

Thermo Scientific Nitus Gamma Backscatter Gauge for Level, Density and Interface Applications in the Petroleum Industry

Powered by highly reliable, patented (U.S. patent #7469033) technology, the Thermo Scientific Nitus gamma backscatter gauge measures the density, level or interface of thick, highly viscous process materials in the largest vessels and pipes with unmatched precision. This non-contacting, non-intrusive sensor is ideal for simplified vessel profiling and responds instantly to process changes for increased plant safety and profitability.



Features & Benefits

- Highly sensitive detector enables system to respond instantly to process changes to avoid overfills
- Non-contacting, non-intrusive technology ensures low maintenance and long life
- High accuracy and repeatability via ALARA-compliant small gamma source (100 mCi/3.7 GBq or less) improves plant safety and lowers capital costs
- Zero drift over a wide temperature range ensures stability of detector for superior measurement accuracy
- Source and detector install on same side of vessel or pipe without shutting down the process
- Remote detector electronics operate up to 50 feet from installation site for easier maintenance

Non-Contacting for Long Life

The internationally-compliant Thermo Scientific Nitus gamma backscatter gauge provides a dynamic new way to monitor level, density or interface applications online for improved process control and a strong return on investment. It features groundbreaking technology that uses a reduced source size to reliably measure level, density and wall buildup in the largest vessels and pipes. To achieve unprecedented precision, two symmetrical detectors that use the same source can be installed to measure the oil/water interface as well as the emulsion between the two. Unlike traditional sensors, the durable Nitus gauge uses non-intrusive, non-contacting gamma backscatter technology that is unaffected by corrosive, abrasive, high temperature and high pressure process materials, ensuring minimal maintenance and long instrument life.

Small Source for Big Tanks & Pipes

Backed by 40 years of neutron backscatter product expertise, the Nitus system is engineered to respond instantly to significant density and level changes, enabling personnel

to avoid process upsets such as tank overfills and other hazardous conditions. The system's breakthrough sensor includes the most stable and sensitive scintillation detector available yet requires a much smaller amount of gamma energy (100 mCi/3.7 GBq or less) to achieve the same measurement precision. In fact, the amount of energy emitted by the source can be reduced by a factor of 200 without sacrificing rapid response or high precision. The smaller source also ensures a safer working environment and lowers capital costs.

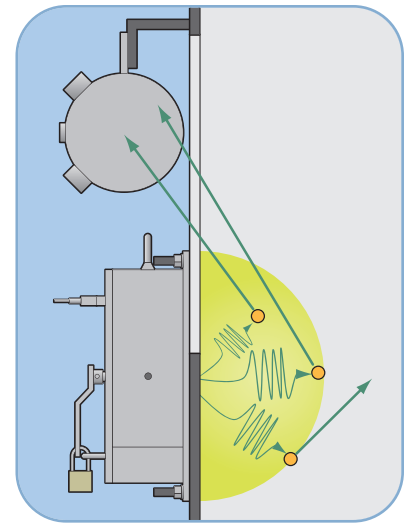
Installs Easily to Outside Wall

Both the Nitus source and detector are installed on the same side of the vessel or pipe without having to shutdown the process, reducing costs and downtime. In addition, the system can be setup using a Thermo Scientific Model 9734 handheld terminal, HART Communication module, Foundation Fieldbus (using Hart 475) module or TMT Comm via a laptop. A user-friendly menu enables quick configuration to expedite installation and start-up.

Principle of Operation

The Nitus system uses energy attenuation to measure level and density. This energy is in the form of Cesium 137 (Cs-137) that is contained in an all-metal, fireproof source head. Energy attenuation is a necessary component of gamma backscatter technology and enables both the source and detector to be mounted externally on the same side of a vessel or pipe. With gamma backscatter, it is not necessary for the sensor to be in contact with the process material which makes the system easier to use and maintain and sets it apart from commonly used density and level technologies.

The backscatter principle that the Nitus system is based on is called the Compton Scatter Effect. A very small amount of energy is emitted via the source into a vessel or pipe. The energy is absorbed by the process material but is also reflected or "scattered" away from the process material. This reflected energy is measured at the location of the detector as either density or level, depending on the application. The overall diameter of a vessel or pipe is a non-issue because, with backscatter, precise measurement is achieved by penetrating a significant portion of the process material but not the entire span. In addition, the source head is specifically designed to maximize the scatter effect to provide more data points to the detector for greater measurement precision. This unique technology heightens productivity, increases plant safety, and reduces maintenance and capital expenditures.



The Nitus source head emits radiation into the vessel with the majority of the energy backscattered and read by the detector.

Building a System

For density applications, two-foot Nitus detectors are generally used, depending on the application. For level applications, detectors are available from one to four feet in length with multiple detectors that can be cascaded to fulfill large span measurement requirements.



