



Nuclear Level Systems

4790 Continuous Gamma Level System

PNF Point Level Measurement System

LevelPRO Continuous Level Gauge

The Thermo Scientific nuclear level systems provide precise, accurate and repeatable measurements, giving the data needed to increase your process efficiency, run a safer system, produce higher quality products and improve your bottom line. Our nuclear technologies meet point level and continuous level measurement needs from the simplest to the most demanding applications.

4790 Continuous Gamma Level System

Features and Benefits

- Non-contacting and non-invasive design makes the 4790 ideal for abrasive, corrosive, high pressure and high temperature applications.
- NEMA 4X transmitter enclosure surrounds the M electronics. Simple, easy-to-use menu structure allows for set-up of 4790 in minutes.
- Sophisticated digital communications between detectors and transmitter insure trouble free operation.
- HART® Smart communications available to facilitate ease of set-up and calibration.
- FMRC and CSA approvals for hazardous environments allow for installation in most environments.
- The 4790 operates from 90 to 264 VAC or 18 to 36 VDC offering several alternatives to fit your power needs.
- With detector lengths ranging to 10 ft, a total span of 40 ft is achievable.

Introduction

The Thermo Scientific 4790 Continuous Gamma Level System raises the standard for non-contacting nuclear level measurement. The 4790 utilizes microprocessor-based electronics, a menu-driven operator interface, a rugged chamber design and state-of-the-art HART communication protocol. These technologies combine to deliver the most reliable and easy-to-use, generally licensed continuous level system available today. Gamma energy provides a simple, reliable, non-intrusive system to monitor and control the level of liquids, solids or slurries, regardless of vessel size and shape. Because measurement occurs outside the containment vessel, the gamma system is not affected by high temperatures, high pressures, corrosives, abrasives, vapors and dusts that could affect or even destroy intrusive measurement devices. This non-intrusive approach also eliminates the need for routine vessel entries that could endanger personnel or allow fugitive emissions.

Principle of Operation

Low level gamma energy is emitted in a controlled pattern from a source housing, through the vessel walls, to an ion chamber-based detector (maximum of four detectors) placed on the other side of the vessel. As the material in the vessel fills, the amount of gamma energy reaching the detector is partially blocked, creating a shadow-like impression on the detector. The microprocessor-based electronics mounted in the detector convert the gamma energy into a digital communication signal that is sent via a standard three-wire instrument cable to the level transmitter. The transmitter includes a menu-driven local display and an isolated 4-20 mA DC output signal for operator interface and level indication. All signal processing and system diagnostics are performed within the transmitter.

M Transmitter

The M-Series Level Transmitter is reliable, flexible and easy to use. Reliability is greatly enhanced due to the microprocessor-based electronics and digital communications between the detector and the transmitter. Digital signal processing eliminates the effects of vibration and electrical noise on the detector's raw output. Software allows the user to select one of the predetermined engineering units (feet, inches, meters, centimeters, % full) or their own special unit of measure. The user can also select the use of a standard, or adaptive, time constant to compensate for quick level tracking. Ease of calibration is derived from the menu-driven, "fill-in-the-blank" operator interface and backlit 4 line, 20 character per line LCD display. The menu driven prompts, displayed in English, quickly guide the user through the steps necessary to set-up, calibrate and operate the system. All the same calibration and communication functions can be performed remotely with HART communications. Users can even customize unique vessel shapes using a built-in, ten-point calibration curve. The NEMA 4X transmitter with FM and CSA approvals is control room mountable, contains non-volatile memory, accepts multiple input power ranges, and the self-diagnostics continually update the system status to the M transmitter's LCD display. Should an error be detected, an asterisk will appear in the upper right corner of the display. The user simply presses the status key to display the error status message.





