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Protection for Resistance Temperature Detectors (RTDs)

Application Note AN001 for ESP 06D, ESP SL06, ESP 06Q, ESP RTD, ESP SL RTD, ESP RTDQ

Thomas&Betts

Protection for Resistance Temperature Detectors (RTDs)

The Resistance Temperature Detector is a widely used device for measuring temperature. In basic terms, the electrical resistance of a sensing resistor, Rt, varies with temperature.

Temperature is simply measured indirectly by reading the voltage drop across the sensing resistor in the presence of a constant current flowing through it using Ohm's Law.

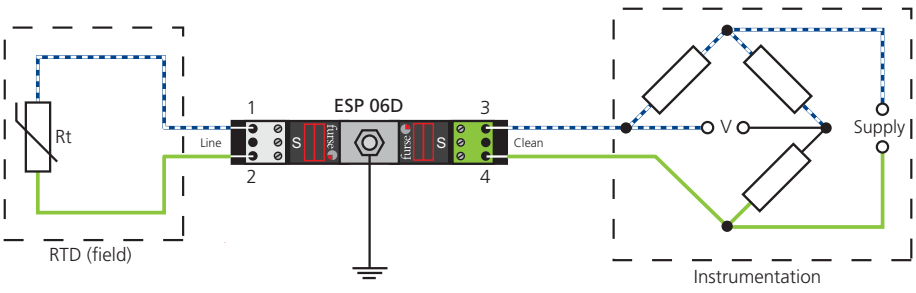
Fundamentally, every sensing resistor is a 2 wire device. It is essential that the resistance values of any external lead wires are taken into account.

Depending on the accuracy required and application, the sensing resistor is terminated with either 2, 3 or 4 wires. Each type of lead wire arrangement is connected to a suitable bridge circuit in the measuring instrumentation.

2 Wire systems

2 Wire systems offer poor accuracy due to lead resistance but are adequate for some industrial applications.

This type of system can be protected using a single 2-channel ESP 06D or space saving Slim Line ESP SL06 lightning barrier (ESP 06D illustrated opposite).



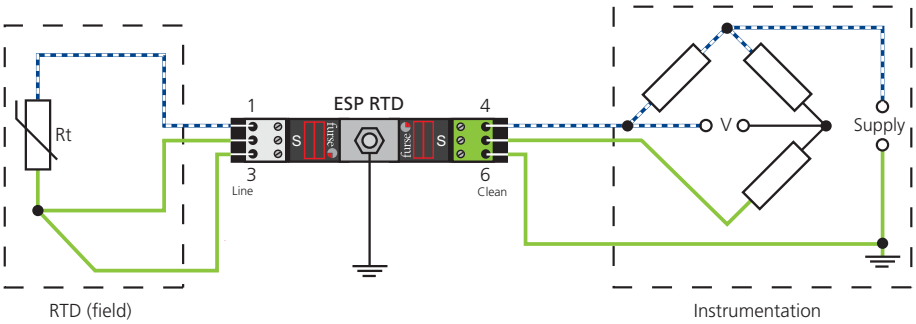
3 Wire systems - earthed bridge

3 Wire systems allow for a good deal of lead resistance compensation and therefore offer better accuracy than a 2 wire system.

In a typical 3 wire system, the bridge circuit is earthed as shown in the diagram opposite. It is therefore necessary to protect all three wires.

This could be accomplished using 2 ESP 06D or ESP SL06 barriers where only 1 channel of the second barrier is utilised. However, this would be bulky and not cost effective due to the unused channel.

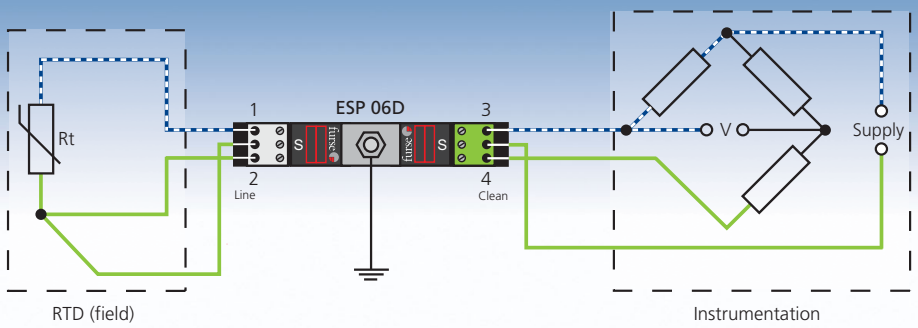
The ESP SL RTD and ESP RTD are 3-channel barriers specifically designed to protect this type of system. All 3 channels are housed in an enclosure identical in size to their respective 06 type barrier.



3 Wire systems - floating bridge

There are also 3 wire systems where the bridge circuit is not earthed and is said to be "floating".

In this system, a single ESP SL06 or ESP 06D barrier can be used to protect the 2 leads from the bridge arms whilst the third (supply) lead is connected to the barrier earth via the screen connection (ESP 06D shown opposite).

