PROCESS AUTOMATION

EX-i-Interface

Eurocards

Edition 2001

PEPPERL+FUCHS

Pepperl+Fuchs has been in business since 1945.

In 1958 we presented a world innovation: the first proximity switch in conjunction with galvanically isolated logic controls.

Pepperl+Fuchs is the largest, most experienced manufacturer of intrinsically safe interface components worldwide. No one offers a more extensive line of intrinsic safety barriers for use in hazardous processing facilities including oil, gas, chemical and petrochemical.

Our products fulfill all the national, European and international (IEC) requirements and P+F has even influenced these standards through its research and development. Furthermore, Pepperl+Fuchs' production and development labs worldwide maintain a certified quality assurance system in accordance with ISO 9001.

In order to guarantee a high degree of local service, the Process Automation and Factory Automation Divisions of Pepperl+Fuchs are represented by subsidiaries in almost every country throughout the world.

Pepperl+Fuchs is not only a specialist in intrinsic safety; our experience and innovation extend from I.S. components to complete system solutions. This comprehensive catalog will give you an overview of out Eurocard product line and the resulting system solutions.

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Additional product catalogs and brochures in the area of process automation describe I.S. interface system components as well as field devices available from
Pepperl+Fuchs. Our catalogs are also available on CD-ROM.

1 Pepperl + Fuchs Documentation and Training Materials

CD ROM Catalog

The Pepperl+Fuchs CD-ROM Catalog contains the data sheets and information for Factory Automation, Process Automation and Kolleg. A product search can be initiated either by a search tree or by model number. Data sheets for sensors are located in the Factory Automation menu; in the Process Automation menu intrinsic safety products can be accessed. The Kolleg menu accesses the instructional Seminar Program and Teachware offered by Pepperl+Fuchs.

Training Package
Pepperl+Fuchs offers training and extended structuring for sensors and the AS-Interface.
Seminars
Other seminars offered by Pepperl+Fuchs:
Preventing Explosions with Intrinsic Safety
Level Control
Remote Process Interface
Signal Conditioners for Process Automation
The seminars take place periodically at Pepperl+Fuchs, “The House Of Technology (e.V.)” in Essen or upon customer request.

You will find more information in the Literature List in Chapter 10.

Ex-i Video
“Preventing Explosions with Intrinsic Safety “

This video provides an overview of the requirements and standards that deal with primary and secondary explosion protection as determined by test agencies throughout the world.
The specifics for intrinsically safe explosion protection are addressed after a brief explanation of the protection methods specified in North American and European standards. Testing techniques and installation guidelines are demonstrated and the advantages of galvanic isolation are outlined.
This 20 minute instructional film is available in standard VHS format, PAL and NTSC and is accompanied by a manual focusing on the main topics.
The video is available in 8 languages (German, English, Spanish, French, Flemish, Italian, Japanese and Chinese), along with the specifications applicable to the appropriate countries.

2 Introduction to Explosion Protection through Intrinsic Safety

When introducing electrical equipment in a hazardous area, extensive regulations must be observed that are subdivided into European (EU) and national requirements. The European standards define the general specifications and the detailed guidelines for methods of protection against explosion. The national requirements primarily contain the installation criteria. Electrical instruments for explosion groups I and II, as well as the T1..T6 temperature classifications, are grouped in DIN EN 50014 (see “Hazardous Sub-division, Explosion Hazards from Sparking and Hot Surfaces” in the following table). DIN EN 50020 presents categories, design and test specifications and model identifications for intrinsically safe instruments. Approvals for electrical instruments that are used in explosive environments are regulated by EG-Ex-Framework Guidelines 76/117/EWG and Guideline 94/9/EG.

The explosion protection method for intrinsic safety always refers to intrinsically safe circuitry that includes an intrinsically safe instrument, an appropriate electrical power source and the interface cables. In intrinsically safe circuits, an explosive environment cannot be ignited by sparking or a thermal effect when using a regulated operation and certain error conditions. In intrinsically safe circuitry for category ia, 2 errors can be calculated (see definition EN 50020), and in category ib only 1 error can be calculated for not causing an explosion. Limiting the power supply, total inductivity and total capacitance within the intrinsically safe circuitry is the basic principle for intrinsically safe explosion protection methods.

The project manager or user can reference the inner limit values for intrinsically safe electrical instruments to the permissible interface values of the appropriate electrical instrument according to the following table:

Intrinsically safe instrument + cable	Proof of Intrinsic Safety	Appropriate Instruments
U_i	>	U_0
I_i	>	I_0
P_i	>	P_0
$L_i + L_c$	<	L_0
$C_i + C_c$	<	C_0

These limit values are printed on the instrument or are taken from the prototype test label. The reference for the limit values corresponds to the DIN VDE 0165 requirement with regards to the proof of intrinsic safety. When establishing complex intrinsically safe circuitry with more than one appropriate electrical instrument, a calculated proof of intrinsic safety should be completed which must then be referenced back to the explosion limit curves for DIN EN 50020, or to the tables that these curves portray.

In this case all active electrically operated sources are summed up in one complex source. “Active” refers to any power source that can provide power to the intrinsically safe circuit under normal and malfunctioning operating conditions.

For the intrinsically safe connector terminals of this complex power source, the working values for:

the maximum output voltage V_0
the maximum output current I_0
the maximum output power P_0

are calculated depending on the combined circuitry of the individual power sources as follows:

calculating for parallel circuits;

I_0 from the sum of the individual currents
V_0 from the maximum value of the individual voltages

The individual values are taken from the declarations of conformity.

The maximum output power is calculated for power supplies with linear current-voltage-power curves with the following formula

$$P_0 = 1/4 * V_0 * I_0$$

Based on the calculated maximum value, the intrinsic safety is checked using the ignition limit curve. Limitations (PTB report W39 is used for non-linear current-voltage curve for systematic power sources) and safety factors are referenced under section 6.1.3.4, 'Reference to Intrinsic Safety', of DIN VDE 0165. In addition to this proof of intrinsic safety, the immunity of the intrinsically safe circuitry must also be assured against surges from other electrical power sources. If both requirements are fulfilled, a safe power limit within the circuitry will not be exceeded, even if there is a short circuit or grounding of the circuitry (EN 60079-14). A detailed description can be found in the 'Preventing Explosions with Intrinsic Safety' manual.

