Intrinsically Safe Remote I/O System

- Intrinsically safe remote I/O system for field devices located in Zone 1 locations
- Redundant power supplies and gateways
- Intrinsically safe connection to PROFIBUS-DP with V1 functionality
- Online programming and configuration of all parameters
- Initial HART operating parameters set consistently from process control system to field device
- Temperature range from -20° to +70°C (-4° to +158°F)
- Exchange and extension of all components during operation
- Simple manual insertion and removal of modules without tools
- 128 discrete or 64 analog intrinsically safe channels via a single bus address
- “Forcing“ and substitute value programming of analog and discrete I/O
### excom® – System Overview

#### Device Features

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Page</th>
<th>Type of Device</th>
<th>Type of Input</th>
<th>Type of Output</th>
<th>Number of Inputs</th>
<th>Number of Outputs</th>
<th>Short-Circuit Monitoring</th>
<th>Wire-Break Monitoring</th>
<th>Min./Max. Current [mA]</th>
<th>Maximum Voltage [V]</th>
<th>Initial Operating Parameters Set</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP1.5</td>
<td>8</td>
<td>gateway</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>•</td>
<td>–</td>
<td>–</td>
<td>GSD</td>
</tr>
<tr>
<td>DM80Ex</td>
<td>10</td>
<td>I/O module</td>
<td>NAMUR</td>
<td>discrete</td>
<td>8</td>
<td>8</td>
<td>•</td>
<td>•</td>
<td>-/-4</td>
<td>9.6</td>
<td>•</td>
<td>–</td>
</tr>
<tr>
<td>DI40Ex</td>
<td>12</td>
<td>1 module</td>
<td>NAMUR</td>
<td>–</td>
<td>4</td>
<td>–</td>
<td>•</td>
<td>•</td>
<td>-/-4</td>
<td>8.7</td>
<td>•</td>
<td>–</td>
</tr>
<tr>
<td>AI40Ex</td>
<td>14</td>
<td>1 module</td>
<td>analog</td>
<td>–</td>
<td>4</td>
<td>–</td>
<td>•</td>
<td>•</td>
<td>0(4)/20</td>
<td>18.9</td>
<td>•</td>
<td>–</td>
</tr>
<tr>
<td>AIH40Ex</td>
<td>16</td>
<td>1 module</td>
<td>analog</td>
<td>–</td>
<td>4</td>
<td>–</td>
<td>•</td>
<td>•</td>
<td>0(4)/20</td>
<td>25.4</td>
<td>•</td>
<td>–</td>
</tr>
<tr>
<td>TI40Ex</td>
<td>18</td>
<td>1 module</td>
<td>analog</td>
<td>–</td>
<td>4</td>
<td>–</td>
<td>•</td>
<td>•</td>
<td>-/-2</td>
<td>2</td>
<td>•</td>
<td>–</td>
</tr>
<tr>
<td>DO40Ex</td>
<td>20</td>
<td>O module</td>
<td>discrete</td>
<td>–</td>
<td>4</td>
<td>–</td>
<td>•</td>
<td>•</td>
<td>4.5</td>
<td>18.9</td>
<td>•</td>
<td>–</td>
</tr>
<tr>
<td>AO40Ex</td>
<td>22</td>
<td>O module</td>
<td>analog</td>
<td>–</td>
<td>4</td>
<td>–</td>
<td>•</td>
<td>•</td>
<td>0(4)/20</td>
<td>18.9</td>
<td>•</td>
<td>–</td>
</tr>
<tr>
<td>AOI40Ex</td>
<td>24</td>
<td>O module</td>
<td>analog</td>
<td>–</td>
<td>4</td>
<td>–</td>
<td>•</td>
<td>•</td>
<td>0(4)/20</td>
<td>26</td>
<td>•</td>
<td>–</td>
</tr>
<tr>
<td>MT18/MT9/MT5</td>
<td>26</td>
<td>backplane</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>PSA230Ex</td>
<td>28</td>
<td>supply</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>PSD24Ex</td>
<td>28</td>
<td>supply</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

#### Page

<table>
<thead>
<tr>
<th>Gateways</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input/Output Modules</td>
<td>10</td>
</tr>
<tr>
<td>Input Modules</td>
<td>12</td>
</tr>
<tr>
<td>Output Modules</td>
<td>20</td>
</tr>
<tr>
<td>Backplanes</td>
<td>26</td>
</tr>
<tr>
<td>Power Supplies</td>
<td>28</td>
</tr>
</tbody>
</table>
Intrinsically Safe Remote I/O System

System Overview

excom® is a remote I/O system for use in potentially explosive hazardous locations. It features bus-compatible, decentralized input and output modules in IP 20 housings (IP 67 in preparation) that support discrete and analog intrinsically safe field devices. The modules are approved for use in Zones 1 and 2. Use in Division 1 requires use of a modified power supply. Consult factory for availability.

The system consists of power supplies, gateways, I/O modules and a backplane. The backplane serves to distribute energy, transmit data and connect field devices. The power supply units ensure that reliable power is supplied to the entire system. A single power supply is sufficient for correct system operation. However, in order to enhance system availability, a second supply may be connected for redundancy.

The gateways fulfill 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. Gateways control data communication between an I/O module and the process control system (PLC). The excom system may be configured with redundant gateways. The I/O modules act as interfaces to the intrinsically safe field devices. They receive intrinsically safe power from the supply units via the backplane. Up to 16 I/O modules may be operated within a single backplane.

Modules are easily connected: gateways, power supplies and I/O modules are simply plugged onto the backplane and latched. After the internal connections have been established, the peripheral components may be connected.

The modules are hot-swappable. They may be plugged onto and removed from the backplane during operation in hazardous locations. When replacing faulty modules, the system automatically checks whether the previous module and the replacement are identical. The system supports substitute value programming.

The internal cycle time of a fully assembled system is below 5 ms (discrete processing; analog signals < 20 ms). The response time also depends upon the type of control system and fieldbus used in the application. If this is too long for some applications, it is possible to carry out direct assignments from inputs to outputs and to configure small function blocks within the system (PID in preparation). The system supports HART-compatible field devices; PROFIBUS-DP-V1 enables HART communication with the PLC.

System Configuration
Required Components for System Assembly

In order to assemble a system, the following components are required as a minimum:

(1) MT5 or MT9 or MT18 backplane
(1) PSD24Ex power supply (24 VDC)
(1) GDP1.5 PROFIBUS-DP gateway, 1.5 Mbps

Then choose from the following discrete or analog input and output modules based upon the application:

- DM80Ex discrete input/output module for connection of NAMUR sensors and low voltage actuators
- DI40Ex discrete input module for connection of NAMUR sensors
- DO40Ex discrete output module for connection of intrinsically safe solenoid valves < 1 W
- AIH40Ex analog input module for connection of 2-wire transmitters with HART functionality
- AI40Ex analog input module for connection of 2-wire transmitters
- TI40Ex analog input module for connection of temperature detectors
- AOH40Ex analog output module for connection of actuators with HART functionality
- AO40Ex analog output module for connection of analog actuators

PLC/SPC Connection

excom® may be connected to the following systems:

- SIEMENS S7/300 and S7/400
- SIEMENS PCS7
- SIEMENS S5 with IM 318 interface module
- ABB Freelance and Symphonie
- Fisher Rosemount Delta V
- ALLEN BRADLEY PLC-5 with 1785-PFB interface module
- GE-Fanuc Series 90™-70 with PROFIBUS-DP interface module
- MODICON QUANTUM™
- MITSUBISHI MELSEC-A™ family
- BOSCH PLC with DESI-DP™ interface module
- S-S TECHNOLOGIES - ISA, PC/104, PCMCIA, MULTIBUS and VME interface module

All other systems featuring PROFIBUS-DP master functionality may also be connected to excom.

