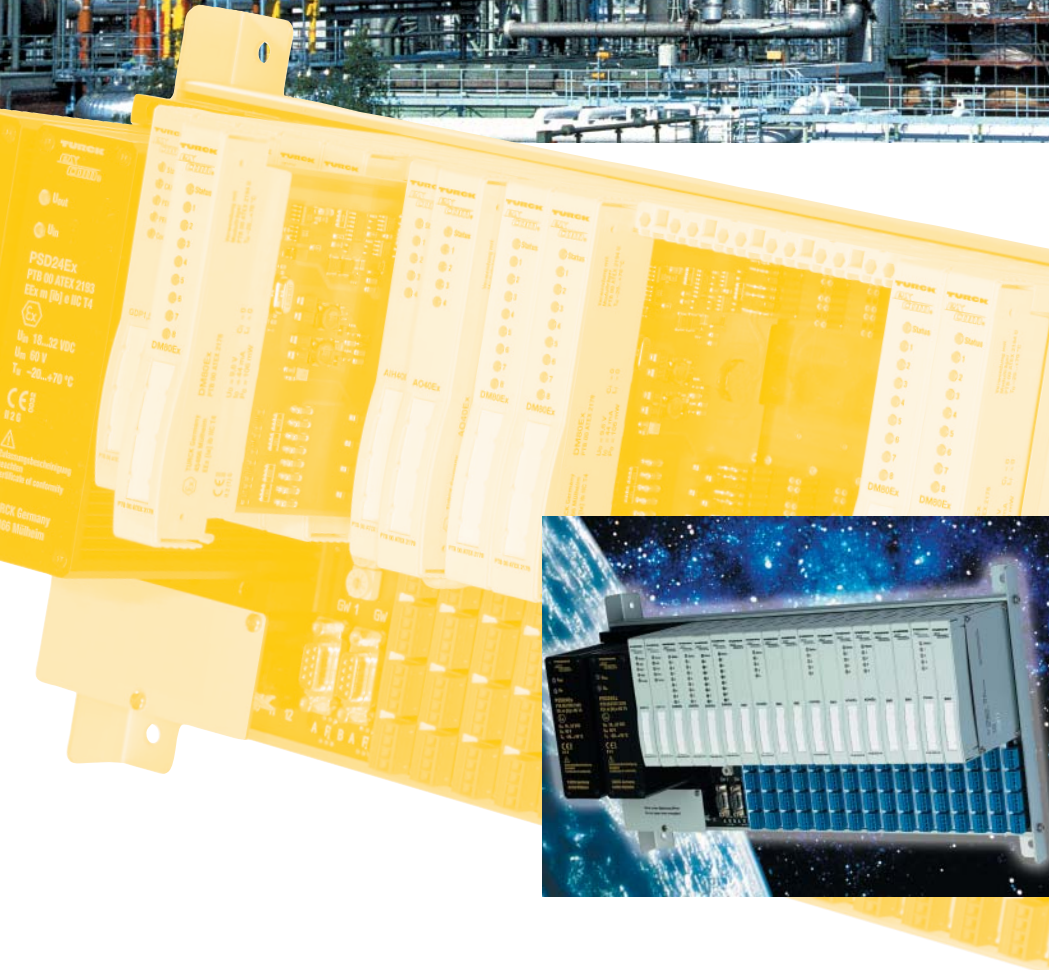
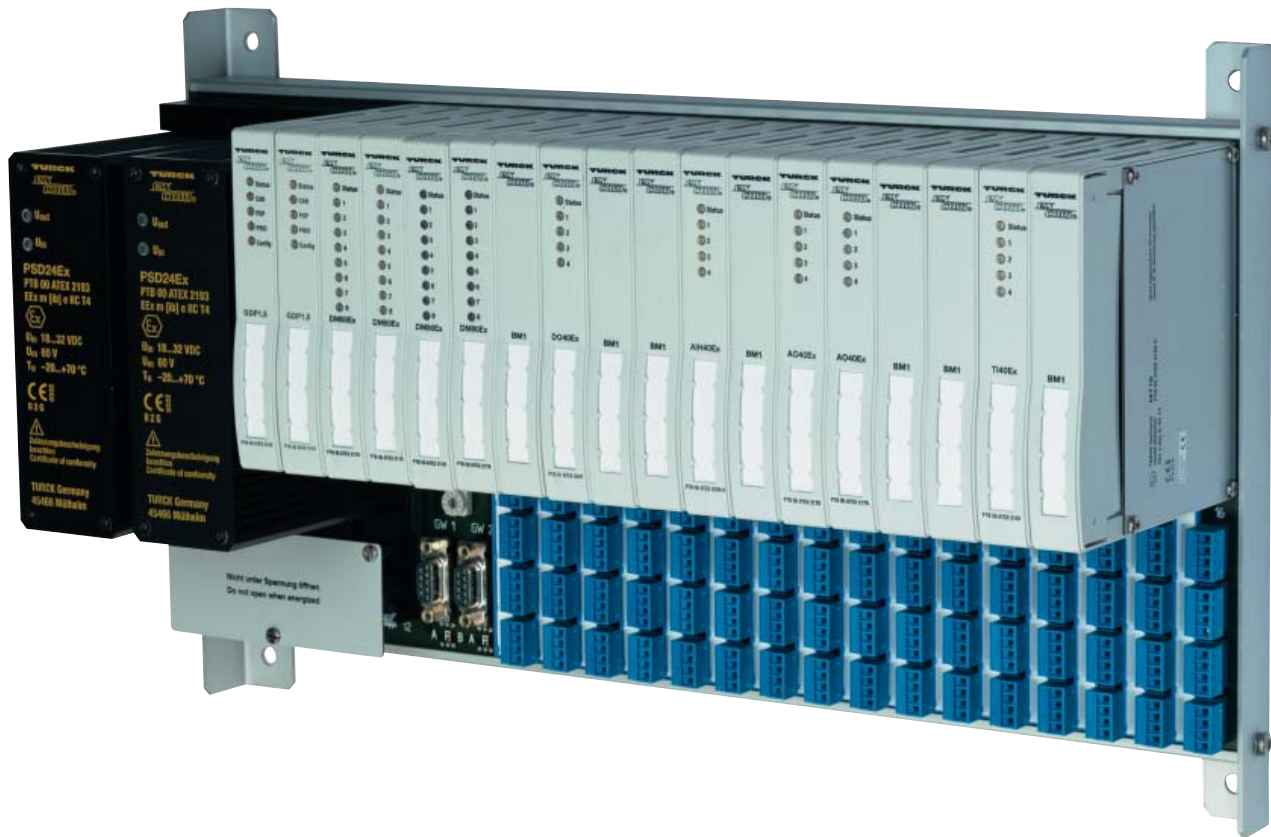


TURCK

Industrial Automation

REMOTE I/O *excom*[®]





- Intrinsically safe remote I/O system for use in zone 1 and zone 2
- Redundant power supplies and gateways
- Intrinsically safe connection to PROFIBUS-DP with V1 functionality
- Online programming and configuration of all parameters
- Consistent HART® parameterisation from the process control system to the field device
- Temperature range from -20...+60 °C
- Exchange and extension of all components during operation
- Simple manual insertion and removal of modules without tools
- 128 binary or 64 analogue intrinsically safe channels via a single bus address
- "Forcing" and substitute value programming of analogue and binary I/O

Intrinsically Safe Remote I/O System

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excom® – System Overview

	Device Feature						Short Description
	Type	Page	Input type	Output type	Number of inputs/ outputs	Galvanic isolation between channels	Device type
Device Spectrum	GDP1,5	12	–	–	–	–	Gateway – PROFIBUS-DP interface
	DM80Ex	14	NAMUR	binary	8I/O	–	8-channel digital input/output module
	DF20Ex	16	NAMUR	–	2I	–	2-channel frequency module
	DI40Ex	18	NAMUR	–	4I	•	4-channel digital input module
	DO40Ex	20	–	binary	4O	•	4-channel digital output module
	AI40Ex	22	analogue ¹⁾	–	4I	•	4-channel analogue input module
	AI41Ex	24	analogue ²⁾	–	4I	•	4-channel analogue input module
	AO40Ex	26	–	analogue	4O	•	4-channel analogue output module
	AIH40Ex	28	analogue ¹⁾	–	4I	–	4-channel analogue input module, HART®
	AIH41Ex	30	analogue ²⁾	–	4I	–	4-channel analogue input module, HART®
	AOH40Ex	34	–	analogue	4O	–	4-channel analogue output module, HART®
	TI40Ex	36	analogue	–	4I	•	4-channel input module for temperature sensors
	MT18/9-...024, MT18-C230	38	–	–	–	–	module rack for 16/8 modules
	PSD24Ex	40	–	–	–	–	24 VDC power supply unit
	PPSA230Ex	42	–	–	–	–	230 VAC/DC converter
	PPSA115Ex	42	–	–	–	–	115 VAC/DC converter

¹⁾ current sourcing (active)

²⁾ current sinking (passive)

System Overview

excom® is a remote I/O system for use in potentially explosion hazardous locations. It provides bus-compatible, decentralised input and output modules in protection degree IP20 for connection of binary and analogue intrinsically safe field devices. The explosion protection type of the systems allows use in zones 1 and 2. The fieldbus circuits are approved for use in zone 0.

The system consists of power supplies, gateways, I/O modules and a module rack to accommodate all components. The backplane is integrated into the module rack. The backplane serves to distribute energy, to transmit data and to connect field devices. The power supply units ensure reliable supply of the entire system. A single power supply is sufficient for correct system operation. In order to enhance system availability, it is possible to connect a second supply unit (redundancy) when using the module rack type MT18....

The gateways fulfil both master and slave functions: as a master they control the internal data bus and as a slave they communicate with the higher level fieldbus. The gateways control the entire data communication between an I/O module and the process control system (PLC). Redundancy of gateways is also possible when using the module rack MT18-...024, thus increasing availability and fail-safety of the system.

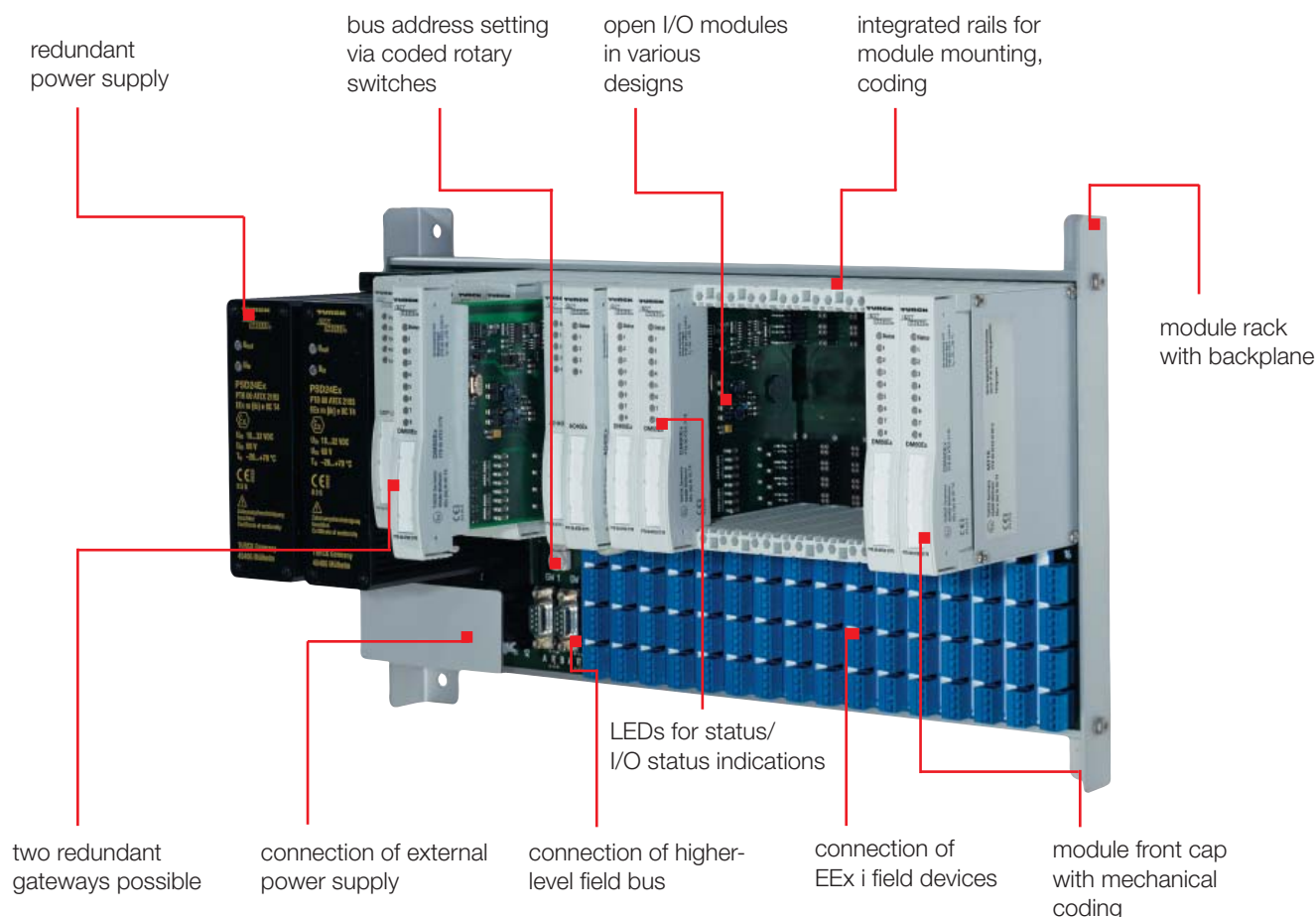
The I/O modules are the interface to the periphery. The inputs and outputs serve to connect field devices in protection type EEx ia IIC. Up to 16 I/O modules may be operated in conjunction with a single module rack. The backplane provides the intrinsically safe supply of the I/O modules - an additional power supply is not needed. Connection of modules is easily accomplished: gateways, power supplies and I/O modules are simply plugged into the rack.

After establishing the internal connections, the field components are connected.

Modules can be plugged into and removed from the rack during operation (hot swapping). Defect devices can be exchanged during operation. The system automatically checks whether the new module accords to the defined slot assignment. The system supports substitute value programming.

The internal cycle time of a fully assembled system is below 5 ms for binary processing and below 20 ms for analogue signals. The response time also depends on the type of PLC and fieldbus used in the application. The system supports connection of HART®-compatible field devices. Consistent HART® communication up to the PLC is possible via the PROFIBUS-DPV1.

System Configuration



Required components for system assembly

In order to assemble a system, it is required to use at least the following components:

1 × MT9-...024	module rack without redundancy function
or MT18-...024	module rack with redundancy function
1 × PSD24Ex	24 VDC power supply unit
1 × GDP1,5	PROFIBUS-DP gateway 1.5 Mbaud
1 × RS485 I.S. coupler	I.S. coupler for Profibus

Binary or analogue input and output modules (depending on the kind of application) from our selection of *excom*® devices:

DM80Ex	binary input/output module for connection of NAMUR sensors and low voltage actuators
DF20Ex	binary input module for frequency measurements or as a counter module
DI40Ex	binary input module for connection of NAMUR sensors
DO40Ex	binary output module for connection of EEx i magnetic valves < 0.5 W
AI40Ex	analogue input module for connection of 2-wire transmitters
AI41Ex	analogue input module for connection of 4-wire transmitters
AO40Ex	analogue output module for connection of analogue actuators
AIH40Ex	analogue input module for connection of 2-wire transmitters with HART® functionality
AIH41Ex	analogue input module for connection of 4-wire transmitters with HART® functionality
AOH40Ex	analogue output module for connection of analogue actuators with HART® functionality
TI40Ex	analogue input module for connection of temperature detectors

PLC/SPC connection

***excom*® may be connected to all systems with PROFIBUS-DP interface (master functionality).**

In order to obtain access to the full function range it is required to use a master with PROFIBUS-DPV1 functionality.

Connections

Bus:

Depending on the kind of module rack, there are either one or two 9-pole D-SUB connectors (redundancy) for bus connection. An explosion proof bus connector (D-SUB connector) must be used, e.g. TURCK type D9T-Ex (see page 55). It is permitted to use copper cables conform to PROFIBUS-DP or fibre optics (with matching transducers, see pages 46 to 49). Due to the RS485 Ex-i layer, it is required to use a segment coupler (RS485 I.S. coupler see page 44) for mounting.

Power supply:

The module rack contains EEx e terminals for connection of the power supply.

Modules:

The modules are connected via two connectors (16 poles/12 poles) with the backplane.

Inputs/outputs:

The module rack contains four 4-pole connectors or cage clamp terminals for connection of field devices.



Attention:

It is indispensable to observe and follow the respective regulations of the various protection classes. The components may only be used in combination with the *excom*® system.

Diagnosis

The gateway provides extended PROFIBUS-DP diagnostics, i.e. the user is provided with the full range of diagnosis data including channel-specific error indications. Additionally, each module is equipped with LEDs for error indications directly in the field. Moreover, all I/O modules feature LEDs for input/output diagnosis and status indications. All LED indications accord to NAMUR NE 44 or DIN EN 60073, i.e.

green	=	operational readiness (power on/module function)
red	=	error
yellow	=	switching status of binary inputs/outputs

Further details are contained in the operation manual.

Addressing

The modules are addressed in accordance to the slot they are inserted in. Thus it is not necessary to carry out address settings on the modules.

A module inserted into slot 0 has the internal address 0, a module in slot 1 is assigned to address 1, ... a module in slot 16 has address 16.

Setting of the PROFIBUS-DP address is carried out via three coded rotary switches. The maximum address of a rack is therefore address 125. According to PROFIBUS-DP, the system is configured as a modular slave and therefore only the actually present I/O modules are assigned to addresses of the programmable logic control or the process control system.