The national specifications mentioned in the first paragraph will be replaced in the future by the following European standards, which have been submitted as first draft standards:

EN 1127-1 Machine Safety/ combustion and explosion protection (Zone 0; 1; 2 for gas and steam / Zone 20; 21; 22 for dust)
EN 60079-10 specifies electrical equipment in hazardous areas (zone divisions)
EN 60079-14 specifies electrical equipment in hazardous areas (installation specification)

The following table shows important general guidelines for explosion protection as applied in the European Union and North America.

<table>
<tr><td></td><td>European Union</td><td>North America</td></tr>
<tr><td>Division of Hazards</td><td>explosive mixture in
Group I: condensation hazards in mines
Group II: other areas outside of mines</td><td>Explosive mixtures of air and
CLASS I: Gases and vapours
CLASS II: Dusts
CLASS III: Fibers or flyings</td></tr>
<tr><td>Ignition Hazards due to Sparks</td><td>Grouping of ignition protection methods intrinsic safety/flame proof enclosure regarding the minimum ignition current/ limit gap according to the minimum ignition energy of representative gases:
Group I Methane
Group IIA Propane
IIB Ethylene
IIC Hydrogen, Acetylene</td><td>Division of the Class according to ignition energy:
CLASS I Group A Acetylene
B Hydrogen
C Ethylene
D Methane
CLASS II Group E Metal dusts
F Coal dusts
G Grain dusts
CLASS III No grouping</td></tr>
<tr><td>Ignition Hazards due to Hot Surfaces</td><td colspan="2">Division into temperature classes per IEC 79-8 for maximum surface temperatures with an ambient temperature of 40°C under the following conditions:
T1 ≤ 450°C T2 ≤ 300°C T3 ≤ 200°C T4 ≤ 135°C T5 ≤ 100°C T6 ≤ 85°C</td></tr>
<tr><td>Division of Hazardous Areas</td><td colspan="2">The following are subdivided at the possibility of the appearance of a dangerous explosive atmosphere:</td></tr>
<tr><td></td><td>for gases, vapours, fogs: (EN 60079-10)
Zone 0 constant or long term
1 occassionally
2 seldom and short term
for dusts: (EN 1127-1)
Zone 20 long term or frequently
21 occassionally
22 short term or accumulation of layers of dust</td><td>for gases or dusts:
} Division 1
} Division 2</td></tr>
<tr><td></td><td colspan="2">Note (see IEC 79-10): constant or long-term represents > 1000 h/year, occassionally represents 10...1000 h/year, seldom or short-term reps. < 10h/year</td></tr>
<tr><td>Gas characteristic</td><td colspan="2">Information regarding gas grouping by ignition energy and gas ignition temparatures as well as flashpoint are contained in</td></tr>
<tr><td></td><td>Redecker, Nabert, Schön/intrinsic safety
ID numbers of combustible gases and vapours</td><td>NFPA 497 M
CSA Nr. C22-1</td></tr>
<tr><td>Approval Sites</td><td>PTB Physikalisch-Technische Bundesanstalt
BVS Bergbauversuchsstrecke
BASEEFA British Approvals Service for Electrical Equipment in Flammable Atmosphere</td><td>UL Underwriters Laboratories,USA
FM Factory Mutual Research, USA
CSA Canadian Standards Association</td></tr>
<tr><td>Installation Requirements</td><td>DIN EN 60079-14 (VDE 0165 Part 1) for explosive gas environments
DIN EN 50281-1-2 (VDE 0165 Part 2) for environments with flammable dust</td><td>NFPA 70 National Electrical Code Art. 500
NFPA 493 Standard for Intrinsically safe operations...</td></tr>
<tr><td colspan="3"></td></tr>
</table>

3 E-System (E-card) Operating Manual

This operating manual is to be used in conjunction with the corresponding data sheets.

Models	**ED2 ... Ex ...**	**24 VDC power supply, intrinsically safe circuit**
	ED0 ... Ex ...	**No separate power supply, intrinsically safe field circuit**
	EGT-...	**24 VDC power supply, intrinsically safe field circuit**
	EGA-...	**24 VDC power supply, intrinsically safe field circuit**

Applications

- Used in the chemical, petrochemical and other industries involving hazardous areas with explosive atmospheres. The E-System galvanically isolates signals (e.g. 20 mA or 10 V standard signals) between the hazardous and safe areas, and supports intrinsically safe I/Os within hazardous areas. The interface module should always be installed within the safe area.
- As noted in the data sheets, E-cards are not intended to isolate signals from high-power applications.

Installation and Operation Outside of the Hazardous Area

- E-cards must meet an IP20 rating, which can be attained with the BGT21/E... 19“ modular racks that meet DIN 41494/ Section 5. The cards require additional protection when installed in harsh environments.
- The E-cards must **always** be installed **outside** the explosive environment! Only intrinsically safe circuits can be used within hazardous areas.
  It is important to isolate the E-card from all non-intrinsically safe circuits.
  Installation of intrinsically safe circuits must be performed according to applicable instructions.
- When connecting I/O devices to E-cards, peak values of all associated components must be within the limits of intrinsic safety.
- Make sure all devices in the system are listed on the EC design certificate! Most important is the observance of the therein contained "Special Requirements"
- Special protective measures in accordance with VDE 0170/ 171, EN 50 014 and EN 50 020B must be taken during installation. A minimum distance of 50 mm must be maintained between intrinsically safe and non-intrinsically safe components. Dividing walls must be used for distances less than 50 mm, or use Pepperl+Fuchs‘ Ex-TKS isolation chamber system.The connections z10, z12, b10, b12, d10, d12 of the female connectors may not be assigned.
- The E-card pins and the modular rack slots are clearly marked for mounting intrinsically safe input and output circuits. The placement of the coded pin holes are determined by the manufacturer and are illustrated in the data sheets.

Maintenance

- The transfer characteristics of the cards are stable over long periods of time so regular servicing is unnecessary.

Repairs

- Repairs or modifications to devices in hazardous areas are allowed only by authorized technicians.

Mechanics

Design	Simple Eurocards in the 100 x 160 mm (per DIN 41494) format; depending on version, using designs: Front panel 4 TE (20.32 mm) and certain functions with front panel 8 TE (40.64 mm) Front panels with 20 TE (101.6 mm) and 36 TE (182.6 mm) are available for power supply modules
Mounting	Single mounting
Material	Base material of the conductor plates is fiberglass resin.
Connection method	Contact through indirect connection with plug connector per DIN 41612, series 2, type F. The standard contacts provided with 32-pin plug connectors are z and d.
Other	The 19"-Module rack with 21 plug connections is available for installation of the cards (for further details see page 229)

Ambient Conditions

Ambient temperature	see data sheet
Storage temperature	-25 °C...+70 °C (-13 °F ... 149 °F)
Humidity	max. 75 % relative humidity without condensation

Galvanic isolation per DIN EN 50 178 and VDE 0106

The E-System devices are designed for use in enclosed electrical operating environments to which only electricians or personnell with electronics experience have access.
The units were tested for installation in contamination level 2, per EN 50 178.
Overvoltage category II per DIN EN 50 178 applies to supply circuits and overvoltage category III per DIN EN 50 178 applies to non-supply circuits.