In order to obtain access to the full range of functions, a PROFIBUS-DP master with V1 functionality should be used.

Connections

Bus:
The MT18 backplane contains two 9-pole D-SUB connectors (redundant) and the MT5 and MT9 backplanes contain one 9-pole D-SUB connector for bus connection. Either copper cables conforming to PROFIBUS-DP specifications or fiber optics with matching transducers may be used. When mounting in a hazardous location, applicable precautionary measures must be used (see Installation Guidelines).

Power supply:
The standard backplane for Zones 1 and 2 features EEx e terminals for power supply connection.

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

Inputs/outputs:
The backplane contains four 4-pole connectors per I/O module for connection to field devices. Several connection methods may be used, such as cage clamp terminals, screws, etc. Please consider the connection options when ordering components.

Caution:
All applicable regulations governing hazardous-location installations must be observed.
Intrinsically Safe Remote I/O System

Diagnostics

The gateway provides extended PROFIBUS-DP diagnostics, i.e. the full range of diagnostic data including channel-specific error indications. Each module is equipped with LEDs for field error indication. All I/O modules also feature LEDs for input/output diagnosis and status indication. LED indications conform 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

Additional details are contained in the operating manual.

Addressing

The modules are addressed according to their physical location, thereby eliminating any need for manual addressing. A module inserted into slot 0 is assigned the internal address 0, a module in slot 15 is assigned to address 15, etc. Three coded rotary switches are used to set the rack’s PROFIBUS-DP address (maximum 127). PROFIBUS-DP sees the system as a variable slave. Therefore, only the I/O modules physically present are assigned addresses by the PLC or process control system.

Communication Rates / Cycle Times

The PROFIBUS-DP master determines the system-specific communication rate. Admissible comm rates range from 9.6 to 1500 kbps. The internal cycle time to process 128 discrete signals is less than 5 ms; to process 64 analog signals requires less than 20 ms. The response time of the entire system largely depends on the number of PROFIBUS-DP nodes and the processing time of the higher level system.

The general formula is:

\[ T_R = 2 \times T_I + 2 \times T_B + 2 \times T_{PLS} \]

Where:
- \( T_R \) = response time
- \( T_I \) = internal cycle time Ex link
- \( T_B \) = cycle time of higher level bus
- \( T_{PLS} \) = cycle time of process control system.

Software/System CD

<table>
<thead>
<tr>
<th>Type</th>
<th>excom® design</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td>- - - -</td>
</tr>
</tbody>
</table>

CD with PROFIBUS-DP configuration program

Download from www.turck.com
Maximum System Extension

PROFIBUS-DP allows no more than 32 nodes to operate on one segment (including the master). The use of repeaters enables the operation of 126 nodes with one PROFIBUS-DP master. Each segment may only be operated with the specified comm rate and maximum cable length. No more than four repeaters may be used on a network above 500 kbps. At 500 kbps and below up to seven repeaters may be used. The maximum cable lengths (without repeaters) depending on the communication rate are shown in the table below:

<table>
<thead>
<tr>
<th>Comm Rate</th>
<th>Bus Segment (length of bus line)</th>
<th>Repeater (max. number)</th>
<th>Nodes (max. number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.6 kbps</td>
<td>3942 ft (1200 m)</td>
<td>7</td>
<td>126</td>
</tr>
<tr>
<td>19.2 kbps</td>
<td>3942 ft (1200 m)</td>
<td>7</td>
<td>126</td>
</tr>
<tr>
<td>93.75 kbps</td>
<td>3942 ft (1200 m)</td>
<td>7</td>
<td>126</td>
</tr>
<tr>
<td>187.5 kbps</td>
<td>3285 ft (1000 m)</td>
<td>7</td>
<td>126</td>
</tr>
<tr>
<td>500 kbps</td>
<td>1314 ft (400 m)</td>
<td>7</td>
<td>126</td>
</tr>
<tr>
<td>1.5 Mbps</td>
<td>656 ft (200 m)</td>
<td>4</td>
<td>126</td>
</tr>
</tbody>
</table>

Installation Guidelines

excom® is a remote I/O system to be installed in Zone 1 or Zone 2 hazardous locations with intrinsically safe connections to field devices in Zone 0 locations. An excom system rated for installation in Division 1 locations is currently under development. Consult factory for availability.

The excom system communicates with a control system via PROFIBUS-DP. When using copper cables an approved segment coupler must be used. In this case, only ten excom modules may be used with one segment coupler. The use of fiber optics is also permitted. If redundancy is required, two gateways may be installed.

The power supply is connected via EEx e (increased safety) terminals. Both power supplies (115/230 VAC or 24 VDC) may be installed and exchanged during operation. Please observe standard safety regulations regarding terminal connections.

Field components such as sensors and actuators located in the hazardous location connect to the I/O modules via terminals. The modules are rated for connection to devices in Zone 0 (protection type EEx ib[ia] IIC T4) and provide secure galvanic isolation. Modules, sensors and actuators may be exchanged hot.

If the system is installed in a hazardous location, suitable field housings are required. It is possible to order devices in appropriate field housings to ensure that the required protection type is fulfilled.

All modules, the gateway to the higher level fieldbus and the power supply carry separate approvals. They may only be used in conjunction with approved backplanes.
The GDP1.5 gateway serves to connect the excom® system to the PROFIBUS-DP network. It is intrinsically safe and may be installed in Zone 1 or Zone 2 hazardous locations without additional protective measures.

Copper cables or fiber optics (requiring additional module) may be used to connect the gateway to the PROFIBUS-DP network. When using copper cables an approved segment coupler must be used on the PROFIBUS-DP side to ensure explosion protection.

The gateway may be configured for a maximum comm rate of 1500 kbps. It does not feature a mechanical interface to the PROFIBUS-DP. Two standard miniature D-SUB connectors on the module rack connect the excom system to the bus. This arrangement allows gateways to be exchanged without interrupting bus communication and enables redundant system configuration.

To reduce response times and facilitate control system operation, the gateway performs input and output assignment and function block processing (e.g. PID algorithms in preparation).

A GSD file for system configuration is available from TURCK. For online configuration use the software tool "excom design".

**Redundancy:** The use of two gateways and two bus lines ensures error-free, continuous communication. Should one of the gateways or bus lines fail, the other immediately takes over.

