PRESSURE SOLUTIONS

P206: Receiver Gauges

Definition:
These are not very common these days, except in extremely hazardous areas.
Before the days of electronic transmitters, the only way to transmit a signal from a sensor to a remote controller or display was using air as a means of transmission. Signals were standardised as 3 to 15 lbf/in², which has been metricated to 20 – 100 kPa. This is the pneumatic equivalent of 4 – 20 mA. This output signal represents 0 to 100% of the input signal.
Pneumatic transmitters can be used to measure many variables.
Where a remote display is required, a RECEIVER GAUGE measures the pressure, and displays it on a scale of some form.

Gauge Construction:
A 100 kPa bourdon tube is used. Usually, scales are designed with a suppressed zero (internal stop). 20 kPa applied will bring the scale to the zero position. Scales are the usual 270°, so the pointer will typically point close to 6 o'clock when no pressure is present.

Standard Scales:
There are three common scales. Most common is 0 – 100% linear. This is typically used for pressure or hydrostatic level. Less so is the 0 - 10√. This is used for flow across orifice plates or venturis where Bernoulli's equation applies (pressure drop proportional to the square of the flow, thus flow proportional to the square root of the pressure drop). Least common is a linear 20 – 100 kPa scale, which displays the signal, rather than what the signal represents.

Custom Scales:
These would be for where the relationship is neither linear nor square root. An example would be flow over a weir which can be measured by measuring the depth of water over the weir. The formula is of the type $Q \propto h^{1,5}$.

Direct Reading Scales:
Sometimes the receiver gauge is required to indicate the process value directly, so we may have for example, a linear scale marked 0 – 300 kPa, or a square root scale marked 0 – 150 Nm³/h.

Calibration Marks:
Scales other than 20 – 100 kPa direct reading, usually have calibration marks added to the dial to assist in calibration. For example, Stewart use a short red mark every 20 kPa. Budenberg use a black triangle every 5 psi and a black dot every 1 psi.

Applications:
Usually today, these will be used in Zone 0 applications, where using air to operate valves etc, controlled by a 20 – 100 kPa signal, offers no risk of explosion.

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