



Nuclear Density Gauges

DensityPRO

DensityPRO+

DensityPRO-C

ConsistencyPRO

CutPRO

3680

Thermo Scientific Nuclear Density Gauges

Energy Attenuation Gauges

DensityPRO, DensityPRO+ and DensityPRO-C

Versatile and Dependable

Thermo Scientific DensityPRO gauges fulfill demanding applications in a number of industries, including refining, petrochemical, mining, pulp and paper, cement and food processing. Designed to measure density in challenging process conditions where pipe sizes can range from 1 in (25.4 mm) to 42 in (1066.8 mm), each system offers a range of features in a small, integrated package that minimizes installation costs. Multiprocessor-based electronics ensure uninterrupted output during data entry with user data stored in non-volatile memory with no battery backup required. The detector can be equipped with an optional temperature compensation board and a resistive temperature device that allows the temperature readings to be input to account for temperature fluctuations, ensuring precision and reliability.

Measurement Technology

Density is measured via energy attenuation or ionizing radiation. A radioactive source (Cs-137 or Co-60) contained in a lead-filled, steel-encased housing is mounted on one side of a pipe with an ion-chamber (available for the DensityPRO+ only) or scintillation detector mounted on the opposite side. Gamma energy emitted by the source passes through the pipe and the process material. As the density of the process material changes, the amount of energy reaching the detector changes also. By converting this energy reading to a density measurement, the system achieves a highly accurate reading, enabling rapid response to variations in density.



The expandable DensityPRO+ system is suitable for mass flow measurements.



The DensityPRO system is available with HART and Foundation Fieldbus protocols.



DensityPRO: A Rugged, Reliable Density Gauge

The DensityPRO features an integrated detector that has an isolated loop-powered, self-powered non-isolated or self-powered 4-20 mA output. The I/O can be configured to measure totalized mass flow, flow or dry solids but not all three. This output can be configured to any of eight independent data or span channels. Units are user-selectable, and options include specific gravity, percent by weight solids, BRIX[°] and API[°]. The DensityPRO can accept an external 4-20 mA flowmeter input and calculate a 4-20 mA mass flow signal output. The system is also certified for HART[®] and Foundation Fieldbus[™] to facilitate integration into plant networks.

DensityPRO+: Remote Transmitter Enables Additional I/O

The DensityPRO+ offers either an ion chamber or a scintillation detector depending on the application. The base unit is supplied with a self-powered (or optional loop-powered) isolated 4-20 mA output. Up to three additional isolated and independent 4-20 mA outputs are available. The open architecture of the remote transmitter enables the inclusion of up to three additional I/O boards, making it suitable for mass flow measurements. In addition, the DensityPRO+ can be configured with two, four or six SPDT relays for use as process alarms, totalization or system fault indication.

DensityPRO-C: An Economical Choice

The rugged, economical DensityPRO-C features compact, surface-mounted electronics that have proven to withstand a minimum of 11 Gs at 40 Hz over an extended timeframe with no adverse effects. It is equipped with a HHT that does not have HART protocol and is intended for applications not requiring an RS232 output, HART communication or relays.

Model 3680, CutPRO and ConsistencyPRO

Non-Intrusive Design Installs Easily

Thermo Scientific nuclear density gauges—the 3680, CutPRO and ConsistencyPRO—redefine the standards for gamma-based measurement systems. Each system combines an improved scintillation-based detector with the power of a “smart” transmitter in an explosion-proof housing. Unaffected by pressure, viscosity, corrosives or abrasives, the non-intrusive systems mount easily around an existing process pipe, eliminating the need for pipe modification and process downtime during installation.

Principles of Operation

The 3680, CutPRO and ConsistencyPRO use the proven technology of gamma beam attenuation for real-time monitoring. The transmitter is mounted on a process pipe opposite the source housing and is put in the direct path of a gamma beam emitted through the process pipe from the source housing. The amount of gamma energy that passes through the pipe is inversely proportional to the density of material within the pipe with the 3680 and CutPRO and directly proportional with the consistency of the material with the ConsistencyPRO. The transmitter’s scintillation-based detector produces photons of light when exposed to the gamma beam which are amplified through a photomultiplier tube. The number of pulses from the scintillator-sensor electronics is directly related to the intensity of the gamma energy received. These pulses are conditioned, counted and scaled by the transmitter’s onboard microprocessor to provide process density information (3680), process API information (CutPRO) or process consistency information (ConsistencyPRO).

Gauge Selection by Application

- Model 3680: General Purpose
- CutPRO: API Interface Detection
- ConsistencyPRO: Consistency in Pulp & Paper

Precise and Reliable

The systems use advanced scintillation detection and drift compensation to produce precision up to ± 0.0001 g/cc depending upon field calibration, reference data and system configuration. Designed for dependability and long life, each system features a rugged, epoxy-painted aluminum alloy housing that is water and dust-tight. Three self-contained compartments make the field wiring terminals accessible without exposing the electronics to the ambient environment. The transmitter’s electronics are not affected by fluctuations in the power supply within the specified range. If power is interrupted, the electronics store the configuration data in non-volatile memory. Upon re-establishment of power, the transmitter is immediately fully functional. The measurement systems’ electronics automatically adapt to almost any AC or DC power source supplied and switches to backup DC power when it is provided. All voltages from 90 to 250 VAC 50/60 Hz and 18 to 36 VDC are accepted. The adaptive damping feature provides a method to quickly respond to changes in the process, with users defining the threshold setting as a percentage of full-scale output and the fast-damping time.