Applications

- Tar sands separators and froth treatment settlers
- PVC tanks
- Reactor vessels
- Auto-clave vessels: high temp and high pressure processes
- Alkylation units
- Gypsum production
- HF Alky for emulsion control
- Dissolving tank water level control (Styrene)
- Asphalt level control
- Atmospheric and vacuum towers
- Fractionation column level control
- FCCU units
- Acid settling tanks
- Desalters and separators

Integrated Electronics

End View

Integrated Electronics (Stainless Steel Models Only)

Detector Size	L (overall length)	S (sensitive length)	Sensor Weight
1-foot	1.22 m (48.0 in)	0.31 m (12.0 in)	55.9 kg (123 lb)
2-foot	1.52 m (60.0 in)	0.61 m (24.0 in)	68.2 kg (150 lb)
3-foot	1.83 m (72.0 in)	0.91 m (36.0 in)	80.4 kg (177 lb)
4-foot	2.13 m (84.0 in)	1.22 m (48.0 in)	92.7 kg (204 lb)

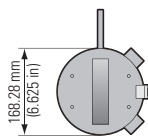
Remote Electronics, Electronics Module

Remote Electronics, Scanner Module

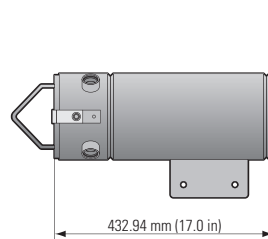
Remote Electronics (Stainless Steel & Water-Cooled Stainless Models)

Detector Size	L (overall length)	S (sensitive length)	Sensor Weight
1-foot	0.72 m (28.5 in)	0.31 m (12.0 in)	33.2 kg (73 lb)
2-foot	1.03 m (40.5 in)	0.61 m (24.0 in)	45.5 kg (100 lb)
3-foot	1.33 m (52.5 in)	0.91 m (36.0 in)	57.7 kg (127 lb)
4-foot	1.64 m (64.5 in)	1.22 m (48.0 in)	70 kg (154 lb)
Electronics	0.43 m (17.0 in)	—	23 kg (50 lb)

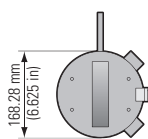
End View

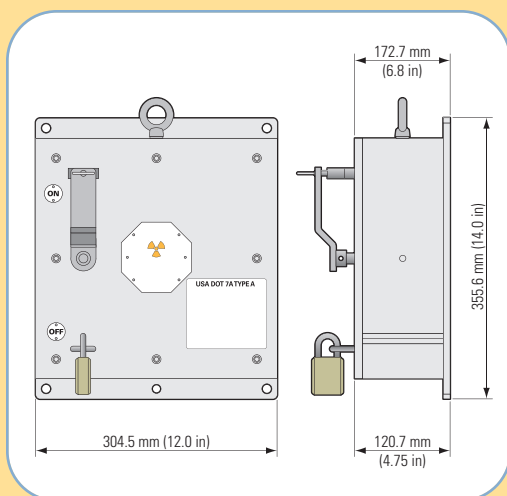
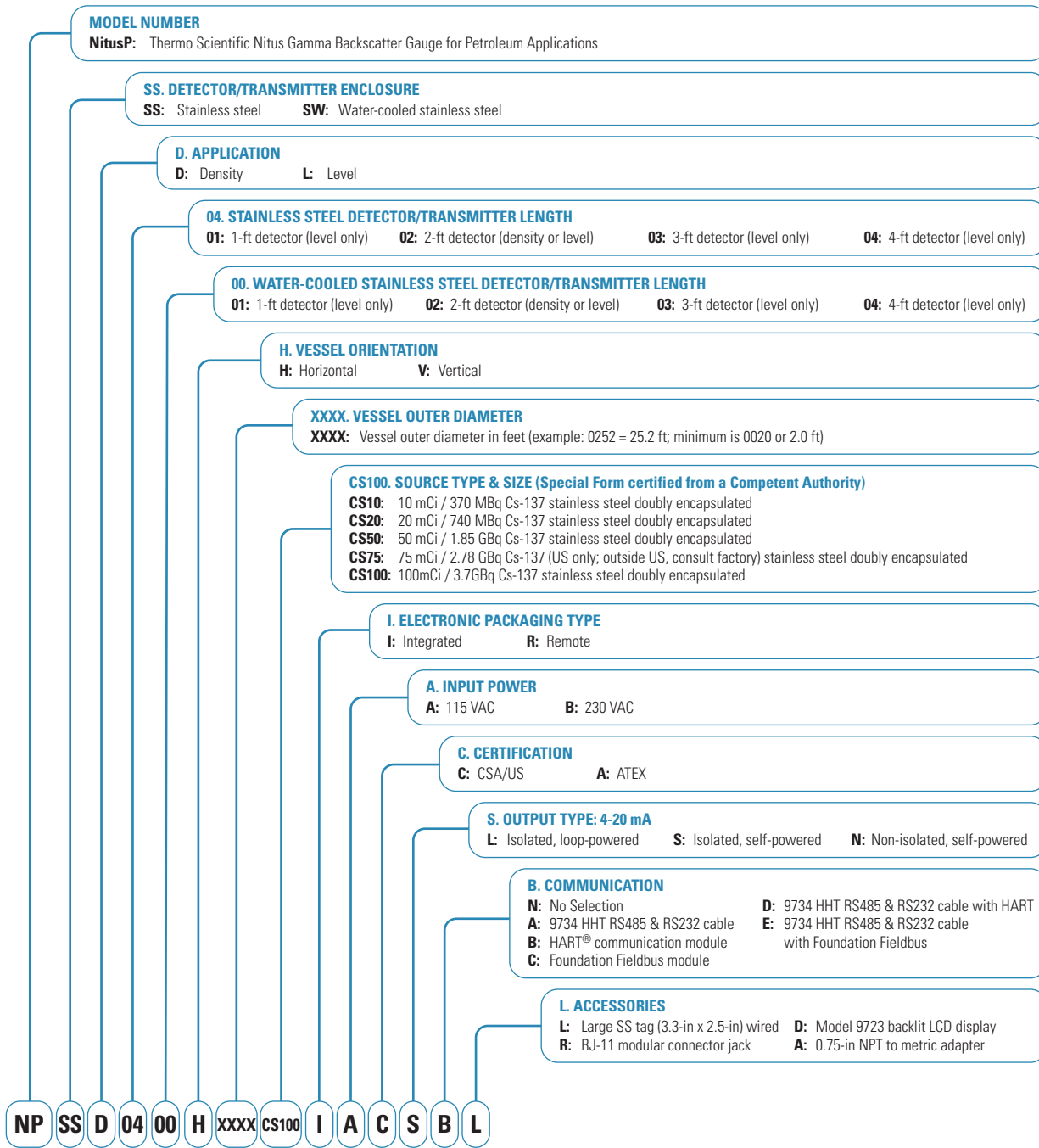


