Version 1.1
ADH0222

DIAMOND POINT VIBRATING PROBES

DP220 / DP230 / DP240 / DP250

(DP240 Not available in ATEX / UKEX)

DP220

DP230

DP240

DP250

Instruction Manual

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IMPORTANT:

For safety reasons, and to ensure proper function of these instruments, it is strongly recommended users carefully read this instruction manual before installation.

Application

The DIAMOND POINT DP220 / DP230 / DP240 / DP250 are vibration-type level control instruments that detect the minimum or maximum level in bins, silos and hoppers, filled with grained or powdered materials (bulk solids). Typical product applications are plastic granules, all kinds of pellets, flour, cement, lime powder etc.

IMPORTANT:

The instruments cannot be used for detecting materials which are sticky and tend to build a deposit on the vibrating blade!

General Notes:

- Installation and maintenance **must** be performed by qualified technical personnel only.
- The DIAMOND POINT vibrating level sensors must be used only in the manner outlined in this instruction manual.
- The DIAMOND POINT vibrating level sensors are sensitive instruments which need to be handled with care. Never expose these instruments to mechanical loads and temperatures higher than indicated in the technical data. Do not make any changes on these instruments.

Models (drawings see page 7)

- **DP220**: standard model, insertion length approx. 170 mm
- **DP230**: with pipe extension welded, insertion length up to 2 m
- **DP240**: with pipe extension screwed, insertion length up to 4m
- **DP250**: with cable extension, insertion length up to 20 m.

Function

The signal from the electronic circuit of the DIAMOND POINT excites the blade of the instrument to vibrate at its resonance frequency of 286 Hz. When material covers the blade of the probe, the vibration stops. This is sensed by the electronic circuitry which forces its output to switch. When the blade gets uncovered, the vibration restarts and the output then switches back.

Technical Data

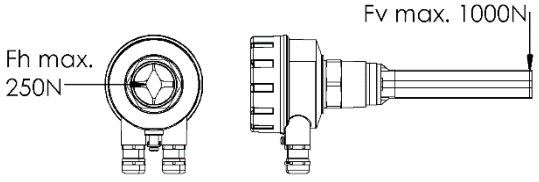
General:

Enclosure:	Die cast aluminium (powder coated RAL2008) Protection IP66 (IP65 for remote electronics installation) Two cable glands M20x1.5
Probe:	Stainless steel 1.4301 / AISI 304 Resonance frequency 286 Hz Extension cable DP250: polyurethane sheathed
Connection:	Thread 1½" EN10226 (BSPT) or 1½" NPT Optionally: Tri Clamp DIN 32676 for DP230
Time Delay	1 second from stop of vibration 2 to 5 seconds for start of vibration
Indication	LED on PCB (option: externally visible)
Material density:	Non-sticky bulk solids, min. 20 grams per litre (10g/l with special model "extreme sensitivity")
Safety:	Protection class I / installation cat. III Pollution degree 2 / altitude max. 2000m

Max. pressure inside bin: 10bar
(0.8 to 1.1 bar for models with ATEX or UKEX approval)

Max. load onto extension cable DP250: 200kg

Max. load onto vibrating blade: horizontal: 250N, vertical: 1000N



Electronics:

Wide range with relay output

Power Supply:	22...250V AC/DC with relay output
Relay Output:	2 volt-free change-over contact (DPDT), Max. AC: 250V-AC, 8A, 2000VA, $\cos\varphi = 1$ Max. DC: 8.0A at 24V-DC / 1.5A at 48V-DC Min. DC: 24V / 100mA
Power consumption:	≤3VA

