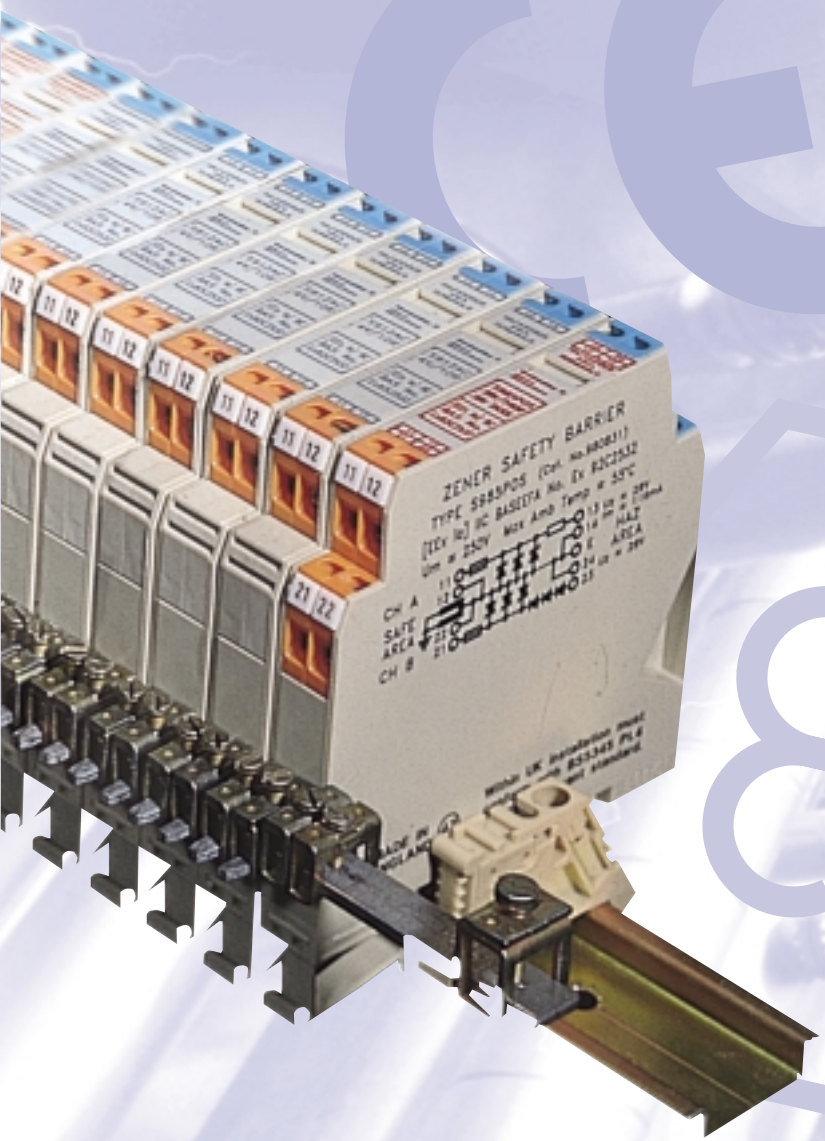
RTK

Zener Barrier Applications



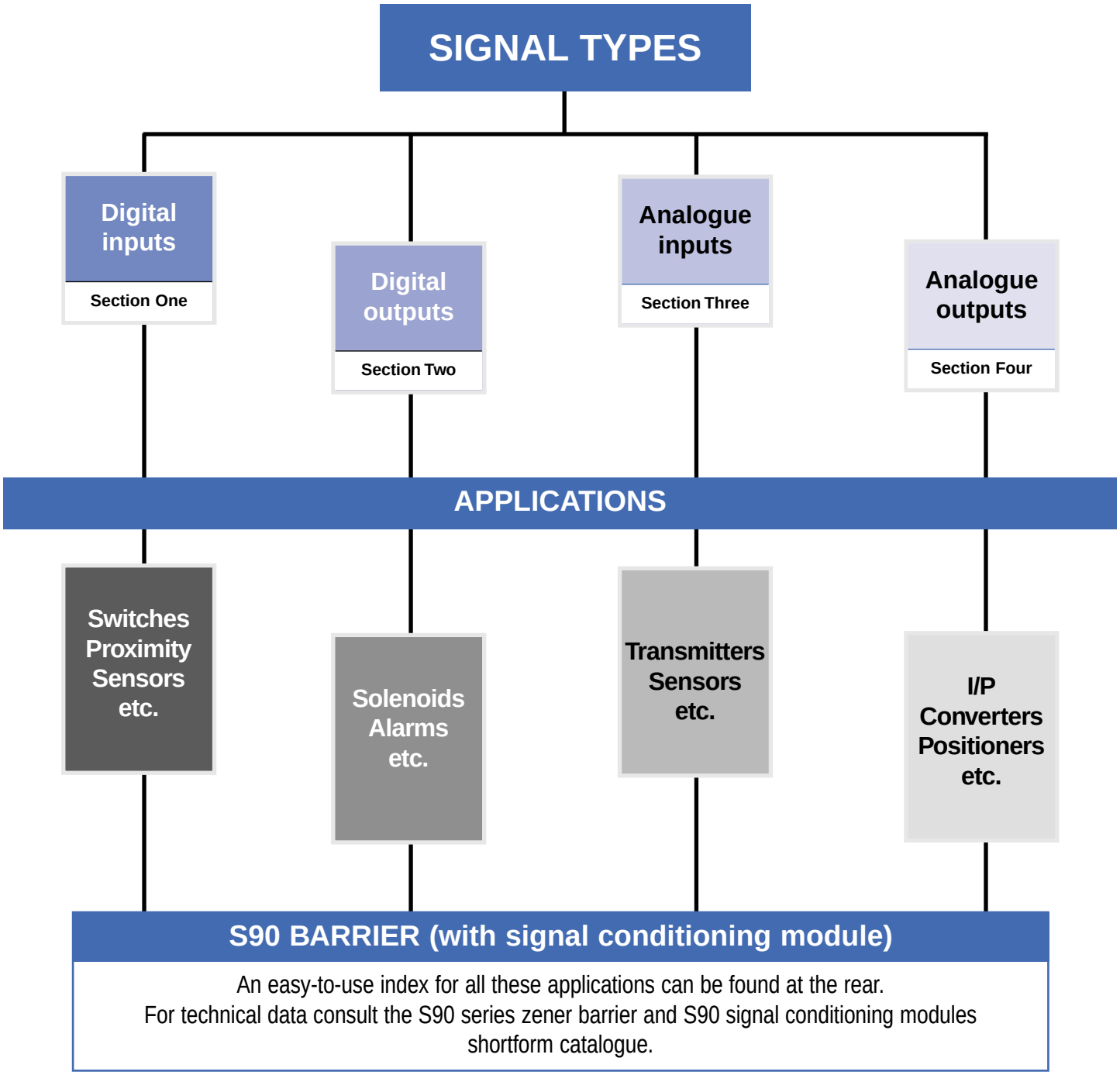
DI Digital Inputs

DO Digital Outputs

AI Analogue Inputs

AO Analogue Ouputs

USER SELECTION GUIDE



An easy-to-use index for all these applications can be found at the rear.
For technical data consult the S90 series zener barrier and S90 signal conditioning modules shortform catalogue.

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Zener Barrier Applications

Section One - Digital Inputs

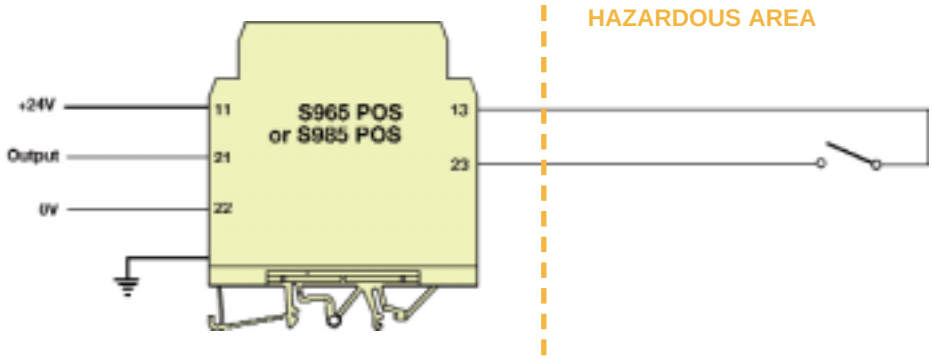

Fig. 1.1.1

The traditional 'failsafe' switch transfer loop includes a diode return channel to return a voltage signal from contacts in the field. Where high power safe area loads such as 12V relays are to be operated the more powerful S985 may be needed, but note that the fuse in S985 can fail with field earth faults.

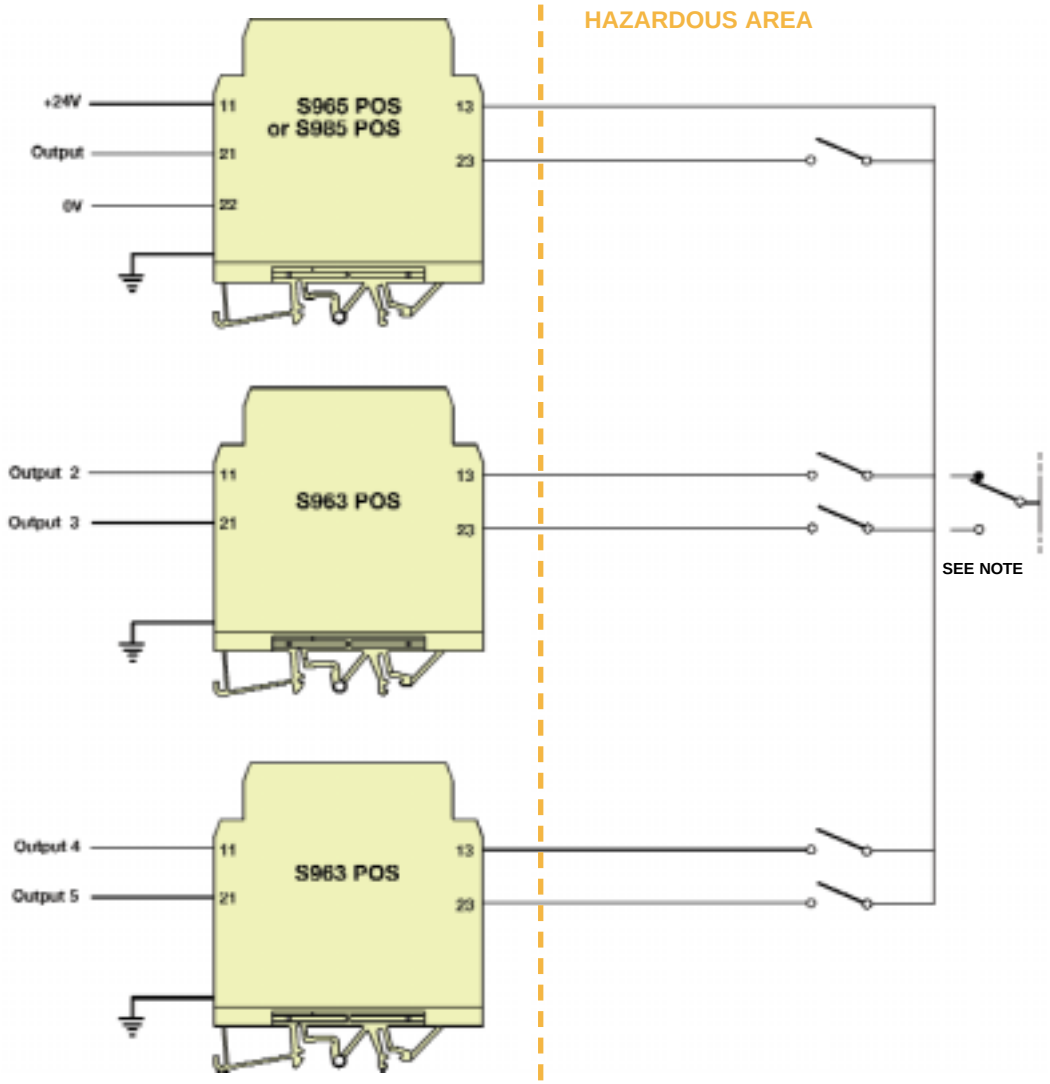

Fig. 1.1.2

Further diode return channels may be added for voltage output signals as shown in this example. These arrangements can be particularly useful in plant extensions to increase the capacity of three switches originally on three cable pairs to five, without increasing either the number of barriers or the cabling. The practical limit to the number of additional switch returns possible with one supply barrier channel will depend on the number of switches which might be closed at the same time, the current taken from each safe area output, and the voltdrop which can be tolerated.
Note, any two switches may be replaced by one changeover contact set as shown.

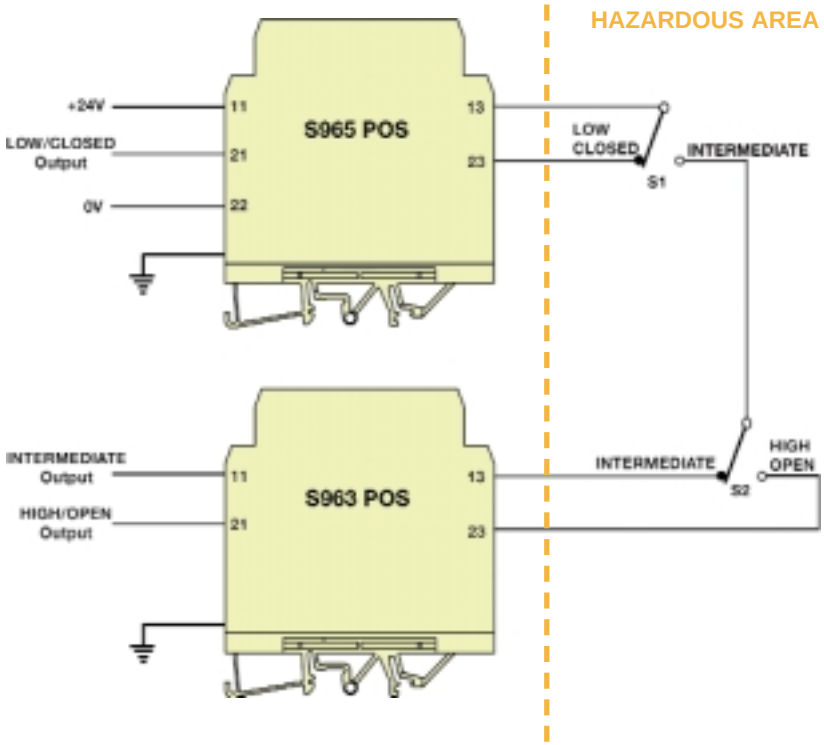

Fig. 1.1.3

S1 and S2 are changeover (2-way) switches which operate at extremes of travel of a tank level (LOW/HIGH) or a valve, damper, shutter (CLOSED/OPEN) etc. The correct interconnection of the two contact sets will allow signalling when the position is INTERMEDIATE as well as when it is fully closed or fully open.