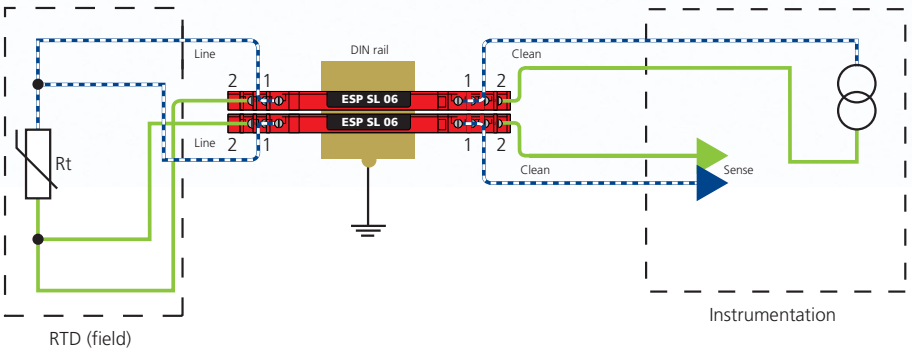


4 Wire systems

4 Wire systems provide the highest accuracy as the lead resistances and connection contact resistances have a negligible effect if the measuring circuit has high input impedance.

The leads are often connected to a constant current circuit.

All 4 channels can be protected using two ESP 06D or ESP SL06 barriers (ESP SL06 shown opposite).



Summary

For 2 wire systems
use 1 x ESP 06D or ESP SL06 Lightning Barrier

For 3 wire systems (earthed bridge)
use 1 x ESP RTD or ESP SL RTD Lightning Barrier

For 3 wire systems (floating bridge)
use 1 x ESP 06D or ESP SL06 Lightning Barrier

For 4 wire systems
use 2 x ESP 06D or ESP SL06 Lightning Barrier

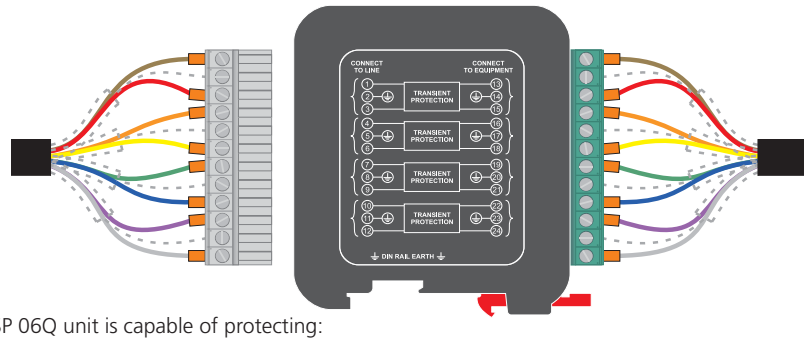
Please note: Information about safe and correct installation of Furse Lightning Barriers can be found in the *ESP Lightning Barrier Installation Instructions, supplied with all products.*

Protecting multiple RTDs

Where there are multiple RTD systems requiring protection, the ESP Q series variants, ESP 06Q and ESP RTDQ, can be utilised.

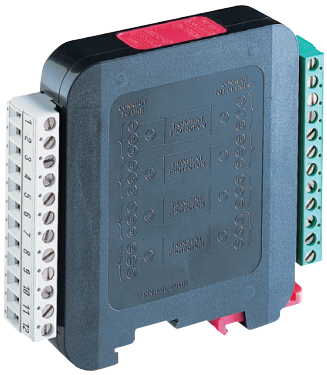
The ESP 06Q provides protection for 4 pairs (8 channels) of wires whilst the ESP RTDQ will protect three sets of 3 wires (9 channels). Diagrams for each type are shown opposite.

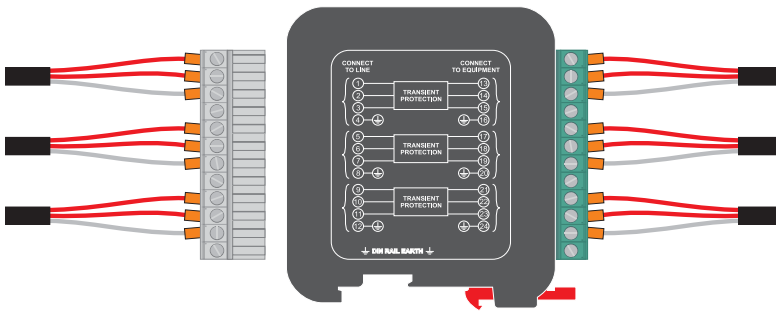
Thus space saving potential and cost effectiveness can be realised over the equivalent number of individual barriers.



An ESP 06Q unit is capable of protecting:

- Four 2 wire systems
- Four 3 wire systems (floating bridge)
- Two 4 wire systems





An ESP RTDQ unit is designed to protect up to three 3 wire systems with an earthed bridge.

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Full specifications of all of the products in the Furse ESP range of transient overvoltage protectors can be found in the Total Solution Product Catalogue.

To request a copy, contact Furse Sales at the address opposite.

Full product data can be downloaded in PDF form from our website at www.furse.com. Copies of the Total Solution Product Catalogue can also be requested from our website.

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AN001-0610