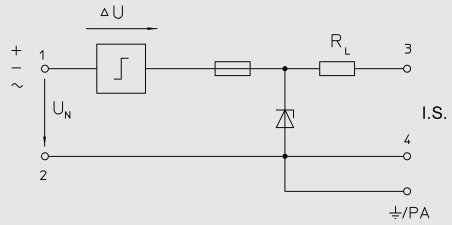
Selection Criteria

Selection of safety barriers is generally carried out in two steps:
- Functional consideration
- Safety consideration

1. Functional consideration

Safety barriers are first selected according to their electrical requirements.
It is therefore necessary to know the electrical data of the connected apparatus.

Further selection criteria:
- Polarity of the voltage at the safety barrier U_N (+, -, ~) in reference to ⏚/PA
- Voltage U_N
- Max. permissible voltage drop across the barrier, caused by the line resistance R_L and / or a constant voltage drop ΔU
- Type of signal to be transmitted;
  voltage signals can only be transmitted via barriers with purely resistive line resistance;
  this limitation does not apply to current signals.



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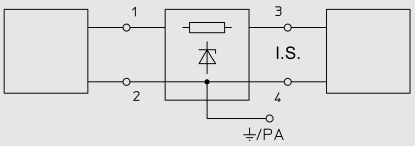
It is furthermore to be examined, if the circuit may be grounded or if an earth-free („floating“) circuit is required due to electrical or measurement reasons.
An earth-free („floating“) circuit can usually be established by using a dual-channel safety barrier or interconnecting two single-channel safety barriers.



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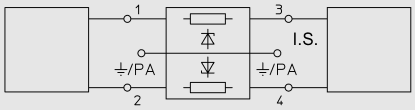
Grounded circuit



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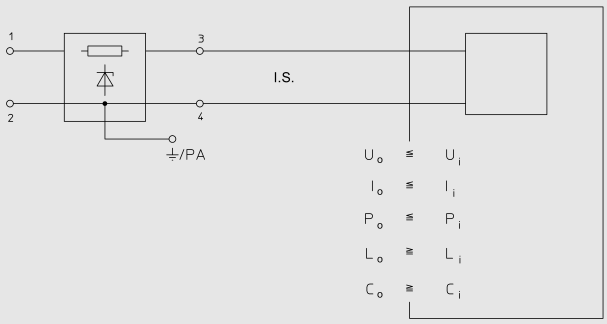
Floating circuit

For many standard application in instrumentation special safety barriers are available, which are designed optimally for the respective application according to the criteria mentioned above.

2. Safety consideration

The safe maximum values of an individual safety barrier (single- or dual-channel) are determined by the certification:
- Maximum voltage U_o
- Maximum current I_o
- Maximum power P_o
- Maximum permissible capacity C_o
- Maximum permissible inductance L_o

It is to be tested however, if the permissible safe maximum values of the intrinsically safe apparatus (field apparatus in the hazardous area) are maintained by the selected safety barrier.



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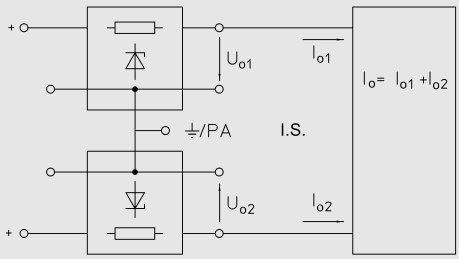
Interconnection of Safety Barriers

If several safety barriers are interconnected, possible current and / or voltage addition is to be taken into consideration from the safety point of view (example 1 and 2).
The maximum values for U_o and I_o permissible for an interconnection as well as the resulting permissible maximum values for C_o and L_o for the various explosion groups can be referred to in the ignition curves (see EN 50020).

Example 1 Interconnection of two safety barriers for positive potential.
From a safety point of view a current addition results, i.e. $I_o = I_{o1} + I_{o2}$
The new voltage U_o is assumed to be the higher of the two values U_{o1} and U_{o2}, thus U_o = max. (U_{o1}, U_{o2})



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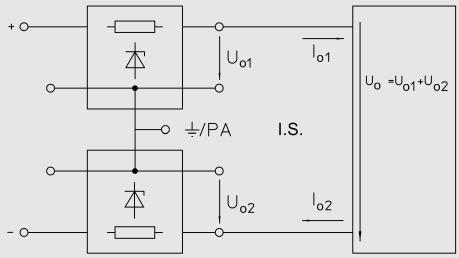
Example 2 Interconnection of two safety barriers for positive and negative potential.
From a safety point of view a voltage addition results, i.e. $U_o = U_{o1} + U_{o2}$
The new current I_o is assumed to be the higher of the two values I_{o1} and I_{o2}, thus I_o = max. (I_{o1}, I_{o2})



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Addition possibilities

I = current addition
U = voltage addition

Example: When interconnecting two safety barriers for alternating potential I + U results, thus a current addition as well as a voltage addition is to be taken into consideration.

Polarity	-	+	~
-	I	U	I and U
+	U	I	I and U
~	I and U	I and U	I and U

The EN 50020, table A.1 contains the permissible value pairs / combinations of permissible maximum safe values for:

- Voltage U_o
- Current I_o
- External capacitance C_o

The following procedure is to be applied:

1. Test, if the value combination U_o and I_o determined is permitted

   Example 1:
   Values 28 V / 100 mA are permitted, since the current I_o can be up to 120 mA at 28 V for explosion group IIC

   Example 2:
   Values 24 V / 210 mA are permitted only for IIB

2. Determination of capacitance C_o from voltage U_o

   Example:
   U_o = 27 V. For IIB the result is C_o = 705 nF

It is not allowed to apply the ignition diagrams acc. to EN 50020 for the assersment of the intrinsic safety in case that safety barriers with electronic current limitations need to be interconnected.
A suitable procedure is described in the PTB report PTB-ThEx-10 which is part of IEC 60079-25.