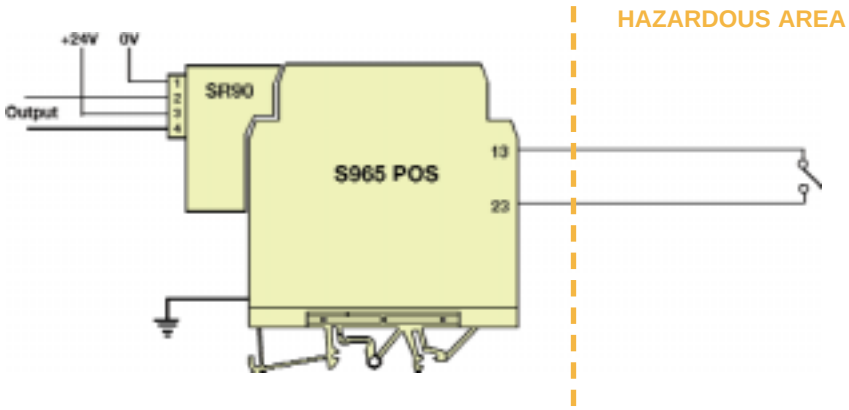

Fig. 1.1.4

The addition of the SR90 relay repeater module provides repeating volt-free contacts, which mimic the action of the contacts in the field. Traditional failsafe operation, when used with a normally closed switch.

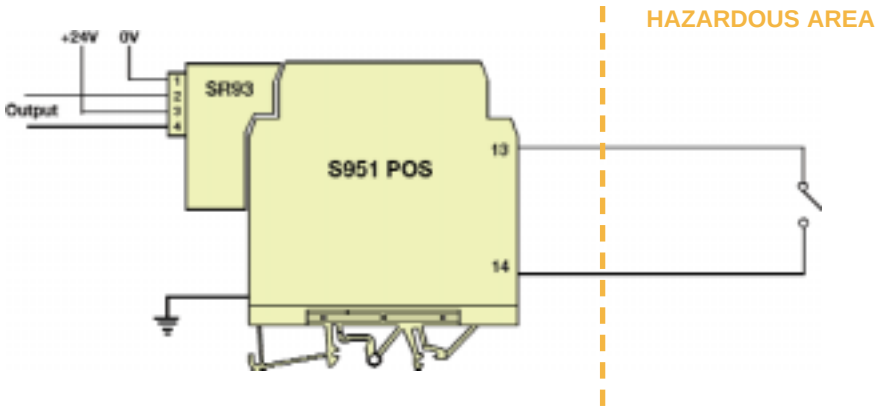

Fig. 1.1.5

The SR93 may be used with a single-channel barrier as an economy switch repeater with relay output. Not failsafe.

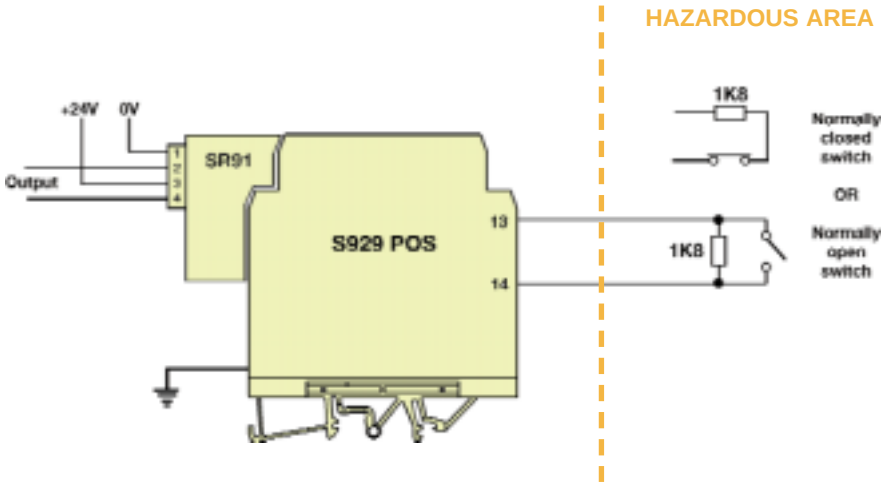

Fig. 1.1.6

The SR91 version features a relay output in which the volt-free contact pair is closed while the field contact is either open or closed, to choice. End-of-line monitoring is incorporated. Failsafe operation.

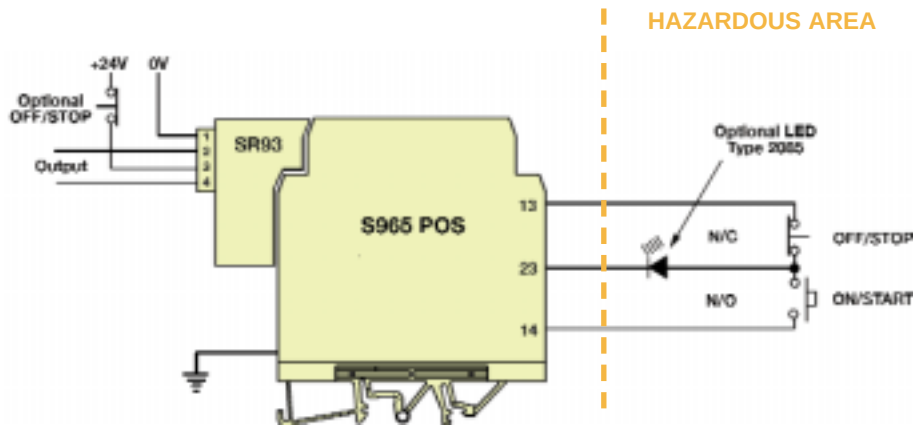

Fig. 1.1.7

The SR93 latching relay module may be used for latching applications such as automatic pump control between two level switches or start/stop control of cranes and other motors from pushbutton stations. Latch or release of the voltfree relay output contact pair is achieved by fleeting or momentary operation of the N/O or N/C field contacts.

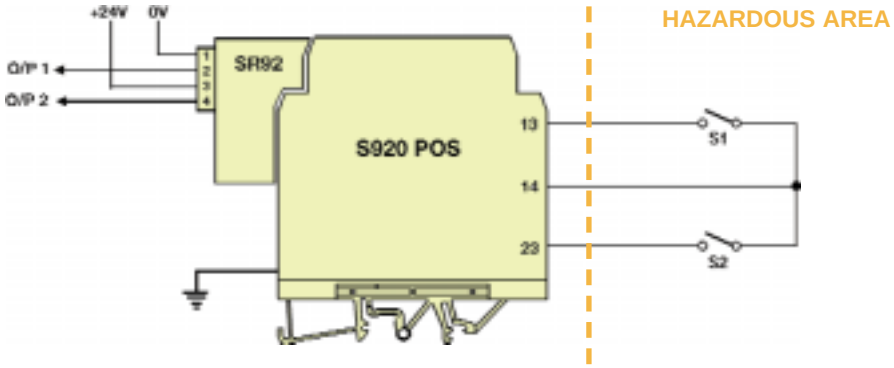

Fig. 1.1.8

The double-channel electronic output module SR92 handles two field switches and delivers two independent outputs, which can sink or source their safe area loads. If the two switches are presented to the barrier as two pairs, then terminal 24 duplicates terminal 14 and is used for the second channel.

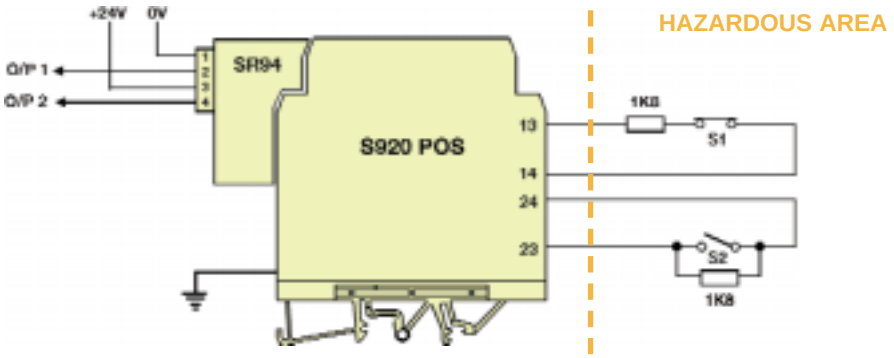

Fig. 1.1.9

The SR94 module is similar to the SR92, but includes line fault monitoring. For a normally closed switch (eg. as S1) the EOL resistor is in series with the switch, while a normally-open switch (e.g. as S2) has the resistor connected across its contacts.

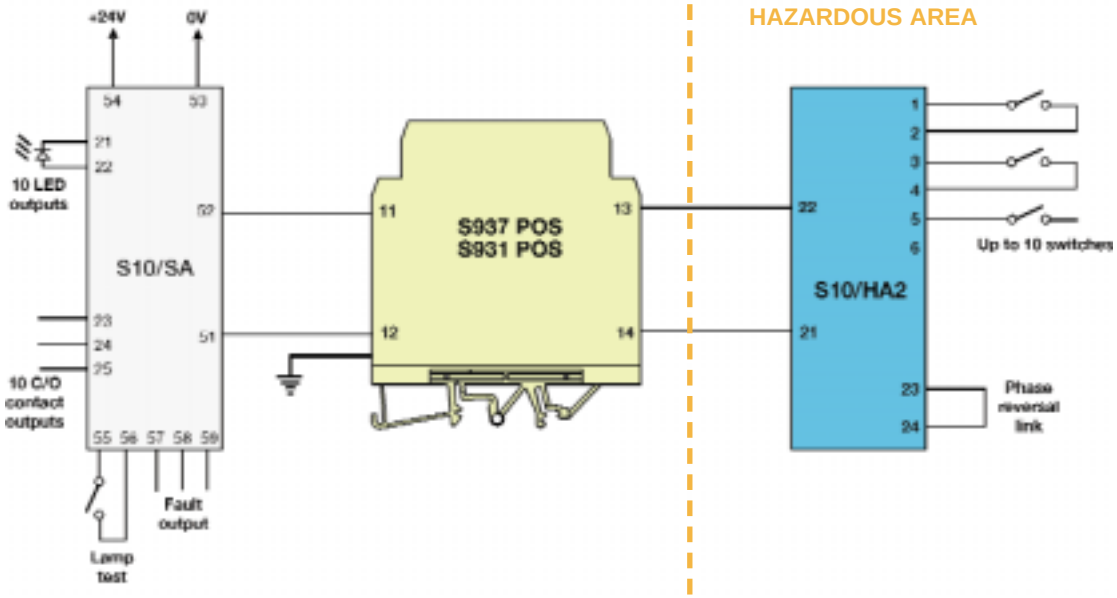

Fig. 1.1.10

The S10 multiplexer system carries up to ten switch signals on only one cable pair. Some of the facilities are indicated above, but please refer to catalogue information for fuller details. The long established S10 has been updated to include phase reversal to accommodate either 'normally-open' or 'normally-closed' switches.

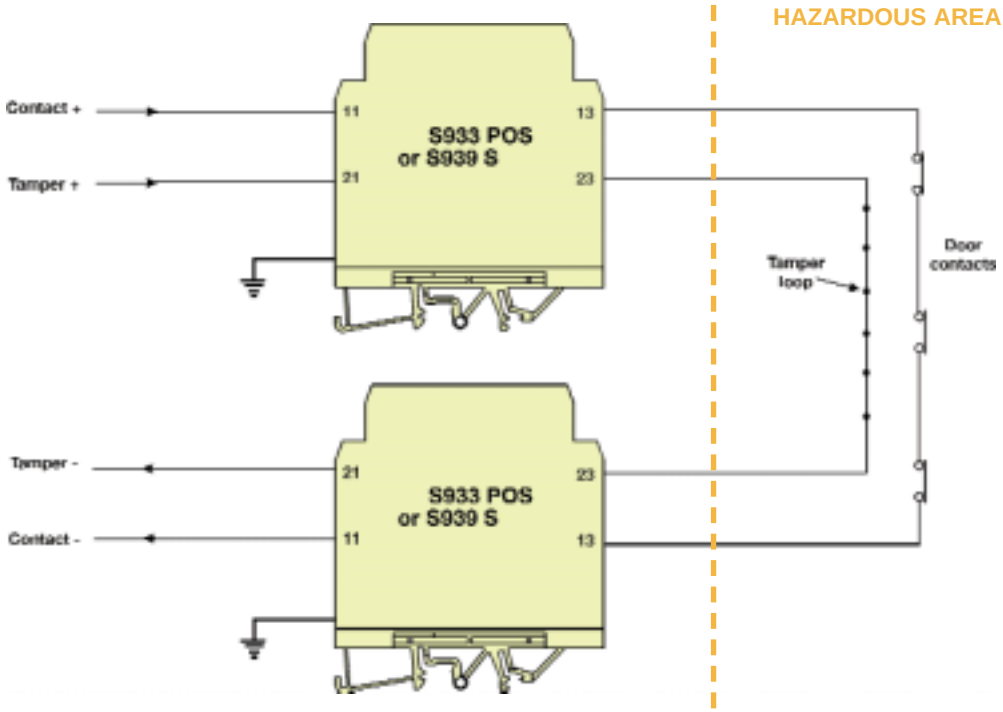

Fig. 1.2.1

For security systems at 12-14 volts the S933POS is the best choice where the supply may be negative-earthed. For an earth-free supply then the S939S would be used, in either case two double-channel units are needed.

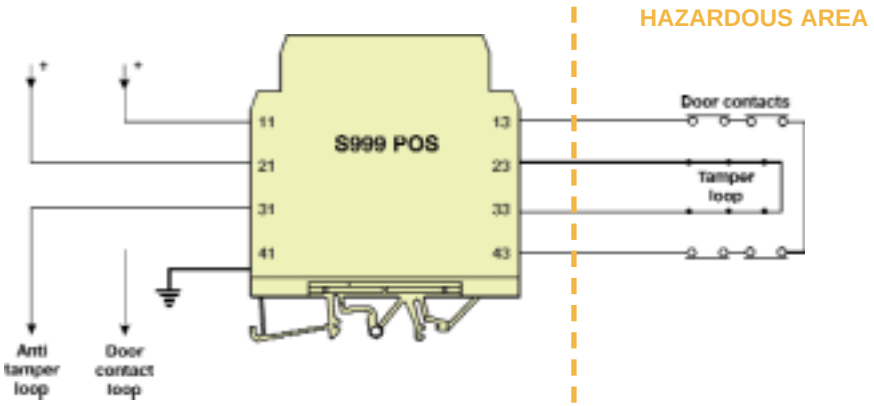

Fig. 1.2.2

Security systems operating at up to 11 volts negative-earthed supply can conveniently take advantage of the 4-channel S999POS barrier.

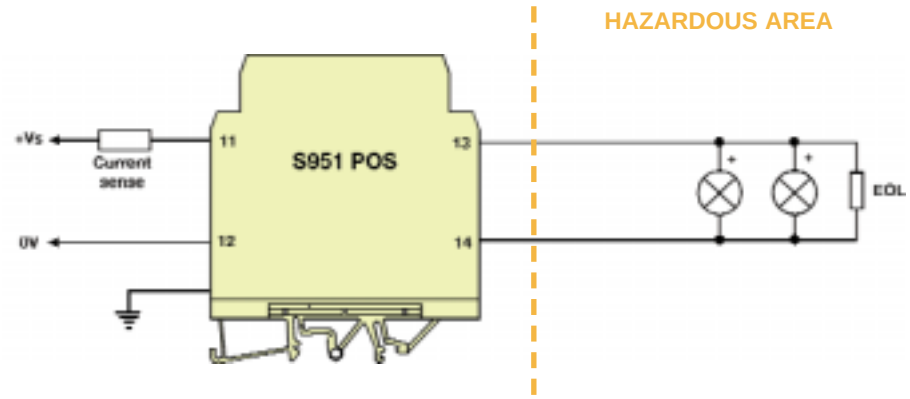

Fig. 1.2.3

Intrinsically safe fire or smoke detectors commonly use a single-channel S951POS barrier as shown above. Alternatively, when used on fire panels with earth monitoring or when the detector current is monitored in the return line, a double channel barrier such as the S965POS or S954S is needed.