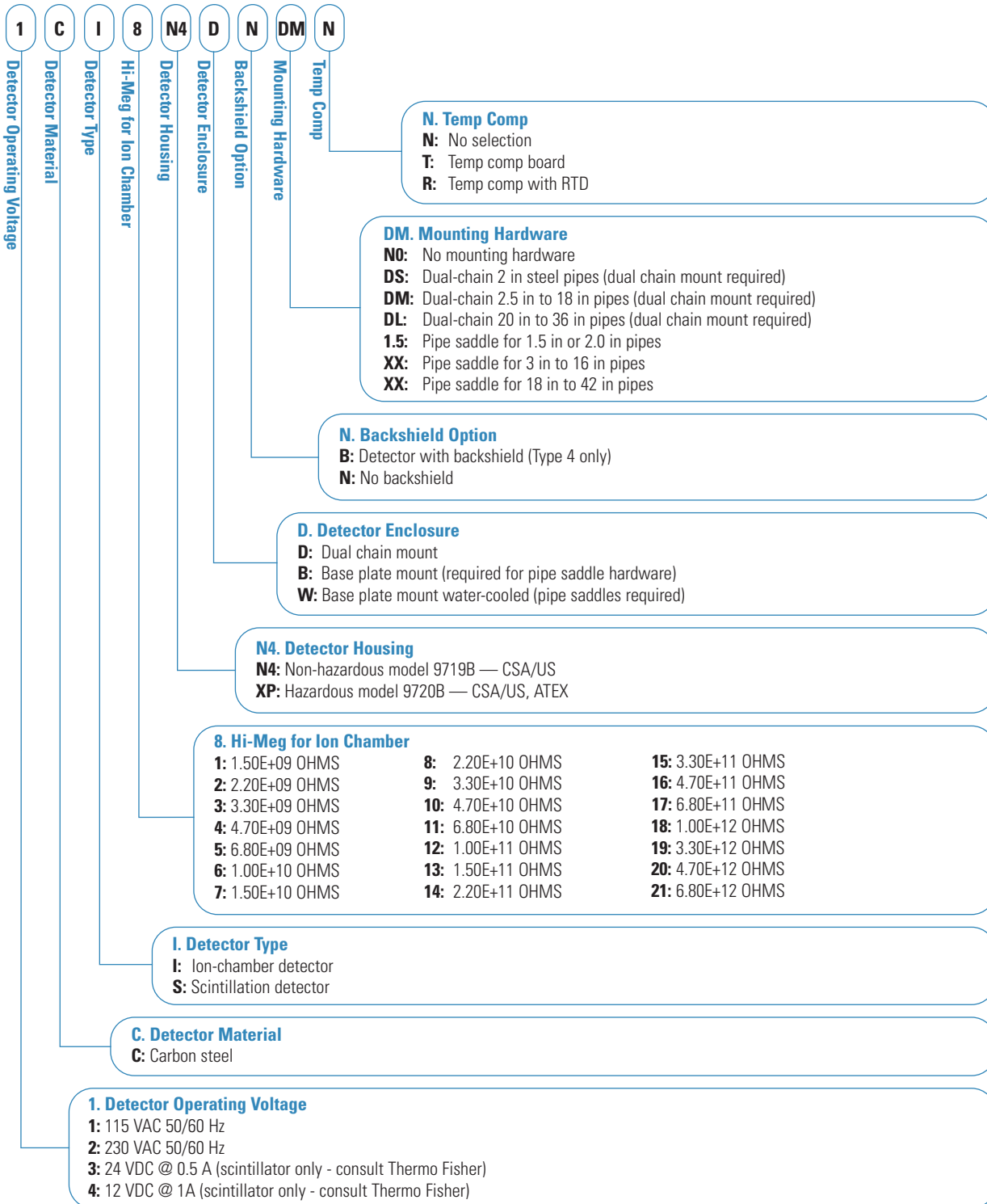


DensityPRO+ Integrated Gamma Density System with Remote Transmitter

Specifications

| Performance Specifications | |
|---|--|
| Precision | From ± 0.001 gm/cc depending upon application |
| Repeatability | ± 0.001 gm/cc depending upon application |
| Stability | Drift less than $\pm 0.05\%$ of radiation change over 6 months |
| Resolution | Analog output 16-bit Internal instrumental IEEE754 floating point |
| Magnetic Field Effect | No effect on output when tested to IEC 770 para. 6.2.10 |
| Ambient Temperature Field | $\pm 0.09\%$ of radiation change per $^{\circ}\text{C}$; $\pm 0.06\%$ of radiation change per $^{\circ}\text{C}$ |
| Surface Radiation | Dependent on the application, source selection and physical installation |
| Power | 115/230 VAC $\pm 10\%$; 50 to 60 Hz; 24 VDC ± 25 ; 12 VDC also available |
| Power Supply Effect | No effect on operation over specified power supply ranges |
| Gamma Ray Source | |
| Type | Cs-137 or Co-60, both stainless steel, doubly encapsulated |
| Size | 10 to 10,000 mCi Cs-137 or 1,000 to 3,000 mCi Co-60 |
| 52XX Series Source Heads | ANSI Accident Condition Fire Test 3 |
| Functional Specifications | |
| Detector/Electronics | PVT plastic scintillator with wide dynamic range (PVT resists shock and moisture damage); Stabilization via electronic control without heater stabilization for optimum performance; Ion chamber |
| Operating Temperature Limits | Gamma Ray Source: -40°C to $+60^{\circ}\text{C}$ (-40°F to $+140^{\circ}\text{F}$) ambient; Water-cooled enclosures are available to extend maximum temperature range of detectors |
| Storage Temperature Limits | -30°C to $+65^{\circ}\text{C}$ (-22°F to $+149^{\circ}\text{F}$) |
| Inputs | Flowmeter: 4 to 20 mA linear; Dry contact closure; Temperature compensation circuitry with 100 ohm platinum RTD 2 or 3 wire |
| Current Outputs | 4 to 20 mA isolated, loop-powered into 700 ohms, field scalable; 4 to 20 mA isolated, self-powered into 700 ohms, field scalable; 4 to 20 mA non-isolated, self-powered into 700 ohms, field scalable |
| Serial Outputs | RS 423 or Bell 202 interface with HART® protocol; Digital signal superimposed on 4-20 mA signal using HART protocol, available for control system interface; Digital signal available via intrinsically safe connection for HART Communicator |
| Contact Closure Inputs | Two programmable dry contact inputs |
| Contact Closure Outputs | Up to six 115 VAC/28 VDC SPDT @ 10 amps (230 VAC SPDT @ 8 A) |
| Source Decay Compensation | Selectable Cs-137, Co-60 or Am-241 |
| Linearization | Logarithmic function and ratio linearization |
| Analog Output Adjustment | Engineering units and range values user-selected; All analog trim and adjustments made through software commands |
| Adjustable Damping | 1 to 1040 seconds |
| Adaptive Damping | See Dynamic Process Tracking |
| Dynamic Process Tracking | Selectable; Automatic 8-to-1 time constant reduction based on process rate of change |
| Transmitter | System architecture: Multiprocessor-based electronics provide uninterrupted output during data entry and system interrogation; Surface-mounted technology provides high degree of reliability; All user data doubly stored in non-volatile memory with no battery backup required; Programming options: Menu-driven offers direct keypad entry; HART Smart Model 375 handheld terminal: used to setup and calibrate gauge, and to enter data; Communicates with any DensityPRO+ via the current loop; BEL202FSK standard; Thermo Scientific 9734 handheld terminal: used to setup and calibrate gauge, and to enter data; communicates with any DensityPRO+ via the RS485 connector; provides upload/download of gauge configuration to/from PC via RS232 interface; Comm PC Interface Software: interface with up to 32 DensityPRO+ units over RS485 loop (RS485 to RS232 converter provided) |
| Physical Specifications | |
| Electrical Connections | Two 3/4 inch NPT fittings; HART Communicator interface connects directly into 4-20 mA loop |
| Interface Cable | Ion chamber cable: standard shielded pair (22 AWG or larger); 1400 m (5000 ft) maximum separation between detector and transmitter; Scintillation cable: two standard shielded pair; 304 m (1000 ft) maximum separation between detector and transmitter |
| Transmitter Display | Thermo Scientific 1400S or 1400A: Four-line backlit display; Easy-to-use setup menus; Displays up to eight readouts simultaneously |
| Gauge Mounting Hardware | Gamma ray source: integral bolt-on bracket; Compatible with chain or saddle mount; Detector: single or dual chain universal mount 63.5 mm (2.5 in) to 914.4 mm (36 in); Pipe saddle mount 50.8 mm (2 in) to 1066.8 mm (42 in); Tabs for mounting on insulated pipes |
| Housing | Detector: Carbon steel polyurethane painted or optional stainless steel 316; Source: carbon steel or optional stainless steel 316, lead filled, polyurethane painted; two position shutter, locks in closed position |
| Detector | PVT plastic scintillator with wide dynamic range; PVT resists shock and moisture damage; Stabilization via electronic control without heater stabilization for optimum performance; Ion chamber |
| Weight, Detector/Electronics | Scintillation detector: 4.5 kg (10 lb); Ion chamber detector: 10 kg (22 lb) |
| Certifications | |
| Canadian Standards Association (CSA/US) | Model 9719B: Class II, Groups E, F & G; Class III; Encl. Type 4 |
| ATEX Hazardous Area | Model 9720B: Class I, Groups B, C & D; Class II, Groups E, F & G; Class III T6; Encl. Type 4 |
| CE | Ex II2G EEx d IICT5 |
| | EMC and LVD |