Isolation for devices with Ex-Certification EN 50 020

The units were tested for use in contamination level 2, per DIN EN 50 178.

E-System (E-card) Operating Manual

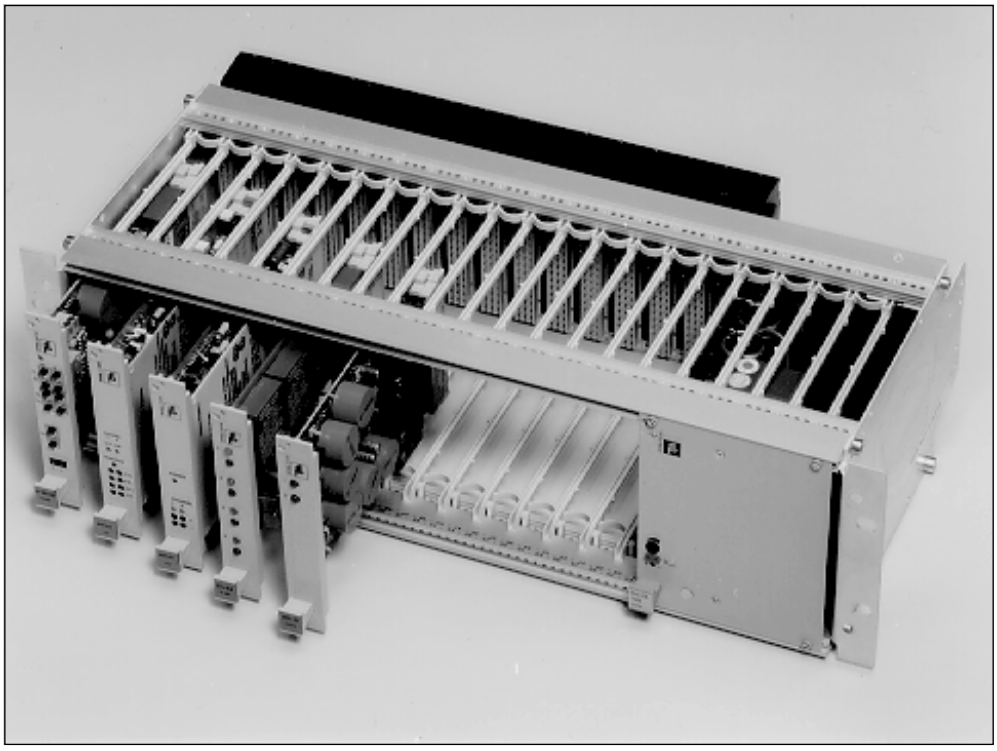
E-System Assembly

When installing Eurocards per IEC 529, a protection class of IP 20 must be maintained. This protection class is achieved with the following assemblies:

1. Mounting of a modular rack with hole punched panels out side of the circuit environment.
2. Mounting a modular rack inside a switch cabinet.

Modular Rack

19"- Modular racks per DIN 41 494 Section 5 with the model number BGT21/E... are available for the installation of the Eurocards. The modular racks have a standard of 21 connection sites and are suited for installation in 19"- Roller guides or 19"-Racks with a row of mounting holes per DIN 41 494 (special designs for wall mounts available upon request).



Modular Rack

The following wiring techniques are available:

HL = Hand Soldering Technique
WW = Wire Wrap Technique (1 mm x 1 mm)
ST = Standard Termipoint Technique (1.6 mm x 0.8 mm)
MT = Maxi Termipoint Technique (2.4 mm x 0.8 mm)
CSI = Crimp-on Snap-in Technique

The model key on page 301 is available for use in ordering modular racks.

We will gladly try to accommadate your specific needs in respect to modular racks that are not covered in this key. For example: modular racks with mixed female connectors, with integrated terminals or shorter version modular racks.

E-System (E-card) Operating Manual

Isolation Chamber System Ex-TKS

Separation is to be maintained and special "mechanical" protective measures are to be applied according to VDE 0170/ 171 or EN 50 014 and EN 50 020 with the use of electronic devices and transformer isolated amplifiers. Therefore, it is necessary to maintain distances of > 50 mm (thread dimension) or to place sufficiently sized isolation walls between intrinsically safe and non-intrinsically safe connections. Both measures are costly and require much rack space. These problems are solved through the Ex-TKS isolation chamber system cheaply, efficiently and in accordance with approvals. With these isolation chamber systems it is possible to equip all or individual connection sites in commercial 19" modular racks per DIN 41 494 so that they meet the appropriate regulations. A connection site that is equipped in such a way must be PTB Nr. Ex 82/202U approved.

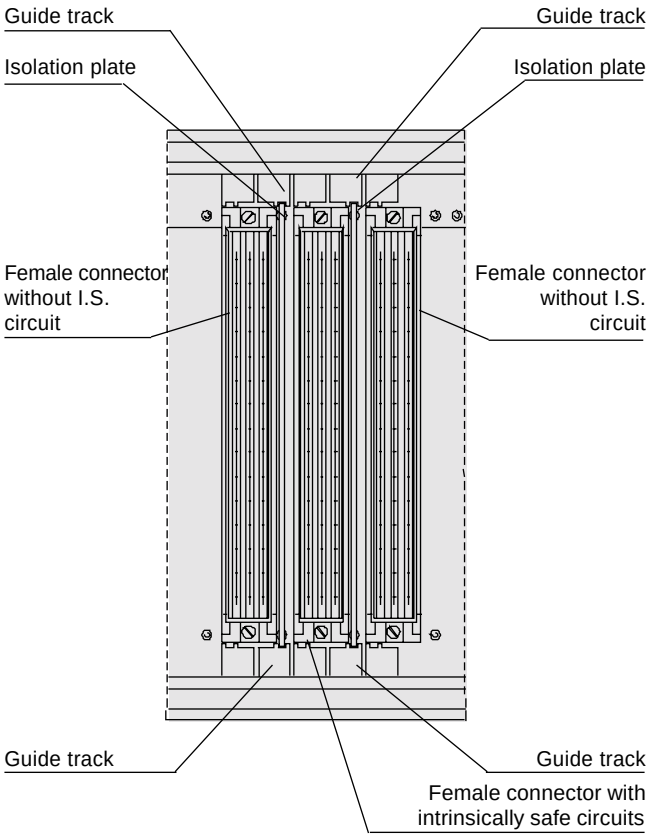
A total approval of the card and the wired connection site must be accomplished in conjunction with the conformity certification of the transformer isolated amplifiers EG... and ED... .

