 1001: Basis + 4.5 Ohm 1010: Basis + 5.0 Ohm 1011: Basis + 5.5 Ohm 1100: Basis + 6.0 Ohm 1101: Basis + 6.5 Ohm 1110: Basis + 7.0 Ohm 1111: Basis + 7.5 Ohm
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	Short-circuit monitoring	**0: ON** 1: OFF
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Ap-

Table 212: TI40Ex R (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	Parameters for all channels		
	0 to 3	Sensor type	**0000: Pt100 (IEC 751)** 0001: Pt200 (IEC 751) 0010: Pt400 (IEC 751) 0011: Pt1000 (IEC 751) 0100: Pt100 (JIS) 0101: Pt1000 (JIS) 0110: Pt100 (SAM 0111: Pt1000 (SAM 1000: Ni100 1011: Cu100 1101: 0...30 Ohm (mOhm) 1110: 0...300 Ohm (10mOhm) 1111: 0...3 kOhm (100 mOhm)
	4/ 5	Filter (PT1)	**00: OFF** 01: 1.2 s 10: 11 s 11: 25 s
	6/ 7	Connection	00: 2L/ 0 Ohm Basis 01: 2L/ 8 Ohm Basis 01: 3L **11: 4L**

TI40Ex T

Table 213: TI40Ex T (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	Parameters for channel 1		
	0	reserved	**0**
	1-3	Reference temperature	**000: 0 C** 001: 10 °C 010: 20 °C 011: 30 °C 100: 40 °C 101: 50 °C 110: 60 °C 111: 70 °C
	4/ 5	Substitute value strategy	**00: Min. value** 01: Max. value 10: Last valid value
	6	Wire break monitoring	**0: ON** 1: OFF
	7	reserved	**0**
1	Parameters for channel 2 (bit configuration identical to channel 1)		
2	Parameters for channel 3 (bit configuration identical to channel 1)		
3	Parameters for channel 4 (bit configuration identical to channel 1)		

Table 213: TI40Ex T (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	Parameters for all channels		
	0 to 3	Sensor type	**0000: Type B** 0001: Type E 0010: Type J 0011: Type K 0100: Type L 0101: Type N 0110: Type R 0111: Type S 1000: Type T 1001: Type U 1010: Type C 1011: Type D 1101: -75..+75 mV [5 µV] 1111: -1.2...+1.2 V [100 µV]
	4/ 5	Filter (PT1)	**00: OFF** 01: 1.2 s 10: 11 s 11: 25 s
	6/ 7	Reference point	00: none 01: Internal **10: Pt100 at terminal** 11: External (thermostat)

DF20 Ex P

Table 214: DF20 Ex P (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	0	A1: Line monitoring	**0: ON** 1: OFF
	1	A2: Line monitoring	**0: ON** 1: OFF
	2	A3: Line monitoring	**0: ON** 1: OFF
	3	A4: Line monitoring	**0: ON** 1: OFF
	4	B1: Line monitoring	**0: ON** 1: OFF
	5	B2: Line monitoring	**0: ON** 1: OFF
	6	B3: Line monitoring	**0: ON** 1: OFF
	7	B4: Line monitoring	**0: ON** 1: OFF
1	0	A: Counter reset	**0: Host-controlled** 1: Terminal
	1	A: Debouncing control inputs	**0: OFF** 1: 50 ms
	2/ 3	A: Direction detection	**00: Forwards (f< 4 kHz)** 01: Host-controlled (f < 4 kHz) 00: Terminal (f< 4 kHz) 11: Terminal (auto, f>1.25 kHz)
	4/ 5	A: Substitute value output	**00: Min. value** 01: Max. value 10: Last valid value

Table 214: DF20 Ex P (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
	6/ 7	A: Substitute value input	**00: Min. value** 01: Max. value 10: Last valid value
2	0	A1: Polarity	**0: Normal** 1: Inverse
	1	A2: Polarity	**0: Normal** 1: Inverse
	2	A3: Polarity	**0: Normal** 1: Inverse
	3	A4: Polarity	**0: Normal** 1: Inverse
	4/ 5	A: Measuring range	00: 0...100 Hz 01: 0...1 kHz **10: 0...4 kHz**
	6	A: Peak time	**0: Host-controlled** 1: Terminal
	7	A: Edge counting	**0: Rising** 1: Rising + falling
3	0	B: Counter reset	**0: Host-controlled** 1: Terminal
	1	B: Debouncing control inputs	**0: OFF** 1: 50 ms
	2/ 3	B: Direction detec-tion	**00: Forwards (f< 4 kHz)** 01: Host-controlled (f < 4 kHz) 00: Terminal (f< 4 kHz) 11: Terminal (auto, f>1.25 kHz)
	4/ 5	B: Substitute value output	**00: Min. value** 01: Max. value 10: Last valid value