DensityPRO+ Ordering Information



DensityPRO Integrated Gamma Density System with HART and Foundation Fieldbus Protocols

Specifications

Performance Specifications

| | |
|---------------------------|--|
| Precision | From ± 0.001 gm/cc depending upon application |
| Repeatability | ± 0.001 gm/cc depending upon application |
| Stability | Drift less than $\pm 0.05\%$ of radiation change over 6 months |
| Resolution | Analog output 16-bit Internal instrumental IEEE754 floating point |
| Magnetic Field Effect | No effect on output when tested to IEC 770 para. 6.2.11 |
| Ambient Temperature Field | $\pm 0.09\%$ of radiation change per °C; $\pm 0.06\%$ of radiation change per °C |
| Surface Radiation | Dependent on the application, source selection and physical installation |
| Power | Available options: 115/230 VAC $\pm 10\%$; 50 to 60 Hz or 24 VDC or 12 VDC; Surge protected 9 to 35 VDC |
| Power Supply Effect | No effect on operation over specified power supply ranges |

Gamma Ray Source

| | |
|--------------------------|--|
| Type | Cs-137 or Co-60, both stainless steel, doubly encapsulated |
| Size | 10 to 10,000 mCi Cs-137 or 1,000 to 3,000 mCi Co-60 |
| 52XX Series Source Heads | ANSI Accident Condition Fire Test 3 |

Functional Specifications

| | |
|------------------------------|---|
| Detector/Electronics | PVT plastic scintillator with wide dynamic range (PVT resists shock and moisture damage); Stabilization via electronic control without heater stabilization for optimum performance |
| Operating Temperature Limits | Transmitter/Detector: -40°C to +60°C (-40°F to +140°F) ambient CSA/US, ATEX; -20°C to +60°C (-4°F to +140°F) ambient CE |
| Storage Temperature Limits | -30°C to +65°C (-22°F to +149°F) |
| Inputs | Flowmeter: 4 to 20 mA linear; Dry contact closure; Temperature compensation circuitry with 100 ohm platinum RTD 2 or 3 wire |
| Current Outputs | 4 to 20 mA isolated, loop-powered into 700 ohms, field scalable; 4 to 20 mA isolated, self-powered into 700 ohms, field scalable; 4 to 20 mA non-isolated, self-powered into 700 ohms, field scalable |
| Serial Outputs | RS 422 or Bell 202 interface with HART® protocol; Digital signal superimposed on 4-20 mA signal using HART protocol, available for control system interface; Digital signal available via intrinsically safe connection for HART Communicator; Foundation Fieldbus certified |
| Contact Closure Inputs | Two programmable dry contact inputs |
| Contact Closure Outputs | Two 115 VAC/28 VDC SPDT @ 10 amps (230 VAC SPDT @ 8 A) |
| Source Decay Compensation | Selectable Cs-137, Co-60 or Am-241 |
| Linearization | Logarithmic function and ratio linearization |
| Analog Output Adjustment | Engineering units and range values user-selected; All analog trim and adjustments made through software commands |
| Adjustable Damping | 1 to 1040 seconds |
| Adaptive Damping | See Dynamic Process Tracking |
| Dynamic Process Tracking | Selectable; Automatic 8-to-1 time constant reduction based on process rate of change |
| Transmitter | System architecture: Multiprocessor-based electronics provide uninterrupted output during data entry and system interrogation; Surface-mounted technology provides high degree of reliability; All user data doubly stored in non-volatile memory with no battery backup required; Programming options: Menu-driven offers direct keypad entry; HART Smart Model 475 handheld terminal: used to setup and calibrate gauge, and to enter data; Also available with Foundation Fieldbus protocol; Communicates with any DensityPRO via the current loop; BEL202FSK standard; Thermo Scientific 9734 handheld terminal: used to setup and calibrate gauge, and to enter data; communicates with any DensityPRO via the RS485 connector; provides upload/download of gauge configuration to/from PC via RS232 interface; Comm PC Interface Software: interface with up to 32 DensityPRO units over RS485 loop (RS485 to RS232 converter provided) |

