Safety for Industrial Processes

Selection Guide

bzg - Zener Barrier

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- 1. Zener barrier principle and reminders about intrinsic safety

1. Zener barrier principle

A Zener barrier is an associated equipment that is installed in the safe area. It is designed to limit the amount of energy that could appear in an electrical circuit passes through the hazardous area despite the connection before the barrier. A barrier consists of:

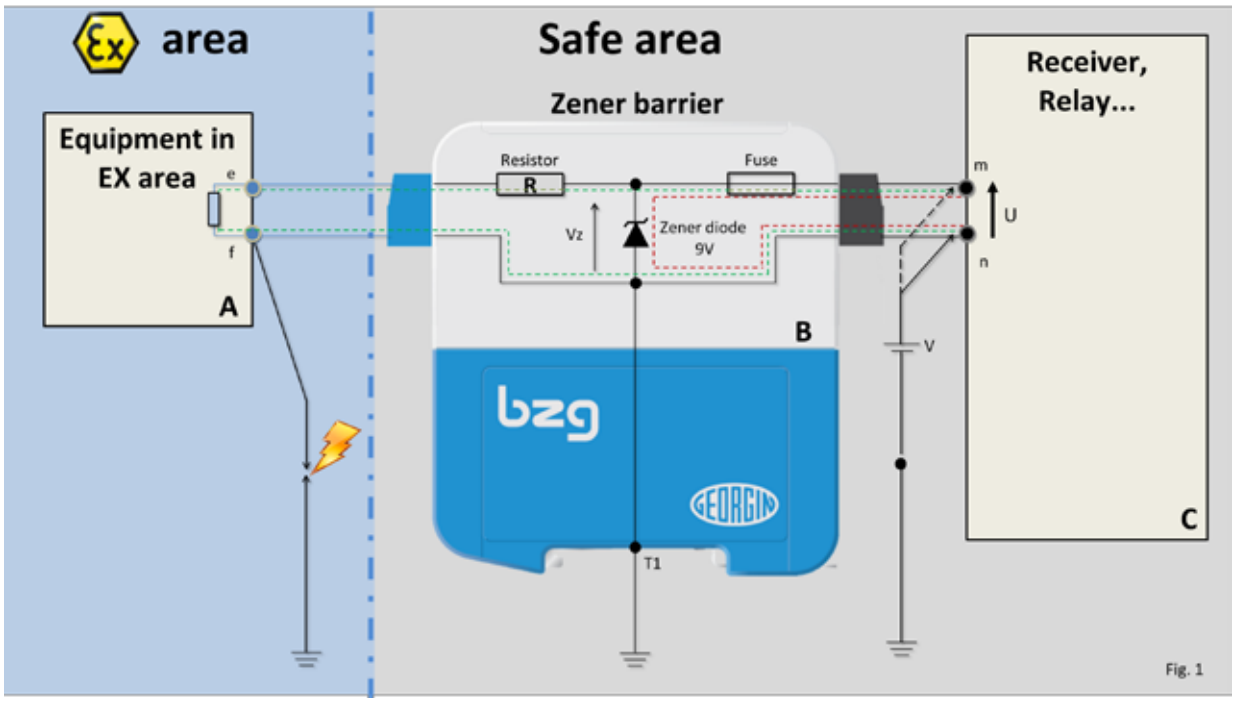
- Resistors to limit the current
- Zener diodes to limit the voltage
- Fuses to protect the components

As any intrinsic safety equipment, the Zener barrier allows cables to short circuit to each other or to metallic parts connected to ground without danger.

The Zener barrier interfacing mode differs from others as there is no galvanic isolation. Cables that pass through the hazardous area thus share common features with those of the safe area. This implies equipotential grounding.

Figure (1) illustrates an intrinsic safety equipment (A) connected to a circuit (C) through a Zener barrier (B) that limits the current, the voltage and the power.

If a fault voltage occurs between the terminals (m) and (n), the Zener diode (protected by a fuse) limits the voltage that risks appearing in the hazardous area and the resistor limits the current to an acceptable value.
If a fault voltage occurs between the terminal (m) or (n) and the ground, the voltage of the wires (e) and (f) relative to ground will not exceed Vz provided that the Zener barrier is correctly grounded at (T1).



Current path in normal operation, U ≤ 9V
Current path in the overvoltage case, U ≤ 9V
The Zener diode becomes conducting
The fuse protects the Zener diode from destruction

The Zener barrier permits wires (e) and (f) to be short circuited without danger. However, if point (n) accidentally reaches a high potential relative to ground, a ground fault at (f) risks causing a dangerous spark.

To ensure the safety of such a wiring, point T1 must be connected to ground as illustrated in Fig.(2). So, in the event of a fault between (m) and (n), the voltage between (e) and (f) will not exceed Vz, the short circuit current between (e) and (f) will not exceed Vz/R, and the ground fault current will be zero for point (f), and equal to Vz/R for point (e).

Notice:
To validate the following statement, grounds T1 and T2 must be at the same potential.
Actually, a Vt difference of potential causes a loop current only limited by line and ground resistances.

Conclusion: Only an equipotential ground network can ensure the safety of a reference ground system.

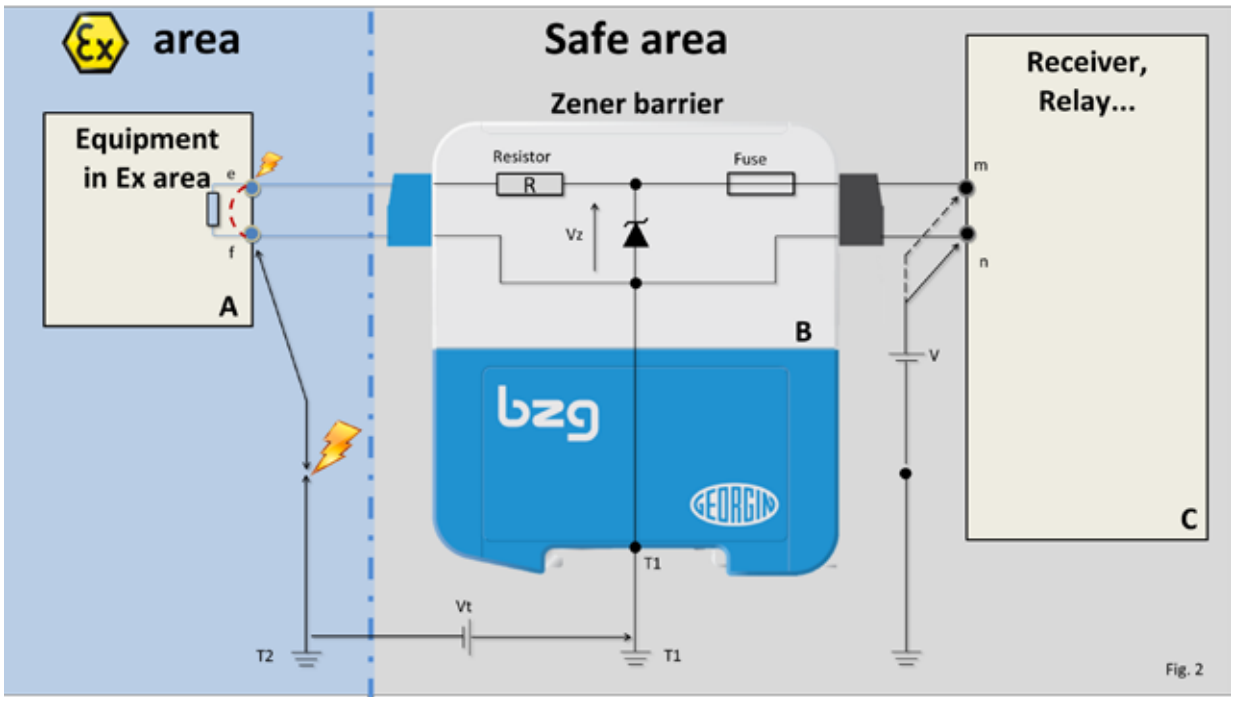


Fig. 2

A wide range of barriers has been developed to fit all type of installation. They differentiate by their electrical circuit diagrams, parameters and functions.
The electrical circuit diagram differs from a barrier to another (See Chapter. 4.3).

There are two main types:

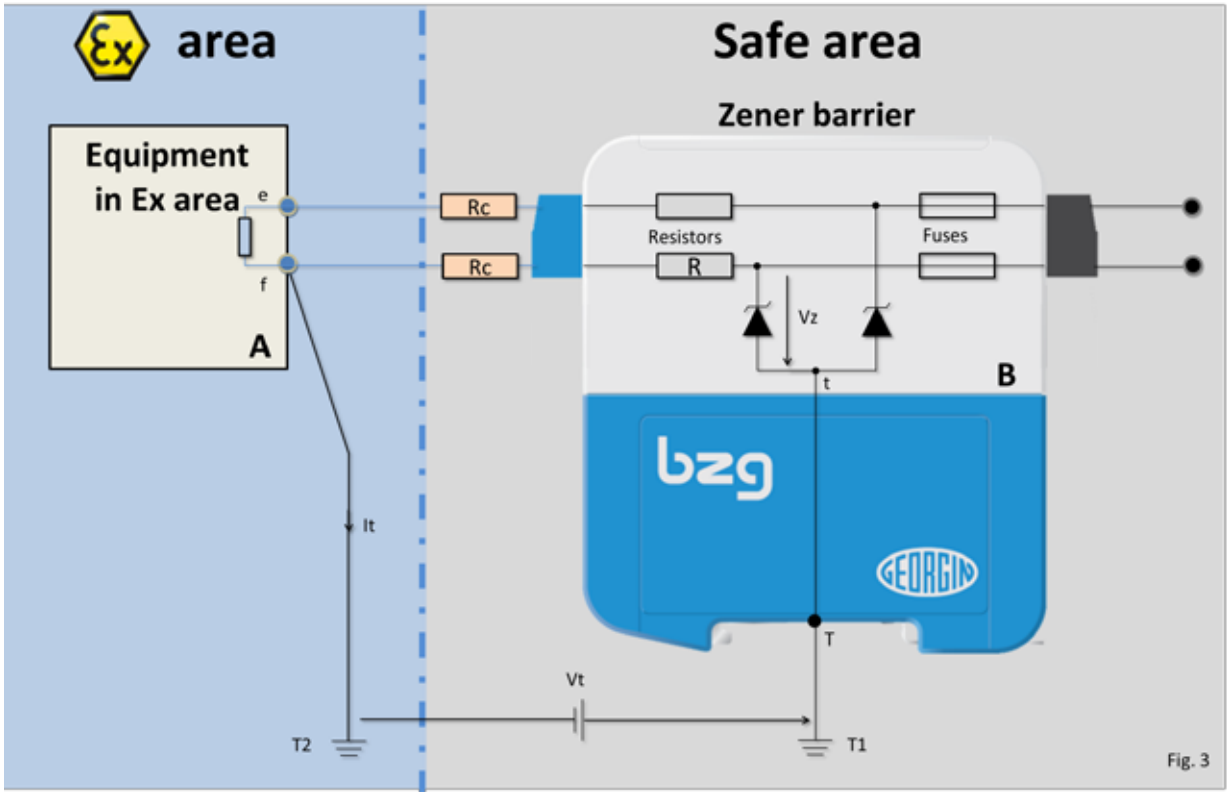
The «single» barriers:

The «double» barriers:

- **Single barriers:**

In this configuration, one of the two metrologic wires is directly connected to the ground (T1) at the barrier (Fig. (2)).
If there is a difference in the potential between T1 and T2, a ground fault (T2) can cause a loop current to occur.
Even if this current does not affect the system, it can impair the measurement of low level signals (e.g. Pt100, thermocouple). An important difference of potential can degrade the safety.

- **Double barriers:**



Vt = Difference of potential between grounds T1 and T2

With a barrier of this type (Fig.(3)), a ground fault at (f) causes a loop current to occur:

- $It \leq (Vt + Vz) / (R + Rc)$ (Rc is the line and contact resistance)

The current It is lower than with a single barrier where it can take the value:

- $It \leq Vt / Rc$

Another advantage is that the double barrier – unlike the single - ensures isolation of the metrologic wires relative to the ground corresponding to the Zener diode threshold.

2. The barriers and their functions

Three main functions:

- A signal current transmission function
- A signal voltage transmission function
- A power supply function

In the **current signal transmission** function, the measured value is the current. The barrier is integrated in a loop connected to a current source. The barrier's protective diodes must not conduct. The barrier brings an additional resistance which must not cause the acceptable loop resistance to be exceeded. The barrier is determined as follows:

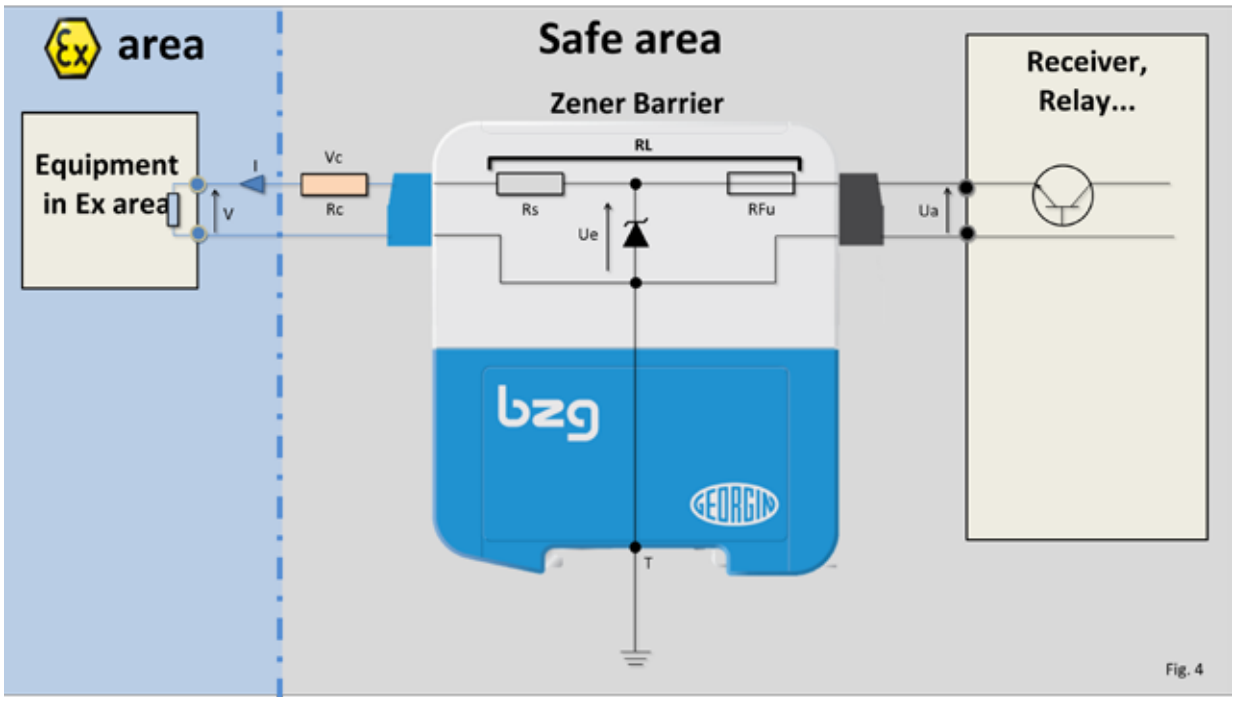


Fig. 4

Ue is the voltage for which a leakage current lower than or equal to I(t) is ensured.

If I is the current and V is the voltage needed in the hazardous area (fig. 4): The following relations must be checked for the equipment operates correctly:

- $V + I \times (Rs + Rc) < Ue$
- $U < Ue$

If these relations are checked, the maximum ohmic value of the cable can be determined as follow:

- $Rc\ max. = [Ue - V - (Rs \times I)]/I$

The fuse resistance R Fu is so negligible that calculation can be made with the value RL of the bzg parameters (see Chapter 4.2) instead of Rs.

Influence of the Zener barrier internal resistance:

Because of V - the voltage needed for the equipment operates in hazardous area-, the loop resistance Rc + RL must be compatible with the supply voltage at the barrier input.
An associated equipment has always an internal resistance (RL) in series with the terminals connected to the intrinsic safety equipment.
The intrinsic safety parameters P_o and I_o of the associated equipment (See chapter 1.3) are determined by this resistance.
This resistance RL can affect the operation of the connected intrinsic safety equipment by generating a voltage drop at its terminals:

- $\Delta u = (RL + Rc) \times I$ consumed by the transmitter

Example :

A 24V supplied transmitter through a Zener barrier with an internal resistor of 200Ω. The cable resistance is negligible.

- Maximum current consumed by the transmitter: 21 mA
- Voltage drop Δu due to the internal resistance: 0.021 x 200 =4.2V
- Effective supply voltage V seen by the transmitter: 24-4.2= 19.8V

In this example, RL is included in the calculation of the maximum load resistance specified by the transmitter manufacturer.

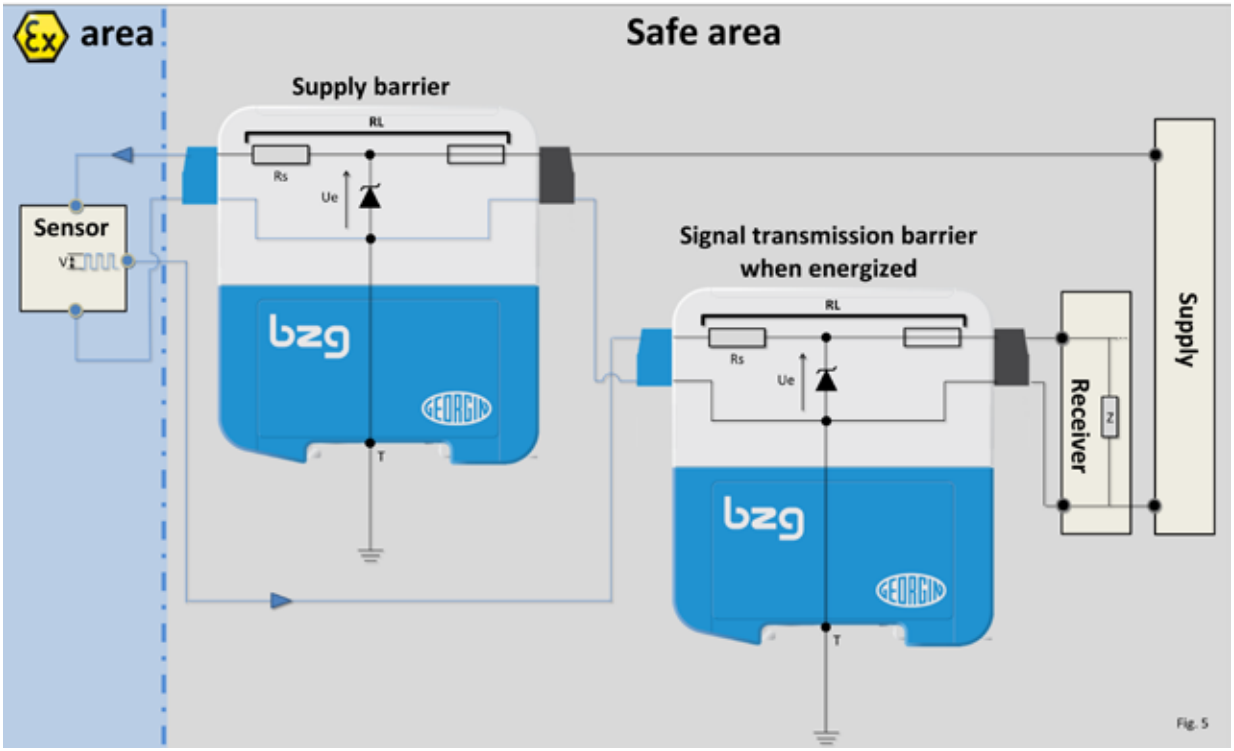
The effective supply voltage V must never be lower than the minimum supply voltage specified.