The isolation chamber system consists of the following components:

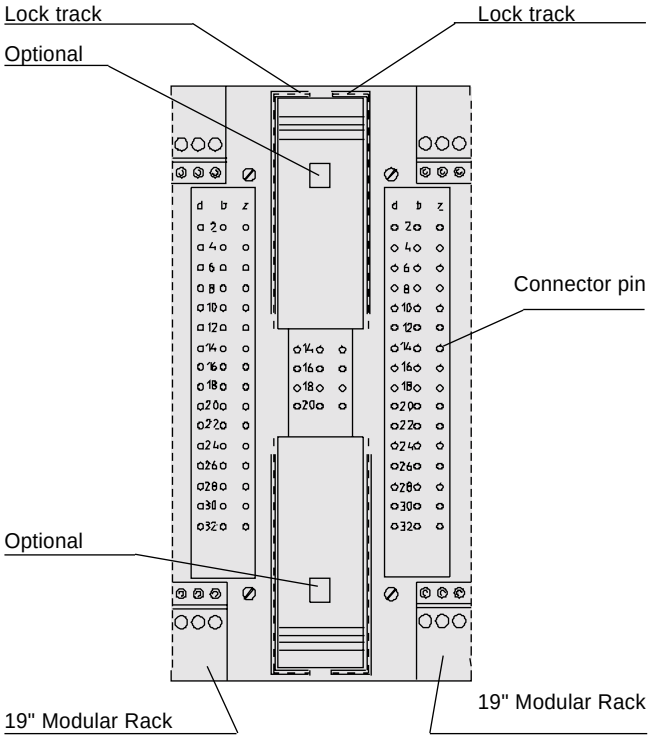
Ex/TKS-1 An Ex-equipment set for **one** connection site in the BGT 21/E... modular rack.
The set consists of: isolation chamber with cover, locking track, screws and coding pin
Ex/TKS-21 Ex-equipment set for **21** connection sites in the BGT 21/E... modular rack.

Ex-TP Isolation board and guide track pair

Front view of a connection site for Transformer Isolated Amplifiers EG-... and ED...

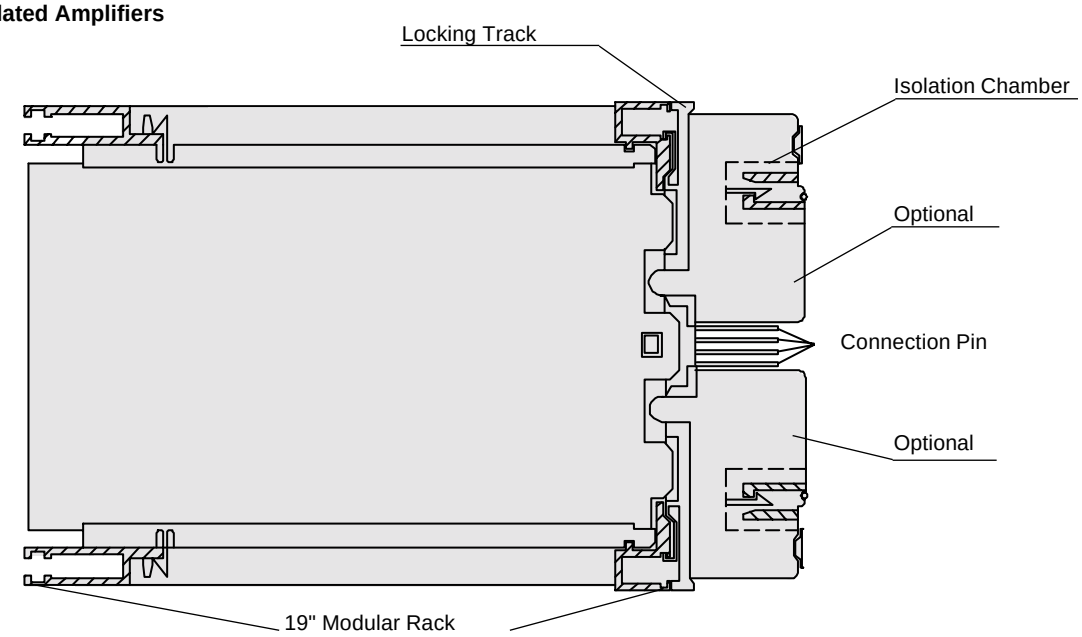


Back view of a connection site for Transformer Isolated Amplifiers EG-... and ED...



E-System (E-card) Operating Manual

Side View of a Connection Site for Transformer Isolated Amplifiers



Mounting the Ex-TKS Isolation Enclosure

The isolation enclosure is suited for all customary wiring methods. Modular racks with isolated enclosures are available fully assembled and on short notice from Pepperl+Fuchs. The mounting of the enclosure is very simple and can be done at any time.

Advantages of the Isolation Enclosure

The cover of the enclosure may be opened for test purposes with a 2 - 4 mm screwdriver. The entire enclosure, as well as the isolation board, may be removed similarly.

No spacing units or connection sites are lost when mounting enclosures and dividing walls onto a 21 connection, modular rack with Eurocards having a front panel width of 4TE (20.32 mm) and a component height of less than 15 mm.

With a component height of more than 15 mm, a space requirement of 1TE (5.08 mm) for the isolation board exists in addition to the front panel width of 4TE. In order to prevent this loss of space, one should take into account when using modular racks with mixed components (Ex / Non-Ex), that all Ex and non-Ex cards may be placed in a respective grouping in the modular rack. The Eurocards between one group of cards and the next group should have a component height of less than 15 mm in order to allow for the efficient installation of the Ex-TP isolation card.

The features and the connectors of Eurocards with non-intrinsic safety circuits and those with intrinsic safety circuits are identical. Ex-Eurocards must be coded in order to prevent confusing one type of card for the other and thereby not utilizing "intrinsic safety" measures when required.