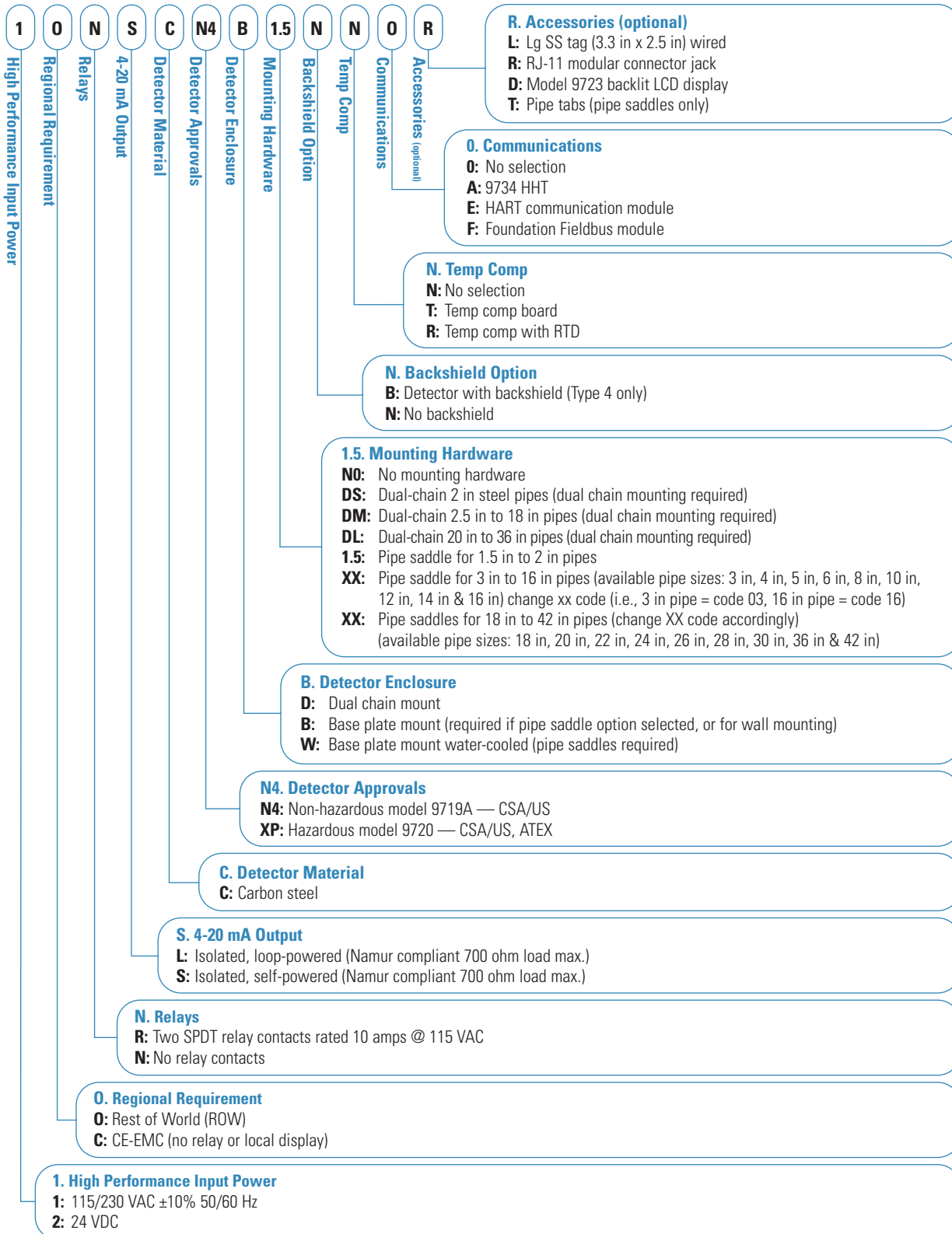
Physical Specifications

| | |
|------------------------------|---|
| Electrical Connections | Two 3/4 inch NPT fittings; HART Communicator interface connects directly into 4-20 mA loop |
| Interface Cable | Shielded 14 to 22 gauge Belden 9318 |
| Transmitter Display | Thermo Scientific 9734 handheld terminal |
| Gauge Mounting Hardware | Gamma ray source: integral bolt-on bracket; Compatible with chain or saddle mount; Transmitter/Detector: single or dual chain universal mount 63.5 mm (2.5 in) to 914.4 mm (36 in); Pipe saddle mount 50.8 mm (2 in) to 1066.8 mm (42 in); Tabs for mounting on insulated pipes |
| Housing | Detector: Carbon steel polyurethane painted or optional stainless steel 316; Source: carbon steel or optional stainless steel 316, lead filled, polyurethane painted; two position shutter, locks in closed position |
| Detector | PVT plastic scintillator with wide dynamic range; Resists shock and moisture damage |
| Weight, Detector/Electronics | 4.5 kg (10 lb) |

Certifications

| | |
|---|---|
| Canadian Standards Association (CSA/US) | Model 9719A: Class II, Groups E, F & G; Class III; Encl. Type 4 Model 9720A: Class I, Groups B, C & D; Class II, Groups E, F & G; Class III T6; Encl. Type 4 |
| ATEX Hazardous Area | Ex II2G EEx d IICT5 |
| CE | EMC and LVD |

DensityPRO Ordering Information



DensityPRO-C Integrated Gamma Density System (no HART Protocol)

Specifications

Performance Specifications

| | |
|---------------------------|--|
| Precision | From ± 0.001 gm/cc depending upon application |
| Repeatability | ± 0.001 gm/cc depending upon application |
| Stability | Drift less than $\pm 0.05\%$ of radiation change over 6 months |
| Resolution | Analog output 16-bit Internal instrumental IEEE754 floating point |
| Magnetic Field Effect | No effect on output when tested to IEC 770 para. 6.2.12 |
| Ambient Temperature Field | $\pm 0.09\%$ of radiation change per °C; $\pm 0.06\%$ of radiation change per °C |
| Surface Radiation | Dependent on the application, source selection and physical installation |
| Power | 115/230 VAC $\pm 10\%$; 50 Hz to 60 Hz |
| Power Supply Effect | No effect on operation over specified power supply ranges |

Gamma Ray Source

| | |
|--------------------------|--|
| Type | Cs-137 or Co-60, both stainless steel, doubly encapsulated |
| Size | 10 to 10,000 mCi Cs-137 or 10 to 3,000 mCi Co-60 |
| 52XX Series Source Heads | ANSI Accident Condition Fire Test 3 |

Functional Specifications

| | |
|------------------------------|--|
| Detector/Electronics | PVT plastic scintillator with wide dynamic range (PVT resists shock and moisture damage); Stabilization via electronic control without heater stabilization for optimum performance |
| Operating Temperature Limits | Transmitter/Detector: -40°C to +60°C (-40°F to +140°F) ambient |
| Storage Temperature Limits | -30°C to +65°C (-22°F to +149°F) |
| Inputs | Flowmeter: 4 to 20 mA linear; Temperature compensation circuitry with 100 ohm platinum RTD 2 or 3 wire |
| Current Outputs | 4 to 20 mA isolated loop-powered into 700 ohms, field scalable |
| Serial Outputs | RS 485 half duplex; RS 232 full duplex |
| Contact Closure Inputs | Not Available |
| Contact Closure Outputs | Not Available |
| Source Decay Compensation | Selectable Cs-137, Co-60 or Am-241 |
| Linearization | Logarithmic function and ratio linearization |
| Analog Output Adjustment | Engineering units and range values user-selected; All analog trim and adjustments made through software commands |
| Adjustable Damping | 1 to 1040 seconds |
| Adaptive Damping | See Dynamic Process Tracking |
| Dynamic Process Tracking | Selectable; Automatic 8-to-1 time constant reduction based on process rate of change |
| Transmitter | Thermo Scientific 9734 handheld terminal: Used to setup and calibrate gauge, and to enter data; communicates with any DensityPRO-C via the RS485 connector; provides upload/download of gauge configuration to/from PC via RS485 interface; Comm PC Interface Software: interface with up to 32 DensityPRO-C units over RS485 loop (RS485 to RS232 converter provided) |