3-wire DC-Version with transistor output

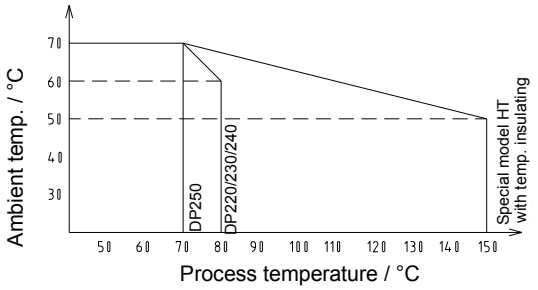
Power Supply:	24V-DC ±10%
Transistor:	Volt free NPN or PNP type (max. 48V DC) 350mA @ 24V-DC, short time max. 1A, max. power 20W, power loss max. 3V, max. leakage current 100µA, short circuit proof
Power consumption:	< 1 VA (blocked transistor)

Max. wire diameter for power supply and output signal: 2.5 mm²
Outside diameter range for cables: Ø7 …13mm

Max. allowed ambient and process temperature range:

	DP 220/230/240	DP250	HT Probe
Process temp.	-40…+80°C	-40…+70°C	-15…+150°C
Ambient temp. enclosure	-40…+70°C	-40…+70°C	-15…+70°C
Ambient temp. encl. ATEX or UKEX	-20…+60°C*	-20…+60°C	-15…+60°C*

*DP240 is **NOT** ATEX or UKEX approved



The vibration type level sensors DIAMOND POINT DP220 / DP230 / DP240 and DP250 meet the requirements of the following regulations:

CE-Conformity

- EU EMC-directive 2014/30/EU
- EU Low Voltage Directive 2014/35/EU
- ROHS2 2011/65/EU

UKCA Conformity

- UK Electro magnetic compatibility Regulations SI 2016 No. 1091
- UK Electrical Equipment (Safety) regulations SI 2016 No. 1101
- Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations SI 2012 No. 3032 (as amended)

The following standards are applied:

- EN 61326-1
- EN 61010 -1
- EN 50581

Approvals

Dust-Ex: The vibration type level sensors DIAMOND POINT DP220StEx / DP230StEx and DP250StEx can be used in the presence of combustible dust according to *ATEX directive 2014/34/EU* or *UKEX* SI *2016 No. 1107 (as amended)*: equipment group II, category 1/2 D or 1/3 D for remote electronics installation.
Approved instruments have the indices "*StEx*" and a nameplate with the following data:

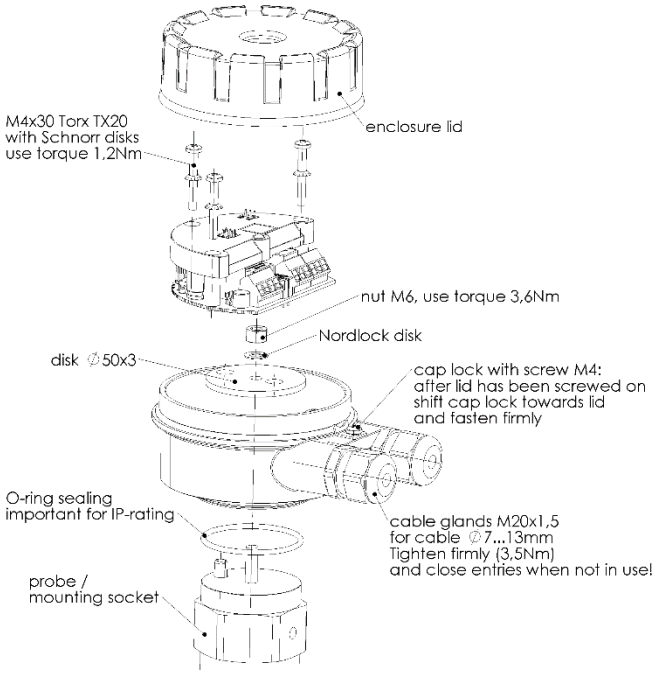
Applied standards: EN 60079-0 and EN 60079-31.

Note: - DP240 is **NOT** ATEX or UKEX approved.

For ATEX or UKEX approved instruments please also read the special safety instructions at page 8 of this manual!

