Radiation-based process instrumentation
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Non-contact measurement with PROTRAC

ProTrac, the radiation-based instrument series for level, switching, density, interface and mass flow measurement, combines robust technology with a wide application spectrum.

Reliable measurement technology for extreme process conditions
Under rough process conditions, many measuring principles quickly reach their limits: extreme temperatures, high pressures, aggressive media or other problematic features of the product can make precise measurement of level, limit level, interface or density impossible.

No problem for ProTrac: the new, radiation-based instrument series ProTrac delivers exact and reliable results with the help of gamma technology even in the most difficult measuring situations. The advantage over other measuring techniques: no sensor components or fittings are required inside the vessel. The measurement technology is mounted on the outside of the process and measures right through the container walls. This measuring principle thus guarantees very high safety and reliability – completely independent of the product and its properties.

More possibilities with PROTRAC
VEGA Grieshaber KG has been the measurement specialist for level, limit level and pressure for over 50 years. Measuring instruments from VEGA reliably deliver volume, level and pressure data from all kinds of media. From the finest to the roughest bulk solids, in adherent or abrasive slurries and liquids.

ProTrac solves even the most difficult measuring problems and sets new standards with regard to safety: all ProTrac sensors were developed in compliance with the strict specifications of IEC/EN 61508 and fulfil the highest requirements.

In addition, all ProTrac sensors have an ingenious asset management system and deliver standardised status messages according to NE 107 for preventive maintenance. Corrective measures can thus be carried out and production standstills avoided or shortened.
PROTRAC: Efficient technology and qualified consultation

Industrial use of radioactivity
French physicist Henri Becquerel discovered the radioactive emissions of uranium in 1896. We can hardly imagine our world today without the many applications of radioactivity. In medicine it has created completely new possibilities for diagnosis and therapy: we encounter them, for example, in radiograph technology and in cancer therapy. In industry radioactive beams are used, among other things, to check welded seams or analyse materials.

Industrial measurement technology also makes use of the uniform properties of radioactivity. Today, the radiation intensity of radiation-based instruments for determining level, density or interface is so low that only special, highly sensitive sensors, such as SoliTrac, are able to pick up this minimal radiation.

Versatility for process automation
Resistance to aggressive media, accurate monitoring and control of production processes, as well as assurance of product quality, are the demands process automation places on measurement technology. The radiation-based ProTrac instruments are the reliable and economic answer to these demands, particularly in rough environments. They reliably control and check the level, the limit level or the density, for example in high pressure boilers, coal bunkers or containers with chemically aggressive or explosive media.
Consultation and service impart confidence

When implementing a radiation-based measurement point, important aspects with regard to radiation protection laws and regulations must be taken into account. VEGA accompanies you step by step through planning and approval and provides individualised consultation. The application technicians at VEGA plan the layout of the measuring point together with you and recommend how ProTrac should be installed to ensure a reliable measurement.

VEGA assists you with the licensing application for operating a radiation-based measuring instrument and advises the person responsible in your company about the safety aspects. And although ProTrac instruments are designed to operate completely maintenance-free for many years, VEGA is a partner you can contact at any time after installation and commissioning. VEGA is your competent partner for all aspects of radiation-based measurement:

- Technical configuration of the measurement point
- Advice about approvals
- Support with logistical processes
- Setup and commissioning
- Return of used radiation sources
The radiation-based measuring principle

How it works

In radiation-based, or nucleonic measurement, a radioactive source sends out focussed gamma rays. A caesium 137 or a cobalt 60 isotope is usually used. A special detector mounted on the opposite side of the tank picks up the radiation. This scintillator detector converts the radiation received into flashes of light that are counted and evaluated. Since gamma rays are blocked or attenuated by changing product, the instrument can calculate the level, the limit level and the density or mass flow from the intensity of the incoming radiation, i.e. from the number of light flashes.

Reliable measurement – even under the toughest process conditions

For some applications, no alternative to radiation-based measurement has been found to this day. Extreme process conditions, as well as difficult mounting situations represent a challenge that only non-contact nucleonic measurement can overcome. It delivers reliable measuring results – totally unaffected by process pressure, process temperature and the chemical properties of the measured product.