Transmission rates/ Cycle times

The PROFIBUS-DP master determines the system-specific transmission rate. Admissible baud rates range from 9.6 to 1500 kBaud.

The internal cycle time for processing of 128 binary signals is below 5 ms and for 64 analogue signals below 20 ms. The cycle time of the higher-level bus and the process control system must be added to the response time of the entire system.

The general formula is:

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

T_R = response time

T_I = internal cycle time Ex link

T_B = cycle time of higher level bus

T_{PLS} = cycle time of the process control system.

Software/System files

Included in delivery
Device data base file (GSD-File)

Download from: **www.turck.com**

→ Headquarters

→ Download

→ Configuration

PROFIBUS-DP (structure)

Up to 126 stations with user data can be operated within a PROFIBUS network. However, the specific transmission characteristics limit the number of stations to 32. If more than 32 stations are to be operated within the network, it must be divided into several segments by installing repeaters and/or segment couplers. The specific task of a repeater is to segment the network, but it can also be used to extend the network by connecting several repeaters in series. The maximum number of series-connected repeaters depends on the manufacturer's technical specifications.

When using a segment coupler, the physical bus characteristics are limited to intrinsically safe electrical values.

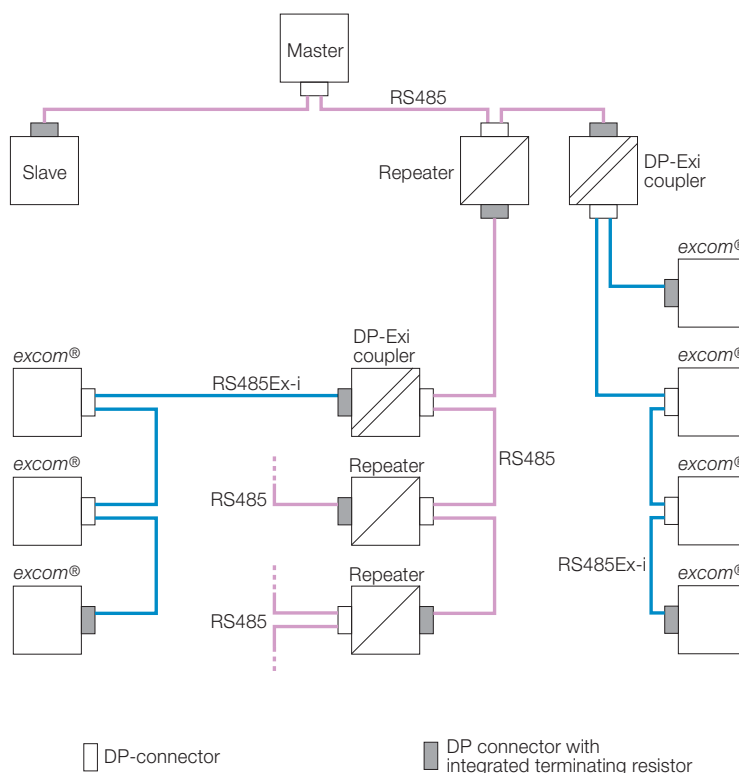
The maximum number of stations in an RS485-Ex i segment is 16. The network expansion accords to that of a non-safe network. Since it is permitted to operate the *excom*® system in zone 1 and to disconnect the gateway from the bus during operation, the RS485-Ex i layer is applied. Due to the special characteristics of the RS485-Ex i layer, *excom*® may only be operated with this type of segment coupler.

Segment couplers and repeaters require a physical address on the bus because of their emitter/receiver circuitry and must therefore be counted to the number of stations within the segment.

Baud rate	Bus Segment (Length of bus line)
9,6 kbps	1200 m
19,2 kbps	1200 m
93,75 kbps	1200 m
187,5 kbps	1000 m
500 kbps	400 m
1,5 Mbps	200 m

Tab.: Maximum line lengths and various transmission speeds according to EN 50170-2 when using type A cables.

Model system structure



Installation guidelines

excom® is a remote I/O system for installation in explosion hazardous areas, zone 1.

The connection to the SPC or PLC is carried out via PROFIBUS-DP. When using copper cables it is required to use an approved segment coupler. The use of fibre-optics (together with a corresponding transformer) is also permitted. If redundancy is needed, it is possible to install two gateways (module rack MT18... only). These may be exchanged during operation.

The external power supply is connected via EEx e terminals (increased safety) located on the module rack and fed to the 24 VDC power supply modules. Please observe the standard safety regulations for all terminal connections. It is permitted to exchange the power supply modules in zone 1 during operation.

If redundancy is required, two power supply units may be employed, provided module rack MT18... is used.

The 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 secure galvanic isolation. As a result, the modules, sensors and actuators may be exchanged during operation (hot-swapping).

If the system is to be installed in zone 1, appropriate field enclosures must be used (see page 52). The customer is responsible for safe field enclosure in accordance to the requirements of EN 50014 and in compliance with the respective operation manuals. Alternatively, factory-assembled systems in special field housing can be ordered from the manufacturer to ensure that protection type IP54 is fulfilled.

All modules, the gateway to the higher level fieldbus, and the power supply feature separate approvals. They may only be used in conjunction with the module rack.

Configuration and parameterisation via DTM

The *excom®* DTM is both device driver and commissioning tool. If the DTM is used in the engineering tool, it can be used for the configuration and parameterisation of the *excom®* systems. In stand-alone tools such as PACTware™ it is used for commissioning and monitoring. It is based on FDT specification 1.2.1.

Structure of the *excom®* DTM

The *excom®* DTM has a modular design. Every *excom®* module is assigned to a separate DTM. The PACTware™ project in Fig. 1 shows the essential components.

The *excom®* DTM Setup contains all the necessary DTMs for configuration and operation. After installation, these DTMs can be accessed via the frame application. In the configuration, access to PROFIBUS-DP is provided via the communication DTM “*excom DP*”. This also has a gateway function for the integration of the *excom®* modules. The module DTMs are available in two categories: device DTMs and gateway DTMs. All modules that do not implement any other communication to the connected field devices are declared as device DTMs. Modules can also contain a gateway function. These are *excom®* modules with integrated HART® functionality. They feature a HART® master functionality that enables the establishment of bidirectional HART® communication between the module and the connected field devices. This therefore enables HART® instrumentation to be parameterised via *excom®* from a central location.

Operation

A parameter view is provided for every *excom®* module. Each view shows the module-specific settings for each channel. An incorrect parameter setting (as possible with the GSD file based configuration) is not possible here since a plausibility check is directly performed on each entry (see Fig. 2).

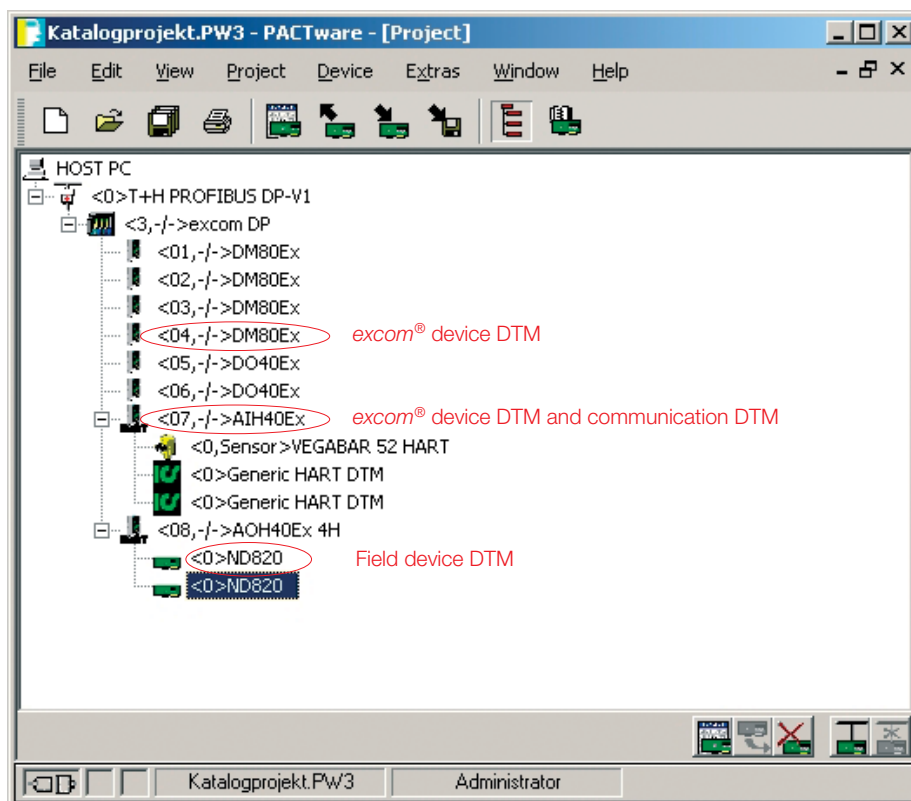


Fig. 1: *excom®* DTM – Elements of a PACTware™ project

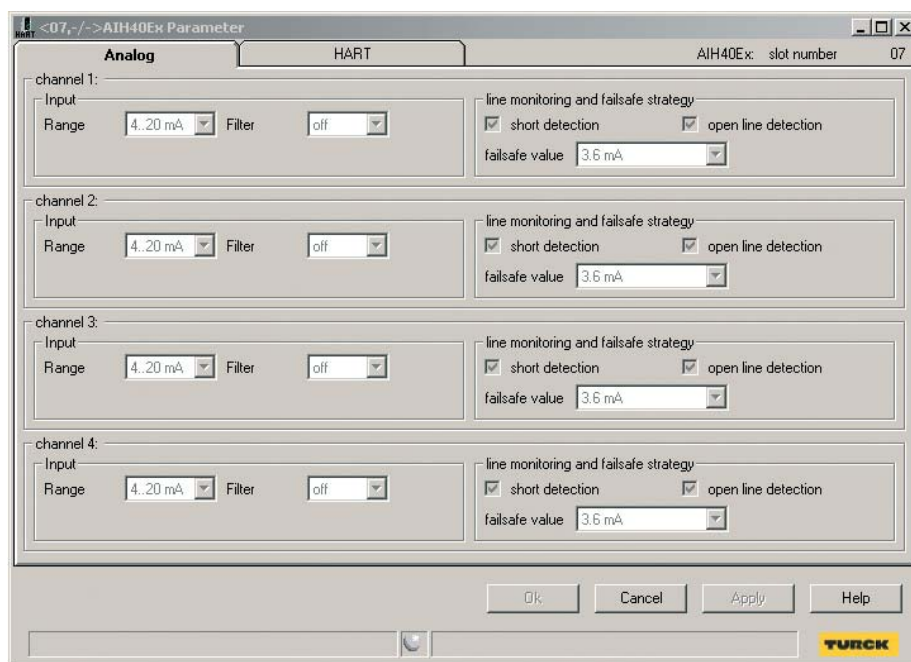


Fig. 2: Dialog window – Parameter view

Monitoring

Each DTM provides a view of the I/O level for visualising the peripheral devices and for displaying the actual process data. The status also provides information on the validity of the data. The data is shown as a bar display, value window or illuminated display (see Fig. 3).

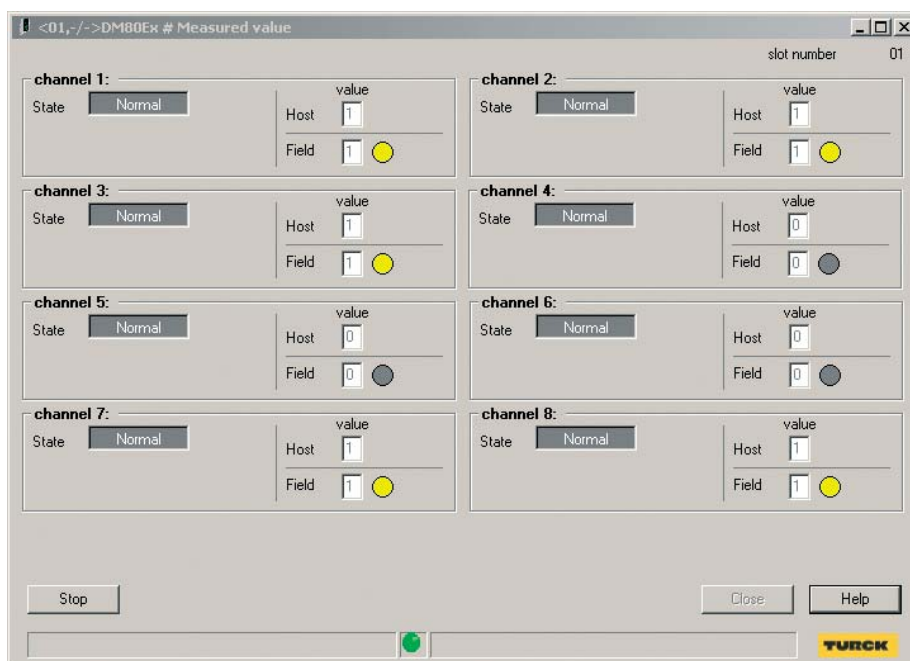


Fig. 3: View of the I/O level – Status and process data

Simulation

The Simulation dialog window considerably simplifies commissioning of excom®, including the peripheral devices used. Input data can be overwritten in order, for example, to simulate benchmark values for the field instrumentation. The actuators can be switched to the required status by means of the output data. Analogue values as shown in Fig. 4 are displayed as a percentage value or in mA. The simulation value for display can be set by means of a slider or as a numerical value.

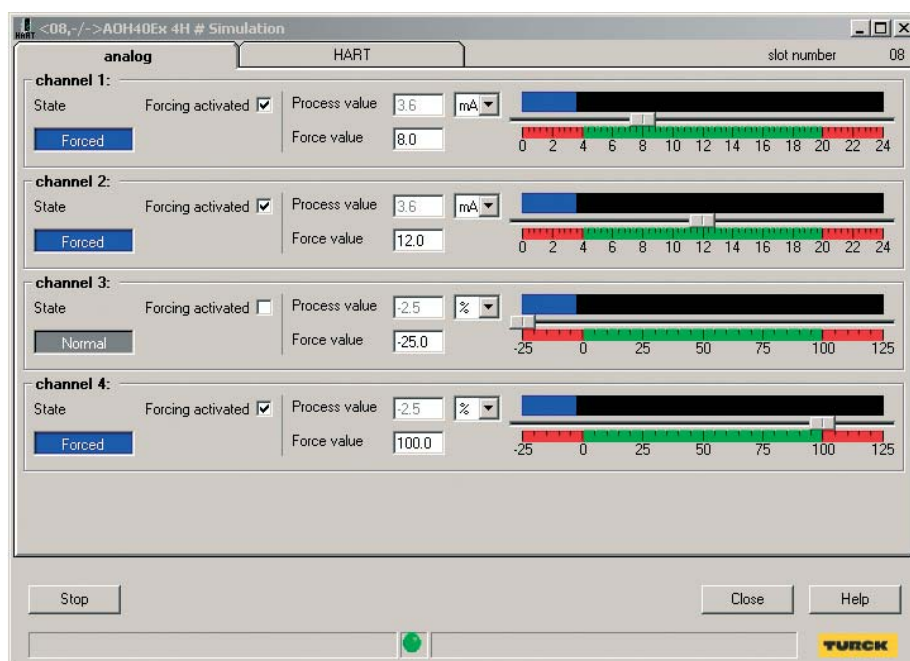


Fig. 4: Dialog window – Simulation of analogue values

Diagnostics and identification

Two other useful views are provided for diagnostics and identification. The diagnostics view shows the channel errors of the peripheral devices. In the event of a fault, this is indicated in plain text with the channel number. The associated terminals are marked in red (see Fig. 5).

The identification view (see Fig. 6) supplies the data required for managing the system such as:

- Device type
- Order number
- Lot code
- Revision levels
- And other device information.

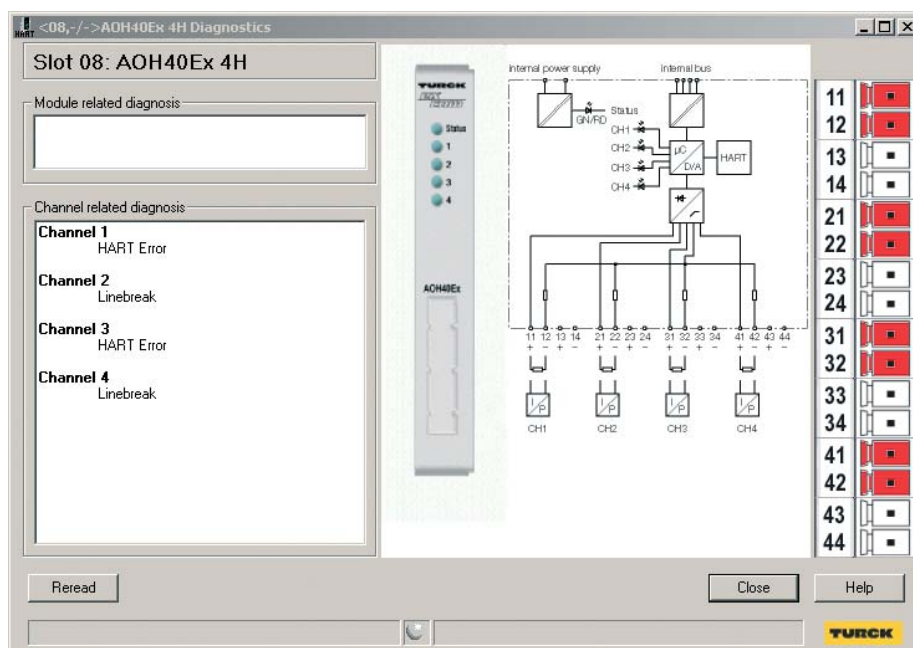


Fig. 5: Diagnostics view

Licensing

The excom® DTM is available in three license versions: **Demo mode**, **Standard** and **Professional**.