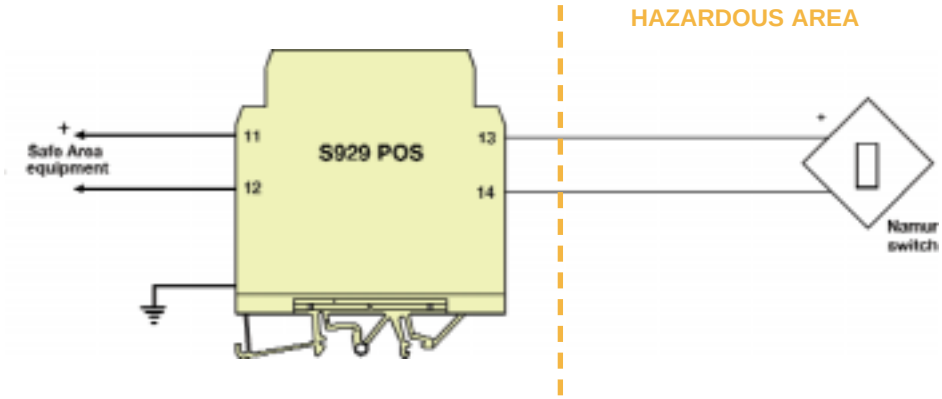

Fig. 1.3.1

When connecting proximity switches through to safe area equipment which is able to power and interrogate the switch, then either the single-channel S929POS is used (where earth one side is tolerated), or the double-channel S920POS for an earth-free pair.

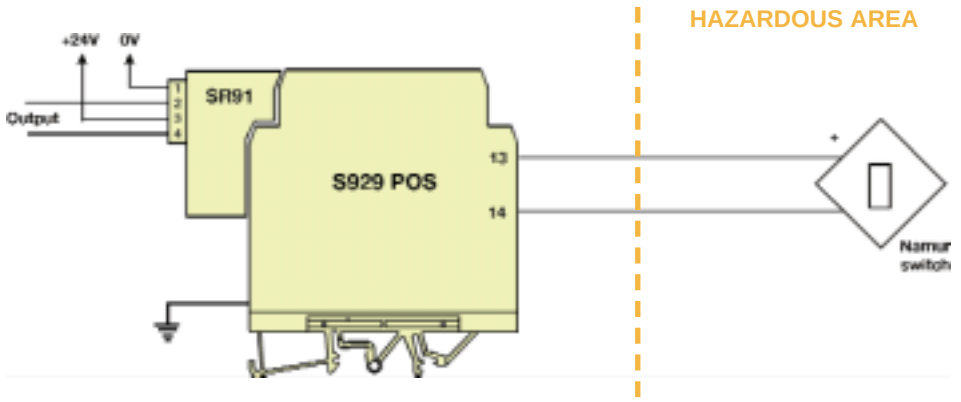

Fig. 1.3.2

The SR91 module delivers a volt-free relay contact output in response to the hazardous area proximity switch. Line monitoring is included.

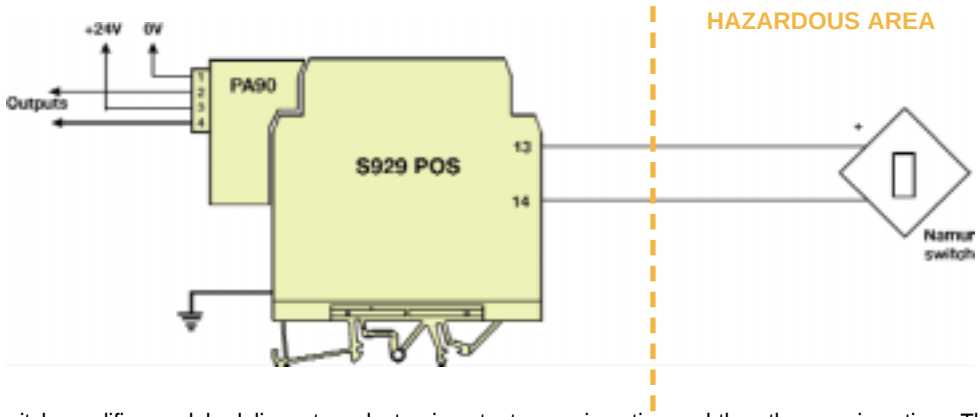

Fig. 1.3.3

The PA90 proximity switch amplifier module delivers two electronic outputs, one inverting and the other non-inverting. The output mode is selected according to the application, both outputs being able to either sink or source the safe area load.

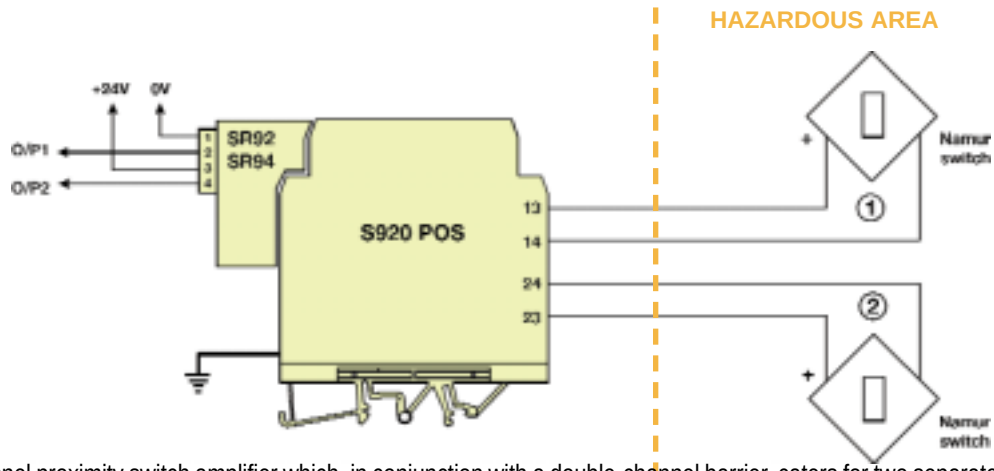

Fig. 1.3.4

The SR92 is a 2-channel proximity switch amplifier which, in conjunction with a double-channel barrier, caters for two separate switch channels and delivers an electronic output for each channel which can sink or source the safe area load. The SR94 is similar, but also includes line fault monitoring.

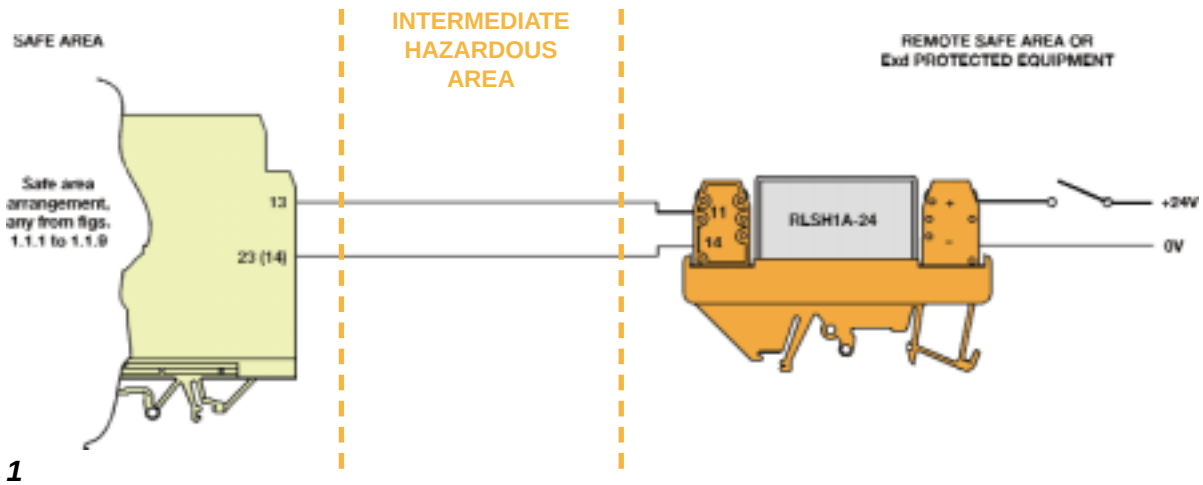

Fig. 1.4.1

Switch signals between two safe areas, passing through a hazardous area, can often be done using a single-channel barrier at one end and a diode return channel at the other. However, differences in earth potential between the two ends can be a problem and this use of a relay interface avoids any difficulties and is to be preferred.

Zener Barrier Applications

Section Two - Digital Outputs

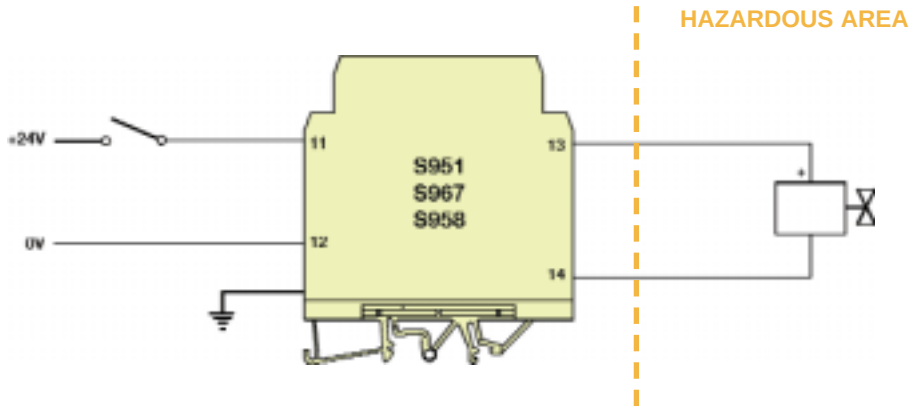

Fig. 2.1.1

Solenoids or solenoid valves are commonly controlled by a switched 24V supply, in which case the correct selection of a single-channel barrier will depend on the parameters of the solenoid in use. The S958 is suitable only for Group IIB solenoids. For economy of space and cost, double-channel barriers such as S953 or S983 may be used to provide two separate circuits.

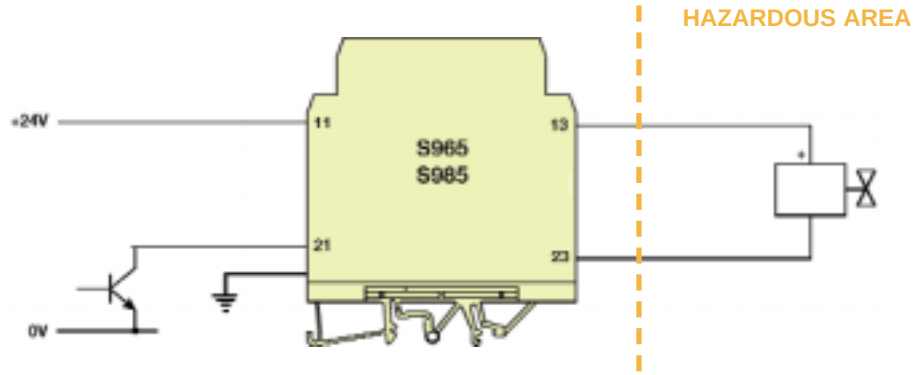

Fig. 2.1.2

Where the solenoid is controlled by an open collector output or a switch to ground, then a double-channel barrier must be used.

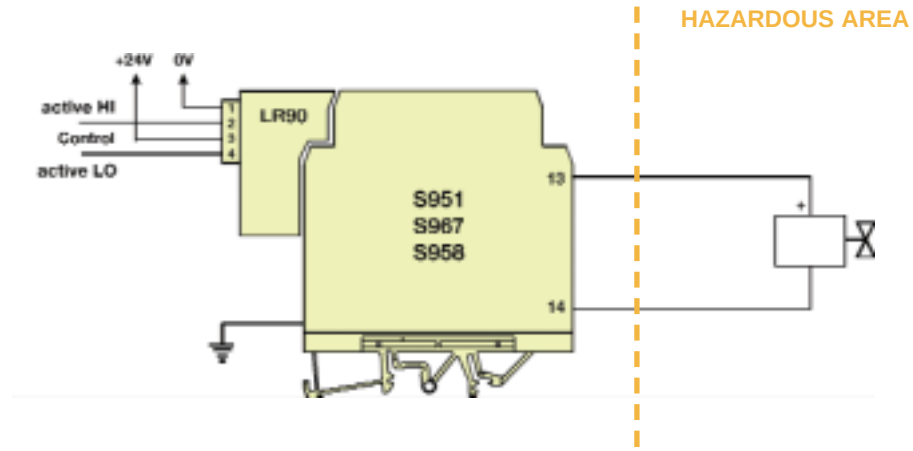

Fig. 2.1.3

Otherwise the LR90 control module may be used on a single-channel barrier. Terminals 2 and 4 are alternative low-level control inputs providing for on/off control from either active-HI(>4.5V) or active-LO sources. The S958 is suitable only for Group IIB solenoids.

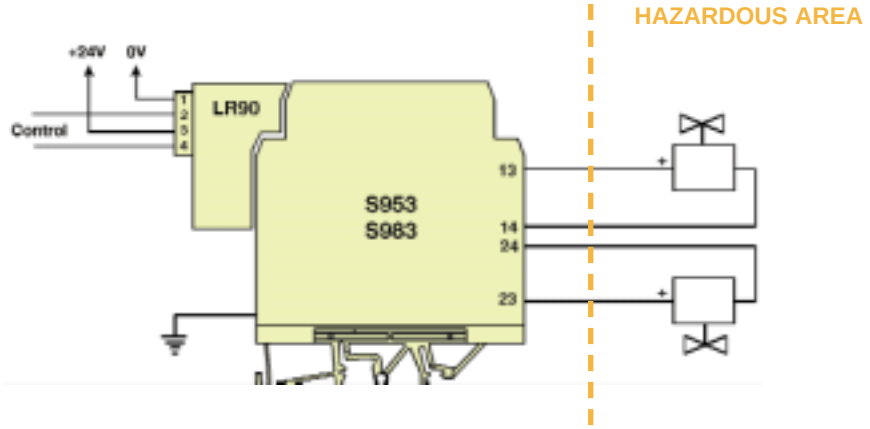

Fig. 2.1.4

On double channel barriers, the LR90 can provide for the alternate control of two solenoids. In gas groups IIA and IIB, the returns to terminals 14 and 24 may be combined into one wire to 14.