The voltage, current and power values limited by the barrier must also be considered. (See chapter 1.3).

The equipment operating voltage in the hazardous area must be lower than the U_o of the associated equipment.
The equipment operating current in the hazardous area must be lower than the I_o of the associated equipment.

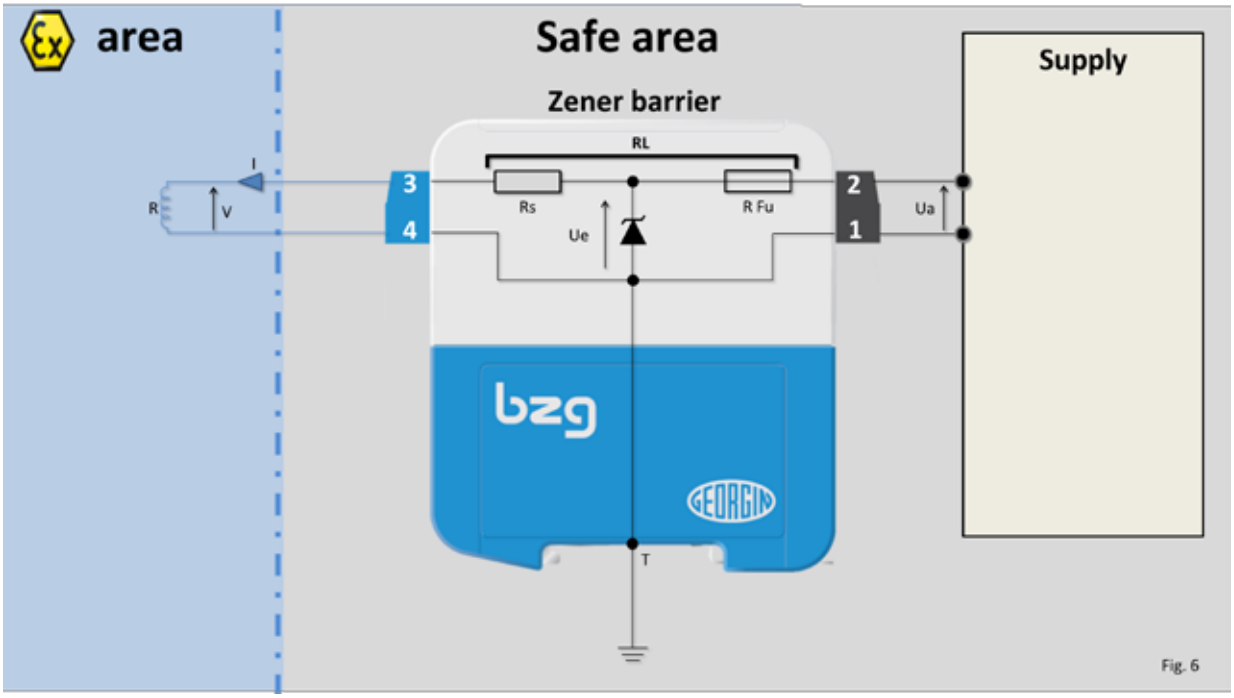
The operating power consumed by the equipment in the hazardous area must be lower than the P_o of the associated equipment.

The **voltage signal transmission** function implies to check that the barrier resistance RL does not badly weaken the signal when the receiver input impedance Z is not illimited (fig. 5).



The value of the pulse V must be lower than Ue, otherwise the generator risks short-circuiting through the resistor Rs. The pulse frequency must be checked.

- The **power supply** function is as follow (Fig. 6):



For this type of barrier the following relations must be checked:
If I is the current needed in the hazardous area.

- $I \leq Ue / (Rs + R)$

The fuse resistance R Fu is so negligible that calculation can be made with the value RL of the bzg parameters (see Chapter 4.2) instead of Rs.

3. Some intrinsic safety concepts

As any intrinsic safety equipment connected to a sensor (itself of intrinsic safety) the assembly constitutes an «intrinsically safe system» -as defined by the standard- which parameters must be compatible regarding intrinsic safety.

Directive 1999 / 92 / CE (ATEX environment user directive) imposes to prove the compliance of the system safety.

To define a Zener barrier it is necessary to gather information about its environment to ensure the correct operation of the system and its reliability.

To define the suitable barrier, it is necessary to gather the following information:

Complete reference of the associated equipment and of the equipment situated in the hazardous area:
To find the equipment concerned in the ATEX certificate and the technical datasheet

Ex : "bzg787P+"

Technical datasheet or instruction sheet for the interfaces and equipment in the hazardous area:
To find the equipment metrologic data

ATEX certificate for interfaces and equipment in the hazardous area:
To find the intrinsic safety parameters and the equipment marking

Cable characteristics: Capacitance and inductance per Km, resistance per Km, length

An intrinsically safe system generally consists of:

- Intrinsic safety equipment installed in a hazardous area
- Associated equipment installed in the safe area
- Connection cable
- Accessories (junction boxes, sockets, switches, etc.)

An associated equipment:

It is located in the safe area. From an intrinsic safety point of view, it must be considered as a source of energy, due to the terminals intended to transit into the hazardous area.
This source of energy is defined by three parameters:

- Voltage: U_o
- Current: I_o
- Power: P_o

This implies that this associated equipment cannot supply a voltage higher than U_o, a current higher than Io or a power higher than P_o to the external environment.

The wiring:

To ensure the system remains safe, the C_o and L_o limiting characteristics are determined for each associated equipment:

- C_o is the maximum capacitance that can be connected to the associated equipment
- L_o is the maximum inductance that can be connected to the associated equipment
- $\sum C_i$ is the sum of the cable and the intrinsic safety equipments present in the loop capacitances
- $\sum L_i$ is the sum of the cable and the intrinsic safety equipments present in the loop inductances

The intrinsic safety equipment:

It is located in the hazardous area. Because its terminals are connected to the associated equipment, it must be considered as an energy receiver.
This energy receiver is characterised by three parameters giving the maximum limits: U_i, I_i, P_i. This implies that this intrinsic safety equipment remains safe as long as the characteristics of the energy supplied to it are lower than U_i, I_i and P_i.

Each intrinsic safety equipment is also characterised by quantities C_i and L_i that correspond to its internal capacitance and inductance values.

The validation of the intrinsic safety parameters of a simple system (Receiver, barrier, equipment in the hazardous area) requires comparing the intrinsic safety parameters of the barrier with those of the equipment in the hazardous area by the following rule:

- Checking of the voltage:
  U_o (barrier) ≤ U_i (equipment in hazardous area)
- Checking of current:
  I_o (barrier) ≤ I_i (equipment in hazardous area)
- Checking of power:
  P_o (barrier) ≤ P_i (equipment in hazardous area)
- Checking of capacitance:
  C_c (cable) + C_i (equipment in hazardous area) ≤ C_o (barrier)
- Checking of inductance:
  $L_c + L_i$ (equipment in hazardous area) ≤ L_o (barrier)

Take a concrete example into consideration:

System composition:

In the hazardous area:

- A: Smart pressure transmitter

Type	FK* - ProcessX Family
Reference	FKPT03V52KABY0Y
Manufacturer	Georgin
Marking	II 1 G Ex ia IIC T4 or T5
Installation zones	0, 1 or 2 (Gaz)
CE type certification	KEMA 10ATEX0031X
ATEX declaration of conformity	dc-ceatex-processX-fren Ind A
Commercial datasheet	fc-FK*-fr
Instruction manual	fi-processX-fren

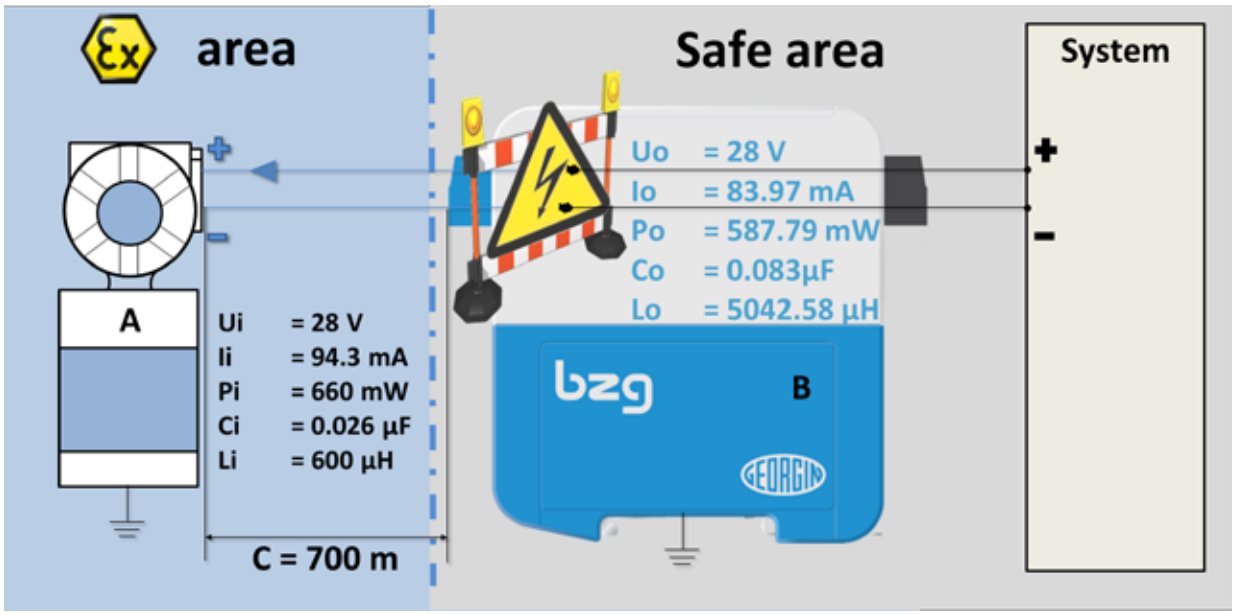
In the safe area:

- B: GEORGIN Zener barrier

Type	bzg
Reference	bzg788+
Manufacturer	Georgin
Marking	II (1) GD [Ex ia Ga] IIC or [Ex ia Ga] IIB or [Ex iaD Da] IIIC
Installation zones	Zone 2 in IP54 box or safe area
CE type certification	INERIS 11ATEX0024X
ATEX declaration of conformity	dc-ceatex-bzg
Commercial datasheet	fc-bzg-fr
Instruction manual	fu-bzg-fren

- C: Connection cable

Type	Shielded pair
Reference	HIJ
Manufacturer	DURAND
Resistance per unit length	10 Ohms/Km
Capacitance per unit length	0.02 µF / Km
Inductance per unit length	1000 µH / Km
Length	700 metres



The safety parameters (U, I, P) of equipments «A» and «B» are compatible for classification:
II 1G Ex ia IIC T4 to T5 (depending on ambient temperature).
For zones: 0, 1 and 2 / 20, 21, 22 according to IEC 60079-10L.