PNF Point Level Measurement System

Introduction

The Thermo Scientific PNF point level measurement system provides cost effective on-off control of circuits. It is mounted externally on tanks, bins, hoppers, pipes, chutes, or other vessels to sense the level of liquids, slurries, and solids. A relay contact output can control high or low level, or operate alarms to signal level changes. The PNF consists of two components: an energy source in a steel-jacketed housing and the detector/electronics. It operates on the principle of gamma ray attenuation. The gamma energy source emits a narrow beam of energy which passes through the vessel walls to the detector. When process material is in the beam path, the energy is attenuated and not all of it reaches the detector. If the process material is not in the beam path, the detector receives an unattenuated amount of energy. The amount of energy at the detector is "counted" by the electronics. As the count rate falls below (for high level) or goes above (for low level) a predetermined reference, the output relay is energized.

Reliability

Reliability is the dominant theme of the PNF level switch. The Geiger-Mueller tube detector has a long history of trouble-free service.

System Features

The PNF measures level across a variable distance, depending upon the application, using digital techniques. The source housing shields the source and confines the energy to a small beam. Source size and housing type are determined by application requirements. Since there are no varying voltages or current levels to be amplified, low signal rates are no problem. Each individual pulse from the detector is counted and accumulated to make high and low decisions, usually allowing source sizes

to be as much as 10 times lower than those required by analog designs. The response time can be set in the field. In general, a long response time can be used to prevent short term uncertainties due to process variations in the area where level is being monitored, and also to allow the use of the minimum source size. Response times of 0.5 seconds to several minutes can be provided. The source shutter can be locked in the *OFF* position for installation, shut-downs, shipment, etc. An optional remote manual actuator is available for most source housings. This enables operation of the source shutter from a distance. An optional shutter indicator switch consisting of SPDT contacts provides remote indication of the source shutter position for greater safety.

Features and Benefits

- Non-contacting, non-invasive high or level indication
- Highly reliable and rugged
- Digital technology
- Simple installation and easy set-up
- FM approved for hazardous areas
- Unaffected by process variables such as pressure, temperature, viscosity or density

LevelPRO Continuous Level Gauge

Introduction

The Thermo Scientific LevelPRO is the next-generation continuous level gauge from Thermo Fisher Scientific, the leader in gamma measurement with more than 45 years of experience. The LevelPRO features menu driven setup, a scintillation detector, and an integrated transmitter/detector design. We also offer a full service approach to gamma gauging, starting with installation, training and on-site service as well as decommissioning and source disposal.

Gamma Measurement Technology

The LevelPRO uses energy attenuation to measure level. A radioactive source (Cs 137 or Co-60) is contained in a lead-filled, steel-encased housing and mounted on one side of a vessel. A strip scintillation detector is mounted on the opposite side of the vessel. Gamma energy emitted by the source passes through the vessel walls and the air space above the process to the detector. As the level of the process material increases, the energy reaching the detector decreases. The LevelPRO electronics convert this change in energy to a level measurement. Using this technique, the LevelPRO can produce a highly accurate level reading and respond rapidly to variations in level.

Scintillation Detectors

The Thermo Scientific LevelPRO features an extremely sensitive and precise scintillation detector which enables the use of small sources. Detectors are offered in different lengths to accommodate various applications, and multiple detectors can be used together for large span requirements. Standard detector lengths are in 1 ft increments from 1 ft to 12 ft. A standard steel enclosure, or an optional water-cooled enclosure, is available for high-temperature installations.

Stability

The scintillation detector used with the LevelPRO is highly stable. This stability is achieved utilizing sophisticated pulse-height stabilization circuitry. By continually monitoring the pulses received from the detector, small changes in pulse height can be detected indicating a change in relative temperature. Using a sophisticated algorithm, the LevelPRO can adjust the reported signal value to compensate for the temperature effects to maintain stability over the operating range of the detector. No separate heater blanket is required. This technique allows the use of extremely small sources in most applications.

Features and Benefits

- Non-contacting design makes the LevelPRO ideal for abrasive, corrosive, high pressure and high temperature applications.
- Integrated transmitter/detector reduces installation and wiring costs
- Unique gamma transmission technology is unaffected by process variables such as pressure, temperature, viscosity or density.
- Scintillation detector sensitivity provides high precision with small source sizes. Typical LevelPRO repeatability is 0.5% of the detector span.
- Input for gas/vapor density or buildup compensation.
- Outputs include level, volume and rate in any user-selected units.