The **Demo mode** is available free of charge and can be downloaded from www.turck.com. The DTM is fully functional, including the HART® communication. It is permanently assigned to a PROFIBUS address defined during the installation. Only one demo DTM can therefore be implemented in a project.

The **Standard** DTM should be used for applications in which individual components of the installation have to be modified or reconfigured occasionally. Like the Demo DTM, the Standard DTM is also restricted to one station address, however, this can be selected in a project as required.

The **Professional** license version is the full version and therefore allows an unrestricted number of station addresses. Both the Standard version and the Professional version are restricted to one computer.

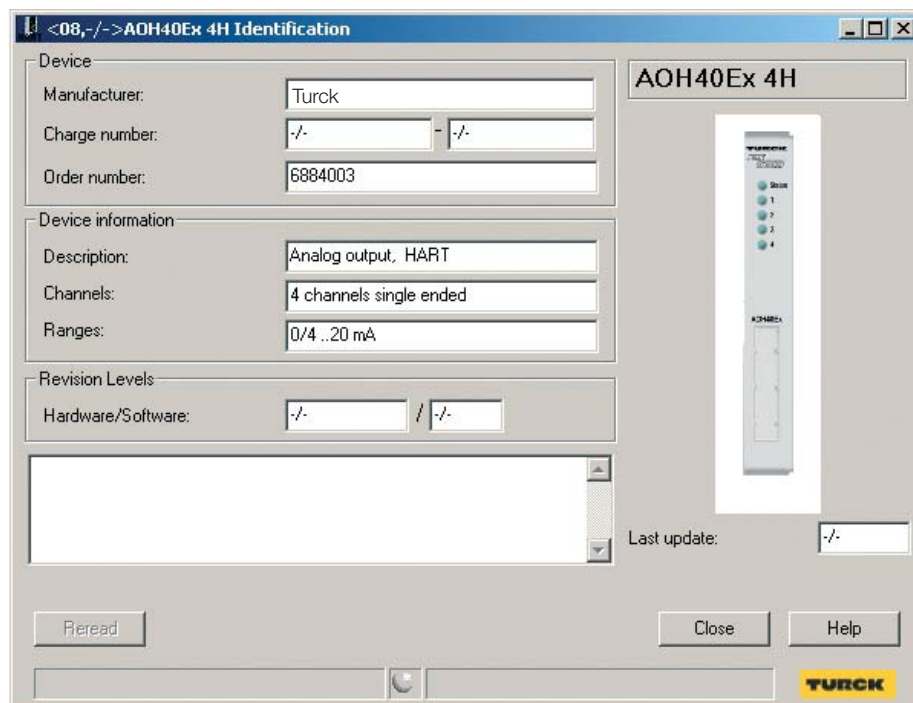


Fig. 6: Identification view



The GDP1,5 serves to connect the ex-com® system to PROFIBUS-DP networks. Connections to the PROFIBUS-DP can be established via fibre optics (additional module, see pages 46 to 49) or copper cables. When using copper cables it is required to use a segment coupler (RS485 I.S. coupler, see page 44) on the PROFIBUS-DP side to ensure explosion protection.

The gateway may be configured for a maximum transmission rate of 1500 kBaud. The bus is connected via a standard miniature D-SUB connector on the module rack.

A device data base file (DDBF) for system configuration is available. This file contains all configuration files and parameter sets needed by the system. When connected to certain host systems, it is possible to alter the system configuration during operation.

The gateway provides the entire range of PROFIBUS diagnostic functions including channel-related diagnosis. Additional manufacturer-specific error codes are generated, e.g. HART® communication errors, power supply errors, configuration errors as well as information on simulators, internal communication and redundancy status.

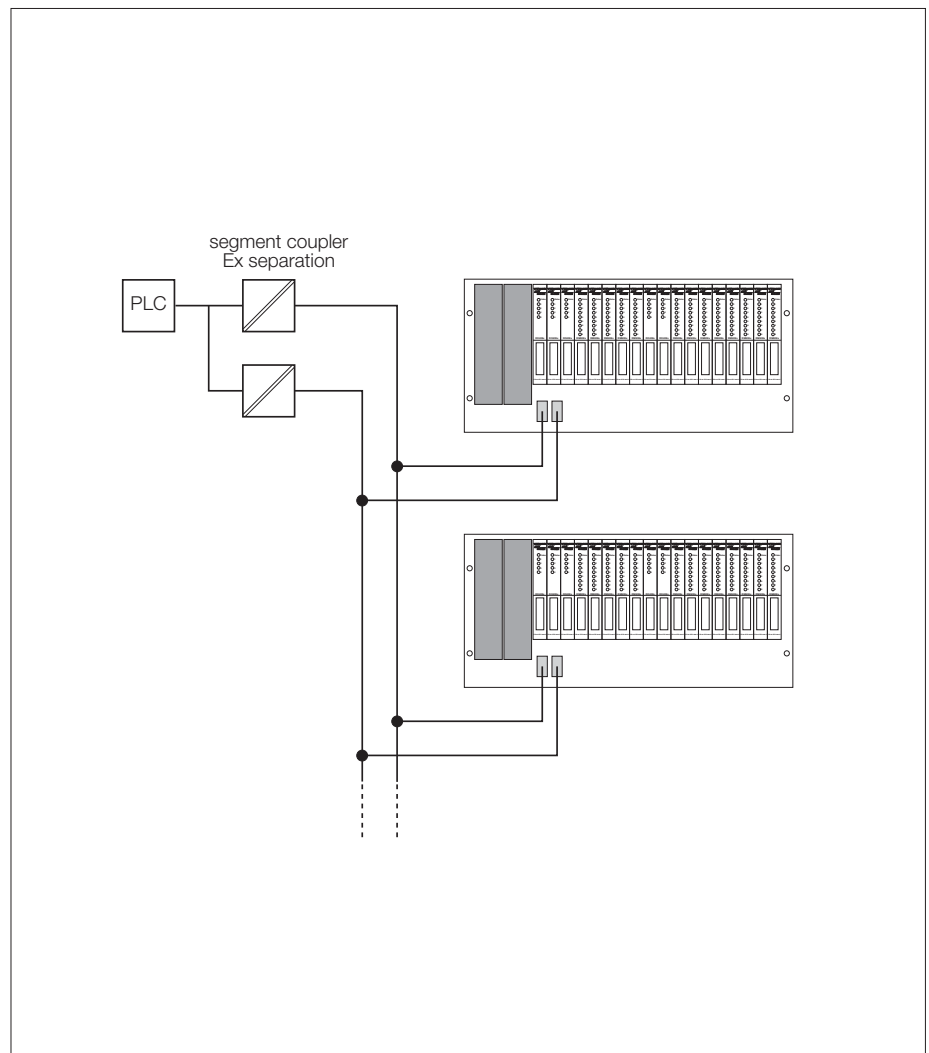
Redundancy: The use of two gateways and two bus lines ensures error-free and continuous communication in case of the failure of one of the gateways or bus lines. If one of the components fails, the other immediately takes over (module rack MT18... only), this is called line redundancy. System redundancy (two masters, each with their own segment coupler connected to a gateway) is also supported.

GDP1,5

- Intrinsically safe gateway for PROFIBUS-DPV1
- Redundant configuration possible
- Up to 16 I/O modules per gateway
- Cycle times:
 - < 5 ms (binary)
 - < 20 ms (analogue)
- LED indications for
 - operational readiness
 - CAN
 - PROFIBUS-DP communication
 - redundancy stand-by
 - configuration errors

Connections

- PROFIBUS-DP via D-SUB connectors on module rack
- Recommended connector D9T-Ex, ident-no.: 6890938



Gateway GDP1,5 PROFIBUS-DP interface

Type	GDP1,5
Ident-no.	6884008
Power supply	from central power supply via module rack
Internal power consumption	< 3 W
Connections	
PROFIBUS-DP	9-pole D-SUB connector on module rack
Supply	via connectors on module rack
Ex Approval	PTB 00 ATEX 2162
Marking	II 2 G SYST EEx ib IIC T4
RS485 field bus connection (terminal pair)	
Protection type	EEx ib IIC/IIB
Maximum 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
LED indications	
Power on	1 x green/red (dual colour LED)
CAN	1 x yellow
PROFIBUS-DP communication	1 x yellow
Redundancy stand-by	1 x yellow
Configuration error	1 x red
General data	
Galvanic isolation	to PROFIBUS-DP acc. to EN 50020 ($U_m = 60$ V)
Degree of protection	IP20
Operating temperature	-20...+60 °C
Relative humidity	95 % at 55 °C according to EN 60068-2
Vibration and shock testing	according to IEC 68-2-6 und IEC 68-2-27
External RS485 field bus system:	
Protection type	SYST EEx ib IIC/IIB
Maximum values per terminal pair:	
– U_i	4.2 V
Accumulated max. value of terminal pairs:	
– I_i	2.66 A
Cables: cable type A or B to EN 50039	
– L'/R':	$\leq 28.5 \mu\text{H}/\Omega$ / $\leq 15 \mu\text{H}/\Omega$ / (loop resistance)
– C':	$\leq 250 \text{ nF}/\text{km}$
Litz wire diameter	$\geq 0.2 \text{ mm}$
	lumped inductances and capacitances within the fieldbus system are not admissible



The DM80Ex is designed for connection of NAMUR sensors (EN 60947-5-6) and actuators. If mechanical contacts are connected when wire-break and short-circuit monitoring is activated, it is required to integrate a resistor circuitry (WM1, ident-no. 0912101).

The module features protection type EEx ib II C and can thus be used in combination with excom® in explosion hazardous locations, zone 1. The inputs/outputs feature protection type EEx ia IIC.

When connecting field devices, please observe that all inputs/outputs feature a common potential.

The input and output performance is programmed via the PROFIBUS master. Possible parameters are: switching performance, input delay, substitute values, wire-break and short-circuit monitoring.

User-defined input/output configuration of the connection points is also possible.

The following arrangements are permitted: 8 inputs/0 outputs, 6 inputs /2 outputs ..., 0 inputs/8 outputs (see device data base file, mode 2).

Therefore the system can be adjusted optimally to specific application needs.

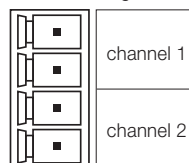
DM80Ex

- Input/output module for NAMUR sensors and actuators
- Protection type of field circuits: EEx ia IIC
- For connection of up to 8 proximity switches according to NAMUR or mechanical contacts
- For connection of up to 8 low power consumers (low-power valves)
- Short-circuit and wire-break detection
- Galvanic isolation between input and output block, bus and power supply
- All inputs/outputs on one common plus potential, i.e. no galvanic isolation between channels
- Configurable input or output function for groups of two channels

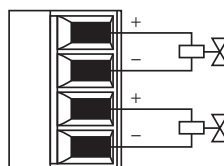
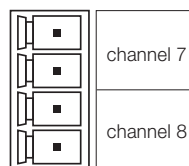
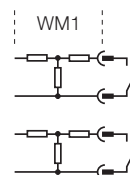
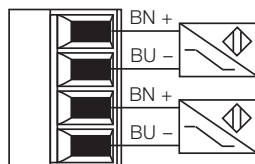
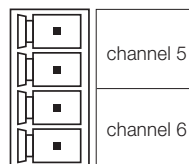
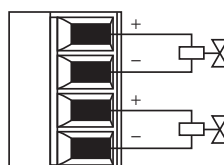
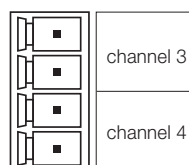
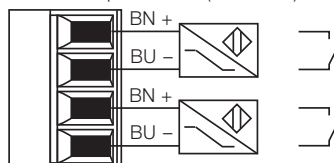
Connections

- Inputs and outputs via connections on module rack

terminal configuration



connection possibilities (selectable)



Input/output module

DM80Ex

8 inputs/outputs for NAMUR sensors/actuators

Type	DM80Ex																	
Ident-no.	6884006																	
Power supply	from central power supply via module rack																	
Internal power consumption	< 1.5 W																	
Inputs	8 sensors acc. to NAMUR (EN 60947-5-6)																	
No-load voltage	8 VDC																	
Short-circuit current	approx. 4 mA per input																	
Switch-on/off threshold	1.8 mA/1.4 mA																	
Switching frequency	< 100 Hz																	
Short-circuit	$R_a < 367 \Omega$																	
Wire-break	< 0.2 mA																	
Outputs	8 actuators																	
No-load voltage	8 VDC																	
Nominal current	approx. 4 mA per output																	
Internal resistance	320 Ω																	
Switching frequency	< 100 Hz																	
Short-circuit	$R_a < 367 \Omega$																	
Wire-break	< 0.2 mA																	
Ex Approval	PTB 00 ATEX 2178																	
Marking	II 2 (1GD) G EEx ib [ia] IIC T4																	
Max. Ex values (fieldbus circuits)	EEx ia IIC/IIB																	
No-load voltage U_0	$\leq 9.6 \text{ V}$																	
Short-circuit current I_0	$\leq 44 \text{ mA}$																	
Max. power P_0	$\leq 106 \text{ mW}$																	
Typical curve	linear																	
Max. internal capacitances L_i	negligible																	
Max. internal capacitances C_i	negligible																	
Max. external capacitances L_0	<table><tr><th rowspan="2">$L_0 \text{ (mH)}$</th><th colspan="2">$C_0 \text{ (}\mu\text{F)}$</th></tr><tr><th>IIC</th><th>IIB</th></tr><tr><td>2</td><td>0.9</td><td>5.1</td></tr><tr><td>1</td><td>1.1</td><td>6.1</td></tr><tr><td>0.5</td><td>1.3</td><td>7.3</td></tr><tr><td>0.2</td><td>1.7</td><td>8.6</td></tr></table>	$L_0 \text{ (mH)}$	$C_0 \text{ (}\mu\text{F)}$		IIC	IIB	2	0.9	5.1	1	1.1	6.1	0.5	1.3	7.3	0.2	1.7	8.6
$L_0 \text{ (mH)}$			$C_0 \text{ (}\mu\text{F)}$															
		IIC	IIB															
2		0.9	5.1															
1		1.1	6.1															
0.5	1.3	7.3																
0.2	1.7	8.6																
Max. external capacitances C_0																		
Parameterisation/configuration																		
Bounce time	0, 10, 20, 50 ms, for groups of two channels																	
Inputs/outputs	for groups of two channels																	
Wire-break monitoring	for groups of two channels																	
Short-circuit monitoring	for groups of two channels																	
Function mode	inputs separately programmable for groups of two channels																	
Substitute value programming	for groups of two channels																	
LED indications																		
Power on/module function	1 x green/red (dual colour LED)																	
Input/output status	8 x yellow/red (dual colour LED)																	
General data																		
Galvanic isolation	to bus and to supply																	
Degree of protection	IP20																	
Operating temperature	-20...+60 °C																	
Relative humidity	95 % at 55 °C according to EN 60068-2																	
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27																	



The input module DF20Ex is equipped with eight channels according to NAMUR which are divided into two blocks. Per block there are one frequency input and three control inputs/outputs.

The module features protection type EEx ib II C and can thus be used in combination with *excom®* in explosion hazardous locations, zone 1. When connecting field devices, please observe that all inputs/outputs feature a common potential. The inputs/outputs feature protection type EEx ia IIC.

The module can be used as counter or frequency input module and is thus suited for pulse counting of binary input signals or frequency measurements of binary pulse sequences of NAMUR sensors.

The counting direction can either be set externally via the control input or parameterised internally.

The maximum frequency of one block is 4 kHz; with 2 blocks the maximum frequency is reduced to 2 kHz.

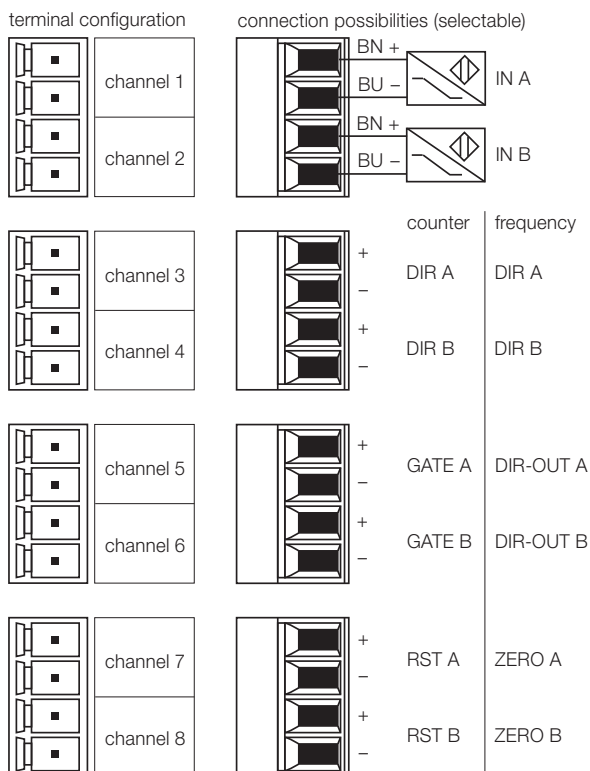
The input and output performance is programmed via the PROFIBUS master. Each channel is equipped with a parameterisable wire-break and short-circuit monitoring function.