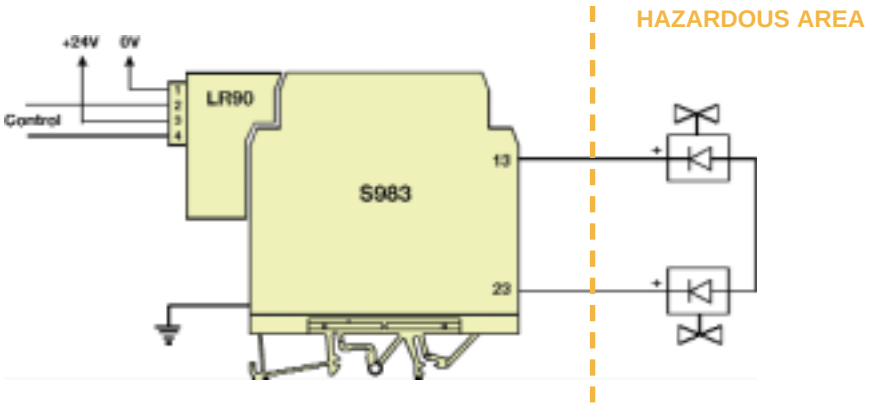

Fig. 2.1.5

Because I.S. solenoids normally contain back-emf protection diodes, this simplification of Fig. 2.1.4 allows the alternate operation of two low-power solenoids on only one cable pair. Suitable for Groups IIA and IIB only.

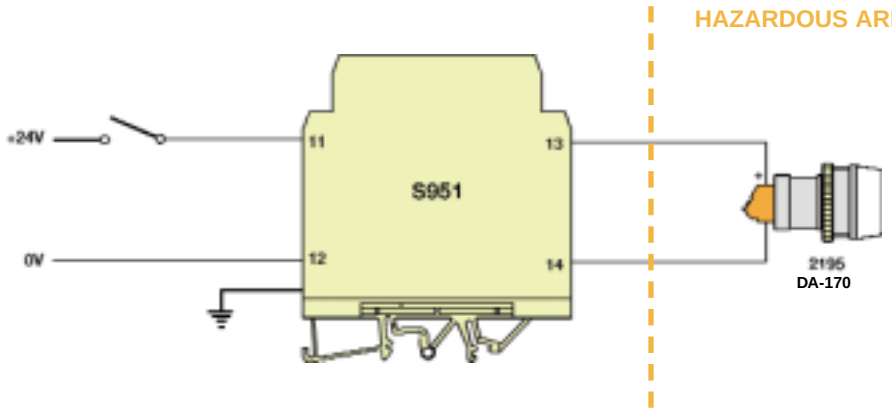

Fig. 2.2.1

LED cluster indicators use a single-channel barrier when the control is in the 24V supply line. Two separate lamp circuits may be energised using the S953 double-channel barrier.

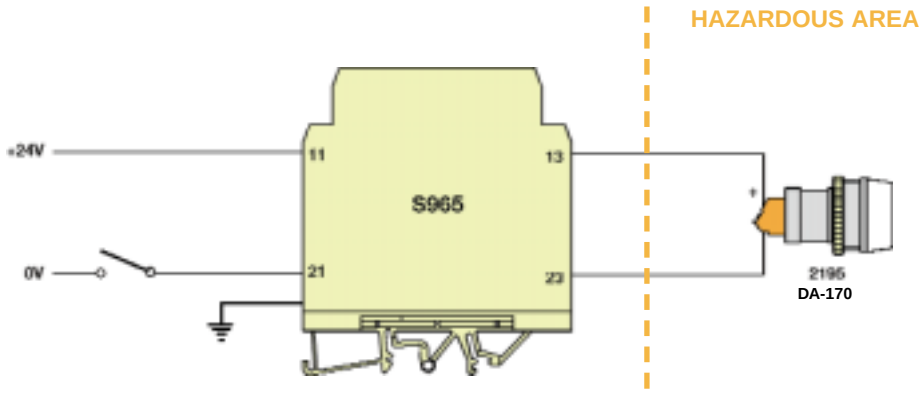

Fig. 2.2.2

Clusters controlled on the return line need a double channel barrier incorporating a diode return channel.

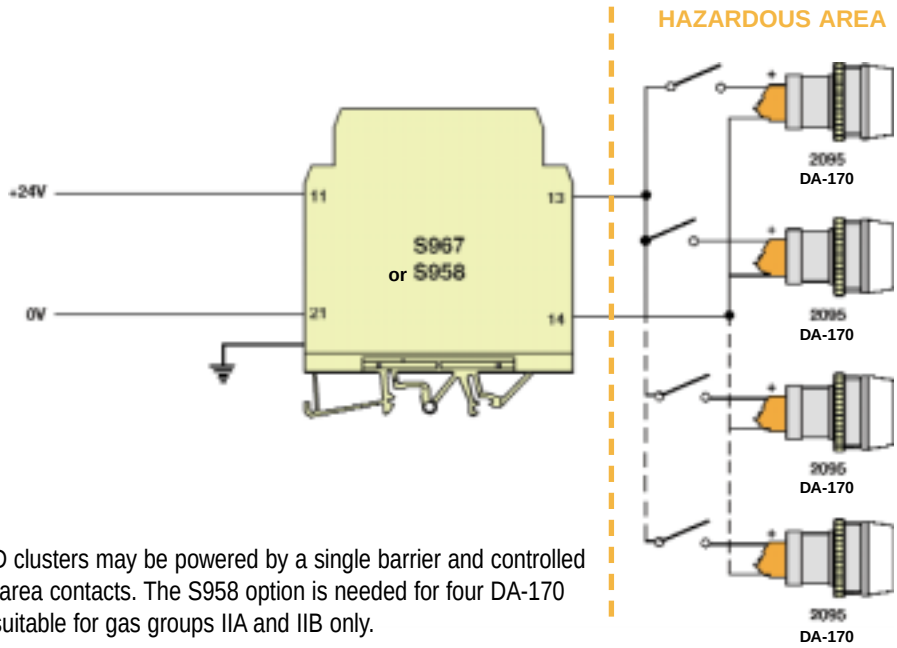

Fig. 2.2.3

Up to four LED clusters may be powered by a single barrier and controlled by hazardous area contacts. The S958 option is needed for four DA-170 lamps, but is suitable for gas groups IIA and IIB only.

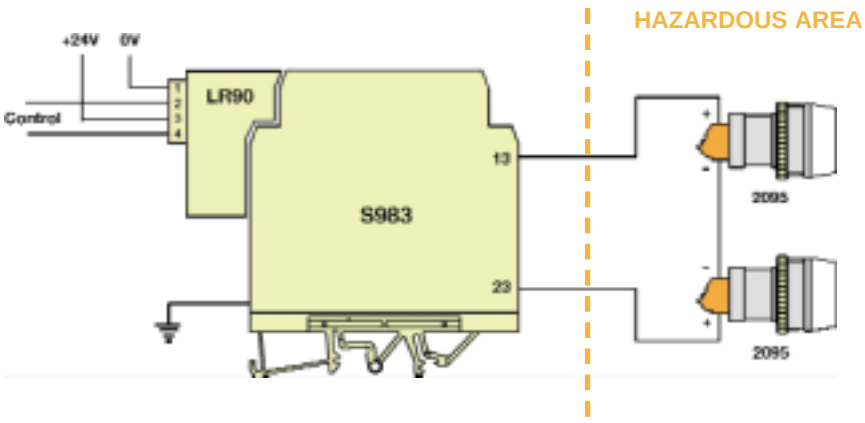

Fig. 2.2.4

Two LED clusters, for example red and green, may be alternately controlled on a single cable pair by means of polarity reversal provided by the LR90 control module.

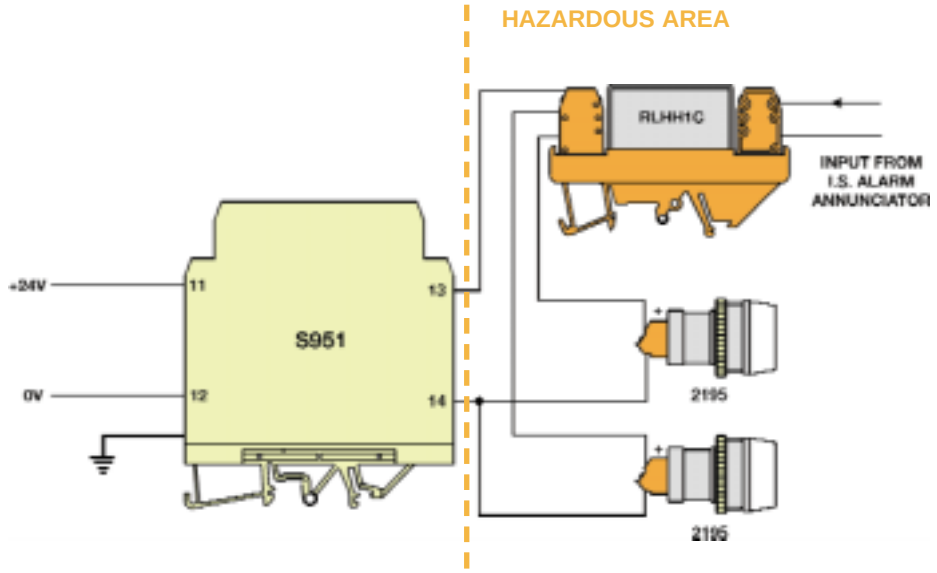

Fig. 2.2.5

Two LED clusters are shown giving normal and alarm indications slaved from a remote alarm annunciator using an IS relay. 'Normal' and 'alarm' lamps are controlled by the relay changeover contacts.

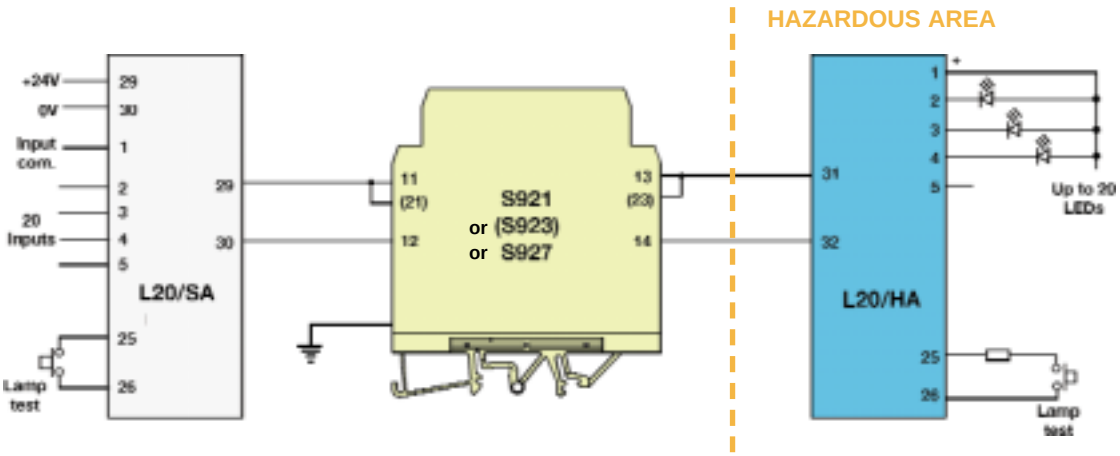

Fig. 2.2.6

The L20 system illuminates up to 20 LEDs on hazardous area mimic panels or alarm annunciators over only one cable pair.

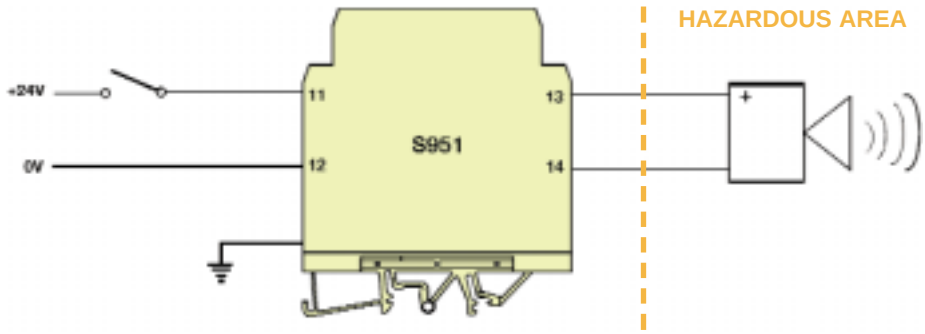

Fig. 2.3.1

Sounders are usually controlled in the 24V supply line using a single channel barrier. Where control is by means of an open-collector or switch in the return line, then the arrangement would be as Fig. 2.2.2 for the LED indicators. More than one alarm sounder may be connected across a single line pair. Two separate sounder circuits can be operated using a double-channel S953 barrier.

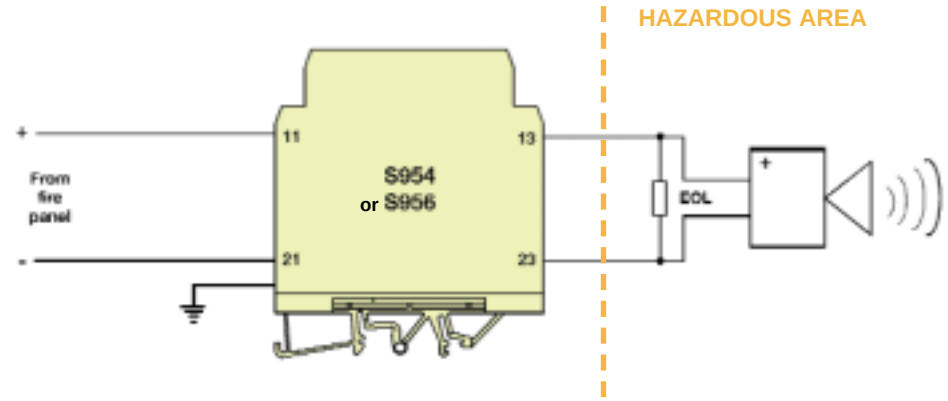

Fig. 2.3.2

Fire alarm systems need to constantly monitor the integrity of the field lines to the sounder. This is done by the application of a small voltage in reverse polarity to that shown, and monitoring the current taken by the end-of-line (EOL) resistor.

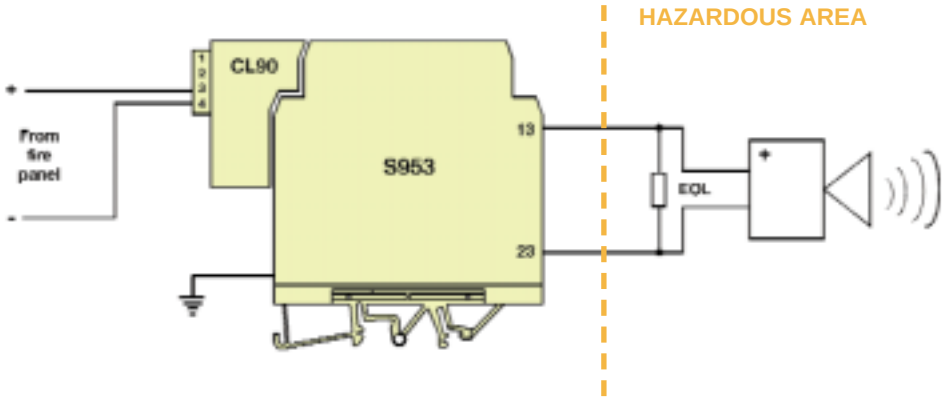

Fig. 2.3.3

Standby batteries on fire alarm systems are often charged to values well in excess of 24V, which can rupture barrier fuses. On panels with a grounded supply, the CL90 current limiter is used to protect the barrier. If the panel includes earth fault monitoring with a floating supply, then the CL90 is not suitable.