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Thermo
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LevelPRO Integrated Continuous Nuclear/Gamma Level

Specifications

Performance Specifications

System Performance 0.5% of span typical

Gamma Ray Source

Source Type Cs-137 or Co-60 both stainless steel doubly encapsulated

Size 10-10,000 mCi Cs-137 or 1,000-2,000 mCi Co-60 (Source size is dependent upon application)

Source Housing Carbon steel, lead filled, polyurethane painted (stainless steel also available)

Two position shutter, locks in "closed" position

30°, 45° and 60° beam angle source housings available (Beam angle is dependent on application)

Integrated Transmitter Detector

System Architecture Multiprocessor based electronics means uninterrupted output during data entry and system interrogation

Surface mount technology provides high degree of reliability

All user data doubly stored in non-volatile memory with no battery backup required

Detection Type PVT plastic scintillator with wide dynamic range. PVT resists shock and moisture damage

Detector Lengths Standard detector lengths are in 1 foot increments from 1 foot to 12 feet (0.3 meters to 3.6 meters)

Multiple detectors can be wired together for large measurement spans (unlimited in number)

Power 115/230 VAC ±10%; 50 to 60 Hz or 24 VDC available

Surge protected 9 to 35 VDC

Operating Temperature -40°C to +60°C (-40°F to +140°F) ambient

Enclosure Construction Carbon steel polyurethane painted

Optional water-cooled detector for higher temperature applications

Approvals FMRC approved Class I, Div. 1, Groups B, C and D; dust-ignition proof in Class II, Div. 1, Groups E, F and G, suitable for Class III, Div. 1 hazardous locations, indoor and outdoor NEMA 4

CSA approved Class I, Div. 1, Groups B, C and D; dust-ignition proof in Class II, Div. 1, Groups E, F and G; suitable for Class III, Div. 1 hazardous locations, indoor and outdoor CSA ENCL 4

LCIE ATEX approved flameproof EEx d IIB+H2 T6, II 2 G IP66

CE Mark

Outputs / Inputs

Current Outputs 4 to 20 mA isolated loop-powered into 800 ohms, field scalable

4 to 20 mA isolated, self-powered into 800 ohms, field scalable

4 to 20 mA non-isolated self-powered into 800 ohms, field scalable

Serial Outputs RS 485 half duplex; RS 232 full duplex

Contact Closure Outputs Two - 115 VAC/28 VDC SPDT @ 10 amps (230 VAC SPDT @ 8 A)

Inputs Signal from another Level PRO detector. Additional input for gas density compensation or buildup available

Dry contact closure

Mounting Hardware

Integrated Transmitter / Detector Integral bolt-on bracket

Gamma Ray Source Integral bolt-on bracket

Local Remote Display

Model 9723 Backlit LCD with two lines: 16 alphanumeric characters

Hazardous enclosure is FMRC and CSA approved: Class I, Div. 1, Groups E, F and G; Class III, Div. 1, hazardous locations. FMRC approved NEMA 4 and CSA TYPE 4

Display powered from electronics

Maximum separation from electronics 91.4 m (300 ft)

Programming

HART Smart Model 275 or 375 Communicator Used to set up and calibrate gauge, and to enter data. Communicates with any LevelPRO via the current loop. BEL202FSK standard.