Assembling

IMPORTANT:
For protection IP66 it is essential to assemble the instruments according to the following sketch. It is very important to watch the appropriate location of the sealing and to apply the correct torques.



Assembling of tube extension DP240

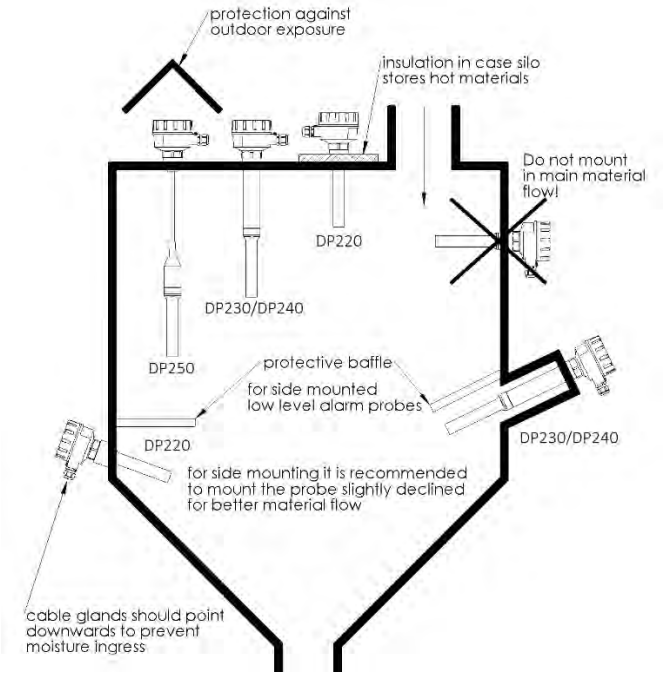
The DP240 is usually supplied in parts: probe, enclosure with electronics, extension cable and mounting socket. The extension tube is normally supplied fully assembled. See page 7 for DP240 drawing.

Mounting

The LEVELSWITCH is installed by screwing the mounting socket of the instrument into the bin wall by means of a 50 mm open end wrench.
A suitable sealing, (e.g. Teflon tape), must be applied onto the thread.

!!! Do not screw in by turning the housing !!!

Please also consider the following when mounting the LEVELSWITCH:



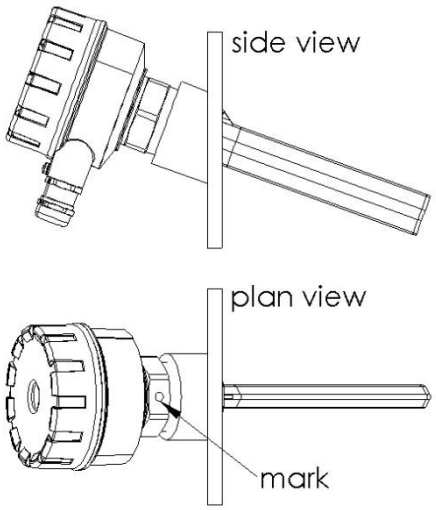
Switching point:

The switching point of the LEVELSWITCH depends on the density of the material: for heavy materials like sand only a few millimetres of the vibrating blade have to be covered for damping the vibration. For very light materials like styrofoam the material must cover the vibrating blade completely in order to damp its vibration.

Vibration of the silo:
In case of heavy vibration of the silo wall it is recommended to install the electronics of the unit at a place where no vibrations are present, see section "*Special models*" on pages 5 and 6.

Side mounting:
When the probe is inserted into the bin from the side, it must be turned until the blade is vertically oriented, so that material can flow freely over the blade and does not rest on it causing false alarm. Alignment of the blade is verified by the two marks in the mounting socket. These will be facing up and down when the orientation of the blade is correct.

(See diagram on following page).