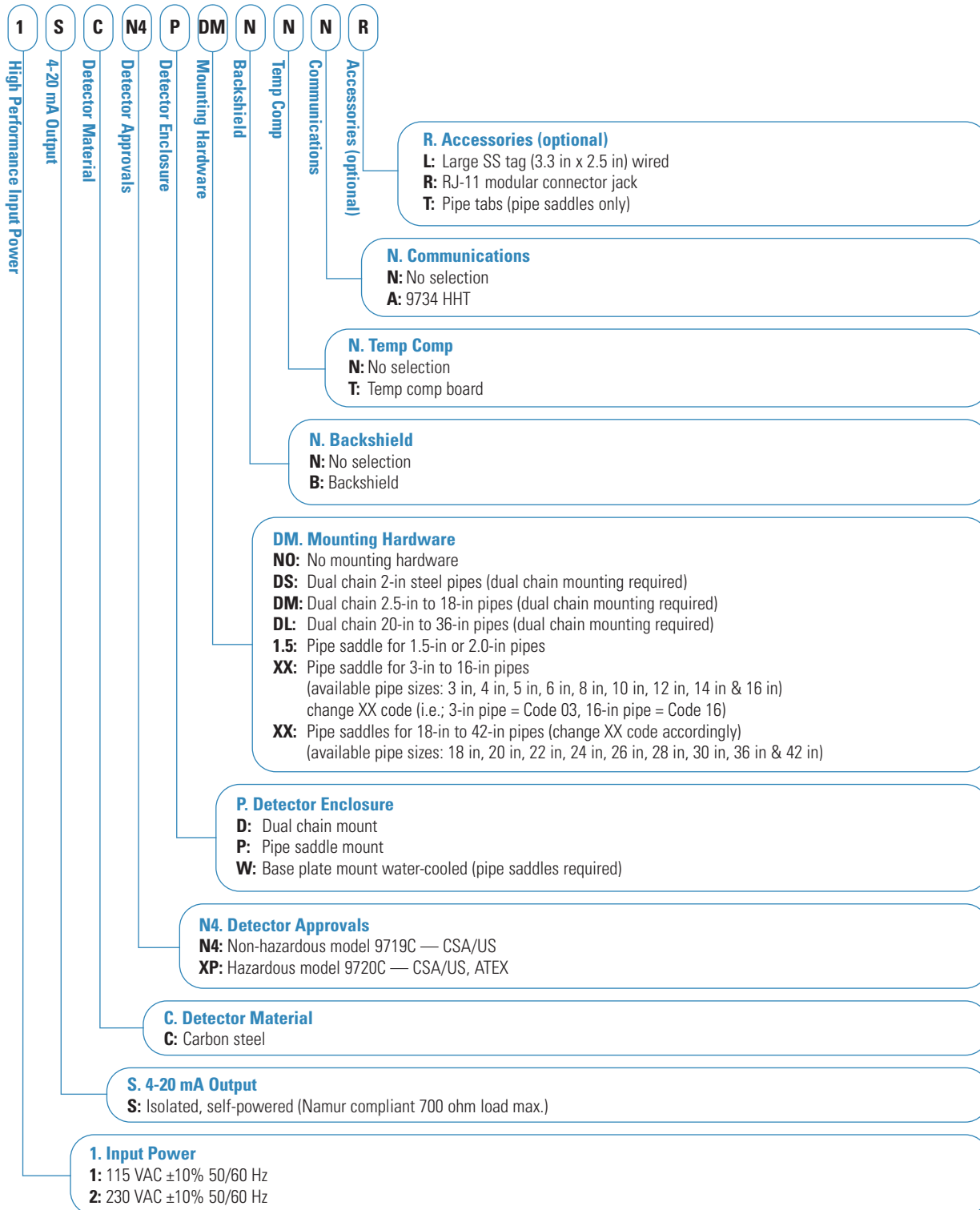
Physical Specifications

| | |
|------------------------------|---|
| Electrical Connections | Two 3/4 inch NPT fittings |
| Interface Cable | Shielded 14 to 22 gauge Belden 9318 |
| Transmitter Display | Thermo Scientific 9734 handheld terminal |
| Gauge Mounting Hardware | Gamma ray source: integral bolt-on bracket; Compatible with chain or saddle mount; Transmitter/Detector: single or dual chain universal mount 63.5 mm (2.5 in) to 914.4 mm (36 in); Pipe saddle mount 50.8 mm (2 in) to 1066.8 mm (42 in); Tabs for mounting on insulated pipes |
| Housing | Detector: Carbon steel polyurethane painted or optional stainless steel 316; Source: carbon steel or optional stainless steel 316, lead filled, polyurethane painted; Two position shutter, locks in closed position |
| Detector | PVT plastic scintillator with wide dynamic range; Resists shock and moisture damage |
| Weight, Detector/Electronics | 2.2 kg (5.0 lb) |

Certifications

| | |
|---|--|
| Canadian Standards Association (CSA/US) | Model 9719C: Class II, Groups E, F & G; Class III; T6; Encl. Type 4 |
| ATEX Hazardous Area | Model 9720C: Class I, Groups B, C & D; Class II, Groups E, F & G; Class III T6; Encl. Type 4 |
| CE | Ex II 2GD Ex d IIC (Tamb -40°C to +60°C) T+80°C, T6 (Zone 1) |
| | EMC and LVD |

DensityPRO-C Ordering Information



Model 3680 Smart Density Transmitter

Specifications

Performance Specifications

| | |
|---------------------------|--|
| Precision | Maximum accuracy of ± 0.001 g/cc. Dependent upon field calibration, reference data and system configuration |
| Repeatability | ± 0.001 g/cc (99% confidence) typical conditions |
| Stability | Drift less than $\pm 0.05\%$ of radiation change over 6 months |
| Resolution | Analog output 16-bit Internal instrumental IEEE754 floating point |
| Magnetic Field Effect | No effect on output when tested to IEC 770 para. 6.2.9 |
| Ambient Temperature Field | $\pm 0.009\%$ of radiation change per $^{\circ}\text{C}$; $\pm 0.006\%$ of radiation change per $^{\circ}\text{C}$ for 3680XB designated transmitters |
| Surface Radiation | Dependent on the application, source selection and physical installation |
| Power | 90-250 VAC, 50-60 Hz or 18-36 VDC |
| Power Supply Effect | No effect on operation over specified power supply ranges |

Gamma Ray Source

| | |
|--------------------------|--|
| Type | Cs-137 or Co-60, both stainless steel, doubly encapsulated |
| Size | 10 to 10,000 mCi Cs-137 or 1,000 to 3,000 mCi Co-60 |
| 52XX Series Source Heads | ANSI Accident Condition Fire Test 3 |

Functional Specifications

| | |
|------------------------------|---|
| Detector/Electronics | PVT plastic scintillator with wide dynamic range (PVT resists shock and moisture damage); Stabilization via electronic control without heater stabilization for optimum performance |
| Operating Temperature Limits | -20°C to $+50^{\circ}\text{C}$ (-4°F to $+122^{\circ}\text{F}$) |
| Storage Temperature Limits | -30°C to $+65^{\circ}\text{C}$ (-22°F to $+149^{\circ}\text{F}$) |
| Inputs | Optional: RTD three-wire 100 ohm temperature sensor and 4-20 mA temperature transmitter inputs; Internal 24 VDC source is available to power the temperature transmitter |
| Current Outputs | 4-20 mA, internally powered, up to 500 ohm load |
| Serial Outputs | RS 423 or Bell 202 interface with HART [®] protocol; Digital signal superimposed on 4-20 mA signal using HART protocol, available for control system interface; Digital signal available via intrinsically safe connection for HART Communicator |
| Contact Closure Inputs | Not Available |
| Contact Closure Outputs | Not Available |
| Source Decay Compensation | Selectable Cs-137, Co-60 or Am-241 |
| Linearization | Logarithmic and multipoint characterization |
| Analog Output Adjustment | Engineering units and range values user-selected; All analog trim and adjustments made through software commands |
| Adjustable Damping | Adjusts between 0.5 seconds and 600 seconds in 0.5 second increments |
| Adaptive Damping | Optionally selectable On or Off with 0.5 to 30 second time constant adjustable in 0.5 second increments; Activation threshold adjustable from 0-100% of span |
| Dynamic Process Tracking | Not required due to Adaptive Damping |
| Transmitter | HART 375 handheld terminal |