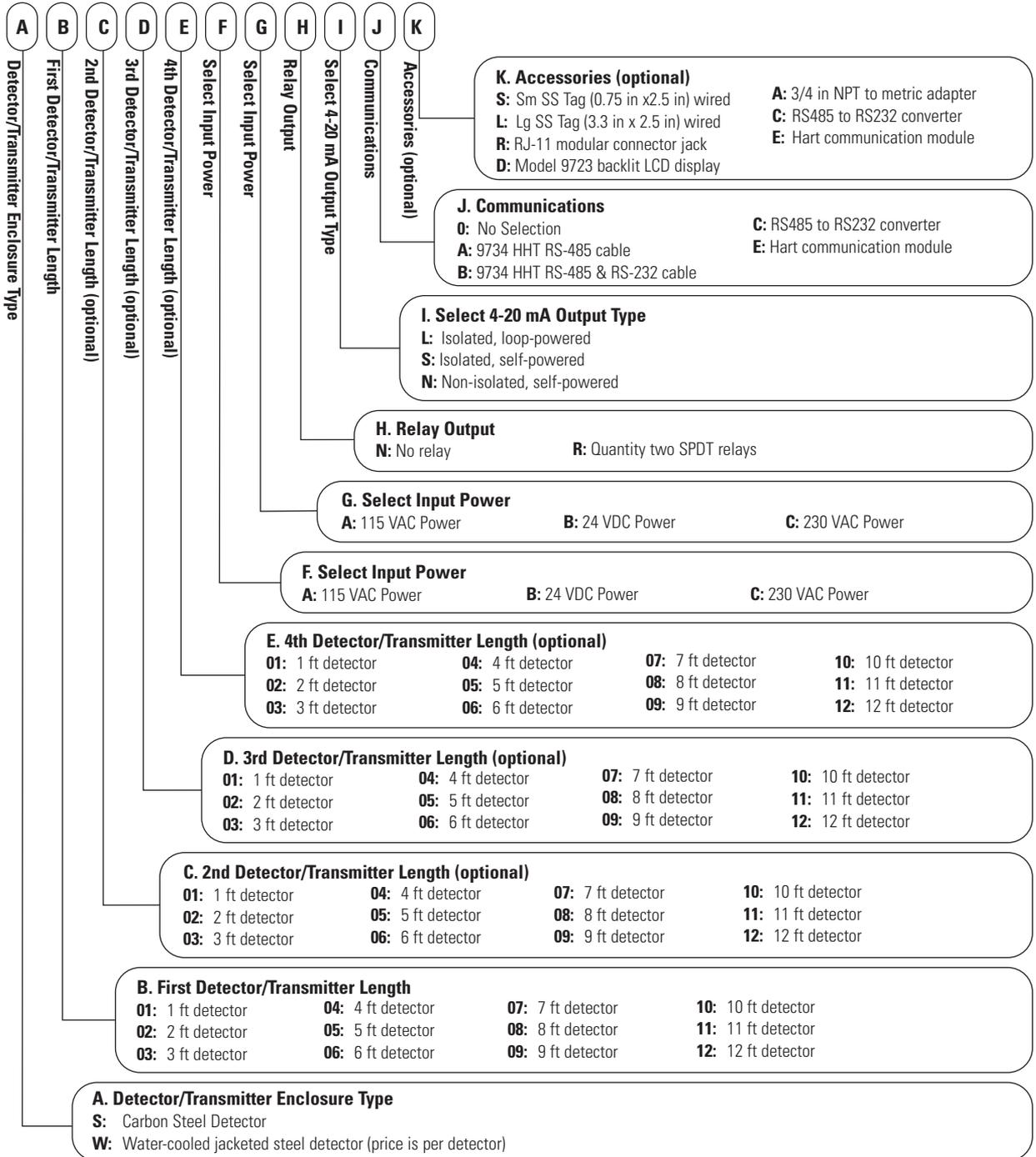
Hand Held Terminal (Model 9734) Used to set up and calibrate gauge and to enter data. Communicates with any LevelPRO via the RS 485 connector. Model 9734 provides upload/download of gauge configuration to/from PC via RS232 interface

Comm PC Interface Software Interface with up to 32 LevelPRO units over RS 485 Loop. RS 485-RS 232 converter provided

LevelPRO Integrated Continuous Nuclear/Gamma Level

A complete system consists of 1 to 4 integrated detector/transmitter(s), any number of sources as applicable to application and type of communication.