Table 214: DF20 Ex P (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
	6/7	B: Substitute value input	**00: Min. value** 01: Max. value 10: Last valid value
4	0	B1: Polarity	**0: Normal** 1: Inverse
	1	B2: Polarity	**0: Normal** 1: Inverse
	2	B3: Polarity	**0: Normal** 1: Inverse
	3	B4: Polarity	**0: Normal** 1: Inverse
	4/5	B: Measuring range	00: 0...100 Hz 01: 0...1 kHz **10: 0...4 kHz**
	6	B: Peak time	**0: Host-controlled** 1: Terminal
	7	B: Edge counting	**0: Rising** 1: Rising + falling

DF20Ex F

Table 215: DF20Ex F (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
0	0	A1: Line monitoring	**0: ON** 1: OFF
	1	A2: Line monitoring	**0: ON** 1: OFF
	2	A3: Line monitoring	**0: ON** 1: OFF
	3	A4: Line monitoring	**0: ON** 1: OFF
	4	B1: Line monitoring	**0: ON** 1: OFF
	5	B2: Line monitoring	**0: ON** 1: OFF
	6	B3: Line monitoring	**0: ON** 1: OFF
	7	B4: Line monitoring	**0: ON** 1: OFF
1	0	A: Measuring cycle	**0: <300 ms (0.1 % resolution)** 1: < 50 ms (1 % resolution)
	1	A: Debouncing control inputs	**0: OFF** 1: 50 ms
	2/ 3	A: Direction detection	**00: Forwards (f< 4 kHz)** 01: Host-controlled (f < 4 kHz) 00: Terminal (f< 4 kHz) 11: Terminal (auto, f > 1.25 kHz)
	4/ 5	A: Substitute value output	**00: Min. value** 01: Max. value 10: Last valid value

Table 215: DF20Ex F (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
	6/ 7	A: Substitute value input	**00: Min. value** 01: Max. value 10: Last valid value
2	0	A1: Polarity	**0: Normal** 1: Inverse
	1	A2: Polarity	**0: Normal** 1: Inverse
	2	A3: Polarity	**0: Normal** 1: Inverse
	3	A4: Polarity	**0: Normal** 1: Inverse
	4/ 5	reserved	**00**
	6/ 7	A: Average value	**00: OFF** 01: 4 values 10: 8 values 11: 16 values
3	0	B: Measuring cycle	**0: <300 ms (0.1 % resolution**) 1: < 50 ms (1 % resolution)
	1	B: Debouncing control inputs	**0: OFF** 1: 50 ms
	2/ 3	B: Direction detection	**00: Forwards (f< 4 kHz)** 01: Host-controlled (f < 4 kHz) 00: Terminal (f< 4 kHz) 11: Terminal (auto, f > 1.25 kHz)
	4/ 5	B: Substitute value output	**00: Min. value** 01: Max. value 10: Last valid value
	6/ 7	B: Substitute value input	**00: Min. value** 01: Max. value 10: Last valid value

Table 215: DF20Ex F (mode 2)

Byte no.	Bit no.	Parameter name	Parameter values
4	0	B1: Polarity	**0: Normal** 1: Inverse
	1	B2: Polarity	**0: Normal** 1: Inverse
	3	B4: Polarity	**0: Normal** 1: Inverse
	2	B3: Polarity	**0: Normal** 1: Inverse
	4/ 5	reserved	**00**
	6/ 7	B: Average value	**00: OFF** 01: 4 values 10: 8 values 11: 16 values

Ordering details

Electronic modules

Table 216: excom® electronic modules

Product	Description	Ident no.
DM80Ex	8-channel input/output module, digital	6884006
DI40EX	4-channel input module, digital	6884004
DO40Ex	4-channel output module, digital	6884007
AI40EX	4-channel input module, analogue, active	6884009
AI41EX	4-channel input module, analogue, passive	6884020
AO40Ex	4-channel output module, analogue	6884002
AIH40EX	4-channel input module, analogue, active, HART®	6884001
AIH41EX	4-channel input module, analogue, passive, HART®	6884005
AOH40EX	4-channel output module, analogue, HART®	6884003
TI40EX	4-channel temperature input module	6884000
DF20EX	2-channel frequency/counter module	6884061