A/ Analysis for U, I and P

- Checking of the voltage:

U_o (barrier)	≤	U_i (equipment in the hazardous area)
28 V	≤	28 V

- Checking of current:

I_o (barrier)	≤	I_i (equipment in the hazardous area)
83.97 mA	≤	94.3 mA

- Checking of power:

P_o (barrier)	≤	P_i (equipment in the hazardous area)
587.79 mW	≤	660 mW

Equipment A limited by the voltage, current and power of equipment B.

B/ Analysis for C and L

- Checking of capacitance:

C_c (cable) + C_i (equipment in the area)	≤	C_o (barrier)
(0.02 µF x 0.7 km) + 0.026 µF	≤	0.083 µF
0.04 µF	≤	0.083 µF

- Checking of inductance:

L_c + L_i (equipment in the hazardous area)	≤	L_o (barrier)
(1000 µH x 0.7 km) + 600 µH	≤	5042.58 µH
1300 µH	≤	5042.58 µH

The capacitance and inductance values of the equipment in the hazardous area are compatible with the maximum external values of the associated equipment.

2. General specifications for bzg

bzg Zener Barrier

1. Function

To limit the level of energy that may appear in an electrical circuit that passes through a hazardous area, whatever the connection before the barrier.

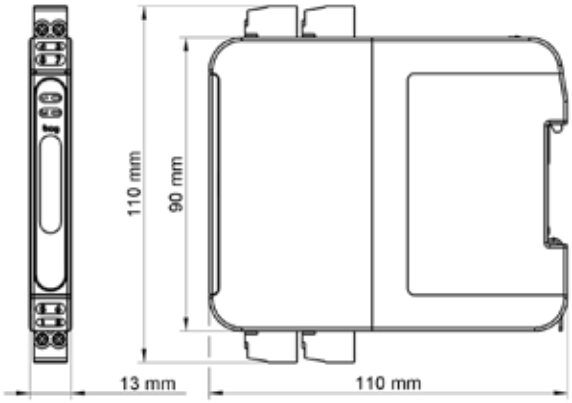
2. Composition

The components of our barriers are individually tested according to selection criteria imposed by the standard and the metrologic characteristics.
After wiring, the assembly of components is coated with a resin that provides mechanical retention and protects the barrier against any modification of the nature of the components or their wiring.
After coating, each component undergoes a new individual test to verify that the resin has not destroyed the electrical characteristics during polymerisation.
A final test permits verification of the electrical and intrinsic safety parameters before packing

3. Mechanical characteristics

Material	Polycarbonate
Mass	≈ 200g
Mounting	On DIN Rail
Storage T°	-25 to 70°C
Operating T°	-20° to 60°C
Relative humidity	5 to 80% without condensation
Protection rating	IP 20

Dimensions :



4. Electrical connection

Electrical connection	Removable screw terminals from 0.2mm² to 2.5mm²
Identification	Blue terminals for the outputs to the ATEX area Black terminals for the outputs to the safe area
Ground connection	Fixed screw terminal for 4mm² cable

5. Installation

- In safe area
- In zone 2 in an IP 54 minimum housing (see chapter 5.)

Refer to the instruction sheet.

6. Certifications

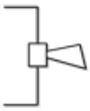
ATEX certification	11ATEX0024X
IECEx certification	INE 11.0009X
Marking	CE0081 II (1) GD [Ex ia Ga] IIC or [Ex ia Ga] IIB or [Ex iaD Da] IIIC CE0081 II 3 (1) G Ex nA [ia Ga] IIC T4 Gc
ATEX	EN 60079-0 / EN 60079-11 / EN 60079-15 / EN 61241-11 / EN 61241-0
IECEx	IEC 60079-0 / IEC 60079-11 / IEC 60079-15 / IEC 61241-11 / IEC 61241-0
E.M.C.	EN 61326-1 & IEC61000-6-2
L.V.D.	NFC 15-100
SIL	SIL 3 / EN 61508 (depending on application)

7. Options

LED on front panel	available depending on models
DIN rail isolator	available on all models (consult us)
Removable marking support	available on all models

3. Selection guide

1. Foreword

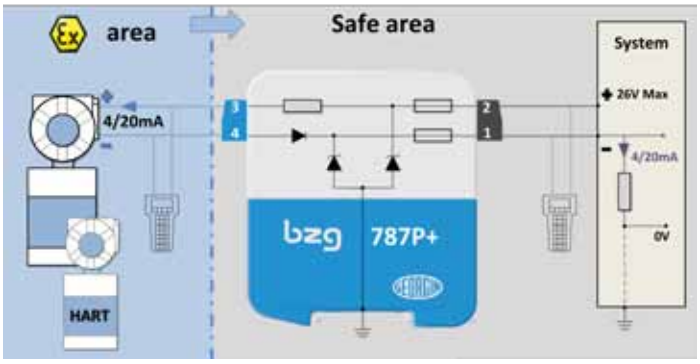
	Hazardous area		4/20mA transmitter
	Zener diode		RTD100
	Fuse		Thermocouple
	Resistor		12V System
	Ground potential		Valve positioner
	Information direction (system viewpoint)	HART	HART communication protocol
	Diode		Switch
	Lamp		Smoke detector
	Siren, Buzzer		Strain gauge bridge
	Solenoid valve		Vibration detector
	4/20mA system readout resistance		Current generator

Coding example:

bzg 2 728 L +

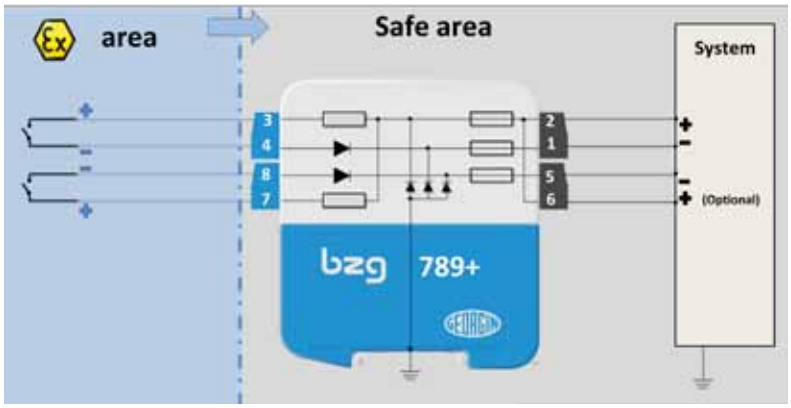
- bzg: Georgin Zener barrier
- **2** : Doubled barrier
  Ø : Single barrier
- *** : Type
- **L** : Version with LED indicator
  P : Higher limiting power (see SI parameter)
  Ø : Version without option
- **+** : Positive polarity
  AC : Not polarised

2. Analogue inputs

bzg787P+ or bzg787LP+		A 4/20mA transmitter connected to a Zener barrier with a floating potential wiring. HART protocol intelligent transmitters are compatible.
bzg788+ or bzg788L+		A 4/20mA transmitter connected to a Zener barrier with a floating potential wiring. HART protocol intelligent transmitters are compatible.
bzg728+ or bzg728L+		A 4/20mA transmitter connected to a Zener barrier with a reference ground wiring. HART protocol intelligent transmitters are compatible.
bzg2728+ or bzg2728L+		Two 4/20mA transmitters connected to a Zener barrier with a reference ground wiring. HART protocol intelligent transmitters are compatible.