**Principle of operation:** The primary active gateway is inserted into slot 0. The gateway in slot 1 is in stand-by mode and monitors data communication in both directions, i.e. data transfer to the PROFIBUS-DP master and to the I/O modules. Both gateways check their data for consistency. If variations exist, e.g. a bus line is disconnected or a gateway does not receive messages, the other gateway becomes active and generates an error indication via the PROFIBUS-DP.

**Recommended connection components:**
- PROFIBUS-DP: RSWW D9 RKSW 455 - 1.0M/1.0M (InterlinkBT)

**Connections**
- PROFIBUS-DP via D-SUB connectors
<table>
<thead>
<tr>
<th><strong>Type</strong></th>
<th>GDP1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ID Number</strong></td>
<td>M6884008</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Power Supply</strong></th>
<th>from central power supply via module rack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal power consumption</td>
<td>&lt; 1.5 W</td>
</tr>
<tr>
<td>Galvanic isolation to PROFIBUS-DP</td>
<td>375 Vpp (per EN 50020)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Connections</strong></th>
<th>9-pole D-SUB connector on module rack via connectors on module rack</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIBUS-DP</td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Intrinsic Safety Parameters</strong></th>
<th>EEx ib IIC T4 (PTB 00 ATEX 2162)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-circuit current I₀</td>
<td>≤ 100 mA</td>
</tr>
<tr>
<td>Maximum voltage U₀</td>
<td>≤ 3.75 V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LED Indications</strong></th>
<th>green/red (dual color LED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power/Fault</td>
<td>yellow</td>
</tr>
<tr>
<td>CAN</td>
<td>yellow</td>
</tr>
<tr>
<td>Internal bus communication</td>
<td>yellow</td>
</tr>
<tr>
<td>PROFIBUS-DP communication</td>
<td>yellow</td>
</tr>
<tr>
<td>Configuration</td>
<td>red</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>General Data</strong></th>
<th>IEC IP 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20° to +70°C (-4° to +158°F)</td>
</tr>
<tr>
<td>Dewing</td>
<td>for a short period only (during system set-up)</td>
</tr>
</tbody>
</table>
Intrinsically Safe Remote I/O System

The DM80Ex is an eight-channel discrete input/output module designed for connection to NAMUR sensors, mechanical contacts, or low power actuators. If mechanical contacts are connected and monitored for wire-break and short-circuit, a resistor circuit must be used.

The module is approved for Zone 1 hazardous locations with connections to approved field devices or simple apparatus in Zone 0. No additional protective measures are required for connected field devices.

When connecting field devices, please observe that all inputs/outputs operate at the same potential – e.g. there is no galvanic isolation between channels.

It is possible to configure circuit monitoring, failsafe mode, polarity, and damping for the entire module using any standard PROFIBUS-DP master and the system GSD file. The software tool “excom design” or a PROFIBUS-DP master with V1 functionality enables the configuration of these parameters separately for each channel.

Additionally, the eight channels of the DM80Ex can be configured as follows:

- 8 inputs/0 outputs, 7 inputs/1 output . . . , 0 inputs/8 outputs

This allows greater flexibility in configuring the system per application requirements.

DM80Ex

- Input/output module for NAMUR sensors and actuators
- Zone 1 hazardous location approval with connections to approved field devices in Zone 0
- Connections for up to 8 NAMUR sensors or mechanical contacts
- Connections for up to 8 low-power actuators (low-power valves)
- Short-circuit and wire-break detection
- Galvanic isolation between input, bus and power supply
- Inputs and outputs at one common potential
- Configurable input or output function

Connections

- Inputs and outputs via MINI COMBICON plug-in terminals; versions available with screw, crimp or cage-clamp connections
## Discrete Input/Output Module

**DM80Ex**  
**8 Input NAMUR/8 Output**

<table>
<thead>
<tr>
<th>Type</th>
<th><strong>DM80Ex</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td>M6884006</td>
</tr>
</tbody>
</table>

### Power Supply
- From central power supply via module rack
- Internal power consumption: $< 1 \text{ W}$
- Galvanic isolation to bus and to supply

### Inputs
- (8) NAMUR sensors or dry contacts
- Input voltage: 8 VDC
- Input current: approx. 4 mA per input
- Switching threshold ON/OFF: 1.8 mA/1.4 mA
- Switching frequency: < 100 Hz
- Short-circuit threshold: $R_s < 367 \Omega$
- Wire-break threshold: < 0.2 mA

### Outputs
- (8) low-power actuators
- Output voltage: 8 VDC
- Nominal output current: < 4 mA per output
- Internal resistance: 320 $\Omega$
- Switching frequency: < 100 Hz
- Short-circuit threshold: $R_s < 1 \text{ k}\Omega$
- Wire-break threshold: < 0.2 mA

### Intrinsic Safety Parameters (Field Circuits)
- EEx ia IIC T4 (PTB 00 ATEX 2178)
- Short-circuit current $I_0$: $\leq 44 \text{ mA}$
- Max. voltage $U_0$: $\leq 9.6 \text{ V}$
- Max. power $P_0$: $\leq 110 \text{ mW}$
- Max. external inductances $L_a$: $\leq 10 \text{ mH}$
- Max. external capacitances $C_a$: $\leq 3 \mu\text{F}$

### Initial Operating Parameters
- Bounce time: 2 - 100 ms per channel
- Inputs/outputs per channel
- Wire-break monitoring per channel
- Short-circuit monitoring per channel
- Function mode inputs separately programmable for each channel
- Substitute value programming per channel

### LED Indications
- Power on/module function: green/red (dual color LED)
- Input/output status: (8) yellow/red (dual color LED)

### General Data
- Hazardous location approval: EEx ib [ia] IIC T4 (PTB 00 ATEX 2178)
- Enclosure: IEC IP 20
- Operating temperature: -20°C to +70°C (-4°F to +158°F)
- Dewing: for a short period only (during system set-up)
Intrinsically Safe Remote I/O System

The DI40Ex is a four-channel discrete input module designed for connection to NAMUR sensors or mechanical contacts. If mechanical contacts are connected and monitored for wire-break and short-circuit, a resistor circuit must be used.

The module is approved for Zone 1 hazardous locations with connections to approved field devices or simple apparatus in Zone 0. No additional protective measures are required for connected field devices.

The DI40Ex is capable of evaluating high-speed events with a repeat frequency of up to 10 kHz. The input delay is adjustable in the range of 100 μs to 100 ms.

The module can be used as a frequency meter or incremental counter.

Using any standard PROFIBUS-DP master and the system GSD file, it is possible to configure circuit monitoring, failsafe mode, polarity and damping for the module.

In addition to all other programmable parameters, it is possible to set two limit values per channel using the software tool “excom design” or a PROFIBUS-DP master with V1 functionality. This feature serves to solve positioning applications (e.g. switching from a low-speed drive to a high-speed drive). Two corresponding outputs may be programmed to switch on or off when a limit value is reached. This feature reduces response time to significantly below standard ratings.

