

Product Specification Sheet

Online Document Number or 00815-0100-5000, Rev AA

April 2002

Electronic Pressure Instrument Specification Guide



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OVERVIEW

This specification defines the requirements for Electronic Pressure Instruments. The specification covers all hardware, software, software configuration, calibration and communications with host control systems, when so required. Also included is auxiliary instrumentation associated with pressure instruments such as primary elements, filled capillary systems and manifolds.

VENDOR REQUIREMENTS

Each pressure instrument shall be individually tested for accuracy using calibration equipment traceable to NIST or an equivalent internationally recognized authority.

The vendor shall provide independent documentation demonstrating that the instrument is suitable for use in Safety Instrumented Systems per IEC 61508.

The vendor shall provide calculations and data proving Mean Time Between Failure (MTBF). The pressure instrument MTBF shall exceed 150- years with a 95% confidence level.

The manufacturer of the pressure instrument shall be certified to the international standard ISO9001.

ENVIRONMENTAL CONDITIONS

All pressure instruments shall be designed for continuous operation in ambient temperatures of -40 °F (-40 °C) to +185 °F (85 °C) and relative humidity of 100%, condensing. Indicating meters shall be designed for continuous operation in ambient temperatures of -4 °F (-20 °C) to +175 °F (80 °C) and relative humidity of 100%, condensing.

The pressure sensor and primary variable producing electronics shall be enclosed in a hermetically sealed 316L SST enclosure.

The instrument shall have built-in transient protection to IEEE standard 587, category B and IEEE standard 472.

INSTRUMENT SPECIFICATIONS

Performance Specifications

Conformance to Specification (± 3 Sigma)

All instrument specifications shall conform to a minimum +3-sigma standard.

Installed Performance

Critical and high performance applications

Instruments for critical and high performance applications (ESD, surge control, custody transfer, batching & blending, etc):

- Shall have a **total performance** error of $\pm 0.125\%$ of calibrated span or better for 50°F (28°C) temperature changes, 1000 psi (69 Bar) static line pressure and a 5:1 turndown.
- Shall have a 10- year **stability** specification of $\pm 0.2\%$ of URL or better for 50°F (28°C) temperature changes, 1000 psi (69 Bar) static line pressure for differential applications.
- Shall have a **total response** time of 150msec or less. Total response time includes dead time (Td) + time constant (Tc). The vendor shall provide test data to this effect.
- Shall provide a **turndown** of 100:1 or greater.

All instruments on custody transfer shall have hardware write protect security.

General monitoring and control applications

Instruments for monitoring and general control applications:

- Shall have a **total performance** error of $\pm 0.15\%$ of calibrated span or better for 50°F (28°C) temperature changes, 1000 psi (69 Bar) static line pressure and a 5:1 turndown.
- Shall have a 5-year **stability** specification of $\pm 0.125\%$ of URL or better for 50°F (28°C) temperature changes, 1000 psi (69 Bar) static line, pressure for differential applications.
- Shall have a **total response** time of 250msec or less. Total response time includes dead time (Td) + time constant (Tc). The vendor shall provide test data to this effect.
- Shall provide a **turndown** of 100:1 or greater.

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Functional Specifications

Hardware/software failure alarm shall be selectable as high, low or custom defined values.

The instrument shall measure pressure over its entire operating range. When pressure exceeds the calibrated analog output span, the analog output shall go to user defined saturation levels. The pressure reading shall continue to be available on the digital output.

Communication

Digital communication with the pressure instrument shall be via open protocols (e.g. HART[®], FOUNDATION[™] fieldbus). Proprietary protocols are not permitted.

Pressure instruments shall communicate with hand held communicators.

Pressure instruments shall be able to fully communicate with Windows-based Instrument Management software via an open communication protocol.

The instrument shall allow field upgrading of communication protocols and the addition of advanced instrument software functions without changing the pressure sensor.

Software

The instrument shall allow the 4-20mA analog output to be scaled to any user defined unit (e.g. 0-2 feet, 0-90000 gallons, 0-300m³/hr.).

The instrument shall allow the digital output of the pressure instrument to be scaled to any user defined unit (e.g. 0-2 feet, 0-90000 gallons, 0-300m³/hr.).

The instrument shall allow custom user-entered digital alerts for both high and low values for the pressure reading. This digital alert will not effect the analog output.

The instrument shall also measure sensor temperature and allow custom user entered digital alerts. This digital alert will not effect the analog output.

It is possible to verify the complete configuration of the pressure transmitter without using a communicator. On powering up, the LCD should sequence through the configuration set up.

All instruments shall store the serial number, materials of construction and tag number in non-volatile memory.

It shall be possible to store last calibration date and next calibration due date in the instrument memory using a hand held configurator. This information should be available on windows based instrument management software.

All instruments shall retain original factory calibration settings in a permanent memory. It shall be possible to recall this calibration using a hand held communicator.

