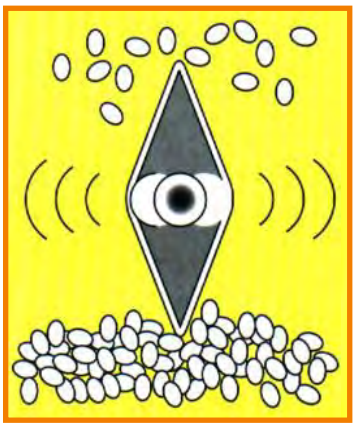
VIBRATING LEVEL SWITCHES FOR SOLIDS

HYCONTROL

DIAMOND POINT - PRINCIPLE OF OPERATION

A piezoelectric crystal is used within the probe to force the blade to oscillate at its fundamental frequency (natural resonance). When the blades come into contact with the process medium, the natural frequency of oscillation is damped; the electronics sense the change in frequency which causes the unit to switch. All vibrating probe level switches operate this way.

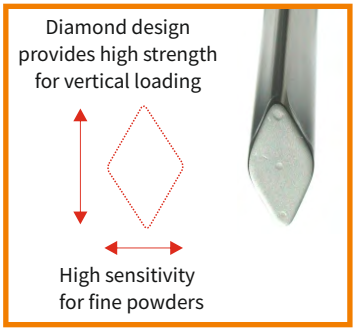
Different electronic outputs allow the user to switch a load on/off or to interface directly with a computer. The units can be programmed to sense high- or low-level and failsafe high or low, with adjustable sensitivity to eliminate false switching. The switch is only sensitive at the tip, so minimising the effect of build-up on tank walls.



Advantages of Diamond Point Technology

The vibration technology at the heart of the DP Series level switches offers many unique advantages over alternative level sensing technologies:

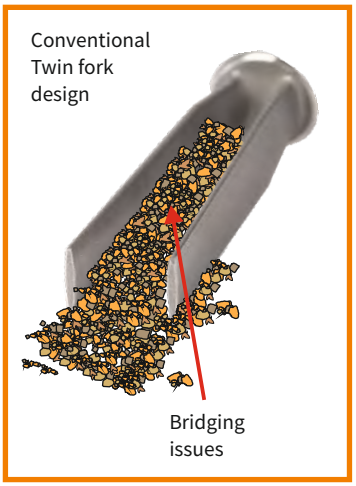
- **No moving parts**
- **No maintenance required**
- **Unaffected by environmental changes, e.g. temperature, pressure, humidity**
- **Unaffected by material changes, such as dielectric constant**
- **Unaffected by dust clouds and agitation**
- **No calibration required**
- **Unique self-cleaning probe**
- **Stainless steel is resistant to corrosion**
- **Minimum bulk density of 10 g/ltr (depending on model)**
- **Ground Level Test facility available**



Hycontrol's diamond point design is unique in both shape and construction. This shape provides a self-cleaning effect that prevents the build-up of falling media along the sensing blade, while in a horizontal position, it will sense a rising surface. The cleverly-engineered web support design gives the probe more strength and stability, thus providing a more accurate reading and preventing premature failure.

Disadvantages of Twin Forks and Rod Designs

- **Conventional twin forks can become bridged, which can cause false alarms**
- **Twin fork designs require more maintenance, increasing ownership costs**
- **More chance of material build-up on wider rods, causing false switching**
- **Round probes are more likely to carve out a hollow place to vibrate inside the material**
- **Weaker design compared to unique patented diamond profile. This diamond design in the vertical loading plane is up to five times stronger with the reinforced web support (*see picture, right*)**



SWITCHES FOR SOLIDS APPLICATIONS

A vibrating level switch for solids must be of a fundamentally different design to a switch for liquids. If a probe used two large parallel blades on powders or solids, it would be too easy for the product to build up and lodge between the blades, stopping the switch's oscillations regardless of product level. For solids applications it is preferable to have only one blade in contact with the product: this eliminates the potential for bridging between the forks and ensures that the switch does not give false alarms.

DP220, 230, 240 & 250 Diamond Point Vibrating Probes

The DP Series's design produces the most rugged but sensitive switch for solids applications. The hollow diamond-shaped blade houses the second vibrating rod inside. The blade is very strong in the vertical direction to withstand falling solids and to ensure that product does not build-up on it but retains its flexibility and sensitivity in the horizontal mode enabling it to sense media with very low bulk densities.