DF20Ex

- Intrinsically safe frequency module for connection of intrinsically safe NAMUR sensors
- Protection type of field circuits: EEx ia IIC
- Operating modes: counter and frequency input
- Control inputs for direction detection, usable as a reset or enable input
- Short-circuit and wire-break detection per channel
- Galvanic isolation between input and output block, bus and power supply
- All inputs/outputs on common plus potential, i.e. no galvanic isolation between channels

Connections

- Inputs and outputs via connections on module rack



Input module

DF20Ex

2 inputs for frequency generators

Type	DF20Ex																	
Ident-no.	6884061																	
Power supply	from central power supply via module rack																	
Internal current consumption	< 1.5 W																	
Inputs/Outputs	8 channels according to NAMUR (EN 60947-5-6)																	
No-load votlage	8 VDC																	
Short-circuit current/nominal current	approx. 4 mA per channel																	
Switch-on/off threshold	1.8 mA/1.4 mA																	
Internal channel resistance	320 Ω																	
Min switching frequency	> 0.1 Hz																	
Max. switching frequency	< 4 kHz/2 kHz																	
Short-circuit	R _a < 367 Ω																	
Wire-break	< 0.2 mA																	
Ex Approval	PTB 00 ATEX 2178																	
Marking	II 2 (1GD) G EEx ib [ia] IIC T4																	
Max. Ex values (fieldbus circuits)	EEx ia IIC/IIB																	
No-load votlage U ₀	≤ 9.6 V																	
Short-circuit current I ₀	≤ 44 mA																	
Max. power P ₀	≤ 106 mW																	
Typical curve	linear																	
Max. internal capacitances L _i	negligible																	
Max. internal capacitances C _i	negligible																	
Max. external capacitances L ₀	<table><tr><th rowspan="2">L₀ (mH)</th><th colspan="2">C₀ (μF)</th></tr><tr><th>IIC</th><th>IIB</th></tr><tr><td>2</td><td>0.9</td><td>5.1</td></tr><tr><td>1</td><td>1.1</td><td>6.1</td></tr><tr><td>0,5</td><td>1.3</td><td>7.3</td></tr><tr><td>0,2</td><td>1.7</td><td>8.6</td></tr></table>	L ₀ (mH)	C ₀ (μF)		IIC	IIB	2	0.9	5.1	1	1.1	6.1	0,5	1.3	7.3	0,2	1.7	8.6
L ₀ (mH)			C ₀ (μF)															
		IIC	IIB															
2		0.9	5.1															
1		1.1	6.1															
0,5	1.3	7.3																
0,2	1.7	8.6																
Max. external capacitances C ₀																		
Parametersation/configuration																		
Operating mode	counter or frequency input, per module																	
Wire-break monitoring	per channel																	
Short-circuit monitoring	per channel																	
Substitutue value programming	per block																	
Counting direction	per block																	
Direction detection	per block																	
Inversion	per channel																	
Damping of control signals	per block																	
Gate input	per block																	
Average forming	per block																	
Accuracy	per block																	
– Resolution	0.1% of actual measuring value with a peak time of 300 ms or 1% of actual measuring value with a peak time of 50 ms																	
LED indications																		
Power on/module function	1 x green/red (dual colour LED)																	
Input/output status	8 x yellow/red (dual colour LED)																	
General data																		
Galvanic isolation	to bus and to supply																	
Degree of protection	IP20																	
Operating temperature	-20...+60 °C																	
Relative humidity	95 % at 55 °C according to EN 60068-2																	
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27																	



The DI40Ex is designed for connection of sensors according to NAMUR (EN 60947-5-6) or mechanical contacts. If mechanical contacts are connected and wire-break and short-circuit monitoring is activated, it is required to implement an appropriate resistor circuitry (WM1, Ident-no. 0912101)

The module features protection type EEx ib II C and can thus be used in explosion hazardous locations, zone 1, in combination with the *excom*® system. The inputs feature protection type EEx ia IIC.

The inputs are galvanically isolated from each other.

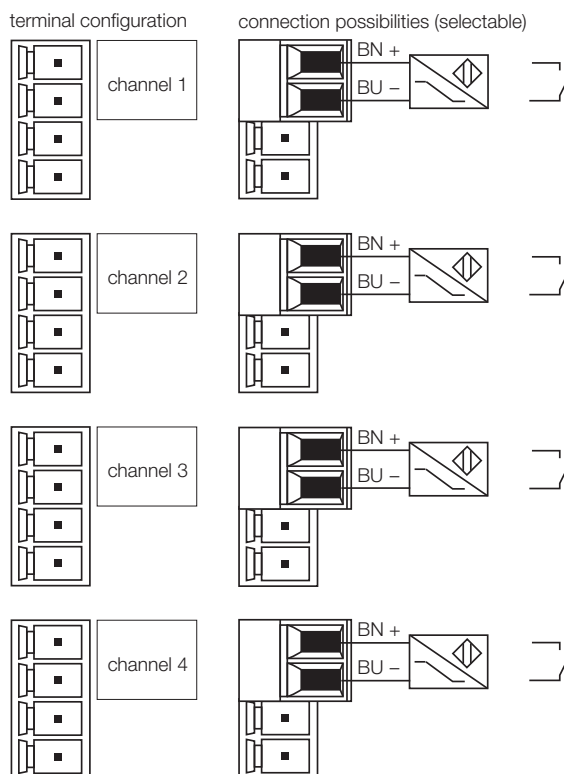
The input performance is programmed via the PROFIBUS master. Possible parameters are: switching performance, input delay, substitute values, wire-break and short-circuit monitoring.

DI40Ex

- Input module for connection of intrinsically safe sensors
- Protection type of field circuits: EEx ia IIC
- For connection of up to four proximity switches according to NAMUR or mechanical contacts
- Wire-break and short-circuit monitoring
- Galvanic isolation between input, bus and power supply
- Galvanic isolation between channels

Connections

- Inputs via connections on module rack



Input module

DI40Ex

4 inputs for NAMUR sensors

Type	DI40Ex												
Ident-no.	6884004												
Power supply	from central power supply via module rack												
Internal power consumption	< 2 W												
Inputs	4 sensors acc. to NAMUR (EN 60947-5-6)												
No-load voltage	8 VDC												
Short-circuit current	approx. 4 mA per input												
Switch-on/off threshold	1.8 mA/1.3 mA												
Switching frequency (binary input)	< 50 Hz												
Short-circuit	$R_a < 367 \Omega$												
Wire-break	< 0.1 mA												
Ex approval	PTB 02 ATEX 2032												
Marking	II 2 (1GD) G EEx ib [ia] IIC T4												
Max. Ex values (field circuits)	EEx ia IIC/IIB												
No-load voltage U_0	$\leq 8.7 \text{ V}$												
Short-circuit current I_0	$\leq 9.6 \text{ mA}$												
Max. power P_0	$\leq 21 \text{ mW}$												
Typical curve	linear												
Max. internal inductances L_i	negligible												
Max. internal capacitances C_i	$\leq 10 \text{ nF}$												
	<table><tr><td></td><td colspan="2">EEx ia and EEx ib</td></tr><tr><td></td><td>IIC</td><td>IIB</td></tr><tr><td>Max. external inductances L_0</td><td>2</td><td>5</td></tr><tr><td>Max. external capacitances C_0</td><td>1.2</td><td>5.2</td></tr></table>		EEx ia and EEx ib			IIC	IIB	Max. external inductances L_0	2	5	Max. external capacitances C_0	1.2	5.2
	EEx ia and EEx ib												
	IIC	IIB											
Max. external inductances L_0	2	5											
Max. external capacitances C_0	1.2	5.2											
Parameterisation/configuration													
Bounce time	0, 10, 20, 50 ms per channel												
Wire-break monitoring	per channel												
Short-circuit monitoring	per channel												
Function mode	per channel												
Substitute value programming	per channel												
LED indications													
Power on/module function	1 x green/red (dual colour LED)												
Input status	4 x yellow/red (dual colour LED)												
General data													
Galvanic isolation	complete channels												
Degree of protection	IP20												
Operating temperature	-20...+70 °C												
Relative humidity	95 % at 55 °C according to EN 60068-2												
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27												



The DO40Ex is designed for connection of intrinsically safe actuators.

The module features protection type EEx ia IIC and can thus be used in combination with excom® in explosion hazardous locations, zone 1. The protection type of the outputs is EEx ia IIC.

The outputs are galvanically isolated from each other.

One actuator per channel can be connected. By selection the connection, each channel has two intrinsically safe circuits with different Ex data.

The values of the solenoid drive are shown in the table on the right. The admissible limit values can be taken from the respective Ex approvals of the valve manufacturers.

The following variations are possible:

- 24 V/6 mA
- 18 V/25 mA
- 15 V/35 mA
- 12 V/45 mA

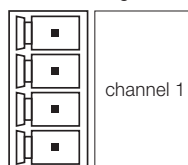
DO40Ex

- Output module for connection of intrinsically safe actuators
- Protection type of field circuits: EEx ia IIC
- For connection of up to four valves or displays
- Wire-break and short-circuit monitoring
- Galvanic isolation between output, bus and power supply
- Galvanic isolation between channels

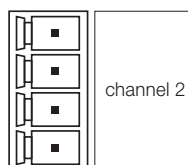
Connections

- Outputs via connections on module rack

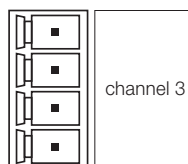
terminal configuration



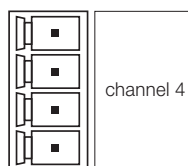
channel 1



channel 2

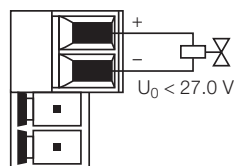
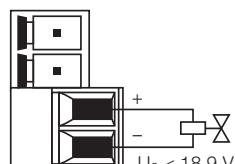
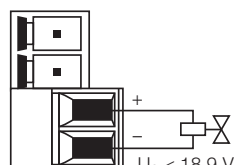
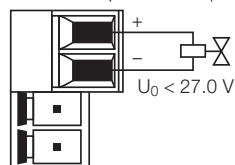


channel 3



channel 4

connection possibilities (selectable)



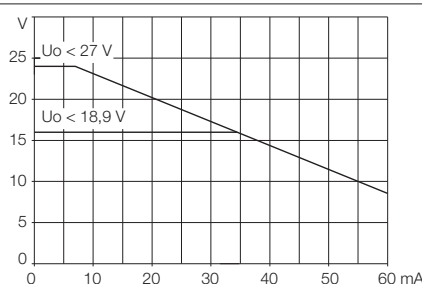
Output module

DO40Ex

4 outputs for actuators 10...24 VDC

Type	DO40Ex																																					
Ident-no.	6884007																																					
Power supply	from central power supply via module rack																																					
Internal power consumption	< 4.5 W																																					
Outputs	4 actuators	4 actuators																																				
No-load voltage	16 VDC	24 VDC																																				
Nominal current	15 V/35 mA; 12 V/45 mA	24V/6 mA; 18 V/25 mA																																				
Internal resistance	300 Ω	300 Ω																																				
Switching frequency	< 100 Hz	< 100 Hz																																				
Short-circuit (cyclic)	$R_a < 180 \Omega$	$R_a < 180 \Omega$																																				
Wire-break	< 1 mA	< 1 mA																																				
Ex Approval	PTB 01 ATEX 2047	PTB 01 ATEX 2047																																				
Marking	II 2 (1GD) G EEx ib [ia] IIC T4	II 2 (1GD) G EEx ib [ia] IIC T4																																				
Maximum Ex values (field circuits)	EEx ia IIC/IIB	EEx ia IIC/IIB																																				
Short-circuit current I_0	≤ 100 mA	≤ 100 mA																																				
No-load voltage U_0	≤ 18.9 V	≤ 27 V																																				
Max. power P_0	≤ 675 mW	≤ 675 mW																																				
Typical curve	trapezoidal	linear																																				
Max. internal inductances L_i	24 nF	24 nF																																				
Max. internal capacitances C_i	negligible	negligible																																				
Max. external inductances L_0																																						
Max. external capacitances C_0																																						
	<table border="1"> <thead> <tr> <th></th><th>IIC</th><th>IIB</th></tr> <tr> <th>L_0 (mH)</th><th>C_0 (nF)</th><th>C_0 (nF)</th></tr> </thead> <tbody> <tr> <td>2</td><td>–</td><td>976</td></tr> <tr> <td>1</td><td>86</td><td>976</td></tr> <tr> <td>0.5</td><td>106</td><td>976</td></tr> <tr> <td>0.2</td><td>156</td><td>1176</td></tr> </tbody> </table>		IIC	IIB	L_0 (mH)	C_0 (nF)	C_0 (nF)	2	–	976	1	86	976	0.5	106	976	0.2	156	1176	<table border="1"> <thead> <tr> <th></th><th>IIC</th><th>IIB</th></tr> <tr> <th>L_0 (mH)</th><th>C_0 (nF)</th><th>C_0 (nF)</th></tr> </thead> <tbody> <tr> <td>2</td><td>–</td><td>286</td></tr> <tr> <td>0.99</td><td>30</td><td>346</td></tr> <tr> <td>0.5</td><td>46</td><td>426</td></tr> <tr> <td>0.2</td><td>66</td><td>576</td></tr> </tbody> </table>		IIC	IIB	L_0 (mH)	C_0 (nF)	C_0 (nF)	2	–	286	0.99	30	346	0.5	46	426	0.2	66	576
	IIC	IIB																																				
L_0 (mH)	C_0 (nF)	C_0 (nF)																																				
2	–	976																																				
1	86	976																																				
0.5	106	976																																				
0.2	156	1176																																				
	IIC	IIB																																				
L_0 (mH)	C_0 (nF)	C_0 (nF)																																				
2	–	286																																				
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0.5	46	426																																				
0.2	66	576																																				
Parameterisation/Configuration																																						
Wire-break monitoring	per channel																																					
Short-circuit monitoring	per channel																																					
Substitute value programming	per channel																																					
Line of action	per channel																																					
LED indications																																						
Power on/module function	1 x green/red (dual colour LED)																																					
Output status	4 x yellow/red (dual colour LED)																																					
General data																																						
Galvanic isolation	complete isolation																																					
Degree of protection	IP20																																					
Operating temperature	-20...+60 °C																																					
Relative humidity	95 % at 55 °C according to EN 60068-2																																					
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27																																					

Load curve





The AI40Ex is designed to connect up to four 2-wire transducers (active input = source mode/transducer passive).

The module features protection type EEx ia IIC and can thus be used in combination with excom® in explosion hazardous locations, zone 1. The inputs feature protection type EEx ia IIC.

The inputs are galvanically isolated from each other.

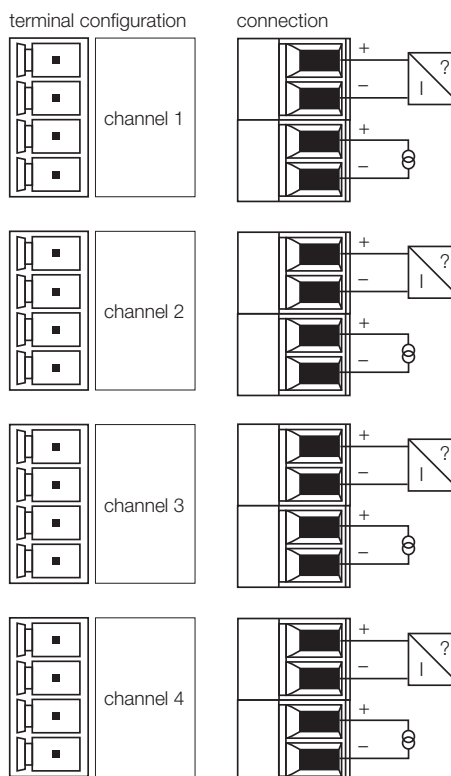
The resolution is 14 bits. To simplify data reproduction, 0...21 mA is then converted in the digitised value range of 0...21000 (irrespective of the measuring range parameters) and transferred to the host system.

AI40Ex

- Intrinsically safe analogue input module for connection of transducers
- Protection type of field circuits: EEx ia IIC
- For connection of up to four 2-wire transducers
- Wire-break and short-circuit monitoring
- Galvanic isolation between input block, bus and power supply

Connections

- Inputs via connections on module rack



Input module

AI40Ex

4 analogue inputs

Type	AI40Ex																			
Ident-no.	6884009																			
Power supply	from central power supply via module rack																			
Internal power consumption	< 3.5 W																			
Inputs	4 analogue sensors																			
Input voltage	> 15.0 VDC at 22 mA (at transducer)																			
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 bit																			
Linearity tolerance	< 0.1 % (of final value)																			
Temperature drift	< 50 ppm/K																			
Rise/release time	< 50 ms (10...90 %)																			
Ex Approval	PTB 03 ATEX 2217																			
Marking	II 2 (1GD) G EEx ib [ia] IIC T4																			
Max. Ex values (field circuits)	EEx ia IIC/IIB																			
	connection to passive field device																			
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_0	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																				
Max. externe Kapazität C_0																				
	<table border="1"> <thead> <tr> <th></th><th>IIC</th><th>IIB</th></tr> </thead> <tbody> <tr> <td>L_0</td><td>0,2 mH</td><td>1,0 mH</td></tr> <tr> <td>C_0</td><td>125 nF</td><td>870 nF</td></tr> </tbody> </table>		IIC	IIB	L_0	0,2 mH	1,0 mH	C_0	125 nF	870 nF	<table border="1"> <thead> <tr> <th></th><th>IIC</th><th>IIB</th></tr> </thead> <tbody> <tr> <td>L_0</td><td>10 mH</td><td>20 mH</td></tr> <tr> <td>C_0</td><td>1400 nF</td><td>7300 nF</td></tr> </tbody> </table>		IIC	IIB	L_0	10 mH	20 mH	C_0	1400 nF	7300 nF
	IIC	IIB																		
L_0	0,2 mH	1,0 mH																		
C_0	125 nF	870 nF																		
	IIC	IIB																		
L_0	10 mH	20 mH																		
C_0	1400 nF	7300 nF																		
Parameterisation/Configuration																				
Wire-break monitoring	per channel																			
Short-circuit monitoring	per channel																			
Substitute value programming	per channel																			
Live zero/dead zero	per channel																			
Software filter	per channel																			
50/60 Hz suppression	> 30 dB																			
LED indications																				
Power on/module function	1 x green/red (dual colour LED)																			
Input status	4 x red																			
General data																				
Galvanic isolation	to bus and to supply																			
Degree of protection	IP20																			
Operating temperature	-20...+70 °C																			
Relative humidity	95 % at 55 °C according to EN 060068-2																			
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27																			



The AI41Ex is designed to connect up to four 4-wire transducers (passive input = sink mode/transducer active).