Orientation of the cable glands:
The cable glands must always point downwards to prevent moisture seeping inside the housing. If the housing is not in the correct position after the probe has been firmly screwed into the bin wall, minor corrections can be made by turning the housing by hand (it is normally very tight).

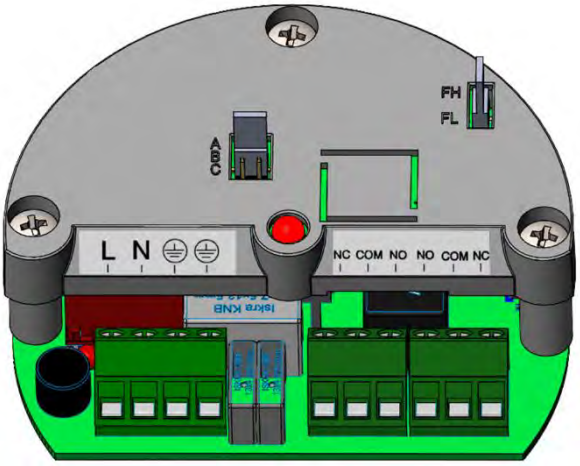
Wiring

Wiring is made according to the following sketch.
It is very important to consider the following safety guidelines!

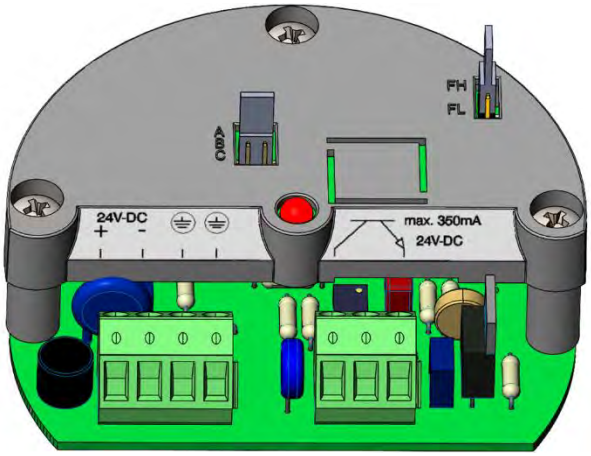
Safety Guidelines:

- The instruments must be used only at fixed installation of the cables for supply voltage and output signal.
- Wiring of these instruments must only be performed by qualified technical personnel.
- Before opening the cover and start of wiring make sure that power supply on all wires has been switched off.
- According to EN 61010-1 a main switch for this instrument has to be installed nearby the instrument with which power supply for this instrument **and** its output can be switched off. This switch must be marked as main switch of the instrument.
- For power supplies ≥ 50V a protective earth has to be connected to the terminal on the enclosure.
- If power supply and relay signal do not have the same source the connecting wires of the power supply have to be separated from the connecting wires of the relay by means of wire fasteners in order to prevent the connecting wires of the power supply from touching the output terminals and vice versa, (which might be possible in case of an error, e.g. a broken wire).

IMPORTANT:
The cable glands can be used for cables with outside diameter 7…13mm. In order to ensure IP rating IP66 cables outside diameter must fall within this range.



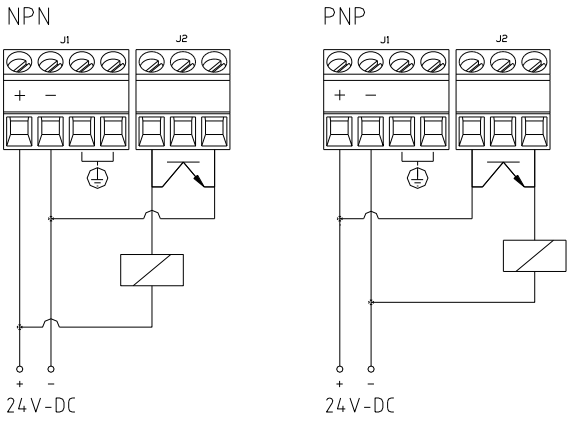
Wide range power supply with relay output DPDT



24V-DC with transistor output

24V-DC with transistor output

Depending on the wiring the transistor output can be either PNP or NPN type, see sketch. The max. switching power of 20W and the max. current of 350mA have to be considered.