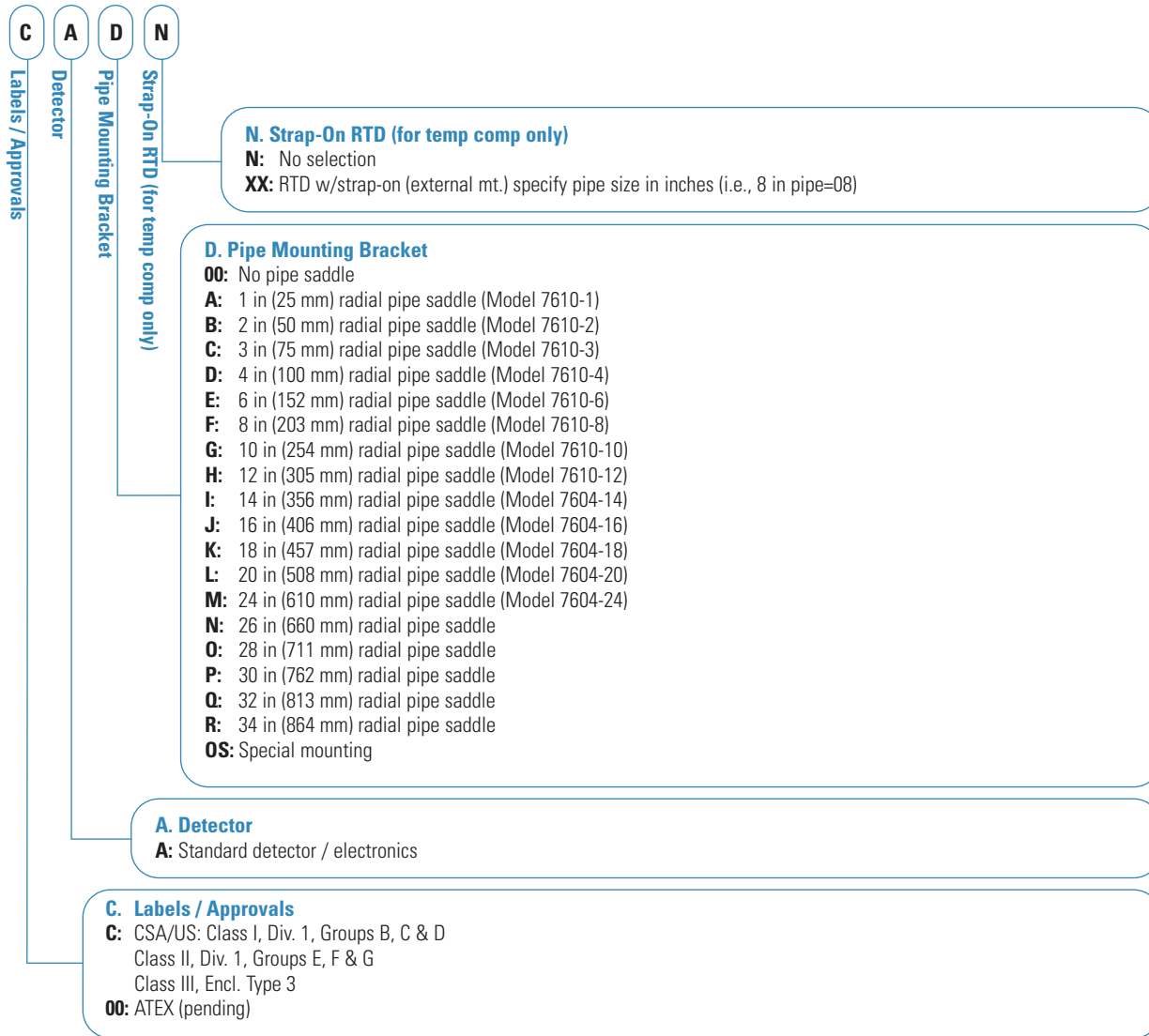
Physical Specifications

| | |
|------------------------------|---|
| Electrical Connections | Five 1/2-NPT conduit connections [PG 13.5 (PG11) and CM20 conduit with adapter]; Barrier terminal strips accept #12 AWG and smaller wiring or 0.312 inch wide spade tags; HART Communicator interface connects directly into 4-20 mA loop and/or intrinsically safe connection behind removable cover |
| Interface Cable | Shielded 14 to 22 gauge Belden 9318 |
| Transmitter Display | HART 375 |
| Gauge Mounting Hardware | Gamma ray source: integral bolt-on bracket; Compatible with saddle mount; Detector: pipe saddle mount 50.8 mm (2 in) to 1066.8 mm (42 in); Tabs for mounting on insulated pipes |
| Housing | Detector: low copper aluminum alloy; Paint: epoxy-polyester; Case seals: 'O' rings and gaskets are Nitrile (Buna-N) rubber; Source housing: carbon steel or optional stainless steel 316, lead filled, polyurethane painted; two position shutter, locks in closed position |
| Detector | PVT plastic scintillator with wide dynamic range; Resists shock and moisture damage |
| Weight, Detector/Electronics | 22 kg (55 lb) |

Certifications

| | |
|---|--|
| Canadian Standards Association (CSA/US) | Class I, Div 1, Groups B, C & D; Class II, Div 1, Groups E, F & G; Class III, Enclosure Type 3 |
| ATEX Hazardous Area | Pending |

Model 3680 Ordering Information



CutPRO Nuclear Density Gauge for API Interface Detection

Specifications

Performance Specifications

| | |
|---------------------------|--|
| Precision | Maximum accuracy of ± 0.0005 g/cc. Dependent upon field calibration, reference data and system configuration |
| Repeatability | ± 0.0005 g/cc (99% confidence) typical conditions |
| Stability | Drift less than $\pm 0.05\%$ of radiation change over 6 months |
| Resolution | Analog output 16-bit Internal instrumental IEEE754 floating point |
| Magnetic Field Effect | No effect on output when tested to IEC 770 para. 6.2.9 |
| Ambient Temperature Field | $\pm 0.009\%$ of radiation change per $^{\circ}\text{C}$; $\pm 0.006\%$ of radiation change per $^{\circ}\text{C}$ for 3680XB designated transmitters |
| Surface Radiation | Dependent on the application, source selection and physical installation |
| Power | 90-250 VAC, 50-60 Hz, or 18-36 VDC |
| Power Supply Effect | No effect on operation over specified power supply ranges |

Gamma Ray Source

| | |
|--------------------------|--|
| Type | Cs-137 or Co-60, both stainless steel, doubly encapsulated |
| Size | 10 to 10,000 mCi Cs-137 or 1,000 to 3,000 mCi Co-60 |
| 52XX Series Source Heads | ANSI Accident Condition Fire Test 3 |