Remote Electronics, Electronics Module



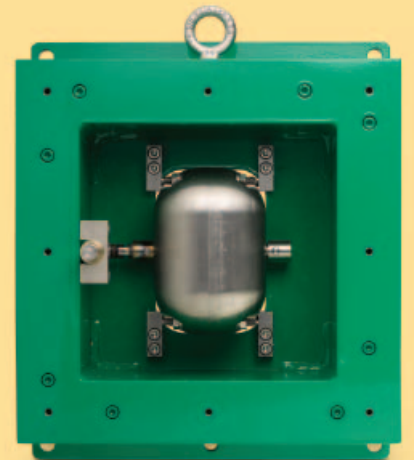
End View





Thermo Scientific Model 6000 Source Head

- Designed to be flush with the curvature of the vessel or pipe to ensure maximum vessel wall penetration and no errant radiation emissions
- Constructed of tungsten with a stainless steel outer containment housing
- Rotary shutter tested to over 1,000,000 cycles with no failures
- Achieved highest ANSI rating (ANSI-94-554-565-R6) for temperature endurance up to +1093°C (+2000°F)
- Meets international radiation safety requirements, including China Type II and India Class III
- Rated to contain up to 1000 mCi/37 GBq of Cs-137
- Source weight: 81.65 kg (180 lb)