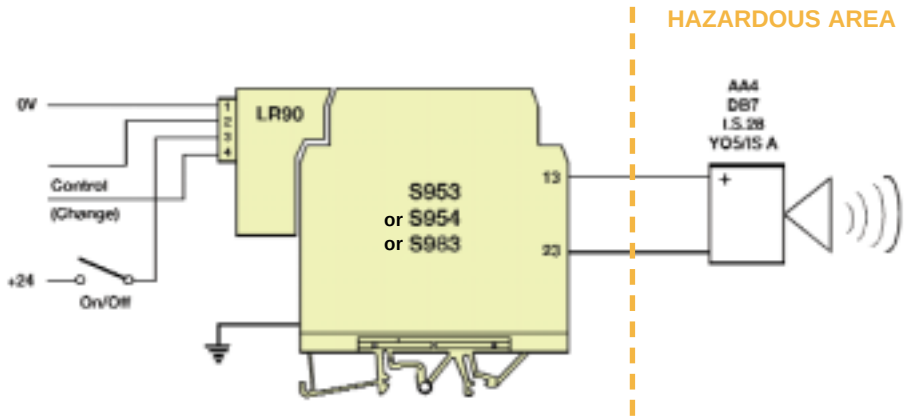

Fig. 2.3.4

Most audible alarm units include a choice of programmable sounds and afford the user the ability to change the sound between any two preselected tones to suit the environment. One method of changing tone, illustrated here, is by transposing the polarity of the field pair by the use of the appropriate control terminal on the LR90 module.

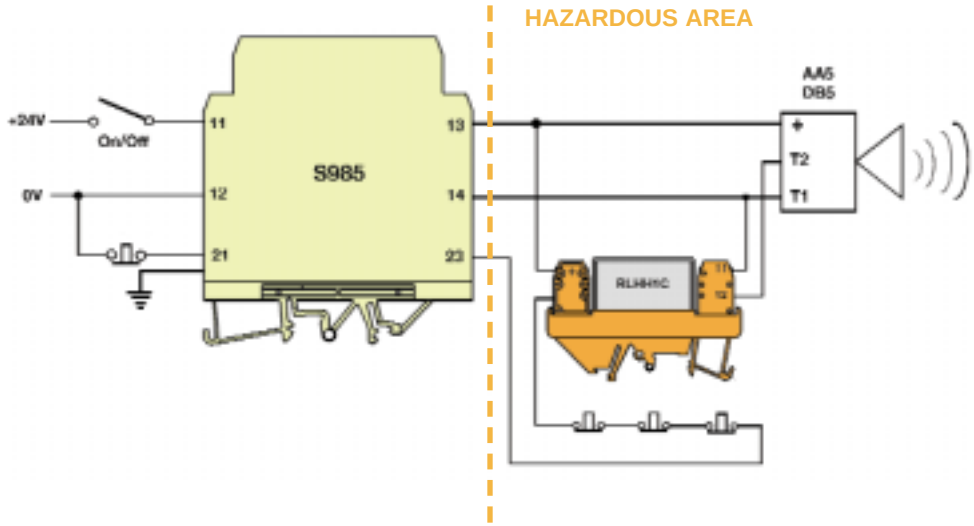

Fig. 2.3.5

Another method of changing the tone ("second stage") of the sounder is by a third wire, in this case taken to ground by the use of an I.S. relay in the field. Any one of the normally closed panic buttons may be operated to bring on the second-stage alarm.

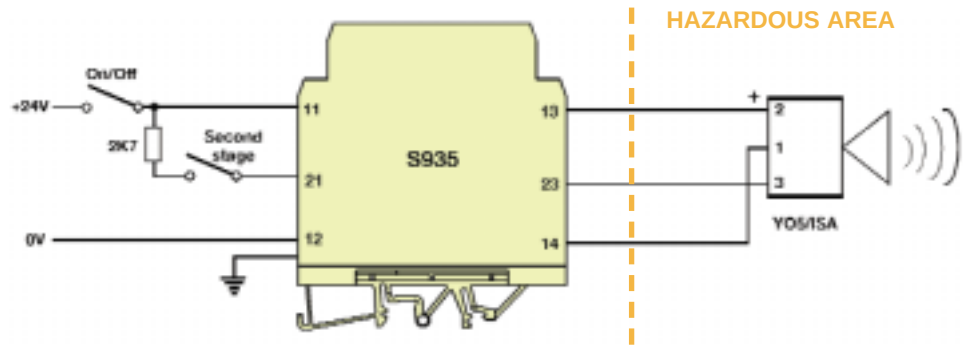

Fig. 2.3.6

One popular sounder uses a different 3-wire system in conjunction with a special 2-channel barrier. The tone change terminal 3 is connected to a +10V supply at barrier terminal 21 or, as in the above illustration, via a 2K7 0.25W resistor to the 24V supply.

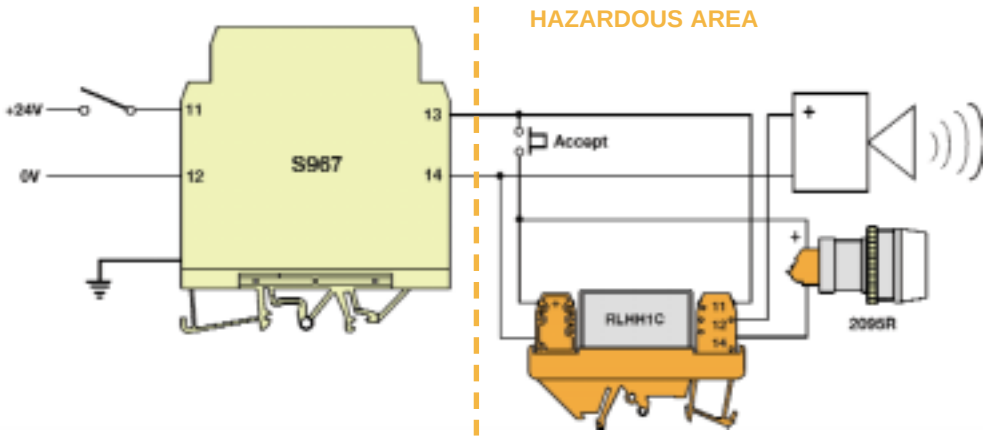

Fig. 2.3.7

It is often a requirement to be able to silence (or "accept") an alarm in the field while corrective action is taken. This arrangement with an RLHHIC relay illuminates an "alarm accepted" indicator until the alarm condition is cleared and the circuit resets.

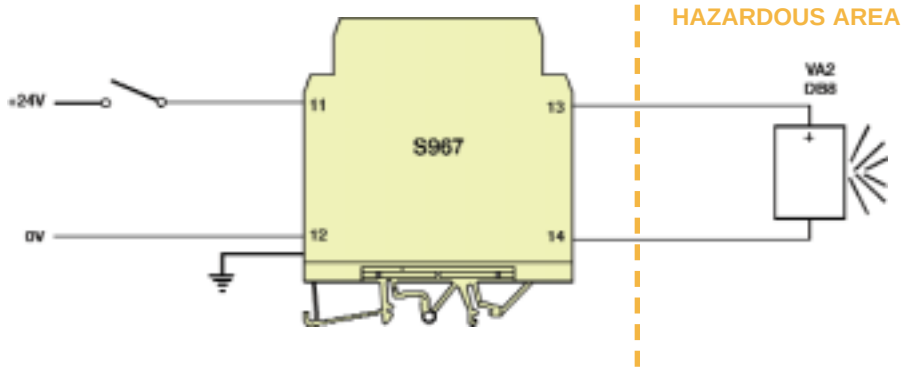

Fig. 2.4.1

Xenon beacon alarms otherwise known as ‘strobes’ or ‘Visilarms’, will normally use a single-channel barrier with earth return. Two separate alarm circuits can be handled by only one S983 dual barrier, with economy in cost and space.

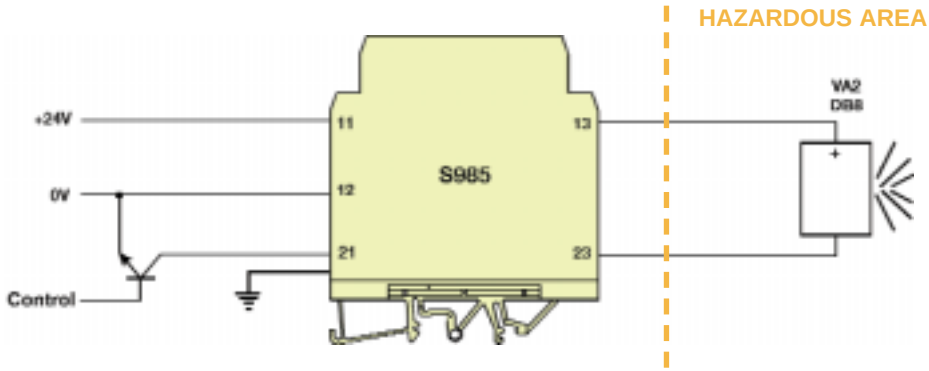

Fig. 2.4.2

Where the on/off control is by an open-collector control signal or by a switch to ground in the return line, then a double channel barrier is used which incorporates a diode return.

Zener Barrier Applications

Section Three - Analogue Inputs

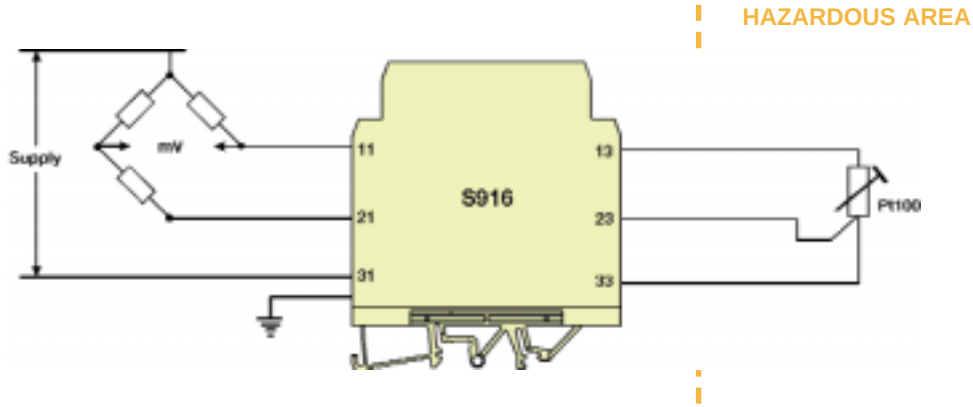

Fig. 3.1.1

The usual 3-wire compensating RTD connection is made through the S916 three-channel barrier.

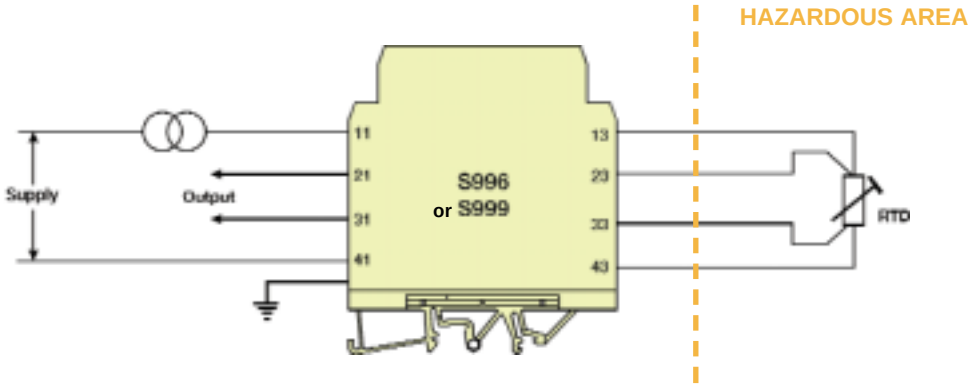

Fig. 3.1.2

4-wire RTD circuits use the 4-channel S996 barrier with 100 ohm sensors while the S999 is more suitable for the higher resistance devices.

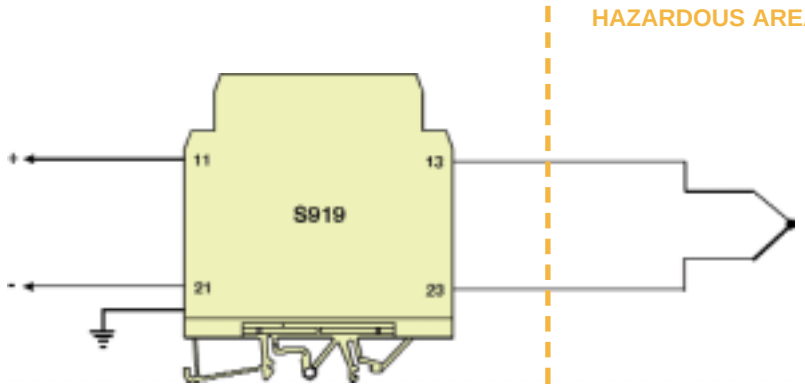

Fig. 3.1.3

The S919 star-connected dual channel barrier is the normal preference for direct thermocouple connections, although several other types may be suitable.

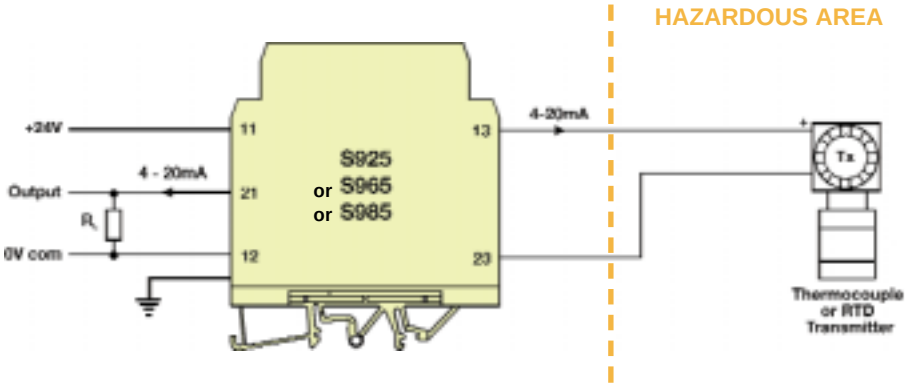

Fig. 3.1.4

The simplest commonly used circuit for a 4-20mA transmitter involves only a double-channel barrier. However, the barrier voltdrop may be too much for some transmitters, see 3.1.8 to 3.1.15 below. Some Smart transmitters are able to function on this arrangement. R_L represents the load path, typically within the input card of the safe area equipment.

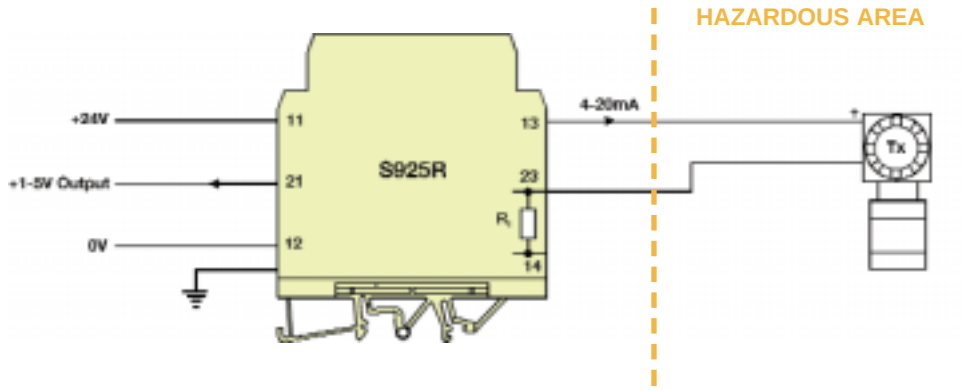

Fig. 3.1.5

Most 4-20mA input cards in data handling systems incorporate a 250-ohm load resistor to convert 4-20mA into 1-5V, the resistor usually being removable to accept 1-5V directly. In this special barrier the R_L=250 ohms is incorporated at the hazardous area terminals thus reducing the length of the current path and giving a useful increase in available voltage.