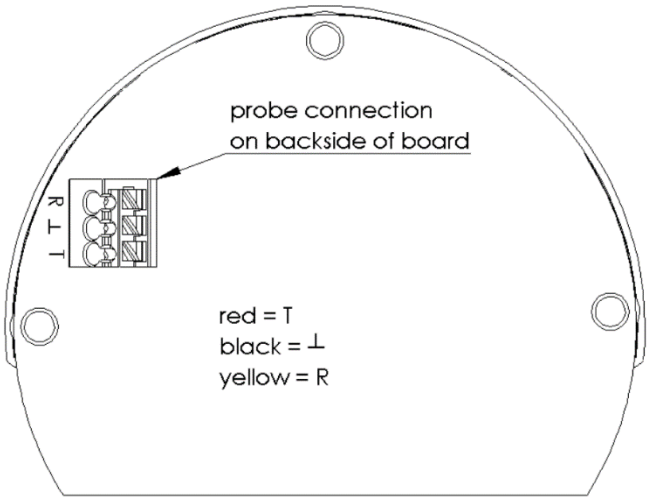


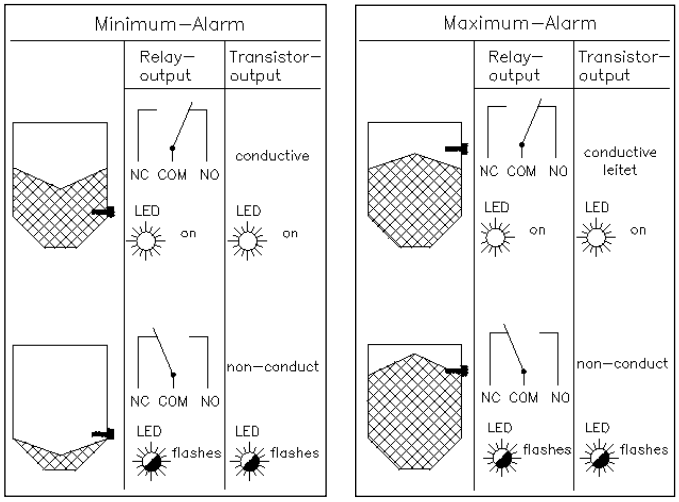
Probe Connection:
DP240 assembly or replacements.

The three wires of the probe get connected to the PCB via spring cage clamps: push the button of the clamp by means of a small screw driver and insert the wire end sleeve into the clamp, then release the button.

T = red
⊥ = black = ground
R = yellow or red

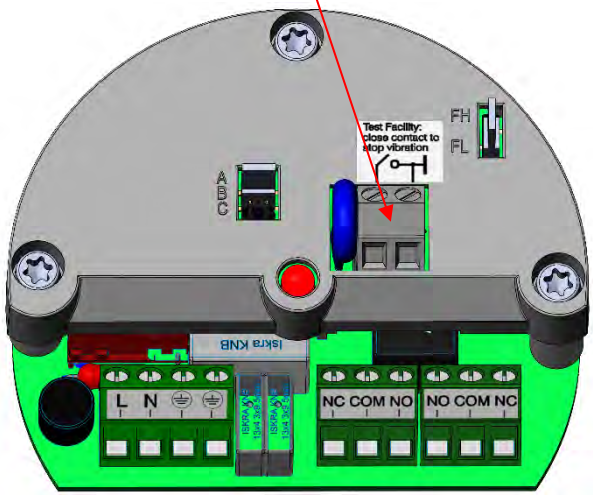
If the probe comes with two red wires these are interchangeable.