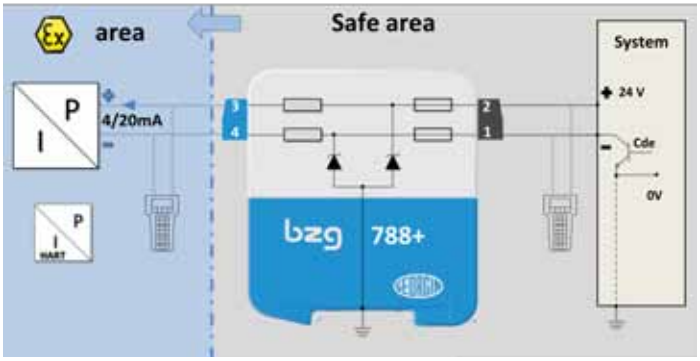
3. Digital inputs

bzg789+

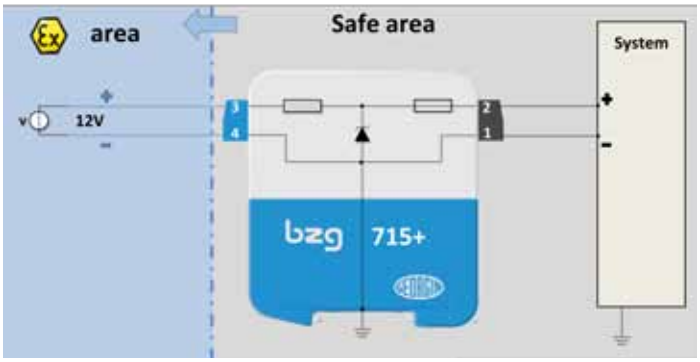
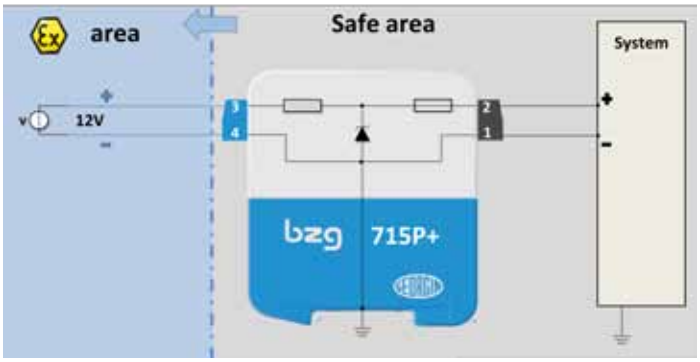
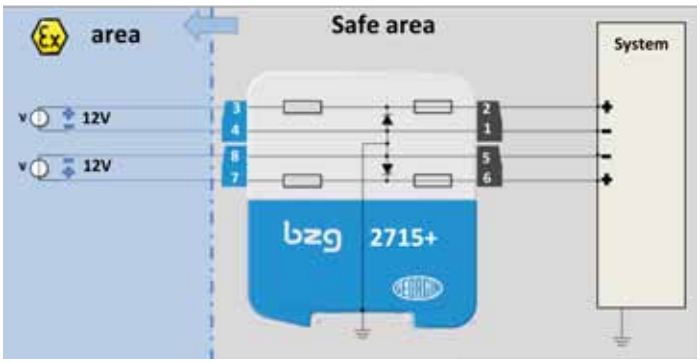
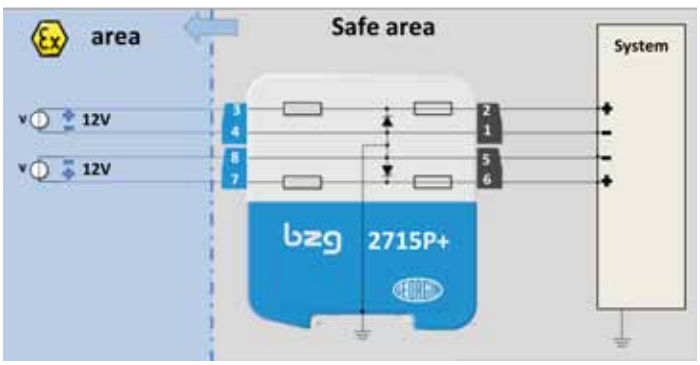


Interfacing with two Switches

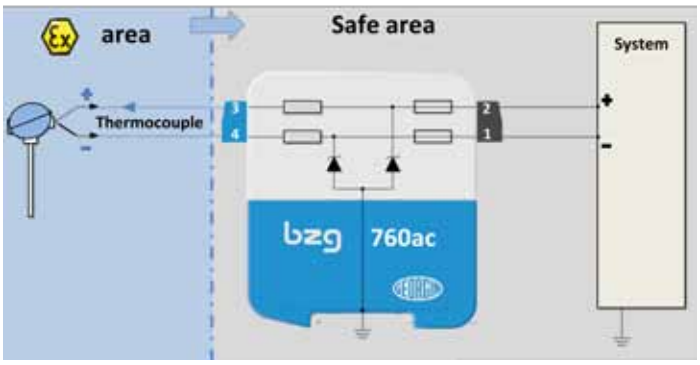
4. Analogue outputs

bzg787P+ or bzg787LP+		Interfacing a valve positioner or a 4/20mA display. Floating potential wiring, diode return
bzg788+ or bzg788L+		Interfacing a valve positioner or a 4/20mA display. Floating potential wiring, resistance return.
bzg728+ or bzg728L+		Interfacing a valve positioner or a 4/20mA display. Reference ground wiring.
bzg2728+ or bzg2728L+		Interfacing two valve positioners or two 4/20mA displays. Reference ground wiring.

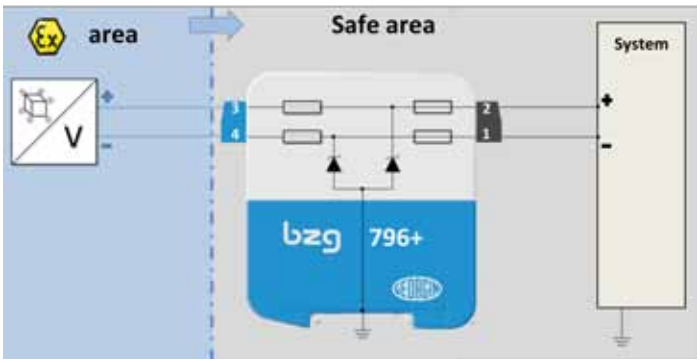
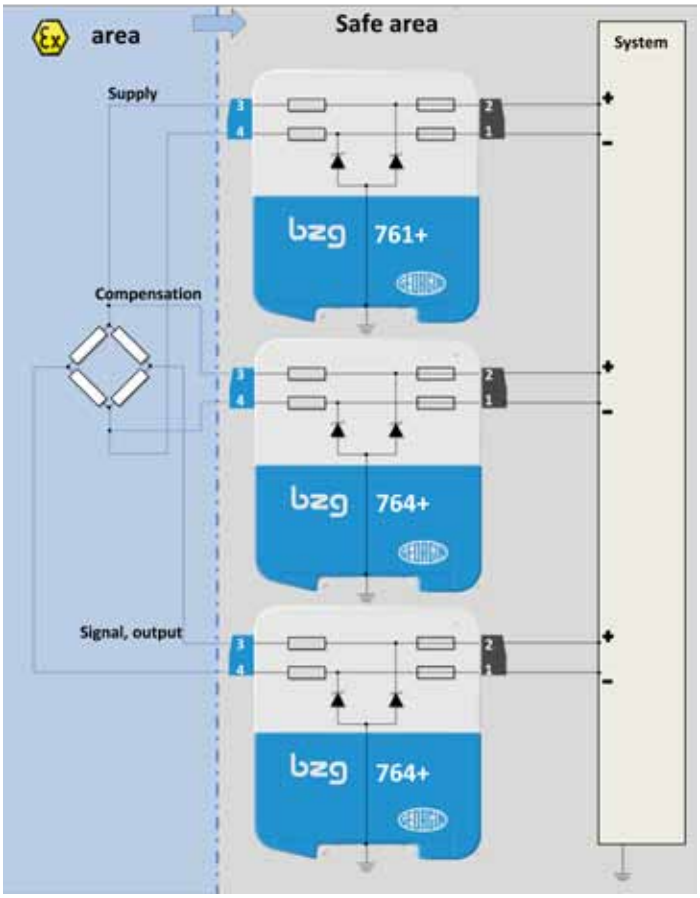
5. Digital outputs

bzg715+		System supplied at 12V. Reference ground wiring.
bzg715P+		System supplied at 12V. Reference ground wiring.
bzg767+		System supplied at 12V. Floating potential wiring.
bzg2715+		Two systems supplied at 12V. Reference ground wiring.
bzg2715P+		Two systems supplied at 12V. Reference ground wiring.

6. Temperature

bzg756ac		Floating potential wiring for a RTD100.
bzg755ac		RTD100 wired to ground.
bzg760ac		Thermocouple wiring.

7. Specific applications

bzg796+		Interfacing a vibrating sensor.
bzg787+		Interfacing a smoke detector.
bzg761 + bzg764 + bzg764		Power supply (bzg761), compensation (bzg764) and output (bzg764) for a strain gauge bridge with a floating potential wiring.