LCD

The instrument display shall be LCD type. It shall display the numeric value and also have a 0-100% scale bar graph corresponding to the analog output. It shall be possible to configure the display for more than one parameter (pressure, scaled output, sensor temperature); in this case the display will toggle / scroll to show all selected parameters. The display will show all alarms and alerts.

It shall be possible to remote mount electronics with a LCD display up to 100ft (30m) from the pressure sensor. These electronics will allow full configuration of the instrument via a hand held communicator.

Complete Point Solutions

All pressure instruments will be supplied with Integral Manifolds.

All instruments for flow measurement will be supplied with primary elements.

FLOW APPLICATIONS

Differential pressure instruments shall be capacitance technology based.

The differential pressure instrument shall have the ability to detect impulse line plugging or should allow field upgrading to include this by the addition of an electronics card.

The instrument shall allow the digital output of the pressure instrument to be scaled to user defined flow units (e.g. 0-200 m³/hr., 0-90000 gal/min.).

The instrument shall allow the 4-20mA analog output to be scaled to any user defined flow units (e.g. 0-200 m³/hr., 0-90000 gal/min.).

The instrument shall contain user definable low flow cut-off functionality.

The vendor shall provide Total Flow Performance calculations detailing instrument performance at minimum, normal and maximum flow conditions at the installed temperature and line pressures.

Differential pressure instruments shall be supplied with 3 or 5 valve integral manifolds duly fitted to the transmitters. The assembly will be pressure tested by vendor before shipment.

The differential pressure instrument shall be supplied mounted directly on the primary element (orifice plate applications where the process temperature <450F (<230C), averaging pitot tube applications where the process temperature is <550F (<285C).

For general orifice plate applications of line sizes of 4 inches (100mm) and below, the pressure instrument shall be supplied with a compact orifice plate. The compact orifice will include an integral manifold that eliminates the need for separate process flanges. To ensure optimal performance, compact orifice will be pre-assembled and tested by the vendor. The compact orifice assembly will have a lay length of 1" (25mm) such that the assembly can mount between standard pipe flanges.

The compact orifice assemblies will be provided with a tool to ensure alignment within 1/32" (0.75mm) during installation.

For general flow applications in line sizes of 4 inches and above an averaging pitot tube shall be considered as an alternate. To ensure optimal performance the primary element, isolation manifold and transmitter shall be pre-assembled and tested by the vendor.

For compressible fluid applications (e.g. steam and gasses), multivariate differential pressure instruments shall be provided. These instruments shall perform real-time calculations for correction of all flow equation variables such as discharge coefficient uncertainty, velocity of approach and gas expansion factors and density based on measurement of pressure, differential pressure and process temperature.

Differential Pressure instruments for custody transfer will have hardware and software write protect security. Hardware security will override software.

Low range differential pressure instruments (below 3inH2O span) used for low flow applications such as furnace and boiler draft measurements shall have a minimum overpressure limit of 300 psig.

Differential Pressure instruments used in applications where steam/heat tracing is used shall measure sensor temperature and allow custom digital temperature alerts to be configured.

The instrument shall allow transfer function selection of linear or square root output.

PRESSURE APPLICATIONS

Pressure and absolute pressure instruments shall be either capacitance or piezoresistive technology based.

Pressure instruments shall be supplied with 2 valve manifolds or block and bleed valves. The instruments shall be calibrated and pressure tested by the vendor with the manifold fitted.

Pressure instruments for custody transfer will have both software and hardware security. Hardware security will override software.

Pressure instruments used in applications where steam/heat tracing is used shall measure sensor temperature and allow custom digital temperature alerts to be configured.

LEVEL APPLICATIONS

Differential pressure instruments used for level measurement shall be capacitance technology based.

Pressure instruments used for level measurement be capacitance or piezoresistive based.

Filled capillary systems used in vacuum applications shall be supplied with welded capillary connections. Threaded connections are not permitted.

Filled capillary systems shall have seals with recessed diaphragms.

Filled capillary systems shall be manufactured with a back up diaphragm pattern behind the process diaphragm to maintain diaphragm integrity and enhance long term performance.

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The vendor shall provide performance calculations for filled capillary pressure instruments that include; maximum working pressure, temperature effects, time response and total probable error at the installed conditions.

The instrument shall allow the digital output of the pressure instrument to be scaled to any user defined level or volume units (e.g. 0-20 m, 0-90000 liters).

The instrument shall allow the 4-20mA analog output to be scaled to any user defined level or volume units (e.g. 0-20 m, 0-90000 liters).

Level instruments that require isolation shall be supplied fitted with integral manifolds. The instruments shall be calibrated and pressure tested by the vendor with the manifold fitted.

Level instruments used in applications where steam/heat tracing is used shall measure sensor temperature and allow custom digital temperature alerts to be configured.

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