This is easily accomplished by dual pin encoding at the female connector (see chapter "Encoding the Eurocard"). The Ex-Eurocards are encoded at the factory. The modular racks provided by Pepperl+Fuchs are pre-coded when the card type is included in the purchase order.

Eurocard Encoding

The danger of mistaking one card for another during the installation or the replacement of Eurocards must be prevented. Therefore, the Eurocard plug connectors are also clearly encoded like the applicable female connectors in the modular rack. Coding holes in the plug connectors and insertable coding pins in the female connectors prevent the insertion of the card in the wrong position.

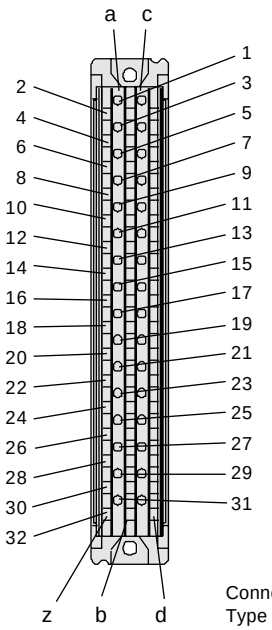
The coding pins (types Panduit, Souriau, Vero) can be inserted at the prescribed sites in the available holes of the female connector with an installation tool. The arrangement of the coding holes is determined at the factory and may be found in the data sheets of the respective types.

The Eurocards with intrinsically safe circuits are designed for

Example: Transformer Isolated Amplifier Type EG 4...
a3 / c7
a3: first coding
c7: second coding

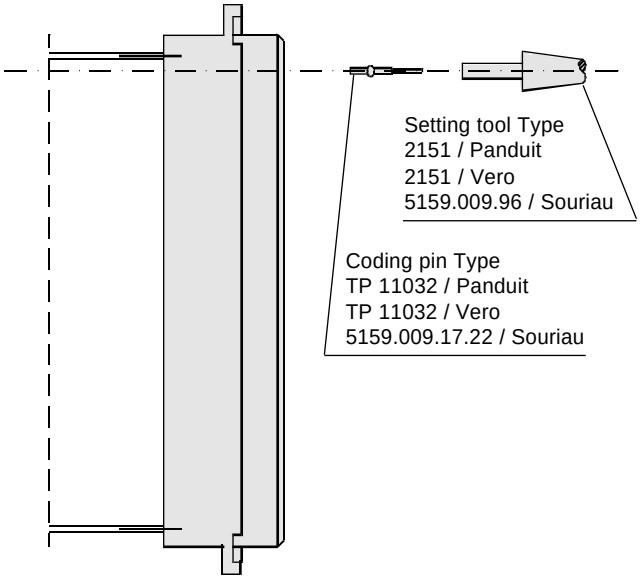
E-System (E-card) Operating Manual

Front View of a Female Connector



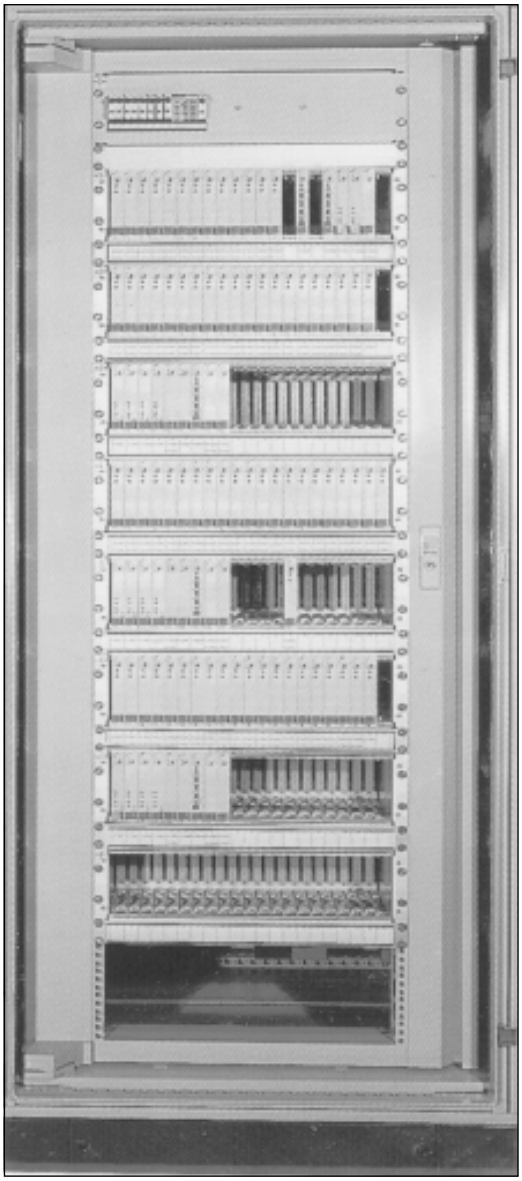
Connector per DIN 41 612
Type F

Side View of Female Connector



Switch Cabinet Assembly

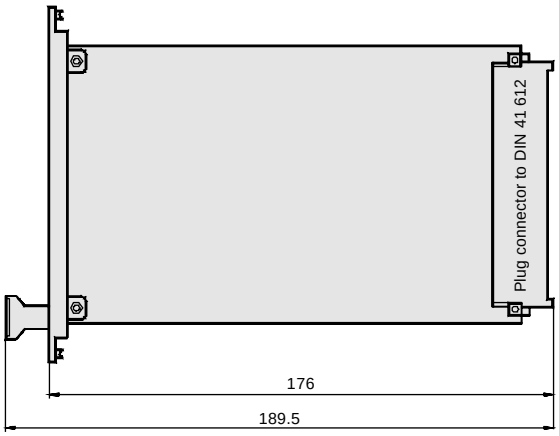
The individual modular racks are are arranged on top of each other by means of roller guides within the switch cabinet. Jumper and terminal connectors can be installed on the back of the switch cabinet which are compatable with the system and field cables.

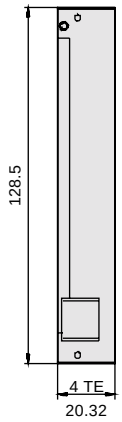


Mechanical Dimensions

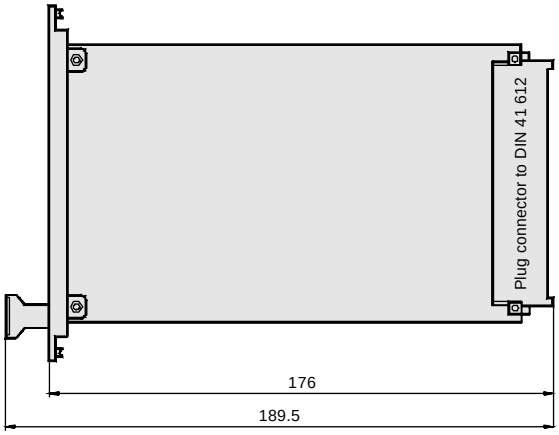
The following is an overview which shows all available designs with their dimensions.