4. Detailled specifications

1. Metrologic parameters – Simple barriers

Model	ATEX Ex nA		Electric characteristics								
	Una (V)	Ina (mA)	Terminals	I(t) (µA)	U(e) (V)	Terminals	U(a) (V)	Ifm (mA)	LR (Ω)	Tol. +/- (%)	Pol.
bzg710+	8.8	100	2/T	10	8.60	2/3	9.5	100	54.6	5	+
bzg2710+	8.8	100	2/T 6/T	10 10	8.60 8.60	2/3 6/7	9.5 9.5	100 100	54.6 54.6	5 5	+
bzg715+	12	85	2/T	10	12.00	2/3	13.8	100	103.6	5	+
bzg2715+	12	85	2/T 6/T	10 10	12.00 12.00	2/3 6/7	13.8 13.8	100 100	103.6 103.6	5 5	+
bzg715P+	12	100	2/T	10	12.00	2/3	13.8	100	50.6	5	+
bzg2715P+	12	100	2/T 6/T	10 10	12.00 12.00	2/3 6/7	13.8 13.8	100 100	50.6 50.6	5 5	+
bzg722+	19	70	2/T	10	19.00	2/3	19.6	100	153.6	5	+
bzg2722+	19	70	2/T 6/T	10 10	19.00 19.00	2/3 6/7	19.6 19.6	100 100	153.6 153.6	5 5	+
bzg728-	-24	50	2/T	10	-24.90	2/3	-26.8	50	311.3	5	-
bzg728+	24	50	2/T	10	24.90	2/3	26.8	50	311.3	5	+
bzg2728-	-24	50	2/T 6/T	10 10	24.90 24.90	2/3 6/7	-26.8 -26.8	50 50	311.3 311.3	5 5	-
bzg2728+	24	50	2/T 6/T	10 10	24.90 24.90	2/3 6/7	26.8 26.8	50 50	311.3 311.3	5 5	+
bzg728L-	-24	50	2/T	10	-24.90	2/3	-26.8	50	2V + 311.3Ω	5	-
bzg728L+	24	50	2/T	10	24.90	2/3	26.8	50	2V+311.3Ω	5	+
bzg2728L-	-24	50	2/T 6/T	10 10	-24.90 -24.90	2/3 6/7	-26.8 -26.8	50 50	2V+311.3Ω 2V+311.3Ω	5 5	-
bzg2728L+	24	50	2/T 6/T	10 10	24.90 24.90	2/3 6/7	26.8 26.8	50 50	2V+311.3Ω 2V+311.3Ω	5 5	+
bzg728P+	24	50	2/T	10	24.90	2/3	26.8	50	248.3	5	+
bzg2728P+	24	50	2/T 6/T	10 10	24.90 24.90	2/3 6/7	26.8 26.8	50 50	248.3 248.3	5 5	+
bzg728LP+	24	50	2/T	10	24.90	2/3	26.8	50	2V + 248.3Ω	5	+
bzg2728LP+	24	50	2/T 6/T	10 10	24.90 24.90	2/3 6/7	26.8 26.8	50 50	2V + 248.3Ω 2V + 248.3Ω	5 5	+
bzg729P+	24	50	2/T	10	24.90	2/3	26.8	50	180.3	5	+
bzg2729P+	24	50	2/T 6/T	10 10	24.90 24.90	2/3 6/7	26.8 26.8	50 50	180.3 180.3	5 5	+
bzg729LP+	24	50	2/T	10	24.90	2/3	26.8	50	2V +180.3Ω	5	+
bzg2729LP+	24	50	2/T 6/T	10 10	24.90 24.90	2/3 6/7	26.8 26.8	50 50	2V +180.3Ω 2V +180.3Ω	5 5	+
bzg801	16	70	2/T	10	15.50	2/3	16.6	100	153.6	5	+
bzg2801	16	70	2/T 6/T	10 10	15.50 15.50	2/3 2/3	16.6 16.6	100 100	153.6 153.6	5 5	+
bzg802	16	100	2/T	10	15.50	2/3	16.6	100	59.6	5	+
bzg2802	16	100	2/T 6/T	10 10	15.50 15.50	2/3 6/7	16.6 16.6	100 100	59.6 59.6	5 5	+
bzg803	16	55	2/T	10	15.50	2/3	16.6	100	252.6	5	+
bzg2803	16	55	2/T 6/T	10 10	15.50 15.50	2/3 6/7	16.6 16.6	100 100	252.6 252.6	5 5	+

Una :	Maximum use voltage in Ex nA [ia] for a T4 class of temperature : -20°C / +60°C
Ina :	Maximum use current in Ex nA [ia] for a T4 class of temperature : -20°C / +60°C
U(e) :	Voltage for which a leakage current lower or equal to I(t) is assured
U(a) :	Maximum voltage input
LR :	Line resistance
Tol :	Tolerance of line resistance
Ifm :	Maximum current that can pass through the barrier (without destruction)
T :	Ground
/ :	On

2. Intrinsic safety parameters – Simple barriers

Model	Intrinsic safety parameters										
	Terminals	Ro (Ω)	Uo (V)	Io (mA)	Po (mW)	Lo IIC (µH)	Co IIC (µF)	L/R IIC (µH/Ω)	Lo IIB (µH)	Co IIB (µF)	L/R IIB (µH/Ω)
bzg710+	3/4	48.45	9.56	197	470	916	3.6	75	3664	26	302
bzg2710+	3/4 7/8	48.45 48.45	9.56 9.56	197 197	470 470	916 916	3.6 3.6	75 75	3664 3664	26 26	302 302
bzg715+	3/4	95.03	14.39	151.42	544.55	1550.73	0.67	65.29	6202.9	4.18	261.17
bzg2715+	3/4 7/8	95.03 95.03	14.39 14.39	151.42 151.42	544.55 544.55	1550.73 1550.73	0.67 0.67	65.29 65.29	6202.9 6202.9	4.18 4.18	261.17 261.17
bzg715P+	3/4	44.77	14.39	322.17	1158.61	342.56	0.67	30.69	1370.22	4.18	122.75
bzg2715P+	3/4 7/8	44.77 44.77	14.39 14.39	322.17 322.17	1158.61 1158.61	342.56 342.56	0.67 0.67	30.69 30.69	1370.22 1370.22	4.18 4.18	122.75 122.75
bzg722+	3/4	142.5	21	147	771	1645	0.188	46	6581	1.27	184
bzg2722+	3/4 7/8	142.5 142.5	21 21	147 147	771 771	1645 1645	0.188 0.188	46 46	6581 6581	1.27 1.27	184 184
bzg728-	3/4	285	27.3	95	648	3939	0.088	54	15758	0.683	21+
bzg728+	3/4	285	27.30	95.79	653.76	3875.00	0.088	54.39	15500.01	0.683	217.54
bzg2728-	3/4 7/8	285 285	27.3 27.3	95 95	648 648	3939 3939	0.088 0.088	54 54	15758 15758	0.683 0.683	219 219
bzg2728+	3/4 7/8	285 285	27.30 27.30	95.79 95.79	653.76 653.76	3875.00 3875.00	0.088 0.088	54.39 54.39	15500.01 15500.01	0.683 0.683	217.54 217.54
bzg728L-	3/4	285	27.3	95	648	3939	0.088	54	15758	0.683	219
bzg728L+	3/4	285	27.30	95.79	653.76	3875.00	0.088	54.39	15500.01	0.683	217.54
bzg2728L-	3/4 7/8	285 285	27.3 27.3	95 95	648 648	3939 3939	0.088 0.088	54 54	15758 15758	0.683 0.683	219 219
bzg2728L+	3/4 7/8	285 285	27.30 27.30	95.79 95.79	653.76 653.76	3875.00 3875.00	0.088 0.088	54.39 54.39	15500.01 15500.01	0.683 0.683	217.54 217.54
bzg728P+	3/4	232.26	27.3	117.5	802	2573	0.088	44	10294	0.683	177
bzg2728P+	3/4 7/8	232.26 232.26	27.3 27.3	117.5 117.5	802 802	2573 2573	0.088 0.088	44 44	10294 10294	0.683 0.683	177 177
bzg728LP+	3/4	232.26	27.3	117.5	802	2573	0.088	44	10294	0.683	177
bzg2728LP+	3/4 7/8	232.26 232.26	27.3 27.3	117.5 117.5	802 802	2573 2573	0.088 0.088	44 44	10294 10294	0.683 0.683	177 177
bzg729P+	3/4	165.62	27.3	164.8	1125	1308	0.088	31.60	5234	0.683	126
bzg2729P+	3/4 7/8	165.62 165.62	27.3 27.3	164.8 164.8	1125 1125	1308 1308	0.088 0.088	31 31	5234 5234	0.683 0.683	126 126
bzg729LP+	3/4	165.62	27.3	164.8	1125	1308	0.088	31	5234	0.683	126
bzg2729LP+	3/4 7/8	165.62 165.62	27.3 27.3	164.8 164.8	1125 1125	1308 1308	0.088 0.088	31 31	5234 5234	0.683 0.683	126 126
bzg801	3/4	142.5	17.2	121	520	2434	0.353	68	9739	2.06	273
bzg2801	3/4 7/8	142.5 142.5	17.2 17.2	121 121	520 520	2434 2434	0.353 0.353	68 68	9739 9739	2.06 2.06	273 273
bzg802	3/4	53.2	17.2	324	1393	339	0.353	25	1357	2.06	102
bzg2802	3/4 7/8	53.2 53.2	17.2 17.2	324 324	1393 1393	339 339	0.353 0.353	25 25	1357 1357	2.06 2.06	102 102
bzg803	3/4	244.02	17.2	70.6	304	7139	0.353	117	28559	2.06	468
bzg2803	3/4 7/8	244.02 244.02	17.2 17.2	70.6 70.6	304 304	7139 7139	0.353 0.353	117 117	28559 28559	2.06 2.06	468 468
T : // : / :	Ground Parallel On										

3. Metrologic parameters – Double barriers

Model	ATEX Ex nA		Electric characteristics								
	Una (V)	Ina (mA)	Terminals	I(t) (µA)	U(e) (V)	Terminals	U(a) (V)	Ifm (mA)	LR (Ω)	Tol. +/- (%)	Pol.
bzg755AC	2	50	2/T 1/T 6/T	1 1 1	0.70 0.70 0.70	2/3 1/4 6/7	4.3 4.3 4.3	50 50 50	26.3 26.3 26.3	0.15 0.15 0.15	+
bzg756AC	2	50	2/T 1/T 6/T	1 1 1	0.70 0.70 0.70	2/3 1/4 6/7	4.3 4.3 4.3	50 50 50	26.3 26.3 26.3	0.15 0.15 0.15	+
bzg760AC	1	100	2/T 1/T	10 10	1.20 1.20	2/3 1/4	4.6 4.6	100 100	50.6 50.6	5 5	+
bzg761+	8	100	2/T 1/T	10 10	7.00 7.00	2/3 1/4	9.2 9.2	100 100	50.6 50.6	5 5	+
bzg764+	8	55	2/T 1/T	10 10	7.00 7.00	2/3 1/4	9.2 9.2	100 100	252.6 252.6	5 5	+
bzg764AC	10	27	2/T 1/T	10 10	10 10	2/3 1/4	11 11	100 100	1003.6 1003.6	5 5	AC
bzg766AC	10	70	2/T 1/T	10 10	10 10	2/3 1/4	11 11	100 100	153.6 153.6	5 5	AC
bzg767+	12	85	2/T 1/T	10 10	12.00 12.00	2/3 1/4	13.8 13.8	100 100	103.6 103.6	5 5	+
bzg787+	24	45	2/T 1/T	10 10	24.90 24.90	2/3 1/4	26.8 26.8	50 50	341.3 0.9V+11.3Ω	5 -	+
bzg787P+	24	50	2/T 1/T	10 10	24.90 24.90	2/3 1/4	26.8 26.8	50 50	252.6 0.9V+3.6Ω	5 -	+
bzg787LP+	24	50	2/T 1/T	10 10	24.90 24.90	2/3 1/4	26.8 26.8	50 50	252.6 2.9V+3.6Ω	5 -	+
bzg788+	24	50	2/T 1/T	10 10	24.90 8.00	2/3 1/4	26.8 9.8	50 50	311.3 62.3	5 5	+
bzg788L+	24	50	2/T 1/T	10 10	24.90 8.00	2/3 1/4	26.8 9.8	50 50	311.3 2V+62.34Ω	5 5	+
bzg789+	20	35	2/T 1/T 5/T 6/T	10 10 10 10	24.90 24.90 24.90 24.90	2/3 1/4 6/7 5/8	26.8 26.8 26.8 26.8	50 50 50 50	658.3 0.9V+11.3Ω 658.3 0.9V+11.3Ω	5 - 5 -	+
bzg796-	-22	40	2/T 1/T	10 10	-22.50 -16.80	2/3 1/4	-24.4 -18.8	50 50	311.3 401.3	5 5	-
bzg796+	22	40	2/T 1/T	10 10	22.50 16.80	2/3 1/4	24.4 18.8	50 50	311.3 401.3	5 5	+