The module features protection type EEx ib IIC and can thus be used in combination with excom® in explosion hazardous locations, zone 1. The inputs feature protection type EEx ia IIC.

The inputs are galvanically isolated from each other.

The resolution is 14 bits. To simplify data reproduction, 0...21 mA is then converted in the digitised value range of 0...21000 (irrespective of the measuring range parameters) and transferred to the host system.

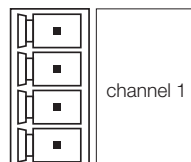
AI41Ex

- Intrinsically safe analogue input module for connection of transducers
- Protection type of field circuits: EEx ia IIC
- For connection of up to four 4-wire transducers
- Wire-break and short-circuit monitoring
- Galvanic isolation between input block, bus and power supply

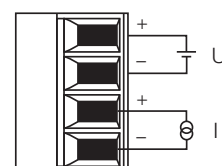
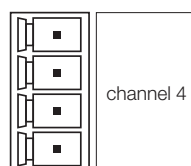
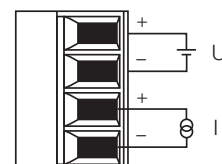
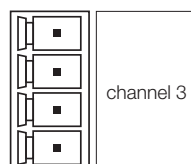
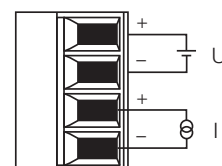
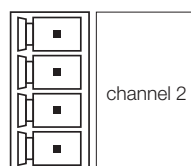
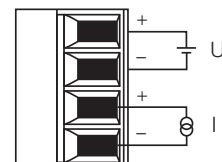
Connections

- Inputs via connections on module rack

terminal configuration



connection



Input module

AI41Ex

4 analogue inputs

Type	AI41Ex																		
Ident-no.	6884020																		
Power supply	from central power supply via module rack																		
Internal power consumption	< 2.0 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 bit																		
Linearity tolerance	< 0.1 % (of final value)																		
Temperature drift	< 50 ppm/K																		
Rise/release time	< 50 ms (10...90 %)																		
Ex Approval	PTB 03 ATEX 2023																		
Marking	II 2 (1GD) G EEx ib [ia] IIC T4																		
Max. Ex values (field circuits)	EEx ia IIC/IIB																		
No-load voltage U ₀	≤ 6.6 V																		
Short-circuit current I ₀	≤ 2.1 mA																		
Max. power P ₀	≤ 3.5 mW																		
Typical curve	linear																		
Max. internal inductances L _i	negligible																		
Max. internal capacitances C _i	negligible																		
Max. external inductances L ₀	<table><tr><td></td><td>IIC</td><td>IIB</td></tr><tr><td>L₀ (mH)</td><td>C₀ (μF)</td><td>C₀ (μF)</td></tr><tr><td>2</td><td>2.0</td><td>11</td></tr><tr><td>1</td><td>2.3</td><td>12</td></tr><tr><td>0,5</td><td>2.7</td><td>15</td></tr><tr><td>0,2</td><td>3.3</td><td>19</td></tr></table>		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
		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																	
Max. external capacitances C ₀																			
Parameterisation/Configuration																			
Wire-break monitoring	per channel																		
Short-circuit monitoring	per channel																		
Substitute value programming	per channel																		
Live zero/dead zero	per channel																		
Software filter	per channel																		
50/60 Hz suppression	> 30 dB																		
LED indications																			
Power on/module function	1 x green/red (dual colour LED)																		
Input status	4 x red																		
General data																			
Galvanic isolation	to bus and to supply																		
Degree of protection	IP20																		
Operating temperature	-20...+70 °C																		
Relative humidity	95 % at 55 °C according to EN 60068-2																		
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27																		



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

The module features protection type EEx ib IIC and can be used in combination with excom® in explosion hazardous locations, zone 1. The protection type of the outputs is EEx ia IIC.

The module is suited for connection of HART®-compatible actuators. Parameterisation can thus be accomplished with an approved modem directly via the connection level of the module rack.

The resolution is 13 bits, i.e. the analogue value of 0...21 mA is reproduced as a figure between 0 and 8191. To simplify data presentation, the host system operates with a value range of 0...21000. This non-linearised value is reduced by the AO40Ex to a resolution of 13 bits.

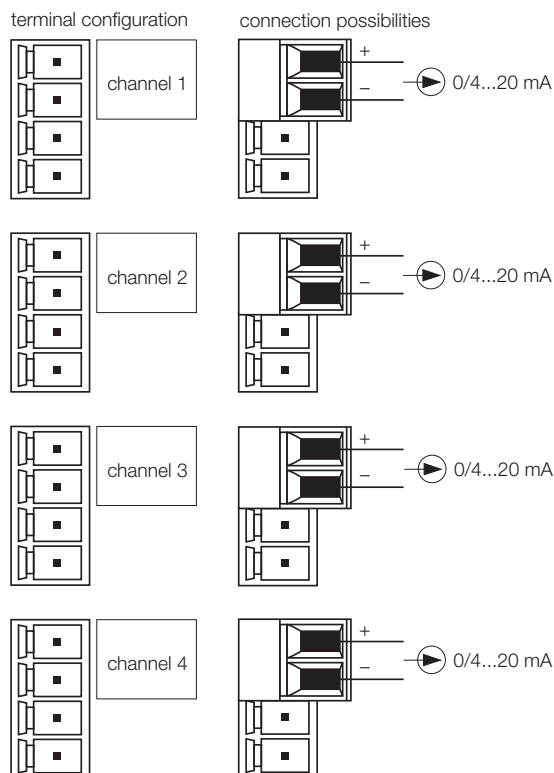
Parameters such as line monitoring, substitute values, can be set separately for each channel. They can be set via a PROFIBUS-DP master only.

AO40Ex

- Intrinsically safe output module for connection of 0/4...20 mA actuators
- Protection type of field circuits: EEx ia IIC
- For connection of up to four actuators
- Wire-break and short-circuit monitoring
- Galvanic isolation between output, bus and power supply
- Galvanic isolation between channels

Connections

- Outputs via connections on module rack



Output module

AO40Ex

4 analogue outputs for actuators

Type	AO40Ex																		
Ident-no.	6884002																		
Power supply	from central power supply via module rack																		
Internal power consumption	< 3.5 W																		
Outputs	4 analogue actuators																		
No-load voltage	< 16 VDC																		
Output current	0/4...20 mA per output																		
External load	< 600 Ω																		
HART® impedance	> 240 Ω																		
Short-circuit	< 100 Ω (in live zero mode only)																		
Wire-break	< 2 mA (in live zero mode only)																		
Resolution	13 bit																		
Linearity tolerance	< 0.1 % of final value																		
Temperature drift	< 50 ppm/K																		
Rise/release time	< 50 ms (10...90 %)																		
Ex Approval	PTB 00 ATEX 2179																		
Marking	II 2 (1) G EEx ib [ia] IIC T4																		
Max. Ex 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. external capacitances C ₀																			
	<table><tr><td></td><td>IIC</td><td>IIB</td></tr><tr><td>L₀ (mH)</td><td>C₀ (μF)</td><td>C₀ (μF)</td></tr><tr><td>2</td><td>0.10</td><td>1</td></tr><tr><td>1</td><td>0.10</td><td>1</td></tr><tr><td>0.5</td><td>0.12</td><td>1</td></tr><tr><td>0.2</td><td>0.15</td><td>1.17</td></tr></table>		IIC	IIB	L ₀ (mH)	C ₀ (μF)	C ₀ (μF)	2	0.10	1	1	0.10	1	0.5	0.12	1	0.2	0.15	1.17
	IIC	IIB																	
L ₀ (mH)	C ₀ (μF)	C ₀ (μF)																	
2	0.10	1																	
1	0.10	1																	
0.5	0.12	1																	
0.2	0.15	1.17																	
Parameterisation/configuration																			
Wire-break monitoring	per channel																		
Short-circuit monitoring	per channel																		
Substitute value programming	per channel																		
Live zero/dead zero	per channel																		
LED indications																			
Power on/module function	1 x green/red (dual colour LED)																		
Output status	4 x red																		
General data																			
Galvanic isolation	complete isolation																		
Degree of protection	IP20																		
Operating temperature	-20...+60 °C																		
Relative humidity	95 % at 55 °C according to EN 60068-2																		
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27																		



The AIH40Ex is designed to connect up to four 2-wire transducers (active input = source mode/transducer passive).

The module features protection type EEx ib IIC and can thus be used in combination with *excom*® in explosion hazardous locations, zone 1. The inputs feature protection type EEx ia IIC.

There is no galvanic isolation between the inputs. When connecting field devices, please observe that all inputs feature a common potential.

The resolution is 14 bits. To simplify data reproduction, 0...21 mA is then converted the digitised value range of 0...21000 (irrespective of the measuring range parameters) and transferred to the host system.

HART®-compatible sensors may be connected to the modules; communication takes place via the integrated HART® controller.

Up to 8 HART® variables (a maximum of four per channel) can be read via the cyclic user data transfer of the PROFIBUS-DP. The bidirectional data transfer between the host system and the HART® transmitter is enabled by PROFIBUS-DPV1 services.

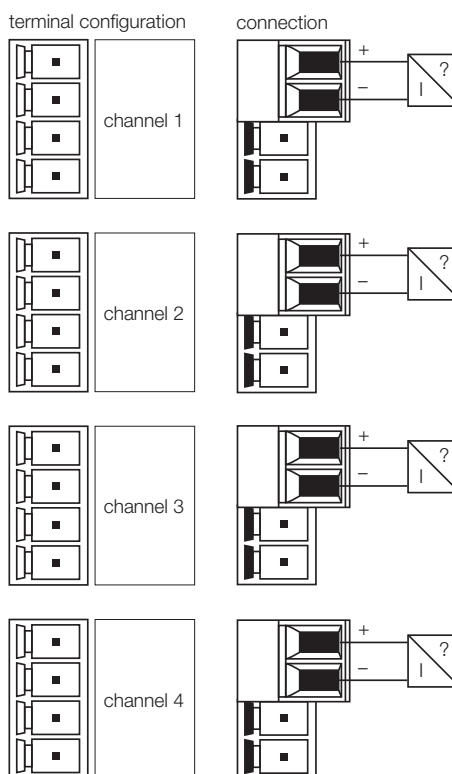
Parameters such as wire-break and short-circuit monitoring, measuring range and HART® communication parameters can be set separately for each channel. They can be set via the PROFIBUS-DP master only.

AIH40Ex

- Intrinsically safe analogue input module for connection of transducers
- Protection type of field circuits: EEx ia IIC
- For connection of up to four 2-wire transducers
- Wire-break and short-circuit monitoring
- Galvanic isolation between input block, bus and power supply
- Inputs connected to a common plus potential, i.e. no galvanic isolation between channels
- Transmission of HART® data

Connections

- Inputs via connections on module rack



Input module

AIH40Ex

4 analogue inputs (HART®)

Type	AIH40Ex												
Ident-no.	6884001												
Power supply	from central power supply via module rack												
Internal power consumption	< 3,5 W												
Inputs	4 analogue sensors												
Input voltage	> 15.0 VDC at 22 mA (at transducer)												
Input current	0/4...20 mA per input												
HART® impedance	> 240 Ω												
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 bit												
Linearity tolerance	< 0.1 % (of final value)												
Temperature drift	< 50 ppm/K												
Rise/release time	< 50 ms (10...90 %)												
Ex Approval	PTB 00 ATEX 2059 X												
Marking	II 2 (1) G EEx [ia] ib IIC T4												
Max. Ex 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												
U ₀	27.54 V												
R	298 Ω												
Max. internal inductances L _i	≤ 0.22 mH												
Max. internal capacitances C _i	≤ 1.1 nF												
Max. external inductances L ₀	<table><tr><td></td><td colspan="2">EEx ia + EEx ib</td></tr><tr><td></td><td>IIC</td><td>IIB</td></tr><tr><td>L₀</td><td>1.78 mH</td><td>1.78 mH</td></tr><tr><td>C₀</td><td>100 nF</td><td>500 nF</td></tr></table>		EEx ia + EEx ib			IIC	IIB	L ₀	1.78 mH	1.78 mH	C ₀	100 nF	500 nF
		EEx ia + EEx ib											
	IIC	IIB											
L ₀	1.78 mH	1.78 mH											
C ₀	100 nF	500 nF											
Max. external capacitances C ₀													
Parameterisation/Configuration													
Wire-break monitoring	per channel												
Short-circuit monitoring	per channel												
Substitute value programming	per channel												
Live zero/dead zero	per channel												
Software filter	per channel												
HART® status polling	per channel												
Mapping of virtual HART® variables	per channel												
50/60 Hz suppression	> 30 dB												
LED indications													
Power on/module function	1 x green/red (dual colour LED)												
Input status	4 x red												
General data													
Galvanic isolation	to bus and to supply												
Degree of protection	IP20												
Operating temperature	-20...+70 °C												
Relative humidity	95 % at 55 °C according to EN 060068-2												
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27												



The AIH41Ex is designed to connect up to four 4-wire transducers (passive input = sink mode/transducer active).

The module features protection type EEx ib IIC and can thus be used in combination with excom® in explosion hazardous locations, zone 1. The inputs feature protection type EEx ia IIC.

There is no galvanic isolation between the inputs. When connecting field devices, please observe that all inputs feature a common potential.

The resolution is 14 bits. To simplify data reproduction, 0...21 mA is then converted in the digitised value range of 0...21000 (irrespective of the measuring range parameters) and transferred to the host system.

HART®-compatible sensors may be connected to the modules; communication takes place via the integrated HART® controller.

Up to 8 HART® variables (a maximum of four per channel) can be read via the cyclic user data transfer of the PROFIBUS-DP. The bidirectional data transfer between the host system and the HART® transmitter is enabled by PROFIBUS-DPV1 services.

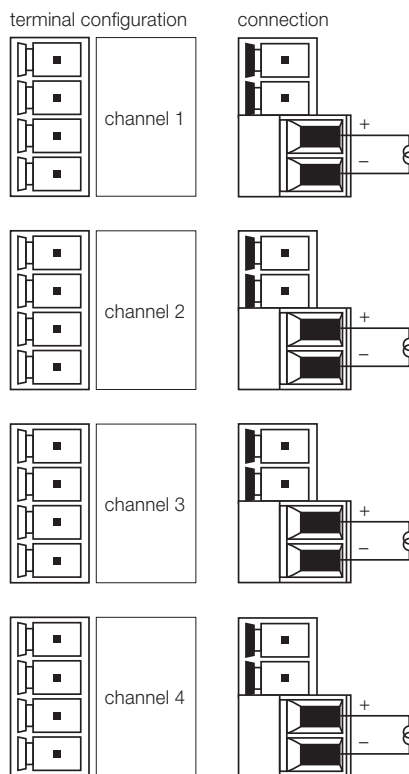
Parameters such as wire-break and short-circuit monitoring, measuring range and HART® communication parameters can be set separately for each channel. They can be set via the PROFIBUS-DP master only.

AIH41Ex

- Intrinsically safe analogue input module for connection of transducers
- Protection type of field circuits: EEx ia IIC
- For connection of up to four 4-wire transducers
- Wire-break and short-circuit monitoring
- Galvanic isolation between input block, bus and power supply
- Inputs connected to a common plus potential, i.e. no galvanic isolation between channels
- Transmission of HART® data

Connections

- Inputs via connections on module rack



Input module

AIH41Ex

4 analogue inputs (HART®)

Type	AIH41Ex
Ident-no.	6884005
Power supply	from central power supply via module rack
Internal power consumption	< 3.5 W
Inputs	4 analogue sensors
Input current	0/4...20 mA per input
HART® impedance	> 240 Ω
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 bit
Linearity tolerance	< 0.1 % (of final value)
Temperature drift	< 50 ppm/K
Rise/release time	< 50 ms (10...90 %)
Ex Approval	PTB 00 ATEX 2059 X
Marking	II 2 (1) G EEx ib [ia] IIC T4
Max. Ex values (field circuits)	EEx ia IIC/IIB
No-load voltage U_0	≤ 7.2 V
Short-circuit current I_0	≤ 16 mA
Max. power P_0	≤ 29 mW
Typical curve	linear
Max. internal inductances L_i	≤ 0.11 mH
Max. internal capacitances C_i	≤ 1.1 nF
Max. external inductances L_0	see tables on page 32
Max. external capacitances C_0	see tables on page 32
Parameterisation/Configuration	
Wire-break monitoring	per channel
Short-circuit monitoring	per channel
Substitute value programming	per channel
Live zero/dead zero	per channel
Software filter	per channel
HART® status polling	per channel
Mapping of virtual HART® variables	per channel
50/60 Hz suppression	> 30 dB
LED indications	
Power on/module function	1 x green/red (dual colour LED)
Input status	4 x red
General data	
Galvanic isolation	to bus and to supply
Degree of protection	IP20
Operating temperature	-20...+70 °C
Relative humidity	95 % at 55 °C according to EN 60068-2
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27

Input module

AIH41Ex

4 analogue inputs (HART®)

Max. external inductances L_0
Max. external capacitances C_0

For active intrinsically safe transducers with linear output curve ($I_i = 100 \text{ mA}$), 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 μF	9,8 mH	33 μF
5 V	2,4 mH	1,3 μF	9,8 mH	8,3 μF
10 V	2,4 mH	358 nF	9,8 mH	2,1 μF
15 V	2,4 mH	158 nF	9,8 mH	1,1 μF
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
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

For active intrinsically safe transducers 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	250 nF

For active intrinsically safe transducers 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 μF
5 V	100 mA	1,99 mH	300 nF	4,89 mH	1,5 μF
10 V	90 mA	1,99 mH	200 nF	4,89 mH	1 μF
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 mA	–	–	0,99 mH	250 nF





The AOH40Ex is designed for connection of intrinsically safe actuators such as control valves or process indicators.