Application diversity through optimised detectors

Different detector models make ProTrac instruments so flexible, that they can readily be adapted to the most difficult measurement tasks: FiberTrac is a flexible detector for level measurement in round and conical vessels. The PVT rod detector SoliTrac is the specialist for cylindrical containers. And the sodium iodide detector in MiniTrac was designed specifically for density measurement and level detection.
Application areas for PROTRAC

- Continuous level measurement
- Density and concentration measurement
- Level detection
- Interface measurement
- Mass flow measurement of bulk solids on conveyor belts or in screw conveyors
- Flow-rate measurement of liquids

Solid and safe

VEGA implemented the highest safety standard for the radiation source. It is designed to prevent any contamination of the measured products, people or the environment: the radioactive isotope is welded in a double safe stainless steel capsule and reliably contained by additional lead shielding. A solid steel outer housing protects it from mechanical damage, destruction, heat or corrosion by environmental effects.

Radiation-based measurement neither contaminates the measured medium nor changes it in any way – it stays just as it is.
A high degree of safety
To increase safety, VEGA has set new standards in radiometry: in the sensitivity of detectors and in the quality of source containers.

VEGA is the first supplier to develop the hardware and software of radiation-based instruments for continuous level measurement, switching and density applications according to IEC/EN 61508. To ensure the safety of employees and production processes, all instruments operate redundantly: critical functions and components are often duplicated, so that the device can automatically fall back on the twin function.

Instrument with early warning system
All ProTrac instruments are equipped with a clever Asset Management system. This means that they operate with self monitoring and diagnosis – already before any kind of disturbance or failure occurs.

Even when only the tiniest deviations from the optimal state are recognized, ProTrac switches from “green” to “yellow” status according to the traffic light principle. There is thus sufficient time to correct the factors that caused the disturbance.
Data transmission in any system

**PROTRAC speaks all languages**

Whether Profibus PA, Foundation Fieldbus or 4 ... 20 mA/HART – ProTrac instruments have a good mastery of all communication standards currently on the market. The instruments speak the language of your automation equipment and can be integrated into any process control system without difficulty. The universally applicable electronics also provides for smooth cooperation between systems: a relay output, analogue and digital inputs and outputs, as well as a serial multi-gauge communication bus, make a wide variety of applications possible.

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**Simple adjustment and safe operation**

With ProTrac, commissioning and operating a radiation-based measurement point is simpler than ever. The on-site adjustment module PLICSCOM can be used to set the parameters of simple level or density applications. For complex measurement tasks incorporating several detectors or additional sensors for temperature or flow-rate measurement, there are high performance DTM and EDDs with user-friendly assistants for commissioning and analysis.
Level measurement with FIBERTRAC and SOLITRAC

The special feature of ProTrac: every ProTrac instrument can be equipped with the most suitable detector type for the particular application. The detector, also called a scintillator, consists of sodium iodide or plastic material that generates flashes of light when excited by gamma radiation. These flashes are converted into electrical impulses and amplified by a photomultiplier. The processing electronics then calculates the precise level of the medium from the electrical impulse rate.

SOLITRAC: solid performance
The robust PVT rod detector of SoliTrac is the specialist for straight sided vessels. The sensor with straight plastic scintillator is available up to 3 m long on request and can be simply mounted on the outer wall of the vessel.

PVT detectors work with a precision of 1 % in a temperature range of -40 to +60 °C.

FIBERTRAC: a flexible solution
FiberTrac has a flexible plastic detector for level measurement on curved and conical vessels. The up to 7 m long detector tube can be adapted to fit the container form. This is made possible through flexible scintillator fibres of plastic. The big advantage: due to the length and flexibility of the detector, one single instrument often suffices where previously several rod detectors had to be connected in series.

Convincing features
Whether the straight SoliTrac or the adaptable FiberTrac: both sensors operate completely independent of the process, since they are attached to the outside of the container or tank.

Suitable clamps and holders are delivered with the instrument for problem-free mounting on vessels. The sensors are maintenance-free and long lasting and work reliably in ambient temperatures from -40 to 60 °C. For measuring tasks in still hotter environments, FiberTrac and SoliTrac are also available with water cooling.