Power supply units

Table 217: Power supply units

Product	Description	Ident no.
PSD24EX	24 VDC power supply unit	6881721
PPSA230EX	230VAC converter	6900293
PPSA115EX	115VAC converter	6900294

Bus interface

Table 218: Bus interface

Product	Description	Ident no.
GDP1,5	Profibus-DP gateway	6884008
SC12Ex	Segment coupler for isolating RS485 and RS485-IS	6884047
OC11Ex/3G	Coupler for converting RS485 signals to FO signals	6890424
OC11Ex/2G	Coupler for converting FO signals to RS485-IS signals	6890423
2-wire fibre optic cable with pre-assembled ST connectors		
LWL-2ST/SY-2.5M	Length: 2.5 m	6611300
LWL-2ST/SY-5M	Length: 5 m	6611301
LWL-2ST/SY-10M	Length: 10 m	6611302
LWL-2ST/SY-25M	Length: 25 m	6611303
LWL-2ST/SY-50M	Length: 50 m	6611304
LWL-2ST/SY-100M	Length: 100 m	6611305
LWL-2ST/SY-250M	Length: 250 m	6611306

Table 218: Bus interface

Product	Description	Ident no.
LWL-2ST/SY-500M	Length: 500 m	6611307
LWL-2ST/SY-1000M	Length: 1,000 m	6611308
LWL-2ST/SY-2500M	Length: 2500 m	6611309

Module rack

Table 219: Module rack

Product	Description	Ident no.
MT9-R024	Module rack for 1 power supply unit 1 gateway, 8 modules, Mini Combicon terminals	9100444
MT18-R024	Module rack for 2 power supply unit 2 gateways, 16 modules, Mini Combicon terminals	9100438
MT9-C024	Module rack for 1 power supply unit 1 gateway, 8 modules, spring-loaded terminals	9100446
MT18-C024	Module rack for 2 power supply unit 2 gateways, 16 modules, spring-loaded terminals	9100440
MT18-C230	Module rack for 2 AC/DC converters, 2 power supply units 2 gateways, 16 modules, spring-loaded terminals	9100443

Housing

Table 220: Housing

Product	Description	Ident no.
EG-VA4055/BLD-U	Housing 400 x 550 x 210 mm with blank flange plate without drillings	6884060
EG-VA4055/M16-K	Housing 400 x 550 x 210 mm with flange plate M16, incl. screw connections	6884056
EG-VA4055/M20-K	housing 400 x 550 x 210 mm with flange plate M20, incl. screw connections	6884059
EG-VA6555/BLD-U	Housing 650 x 550 x 210 mm with blank flange plate without drillings	6884055
EG-VA6555/M16-K	Housing 650 x 550 x 210 mm with flange plate M16, incl. screw connections	6884051
EG-VA6555/M20-K	Housing 650 x 550 x 210 mm with flange plate M20, incl. screw connections	6884052

Systems

Table 221: Systems

Product	Description	Ident no.
EG-VA4055/ BV681111	Stainless steel housing with M16 flange plate, filter (1) and module rack MT9, Mini-Combicon terminals	6884082
EG-VA4055/ BV681112	Stainless steel housing with M20 flange plate, filter (1) and module rack MT9 integrated, Mini-Combicon terminals	6884083

Table 221: Systems

Product	Description	Ident no.
EG-VA4055/ BV681211	Stainless steel housing with M16 flange plate, filter (1) and module rack MT9, spring-loaded terminals	6884084
EG-VA4055/ BV681212	Stainless steel housing with M20 flange plate, filter (1) and module rack MT9, spring-loaded terminals	6884085
EG-VA6555/ BV680111	Stainless steel housing with M16 flange plate, filter (1) and module rack MT18, Mini-Combicon terminals	6884089
EG-VA6555/ BV680112	Stainless steel housing with M20 flange plate, filter (1) and module rack MT18, Mini-Combicon terminals	6884088
EG-VA6555/ BV680121	Stainless steel housing with M16 flange plate, filter (2) and module rack MT18, Mini-Combicon terminals	6884087
EG-VA6555/ BV680122	Stainless steel housing with M20 flange plate, filter (2) and module rack MT18, Mini-Combicon terminals	6884086
EG-VA6555/ BV680211	Stainless steel housing with M16 flange plate, filter (1) and module rack MT18, spring-loaded terminals	6884078
EG-VA6555/ BV680212	Stainless steel housing with M20 flange plate, filter (1) and module rack MT18, spring-loaded terminals	6884079
EG-VA6555/ BV680221	Stainless steel housing with M16 flange plate, filter (2) and module rack MT18, spring-loaded terminals	6884080