The module features protection type EEx ia IIC and can be used in combination with excom® in explosion hazardous locations, zone 1. The protection type of the outputs is EEx ia IIC.

The module is suited for connection of HART®-compatible actuators which communicate directly with the HART® controller.

The resolution is 12 bits, i.e. the analogue value of 0...21 mA is reproduced as a figure between 0 and 4095. To simplify data presentation, the host system operates with a value range of 0...21000. This non-linearised value is reduced by the AOH40Ex to resolution of 12 bits.

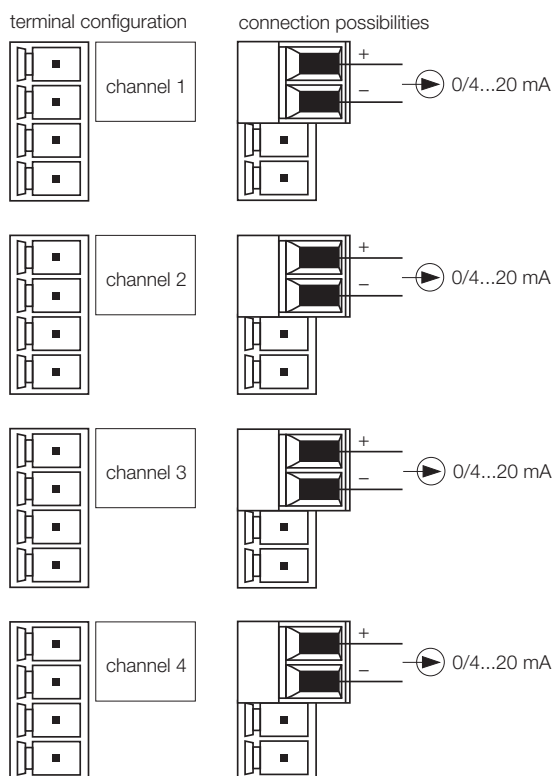
Parameters such as line monitoring, substitute values, can be set separately for each channel. They can be set via a PROFIBUS-DP master only.

AOH40Ex

- Intrinsically safe output module for connection of 0/4...20 mA actuators
- Protection type of field circuits: EEx ia IIC
- For connection of up to four actuators
- Wire-break and short-circuit monitoring
- Galvanic isolation between output, bus and power supply
- Outputs connected to a common frame potential, i.e. no galvanic isolation between channels
- Transmission of HART® data

Connections

- Outputs via connections on module rack



Output module

AOH40Ex

4 analogue outputs for actuators

Type	AOH40Ex												
Ident-no.	6884003												
Power supply	from central power supply via module rack												
Internal power consumption	< 3.5 W												
Outputs	4 analogue actuators												
No-load voltage	< 16 VDC												
Output current	0...22 mA per output												
External load	< 600 Ω												
HART® impedance	> 240 Ω												
Short-circuit	< 50 Ω (in live zero mode only)												
Wire-break	> 15 V (in live zero mode only)												
Resolution	12 bit												
Linearity tolerance	< 0.1 % of final value												
Temperature drift	< 50 ppm/K												
Rise/release time	< 50 ms (10...90 %)												
Ex Approval	PTB 00 ATEX 2051												
Marking	II 2 (1) G EEx ib [ia] IIC T4												
Max. Ex 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	≤ 0.22 mH												
Max. internal capacitances C _i	≤ 1.1 nF												
Max. external inductances L ₀	<table><tr><td></td><td colspan="2">EEx ia und EEx ib</td></tr><tr><td></td><td>IIC</td><td>IIB</td></tr><tr><td>L₀</td><td>1,78 mH</td><td>1,78 mH</td></tr><tr><td>C₀</td><td>100 nF</td><td>500 nF</td></tr></table>		EEx ia und EEx ib			IIC	IIB	L ₀	1,78 mH	1,78 mH	C ₀	100 nF	500 nF
		EEx ia und EEx ib											
		IIC	IIB										
L ₀	1,78 mH	1,78 mH											
C ₀	100 nF	500 nF											
Max. external capacitances C ₀													
Parameterisation/configuration													
Wire-break monitoring	per channel												
Short-circuit monitoring	per channel												
Substitute value programming	per channel												
Live zero/dead zero	per channel												
LED indications													
Power on/module function	1 x green/red (dual colour LED)												
Output status	4 x red												
General data													
Galvanic isolation	to bus and to supply												
Degree of protection	IP20												
Operating temperature	-20...+70 °C												
Relative humidity	95 % at 55 °C according to EN 60068-2												
Vibration and shock testing	according to IEC 68-2-6 and IEC 68-2-27												



The TI40Ex is designed for connection of 2, 3 and 4-wire temperature detectors, types Pt100, Pt200, Pt400, Pt1000, Ni100 and Cu100, as well as for connection of thermo-element types B, E, D, J, K, L, N, R, S, T and U. The module may also be used for measuring low voltage signals (-75...+75 mV, -1,2...+1,2 V) and for resistance measurements (0...30 Ω , 0...300 Ω , 0...3 k Ω).

The module features protection type EEx ia IIC and can thus be used in combination with excom® in explosion hazardous locations, zone 1. The inputs feature protection type EEx ia IIC.

When connecting 2-wire temperature detectors, compensation is accomplished during on-line parameterisation.

The measuring circuits as well as the two additional terminals are short-circuited and compensation is carried out automatically. When using thermo-elements, cold junction compensation can be accomplished separately for each channel by connecting resistance detectors as specified above, e.g. Pt100 resistors, to the two unused terminals. Selection and parameterisation of internal compensation via an integrated Pt100 resistance detector affects all channels.

The resolution is 16 bits, i.e. the analogue value is reproduced as a figure between 0 and 65536. The temperature is indicated as a value in Kelvin. For conversion to °C, please observe an offset of 273.2.

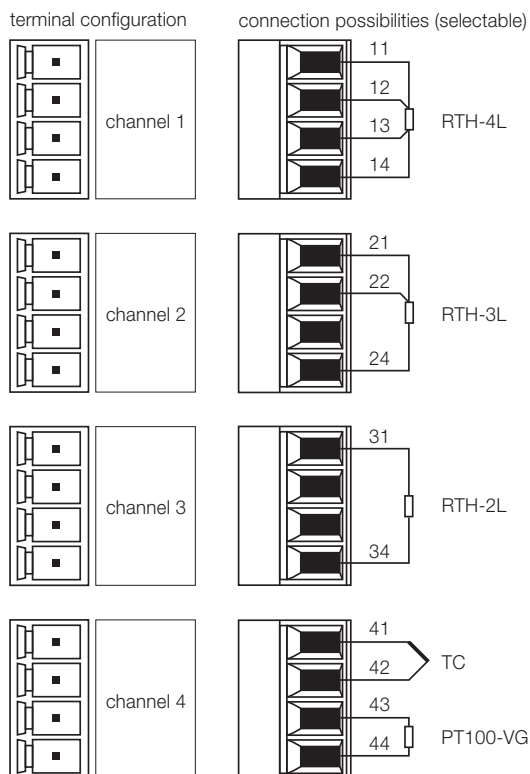
Parameters such as line monitoring, substitute values, can be set separately for each channel. They can be set via a PROFIBUS-DP master only.

TI40Ex

- Intrinsically safe analogue input module for connection of temperature detectors such as Pt100, Pt200, Pt400, Pt1000, Cu100 and Ni100 as well as thermo-elements, types B, E, D, J, K, L, N, R, S, T, U
- Protection type of field circuits: EEx ia IIC
- For connection of up to four 2-, 3- or 4-wire detectors
- Wire-break and short-circuit monitoring
- Galvanic isolation between input, bus and power supply
- Galvanic isolation between channels

Connections

- Inputs via connections on module rack

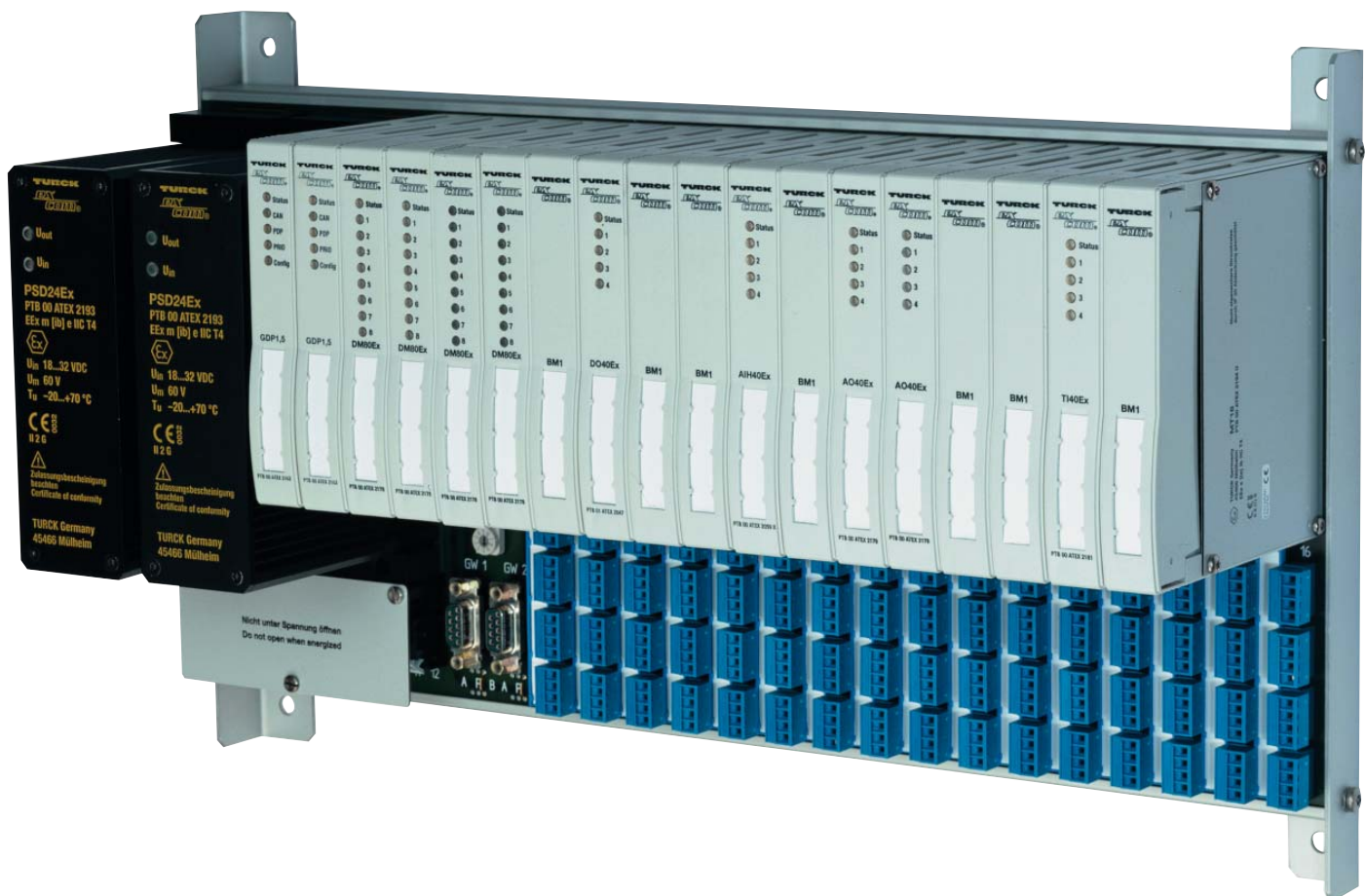


Input module

TI40Ex

4 inputs for thermo-elements

Type	TI40Ex																																					
Ident no.	6884000																																					
Power supply	from central power supply via module rack																																					
Internal power consumption	< 3 W																																					
Inputs	four 2-/3-/4-wire resistance temperature detectors																																					
Input (resistance temperature detector)	types Pt100, Pt200, Pt400, Pt1000, Ni100 and Cu100																																					
– Line resistance (4-wire)	< 50 Ω																																					
– Line resistance (3-wire)	< 10 Ω																																					
– Line resistance (2-wire)	< 5 Ω																																					
– Resolution	16 bits																																					
– Short-circuit	< 5 Ω																																					
– Wire-break	> 500 Ω measuring range 0...300 Ω																																					
	> 4000 Ω measuring range 0...3 kΩ																																					
Input (thermo-element)	types B, E, D, J, K, L, N, R, S, T and U																																					
– Resolution	16 bits																																					
– Wire-break	< 100 nA / > 150 mV																																					
Calibration accuracy	< 0,2 K; < 80 mΩ; < 0.01 mV																																					
Linearity tolerance	< 0.05 % (of final value), min. 10 μV																																					
Temperature drift	< 50 ppm/K																																					
Rise/release time	<1.3 s (10...90 %)																																					
Ex Approval	PTB 00 ATEX 2181																																					
Marking	II 2 (1) G EEx ib [ia] IIC T4																																					
Max. Ex values (field circuits)	EEx ia IIC/IIB																																					
	connection to passive field device																																					
	(e.g. resistance detectors)																																					
No-load voltage U ₀	≤ 5.5 V																																					
Short-circuit current I ₀	≤ 25 mA																																					
Max. power P ₀	≤ 35 mW																																					
Typical curve	linear																																					
Max. internal inductances L _i	negligible																																					
Max. internal capacitances C _i	60 nF																																					
Max. external inductances L ₀																																						
Max. external capacitances C ₀																																						
	<table><tr><td></td><td>IIC</td><td>IIB</td></tr><tr><td>L₀ (mH)</td><td>C₀ (μF)</td><td>C₀ (μF)</td></tr><tr><td>2</td><td>2.6</td><td>15</td></tr><tr><td>1</td><td>2.9</td><td>17</td></tr><tr><td>0.5</td><td>3.6</td><td>21</td></tr><tr><td>0.2</td><td>4.5</td><td>27</td></tr></table>		IIC	IIB	L ₀ (mH)	C ₀ (μF)	C ₀ (μF)	2	2.6	15	1	2.9	17	0.5	3.6	21	0.2	4.5	27	<table><tr><td></td><td>IIC</td><td>IIB</td></tr><tr><td>L₀ (mH)</td><td>C₀ (μF)</td><td>C₀ (μF)</td></tr><tr><td>2</td><td>1.6</td><td>9.8</td></tr><tr><td>1</td><td>1.9</td><td>12</td></tr><tr><td>0.5</td><td>2.3</td><td>14</td></tr><tr><td>0.2</td><td>3.0</td><td>19</td></tr></table>		IIC	IIB	L ₀ (mH)	C ₀ (μF)	C ₀ (μF)	2	1.6	9.8	1	1.9	12	0.5	2.3	14	0.2	3.0	19
	IIC	IIB																																				
L ₀ (mH)	C ₀ (μF)	C ₀ (μF)																																				
2	2.6	15																																				
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L ₀ (mH)	C ₀ (μF)	C ₀ (μF)																																				
2	1.6	9.8																																				
1	1.9	12																																				
0.5	2.3	14																																				
0.2	3.0	19																																				
Parameterisation/configuration																																						
Wire-break monitoring	per channel																																					
Short-circuit monitoring	per channel																																					
Substitute value programming	per channel																																					
Software filter	per channel																																					
50/60 Hz suppression	> 20 dB																																					
LED indications																																						
Power on/module function	1 x green/red (dual colour LED)																																					
Input status	4 x red																																					



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

- Module rack for connection of up to 8/16 I/O modules, 1/2 gateways and 1/2 power supply units
- Protection type EEx e, EEx i
- Up to 128 binary or 64 analogue inputs/outputs
- Connection of two (redundant) gateways (rack MT18 only)
- Connection of two (redundant) power supply units (rack MT18 only)

Connections

- Inputs and outputs via plug-in terminals, system MINI COMBICON or firmly soldered cage clamp terminals counter parts in screw technology, see identifier in type designation:
R = MINI COMBICON screw terminals
C = Cage-clamp terminals (soldered)
- Bus connection via miniature 9-pole D-SUB connector
- Power supply via EEx e screw terminals

The module racks MT18-R024, MT18-C024 and MT18-C230 consist of the backplane and the actual rack system. It accommodates two gateways, two power supplies or AC/DC converter and sixteen I/O modules. Up to 128 binary inputs/outputs or 64 analogue inputs/outputs can be connected to the rack. Any combination is possible.

A further module rack version such as the MT9-R024 or MT9-C024 is also available. The module rack allows connection of one power supply unit, one gateway and up to eight I/O modules. In contrast to the MT18-... module rack, it is not possible to configure a redundant system with double gateways or power supplies.

Modules can be inserted and removed during operation without interruption of data communication (gateways and power supplies may only be "hot-swapped" in case of a redundant system design).

The module rack features a combined protection type: EEx e and EEx i. It is thus suited for installation in zone 1.

The power supply for the modules is located on the backplane. Its energy is limited to avoid sparking. Therefore modules can be plugged into or removed from the rack in zone 1 during operation.

The rack system is made of extruded aluminium sections to increase robustness and ensure shielding. The module racks are suited for wall mounting and 19" rail mounting.

