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INOR Why use isolated transmitters?

Measurements with thermocouples

Figure 1 shows a typical situation, when using thermocouples connected to a PLC or DCS over a non-isolated transmitter.
The isolation to ground R_{ISO} is sometimes rather low, e.g. at high temperatures and/or small dimensions of the thermocouple.
An undesired "ground current" L of variable magnitude, depending on the actual situation, will arise. The ground current will flow through the thermocouple and cause voltage drops over the resistances R_{L1} and R_{L2} in the thermocouple leads. These voltage drops will interact with the EMF generated by the thermocouple and can cause significant measuring errors.
It is sometimes hard to foresee and calculate these errors, but it is not unusual that they can reach 5-10 % of the measuring range.
If the transmitter is galvanically isolated between the input and output circuit, the ground loop will be cut off, and the ground current will be stopped. No errors will arise due to a low isolation between thermocouple and ground.

Measurements with RTDs

Figure 2 shows an RTD sensor connected to a PLC or DCS over a non-isolated transmitter.
The isolation to ground R_{ISO} is normally very high in a "healthy" RTD, typically 50 to 500 MQ. However, under certain conditions it happens that the internal isolation of an RTD can be significantly reduced.
Reasons might be wear or damage causing moisture to penetrate into the RTD.
Depending of the value of R_{ISO} a certain portion I_{Err} of the measuring current I_m will pass through the ground and not through the RTD sensor. This will cause a measuring error.
If the transmitter is galvanically isolated between the input and output circuit, the ground loop will be cut off, and the ground current will be stopped. No errors will arise due to a low isolation between RTD and ground.

Conclusion

To ensure good measurements, use isolated transmitters.

Fig. 1

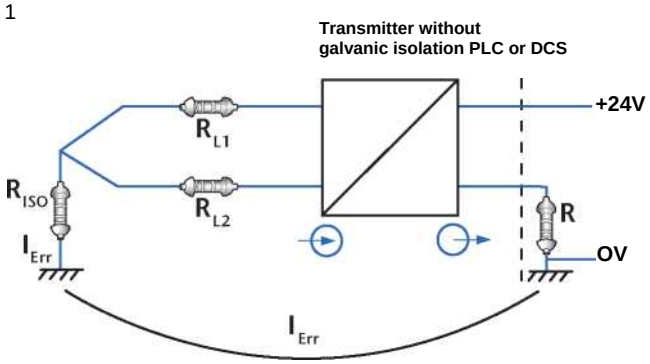

Fig. 2