**DI40Ex**

- Intrinsically safe high-speed counter module for connection of intrinsically safe sensors
- Zone 1 hazardous location approval with connections to approved field devices in Zone 0
- Connections for up to four NAMUR sensors or mechanical contacts
- Wire-break and short-circuit monitoring
- Galvanic isolation between input, bus and power supply
- Galvanic isolation between inputs
- Adjustable limit values

**Connections**

- Inputs via MINI COMBICON plug-in terminals; versions available with screw, crimp or cage-clamp connections
### Discrete Input Module

**DI40Ex**

4 Input NAMUR

<table>
<thead>
<tr>
<th><strong>Type</strong></th>
<th>DI40Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ID Number</strong></td>
<td>M6884004</td>
</tr>
</tbody>
</table>

**Power Supply**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>from central power supply via module rack</td>
<td></td>
</tr>
<tr>
<td>Internal power consumption</td>
<td>&lt; 1 W</td>
</tr>
<tr>
<td>Galvanic isolation</td>
<td>between channels</td>
</tr>
</tbody>
</table>

**Inputs**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4) NAMUR sensors</td>
<td></td>
</tr>
<tr>
<td>Input voltage</td>
<td>8 VDC</td>
</tr>
<tr>
<td>Input current</td>
<td>&lt; 3 mA per input</td>
</tr>
<tr>
<td>Switching threshold ON/OFF</td>
<td>1.8 mA/1.4 mA</td>
</tr>
<tr>
<td>Switching frequency (frequency meter/counter)</td>
<td>&lt; 10 kHz</td>
</tr>
<tr>
<td>Switching frequency (discrete input)</td>
<td>&lt; 100 Hz</td>
</tr>
<tr>
<td>Short-circuit threshold</td>
<td>$R_s &lt; 367 , \Omega$</td>
</tr>
<tr>
<td>Wire-break threshold</td>
<td>&lt; 0.2 mA</td>
</tr>
<tr>
<td>Counter value</td>
<td>32 bit</td>
</tr>
</tbody>
</table>

**Intrinsic Safety Parameters (Field Circuits)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_0$</td>
<td>≤ 8.8 mA</td>
</tr>
<tr>
<td>$U_0$</td>
<td>≤ 8.7 V</td>
</tr>
<tr>
<td>$P_0$</td>
<td>≤ 20 mW</td>
</tr>
<tr>
<td>Max. external inductances $L_s$</td>
<td>≤ 330 mH</td>
</tr>
<tr>
<td>Max. external capacitances $C_s$</td>
<td>≤ 6 µF</td>
</tr>
</tbody>
</table>

**Initial Operating Parameters**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bounce time</td>
<td>0.01 - 10 ms per channel</td>
</tr>
<tr>
<td>Wire-break monitoring</td>
<td>per channel</td>
</tr>
<tr>
<td>Short-circuit monitoring</td>
<td>per channel</td>
</tr>
<tr>
<td>Function mode</td>
<td>per channel</td>
</tr>
<tr>
<td>Substitute value programming</td>
<td>per channel</td>
</tr>
</tbody>
</table>

**LED Indications**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power on/module function</td>
<td>green/red (dual color LED)</td>
</tr>
<tr>
<td>Input status</td>
<td>(4) yellow/red (dual color LED)</td>
</tr>
</tbody>
</table>

**General Data**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous location approval</td>
<td>EEx ia IIC T4 (PTB approval pending)</td>
</tr>
<tr>
<td>Enclosure</td>
<td>IEC IP 20</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20° to +70°C (-4° to +158°F) for a short period only (during system set-up)</td>
</tr>
<tr>
<td>Dewing</td>
<td></td>
</tr>
</tbody>
</table>
The AI40Ex is a four-channel analog input module designed for connection to 2-wire 4-20 mA transmitters or 0/4-20 mA current sources. A transmitter supply voltage of >15.0 V at 22 mA is provided to power 2-wire transmitters. HART-compatible transmitters may be connected and communicated with via an approved HART modem on the field side of the system. However, HART communications will not pass through the AI40Ex.

The module is approved for Zone 1 hazardous locations with connections to approved field devices in Zone 0. No additional protective measures are required for connected field devices.

The resolution is 14 bits, i.e. the analog value of 0-25 mA is represented as a number between 0 and 16384. Data representation depends upon the type of control system used.

Using any standard PROFIBUS-DP master and the system GSD file, it is possible to configure circuit monitoring, failsafe mode, input range, and damping for the module. The software tool “excom design” or a PROFIBUS-DP master with V1 functionality enables the configuration of these parameters separately for each channel.

**AI40Ex**

- Intrinsically safe analog input module for connection of transducers
- Zone 1 hazardous location approval with connections to approved field devices in Zone 0
- Connections for up to four 2-wire transmitters or current sources
- Wire-break and short-circuit monitoring
- Galvanic isolation between input, bus and power supply
- Galvanic isolation between inputs

**Connections**

- Inputs via MINI COMBICON plug-in terminals; versions available with screw, crimp or cage-clamp connections
### Analog Input Module
#### AI40Ex
4 Input

<table>
<thead>
<tr>
<th>Type</th>
<th>AI40Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td>M6884009</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Supply</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>from central power supply via module rack</td>
<td></td>
</tr>
<tr>
<td>Internal power consumption</td>
<td>&lt; 2 W</td>
</tr>
<tr>
<td>Galvanic isolation</td>
<td>complete isolation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4) analog sensors</td>
<td></td>
</tr>
<tr>
<td>Input voltage</td>
<td>&gt; 15.0 VDC at 22 mA (at transducer)</td>
</tr>
<tr>
<td>Input current</td>
<td>0/4 to 20 mA per input</td>
</tr>
<tr>
<td>HART impedance</td>
<td>240 Ω</td>
</tr>
<tr>
<td>Overrange</td>
<td>&gt; 22 mA</td>
</tr>
<tr>
<td>Short-circuit</td>
<td>&lt; 5 V (in live zero mode only)</td>
</tr>
<tr>
<td>Underrange</td>
<td>2 to 3.6 mA</td>
</tr>
<tr>
<td>Wire-break</td>
<td>&lt; 2 mA (in live zero mode only)</td>
</tr>
<tr>
<td>Resolution</td>
<td>14 bit</td>
</tr>
<tr>
<td>Linearity tolerance</td>
<td>&lt; 0.1 % of full scale</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>&lt; 50 ppm/K</td>
</tr>
<tr>
<td>Rise/release time</td>
<td>&lt; 50 ms (10 - 90 %)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intrinsic Safety Parameters (Field Circuits)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEx ia IIC T4 (PTB approval pending)</td>
<td></td>
</tr>
<tr>
<td>Short-circuit current $I_0$</td>
<td>$\leq 93$ mA</td>
</tr>
<tr>
<td>Max. voltage $U_0$</td>
<td>$\leq 18.9$ V</td>
</tr>
<tr>
<td>Max. power $P_0$</td>
<td>$\leq 500$ mW</td>
</tr>
<tr>
<td>Max. external inductances $L_a$</td>
<td>$\leq 4$ mH</td>
</tr>
<tr>
<td>Max. external capacitances $C_a$</td>
<td>$\leq 100$ nF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial Operating Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire-break monitoring</td>
<td>per channel</td>
</tr>
<tr>
<td>Short-circuit monitoring</td>
<td>per channel</td>
</tr>
<tr>
<td>Substitute value programming</td>
<td>per channel</td>
</tr>
<tr>
<td>Live zero/dead zero</td>
<td>per channel</td>
</tr>
<tr>
<td>Software filter</td>
<td>per channel</td>
</tr>
<tr>
<td>50/60 Hz suppression</td>
<td>$&gt; 30$ dB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LED Indications</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power on/module function</td>
<td>green/red (dual color LED)</td>
</tr>
<tr>
<td>Input status</td>
<td>(4) red</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous location approval</td>
<td>EEx ib [ia] IIC T4 (PTB approval pending)</td>
</tr>
<tr>
<td>Enclosure</td>
<td>IEC IP 20</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20° to +70 °C (-20° to +70°F)</td>
</tr>
<tr>
<td>Dewing</td>
<td>for a short period only (during system set-up)</td>
</tr>
</tbody>
</table>
Intrinsically Safe Remote I/O System