Module Rack

MT9/18-...*)024 / MT18-C*)230

Module rack for 8/16 modules

Type	MT9-R024 MT9-C024	MT18-R024 MT18-C024	MT18-C230
Connections			
Bus (D-SUB, miniature 9-pole version)	1	2	2
Supply (EEx e dual screw terminals)	3	6	6
Connection profile	0.2...4 mm², rigid, or 0.2...2.5 mm² with wire sleeve		
Field devices	per module: 4 x 4 terminals		
Connection profile	0.25...1.5 mm² with wire sleeve (without plastic sleeve)		
Slots			
Power supply	1	2	2
AC/DC converter	–	–	2
Gateway	1	2	2
I/O module	8	16	16
Adjustments			
Bus address	3 decimal-coded rotary switches		
Ex Approval			
Marking	PTB 00 ATEX 2194 U II 2 (1) G EEx e ib [ia] IIC	PTB 00 ATEX 2194 U II 2 (1) G EEx e ib [ia] IIC	PTB 00 ATEX 2194 U II 2 (1) G EEx e ib [ia] IIC
Power supply connection	EEx e IIC	EEx e IIC	EEx e IIC
– U _{in}	≤ 32 V	≤ 32 V	≤ 250 V
– I _{in}	≤ 11 A	≤ 11 A	≤ 5 A
– P _{in}	≤ 100 W	≤ 100 W	≤ 130 VA
General data			
Degree of protection	IP20		
Operating temperature	-20...+70 °C		
Relative humidity	95 % at 55 °C acc. to EN 60068-2		
Vibration and shock testing	acc. to IEC 68-2-6 and IEC 68-2-27		
Dimensions (w x h x d) [mm] (without mounting brackets)	226.5 x 210 x 130	439.5 x 210 x 130	439.5 x 210 x 130

*) R = MINICOMBICON screw terminals
C = Cage-clamp terminals (soldered)



The power supply unit PSD24Ex is designed to power the *excom*® system and is sufficient for a fully assembled system.

The power supply features a protection type combining EEx m, EEx e and EEx i and can thus be installed in zone 1. Power supplies are integrated into protective aluminium housings and are fully encapsulated.

If the system is configured with redundant power supplies, a defect power supply may be removed from the rack for replacement during operation (provided module rack MT18-...024 is used).

The PSD24Ex provides a supply voltage of 18...32 VDC.

Connection of the external supply is established via Ex e terminals. It is not permitted to access live terminals of this kind. They are located under a protective cap and may only be accessed after suspending the power supply.

Redundancy:

Two power supplies may be used. If one of the devices or the incoming line fails, the second power supply immediately takes over the supply of the entire system. It is possible to use different potentials for supply.

PSD24Ex

- DC power supply unit for supply of a fully assembled module rack
- Redundant operation possible
- Protection type EEx m, EEx e, EEx i
- Supply of up to 128 binary or 64 analogue inputs/outputs
- Aluminium housing
- Complete encapsulation

Connections

- Via module rack

Power supply

PSD24Ex

24 VDC Ex power supply

Type	PSD24Ex
Ident-no.	6881721
Power supply	
External	18...32 VDC (ripple $W_{pp} < 10 \%$)
Power output	60 W
LED indications	
Power on/module function	1 x green
Supply	1 x green
Ex Approval	PTB 00 ATEX 2193
Marking	II 2 G EEx m [ib] e IIC T4
– U_m	60 V
General data	
Galvanic isolation	complete isolation
Degree of protection	IP50
Operating temperature	-20...+70 °C
Relative humidity	95 % at 55 °C according 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)	45 mm x 155 mm x 106 mm



The AC/DC converters PPSA230Ex and PPSA115Ex are designed to power the excom® system and is sufficient for a fully assembled system.

The power supply features a protection type combining EEx m and EEx e and can thus be installed in zone 1.

Power supplies are integrated into protective aluminium housings and are fully encapsulated.

If the system is configured with redundant AC/DC converters, a defect AC/DC converter may be removed from the rack for replacement during operation.

The PPSA230VAC provides a supply voltage of 230 VAC, the PPSA115Ex provides 115 VAC.

Connection of the external supply is established via Ex e terminals. It is not permitted to access live terminals of this kind. They are located under a protective cap and may only be accessed after suspending the power supply.

Redundancy:

Two AC/DC converters may be used. If one of the devices or the incoming line fails, the second converter immediately takes over the supply of the entire system. It is possible to use different potentials for supply.

**PPSA230Ex
PPSA115Ex**

- AC/DC converter for supply of a fully assembled module rack
- Supply voltage:
 - PPSA230Ex: 230 VAC
 - PPSA115Ex: 115 VAC
- Redundant operation possible
- Protection type EEx m, EEx e
- Supply of up to 128 binary or 64 analogue inputs/outputs
- Aluminium housing
- Complete encapsulation

Connections

- Via module rack

AC/DC converter PPSA230Ex/PPSA115Ex 230/115 VAC Ex AC/DC converter

Type	PPSA230Ex	PPSA115Ex
Ident-no.	6900293	6900294
Supply voltage		
Input voltage	≤ 230 VAC	≤ 115 VAC
Power consumption	≤ 75 VA	≤ 75 VA
Output voltage	≤ 32 VDC	≤ 32 VDC
Power output	≤ 60 W	≤ 60 W
Ex Approval	PTB 04 ATEX 2047	PTB 04 ATEX 2047
Marking	II 2 G EEx e m IIC T4	II 2 G EEx e m IIC T4
– U _m	250 V	250 V
General data		
Galvanic Isolation	complete isolation	complete isolation
Degree of protection	IP50	IP50
Operating temperature	-20...+70 °C	-20...+70 °C
Relative humidity	95 % at 55 °C acc. to EN 60068-2	95 % at 55 °C acc. to EN 60068-2
Vibration and shock testing	acc. to IEC 68-2-6 and IEC 68-2-27	acc. to IEC 68-2-6 and IEC 68-2-27
Mounting	flange, 4 x M4 screws (Torx)	flange, 4 x M4 screws (Torx)
Dimensions (w x h x d) [mm]	45 x 155 x 106	45 x 155 x 106



The segment coupler SC12Ex is mounted in the non-hazardous area and features protection rating IP20.

The coupler enables redundant power supply. The two operating voltage inputs are isolated by diodes. Load distribution depends on the supply voltage rating. The operational voltage range is specified with 18...32 VDC.

If the rotary switch is set to „0“ (see Tab. 1 on the other page), the baud rate is detected automatically by the coupler. For this, the start delimiter of the PROFIBUS messages is evaluated.

Three subsequent valid start delimiters must be received in order to determine the final baud rate value.

All messages are checked for plausibility by means of the start delimiter. Baud rate detection is started by a Reset.

If no messages are received by the interface for a period of 1.7 s, the baud rate detection starts again.

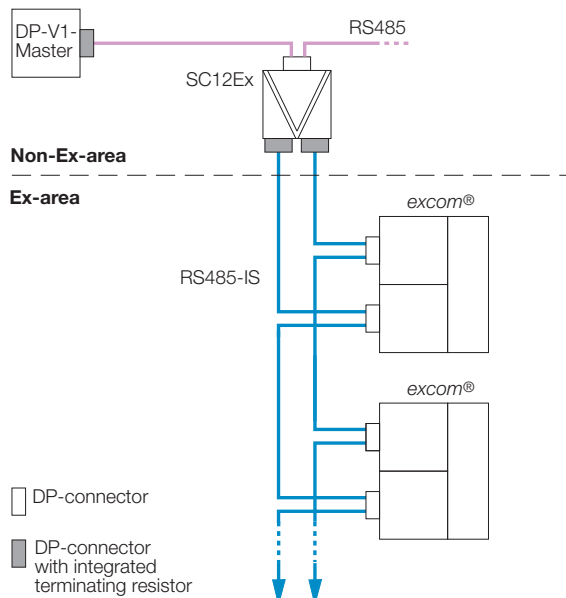
Alternatively, it is possible to set a fixed baud rate value using a rotary switch.

The coupler features one status LED for each of the three PROFIBUS segments, one LED for each power line and one status LED for automatic baud rate detection.

SC12Ex

- I.S. barrier between RS485 and RS485-IS
- 2 x RS485-IS for up to 62 additional modules or 31 modules in case of line redundancy
- All segments are equal communication channels
- Automatic baud rate detection (selection of baud rate via rotary switch)
- Regeneration of amplitude and phase

System construction with a segment coupler SC12Ex



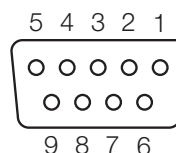
Pin configuration (SUB-D connectors see page 53)

RS485-IS

- 1 = Shield
- 2 = n. c.
- 3 = RxD/TxD-P (Received/transmitted data P, wire B)
- 4 = n. c.
- 5 = ISGND (Bus termination ground)
- 6 = ISP (Bus termination plus)
- 7 = n. c.
- 8 = RxD/TxD-N (Received/transmitted data N, wire A)
- 9 = n. c.

RS485

- 1 = n. c.
- 2 = n. c.
- 3 = RxD/TxD-P
- 4 = n. c.
- 5 = DGND
- 6 = DP
- 7 = n. c.
- 8 = RxD/TxD-N
- 9 = n. c.



The PROFIBUS-DP segment coupler SC12Ex by TURCK is designed for intrinsically safe PROFIBUS-DP interfacing. Equipped with a standard RS485 interface and two RS485-IS interfaces, this coupler is designed to cover various applications in explosion hazardous areas. The coupler is capable of working with both lines of the intrinsically safe I/O system *excom®* (line redundancy). Thus only a single device is needed to provide intrinsically safe separation and line redundancy.

PROFIBUS-DP – Segment coupler (RS485-IS) SC12Ex

Type	SC12Ex
Ident-no.	6884047
Operational voltage U_B	18...32 VDC
Current consumption	< 200 mA
Transmission rate	9.6 kbps...1.5 Mbps (self-detecting)
Galvanic isolation (acc. EN 50020)	
Between RS485-IS and RS485	375 V
Between RS485-IS and input voltage	375 V
Between RS485-IS segments	30 V
Ex-Approval acc. EC type examination certificate	PTB 03 ATEX 2115
Maximum nominal values	
RS485-IS(a)/RS485-IS(b) field bus connection:	
– No load voltage U_0	3,71 V
– Short-circuit current I_0	129 mA
– Power P_0	120 mW
Characteristic curve	linear
Internal Inductances/Capacitances L_i/C_i	negligible
External RS485 field bus system:	
SYST EEx ib IIC	
– U_i	4,2 V
– I_i	4,8 A
Ambient temperatur T_u	-20...+70 °C
Marking of the device	II (2) GD [EEx ib]
LED indications	
Operation of PS1 and PS2	2 x green
– green	input voltage o.k.
– off	input voltage too low
Status PROFIBUS segments	3 x red/yellow (dual colour LED)
– red	wrong start delimiter received
– yellow	receipt of valid data
– off	no data exchange
Automatic baud rate detection	1 x yellow
– permanent yellow	baud rate detected
– yellow flashing	baud rate detection active
– off	baud rate setting via rotary switch
Housing	
Dimensions (L x W x H)	142 x 105,5 x 31 mm
Housing material	Aluminium, anodized
Cover material	FR4, grey/blue
Protection degree	IP20
Operating temperature	-20...+70 °C

Tab. 1: Rotary switch position

Position 0	Automatic baud rate detection
Position 1	9.60 kbps
Position 2	19.20 kbps
Position 3	45.45 kbps
Position 4	93.75 kbps
Position 5	187.50 kbps
Position 6	500.00 kbps
Position 7	1.50 Mbps
Position 8	not assigned
Position 9	not assigned



The fibre-optic coupler OC11Ex/2G converts the electrical PROFIBUS-DP signals from copper cables to optical signals for fibre-optic transmission.

The fibre-optic coupler ensures potential-free and fail-safe transmission of bus signals from the safe to the explosion hazardous area, even over very long distances.

In zone 1 the OC11Ex/2G receives the optical signals via its fibre-optic interface and converts these for output by the RS485-IS interface at intrinsically safe signal levels to the TURCK zone 2 coupler OC11Ex/3G (see page 48 and Fig. below). The RS485-IS interface complies fully with the PROFIBUS guidelines of the PNO. The fibre-optic coupler OC11Ex/2G is equipped with

- an intrinsically safe PROFIBUS interface RS485-IS (according to the "RS485-IS" guideline of the PNO committee).
- an intrinsically safe optical interface with ST connectors for emitter and receiver connection.

Up to 31 bus devices can be connected to the fibre-optic coupler. Baud rates of 9.6 kbps up to 1,5 Mbps can be set and are automatically detected by the device. For diagnostics, there are 4 status LEDs to indicate the active power supply, the fibre-optic segment, the RS485-segment and the baud rate status. The device is equipped with an M8 communication interface.

Line errors (wire-break/short-circuit) are not transferred from one segment to the other, so that fail-safe and independent operation of all segments is ensured.

In order not to restrict the maximum system expansion and line length of a PROFIBUS segment, amplitude and phase are regenerated by the coupler.

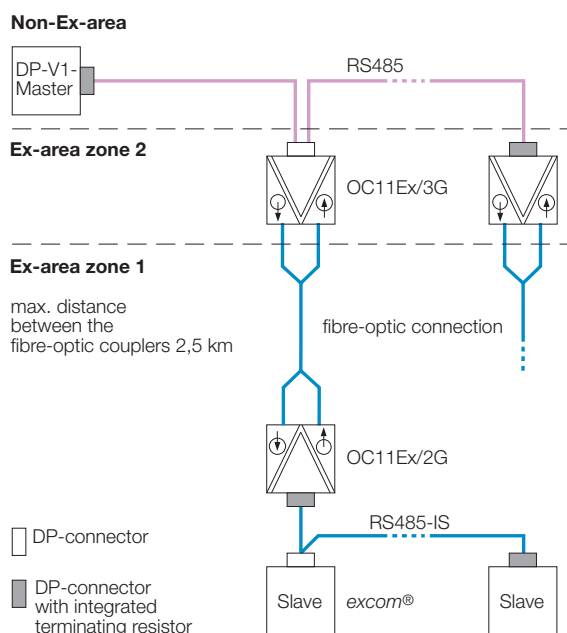
With the coupler OC11Ex/2G, the shield is always capacitively coupled to the equipotential bond (PA).

Pre-assembled fibre optic cables are provided on page 50.

OC11Ex/2G

- Data exchange between electrically wired and optical PROFIBUS-DP via fibre-optics
- Fibre-optic coupler OC11Ex/2G for Zone 1
- RS485-IS interface for up to 31 nodes
- Transmission of bus signals over long distances
- Fail-safe communication
- Automatic baud rate detection (selection of baud rate via rotary switch)
- Regeneration of amplitude and phase

System construction with coupler OC11Ex/...

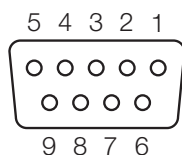


PROFIBUS-DP – Fibre-optic coupler for zone 1 OC11Ex/2G

Type	OC11Ex/2G
Ident-no.	6890423
Operating voltage	18...32 VDC
Current consumption	< 100 mA
Transmission rate	9,6 kBit/s...1,5 Mbit/s (auto-detection)
Galvanic isolation	
from supply voltage (to EN 50020)	60 V
Ex-approval	PTB 05 ATEX 2051 X
Marking of device	EEx e mb ib [ib op is] IIC T4
Max. Ex values according to PNO work group "RS485-IS"	U ₀ = 4,2 V; I ₀ = 4,8 A
LED indications	
Operation	1 × green
– green	input voltage o.k.
– off	input voltage too low
Status PROFIBUS segments	2 × red/yellow (dual colour LED)
– red	error in PROFIBUS/fibre-optic segment
– yellow	receipt of valid data
– off	no data transmission
Automatic baud rate detection	1 × yellow
– permanent yellow	baud rate detected
– yellow flashing	baud rate detection active
– off	baud rate setting via rotary switch
Connection technology	
– PROFIBUS-DP	1 × SUB-D connector, 9-pole A special PROFIBUS SUB-D connector, approved for intrinsically safe applications (e.g. D9T-RS485IS, with the TURCK ident-no. 6890944, see page 53) is required; standard connectors may not be used!
– Fibre-optic	2 × ST connectors
– Voltage supply	EEx e terminal, 4-pole
– Communication interface	1 × M8 connector
– Equipotential bond (PA)	M5 × 1 earthing stud
Housing	
Dimensions [mm]	72 × 105,5 × 31
Housing material	Aluminium, anodized
Cover Material	FR4, grey
Degree of protection (IEC 60529/EN 60529)	IP20
Ambient temperature	-20...+70 °C

Wiring diagram

(SUB-D connectors see page 53)



RS485-IS

- 1 = Shield
- 2 = n. c.
- 3 = RxD/TxD-P (received/transmitted data P, wire B)
- 4 = n. c.
- 5 = ISGND (Bus termination ground)
- 6 = ISP (Bus termination plus)
- 7 = n. c.
- 8 = RxD/TxD-N (received/transmitted data N, wire A)
- 9 = n. c.



The fibre-optic coupler OC11Ex/3G converts the electrical PROFIBUS-DP signals from copper cables to optical signals for fibre-optic transmission.

The fibre-optic coupler ensures potential-free and fail-safe transmission of bus signals from the safe to the explosion hazardous area, even over very long distances.

The fibre-optic coupler OC11Ex/3G is installed in the non-explosion hazardous area or zone 2. The coupler's standard RS485 interface receives the PROFIBUS-DP signals, whereas its intrinsically safe fibre-optic interface provides the optical signals to the TURCK zone 1 coupler OC11Ex/2G (see page 46 and Fig. below). The fibre-optic coupler OC11Ex/3G is equipped with

- an RS485 interface – a standard PROFIBUS interface with RS485 levels according to EIA 485 (the control line for direction reversal is not connected)
- an intrinsically safe optical interface with ST connectors for emitter and receiver connection.