LPRO –



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Model 4790 Nuclear Level System

Specifications

Performance Specifications

Precision	±1% Span
Stability	Drift less than 1.0% absolute radiation change per 6 months

Gamma Ray Source

Source Type	Cs-137 or Co-60 both stainless steel doubly encapsulated
Size	10-10,000 mCi Cs-137 or 1,000-2,000 mCi Co-60 (Source size is dependent upon application)
Source Housing	Carbon steel, lead filled, polyurethane painted (stainless steel also available) Two position shutter, locks in "closed" position 30°, 45° and 60° beam angle source housings available (Beam angle is dependent on application)

Ion Chamber Detector(s)

Multi-Detector	Up to four (4) detectors may be used
Supply Voltage/Consumption	Power supplied from M transmitter
Operating Temperature Range	-25°C to 60°C (-13°F to +140°F)
Humidity	10% to 95% RH non-condensing
Minimum Operational Radiation Field	0.2 mR/hr
Enclosure	ANSI 300 Series stainless steel
Connections	Two 3/4-in NPT conduit entries
Output	Single 3-wire instrument cable for digital communication to the M transmitter In multi-detector installations, each detector is wired in parallel
Interconnecting Cable	Maximum length 763 m (2500 ft) between detector and transmitter Standard three conductors, shielded (Belden Model 9365)

Factory Mutual (FM) Approved for

Explosion Proof	Class I, Division 1, Groups B, C, D
Dust-Ignition Proof	Class II, Division 1, Groups E, F, G
Non-Incendive	Class I, Division 2, Groups A, B, C, D NEMA 4X

Canadian Standards Association (CSA)

Explosion Proof	Class I, Division I, Groups B, C, D; Class I, Division 2, Groups A, B, C, D
Dust-Ignition Proof	Class II, Division I, Groups E, F, G; Class III Type 4 enclosure

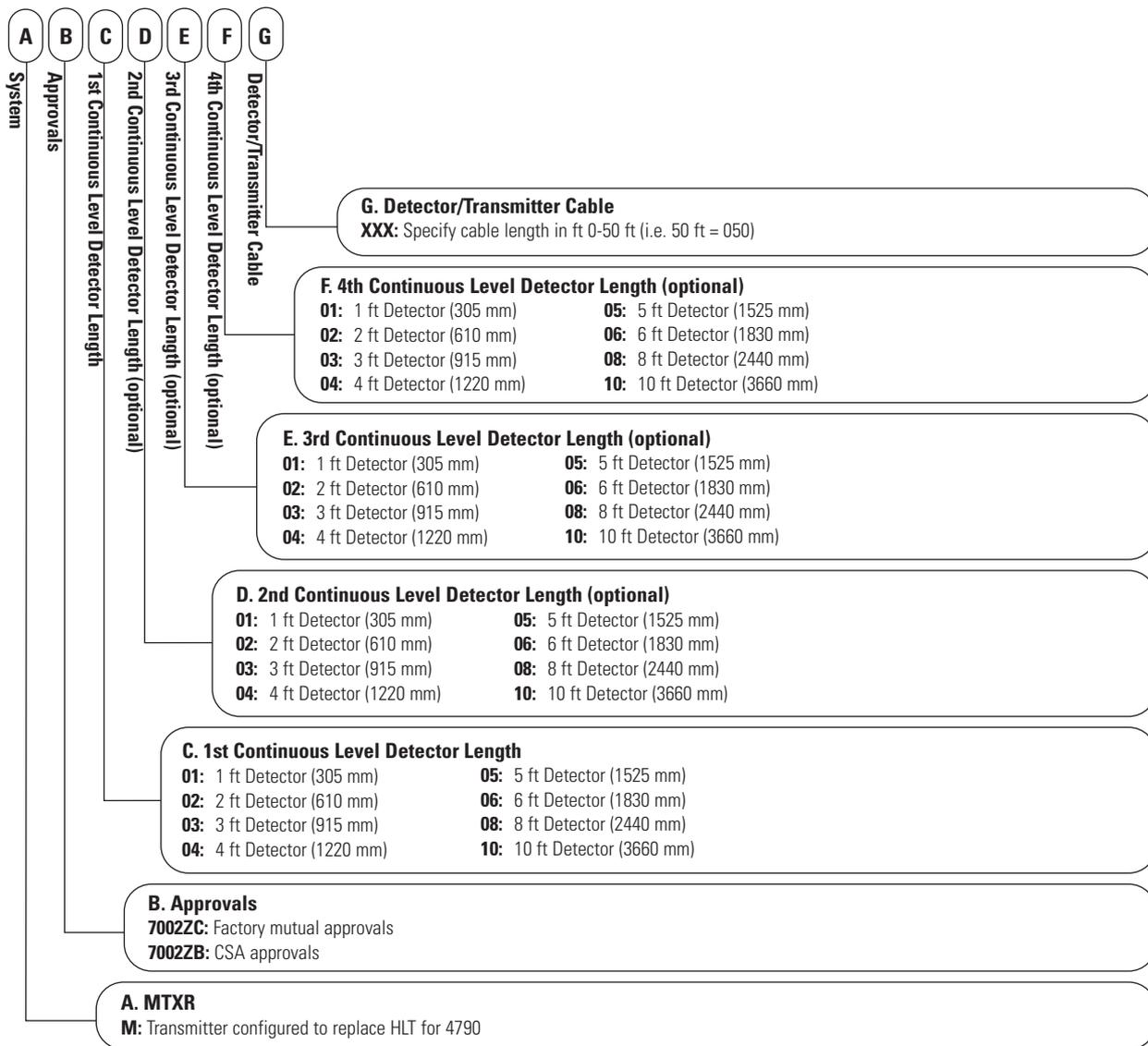
M Transmitter (Model 1400A)