The AIH40Ex is a four-channel analog input module designed for connection to HART-compatible 2-wire 4-20 mA transmitters or 0/4-20 mA current sources. The module can be configured to allow HART communications signals to pass through unimpeded. A transmitter supply voltage of >15.0 V at 22 mA is provided to power 2-wire transmitters.

The module is approved for Zone 1 hazardous locations with connections to approved field devices in Zone 0. No additional protective measures are required for connected field devices.

The resolution is 14 bits, i.e. the analog value of 0-25 mA is represented as a number between 0 and 16384. Data representation depends upon the type of control system used.

When connecting field devices, please observe that all inputs operate at the same potential – e.g. there is no galvanic isolation between channels.

Using any standard PROFIBUS-DP master and the system GSD file, it is possible to configure circuit monitoring, failsafe mode, HART status, and damping for the module. The software tool “excom design” or a PROFIBUS-DP master with V1 functionality enables the configuration of these parameters separately for each channel.

**AIH40Ex**

- Intrinsically safe analog input module for HART-compatible transducers
- Zone 1 hazardous location approval with connections to approved field devices in Zone 0
- Connections for up to four 2-wire transmitters or current sources
- Wire-break and short-circuit monitoring
- Galvanic isolation between input, bus and power supply
- Inputs at common potential
- Transmission of HART signals

**Connections**

- Inputs via MINI COMBICON plug-in terminals; versions available with screw, crimp or cage-clamp connections
<table>
<thead>
<tr>
<th><strong>Type</strong></th>
<th>AIH40Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ID Number</strong></td>
<td>M6884001</td>
</tr>
</tbody>
</table>

**Power Supply**

- from central power supply via module rack
- Internal power consumption: $< 2$ W
- Galvanic isolation: complete isolation

**Inputs**

- Inputs: $(4)$ analog sensors
- Input voltage: $> 15.0$ VDC at $22$ mA (at transducer)
- Input current: $0/4$ to $20$ mA per input
- HART impedance: $240$ Ω
- Overrange: $> 22$ mA
- Short-circuit: $< 5$ V (in live zero mode only)
- Underrange: $2$ to $3.6$ mA
- Wire-break: $< 2$ mA (in live zero mode only)
- Resolution: $14$ bit
- Linearity tolerance: $< 0.1$ % (of full scale)
- Temperature drift: $< 50$ ppm/K
- Rise/release time: $< 50$ ms (10 - 90 %)

**Intrinsic Safety Parameters (Field Circuits)**

- EEx ia IIC T4  (PTB 00 ATEX 2059)
- Short-circuit current $I_0$: $\leq 93$ mA
- Max. voltage $U_0$: $\leq 25.4$ V
- Max. power $P_0$: $\leq 600$ mW
- Max. external inductances $L_a$: $\leq 4$ mH
- Max. external capacitances $C_a$: $\leq 20$ nF

**Initial Operating Parameters**

- 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: green/red (dual color LED)
- Input status: $(4)$ red

**General Data**

- Hazardous location approval: EEx ib [ia] IIC T4  (PTB 00 ATEX 2059)
- Enclosure: IEC IP 20
- Operating temperature: $-20^\circ$ to $+70^\circ$ C  ($-4^\circ$ to $+158^\circ$ F)
- Dewing: for a short period only (during system set-up)
Intrinsically Safe Remote I/O System

The TI40Ex is a four-channel analog input module designed for connection to 2-, 3-, and 4-wire RTDs or thermocouples. PT100, PT1000, and Ni100 RTDs are supported, as well as types B, E, J, K, L, N, R, S, and T thermocouples.

The module is approved for Zone 1 hazardous locations with connections to approved field devices or simple apparatus in Zone 0. No additional protective measures are required for connected field devices.

Input compensation for 2-wire RTDs occurs on-line during initial operating parameter assignment. The module short-circuits the measuring circuit as well as the two additional terminals and automatically compensates for lead resistance.

When using thermocouple inputs, PT100 resistors may be used across the two unused terminals of each channel for cold junction compensation.

The resolution is 16 bits, i.e. the analog value of 0-25 mA is represented as a number between 0 and 65536. Data representation depends upon the type of control system used.

Using any standard PROFINET-DP master and the system GSD file, it is possible to configure circuit monitoring, failsafe mode, damping, and sensor type for the module. The software tool "excom design" or a PROFINET-DP master with V1 functionality enables the configuration of these parameters separately for each channel.

TI40Ex

- Intrinsically safe analog input module for RTDs such as PT100, PT1000 and Ni100 as well as B, E, J, K, L, N, R, S and T style thermocouples
- Zone 1 hazardous location approval with connections to approved field devices in Zone 0
- Connections for 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 MINI COMBICON plug-in terminals; versions available with screw, crimp or cage-clamp connections
<table>
<thead>
<tr>
<th>Type</th>
<th>TI40Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td>M6884000</td>
</tr>
</tbody>
</table>

**Power Supply**
- from central power supply via module rack
- Internal power consumption: $<$ 1 W
- Galvanic isolation: complete

**Inputs**
- 4 connected 2-/3-/4-wire resistance temperature detectors (RTDs) or thermocouples
- Line resistance (4-wire): $<$ 50 $\Omega$
- Line resistance (3-wire): $<$ 10 $\Omega$
- Line resistance (2-wire): $<$ 5 $\Omega$
- Resolution: 16 bit
- Short-circuit threshold: $<$ 5 $\Omega$
- Wire-break threshold: $>$ 500 $\Omega$
- Input (thermocouple)
  - Wire-break threshold: $<$ 100 mA / $>$ 150 mV
  - Resolution: 16 bit
  - Linearity tolerance: $<$ 0.05 % (of full scale)
  - Temperature drift: $<$ 50 ppm/K
  - Rise/release time: $<$ 200 ms (10 - 90 %)

**Intrinsic Safety Parameters (Field Circuits)**
- EEx ia IIC T4 (PTB 00 ATEX 2181)
  - Short-circuit current $I_0$: $\leq$ 2 mA
  - Max. voltage $U_0$: $\leq$ 5.4 V
  - Max. power $P_0$: $\leq$ 2 mW
  - Max. external inductances $L_a$: $\leq$ 5 mH
  - Max. external capacitances $C_a$: $\leq$ 1650 nF

**Initial Operating Parameters**
- 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: green/red (dual color LED)
- Input status: (4) red

**General Data**
- Hazardous location approval: EEx ib [ia] IIC T4 (PTB 00 ATEX 2181)
- Enclosure: IEC IP 20
- Operating temperature: -20° to +70°C (-4° to +158°F)
- Dewing: for a short period only (during system set-up)
Intrinsically Safe Remote I/O System

The DO40Ex is a four-channel discrete output module designed for connection to intrinsically safe actuators (such as solenoids valves) and annunciators.