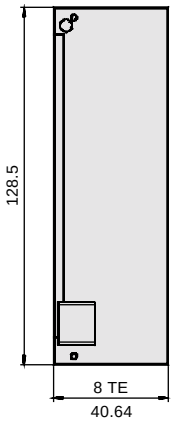
Type A



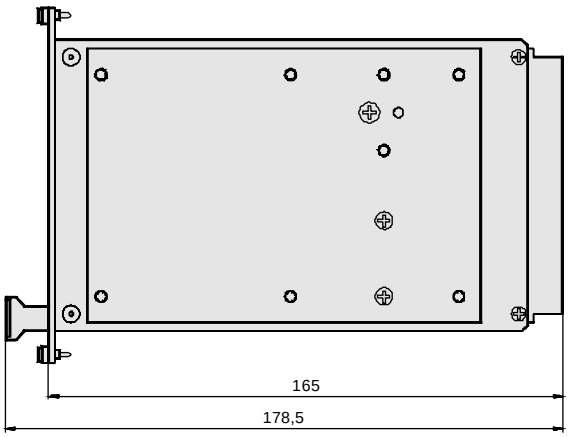


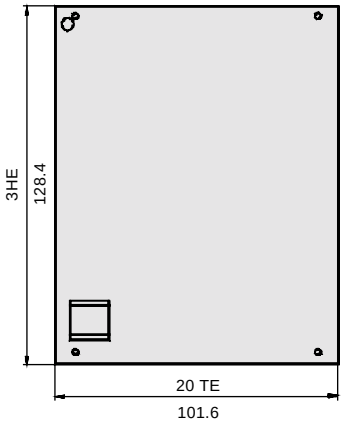
Type B



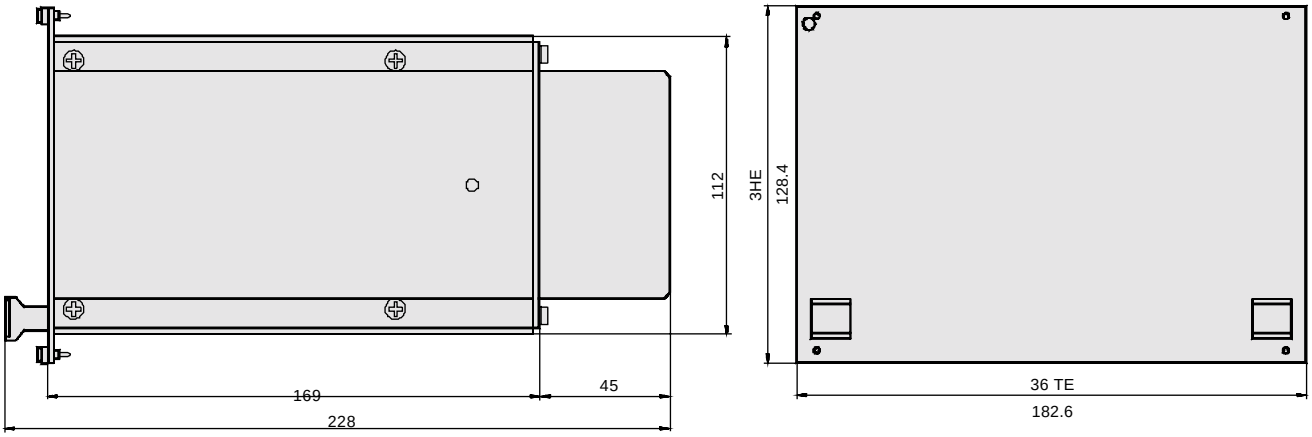


Type C





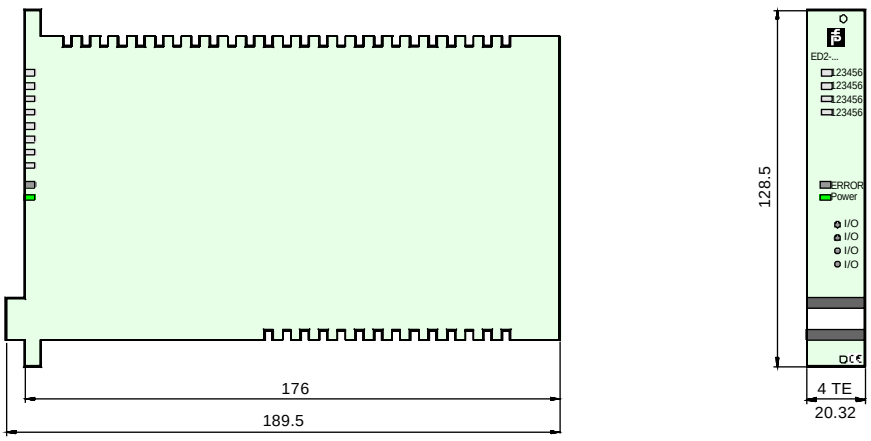
Type D



New Eurocard Housing

New:

- Design
- Face plate optimally sectioned
- Labeling strip for:
  device specifications (functions diagrams etc.)
  customer specifications
- Isolation cards between the individual Eurocards are no longer necessary
  Compatability:
- meets the Eurocard standard DIN 41494
- Isolation cabinet system Ex-TKS may be installed
- Label carrier accessory is available for delivery

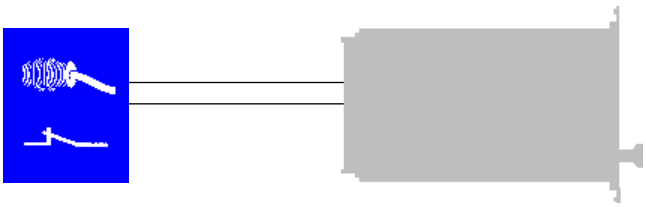


4 Function Overview

The following overview should aid you in finding the suitable product for your application.