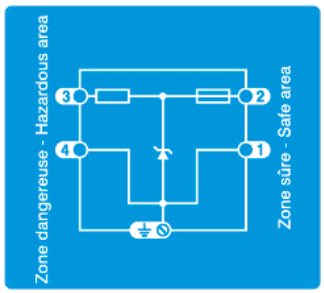
Una :	Maximum use voltage in Ex nA [ia] for a T4 class of temperature : -20°C / +60°C
Ina :	Maximum use current in Ex nA [ia] for a T4 class of temperature : -20°C / +60°C
U(e) :	Voltage for which a leakage current lower or equal to I(t) is assured
U(a) :	Maximum voltage input
LR :	Line resistance
Tol :	Tolerance of line resistance
Ifm :	Maximum current that can pass through the barrier (without destruction)
T :	Ground
/ :	On

4. Intrinsic safety parameters – Double barriers

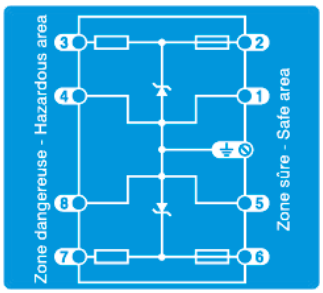
Model	Intrinsic safety parameters										
	Terminals	Ro (Ω)	Uo (V)	Io (mA)	Po (mW)	Lo IIC (µH)	Co IIC (µF)	L/R IIC (µH/Ω)	Lo IIB (µH)	Co IIB (µF)	L/R IIB (µH/Ω)
bzg755AC	3/T 4/T 7/T	14.7 9.8 9.8	3.15 3.15 3.15	214.29 321.43 321.43	168.75 253.13 253.13	774.32 344.14 344.14	100 100 100	210.7 140.47 140.47	3097.28 1376.57 1376.57	1000 1000 1000	842.80 140.47 140.47
bzg756AC	3/T 4/T 7/T	14.7 9.8 9.8	3.15 3.15 3.15	214.29 321.43 321.43	168.75 253.13 253.13	774.32 344.14 344.14	100 100 100	210.7 140.47 140.47	3097.28 1376.57 1376.57	1000 1000 1000	842.80 140.47 140.47
bzg760AC	3/T 4/T **3/4** 3/T//4/T	44.69 44.69 **89.38** 22.35	4.94 4.94 **5.64** 4.94	110.53 110.53 **63.10** 221.05	136.36 136.36 **88.89** 272.72	2910.56 2910.56 **8929.41** 727.64	100 100 **54** 100	260.74 260.74 **399.97** 130.37	11642.23 11642.23 **35717.62** 2910.56	1000 1000 **1000** 1000	1042.98 1042.98 **1599.89** 521.49
bzg761+	3/T 4/T **3/4** 3/T//4/T	44.67 44.67 **89.34** 22.34	9.56 9.56 **10.26** 9.56	214 214 **114.84** 428.00	511.19 511.19 **294.41** 1022.37	776.41 776.41 **2696.12** 194.10	3.6 3.6 **2.63** 3.6	69.55 69.55 **120.77** 34.78	3105.62 3105.62 **10784.48** 776.41	26 26 **18** 26	278.22 278.22 **483.07** 139.11
bzg764+	3/T 4/T **3/4** 3/T//4/T	236.69 236.69 **473.25** 118.33	9.56 9.56 **10.26** 9.56	40.39 40.39 **21.68** 80.79	96.49 96.49 **55.57** 192.98	21791.74 21791.74 **75673.19** 5447.94	3.6 3.6 **2.63** 3.6	368.49 368.49 **639.81** 184.25	87166.98 87166.98 **302692.76** 21791.74	26 26 **18** 26	1473.97 1473.97 **2559.23** 736.99
bzg764AC	3/T 4/T **3/4** 3/T//4/T	950 950 **1900** 475	11.2 11.2 **22.4** 11.2	11.79 11.79 **11.79** 23.58	33 33 **66** 66	255810 255810 **255810** 63952	1.84 1.84 **0.156** 0.156	1077 1077 **538** 528	1000000 1000000 **1000000** 255810	12.6 12.6 **1.09** 1.09	4308 4308 **2154** 2154
bzg766AC	3/T 4/T **3/4** 3/T//4/T	142.50 142.50 **285** 71.25	11.2 11.2 **22.4** 11.2	78.6 78.6 **78.6** 157.1	220 220 **440** 440	5755 5755 **5755** 1438	1.84 1.84 **0.156** 0.156	161 161 **80** 80	23022 23022 **23022** 5762	12.6 12.6 **1.09** 1.09	646 646 **323** 323
bzg767+	3/T 4/T **3/4** 3/T//4/T	95.03 95.03 **190.06** 47.52	14.39 14.39 **15.79** 14.39	151.42 151.42 **83.08** 302.84	544.55 544.55 **327.85** 1089.1	1550.73 1550.73 **5151.40** 387.68	0.67 0.67 **0.478** 0.67	65.29 65.29 **108.45** 32.65	6202.90 6202.90 **20605.61** 1550.73	4.18 4.18 **2.88** 4.18	261.17 261.17 **433.80** 130.59
bzg787+	3/T 4/T **3/4** 3//4/T	313.5 - **313.51** 313.5	27.30 0.00 **28** 27.30	87.08 0.00 **89.31** 87.08	594.33 0.00 **625.20** 594.33	4688.75 - **4457.24** 4688.75	0.088 - **0.083** 0.088	59.82 - **56.87** 59.82	18755.01 - **17828.98** 18755.01	0.683 - **0.65** 0.683	239.30 - **227.48** 239.30
bzg787P+	3/T 4/T **3/4** 3//4/T	236.55 - **236.55** 236.55	27.30 0.00 **28** 27.30	115.41 0.00 **118.37** 115.41	787.67 0.00 **828.58** 787.67	2669.49 - **2537.68** 2669.49	0.088 - **0.083** 0.088	45.14 - **42.91** 45.14	10677.95 - **10150.73** 10677.95	0.683 - **0.65** 0.683	180.56 - **171.65** 180.56
bzg787LP+	3/T 4/T **3/4** 3//4/T	236.55 - **236.55** 236.55	27.30 0.00 **28** 27.30	115.41 0.00 **118.37** 115.41	787.67 0.00 **828.58** 787.67	2669.49 - **2537.68** 2669.49	0.088 - **0.083** 0.088	45.14 - **42.91** 45.14	10677.95 - **10150.73** 10677.95	0.683 - **0.65** 0.683	180.56 - **171.65** 180.56
bzg788+	3/T 4/T **3/4** 3/T//4/T	285 48.48 **333.45** 41.41	27.30 9.56 **28** 10.15	95.79 197.21 **83.97** 245.11	653.76 471.09 **587.79** 621.96	3875 914.18 **5042.58** 591.82	0.088 3.6 **0.083** 2.75	54.39 75.47 **60.49** 57.17	15500.01 3656.74 **20170.32** 2367.29	0.683 26 **0.65** 18.70	217.54 301.90 **241.96** 228.67
bzg788L+	3/T 4/T **3/4** 3/T//4/T	285 48.48 **333.45** 41.41	27.30 9.56 **28** 10.15	95.79 197.21 **83.97** 245.11	653.76 471.09 **587.79** 621.96	3875 914.18 **5042.58** 591.82	0.088 3.6 **0.083** 2.75	54.39 75.47 **60.49** 57.17	15500.01 3656.74 **20170.32** 2367.29	0.683 26 **0.65** 18.70	217.54 301.90 **241.96** 228.67
bzg789+	3/T 7/T 4/T & 8/T 3//7/T **3/4 & 8/7** 3//7/4 & 3//7/8	589 589 - 294.5 **588.98** 294.49	27.30 27.30 0.00 27.30 **28** 28	46.35 46.35 0.00 92.70 **47.54** 95.08	316.34 316.34 0.00 632.67 **332.77** 665.53	16550.56 16550.56 - 4137.64 **15733.38** 3933.34	0.088 0.088 - 0.088 **0.083** 0.083	112.4 112.4 - 56.2 **106.85** 53.42	66202.25 66202.25 - 16550.56 **62933.51** 15733.38	0.683 0.683 - 0.683 **0.650** 0.650	449.59 449.59 - 224.80 **427.39** 213.70
bzg796-	3/T 4/T **3/4** 3/T//4/T	285 370.5 **655.5** 161.08	25.2 9.56 **25.9** 18.4	88.4 25.79 **39.5** 114	557 61.6 **255.8** 525	4547 53459 **22774** 2725	0.107 3.6 **0.1** 0.285	63 577 **138** 67	18190 213836 **91098** 10903	0.82 26 **0.77** 1.69	255 2308 **555** 270
bzg796+	3/T 4/T **3/4** 3/T//4/T	285 370.52 **655.53** 161.08	25.20 18.90 **25.90** 22.46	88.42 51.01 **39.51** 139.43	557.05 241.03 **255.84** 782.95	4547.75 13663.45 **22774.74** 1828.84	0.107 0.262 **0.1** 0.154	63.83 147.51 **138.98** 45.41	18190.98 54653.79 **91098.94** 7315.35	0.82 1.6 **0.77** 1.080	255.31 590.05 **555.91** 181.65
T : // : / :	Ground Parallel On										