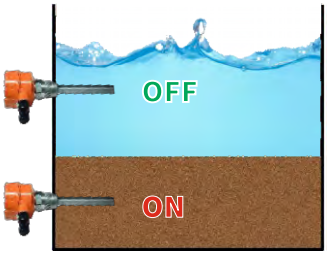
DP600, 630 & 650 Vibrating Probes

The DP6 Series uses the piezo element to excite an 85 mm long stainless steel rod to its resonant frequency of 460 Hz. When the material covers the rod, it stops the vibration. These probes are suitable for use on pellets and granules and will detect solid materials with a bulk density greater than 90 grams per litre. It is unsuitable for sticky materials or those that tend to hang up.

DP660 OEM Vibrating Probe

The DP660 model is a low-cost OEM product designed specifically to be supplied in volume and fitted into other companies products. It has a 1-inch NPT, BSP or DIN 2999 G1 process connection and a PNP or relay output. It is suitable for products with a bulk density of 90 g/l or greater.

Sediment Detection Option



Hycontrol's vibrating probes are designed to detect all kinds of bulk solids; powdered, grained or in a granular state. Their robust design and high sensitivity make them perfect for a wide range of applications, from heavy materials in rough environments down to light materials and powders. DP Series probes can also detect solids beneath liquids, using a special model option for sediment detection. Typical applications for this include detecting salt underwater in salt saturators and sand settlement from production processes.

Typical Solids Applications

- **Grains**
- **Spices**
- **Cornflakes**
- **Powdered clay**
- **Lime**
- **Sugar**
- **Pellets**
- **Wood shavings**
- **Tea leaves**
- **Soda**
- **Ground glass**
- **Polystyrene**
- **Powered milk**
- **Coffee beans**
- **Carbon black**
- **Styrofoam**
- **Salt**
- **Animal food**
- **Plastic granules**
- **Filler materials**
- **Frozen chips**
- **Peanuts**
- **Foundry sand**
- **Cellulose**
- **Flour**
- **Gravel**
- **Sweets**
- **Cement**
- **Beans**
- **Tobacco**
- **Chalk**

LEVEL SWITCHES - DP220/DP230/DP240/DP250

The Diamond Point level switches are designed specifically for dry products ranging from stone aggregates and heavy materials such as cement to very low-density materials like cornflakes and fine powder or flour.

The unique principle of operation and shape ensures that the probes are self-cleaning, and because they are only sensitive at the tip, they are not influenced by build-up on the silo walls.

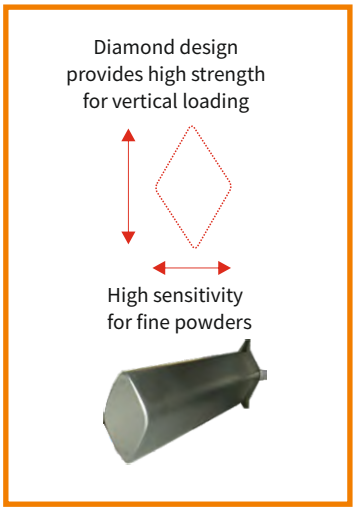
With its reinforced diamond-shaped vibrating blade, the single-blade design prevents the material from building-up or bridging, which are typical problems associated with the dual-bladed tuning fork design.

As it is very sensitive in the lateral mode, the level switch works with extremely light materials with densities as low as 20 grams per litre.

The strong stainless steel construction gives the DP Series level switch strength in the vertical axis for heavy materials such as cement or aggregates.

Material build-up on the container wall does not influence the DP Series level switch's function as only the vibrating blade's tip is sensitive and not the base.

The electronic circuit of the switch includes an indication of power failure. Fail-safe high or low is selectable.



Standard Diamond Point Probe: DP220

The standard model DP220 has an insertion length of approximately 173 mm. it can be mounted from the top or side for high- or low-level detection. Connection to the vessel is made via 1 ½" BSP, NPT or DIN thread.