Thermo Scientific Nitus Gamma Backscatter Gauge for the Petroleum Industry

Performance Specifications	
Precision	Level measurement: $\pm 0.5\%$ of total span on steel wall thickness up to 3.81 cm and material density of up to 2.2 g/cm ³ Density measurement: ± 0.001 g/cm ³ on steel wall thickness of 2.54 cm and material density of up to 2.2 g/cm ³ ; ± 0.005 g/cm ³ on steel wall thickness of 3.81 cm and material density of up to 2.2 g/cm ³
Response Time	1 second, depending on application and source size
Ambient Temperature Field	Standard: -40°C to +75°C (-40°F to +167°F)
Gamma Ray Source	
Source Type	Cs-137 stainless steel, doubly encapsulated
Source Size	10-1,000 mCi (0.37-37 GBq) Cs-137 (source size dependent upon application; most applications require 100 mCi/3.7 GBq or less)
Durability	Tested to 1,000,000 on/off cycles with no failures; Fire-tested to +1093°C (+2000°F) for four hours; shock-tested for multiple drops from one meter to concrete; Maximum temperature rating of +800°C (+1472°F)
Functional Specifications: Transmitter Detector	
System Architecture	Two options available: integrated electronics or remote electronics Multiprocessor-based electronics for uninterrupted output during data entry and system interrogation All user data doubly-stored in non-volatile memory with no battery backup required
Detection Type	PVT plastic scintillator with wide dynamic range; resists shock and moisture damage Dual PMT configuration improves signal-to-noise ratio
Detector Stabilization	Electronic control without heater stabilization for optimum performance
Power	115/230 VAC, 50 Hz to 60 Hz, 500 mA max
Software	Comm PC Interface Software: Interface with up to 32 Nitus units over RS485 Loop; RS485/RS232 converter provided
Programming	HART Smart Model 475: Used to setup and calibrate gauge, and to enter data; Communicates with any Nitus or 375 system via the current loop; BEL202FSK standard Thermo Scientific Model 9734 Handheld Terminal (HHT): Used to setup and calibrate gauge and to enter data; Communicates with Nitus system via the RS485 connector; Provides upload/download of gauge configuration to/from PC via RS232 interface; TMT Comm; Foundation Fieldbus (FISCO compliant)
Operating Temperature Range	-40°C to +75°C (-40°F to +167°F) ambient
Inputs	Signal from another Nitus detector; additional input for gas density compensation or buildup available; Dry contact closure; Temperature compensation circuitry with 100 ohm platinum RTD 2 or 3 wire
Current Outputs	4-20 mA isolated, loop-powered into 800 ohms, field-scalable; 4-20 mA isolated, self-powered into 800 ohms, field-scalable; 4-20 mA non-isolated, self-powered into 800 ohms, field-scalable
Serial Outputs	RS485 half-duplex; RS232 full-duplex (optional with HART or Foundation Fieldbus)
Source Decay Compensation	Selectable Cs-137 or Co-60
Linearization	Logarithmic and multi-point characterization
Circuitry	Digital; Fully integrated
Physical Specifications	
Electrical Connections	Two ¾-in NPT fittings; HART Communicator interface connects directly into 4-20 mA loop
Interface Cable	Shielded 14 to 22 gauge Belden 9318
Local Remote Display	Thermo Scientific Model 9723: Backlit LCD with two lines, 16 alphanumeric characters; Powered from electronics; Maximum separation from electronics 91.4 m (300 ft)
Mounting Hardware	Detector: Integral bolt-on bracket; Source head: Integral bolt-on bracket
Housing	Detector: Stainless steel or water-cooled stainless steel Source head: Stainless steel construction with tungsten core; Two position rotary shutter, lockable in both "open" and "closed" position
Detector Size	Density Measurement: 2-ft (0.6-m) detector mounted perpendicular or horizontal to pipe; Application dependent Level Measurement: 1-ft (0.3-m) increments from 1 ft to 4 ft (0.3 m to 1.2 m); Multiple detectors can be wired together for large measurement spans
Weight, Detector/Electronics	Dependent on application; Consult Thermo Fisher Scientific
Certifications	
CSA/US	Detector: Class I, Div 1, Groups B, C and D; Class II, Div 1, Groups E, F and G; Class III; T6; Type 4X Encl Local display: Class I, Div 1, Groups E, F and G; Class III, Div 1, hazardous locations; Type 4 Encl
ATEX Hazardous Area	Detector: Ex II 2 G Ex d IIB +H ₂ Gb T6 [Ta = -40°C to +75°C]; Ex d IIB +H ₂ Gb T5 [Ta = -40°C to +85°C] (remotely-mounted electronics certified to maintain rating) Local display: Hazardous enclosure: ATEX Ex 2 G Ex d IIC T6 [amb -40°C to +60°C]
CE	CE mark
IECEX	CSA 10.0009

© 2011 Thermo Fisher Scientific Inc. All rights reserved. Results may vary under different operating conditions. Specifications, terms and pricing are subject to change. Not all products are available in all countries. Please consult your local sales representative for details. Literature Code PI.2084.0511

Unit 702-715, 7/F Tower West Yonghe Plaza No. 28, Andingmen East Street Beijing 100007 CHINA	+86 (10) 8419-3588 +86 (10) 8419-3580 fax
A-101, ICC Trade Tower, Senapati Bapat Road Pune 411016 Maharashtra INDIA	+91 (20) 6626 7000 +91 (20) 6626 7001 fax
Ion Path, Road Three, Winsford, Cheshire CW7 3GA UK	+44 (0) 1606 548700 +44 (0) 1606 548711 fax
1410 Gillingham Lane Sugar Land, TX 77478 USA	+1 (800) 437-7979 +1 (713) 272-0404 +1 (713) 272-4573 fax

www.thermoscientific.com

Thermo
SCIENTIFIC