System Architecture	Multiprocessor based electronics means uninterrupted output during data entry and system interrogation Surface mount technology provides high degree of reliability All user data doubly stored in non-
Approvals	FMRC approved for use in Class 1, Div.2, Groups A,B,C,D; Class II Div.2, Groups F,G; Class III, Div. 2; NEMA 4X CSA approved as above plus Class II, Div. 2, Group E; ENCL. TYPE 4X
Display	Four-line backlit display; easy-to-use setup menus; displays up to eight readouts simultaneously
Current Outputs	4 to 20 mA isolated self-powered or loop-powered into 800 ohms, field scalable One (1) current output standard Up to three current outputs available each representing independent span channels
Contact Closure Outputs	Up to 4 – 115 VAC/28 VDC SPDT @ 10 amps (230 VAC SPDT @ 8 amps)
Inputs	Dry contact closure
Operating Temperature	-40°C to +60°C (-40°F to +140°F)

4790 Continuous Nuclear/Gamma Level

A complete system consists of one to four integrated detector/transmitter(s), any number of sources as applicable to application and type of communication.

HLT –



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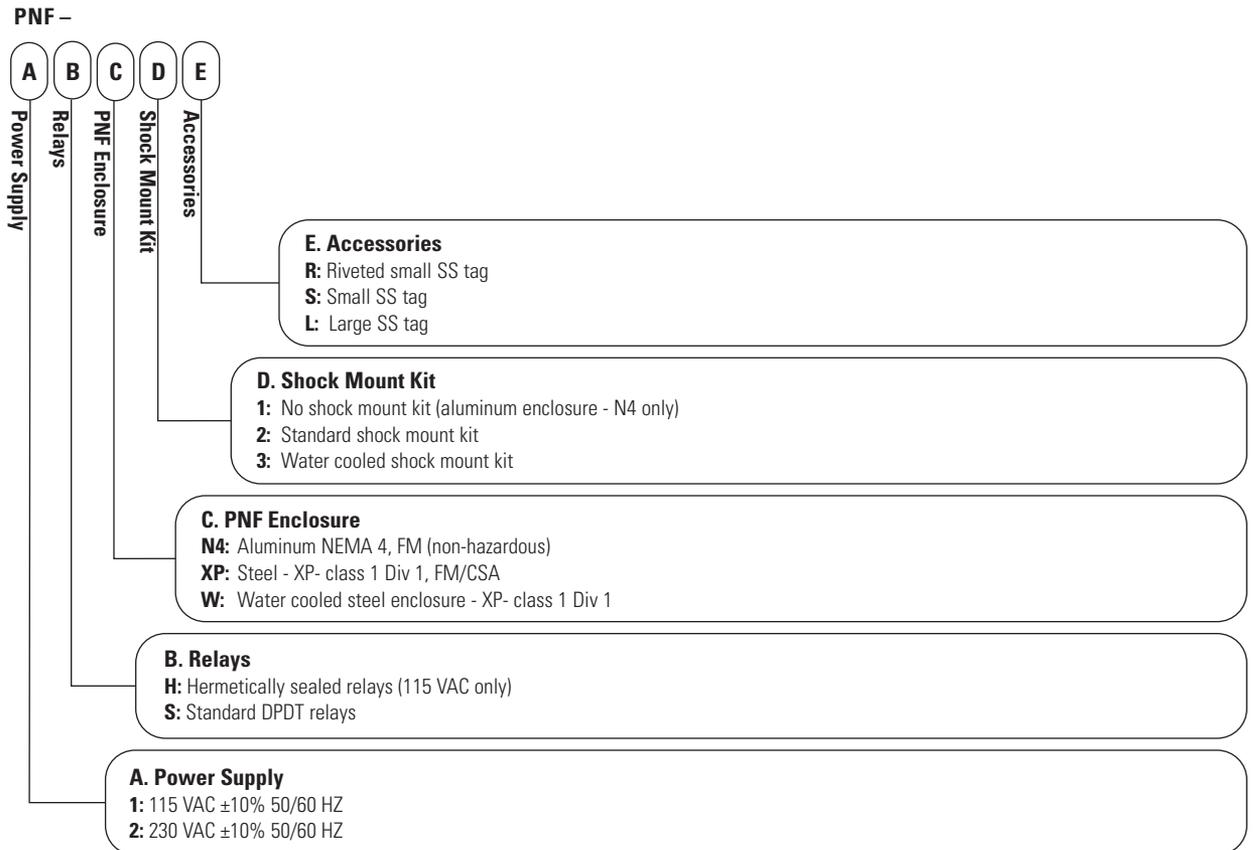
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Specifications

Detector / Electronics	
Reproducibility	±6 mm (0.25 in)*
Response Time	0.5 seconds to several minutes*