Welded Extension: DP230

Suppose the application requires ATEX/UKEX or a longer insertion length. In that case, this model offers the possibility to adapt the insertion length exactly to the size needed using a welded pipe between the vibrating probe and the 1½" mounting socket. The maximum insertion length for DP230 is two metres. The DP230 is suitable for top mounting.

Threaded Extension: DP240

The DP240 provides the flexibility of different insertion lengths up to four metres. A 1" pipe performs the extension with threads on both ends, screwed between the vibrating probe and the 1½" mounting socket. As no special equipment is necessary for making the extension, it is possible for the customer to obtain and mount the extension tube at their site, reducing spares and saving transportation costs. The DP240 is suitable for top mounting but **NOT** for ATEX/UKEX applications.

Flexible Cable Extension: DP250

The DP250 can be supplied with up to 20 metres of a polyurethane sheathed steel rope reinforced cable. The DP250 is for top mounting only via the 1½" DIN or NPT thread. The DP250 has the advantage of offering very long insertion lengths, but it is easily transported. It can be shipped in very compact boxes in comparison to the extension tube models DP230 and DP240. The DP250 can be used to detect solids or for the detection of sediment beneath a liquid.

LEVEL SWITCHES - DP600/DP630/DP650/DP660

The DP6 Series has a single solid stainless steel rod that is vibrated by the piezoelectric element. Its small size is ideal for use in small hoppers containing granular materials or pellets, like plastics, food or grain. **Users should note that the circular construction of the DP6 Series means it is not as sensitive to light materials as other DP probes.** These probes will detect solid materials with a bulk density greater than 90 grams per litre and are unsuitable for sticky materials or those that tend to hang up.

Standard Probe: DP600

The standard model DP600 has an insertion length of approximately 173 mm and can be mounted to the container from the top or side for high- or low-level detection. Connection to the vessel is made via a 1" BSP, NPT or DIN thread.

Pipe Extension: DP630

The application may require a longer insertion length. In that case, this model allows adaptation of the insertion length to achieve the exact size needed using a welded pipe between the vibrating probe and the 1" mounting socket. The maximum insertion length for DP630 is two metres. The DP630 is only suitable for top mounting.

Flexible Cable Extension: DP650

The DP650 can be supplied with up to four metres of a polyurethane sheathed, steel rope reinforced cable and is only for top mounting. The connection to the vessel is made by a 1" DIN or NPT thread. The DP650 offers longer insertion lengths and can be shipped in very compact boxes compared to the extension tube model DP630. The DP650 can be used to detect solids or for the detection of sediment below a liquid level.

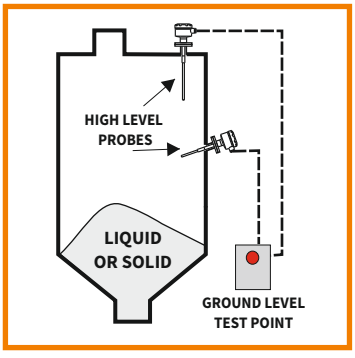
OEM Model: DP660

The DP660 model is a low-cost OEM product designed specifically to be supplied in volume and fitted into other companies product, providing the best technology for the lowest price. It is only suitable for products with a bulk density of over 90 g/l. The DP660 can be mounted on the top or on the container's side for both high or low detection via the 1" NPT, BSP or DIN 2999 G1 process connection. The probe features a PNP or relay output.

Ground Level Test Facility

Hycontrol vibrating switches can be connected to a test switch or panel mounted at the bottom of the tank or silo, which allows the high-level probes to be tested without the need to climb to the top. The test is designed to be operated before each fill starts.

A single push of the **Ground Level Test (GLT)** button on the control panel stops the probe from vibrating, testing the probe electronics are working. Any connected alarms will also operate during the test to check that they are functioning correctly. The GLT feature helps reduce product wastage, avoid costly cleanup operations from any overspill incidents, and improve overall safety in the working environment.