The module is approved for Zone 1 hazardous locations with connections to approved field devices or simple apparatus in Zone 0. No additional protective measures are required for connected field devices.

The output load curve for each of the four outputs is shown on the table on the right. For example, the following output variations are possible:

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

Using any standard PROFIBUS-DP master and the system GSD file, it is possible to configure circuit monitoring, fail-safe mode, and polarity for the module. The software tool “excom design” or a PROFIBUS-DP master with V1 functionality enables the configuration of these parameters separately for each channel.

DO40Ex

- Discrete output module for intrinsically safe actuators
- Zone 1 hazardous location approval with connections to approved field devices in Zone 0
- Connections for up to four valves or indicators
- Wire-break and short-circuit monitoring
- Galvanic isolation between output, bus and power supply
- Galvanic isolation between channels

Connections

- Outputs via MINI COMBICON plug-in terminals; versions available with screw, crimp or cage-clamp connections
### Discrete Output Module

**DO40Ex**

*4 Output, 10 to 24 VDC*

<table>
<thead>
<tr>
<th>Type</th>
<th>DO40Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td>M6884007</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Supply</th>
<th>from central power supply via module rack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal power consumption</td>
<td>&lt; 3 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs</th>
<th>(4) actuators</th>
<th>(4) actuators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>16 VDC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Nominal current</td>
<td>15 V / 35 mA; 12 V / 45 mA</td>
<td>24V / 6 mA; 18 V / 25 mA</td>
</tr>
<tr>
<td>Internal resistance</td>
<td>300 Ω</td>
<td>300 Ω</td>
</tr>
<tr>
<td>Switching frequency</td>
<td>&lt; 100 Hz</td>
<td>&lt; 100 Hz</td>
</tr>
<tr>
<td>Short-circuit threshold</td>
<td>&lt; 5 V</td>
<td>&lt; 5 V</td>
</tr>
<tr>
<td>Wire-break threshold</td>
<td>&lt; 1 mA</td>
<td>&lt; 1 mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intrinsic Safety Parameters (Field Circuits)</th>
<th>EEx ia IIC T4 (PTB 00 ATEX 2180)</th>
<th>EEx ia IIC T4 (PTB 00 ATEX 2180)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-circuit current $I_0$</td>
<td>≤ 110 mA</td>
<td>≤ 110 mA</td>
</tr>
<tr>
<td>Max. voltage $U_0$</td>
<td>≤ 18.9 V</td>
<td>≤ 27 V</td>
</tr>
<tr>
<td>Max. power $P_0$</td>
<td>≤ 700 mW</td>
<td>≤ 700 mW</td>
</tr>
<tr>
<td>Max. external inductances $L_a$</td>
<td>≤ 2 mH</td>
<td>≤ 2 mH</td>
</tr>
<tr>
<td>Max. external capacitances $C_a$</td>
<td>≤ 100 nF</td>
<td>≤ 100 nF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial Operating Parameters</th>
<th>per channel</th>
<th>per channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire-break monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-circuit monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substitute value programming</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LED Indications</th>
<th>green/red (dual color LED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power on/module function</td>
<td>(4) yellow/red (dual color LED)</td>
</tr>
<tr>
<td>Output status</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General Data</th>
<th>EEx ib [ia] IIC T4 (PTB 00 ATEX 2180)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous location approval</td>
<td></td>
</tr>
<tr>
<td>Enclosure</td>
<td>IEC IP 20</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20° to +70°C (-4° to +158°F)</td>
</tr>
<tr>
<td>Dewing</td>
<td>for a short period only (during system set-up)</td>
</tr>
</tbody>
</table>

**Load curve**
The AO40Ex is a four-channel analog output module designed for connection to intrinsically safe analog actuators. HART-compatible actuators may be connected and communicated with via an approved HART modem on the field side of the system. However, HART communications will not pass through the AO40Ex.

The module is approved for Zone 1 hazardous locations with connections to approved field devices in Zone 0. No additional protective measures are required for connected field devices.

The resolution is 13 bits, i.e. the analog value of 0-25 mA is represented as a number between 0 and 8192. Data representation depends upon the type of control system used.

Using any standard PROFIBUS-DP master and the system GSD file, it is possible to configure circuit monitoring, failsafe mode, and output range for the module. The software tool “excom design” or a PROFIBUS-DP master with V1 functionality enables the configuration of these parameters separately for each channel.

AO40Ex

- Intrinsically safe analog output module for 0/4 to 20 mA actuators
- Zone 1 hazardous location approval with connections to approved field devices in Zone 0
- Connections for 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 MINI COMBICON plug-in terminals; versions available with screw, crimp or cage-clamp connections

Terminal Configuration

- Channel 1
- Channel 2
- Channel 3
- Channel 4

Connection Possibilities

- 0/4...20 mA

Courtesy of Steven Engineering, Inc.
## Analog Output Module
### AO40Ex
#### 4 Output

<table>
<thead>
<tr>
<th><strong>Type</strong></th>
<th>AO40Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ID Number</strong></td>
<td>M6884002</td>
</tr>
</tbody>
</table>

### Power Supply
- **from central power supply via module rack**
  - **Internal power consumption**: < 2 W
  - **Galvanic isolation**: complete isolation

### Outputs
- **4** analog actuators
  - **Output voltage**: < 16 VDC
  - **Output current**: 0/4 to 20 mA per output
  - **External load**: < 600 Ω
  - **HART impedance**: > 240 Ω
  - **Short-circuit threshold**: < 100 Ω (in live zero mode only)
  - **Wire-break threshold**: < 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 to 90 %)

### Intrinsic Safety Parameters (Field Circuits)
- **EEEx ia IIC T4** (PTB 00 ATEX 2179)
  - **Short-circuit current I₀**: ≤ 93 mA
  - **Max. voltage U₀**: ≤ 18.9 V
  - **Max. power P₀**: ≤ 500 mW
  - **Max. external inductances Lᵦ**: ≤ 4 mH
  - **Max. external capacitances Cᵦ**: ≤ 100 nF

### Initial Operating Parameters
- **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**: green/red (dual color LED)
- **Output status**: (4) red

### General Data
- **Hazardous location approval**: EEEx ib [ia] IIC T4 (PTB 00 ATEX 2179)
- **Enclosure**: IEC IP 20
- **Operating temperature**: -20° to +70°C (-4° to +158°F)
- **Dewing**: for a short period only (during system set-up)
The AOH40Ex is a four-channel analog output module designed for connection to HART-compatible intrinsically safe analog actuators. The module can be configured to allow HART communications signals to pass through unimpeded.

