

Nuclear Density Measurement



Density

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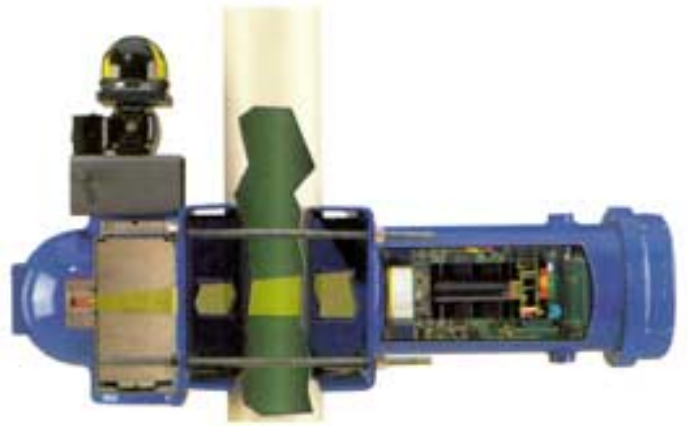
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Nuclear Density Measurement

Nuclear Density Measurements

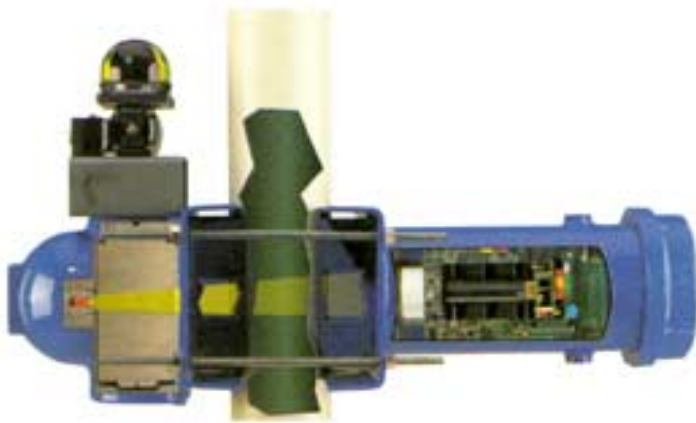
Principle of Operation

Nuclear density gauges consist of a sealed source in a sourceholder and a scintillation detector. The sourceholder is mounted on the side of a pipe or chute with the detector on the opposite side. A focused beam of radiation is transmitted from the source through the pipe and process material to the detector. As the density of the material in the pipe changes the amount of radiation reaching the detector changes. The greater the density of the material, the lower the radiation field at the detector; the lower the density of the material, the higher the radiation field at the detector.



Low density material allows greater radiation to reach the scintillation detector.

When the radiation strikes the scintillation crystal, pulses of light are emitted which are detected by the photomultiplier tube. The amount of light is proportional to the amount of radiation striking the detector. The photomultiplier tube then creates a signal that is proportional to the amount of light received which is sent to the electronics for conversion to a 4 to 20mA or other useable process signal.



High density material allows less radiation to reach the scintillation detector.

* Doesn't quite match your application? Contact our factory application engineers, for the many options available on this unit



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Nuclear Density Measurement

Benefits of Nuclear Density Measurements

On-line Measurement

Measurement of product made in the process pipeline; no sampling of product required to analyse density.

Real Time Process Control

Measurement in real time allows immediate feedback and continuous process control.

True Density

Density is directly measured as mass in a given volume. Density measurement is not inferred from another process variable prone to change differently from density, such as deflection, viscosity, or refractive properties.

Low Maintenance & High Reliability

Being non-invasive to the process and with no moving parts, nuclear density gauges provide reliable long-term measurements. No parts are intrusive to the process that could foul, corrode or wear.