	DP220	DP230	DP240 (not EX)	DP250
Enclosure	Die Cast Aluminium			
	IP66/7			
Electrical Connection	PG13.5 x2			
Material Wetted Parts	Stainless Steel 1.4301			
Process Connection	1½ DIN 2999 or 1½ NPT			
Max. Vertical Load at End of Blade	1000N			
Max. System Pressure	10 bar (0.8 to 1.1 bar for models with ATEX or UKEX approval)			
Max. External Length	173 mm	2 m	4 m	20 m
SHT Option	-15° C to +250° C			N/A
System Temperature	-20° C to +80° C			
Power Supply and Output	22 – 250 V AC, 3 VA, Relay DPDT 250 V AC 8A *or* 24 V DC ±10%, 3 wire, NPN or PNP <350 mA			
Indication (Internal)	Relay - Red			
	Power - Yellow			
Switch Delay	1 – 5 seconds			
Min. Product Density	20 grams per litre (10 g/l special)			
Ambient Temp. Range	-20° C to +60° C			

Approvals

	DP220	DP230	DP240	DP250
ATEX (Optional)	2014/34/EU		N/A	2014/34/EU
ATEX Dust (Optional)	Group II 1/2D Ex ta/tb IIIC T95°C Da/Db		N/A	Group II 1/2D Ex ta/tb IIIC T95°C Da/Db
ATEX Dust Remote Electronics (Optional)	Group II 1/3D Ex ta/tc IIIC T95°C Da/Dc		N/A	Group II 1/3D Ex ta/tc IIIC T95°C Da/Dc
ROHS2	2011/65/EU & SI 2012 No. 3032 (as amended)			
EMC	2014/30/EU & SI 2016 No. 1091			
Low Voltage	2014/35/EU & SI 2016 No. 1101			
Ground Level Test Facility	Optional			

ATEX/UKEX Classifications (Except DP240)

	Equipment Group	Category	Equipment Protection Level	Suitable for zones
Vibrating probe	II	1 D	Da	20, 21, 22 or non-explosive atmospheres
Enclosure with electronics	II	2 D	Db	21, 22 or non-explosive atmospheres
Remote electronics installation	II	3 D	Dc	22 or non-explosive atmospheres
Protection is provided according to EN60079-0 and EN60079-31		- Dust-tight enclosure IP6X - Limited surface temperature		

	DP600	DP630	DP650	DP660
Enclosure	Die Cast Aluminium			Stainless Steel
	IP66/7			IP65
Electrical Connection	M16 (Option for 2)			DIN 43650
Material Wetted Parts	Stainless Steel 1.4301 / AISI 304			Stainless Steel 1.4301
Process Connection	1”BSPT/ DIN 2999/1”NPT			
Max. Vertical Load at End of Blade	80N			
Maximum Extension Length	-	1m	4m	-
Max. System Pressure	10 bar (0.8 to 1.1 bar for models with ATEX or UKEX approval)			
System Temperature	-20° C to +80° C			70° C
Power Supply and Output	20 – 250 V AC, 3 VA, Relay SPDT 250 V AC 5A *Or* 20 … 30 V DC, 2 wire, 8/16mA			24 V DC, NPN or PNP (<350 mA @ 24 V DC)
Indication (Internal)	Relay - Red			
	Power - Yellow			-
Switch Delay	1 – 5 seconds			
Min. Product Density	90 grams per litre	20 grams per litre		90 grams per litre
Ambient Temp. Range	-20° C to +60° C			

Approvals

	DP600	DP630	DP650	DP660
ATEX (Optional)	2014/34/EU			N/A
ATEX Dust (Optional)	Group II 1/2D Ex ta/tb IIIC T95°C Da/Db			N/A
ATEX Dust Remote Electronics (Optional)	Group II 1/3D Ex ta/tb IIIC T95°C Da/Dc			N/A
EMC	2014/30/EU & SI 2016 No. 1091			
Low Voltage	2014/35/EU & SI 2016 No. 1101			
ROHS2	2011/65/EU & SI 2012 No. 3032 (as amended)			