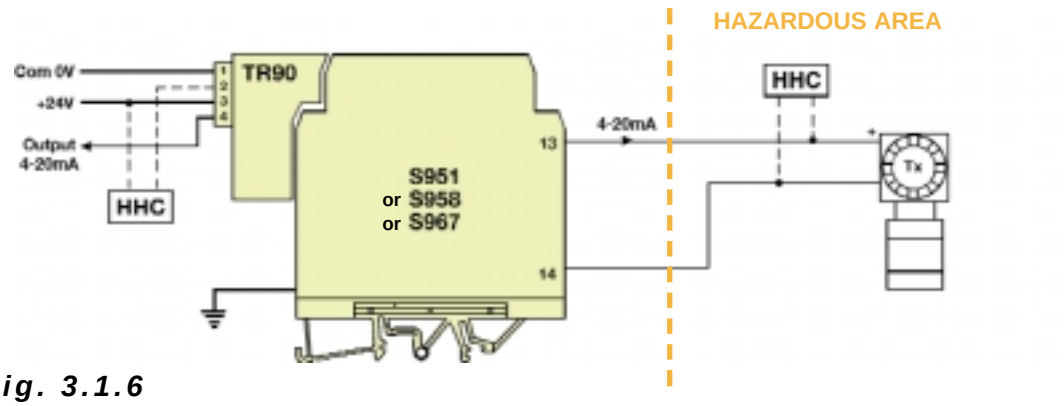

Fig. 3.1.6

The use of transmitter current repeaters improves input and output voltage capabilities. The TR90 is a general-purpose model suitable for both non-Smart and Smart transmitters although safe area communication is only via module terminal 2, not on the repeat current output line. The S958, in all diagrams, is suitable for Groups IIB and IIA only.

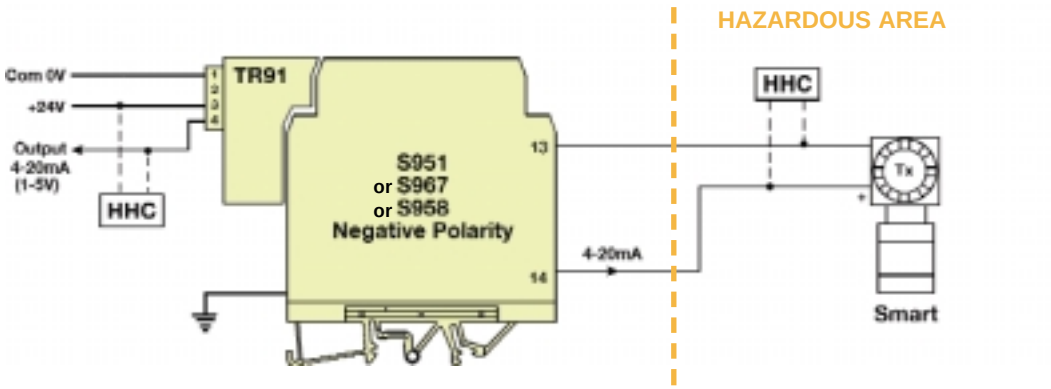

Fig. 3.1.7

The TR91 is optimised for bidirectional communications with Smart transmitters, but note that negative polarity barriers are used. If module terminal 2 is linked to 4, then the internal load is brought into circuit and the output is changed to 1-5 volts.

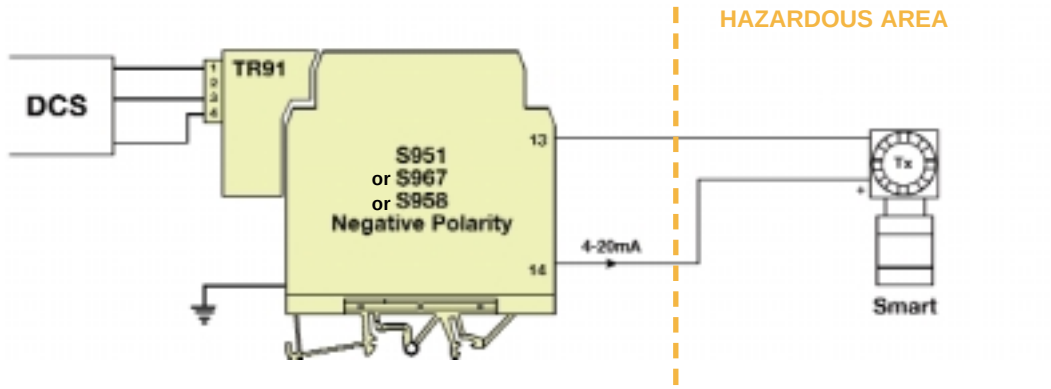

Fig. 3.1.8

The TR91 allows bidirectional communication between the transmitter and the DCS.

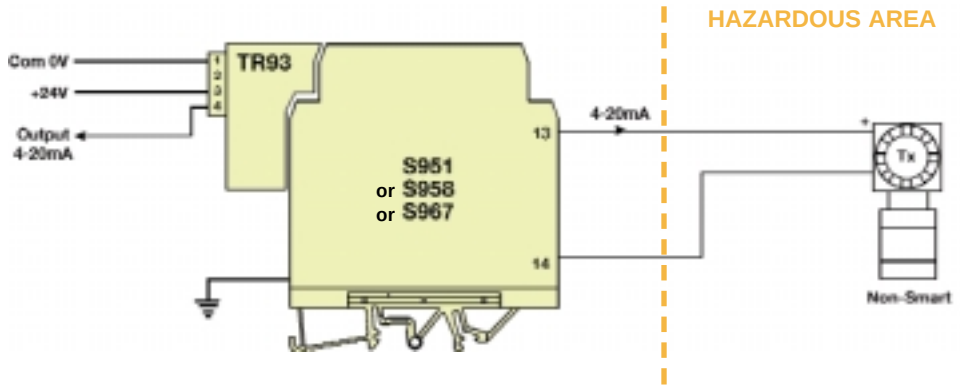

Fig. 3.1.9

The TR93 module is optimised for use with non-Smart 4-20mA intrinsically safe 2-wire transmitters, giving the highest compliance.

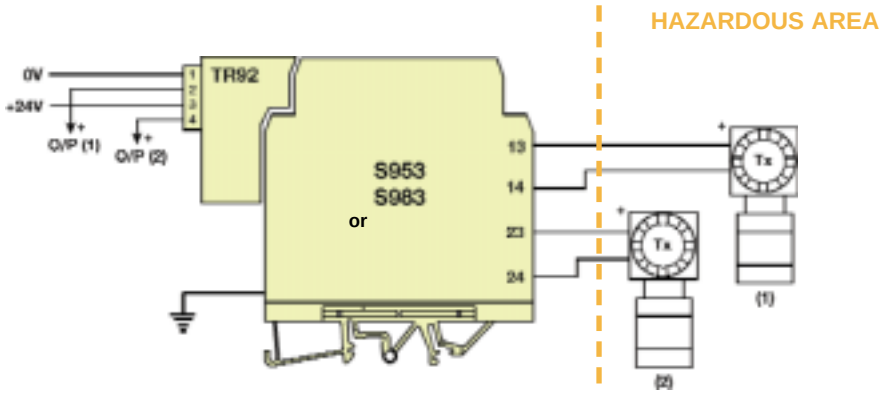

Fig. 3.1.10

The TR92 twin current repeater module provides for two channels of 4-20mA transmitters in a very compact and cost-saving assembly. In gas groups IIA and IIB, the return wires may be a simple conductor to terminal 14 or 24.

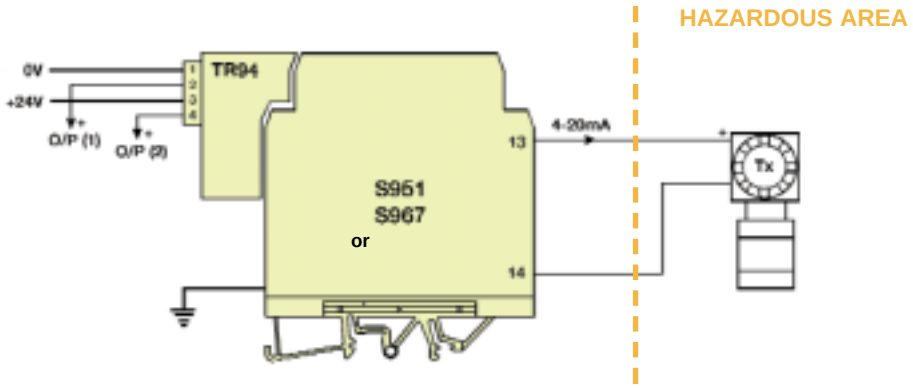

Fig. 3.1.11

The TR94 module delivers two independent repeat outputs from a single field transmitter, and is used typically where signals are required both for local control and for remote repeat indication purposes.

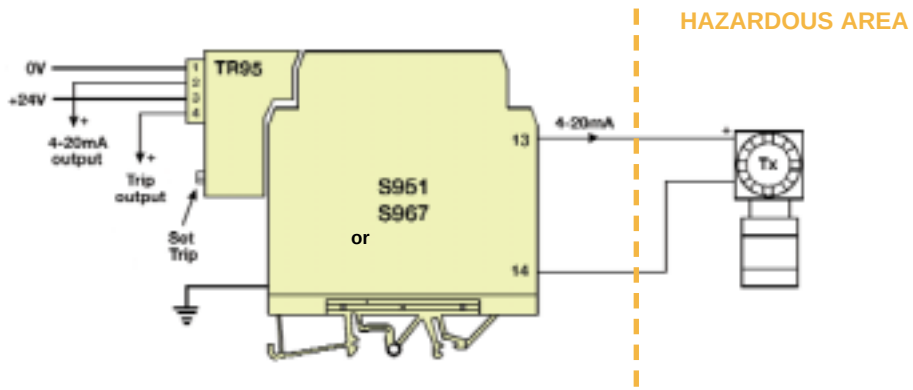

Fig. 3.1.12

The TR95 transmitter repeater delivers a digital setpoint output in addition to the repeated 4-20mA signal. Two versions of TR95 are available, to give the choice of output ON (TR95H) or OFF (TR95L) when above the set point. The setpoint adjustment is below the 4-pole connector.

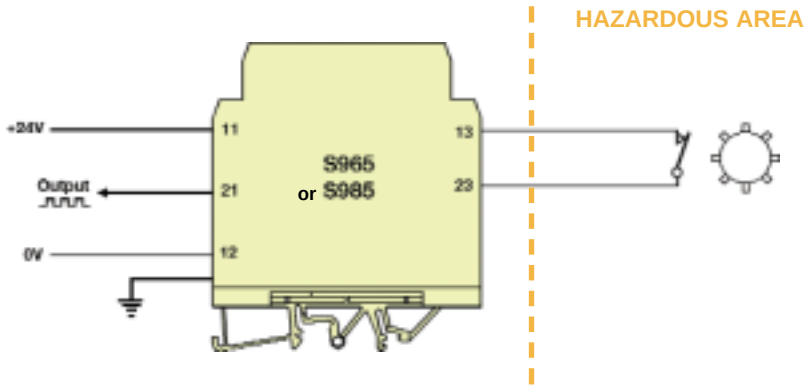

Fig. 3.3.1

Pulses may be generated by reed switch contacts, which are operated by a magnetised rotor to give a frequency proportional to speed. Adaptable to other event-counting applications. The mechanical contacts are unsuitable for high frequencies.

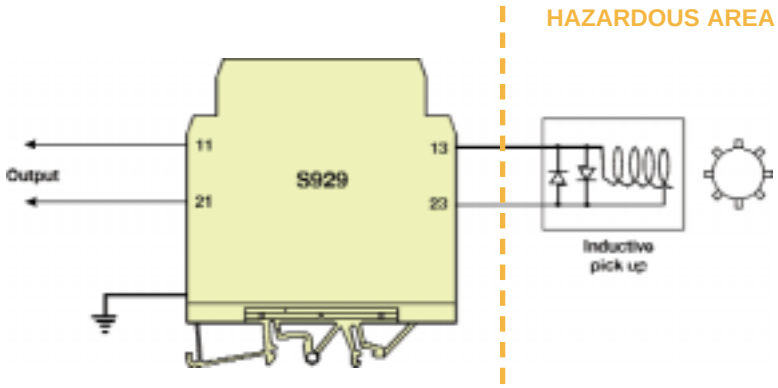

Fig. 3.3.2

A magnetised rotor will generate pulses in an inductive pickup, information relating to speed may be taken from either the frequency or the amplitude of the pulse train, according to application. This style of sensor is generally not suitable for very low frequencies.

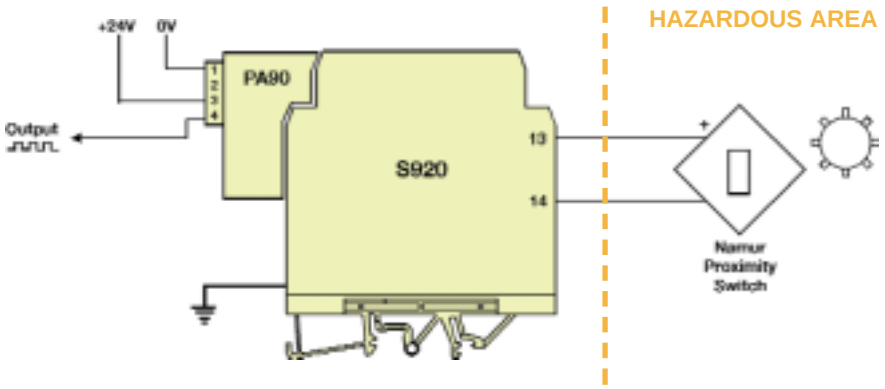

Fig. 3.3.3

A toothed wheel, which does not need to be magnetised, switches the NAMUR device to give a train of output pulses. Adaptable for counting in many diverse applications, an upper frequency limit depends only on the response speed of the chosen sensor.

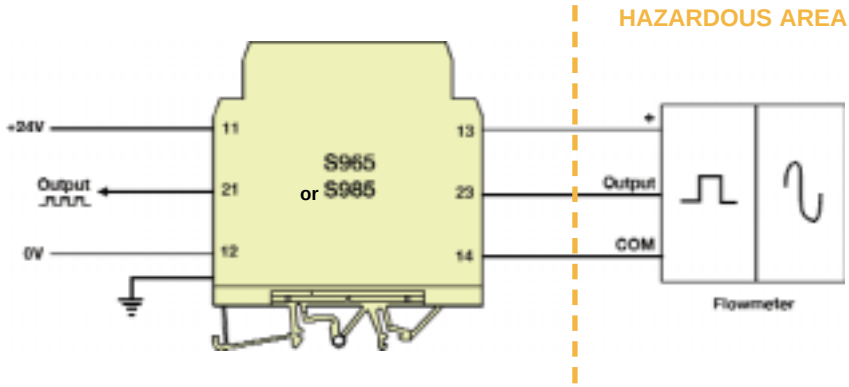

Fig. 3.3.4

Some proprietary flowmeters include conditioning electronics with the sensor, and deliver a square wave output pulse train.