5. Electrical circuit diagrams

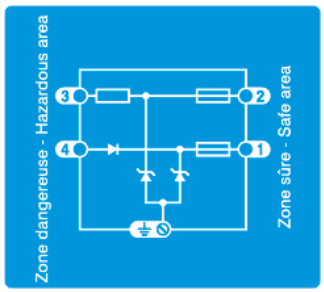
bzg 710+
bzg 715+
bzg 715P+
bzg 722+
bzg 728+
bzg 728L+
bzg 728P+
bzg 728LP+
bzg 729P+
bzg 729LP+
bzg 801
bzg 802
bzg 803



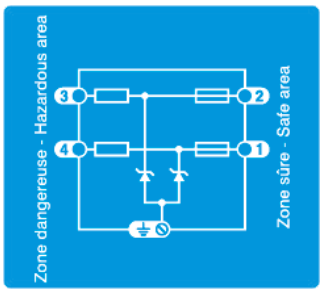
bzg 2710+
bzg 2715+
bzg 2715 P+
bzg 2722+
bzg 2728+
bzg 2728 L+
bzg 2728P+
bzg 2728LP+
bzg 2729P+
bzg 2729LP+
bzg 2801
bzg 2802
bzg 2803



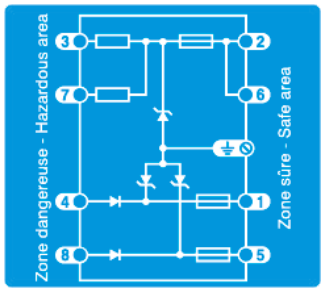
bzg 787+
bzg 787P+
bzg 787LP+



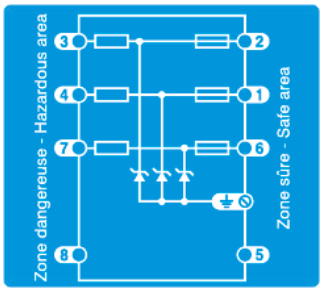
bzg 767+
bzg 788+
bzg 788L+
bzg 760AC
bzg 761+
bzg 764+
bzg 796+



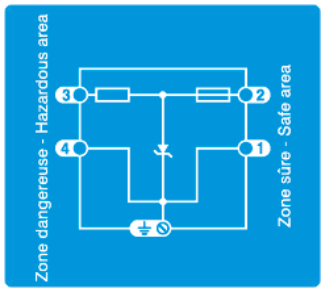
bzg 789+



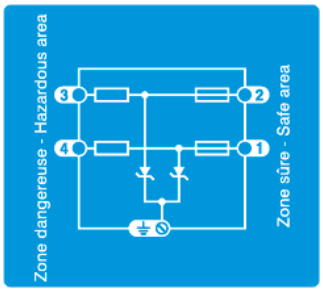
bzg 755AC
bzg 756AC



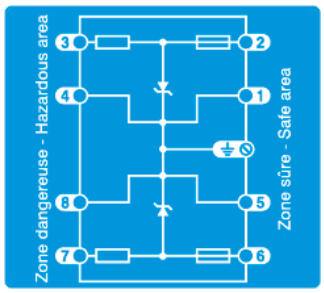
bzg 728-
bzg 728L-



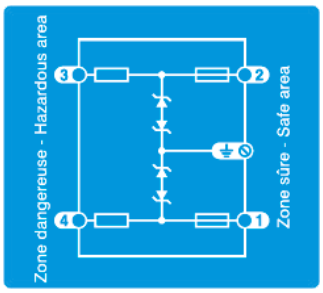
bzg 796-



bzg 2728-
bzg 2728L-



bzg 764AC
bzg 766AC



- 5. Using bzg

1. Function

The bzg Zener barriers are designed to limit energy which may appear in hazardous area.
They permit signal interfacing between the ATEX area and the safe area.

2. Use and marking

(in compliance with the ATEX directive 94/9/CE)
Location equipment: Surface industries.
Method of protection: Intrinsic Safety (I.S.): "Ex ia" / Ex nA [ia] safety.
Type of Equipment: associated equipment that must be installed in the safe area or in zone 2 in an IP54 housing (see chapter 5.9.).
Suitable to interface with category 1, 2 or 3 equipment installed in:

- Zone 0, 1 or 2 for gases of groups IIA, IIB or IIC (according to EN/IEC 60079-0)
- Zone 20, 21 or 22 for dust of groups IIA, IIB or IIC (according to EN/IEC 60079-0)

EC type examination certificate number: INERIS 11ATEX0024X.
IECEx conformity certificate: INE 11.0009X.
ATEX /IECEx classification:

- II (1) GD [Ex ia Ga] IIC or [Ex ia Ga] IIB or [Ex iaD Da] IIIC
- II 3 (1) G Ex nA [ia Ga] IIC T4 Gc
- II 3 (1) G Ex nA [ia Ga] IIB T4 Gc

3. Certifications

Used and installed respecting this user manual, this equipment complies with the following test standards:

- ATEX : EN 60079-0 / EN 60079-11 / EN 60079-15 / EN 61241-11 / EN 61241-0
- IECEx : IEC 60079-0 / IEC 60079-11 / IEC 60079-15 / IEC 61241-11 / IEC 61241-0
- CEM : EN 61326-1 & EN61000-6-2
- DBT : NFC 15-100
- SIL : EN 61508 (SIL 2 or SIL 3 depending on application)

4. Safety parameters

See chapter 4.2.

5. Electrical data

See chapter 4.1.

6. Mechanical data

Dimensions: see chapter 2.2
Weight: ≈ 200g
Housing material: Polycarbonate
Protection index: IP20

7. Installation

The equipment is designed for an association complying with intrinsic safety. The installation must comply with the EN/IEC 60079-14 standard in particular § 12.

8. Fixing and mounting

Mounting must be done when NOT-ENERGIZED.
The equipment is designed to be mounted on an Omega type DIN rail.
Mount the equipment by placing the DIN bracket of the upward part of the barrier onto the rail. Then lock it by pushing downward.
Place the screwdriver in hole **1** and pull down the DIN bracket with a lever effect to unlock the barrier from the rail.
The ground terminal must be connected to an equipotential ground network by a wire with 4 mm² minimum wire section.
It is possible to insulate the DIN bzg bracket from the rail with an insulation kit (consult us).
The horizontal or vertical position of the barrier does not matter.
The bzg has a removable label holder on the front panel. To open it insert a screwdriver in hole **2** located at the top of the front panel.

9. Location

- Safe area location:

The equipment must be installed in a non explosive atmosphere, in a clean environment, protected from condensation and corrosive or conductive dusts.
The ambient temperature must be between -20°C and +60°C.
However, note that the life of electronic equipment reduces as the operating temperature increases (approximately one half per 10°C).
All precautions must be taken to avoid the proximity of systems likely to generate electromagnetic radiation higher than 10V/m or able to heat the equipment by radiation.

- Zone 2 location:

The ambient temperature must be between -20°C and +60°C.
In compliance with the EN/IEC 60079-15 and EN/IEC60079-0 standards the equipment must be placed in an IP 54 minimum housing.
In compliance with the EN/IEC 60079-14 standard the installation must be made by qualified staff.
To respect the temperature classification, the number of barriers mounted in the housing must comply with the maximum power the housing can dissipate.
A system of flanges must be installed close to the barrier to avoid tearing out the connectors (flange permitting cable retention for a force of at least 15N).

10. Electrical wiring

Electrical wiring must only be executed when NOT-ENERGIZED with wires of 2.5 mm² maximum.
For connection refer to the typical diagrams (see chapter 4.3).
The ground must be connected by a 4mm² minimum conductor.
The coupling torque of the connection terminal screws must be between 0.4Nm and 0.5Nm.

11. Special conditions for safe use

The intrinsic safety terminals must only be connected to intrinsic safety equipment or complying with §5.7 of standard EN/IEC 60079-11.
Moreover, the association of equipment and the connection cable must be compatible from the intrinsic safety viewpoint.
The maximum rms value of the fault voltage that could be accidentally allowed to appear continuously on the bzg barrier input terminals is 250V.

12. Additional conditions for use in a system with Safety Instrumented Functions (SIL)

- The user must determine the SIL level according to the type of Safety Instrumented System of the bzg (continuous mode stress or on stress). Refer to the declaration dcsil-bzg-fren.
- According to the EN 61508 standard, the bzg must be periodically tested and must be subject to a maintenance policy.
- In the stress mode use, the SIL level can only be maintained in a TL test period and for a mean time to repair (MTTR).
- The electrical signal passing through the bzg must be monitored to detect any failure of the safety system.

13. Cable path

The nature and routing of cables running in a hazardous area (intrinsic safety cables) must comply with the requirements of §6.1, 6.2.1 and 6.3 of standard EN/IEC 60079-11.
All precautions must be taken to avoid electromagnetic couplings with other cables that could generate hazardous voltage or currents.
Intrinsic safety cables must be flanged so as to avoid accidental contact with other cables in the event of tearing out of the terminal.

14. Maintenance

Precautions to be observed during maintenance:
- Dismantling must be done when NOT-ENERGIZED.

If a fault is suspected or observed, the equipment must be returned to our services or mandatory, who are only authorised to undertake evaluation.
Some models are equipped with one or two red LED on the front permitting display of the presence of a current in the loop (e.g.: the bzg787LP+).

Safety for Industrial Processes

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Subject to modifications due to technical advances