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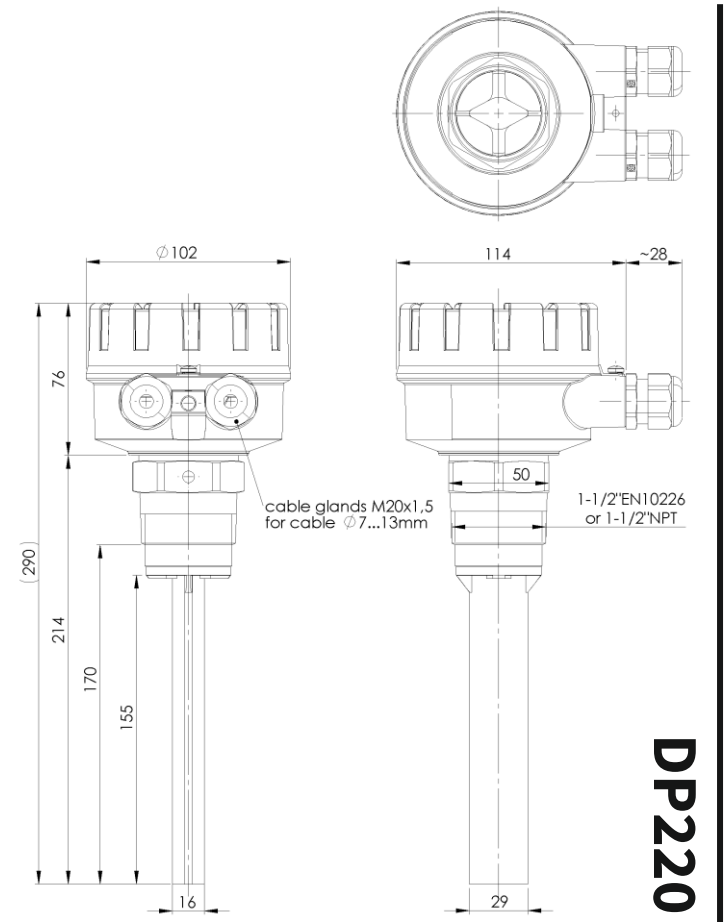
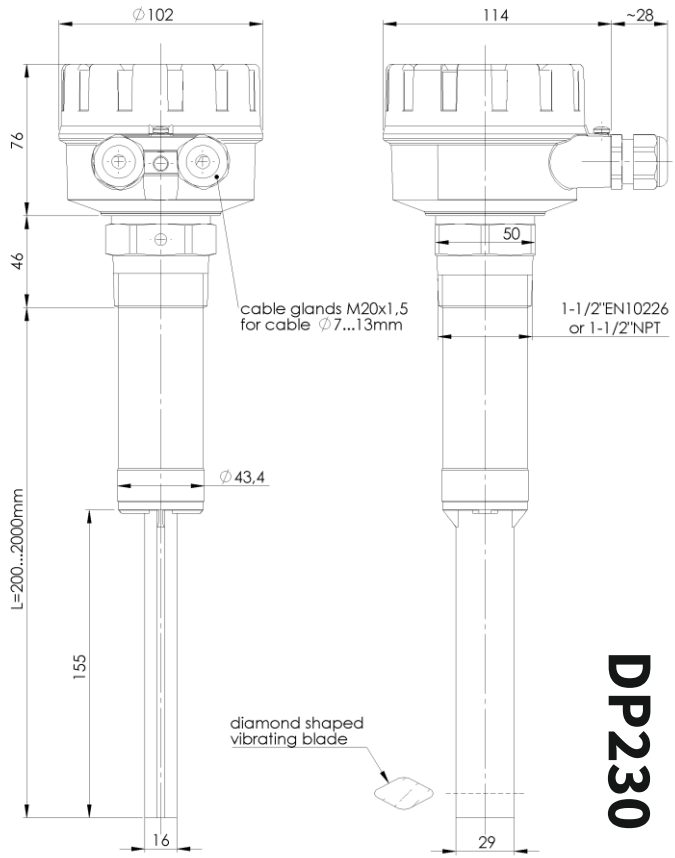
TECHNICAL DRAWINGS