The module is approved for Zone 1 hazardous locations with connections to approved field devices in Zone 0. No additional protective measures are required for connected field devices.

The resolution is 13 bits, i.e. the analog value of 0-25 mA is represented as a number between 0 and 8192. Data representation depends upon the type of control system used.

When connecting field devices, please observe that all outputs operate at the same potential – e.g. there is no galvanic isolation between channels.

Using any standard PROFIBUS-DP master and the system GSD file, it is possible to configure circuit monitoring, failsafe mode, and HART status for the module. The software tool “excom design” or a PROFIBUS-DP master with V1 functionality enables the configuration of these parameters separately for each channel.

AOH40Ex

- Intrinsically safe analog output module for 0/4 to 20 mA HART-compatible actuators
- Zone 1 hazardous location approval with connections to approved field devices in Zone 0
- Connections for up to four actuators
- Wire-break and short-circuit monitoring
- Galvanic isolation between output, bus and power supply
- Outputs connected to a common potential
- Transmission of HART signals

Connections

- Outputs via plug-in MINI COMBICON terminals; versions available with screw, crimp or cage-clamp connections

terminal configuration

connection possibilities

channel 1

channel 2

channel 3

channel 4

0/4...20 mA
## Analog Output Module
### AOH40Ex
#### 4 Output (HART)

<table>
<thead>
<tr>
<th>Type</th>
<th>AOH40Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td>- - - -</td>
</tr>
</tbody>
</table>

**Power Supply**
- Power Supply: from central power supply via module rack
- Internal power consumption: < 2 W
- Galvanic isolation: complete isolation

**Outputs**
- (4) analog actuators
- Output voltage: < 15.0 VDC
- Output current: 0/4 to 20 mA per output
- External load: < 600 Ω
- HART impedance: > 240 Ω
- Short-circuit threshold: < 100 Ω (in live zero mode only)
- Wire-break threshold: < 2 mA (in live zero mode only)
- Resolution: 13 bit
- Linearity tolerance: < 0.1 % of full scale
- Temperature drift: < 50 ppm/K
- Rise/release time: < 50 ms (10 to 90 %)

**Intrinsic Safety Parameters (Field Circuits)**
- EEx ia IIC T4 (PTB approval pending)
  - Short-circuit current $I_0$: $\leq 93$ mA
  - Max. voltage $U_0$: $\leq 26$ V
  - Max. power $P_0$: $\leq 600$ mW
  - Max. external inductances $L_a$: $\leq 4$ mH
  - Max. external capacitances $C_a$: $\leq 20$ nF

**Initial Operating Parameters**
- Wire-break monitoring: per channel
- Short-circuit monitoring: per channel
- Substitute value programming: per channel
- Live zero / dead zero: per channel
- HART status polling: per channel
- Mapping of virtual HART variables: per channel
- 50/60 Hz suppression: integrated

**LED Indications**
- Power on/module function: green/red (dual color LED)
- Output status: (4) red

**General Data**
- Hazardous location approval: EEx ib [ia] IIC T4 (PTB approval pending)
- Enclosure: IEC IP 20
- Operating temperature: -20° to +70°C (-4° to +158°F)
- Dewing: for a short period only (during system set-up)
Intrinsically Safe Remote I/O System

MT18
MT9
MT5

- Backplane that supports up to 16/8/4 I/O modules, 2/1/1 gateways and 2/1/1 power supply units
- Protection type EEx m, EEx e, EEx i
- Up to 128 discrete or 64 analog inputs/outputs
- Connections for two redundant gateways (MT18 only)
- Connections for two redundant power supply units (MT18 only)

Connections
- Inputs and outputs via plug-in MINI COMBICON terminals; versions available with screw, crimp or cage-clamp connections (consult factory)
- Bus connection via miniature 9-pole D-SUB connector
- Power supply via EEx e screw terminals

The MT18 backplane supports two gateways, two power supplies and sixteen I/O modules. Up to 128 discrete inputs/outputs or 64 analog inputs/outputs may be connected in any combination.

Modules may be exchanged during system operation without interrupting data communication (gateways and power supplies only in case of redundant system design).

The backplane features a combined protection type of EEx m, EEx e and EEx i and is approved for installation in Zone 1 locations. Consult factory for availability of backplanes with Division 1 approval.

The backplane is made of extruded aluminium sections for increased stability and ensured shielding. It is suited for wall mounting and 19" rail mounting.

Modules receive power via the backplane. Supply energy is limited to levels suitable for Zone 1 (protection type EEx [ib] IIC). Therefore, modules can be exchanged during system operation.

Other backplanes such as the MT9 and MT5 are available (consult factory for custom versions). The MT9 version supports one power supply, one gateway and up to eight I/O modules. The MT5 supports one power supply, one gateway and up to four I/O modules. Unlike the MT18, the MT5 and MT9 are not designed to configure a redundant system with double gateways or power supplies.
### Backplane

#### MT18/MT9/MT5

Support 16/8/4 Modules

<table>
<thead>
<tr>
<th>Type</th>
<th>MT18</th>
<th>MT9</th>
<th>MT5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td>M9100390</td>
<td>M9100388</td>
<td>M9100389</td>
</tr>
</tbody>
</table>

#### Power Supply

<table>
<thead>
<tr>
<th></th>
<th>External</th>
<th>18 to 33 VDC/85 to 250 VAC</th>
<th>18 to 33 VDC/85 to 250 VAC</th>
<th>18 to 33 VDC/85 to 250 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Power</td>
<td>80 W/100 VA</td>
<td>40 W/50 VA</td>
<td>25 W/30 VA</td>
</tr>
</tbody>
</table>

#### Connections

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>MT18</th>
<th>MT9</th>
<th>MT5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus (D-SUB, miniature 9-pole version)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Supply (EEx e dual screw terminals)</td>
<td></td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Field devices</td>
<td></td>
<td>4 x 4 terminals per module in screw, crimp or cage-clamp styles (total 256)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Slots

<table>
<thead>
<tr>
<th></th>
<th>MT18</th>
<th>MT9</th>
<th>MT5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Gateway</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>I/O module</td>
<td>16</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Adjustments

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>MT18</th>
<th>MT9</th>
<th>MT5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus address</td>
<td></td>
<td></td>
<td>(3) decimal-coded rotary switches (0 to 127)</td>
<td></td>
</tr>
</tbody>
</table>

#### Dimensions (w x h x d) [mm]

<table>
<thead>
<tr>
<th>(without mounting brackets)</th>
<th>MT18</th>
<th>MT9</th>
<th>MT5</th>
</tr>
</thead>
<tbody>
<tr>
<td>439.5 x 260 x 130</td>
<td>226.5 x 210 x 130</td>
<td>153.5 x 210 x 130</td>
<td></td>
</tr>
</tbody>
</table>

#### General Data

<table>
<thead>
<tr>
<th>Hazardous location approvals</th>
<th>(PTB 00 ATEX 2194U)</th>
<th>EEx e m [ib] IIC T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Bus connection</td>
<td>EEx ib IIC T4</td>
<td></td>
</tr>
<tr>
<td>- Power supply</td>
<td>EEx e IIC T4</td>
<td></td>
</tr>
<tr>
<td>- I/O field device connections</td>
<td>EEx ia IIC T4</td>
<td></td>
</tr>
<tr>
<td>Enclosure</td>
<td>IEC IP 20</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20° to +70°C (-4° to +158°F)</td>
<td></td>
</tr>
<tr>
<td>Dewing</td>
<td>for a short period only (during system set-up)</td>
<td></td>
</tr>
</tbody>
</table>
Intrinsically Safe Remote I/O System

The PSA230Ex and PSD24Ex power supplies provide power to two gateways and a maximum of sixteen I/O modules. This equates to 128 discrete inputs/outputs or 64 analog inputs/outputs in any combination.