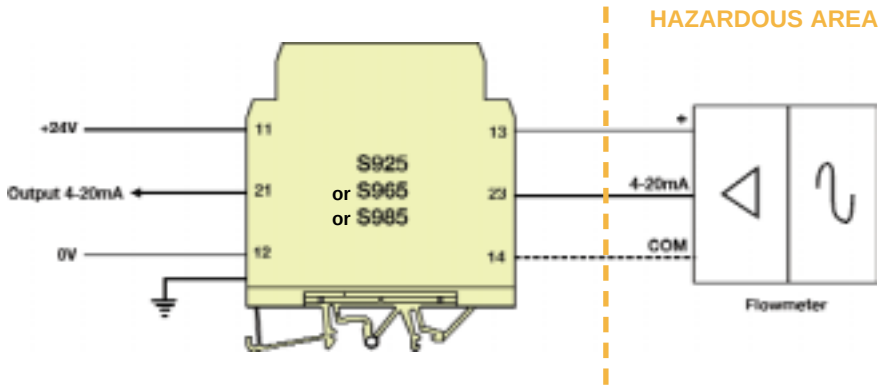

Fig. 3.3.5

Some flowmeters deliver a 4-20mA output current proportional to flow. As with other 4-20mA transmitters, the arrangements of Figs.3.1.7 to 3.1.15 may also be appropriate for 2-wire devices.

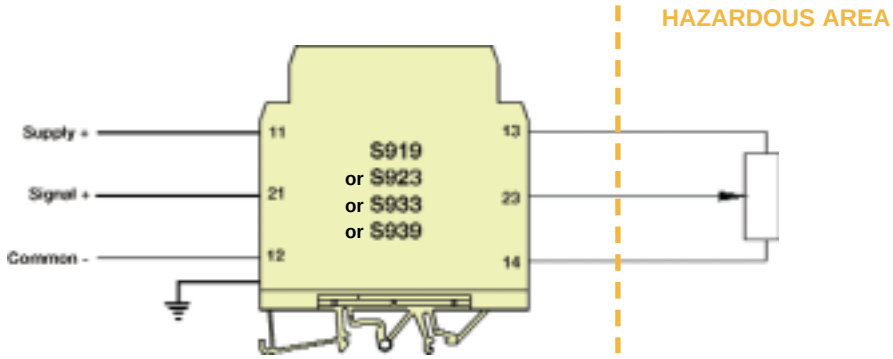

Fig. 3.4.1

A position transmitter or other potentiometric transducer usually uses a 2-channel barrier with earth return. Use S919 or S923 for supplies of up to 6V, or S933 or S939 for up to 12V.

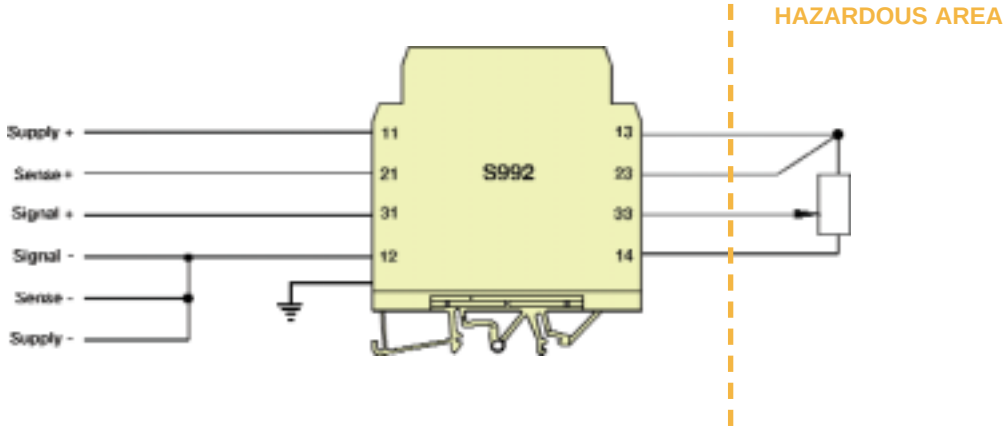

Fig. 3.4.2

For the most critical applications, it may be necessary to use a power supply having remote sensing facilities.

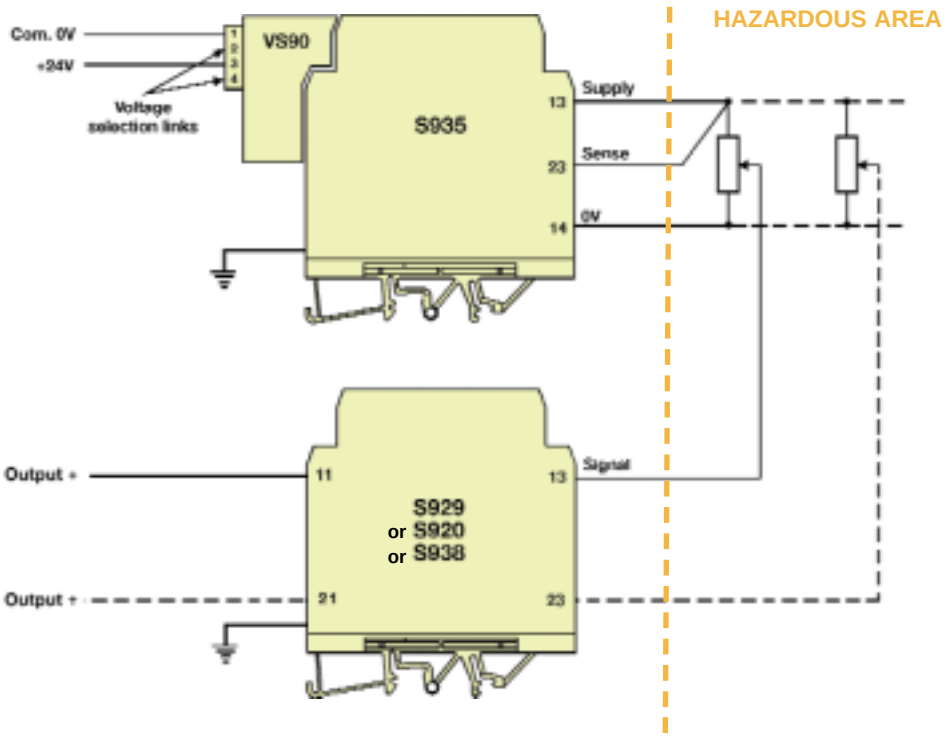

Fig. 3.4.3

Stabilised power supply for potentiometers in critical applications can use the VS90 module to deliver regulated 6, 8 or 10 volts to one or more potentiometers in the field, energised from the bulk 24V supply. Suitable in gas groups IIB and IIA only.

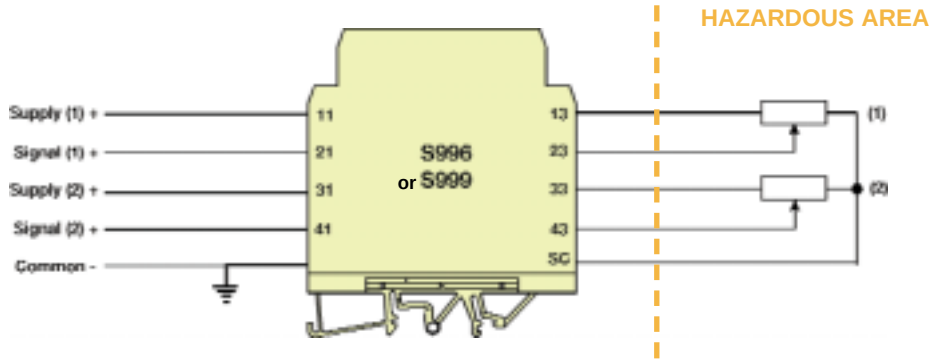

Fig. 3.4.4

A 4-channel barrier can handle two independent potentiometers. The return wires to terminal SC may be run individually or be combined as shown, or may employ the screen of a 4-core screened and insulated cable.

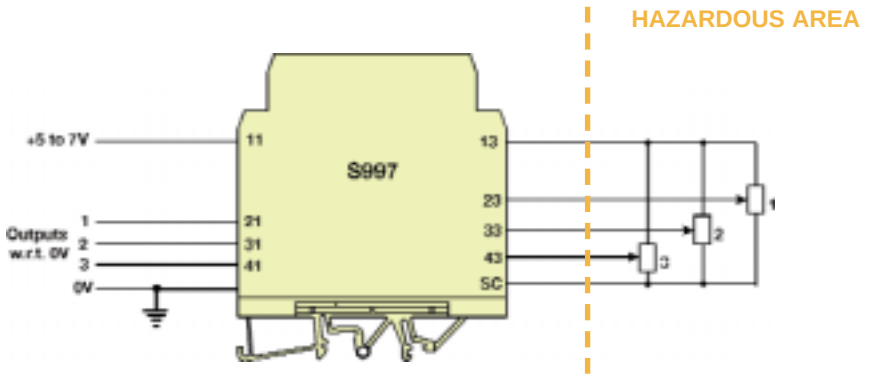

Fig. 3.4.5

Three field potentiometers can be handled by a single barrier.

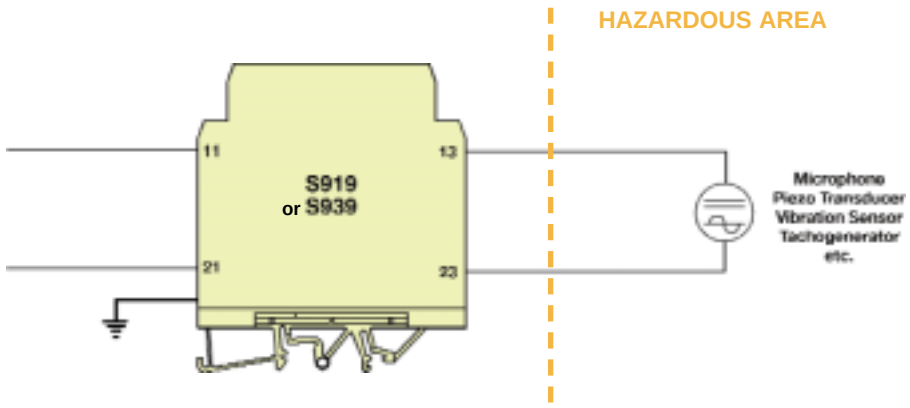

Fig. 3.5.1

The S919 is the preferred barrier for low level analogue inputs, although for some a.c. signals having a line-to-line amplitude exceeding 6 volts the S939 would be used instead.

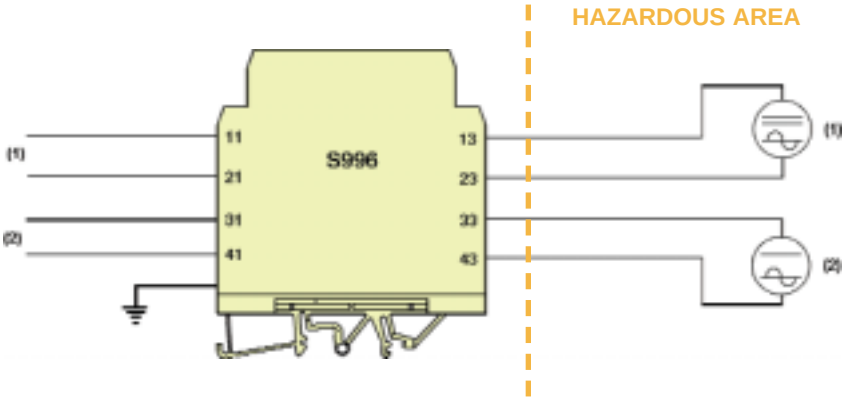

Fig. 3.5.2

Two independent channels of low-level analogue signals may be carried by the S996 4-channel barrier. Because the S996 is positive-polarised, it is not suitable in the few instances where either signal line goes negative with respect to earth by more than 500mV peak.

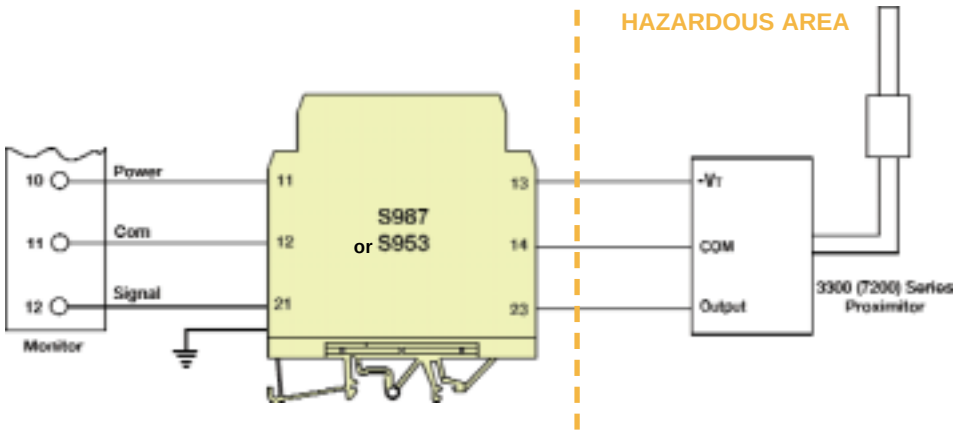

Fig. 3.5.3

The S987NEG barrier is specially constructed to match the Bently Nevada systems for monitoring acceleration, velocity and displacement. In gas groups IIB and IIA, the S953NEG is a suitable alternative with the 7200 series proximitor only.

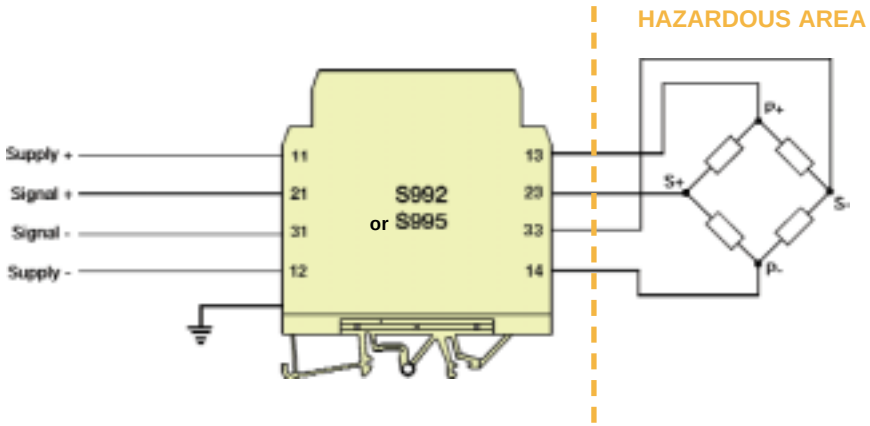

Fig. 3.5.4

The simplest arrangement for a straingauge bridge transducer on unipolar supply. Use S992 for up to 6 volts supply, or S995 for up to 12 volts.