DP220



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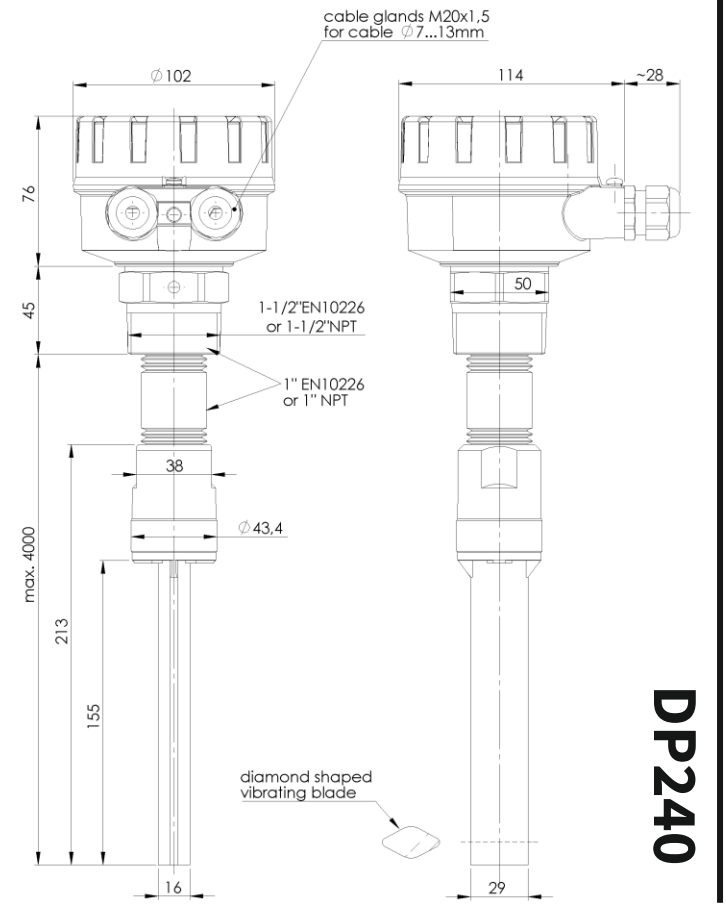

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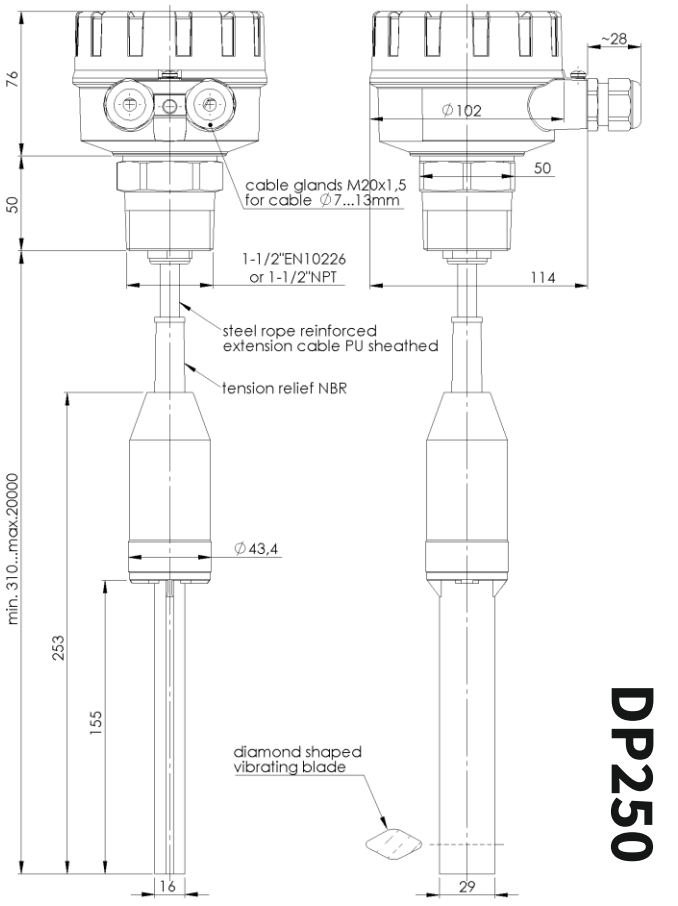
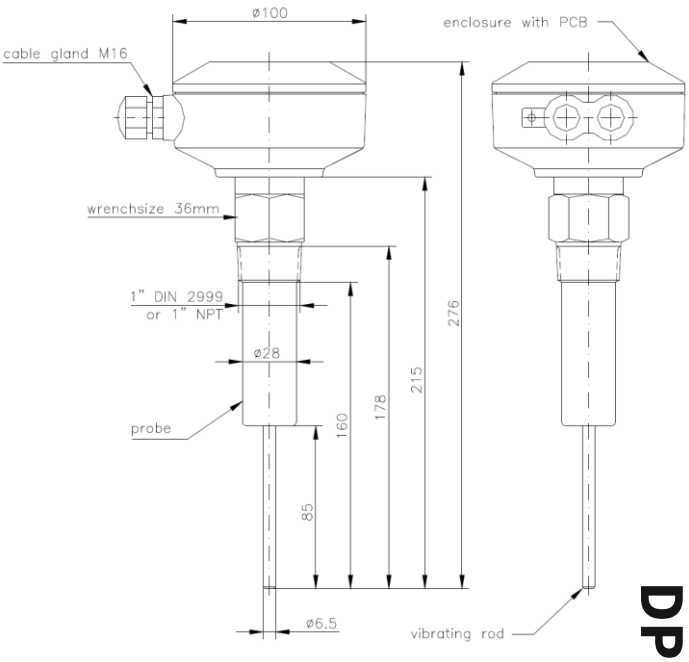