Up to 31 bus devices can be connected to the fibre-optic coupler. Baud rates of 9.6 kbps up to 1,5 Mbps can be set and are automatically detected by the device. For diagnostics, there are 4 status LEDs to indicate the active power supply, the fibre-optic segment, the RS485-segment and the baud rate status. The device is equipped with an M8 communication interface.

Line errors (wire-break/short-circuit) are not transferred from one segment to the other, so that fail-safe and independent operation of all segments is ensured. In order not to restrict the maximum system expansion and line length of a PROFIBUS segment, amplitude and phase are regenerated by the coupler.

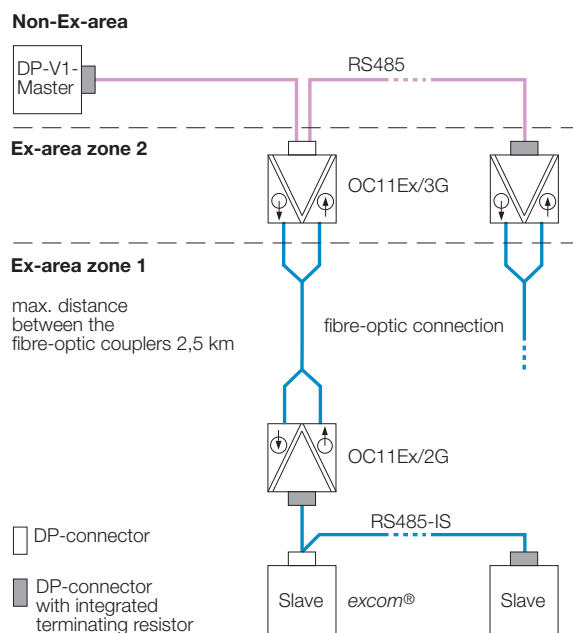
Internally, the shield is connected capacitively to the equipotential bond (PA). However, the user may choose an appropriate shielding concept that suits his specific installation requirements and actual causes of interference.

Pre-assembled fibre optic cables are provided on page 50.

OC11Ex/3G

- Data exchange between electrically wired and optical PROFIBUS-DP via fibre-optics
- Fibre-optic coupler OC11Ex/3G for Zone 2
- RS485 interface for up to 31 nodes
- Transmission of bus signals over long distances
- Fail-safe communication
- Automatic baud rate detection (selection of baud rate via rotary switch)
- Regeneration of amplitude and phase

System construction with coupler OC11Ex/...

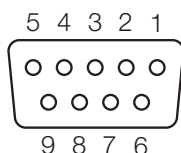


PROFIBUS-DP – Fibre-optic coupler for zone 2 OC11Ex/3G

Type	OC11Ex/3G
Ident-no.	6890424
Operating voltage	18...32 VDC
Current consumption	< 100 mA
Transmission rate	9,6 kBit/s...1,5 Mbit/s (auto-detection)
Galvanic isolation	
from supply voltage (to EN 50020)	60 V
Ex-approval	PTB 05 ATEX 2052 X / PTB 05 ATEX 2053 X
Marking of device	[Ex ib op is] IIC / EEx nA II T4
LED indications	
Operation	1 × green
– green	input voltage o.k.
– off	input voltage too low
Status PROFIBUS segments	2 × red/yellow (dual colour LED)
– red	error in PROFIBUS/fibre-optic segment
– yellow	receipt of valid data
– off	no data transmission
Automatic baud rate detection	1 × yellow
– permant yellow	baud rate detected
– yellow flashing	baud rate detection active
– off	baud rate setting via rotary switch
Connection technology	
– PROFIBUS-DP	1 × SUB-D connector, 9-pole
– Fibre-optic	2 × ST connectors
– Voltage supply	COMBICON screw connector, 3-pole
– Communication interface	1 × M8 connector
– Equipotential bond (PA)	M5 × 1 earthing stud
Housing	
Dimensions [mm]	72 × 105,5 × 31
Housing material	Aluminium, anodized
Cover Material	FR4, grey
Degree of protection (IEC 60529/EN 60529)	IP20
Ambient temperature	-20...+70 °C

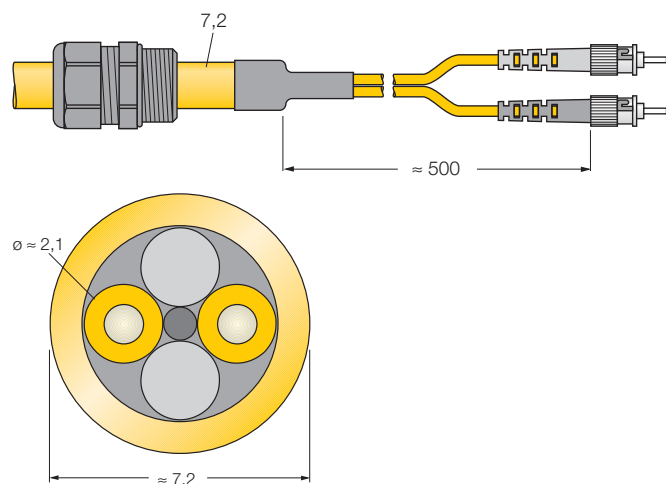
Wiring diagram

(SUB-D connectors see page 53)



RS485

- 1 = n. c.
- 2 = n. c.
- 3 = RxD/TxD-P
- 4 = n. c.
- 5 = DGND
- 6 = DP
- 7 = n. c.
- 8 = RxD/TxD-N
- 9 = n. c.

**PROFIBUS-DP – Fibre-optic cable, pre-assembled
CABLE LWL-2ST/SY-*...M**


- 2-wire fibre-optic cable for optical signal processing
- Suited for application in dry and humid environments
- High flame retardance acc. to IEC 60332-3, category C
- Colour of outer jacket: yellow

Types and ident-no.

see table on other page

Cable construction

Fibre	graded-index optical waveguide G62,5/125 µm
Conductor	compact conductor, Ø 0.9 mm
Strain relief	Aramid fibre over conductor's
Inner jacket	halogen-free compound, Ø approx. 2.1 mm
– Colour	yellow with consecutive numbering
Stranding	fibre-optic elements and blind elements stranded via central strain relief component
Wrapping	at least one layer of fleece foil
Outer jacket	polyvinyl chloride (PVC)
– Colour	yellow
– Imprint	TURCK LWL cable KL-AT-V(ZN)HY-II 2 × G62,5/125 -20...+60 °C Year of Manufacture

Geometric data

Diameter across fibre-optic element	approx. 2.1 mm
Tensile load capacity	600 N
Insulation thickness (outer jacket)	nom. 1.0 mm
Outer diameter	approx. 7.2 mm
Weight	approx. 50 kg/km

Ambient temperature

– stationary/at rest	-20 ... +60 °C
– moving	-5 ... +50 °C
Minimum bending diameter	20 × cable Ø
Flame retardance	to IEC 60332-3, category C

Fibre qualities (optical fibre)

Fibre type	G62,5/125
Attenuation coefficient	
– at 850 nm	max. 3.0 dB/km
– at 1300 nm	max. 0.7 dB/km
Band width	
– at 850 nm	min. 250 MHz × km
– at 1300 nm	min. 800 MHz × km
Numerical aperture (nominal rating)	0.275
Refractive index	
– at 850 nm (nominal value)	1.496
– at 1300 nm (nominal value)	1.491
Test load	100 kpsi

Fibre-optic cable connection

2 × ST connectors

PROFIBUS-DP – Fibre-optic cable, pre-assembled
CABLE LWL-2ST/SY-*...M

Type	* Cable length [m]	Ident-no.
CABLE LWL-2ST/SY-2,5M	2.5	6611300
CABLE LWL-2ST/SY-5,0M	5.0	6611301
CABLE LWL-2ST/SY-10M	10	6611302
CABLE LWL-2ST/SY-25M	25	6611303
CABLE LWL-2ST/SY-50M	50	6611304
CABLE LWL-2ST/SY-100M	100	6611305
CABLE LWL-2ST/SY-250M	250	6611306
CABLE LWL-2ST/SY-500M	500	6611307
CABLE LWL-2ST/SY-1000M	1000	6611308
CABLE LWL-2ST/SY-2500M	2500	6611309

EEx e stainless steel enclosure for use of excom® in zone 1

EG-VA6555/...

EG-VA6555/BV67...

EG-VA6555/BV68...



- EEx e stainless steel housing with a hinged cover, inspection window (EG-VA6555/... and EG-VA6555/BV68...) and flange plate is designed for insertion of the excom® module rack
- Base part with drain, 4 welded clips on the outside
- 2 mounting rails (C-rails) on rubber padding for mounting the 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
- EG-VA6555/...: The flange plate and front cover delivered with the base housing
EG-VA6555/BV67...: The front cover delivered with the base housing, factory-mounted module rack and filter
EG-VA6555/BV68...: The flange plate and front cover delivered with the base housing, factory-mounted module rack and filter

The type EGVA6555/... EEx e range of stainless steel housings offer an outstandingly comprehensive housing concept. TURCK also offers customised solutions enabling the user to configure the housing as required.

The housings are made from ruggedised stainless steel, so that they can be installed in zone 1, even in hostile and corrosive environments.

The same housing types with the dimensions 400 × 550 × 210 mm are available for the MT9... module rack.

Type	EG-VA6555/...	EG-VA6555/BV67...	EG-VA6555/BV68...
Ident.-no.	on request	on request	on request
Ex-Approval acc. to CE examination	PTB 00 ATEX 1101 U	PTB 03 ATEX 1028	PTB 03 ATEX 1028
Marking	II 2 G EEx e II	II 2 G EEx em ib [ia] IIC T4	II 2 G EEx em ib [ia] IIC T4
Housing material	stainless steel 1.4404/AISI 316L	stainless steel 1.4301/AISI 304	stainless steel 1.4404/AISI 316L
Thickness	1.5 mm	1.5 mm	1.5 mm
Surface	grinded (grain 240)	grinded (grain 240)	grinded (grain 240)
Seal materials	Acrylic, Silicone, CR cellular caoutchouc	Acrylic, Silicone, CR cellular caoutchouc	Acrylic, Silicone, CR cellular caoutchouc
Inspection window	ESG safety glass with seal	–	ESG safety glass with seal
Degree of protection (IEC/EN 60529)	IP65	IP54	IP54
Impact strength (EN 50014)	> 7 Joule	> 7 Joule	> 7 Joule
Vibration test	acc. to IEC 68-2-6	acc. to IEC 68-2-6	acc. to IEC 68-2-6
Shock testing	acc. to IEC 68-2-27	acc. to IEC 68-2-27	acc. to IEC 68-2-27
Operating temperature	-20...+80 °C	-20...+53 °C	-20...+53 °C
Dimensions	650 × 550 × 210 mm	650 × 550 × 210 mm	650 × 550 × 210 mm
Flange plate	2.0 mm stainless steel with mounting holes and drillings for cable glands	Cable glands used in the housing floor (fixed M20 hole pattern)	2.0 mm stainless steel with mounting holes and factory-mounted cable glands

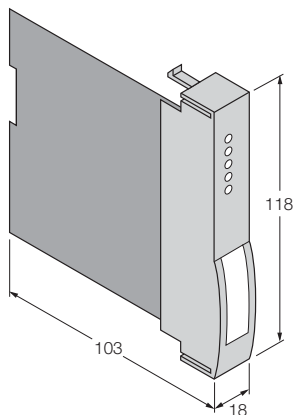
PROFIBUS-DP

Bus connectors RS485



Type	D9T-RS485	D9T-RS485PG	D9T-RS485IS	D9S-RS485
Ident-no.	6890942	6890943	6890944	6780103
Manufacturer	Siemens	Siemens	Siemens	Siemens
Manufacturer designation	6ES7 972-0BA60-0XA0	6ES7 972-0BB60-0XA0	6ES7 972-0DA60-0XA0	6ES7 972-0BA30-0XA0
Cable exit	35° for soldering	35° for soldering	35° for soldering	30° for soldering
Transmission rate	9.6 kbps...12 Mbps	9.6 kbps...12 Mbps	9.6 kbps...12 Mbps	9.6 kbps...12 Mbps
Interface type	RS485	RS485	RS485-IS	RS485 / RS485-IS
Node connector	9-pole SUB-D connector	9-pole SUB-D connector	9-pole SUB-D connector	9-pole SUB-D connector
Bus cable connection	4 insulation piercing connections (FastConnect® technology) for wires Ø 0,644 ± 0,040 mm	4 insulation piercing connections (FastConnect® technology) for wires Ø 0,644 ± 0,040 mm	4 insulation piercing connections (FastConnect® technology) for wires Ø 0,644 ± 0,040 mm	4 insulation piercing connections (FastConnect® technology) for wires Ø 0,644 ± 0,040 mm
Terminating resistor	Integrated termination combination can be switched-in via slide switch	Integrated termination combination can be switched-in via slide switch	Termination resistor integrated and switched-in via slide switch	No integrated termination resistor
Disconnection function	The outgoing bus is disconnected when the resistor is activated	The outgoing bus is disconnected when the resistor is activated	No disconnection function	No disconnection function
Power supply U_N	5.0 VDC	5.0 VDC	3.3 VDC	–
Ambient temperature T _A	0...+60 °C	0...+60 °C	-25...+70 °C	0...+60 °C
Storage temperature	-25...+80 °C	-25...+80 °C	-25...+80 °C	-25...+80 °C
Relative humidity	max. 75 % at +25 °C	max. 75 % at +25 °C	max. 75 % at +25 °C	max. 75 % at +25 °C
Dimensions (W x H x D) in mm	16 x 54 x 38	16 x 54 x 38	16 x 54 x 38	15 x 58 x 34
Weight	ca. 40 g	ca. 40 g	ca. 40 g	ca. 30 g
Degree of protection	IP20	IP20	IP20	IP20
PG connection socket	no	yes	no	no
Ex marking	–	–	II 2 G EEx ib IIC T4	–
Notes	Connector can be used on the non-intrinsically safe side of the SC12Ex and OC11Ex/3G segment coupler!	Connector can be used, instead of the D9T-RS485, on the non-intrinsically safe side of the SC12Ex and OC11Ex/G segment coupler	Only use on devices with an RS485-IS interface! Connector must be used on the intrinsically safe side of the SC12Ex and OC11Ex/2G segment coupler!	Connector can be used, instead of the TURCK connector D9T-Ex (see page 55), on the intrinsically safe terminal of the GDP1,5!

Accessories

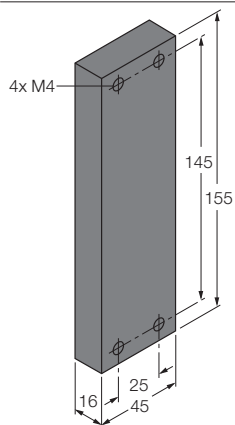


BM1

Dummy module for empty slots

Ident-no.: 6884036

- Dummy module for unused slots in the module rack

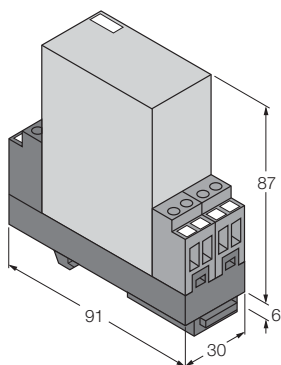


BM-PS

Power supply cover (MT18...)

Ident-no.: 6884044

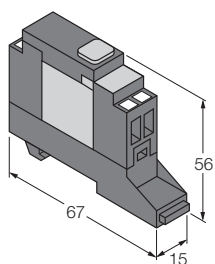
- Power supply cover for the unused slot of the power supply



MODEX filter

Ident-no.: 6884062

- Capacitor for improving startup behaviour/ increasing operational reliability

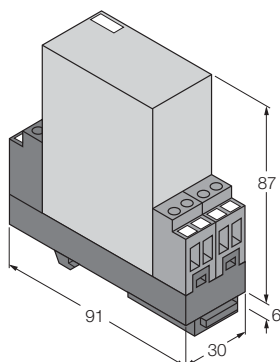


MODEX switching terminal

Ident-no.: 6884069

- Switching terminal for manual switching in hazardous area (enabling of downstream devices)

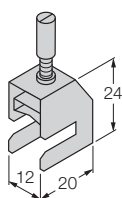
Accessories



MODEX isolating relay

Ident-no.: 6884070

- Isolating relay for isolating intrinsically safe and non-intrinsically safe circuits

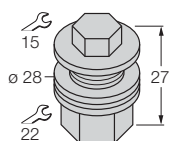


SK8

Phoenix shield terminal

Ident-no.: 6900360

- Shield terminal for connecting the shield to the shield bus

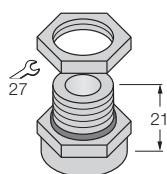


ELST-M20Ex

IP54 plastic M20 venting pipe

Ident-no.: 6884033

- Pressure compensation element for preventing condensation water in the device

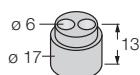


ELVA-M20Ex

IP65 stainless steel M20 venting pipe

Ident-no.: 6884110

- Pressure compensation element for preventing condensation water in the device

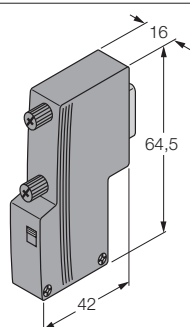


DE-V20BU-TWIN

Twin sealing insert for blue M20 cable gland

Ident-no.: 6884075

- Multi-sealing insert (2 × 6 mm) for Ex standard M20 cable gland



D9T-Ex

Bus connector

Ident-no.: 6890938

- RS485-IS bus connector on excom® gateway GDP1,5

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