Ground Level Test Facility (GLTF):

Ground level test is to be performed when probe is vibrating:
When the contact of the GLTF terminals gets closed, the vibration stops and the output switches accordingly. Reopening of the test contact allows the probe to restart its vibration and the output signal switches back. For installation use a standard pushbutton and a two wire shielded cable, connect both wires to the GLTF terminals. Connect the screen of the shielded cable to ground (right clamp). The pushbutton can be installed up to 500m away from the electronics but the resistance of the cable should not exceed 100 Ohms /km.



Adjustment

Sensitivity:
Selectable by jumper

Pos. A: Use this setting only for very light materials with densities down to 20g/l, the sensitivity is very high at this setting.

Pos. B: Standard setting, sufficient for most materials.

Pos. C: For heavy materials with high densities which may form a deposit on the vibrating blade. As the sensitivity of the instrument is low at position C, very light material cannot be detected at this setting!

Failsafe high (FH) / Failsafe low (FL):
Switching Logic: see following sketch.

Failsafe high: jumper in position FH:
The relay is de-energized or transistor blocked when the blade is covered by material (dependent on model).

Failsafe low: jumper in position FL:
The relay is de-energized or transistor blocked when the blade is free (not covered by material) (dependent on model).

Output signals alarm as well at power failure.
If power fails the LED is off.

Special Models

Special model for high temperatures:

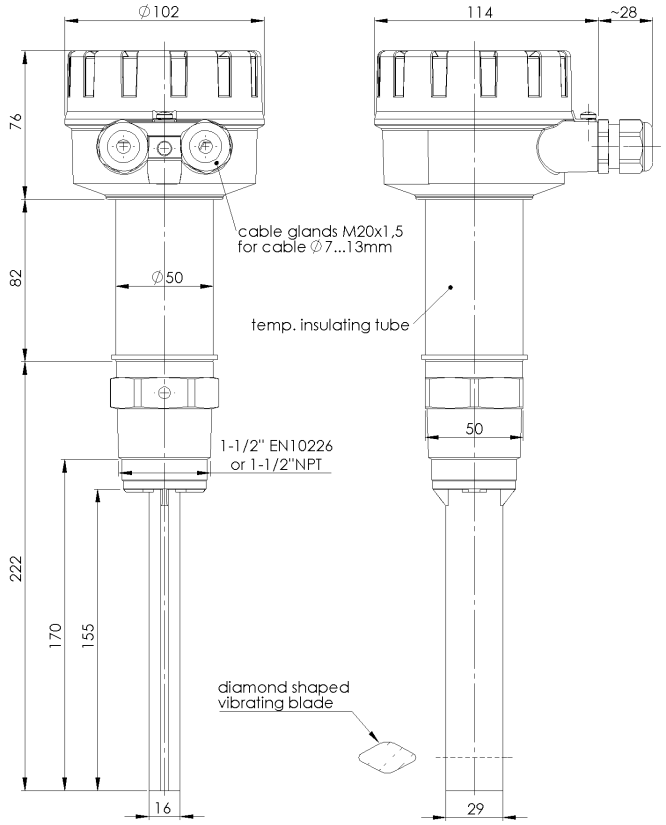
Available for DP220, DP230 and DP240. These models can be used for process temperatures up to 150°C.

Important: the instruments appear similar to the standard instruments, therefore they are marked with labels *"Special Model HT"* and the serial numbers of probes and electronics have the indices *"-HT"*. **Special model probes must only be used together with the appropriate special model electronics and vice versa!** In order to ensure that the max. ambient temperature of the electronics, (70C°, resp. 60°C for ATEX or UKEX models), will not be exceeded due to thermal conduction via the probe a temperature insulating tube has to be mounted between probe and enclosure or the electronics has to be installed in a remote enclosure (see page 6).

Temperature Insulating Tube:

Already assembled.