DP250



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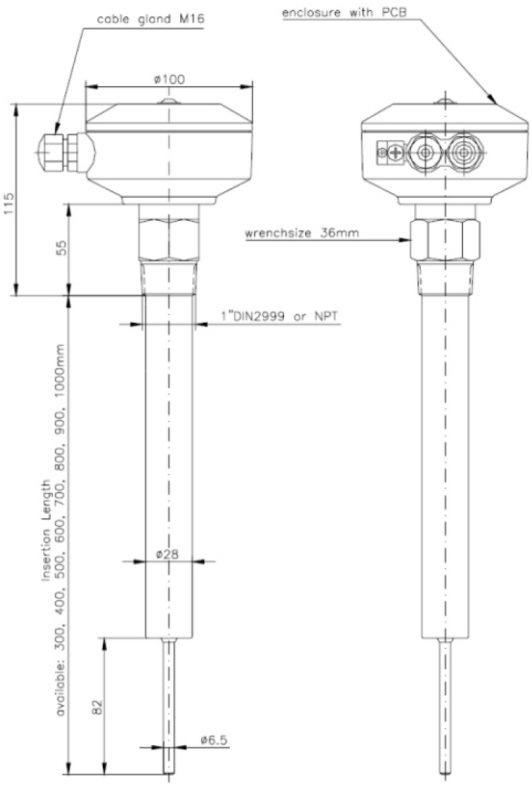

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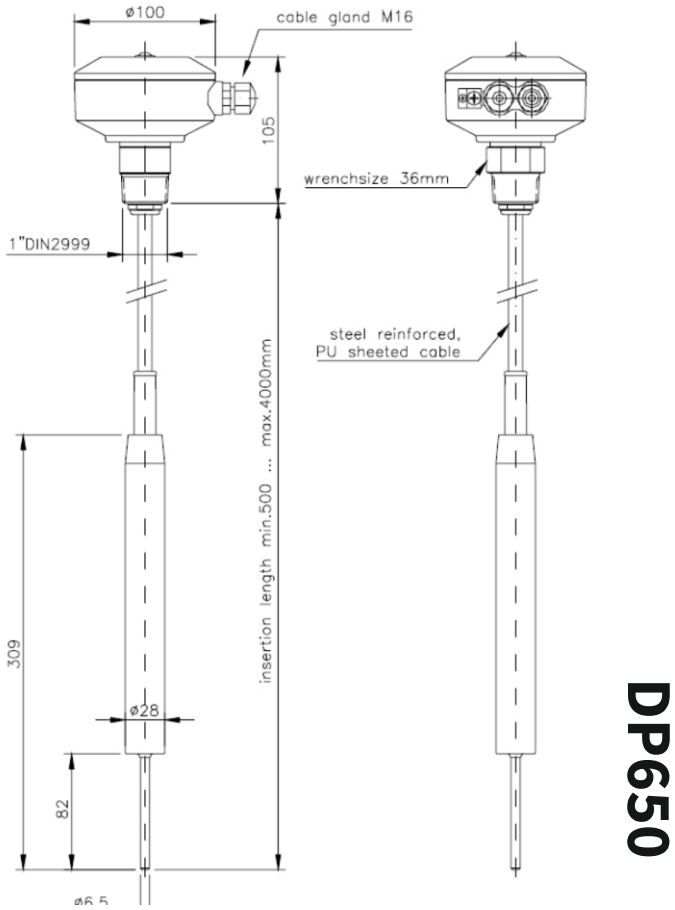

