4-20 mA Transmitter Wiring Options

Transmitters are available with a wide variety of signal outputs. The 4-20mA analogue signal is by far the most commonly used in industrial applications. Several physical 4-20mA wiring options exist. This guidance note aims to outline these options.

Industrial transmitters are available for monitoring many parameters such as pressure, temperature and flow. Zellweger Analytics’ gas detectors / transmitters offer 4-20mA outputs, where 4 mA equates to a zero gas reading and 20 mA equates a full scale reading of the calibrated gas range.

This signal is sent to a remotely located control panel. The control panel uses this signal and activates executive actions via relay contacts, e.g. audible and visual alarms or initiate plant shut down procedures.

Transmitters typically require a 24Vdc supply. This supply can be derived local to the transmitter or supplied direct from the associated control panel.

Several transmitter wiring options exist. The design of the associated control panel dictates which option should be used.

These wiring options include:

- Current source transmitter, non isolated (3 wire)
- Current sink transmitter, non isolated (3 wire)
- Fully isolated (4 wire)
- Two wire loop powered transmitters

Most modern transmitters can be wired in a current sink or source format, selection is often made by the use of specific terminals or the location of a link within the transmitter. However some transmitters may be limited to either a sink or source configuration. Check the transmitter’s technical manual for the available options.

When transmitters are wired in a current source configuration it follows that the control system will be current sink, and vice versa. Therefore it is important to qualify whether it is the transmitter or the control system that is to be wired in a specific configuration.

For the purposes for this guidance note it is assumed that both the transmitter and the remote control panel require a 24Vdc supply.
Fire and flame detection

Current source transmitter, non isolated (3 wire)

This is the most common configuration of modern 4-20mA transmitters. The transmitter and control panel can use the same 24V and 0V dc supply lines. The 4-20mA signal flows through the 24V dc line and the signal line to the controller.

Advantages:
• Only three cable cores are required to the transmitter.
• A common power supply can be used for both the transmitter and the control panel.

Disadvantages:
• Any electrical interference or pick up may be transmitted along the signal line, which could generate a spurious alarm in the control panel.

Current sink transmitter, non isolated (3 wire)

The transmitter and control panel can use the same 0V and 24V dc supply lines. The 4-20mA signal flows through the 0V dc line and the signal line to the controller.

Advantages:
• Only three cable cores are required to the transmitter.
• A common power supply can be used for both the transmitter and the control panel.

Disadvantages:
• Any electrical interference or pick up may be transmitted along the signal line, which may generate a spurious alarm in the control panel.

Fully isolated (4 wire)

The transmitter and control panel use separate 24V dc supplies. The 4-20mA signal flows through two separate cable cores between the transmitter and control panel. It is assumed that the power to drive the 4-20mA loop is derived from the control panel.

Advantages:
• Electrical interference on the voltage supply lines will not be transferred to the 4-20mA signal line, reducing the risk of spurious signals being received at the controller.

Disadvantages:
• An additional cable core is required for each transmitter compared to current sink and source options.
• A separate power supply is required for both the transmitter and control panel.
Fire and flame detection

Two wire loop powered transmitters

This configuration supplies power and 4-20mA signal over a two wire loop connection between the transmitter and the control panel.

Not all transmitters can be wired in this format and must be specifically designed to accommodate this configuration.

Advantages:
• Has low power consumption.
• Only two cable cores are required to the transmitter.

Disadvantages:
• Transmitter discrete fault signalling cannot be set at 0mA as this configuration continues to draw some current in a fault condition. This configuration is not suitable for control panels that require a 0mA signal for a fault indication.

Sub 4mA status signalling is limited due to the reduced range of mA available between fault and a zero gas reading.

Not suitable for power hungry transmitters, e.g. catalytic gas detectors, or Infrared gas detectors using optical heating elements.

24V dc & 4-20mA Signal line

0V dc & 4-20mA Signal line

Transmitter

Control Panel

Power Supply 24V dc

Field

Control room

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