To enable precise adaptation to any measuring range, the detectors are available in different lengths. Multiple sensors can also be cascaded.
**FIBERTRAC**

Radiation-based sensor for continuous level measurement
- Flexible plastic detector for round and conical vessels
- Measuring range up to 7 m
- Cascadable for larger measuring ranges
- Signal output 4 ... 20 mA/HART, Profibus PA, Foundation Fieldbus
- Self-monitoring and diagnosis acc. to NE 107

| Measuring range: | 1 ... 7 m |
| Process temperature: | any |
| Ambient temperature: | -40 ... +50 °C |
| Process pressure: | any |
| Measuring precision: | ± 0.5 % |

**SOLITRAC**

Radiation-based sensor for continuous level measurement
- PVT rod detector for cylindrical vessels
- Measuring range up to 3 m
- Cascadable for larger measuring ranges
- Signal output 4 ... 20 mA/HART, Profibus PA, Foundation Fieldbus
- Self-monitoring and diagnosis acc. to NE 107

| Measuring range: | 1 ... 3 m |
| Process temperature: | any |
| Ambient temperature: | -50 ... +60 °C |
| Process pressure: | any |
| Measuring precision: | ± 0.5 % |
MiniTrac is a real all-rounder. It is employed everywhere where the density or limit level of liquids or bulk solids has to be monitored. It can be mounted on any kind of vessel: on simple tanks and bunkers as well as stirring vessels, on sluices or on high-pressure reactors. Due to its small dimensions, MiniTrac finds room almost anywhere – for example on pipelines or in the narrow corners of feed hoppers. MiniTrac is equipped with a crystal scintillator of sodium iodide (NaI) that can measure with a reproducibility of 0.1%.

**Thin or viscous**

Radiation-based density measurement is gaining more and more importance in the chemical industry. Since products in this sector are often highly corrosive, the only reasonable alternative is non-contact measurement. The food and pharmaceutical industries depend, for hygienic reasons, on measuring instruments that can “see through things”. But radiation-based density measurement is especially important in petrochemical and offshore applications: knowing the consistency of the drilling mud and being able to recognize different types of oil in a pipeline are absolutely essential in these sectors.

**Full or empty**

MiniTrac is also used when the minimum or maximum level in a vessel has to be monitored. This serves to avoid overfilling or protect pumps from running dry.

Mounted at the height of the desired minimum or maximum level, MiniTrac delivers a reliable switching command when the respective level is exceeded or underrun. It can also be used to monitor blockage and the formation of buildup.
MINITRAC

Radiation-based sensor for density measurement and level detection

- NaI detector integrated in sensor housing
- Signal output 4 ... 20 mA/HART, Profibus PA, Foundation Fieldbus
- Self-monitoring and diagnosis acc. to NE 107

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<tr>
<td>Ambient temperature:</td>
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<tr>
<td>Process pressure:</td>
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</tr>
<tr>
<td>Measuring precision:</td>
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Mass flow measurement with WEIGHTRAC

The ancient Greeks already knew it: everything flows. But how big the flow really is, is not always easy to determine. Conventional flow-rate measuring techniques often reach their limits in bulk solids applications.

Everything flows

WeighTrac is the radiation-based alternative to the mechanical belt weigher: when implemented on conveyor belts or in screw conveyors, WeighTrac reliably delivers the flow rate as well as the summed throughput of bulk solids.

In the process, the radiation source sends its signals through the bulk solid, which damps the gamma rays more or less depending on material quantity and density. WeighTrac calculates the mass throughput from the intensity of the incoming radiation and the speed signal of the tachometer.

WeighTrac can also be retro-installed on existing conveyor systems without great effort. The system is set up and put into operation by entering theoretical values – costly, time-consuming calibration is thus not required. The contactless measuring technique makes WeighTrac wear and maintenance-free.

### WEIGHTRAC

Radiation-based sensor for mass flow measurement

- PVT rod detector
- Precise bulk solids measurement on conveyor belts or screw conveyors
- Simple mounting by means of measuring frame
- Signal output 4 ... 20 mA/HART, Profinet PA, Foundation Fieldbus
- Self-monitoring and diagnosis acc. to NE 107

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<tr>
<td>Ambient temp.</td>
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<tr>
<td>Process pressure</td>
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<tr>
<td>Measuring precision</td>
<td>±1 % of measuring range end value</td>
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Source container VEGASOURCE

Safety for people and environment: the radioactive source is embedded in a multi-layered source container. The screening effect of VEGASOURCE permits its use without a control area and guarantees operational safety through pneumatic on/off switching.

A safely packaged radiation source

The source container VEGASOURCE fulfils two important functions: on the one hand, the lead casing protects the surrounding area, secondly it also protects the capsule containing the radioactive isotope from mechanical or chemical damage.