Sensors and Contacts

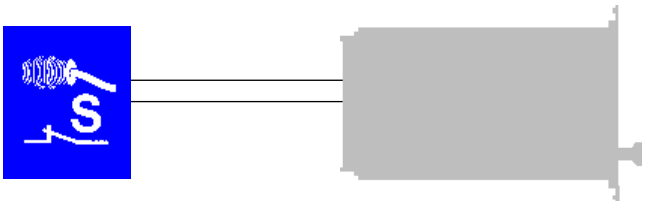
Additional products and technical data may be found in the chapter on Transformer Isolated Amplifiers,page 21.



i.e. ED2-SR-Ex4

NAMUR Sensors and Contacts

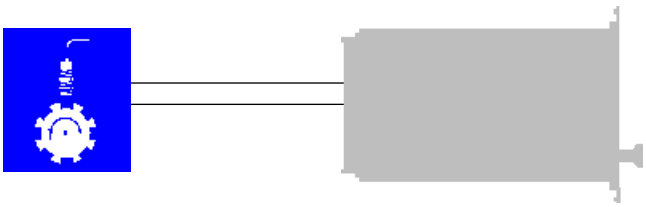
Additional products and technical data may be found in the chapter on Transformer Isolated Amplifiers in Intrinsic Safety, page 85.



i.e. ED2-SH-Ex2.R1

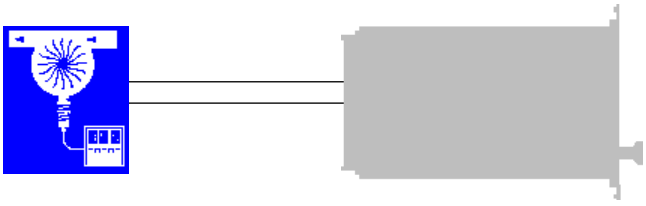
Rotation Speed Monitoring

Additional products and technical data may be found in the chapter on Pulse Evaluation Units, page 99.



Flow Measurement

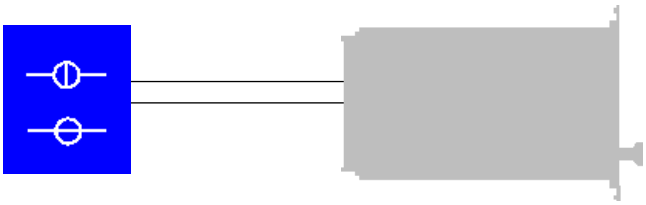
Additional products and technical data may be found in the chapter on Pulse Evaluation Units, page 99.



i.e. EG1-M2-JT

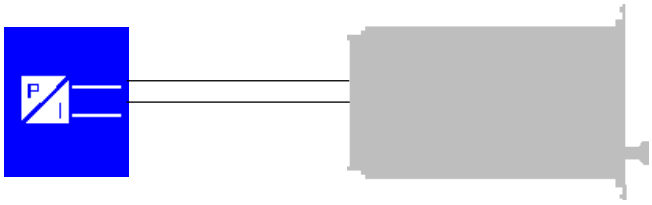
Power Supplies

Additional products and technical data may be found in the chapter on Galvanically Isolated Analog Repeaters, page139.



i.e. ED0-CS-Ex4.52

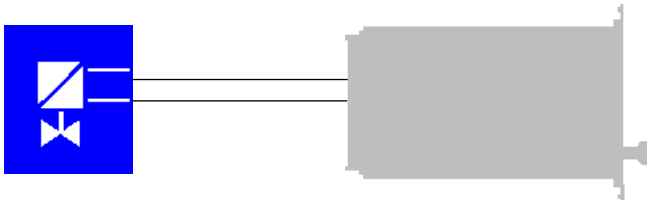
I/P Converter, Positioner



i.e. EGT-105

Additional products and technical data may be found in the chapter on Galvanically Isolated Analog Repeaters, page 139.

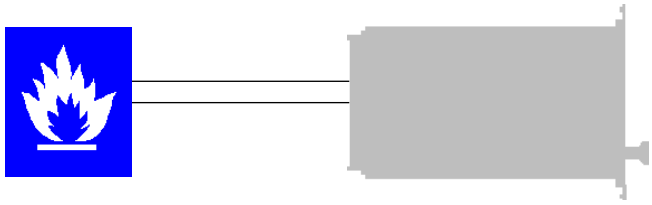
Valve



i.e. ED2-VM-Ex4.35

Additional products and technical data may be found in the chapter on Solenoid Valve Driver Modules, page 121.

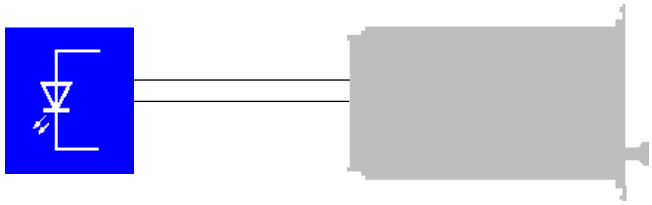
Fire and Smoke Detectors



i.e. ED0-CS-Ex4.51

Additional products and technical data may be found in the chapter on Galvanically Isolated Analog Repeaters, page139.

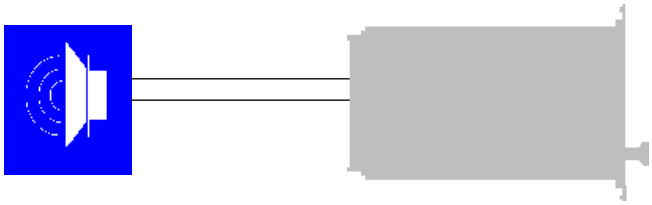
LED Indicators



i.e. EGA-041

Additional products and technical data may be found in the chapter on Solenoid Valve Driver Modules, page 121.

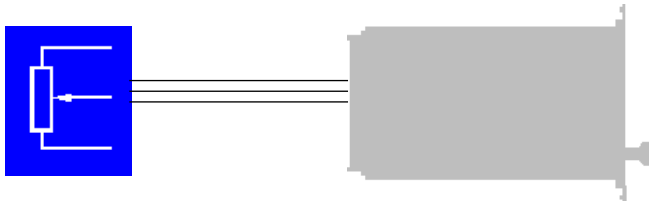
Audible Alarms



i.e. ED2-VD-Ex2.1835

Additional products and technical data may be found in the chapter on Solenoid Valve Driver Modules, page 121.

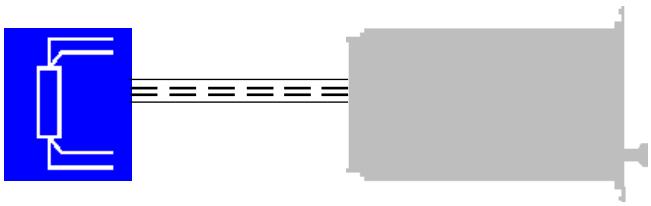
Potentiometer



i.e. EGC-020

Additional products and technical data may be found in the chapter on Galvanically Isolated Analog Repeaters, page 139.