Low Total Installation Cost

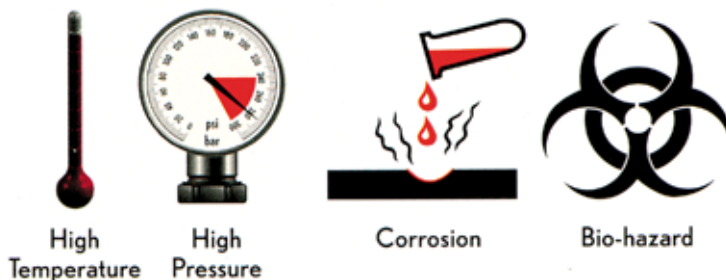
No intrusions or additions are required in pipeline to install an ABLE Density Gauge in standard applications.

Measurement in Wide Variety of Pipe Sizes

Measurements can be made in all pipe diameters from 50mm to 800mm. The addition of bypass pipes are typically not required.

Ease of Calibration

For most applications, nuclear density gauges are calibrated by the throughput of liquids having a known specific gravity.



On-line Measurement

Non-invasive nature of measurement allows use in processes with:

- High Temperature
- High Pressure
- Corrosive
- Volatile & Biohazard

Mass Flow Measurement

When used in conjunction with a flow meter, nuclear density gauges provide highly accurate measurement of percent solids for most slurries.

Percent Solids Measurement

When carrier fluid remains stable, nuclear density gauges provide highly accurate measurement of percent solids for most slurries

Bulk Density Measurement

For many solids and powders, density measurements are possible. These applications require an area where the powder is flowing but 'packed' in a chute or small hopper.

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Nuclear Density Measurement

Advantages

Support & Training

ABLE's staff of professionals offers the training, field service and radiation safety support required for the efficient and safe use of nuclear gauges.



ABLE has been in the forefront of nuclear gauging technology for almost fifty years with installed gauges working since the 1950's. Density gauges, like the one shown above, have been in service since the 1960's.

Special Capability

ABLE have designed hundreds of speciality density systems for unique applications. Please consult ABLE with your special needs.

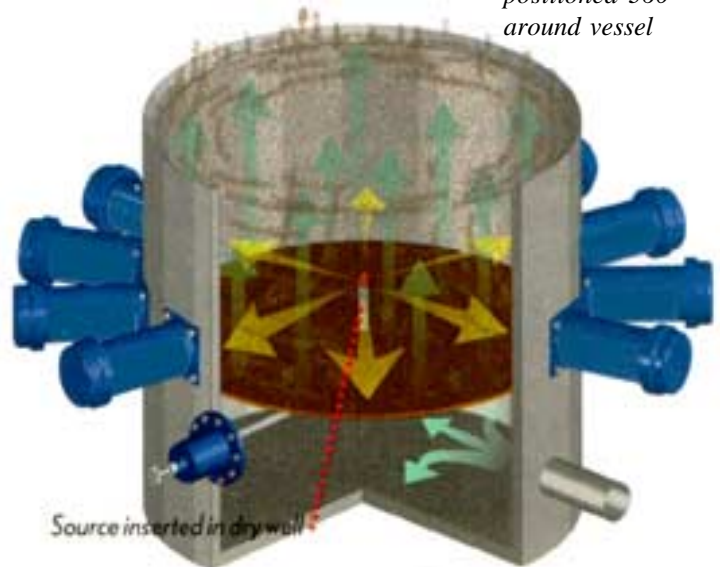
Density gauges are positioned 360° around vessel

Commitment to Development

HART Protocol, fireproof sourceholders, increased special capabilities and other innovations are examples of ABLE's continuing dedication and commitment to advancing nuclear gauge technology.

Excellence in Service

ABLE's network of service Engineers provides excellence in service and support, worldwide.



High Durability Powder Coat Epoxy

ABLE's nuclear instruments are delivered standard with baked-on powder epoxy coating for protection against harsh plant environments.

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Nuclear Density Measurement



Available with industry standard HART protocol for remote programming and calibration. HART hand-held terminals and modems eliminate the need for external electronics, with a 4 to 20mA signal directly from the detector electronics.

Automated Failsafe Sourceholders

ABLE offers a fully automated sourceholder for remote shutter operation and failsafe shut-down.

Advanced Detector Technology

ABLE's latest generation density detector employs the best technology to ensure the highest levels of accuracy and reliability.