The radioactive material is enclosed by several thick, stainless steel capsules that are tightly welded together. The container fulfils the highest safety requirements as per ISO 2919 and ANSI N43.6 with classification C 66646.

The radiation is focussed as it exits through a narrow slit in the direction of the measured medium. In all other directions, it is absorbed by the protective container.

The outlet of the VEGASOURCE source container can be closed mechanically with a shutter mechanism, and, if necessary, also pneumatically. This “turning off” of the radiation is necessary, for example, when servicing work on the process vessel is carried out.

VEGASOURCE

Protective container for the radiation source

- Best possible shielding with low container weight
- Simple exchange of radioactive source
- Optionally with pneumatic or electrical shutter
- Optional fire-proof version acc. to IEC Norm 60405 as well as ISO 7205

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<th>Process temperature:</th>
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<td>-50 ... +100 °C</td>
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<tr>
<td>Process pressure:</td>
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Application example: level

Polyester melt

It's hard to imagine life without polyester. It can be found in beverage bottles, in clothes, in varnishes and in circuit boards. This versatile synthetic material is created in a polyester melt reactor, in which terephthalic acid is esterified with monoethylene glycol. The process conditions in such a reactor place heavy demands on a level instrument: the process temperature climbs up to +280 °C and there is a vacuum inside the vessel. The vessel itself is completely enclosed by a heating jacket. In addition, a disc agitator causes rotational movement of the contents.

To guarantee constant quality of the polyester melt, the level in the reactor is continuously monitored.

Level measurement with SOLITRAC and FIBERTRAC despite rotation and heat

The ProTrac sensors SoliTrac and FiberTrac are particularly suitable for level measurement in a polyester reactor.

The measuring equipment, mounted on the outside of the vessel, delivers reliable process data – without touching the product or the vessel. The isotope caesium-137 is used as the radiation source. Since it has a half-life of 30 years, the source usually never has to be exchanged and is therefore virtually maintenance-free.
Application example: limit level

**Digester**

In cellulose production, wood chips are broken down chemically with the help of cooking liquor. After the cooking process is finished, a part of the raw wood material is dissolved in this medium. To be used again, the lye (cooking liquor) must be regenerated. This is carried out in special reactors in which the lye is cleaned through oxidation. The oxidation process takes place at a temperature of around +160 °C and a pressure of 10 bar in an oxygen atmosphere. Precise monitoring of the level is required for automated digester operation.

**Reliable point level detection with MINITRAC**

The screw conveyors must be switched off when the maximum value is reached. Due to the process conditions, this measurement must be absolutely reliable and maintenance-free. The nucleonic level switch MiniTrac fulfils these requirements perfectly. It operates contactlessly and is thus independent of the critical process conditions and not influenced by buildup or product density fluctuations.

**MINITRAC**

- Non-contact measurement
- Independent of pressure and extreme temperatures
- NaI scintillator
- Simple retro installation
- Maintenance-free
- SIL2 qualified

**VEGASOURCE**

- Best possible shielding allows use without control area
- Low space requirements and simple mounting
- Operational safety through optional pneumatic on/off switching
Flue gas desulfurization

To lower their emission values, coal-fired power stations operate expensive systems for flue gas desulfurization. Many of these systems use the wet method, whereby lime in the form of a lime water suspension is used as a “detergent”: the lime water suspension is sprayed into the untreated flue gas in the scrubbing tower. The sulphur dioxide contained in the exhaust fumes is largely absorbed by the ensuing chemical reaction.

The concentration – that is the density – of the lime milk is decisive for an effective flue gas desulfurization and must be monitored continuously.

Lime milk density measurement with MINITRAC

The fine particles in the lime water are very abrasive and settle out quickly.

To achieve a high flow velocity – and thus a slower settling out of material – pipes with diameters less than 100 mm are usually employed.

The required measuring precision is reached by sending the radiation through the pipe at an angle of 30°. MiniTrac can be easily installed in this position with the variable mounting accessories.

MINITRAC
- Non-contact measurement
- NaI scintillator
- Simple retro installation
- Maintenance-free
- SIL2 qualified

VEGASOURCE
- Best possible shielding allows use without control area
- Low space requirements and simple mounting
- Operational safety through optional pneumatic on/off switching
Application example: mass flow

Clinker conveyor belt

In cement production, raw meal is burned into clinker in long rotary furnaces. Directly after leaving the rotary furnace, the clinker has a temperature of over +1300 °C and is subsequently cooled down to around +200 °C. The still red-hot clinker is transported to a temporary storage location by a cell conveyor. The high product temperatures make this a difficult measuring task.