The power supplies feature a combined protection type: EEx m, EEx e and EEx i and can be installed in Zone 1 or Zone 2 hazardous locations. They are integrated into protective aluminum housings and are fully encapsulated, eliminating the need for additional explosion protection measures. Power supplies for Division 1 locations are currently under development. Consult factory for availability.

If the system is configured with redundant power supplies one of which malfunctions, it may be replaced without interrupting system operation.

The PSA230Ex accepts 85 to 250 VAC while the PSD24Ex accepts 18 to 33 VDC.

Each supply is connected to the backplane via Ex e terminals, which may not be accessed live. They are located under a protective cap and may only be accessed after suspending the supply voltage.

**Redundancy:**
It is possible to use two power supplies. If one of the devices or the incoming line fails, the second supply takes over as system supply. The supplies do not need to be the same.

**PSA230Ex**
**PSD24Ex**
- AC and DC power supply units to supply a fully configured backplane
- Redundant design with MT18 backplane
- Protection type EEx m, EEx e, EEx i
- Supply of up to 128 discrete or 64 analog inputs/outputs
- Aluminum housing
- Complete encapsulation

**Connection**
- Via backplane
### Intrinsically Safe Power Supply

**PSA230Ex/PSD24Ex**

230 VAC/24 VDC

<table>
<thead>
<tr>
<th>Type</th>
<th>PSA230Ex</th>
<th>PSD24Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number</td>
<td>M6881720</td>
<td>M6881721</td>
</tr>
</tbody>
</table>

#### Power Supply

<table>
<thead>
<tr>
<th>External Power Supply</th>
<th>85 to 250 VAC (50/60 Hz)</th>
<th>18 to 33 VDC (ripple $W_{pp} &lt; 10%$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>100 VA</td>
<td>75 W</td>
</tr>
<tr>
<td>Power output</td>
<td>60 W</td>
<td>60 W</td>
</tr>
<tr>
<td>Galvanic isolation</td>
<td>375 V peak value per EN 50020</td>
<td>375 V peak value per EN 50020</td>
</tr>
</tbody>
</table>

#### LED Indications

<table>
<thead>
<tr>
<th>Power on/module function</th>
<th>green</th>
<th>green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>green</td>
<td>green</td>
</tr>
</tbody>
</table>

#### General Data

<table>
<thead>
<tr>
<th>Hazardous location approvals</th>
<th>EEx e m ib IIC T4 (PTB 00 ATEX 2193)</th>
<th>EEx e m ib IIC T4 (PTB 00 ATEX 2193)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>IEC IP 50</td>
<td>IEC IP 50</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20° to +70°C (-4° to +158°F)</td>
<td>-20° to +70°C (-4° to +158°F)</td>
</tr>
<tr>
<td>Dewing</td>
<td>for a short period only (during system set-up)</td>
<td>for a short period only (during system set-up)</td>
</tr>
<tr>
<td>Dimensions (w x h x d)</td>
<td>45 mm x 155 mm x 106 mm</td>
<td>45 mm x 155 mm x 106 mm</td>
</tr>
<tr>
<td>Mounting</td>
<td>flange, (4) M4 screws</td>
<td>flange, (4) M4 screws</td>
</tr>
</tbody>
</table>
NOTES
TURCK Inc. sells its products through Authorized Distributors. These distributors provide our customers with technical support, service and local stock. TURCK distributors are located nationwide - including all major metropolitan marketing areas.

For Application Assistance or for the location of your nearest TURCK distributor, call:

1-800-544-PROX (1-800-544-7769)

Specifications in this manual are subject to change without notice. TURCK also reserves the right to make modifications and makes no guarantee of the accuracy of the information contained herein.

Literature and Media questions or concerns?
Contact Marketing Services at TURCK USA: media@turck.com

Related Literature from TURCK

- Automation Controls B0154
- Sensors B2000
- Cordsets B2001
- multimodul Interfaces B0144
- NAMUR Junctions B0402
- MZ Series Barriers B0148
The Industry Leader in Proximity Sensing, Cordsets and Interface Technology

**Proximity Sensors**
Industry’s broadest line of inductive and capacitive proximity sensors.

**Cordsets and Junctions**
Industry standard cordsets and junction boxes connect the most popular switch and sensor styles.

**Flow Monitors**
Monitors for sensing the flow of liquids and gases during industrial processes.

**Interface Devices**
Interface and logic products for automation and intrinsically safe environments.

**InterlinkBT**
Device-level interconnect and bus products for sensors and actuators.

Call today for our latest literature:

**Sensors Division**
Sensors Catalog - B2000
Flow Monitors Catalog - B0155
email: sensors@turck.com

**Intrinsic Safety Products Division**
Automation Controls Catalog - B0154
*multimodul* Catalog - B0144
email: barriers@turck.com

**Special Products Division**
Cordsets Catalog - B2001
Releco Relay Catalog - B0234
email: cordsets@turck.com

**InterlinkBT, LLC**
InterlinkBT Catalog - B9000
Beckhoff Bus Terminal Catalog - B9005
email: kknobl@interlinkbt.com
1-888-546-5880

**TURCK USA**
TURCK Inc.
3000 Campus Drive
Minneapolis, MN 55441
Phone: (763) 553-7300
FAX: (763) 553-6708
Application Support: 1-800-544-PROX (7769)

**TURCK Canada**
CHARTWELL ELECTRONICS, INC.
140 Duffield Drive
Markham, Ontario
Canada, L6G 1B5
Phone: (905) 513-7100
FAX: (905) 513-7101

**TURCK Mexico**
ICESA - MODICON
Ant. Camino a Sta. Monica No. 7
San Lucas Tepetitlcalco
54050 Tlalnepantla
Edo. de Mexico
Phone: (52) 5-397-8644
FAX: (52) 5-398-9888

**InterlinkBT**
InterlinkBT, LLC
3000 Campus Drive
Minneapolis, MN 55441
Phone: (763) 694-2300
FAX: (763) 694-2399
Application Support: 1-888-546-5880

Printed in USA  B0168  03/01

Courtesy of Steven Engineering, Inc. • 230 Ryan Way, South San Francisco, CA, 94080-6370 • Main Office: (650) 588-9200 • www.stevenengineering.com