High Durability Powder Coat Epoxy

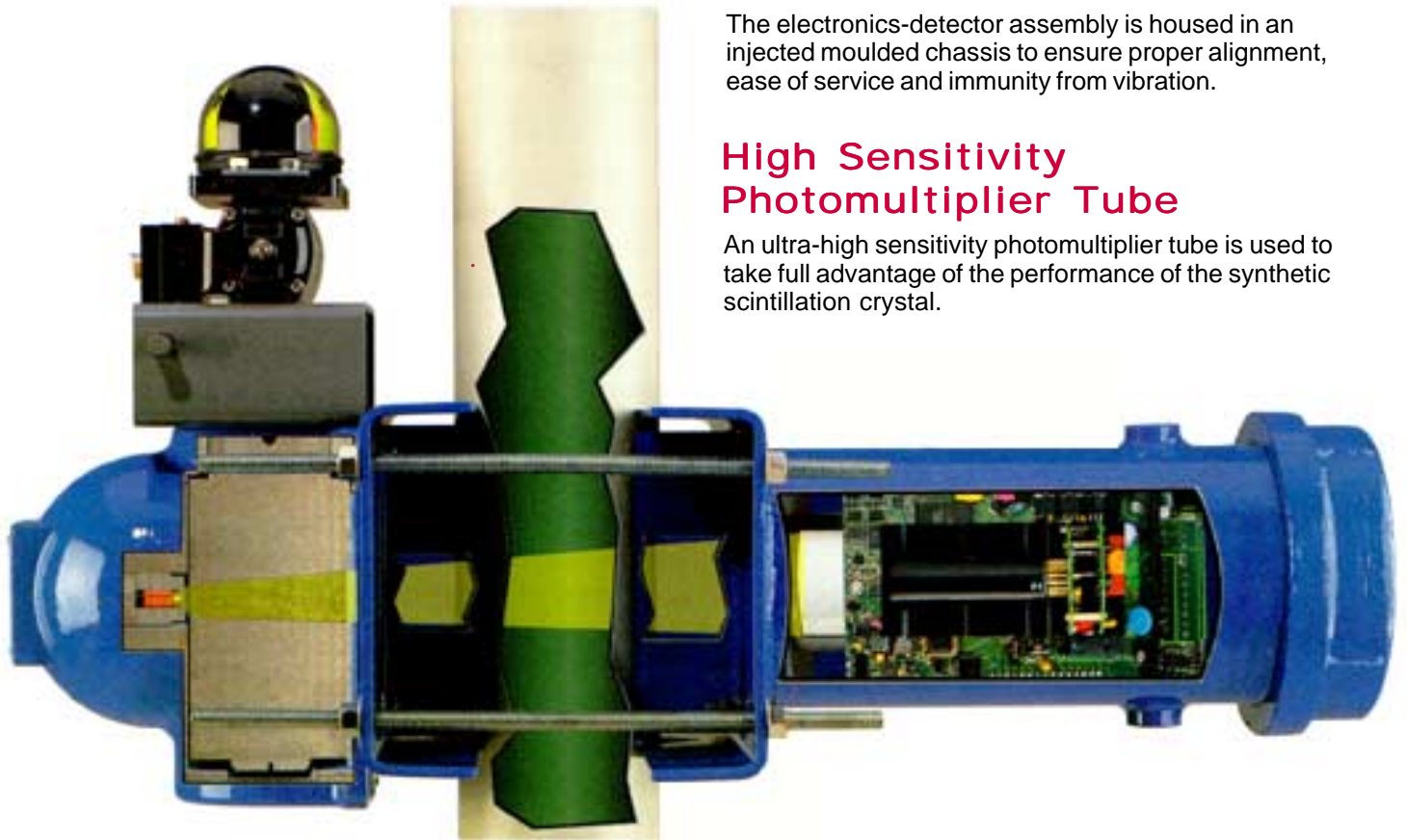
ABLE's nucleonics systems are delivered standard with baked-on powder epoxy coating for protection against harsh plant environments.