Mounted between HT-probe and enclosure in order to avoid heat-up of the electronics by high process temperatures. The tube is fixed onto the mounting socket of the probe by means of an 80mm long mounting nut M6. The enclosure is fixed onto the tube by means of a washer ∅50x3 and a screw M6x12. The green O-ring sealings, (special material Viton), can withstand high temperatures up to 150°C. Use torque 3Nm for the screwing of mounting nut and screw M6x12.



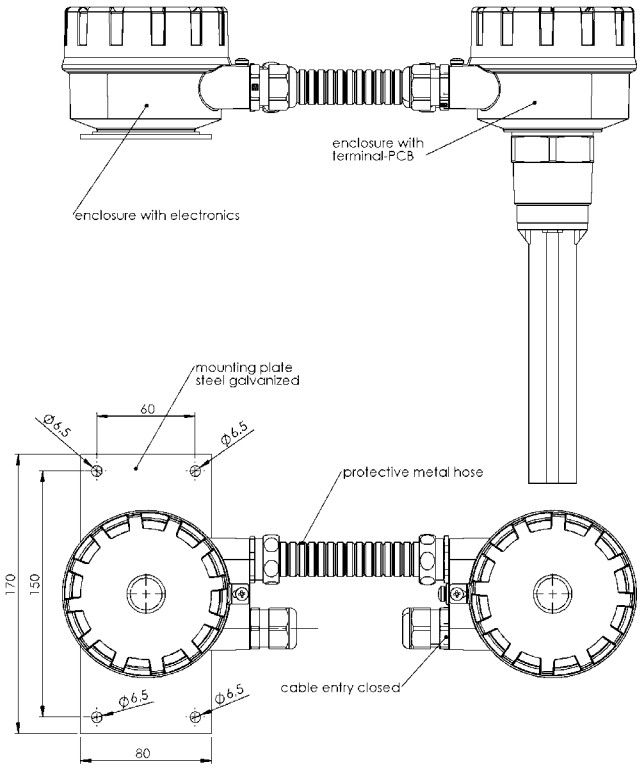
Special Model "Extreme Sensitivity"

This special model is for applications where extremely light material has to be detected. It works for materials with bulk densities down to 10 grams per litre, driven by special electronics. This model also has three sensitivity settings ABC but even Pos. C is more sensitive than Pos. A of the standard model.

Remote Electronics Installation

For ATEX or UKEX models refer to Ex safety guidelines on pages 9 & 10. The drawing shows a remote electronics installation of the DP220. Remote electronics installation is also possible for DP230, DP240 and DP250. If the temperature outside the bin near the bin wall exceeds the maximum ambient temperature of the PCB, (70°C, resp. 60°C for models with ATEX or UKEX approval), it is necessary to install the PCB in a remote enclosure away from the bin where the temperature is in the allowed range or to use the temperature insulating tube. Remote electronics installation is also necessary in case of heavy vibrations of the bin. In this case the remote enclosure has to be installed in a place away from the vibrations.

PCB and probe are connected by a shielded cable via the terminal PCB which is located inside the enclosure, fixed on top of the mounting socket of the probe. A metal hose, screwed between the remote enclosure and the enclosure that contains the terminal PCB, protects the cable. The remote enclosure can be installed by means of the mounting plate. Cable and metal hose can withstand temperatures up to 80°C. In order to achieve IP65 protection both connections of the metal hose have to be tightened firmly (torque 3 to 4 Nm).