Exact regulation of the feed rate of the clinker is important for production control.

Mass flow measurement with WEIGHTRAC

Radiation-based measurement is ideal for mass flow monitoring of hot clinker: WeighTrac determines the flow rate contactlessly and completely unaffected by the temperature of the clinker. Another advantage of the radiation-based mass flow measurement: WeighTrac can be easily integrated into existing conveying systems. In addition to the flow rate, the instrument can measure the density of the clinker material, the so-called liter weight.

WEIGHTRAC
- Non-contact measurement
- Simple mounting by means of measuring frame
- Simple retro installation
- High reproducibility
- PVT scintillator allows low radiation activity
plics® – easier is better

**Electronics**

- 4 ... 20 mA/HART
- Profibus PA
- Foundation Fieldbus

**Housings**

- Aluminium double chamber
- Stainless steel double chamber

**Indicating and adjustment module**

-PLICSCOM
- VEGACONNECT

**Sensors**

- Explosion protection
- Functional safety
- PVT scintillator
- Flexible plastic scintillator
- Nal-szintillator

PLICSCOM VEGACONNECT

plics® – easier is better
Trend-setting measurement technology orientates itself around the people who use it. That's why we developed plics® – the world's first modular product system for instrumentation. Every one of our sensors is custom built from plics® components and thus optimally fulfils the requirements of any industry and its specific applications.

**Simpler planning with plics®**

The free choice and combination of sensor, process fitting, electronics and housing simplifies instrument selection and engineering for use in machines and plants. With plics®, cost reduction starts right at the planning stage.

**Clear advantages in plant construction**

Short delivery time, uncomplicated connection, fast setup and commissioning save the plant builder significant time and costs. The configuration, wiring and setup of VEGA instruments are always the same, so whoever knows this can work with any plics® measuring principle and application at any time.

**Assistance for the user**

plics® gives a convincing performance in daily use due to its high operational reliability, simplified servicing, and reduced spare parts stocking through the use of many identical parts. The consistency of technology and operation simplifies and accelerates work with different plics® instruments.

**Radiation-based measurement with all the advantages of plics®**

The new ProTrac sensors now make the advantages of the plics® instrument concept available to radiation-based level, density and mass flow measurement, as well as radiation-based level detection.

- Detectors for widely different applications
- Robust housings for every application: aluminium or stainless steel
- Integrated asset management function
- Standardised electrical connection concept
- Fast setup and commissioning via user-specific, menu-driven operation
Where man and machine meet: adjustment and system integration

Instrument adjustment on site with PLICSCOM

The indicating and adjustment module PLICSCOM can be plugged into any plics® instrument at any time. It functions as a measured value indication on the instrument and as an on-site adjustment device. The structure of the adjustment menu is clearly organized and makes setup and commissioning easy. In addition, the status messages are displayed in clear, readable text. When an instrument is exchanged, PLICSCOM ensures fast availability of the measuring point: all sensor data are saved by pressing a key on PLICSCOM and later copied into the replacement sensor.
Instrument adjustment via PC and control system

FDT/DTM technology is an innovative, manufacturer-independent description technology for field instruments. Complex field instruments can be operated as easily with laptop computers and PCs as with the current engineering and operating environments of control systems. With DTM the sensors are configurable down to the last detail and important adjustments can be carried out easily and quickly. As a system-independent operating platform for DTM, PACTware is the first choice for many field device manufacturers. VEGA also delivers the corresponding field device descriptions for system environments that require EDD description technology.

All current standards for measurement data transmission

VEGA offers practice oriented solutions: from the proven 4 ... 20 mA/HART measurement data transmission to Fieldbus technologies like Profibus PA or Foundation Fieldbus to wireless transmission. For level detection, the selection ranges from contactless switch to relay and transistor right through to NAMUR signal.

Communication at all levels

VEGA supports all main standards for uniform, centralized field instrument operation. If the instruments are integrated in primary management or control systems, the field instruments can be accessed for adjustment, servicing and diagnosis purposes via the existing infrastructure. Both DTM as well as EDD description technologies are supported.