Molded Carrier Chassis

The electronics-detector assembly is housed in an injected moulded chassis to ensure proper alignment, ease of service and immunity from vibration.

High Sensitivity Photomultiplier Tube

An ultra-high sensitivity photomultiplier tube is used to take full advantage of the performance of the synthetic scintillation crystal.



Advanced Lead-free Fireproof Sourceholder

ABLE Smart Pro electronics and multigauge Pro Pac utilise advanced software to handle difficult applications and conditions.

High Durability Synthetic Scintillation Crystal

Synthetic scintillation crystals are used in place of older sodium iodide crystals to provide high performance with better protection against vibration, moisture and temperature shifts.

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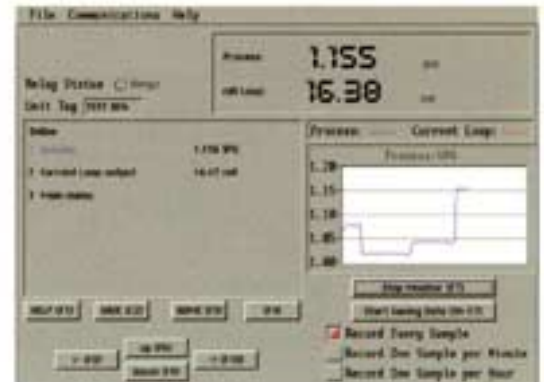
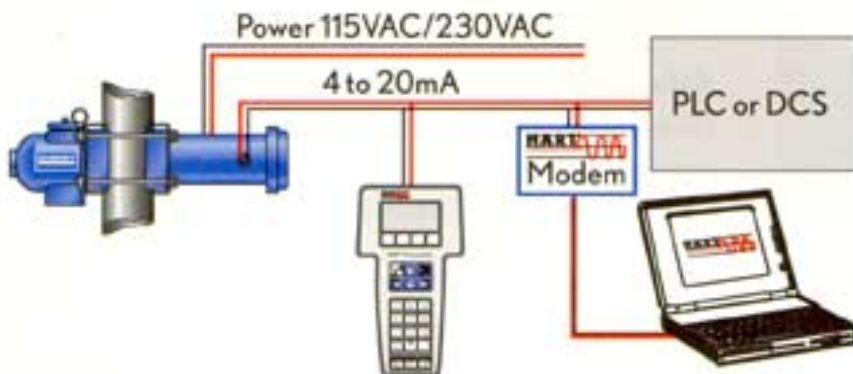


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Nuclear Density Measurement

HART Protocol



Using either a HART Hand-held Terminal or a personal computer with our software, programming is made easy anywhere on the 4 to 20mA communication line to the sensors.

Software has been designed using HART Standard Communication Protocol allowing communication from a personal computer.

Transmitter Direct Output of 4 to 20 mA Measurement Signal

The DSTH Density Transmitter provides a calibrated density measurement 4 to 20 mA output directly from the detector. Periodic communication with the transmitter for calibration, set-up and diagnostic can be established anywhere on the 4 to 20 mA loop using a HART hand-held terminal.

HART Protocol Means No Additional Wires or Electronics

ABLE transmitters use HART Protocol. HART is worldwide instrumentation standard allowing communication signals superimposed on the 4 to 20mA density measurement signal. All communications are handled over the 4 to 20mA line without opening the detector housing.

Relay Output for Diagnostic or Process Alarm

A relay output is software configurable for a diagnostic or process alarm. As a diagnostic alarm, the relay will trip on user-selectable conditions. As a process alarm, the relay will trip at a user-selectable point in the density span.

Software for HART Transmitter with HART Modem

The software and a HART modem turn any PC into a transmitter communication tool. Easy to use menus, graphics and help messages make calibration and diagnostics easy and uncomplicated.

Standard HART Communication Hand-Held Terminal

ABLE density transmitters with HART are compatible with standard HART communicator hand-held terminals, eliminating the need for specialised communication equipment.

Smart Pro Electronics

The model DS uses ABLE's feature packed SmartPro remote electronics for operation, calibration, set-up and diagnostics. The ProPac employs the same capabilities of the SmartPro in a multi-channel version that allows up to four density gauges to work with one electronics assembly.