Table 221: Systems

Product	Description	Ident no.
EG-VA6555/ BV680222	Stainless steel housing with M20 flange plate, filter (2) and module rack MT18, spring-loaded terminals	6884081

Other products can be requested by using the "Ordering code for the systems approved as a whole" page 2-43.

excom® accessories

Table 222: *excom*® accessories

Product	Description	Ident no.
BM1	Dummy module for free slots	6884036
BM-PS	Power supply unit cover (MT18)	6884044
MODEX filter	Capacitor for improving startup behaviour / increasing operational reliability	6884062
MODEX switching terminal	MODEX isolating relay EExde(ia) IIC 12 VDC, 2 S, 24 VDC, 2 A	6884069
MODEX isolating relay	MODEX isolating relay EExde(ia) IIC 12 VDC, 2 S, 24 VDC, 2 A	6884070
Phoenix shield terminal	Shield terminal for connecting the shield to the shield bus	6900360
ELST-M20EX	M20 venting pipe for field housing	6884033
DE-V20BU-TWIN	Twin sealing insert for blue M20 cable gland, 2 x 6 mm bushing, Elastomer	6884075
EG-VAEX-PE	Earthing set for field housing	6884037

Table 222: excom® accessories

Product	Description	Ident no.
EG-VAEX-V08/1	M16 screw connection kit (4 x 08) for field housing EG-VA4055	6884038
EG-VAEX-V16/1	M16 screw connection kit (4 x 16) for field housing EG-VA6555	6884039
EG-VAEX-V08/2	M20 screw connection kit (4 x 08) for field housing EG-VA4055	6884063
EG-VAEX-V16/2	M20 screw connection kit (4 x 20) for field housing EG-VA6555	6884064
PCS7 DRIVER-VS4	Driver for Siemens Process Control System PCS7, version 4	6884045
PCS7 DRIVER-VS5	Driver for Siemens Process Control System PCS7, version 5	6884035
V16PA-BU-EX	Cable glands M16, blue	6884025
V20PA-BU-EX	Cable glands M20, blue	6884049
V20PA-BK-EX	Cable glands M20, black	6884026
VS16PA-EX	M16 screw plug	6884029
VS20PA-EX	M20 screw plug	6884030
GM16	Lock nut for M16 screw connection	6884027
GM20	Lock nut for M20 screw connection	6884028
VST-V16EX	Blanking plug for M16 cable glands	6884031
VST-V20EX	Sealing plugs for M20 screw connection	6884032
VSTS22	22 mm socket spanner for M16 screw connection	6884043

Table 222: excom® accessories

Product	Description	Ident no.
VSTS27	27 mm socket spanner for M20 screw connection	6884073
CABLE 451B	Blue Profibus-DP cable, material TPE, with trailing capability	6914367
D9T-EX	Sub-D connector for connection of the gateway GDP1,5 in the explosion hazardous area	6890938
D9T-RS485IS	Sub-D connector for connecting intrinsically safe (RS485-IS) terminal of the segment coupler SC12Ex	6890944
D9T-RS485	Sub-D connector for connecting non-intrinsically safe (RS485) terminal of the segment coupler SC12Ex	6890942

Glossary

C

Category “ia”

Category “ia” indicates that the intrinsically safe electrical equipment should not be able to cause an ignition under normal operating conditions in the event of a single fault or any combination of two faults. Intrinsic safety must be ensured even when two independent faults occur at the same time.
For this reason, components used to limit the electrical energy or protective parts of an apparatus of category “ia” must be present in triplicate.

Category “ib”

An electrical apparatus of category “ib” should not be capable of causing ignition under normal operating conditions in the event of a single fault. Intrinsic safety must be ensured even when a fault occurs.
Any apparatus in category “ib” must have all components used to limit the electrical energy and protective parts in duplicate.