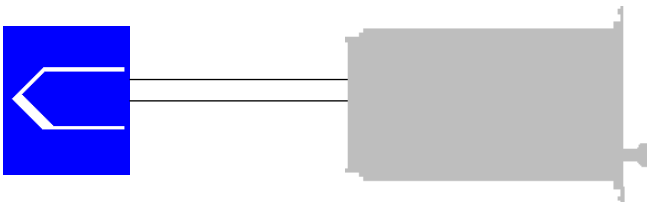
Pt 100



i.e. ED2-TR-Ex1

Additional products and technical data may be found in the chapter on Galvanically Isolated Analog Repeaters, page 139.

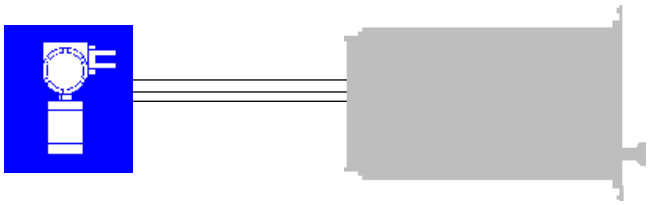
Thermocouple



i.e. ED2-VR-Ex2.50M

Additional products and technical data may be found in the chapter on Isolated Repeaters, page 142.

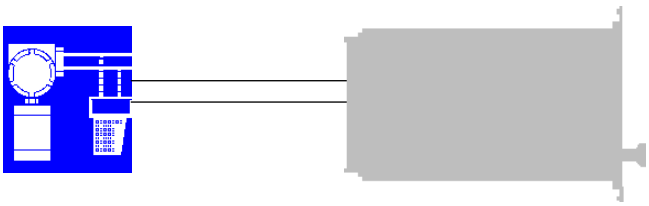
Transmitter



i.e. EGT-101

Additional products and technical data may be found in the chapter on Transmitter Repeater Units and SMART Transmitter Repeater Units, page 165.

SMART Transmitter



i.e. EGT-014

Additional products and tecnical data may be found in the chapter on Transmitter Repeater Units and SMART Transmitter Repeater Units, page165.

5 Key to model numbers:

Position 1	**E**	=	Eurocard
Position 2	**D**	=	DC Power Supply
	A	=	AC Power Supply
Position 3	**0**	=	Without Power Supply (loop powered)
	2	=	up to 24 V DC
	6	=	up to 230 V AC (only Current Supply)
Position 4	**CD**	=	Current Driver
	CR	=	Current Repeater
	CS	=	Passive Current Repeater
	DW	=	Rotation Speed Monitor
	FSU	=	Frequency Current Converter
	GS	=	Trip Amplifier for Current / Voltage Signals
	GR	=	Trip Amplifier for Resistance Thermometer (RTD)
	IT	=	Pulse Divider
	PT	=	Potentiometer Converter
	RR	=	Resistance Repeater
	SD	=	Solenoid Driver
	SH	=	Safety Design
	SL	=	Solenoid Driver with Logic Input
	SOT	=	Switch Isolator with passive, potential free Transistor Output
	SR	=	Switch Isolator with Relay Output
	SRT	=	Switch Isolator with active Transistor and Relay Output
	ST	=	Switch Isolator with active Transistor Output
	STC	=	SMART-Transmitter Power Supply with Current Output
	STV	=	SMART-Transmitter Power Supply with Voltage Output
	TR	=	Resistive Temperature Device Converter
	TT	=	Thermocouple/mV Signal Converter
	UT	=	Universal Temperature Converter
	VD	=	Solenoid Driver
	VM	=	Solenoid Driver
	VR	=	Voltage Repeater
	WAC	=	Strain Gauge Converter with Current Output
	WAV	=	Strain Gauge Converter with Voltage Output

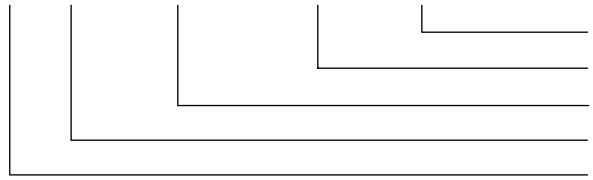
Key to Model Numbers for Switch Isolators

E __ __ - __ __ __ __ - __ __

Pos. 5 Design, Additional Function
Pos. 4 Type of Output
Pos. 3 Number of Channels
Pos. 2 Technical Design

Key to Model Numbers for Other Device Groups

E __ __ - __ __ __ - __ __ __ - __



Pos. 6 Additional Function
Pos. 5 Function
Pos. 4 Device Series, Variations
Pos. 3 Device Group
Pos. 2 Technical Design

Position 1:

System	**E**	=	Eurocard

Position 2:

Technical Design	**G**	=	Galvanically Isolated
	R	=	Relay Card for Ex-i Circuit Switching

Position 3:

a) for Switch Isolators	**1 ... 8**		Number of Channels
b) for other Device Groups	**A**	=	Solenoid Drivers
	M	=	Trip Amplifiers
	C	=	Temperature Converters

Position 4:

a) for Switch Isolators Type of Output	**R**	=	Relay Output
	RLK	=	Relay output with signaling of lead breakage and short circuit
	T	=	Transistor Output
	TLK	=	Transistor output with signaling of lead breakage and short circuit
	OT	=	Potential free transistor output
	OTLK	=	Potential free transistor output with signaling of lead breakage and short circuit
b) other Device Groups Device Series, Variants	**Mn**	=	Microprocessor Control (n = 1 ... 9 = Device Variants)
	nnn	=	Device Series, Variations of Galvanically Isolated Analog Devices and Solenoid Drivers (n = Zahl)

Position 5:

a) for Switch Isolators Design, Additional Function	**HF**	=	High Frequency Design
	Bi	=	Bi-stable Design
	X, Y...	=	Modified Design of a Standard Device
b) for other Device Groups Function	**FSU**	=	Frequency Current Converter
	DW	=	Rotation Speed Monitor
	IT	=	Pulse Divider
	GLU	=	Synchronization Monitor
	DRM	=	Rotational Direction Indicator

Position 6:

not for Switch Isolators			
Additional Function	**X, Y...**	=	Modified Design of a Standard Device