X-Ray Safeguard

Prevents false low reading caused by radiographic (X-Ray) weld inspection equipment. Automatically holds the analogue mA output at the most recent valid measurement.

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Common Density Applications

Pulp & Paper

White liquor

- Black liquor
- Green liquor
- Lime mud

Soaps & Detergents

- Liquid soap density
- Dry detergent bulk density

Mining Slurries

Coal

- Potash
- Brine
- Phosphates
- Calcium compounds
- Limestone
- Gold
- Taconite
- Copper

Waste Treatment

Sludge density

Chemical

- Acid concentration/mixture
- Polymer density
- Ammonia lime Slurry
- Lime Slurry

Refinery/Pipeline

Crude oil density

- Refined product density
- Pipeline product interface

Food & Grain

- Soy slurry
- Tomato sauce concentration
- Orange juice concentration
- Mash density (starch)

Model DSTH/HART Transmitter (Specific)

Current Loop OutputDSTH

4 to 20mA into 300 to 1000 ohm

Cable Length

Maximum

1000m

Model DS/Output to Smart Pro (Specific)

Current Loop OutputDS

0 to 10 kHz optoisolated digital frequency

Cable Length

Maximum

1525m

AC Power

DS/DSTH

90 or 270 VAC at 50 to 60Hz, at 20VA max power consumption

DC Power

DS/DSTH

10-54VDC (less than 100mV, 1-1000 Hz ripple) at 10VA

Operating

DS/DSTH

-20°C to 60°C, Lower temperatures available

Temperature

Water cooling required above 60°C

Hazardous

CENELEC

EExd IIC T5, IP-66

Area Ratings

Housing

DS/DSTH

Epoxy powder coat

Smart Pro and Pro Pac Support Electronics

Inputs

Measurement signal

Frequency, 0-100kHz, optoisolated

Temperature

RTD or temperature transmitter 4-20mA or voltage

Compensation

Electrical

Power requirements

90VAC or 270VAC at $\pm 10\%$, 50 or 60Hz, 10W max (60W for Pro Pac)

Redundant power supply optional (for Pro Pac)

Temperature

Smart Pro & Pro Pac

Ambient: 0 to 50°C

Smart Pro Wall Unit

Weight

4.5 kg

Pro Pac Rack Unit

Weight

9.1 kg

Outputs

Analog (2)

4 to 20mA into 0 to 1000 ohm

Relay (4) SPDT

2A at 120VAC Standard (others available)

TTL Logic Level (five)

Open collector, 300mA (max) at 30V (max) resistive load, or 20V (max) inductive load

Serial Ports

Individual settings from 300 to 19200 baud. Two full and two partial RS-232C ports, or one partial RS-232C port and one partial RS-422/485 port.

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- DS Scintillator detector with frequency output to ABLE Smart Pro or Pro Pac
DSTH Scintillator detector and transmitter with 4 to 20mA output and HART protocol
- Voltage
V4 90-270VAC 50/60Hz (for models DS/DSTH)
V5 10-54VDC (for models DS/DSTH)
- Hazardous Area Approvals (for all models)
H0 No certification
H1 CSA certification
H2 CENELEC certification
- Pipe Bracket (xx = pipe size)
B0 No brackets
B1xx50 mm - 355mm brackets
B2xx406mm - 508mm brackets
B3xx560mm - 813mm brackets
- Standard Options
S00 No options
S22 No housing
S50 HART hand-held terminal (only model DSTH)
S51 HART modem and software (only model DSTH)
- Packing (for all models)
P0 Truck packing (open skid)
P1 Air packing (closed wooden box)
P2 Ocean packing (wood box with liner)
- Extra Manuals (for all models)
D1xx DS manual (xx=quantity)
D2xx DSTH manual (xx=quantity)
- Cables (for all models)
C0 No cables
C1xx Belden 8760 for conduit (xx=length per 1m)
C2xx Belden 9341 for cable tray (xx=length per 1m)

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