E

Explosive atmosphere

An explosive atmosphere contains flammable mixtures of gases, vapours, mist and dusts with air under atmospheric conditions.

Explosive atmosphere (dangerous)

A dangerous explosive atmosphere is a mixture containing flammable gases, vapours and oxygen which can cause damage to persons directly or indirectly through an explosion when ignited.

Explosive mixture (general term)

A combustible (flammable) mixture is a mixture of gases or vapours, or a mixture of gases and vapours with mists and dusts, capable of propagating a reaction after ignition.

Explosion hazardous area

An explosion hazardous area is a location where a potentially explosive atmosphere may exist due to local operating conditions.

Explosion hazard

An explosion hazard exists in locations:

- in which a flammable substance can exist under normal operating or fault conditions, and in a form that can create a flammable mixture in which the concentration of the substance is high enough to form an explosive mixture;

- where the explosive or ignitable mixtures can come in contact with a source of ignition and continue to burn after ignition.

Explosion protection, primary

The primary method of explosion protection comprises measures which prevent formation of a dangerous atmosphere:

- avoiding the use of flammable liquids
- increasing the flash point
- limiting the concentration to safe levels
- by means of natural and technical ventilation
- monitoring the concentration

The primary method of protection is not described in this document. Please refer to the explosion protection regulations of the professional association of the chemical industry (Ex-RL) and the EN 1127-1.

Explosion protection, secondary

The secondary method of explosion protection comprises measures which prevent ignition of a dangerous atmosphere. For this purpose, design measures or electrical techniques are used so that:

- the electrical equipment can no longer form an effective ignition source and the combination of ignition source and explosive atmosphere is prevented.

the propagation of combustion to the surrounding explosive atmosphere is prevented

I

.Intrinsic safety - explosion protection type (i) [EN 50020]

All other protection types except “intrinsic safety” attempt to contain the explosion to the inside of the housing and to prevent penetration of an ignitable gaseous mixture.
The method of “intrinsic safety” is based on a different approach. It limits the electrical energy of a circuit to such an extent, that excessive temperatures cannot occur, or arcs and sparks are incapable of generating the energy needed to ignite an explosive atmosphere.
Due to the limited energy, these circuits are mainly suited to applications in the field of measuring, control and instrumentation. “Intrinsic safety” has some inherent advantages over other protection types. For example, the wiring and maintenance of live circuits.

Intrinsically safe electrical equipment

Intrinsically safe electrical equipment is any apparatus in which all circuits are intrinsically safe. Direct installation in hazardous locations is permitted, provided that all related requirements are met. An example is a NAMUR sensor approved according to EN 50227 or a transmitter.

Increased safety - protection type (e) [EN 50019]

Protection type (e) applies to electrical equipment or components of electrical equipment which do not generate sparks or arcs under normal conditions, do not adopt excessive temperatures and whose nominal voltage does not exceed the value of 1 kV.

T

Temperature classes

The temperature class specifies the maximum permissible surface temperature of an apparatus. In this case, the explosion protected apparatus can be approved for different temperature classes - a decision which depends on technical and financial considerations. The lowest possible temperature classification is therefore mostly achieved with relatively extensive technical measures and correspondingly high expenditure, depending on the type of protection. "Intrinsically safe" products are comparably more efficient and cheaper. Only intrinsically safe equipment, that is directly installed in explosion hazardous areas, requires temperature classification. For associated equipment this classification is not needed.

V

Verification of intrinsic safety

According to EN60079-14 intrinsic safety must be documented and confirmed when interconnecting intrinsically safe apparatus and associated equipment.

Z

Zone 0

Zone 0 comprises locations in which a dangerous explosive atmosphere is present continuously or frequently.
Probability of the occurrence of an ignitable mixture: constant, for long periods or frequently (guide value: >1000 h/a).

Zone 1

Zone 1 are locations in which an explosive or dangerous explosive atmosphere is likely to occur.
Probability of the occurrence of an ignitable mixture: occasionally during normal operation (guide value: 10...1000 h/a).

Zone 2

Zone 2 are locations in which an explosive or dangerous explosive atmosphere is likely to occur only rarely and for a short time.
Probability of the occurrence of an ignitable mixture: unlikely or rarely and then only for a short time (guide value: <10 h/a).

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