Functional Specifications

| | |
|------------------------------|---|
| Detector/Electronics | PVT plastic scintillator with wide dynamic range (PVT resists shock and moisture damage); Stabilization via electronic control without heater stabilization for optimum performance |
| Operating Temperature Limits | -20°C to $+50^{\circ}\text{C}$ (-4°F to $+122^{\circ}\text{F}$) |
| Storage Temperature Limits | -30°C to $+65^{\circ}\text{C}$ (-22°F to $+149^{\circ}\text{F}$) |
| Inputs | Optional: RTD three-wire 100 ohm temperature sensor and 4-20 mA temperature transmitter inputs; Internal 24 VDC source is available to power the temperature transmitter |
| Current Outputs | 4-20 mA, internally powered, up to 500 ohm load |
| Serial Outputs | RS 423 or Bell 202 interface with HART [®] protocol; Digital signal superimposed on 4-20 mA signal using HART protocol, available for control system interface; Digital signal available via intrinsically safe connection for HART Communicator |
| Contact Closure Inputs | Not Available |
| Contact Closure Outputs | Not Available |
| Source Decay Compensation | Selectable Cs-137, Co-60 or Am-241 |
| Linearization | Logarithmic and multipoint characterization |
| Analog Output Adjustment | Engineering units and range values user-selected; All analog trim and adjustments made through software commands |
| Adjustable Damping | Adjusts between 0.5 seconds and 600 seconds in 0.5 second increments |
| Adaptive Damping | Optionally selectable On or Off with 0.5 to 30 second time constant adjustable in 0.5 second increments; Activation threshold adjustable from 0-100% of span |
| Dynamic Process Tracking | Not required due to Adaptive Damping |
| Transmitter | HART 375 handheld terminal |

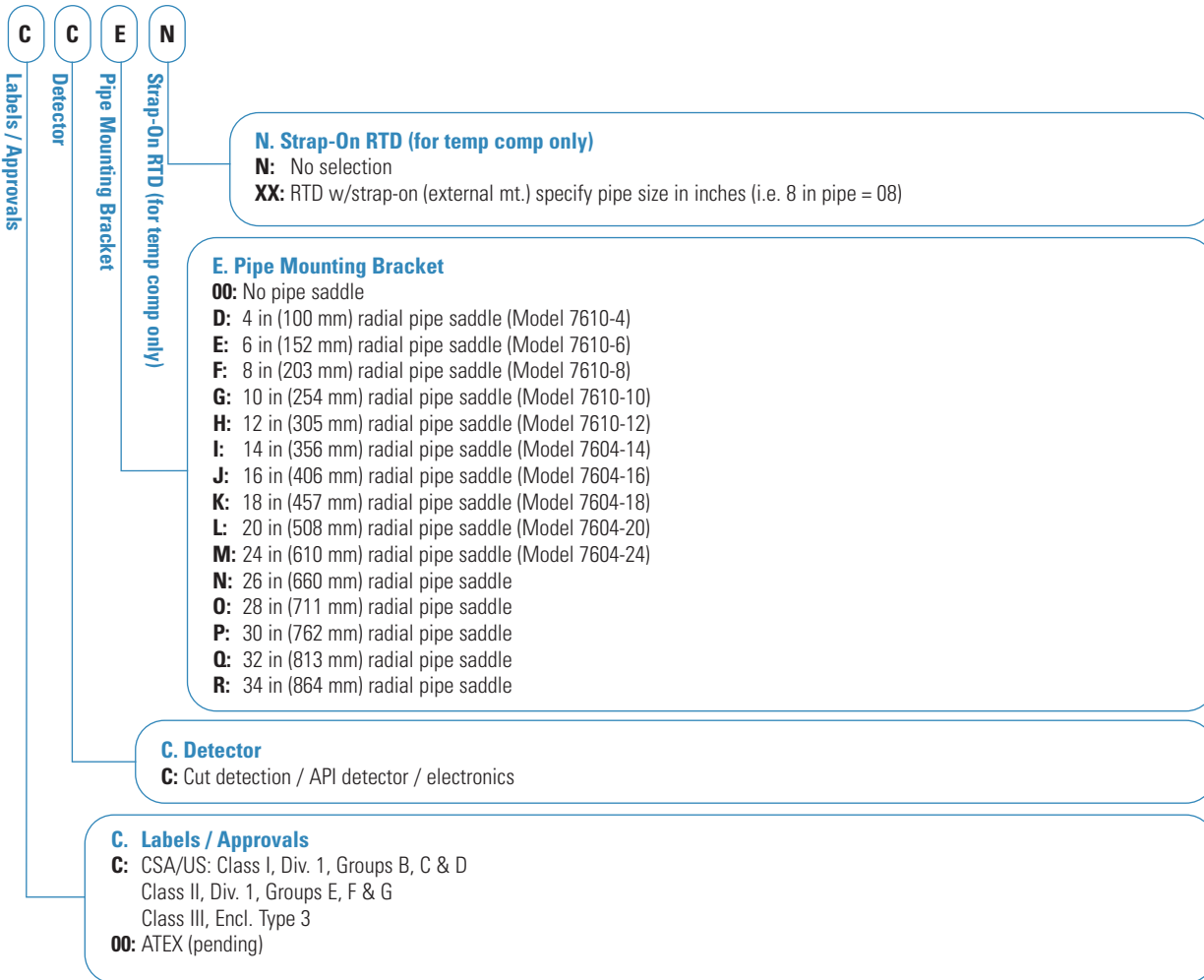
Physical Specifications

| | |
|------------------------------|---|
| Electrical Connections | Five 1/2-NPT conduit connections [PG 13.5 (PG11) and CM20 conduit with adapter]; Barrier terminal strips accept #12 AWG and smaller wiring or 0.312 inch wide spade tags; HART Communicator interface connects directly into 4-20 mA loop and/or intrinsically safe connection behind removable cover |
| Interface Cable | Shielded 14 to 22 gauge Belden 9318 |
| Transmitter Display | HART 375 |
| Gauge Mounting Hardware | Gamma ray source: integral bolt-on bracket; Compatible with saddle mount; Detector: pipe saddle mount 50.8 mm (2 in) to 1066.8 mm (42 in); Tabs for mounting on insulated pipes |
| Housing | Detector: low copper aluminum alloy; Paint: epoxy-polyester; Case seals: 'O' rings and gaskets are Nitrile (Buna-N) rubber; Source housing: carbon steel or optional stainless steel 316, lead filled, polyurethane painted; two position shutter, locks in closed position |
| Detector | PVT plastic scintillator with wide dynamic range; Resists shock and moisture damage |
| Weight, Detector/Electronics | 22 kg (55 lb) |

Certifications

| | |
|---|--|
| Canadian Standards Association (CSA/US) | Class I, Div 1, Groups B, C & D; Class II, Div 1, Groups E, F & G; Class III, Enclosure Type 3 |
| ATEX Hazardous Area | Pending |