Product Temperature	Unlimited
Ambient Temperature	Standard: -40°C to +94°C (-40°F to +200°F); Optional water cooled housing available for high temperature operation
Detector Type	Halogen quenched Geiger-Mueller tube
Output	DPDT contacts (10 amps @ 115 volts) or hermetically sealed at 115 VAC @ 5 amps
Power Requirements	115 or 220 VAC ±15% @ 10VA, 50/60 Hz
Detector Housing	Standard is FM & CSA approved; Explosion proof Class I, Div 1, Gp B, C, & D; Class II, Div 1, Groups E, F, & G; Class III, Div 1 and NEMA 4. Optional lightweight and water cooled housings available
Mounting	External; with customer supplied brackets; Shock mounting bracket available
Size	Standard: 315 mm x 90 mm (15 in x 3.5 in)
Weight	7.7 kg (17 lbs)
Failsafe	Choice of either high level or low level fail safe operation
Lightweight Detector Housing (optional)	Aluminum construction with integral mounting bracket Size is 283 mm x 152 mm x 152 mm (11 in x 6 in x 6 in) Weight is 2 kg (4.5 lb)
Source and Source Housing	
Source Size	Cs-137 10 mCi to 10,000 mCi (dependent upon application) Cobalt 60 1,000 mCi to 2,000 mCi
Approvals	All source housings meet or exceed the safety requirements of the NRC and DOT, and various state agencies

*Exact value depends upon requirements of specific application.

PNF Nuclear Level System



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