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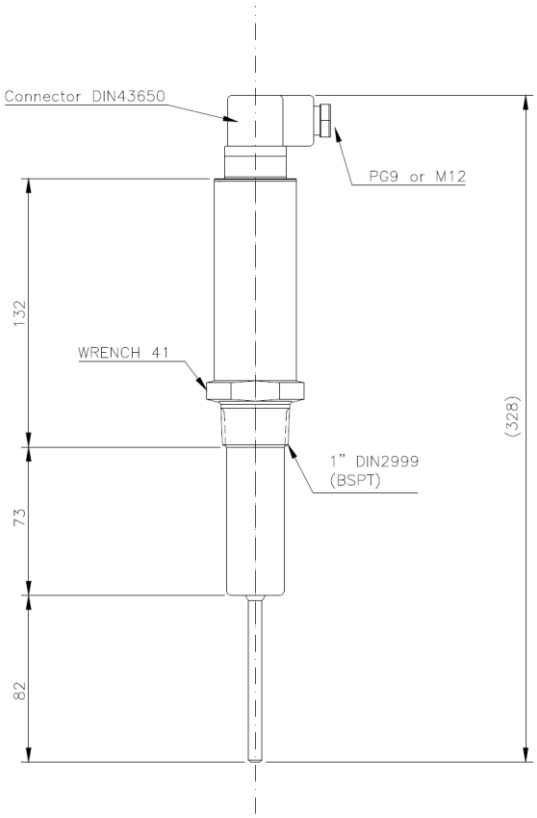


DP660

HYCONTROL LEVEL TECHNOLOGIES

Product Range for Solids:

(1) TDR radar

(2) 80 GHz FMCW radar

(3) 2-wire ultrasonic transmitter

(4) RF admittance level switch

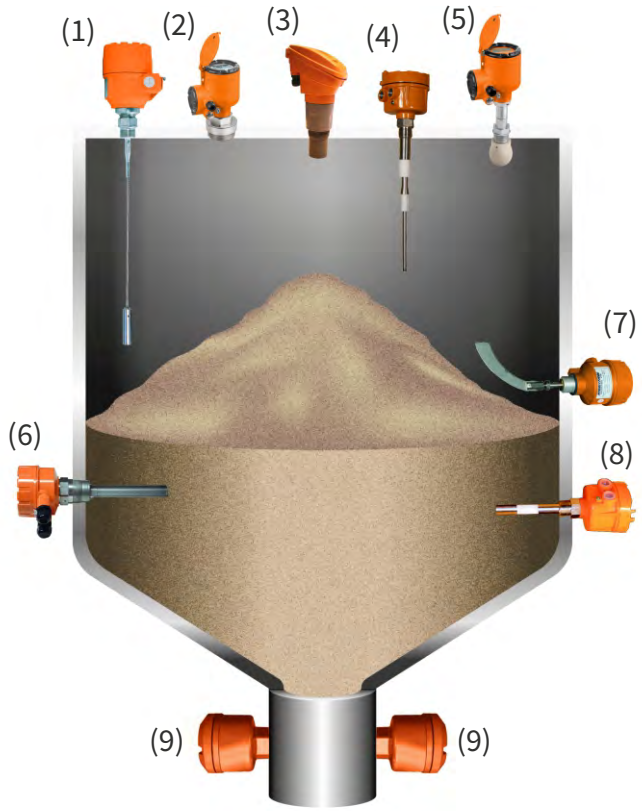
(5) 24 GHz FMCW radar

(6) Vibrating level probe

(7) Rotary paddle switch

(8) Capacitance level switch

(9) Microwave flow & blockage switch



Product Range for Liquids:

(1) Bypass level indicator

(2) 80 GHz FMCW radar

(3) Foam control system

(4) 24 GHz FMCW radar

(5) 2-wire ultrasonic transmitter

(6) TDR radar

(7) Capacitance level switch

(8) RF admittance level switch

(9) Tuning fork vibrating level switch

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