CutPRO Ordering Information



ConsistencyPRO Nuclear Density Gauge for Consistency in Pulp & Paper

Specifications

Performance Specifications

| | |
|---------------------------|--|
| Precision | Maximum accuracy of ± 0.0005 g/cc. Dependent upon field calibration, reference data and system configuration |
| Repeatability | ± 0.0005 g/cc (99% confidence) typical conditions |
| Stability | Drift less than $\pm 0.05\%$ of radiation change over 6 months |
| Resolution | Analog output 16-bit Internal instrumental IEEE754 floating point |
| Magnetic Field Effect | No effect on output when tested to IEC 770 para. 6.2.9 |
| Ambient Temperature Field | $\pm 0.009\%$ of radiation change per $^{\circ}\text{C}$; $\pm 0.006\%$ of radiation change per $^{\circ}\text{C}$ for 3680XB designated transmitters |
| Surface Radiation | Dependent on the application, source selection and physical installation |
| Power | 90-250 VAC, 50-60 Hz or 18-36 VDC |
| Power Supply Effect | No effect on operation over specified power supply ranges |

Gamma Ray Source

| | |
|--------------------------|--|
| Type | Cs-137 or Co-60, both stainless steel, doubly encapsulated |
| Size | 10 to 10,000 mCi Cs-137 or 1,000 to 3,000 mCi Co-60 |
| 52XX Series Source Heads | ANSI Accident Condition Fire Test 3 |

Functional Specifications

| | |
|------------------------------|---|
| Detector/Electronics | PVT plastic scintillator with wide dynamic range (PVT resists shock and moisture damage); Stabilization via electronic control without heater stabilization for optimum performance |
| Operating Temperature Limits | -20°C to $+50^{\circ}\text{C}$ (-4°F to $+122^{\circ}\text{F}$) |
| Storage Temperature Limits | -30°C to $+65^{\circ}\text{C}$ (-22°F to $+149^{\circ}\text{F}$) |
| Inputs | Optional: RTD three-wire 100 ohm temperature sensor and 4-20 mA temperature transmitter inputs; Internal 24 VDC source is available to power the temperature transmitter |
| Current Outputs | 4-20 mA, internally powered, up to 500 ohm load |
| Serial Outputs | RS 423 or Bell 202 interface with HART [®] protocol; Digital signal superimposed on 4-20 mA signal using HART protocol, available for control system interface; Digital signal available via intrinsically safe connection for HART Communicator |
| Contact Closure Inputs | Not Available |
| Contact Closure Outputs | Not Available |
| Source Decay Compensation | Selectable Cs-137, Co-60 or Am-241 |
| Linearization | Logarithmic and multipoint characterization |
| Analog Output Adjustment | Engineering units and range values user-selected; All analog trim and adjustments made through software commands |
| Adjustable Damping | Adjusts between 0.5 seconds and 600 seconds in 0.5 second increments |
| Adaptive Damping | Optionally selectable On or Off with 0.5 to 30 second time constant adjustable in 0.5 second increments; Activation threshold adjustable from 0-100% of span |
| Dynamic Process Tracking | Not required due to Adaptive Damping |
| Transmitter | HART 375 handheld terminal |

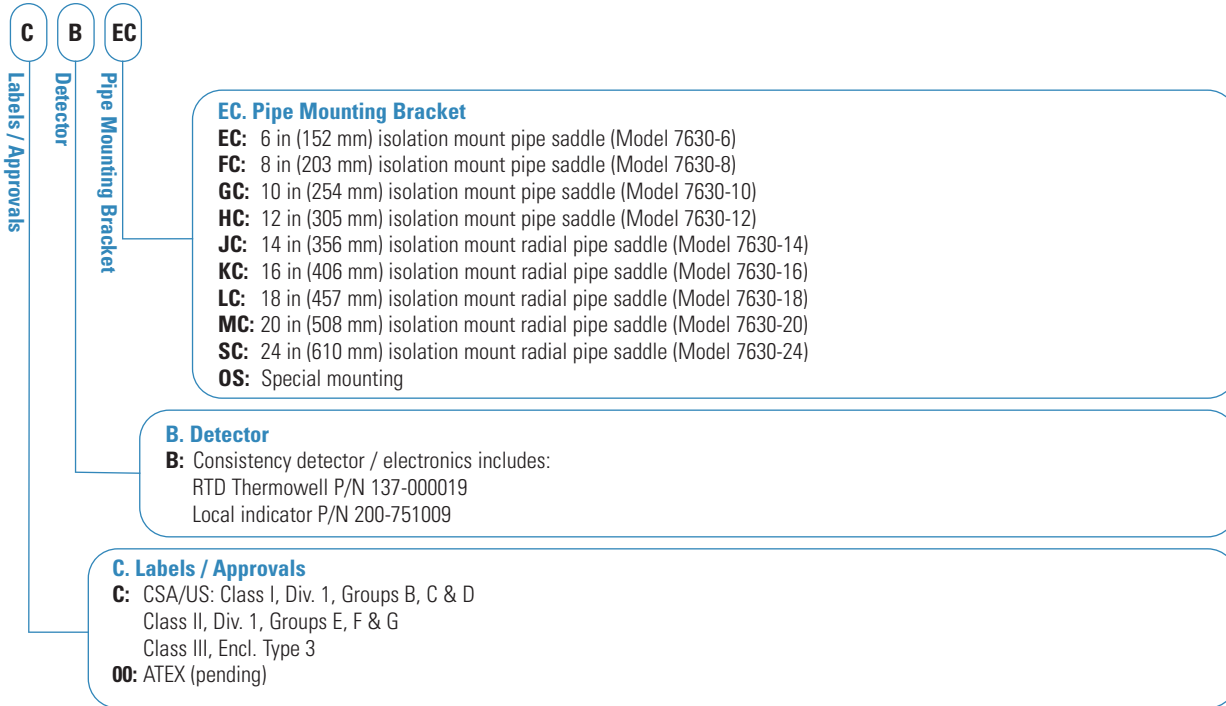
Physical Specifications

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|------------------------------|---|
| Electrical Connections | Five 1/2-NPT conduit connections [PG 13.5 (PG11) and CM20 conduit with adapter]; Barrier terminal strips accept #12 AWG and smaller wiring or 0.312 inch wide spade tags; HART Communicator interface connects directly into 4-20 mA loop and/or intrinsically safe connection behind removable cover |
| Interface Cable | Shielded 14 to 22 gauge Belden 9318 |
| Transmitter Display | HART 375 |
| Gauge Mounting Hardware | Gamma ray source: integral bolt-on bracket; Compatible with saddle mount; Detector: pipe saddle mount 50.8 mm (2 in) to 1066.8 mm (42 in); Tabs for mounting on insulated pipes |
| Housing | Detector: low copper aluminum alloy; Paint: epoxy-polyester; Case seals: 'O' rings and gaskets are Nitrile (Buna-N) rubber; Source housing: carbon steel or optional stainless steel 316, lead filled, polyurethane painted; two position shutter, locks in closed position |
| Detector | PVT plastic scintillator with wide dynamic range; Resists shock and moisture damage |
| Weight, Detector/Electronics | 22 kg (55 lb) |

Certifications

| | |
|---|--|
| Canadian Standards Association (CSA/US) | Class I, Div 1, Groups B, C & D; Class II, Div 1, Groups E, F & G; Class III, Enclosure Type 3 |
| ATEX Hazardous Area | Pending |

ConsistencyPRO Ordering Information



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