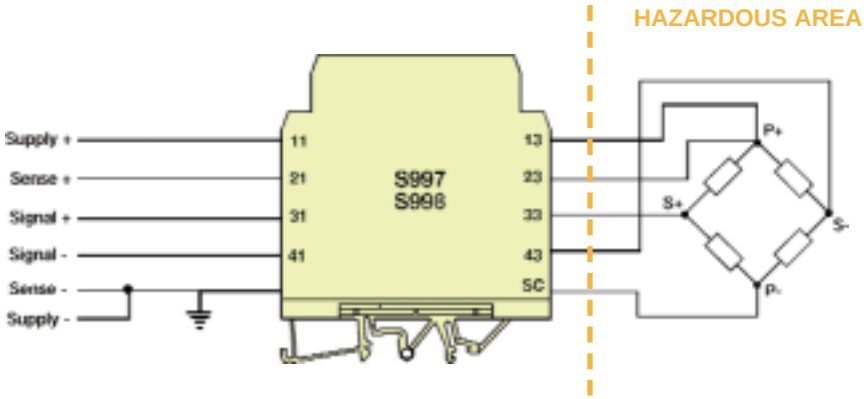

Fig. 3.5.5

Increased stability for a straingauge transducer is provided when the power supply is fitted with remote sense terminals. If the bridge circuit comprises of more than 350 Ohm bridges in parallel, then the S998 should be used.

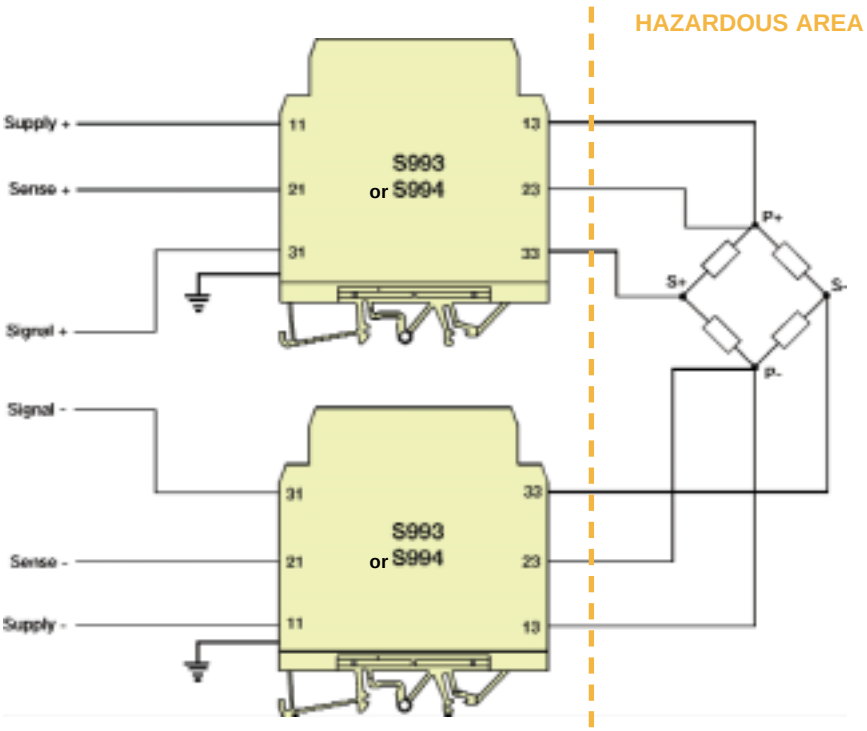

Fig. 3.5.6

Optimum performance is obtained with balanced (equal positive and negative) power supply. Use S993 for up to +/-7V supply or S994 to +/-9V, on the safe area side.

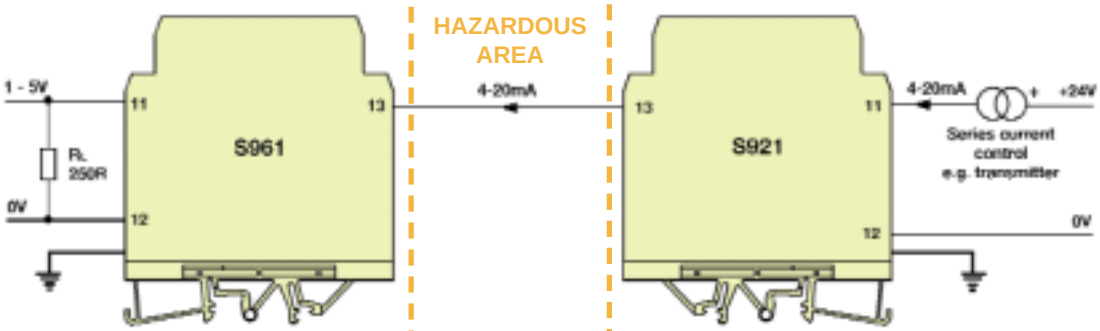

Fig. 3.6.1(a)

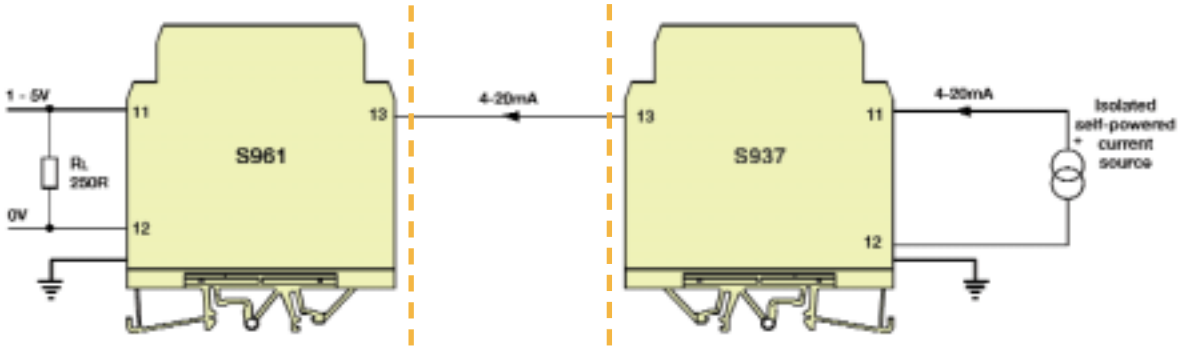

Fig. 3.6.1(b)

Analogue signals of 4-20mA may be passed through from one safe area (or item of Exd protected field equipment) through to another safe area on a single conductor, provided that the difference in earth potential or "0V" levels is within the voltage compliance of the current source. In fact, because of the risk of circulating earth fault currents, it is not only unnecessary but also often unwise to run a second conductor and make a 'pair' for the signal. Earth voltage variations are not superimposed on the current signal. The load resistor R_L will normally be incorporated in the input card of the receiving equipment.

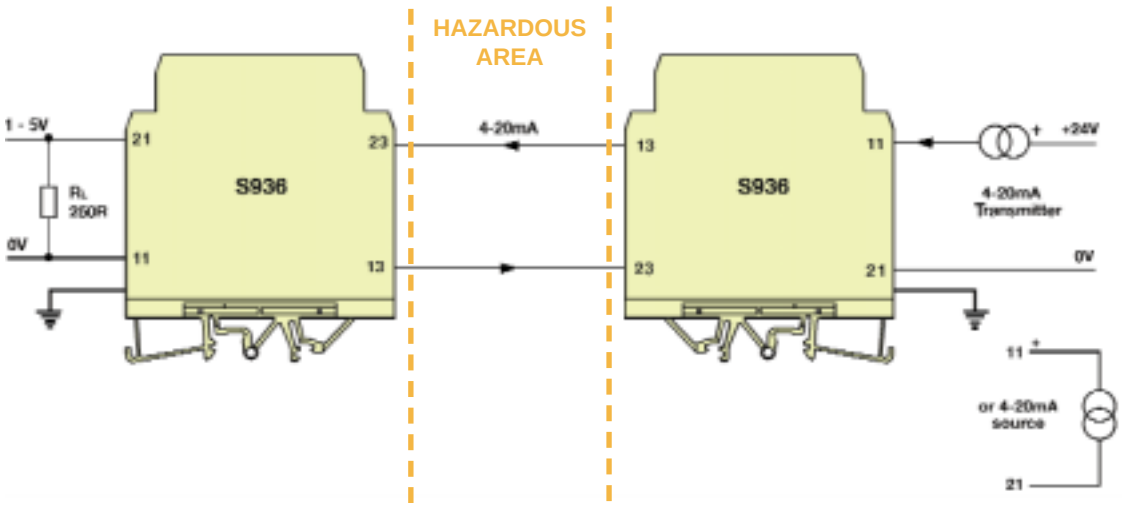

Fig. 3.6.2

This variation from Fig. 3.6.1 uses a double-channel barrier at each end of the cable and does permit a conventional pair for the signal, free of direct earth connection. Earth fault considerations make the circuit suitable for gas groups IIB and IIA only.

Zener Barrier Applications

Section Four - Analogue Outputs

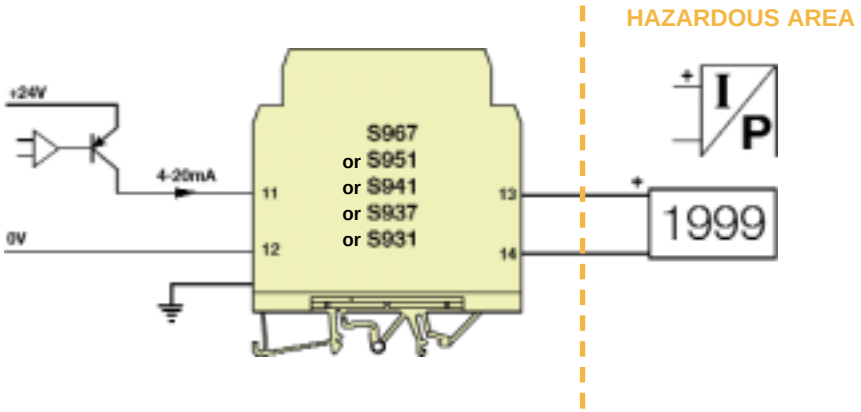

Fig. 4.1.1

Where the current is controlled in the supply line, then a single channel barrier is all that is required. While a 28V300R unit such as the S951 is often used, if loop voltdrop is a problem with a restricted source capability, then a lower voltage (lower resistance) barrier may be used with advantage. Two separate channels can be carried on the S933, S953 or S983 barriers.

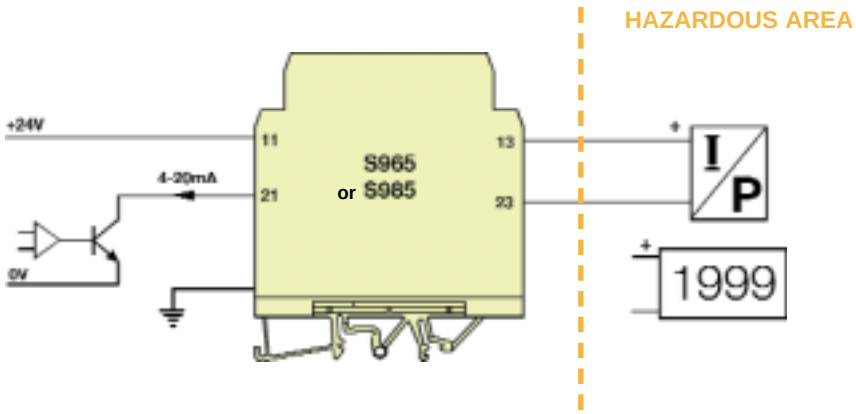

Fig. 4.1.2

When the current is controlled in the return line, then only double-channel 28V barriers can be used. As with all applications, the final choice of barrier must depend on the published safety parameters of the field device. Digital meter terminals are usually classified as simple apparatus, further simplifying barrier selection.

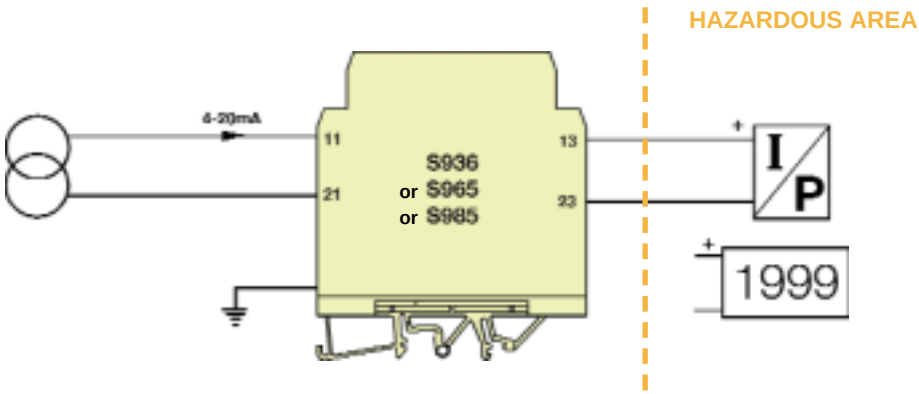

Fig. 4.1.3

Where the controlling current is from an isolated source, then a single-channel barrier may be used as in 4.1.1 above or, if the source must be kept earth-free, then a double-channel barrier will be needed as shown here.

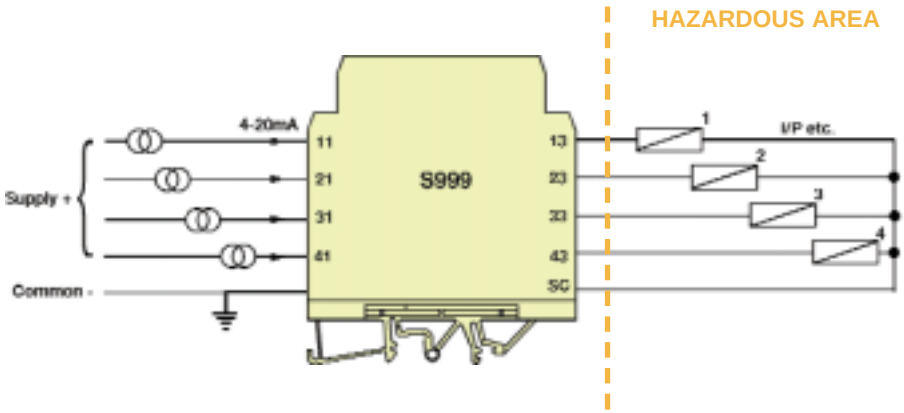

Fig. 4.1.4

For field loads with a coil resistance not exceeding 400ohms, or for digital meters, the S999 barrier can handle four independent loops of the type illustrated in Fig. 4.1.1 above. A 4-core cable with insulated screen may be used to a field junction box. Care will be needed with cable parameters in a Group IIC hazard.

Zener Barrier Applications

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E. & O.E.

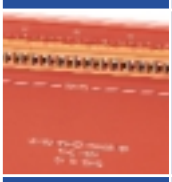
RTK


S90 Zener Barriers


Zener Barrier Signal Conditioning


Isolation Interfaces


Intrinsically Safe Relays


Multiplexers


Light Towers


Intrinsically Safe Annunciators


Flameproof Annunciators


Sounders


Xenon Beacons


LED Clusters and Switches

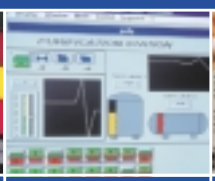

Systems

HAZARDOUS AREAS

SAFE AREAS


Alarm Annunciators


Display Fascias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