Spare Parts

The following spare parts are available:

- vibrating probe
- electronics
- enclosure
- mounting socket (for DP240 only)

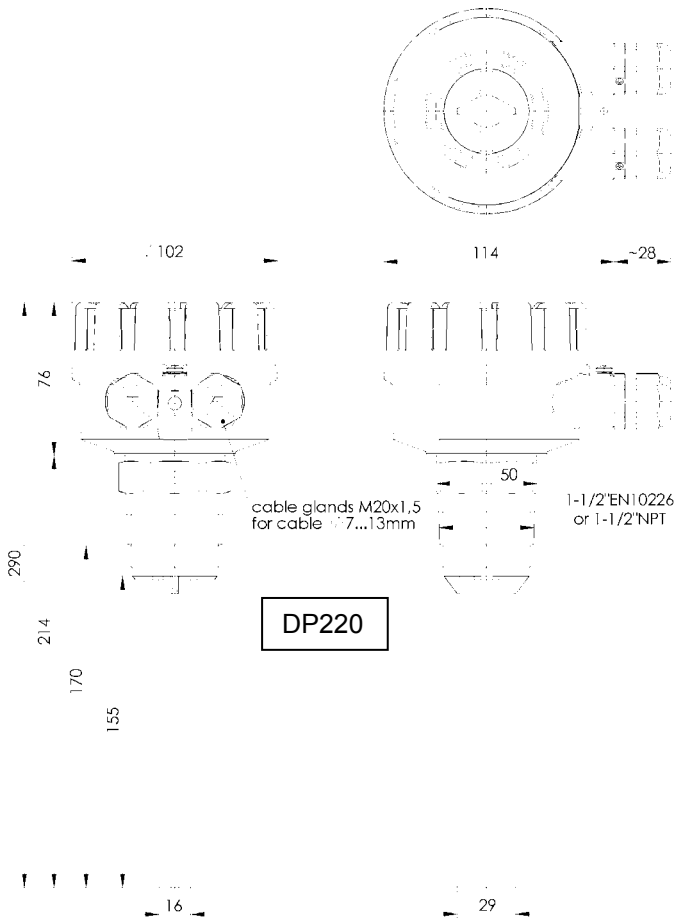
Contact the distributor who has supplied you with this instrument for spare parts or contact Hycontrol directly.

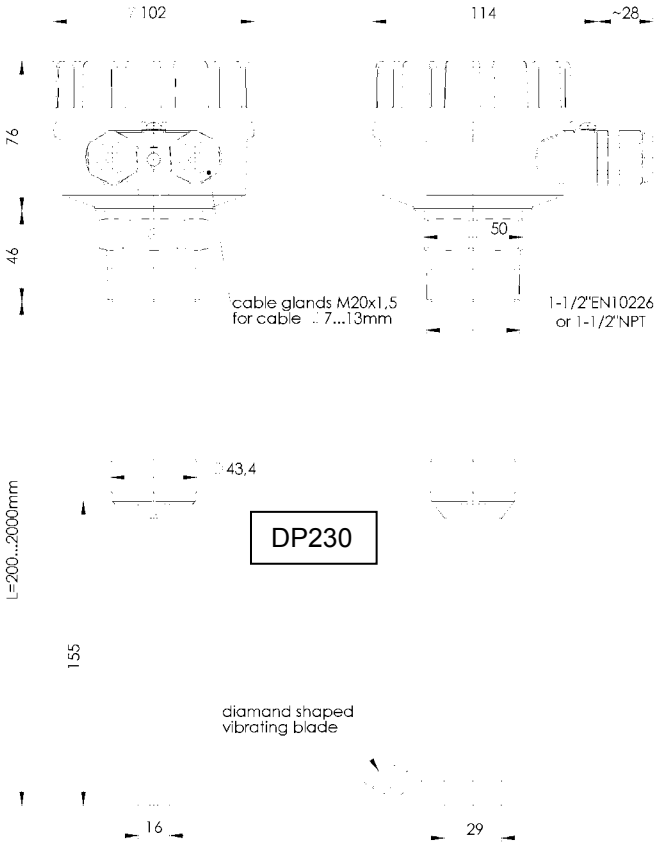
Spare parts must be mounted by qualified personnel only according to the descriptions in this instruction manual. Care must be taken that special model probes will only be used together with the appropriate special model electronics.

Maintenance

The DIAMOND POINT vibrating type level switches require no maintenance. For applications with materials that tend to be sticky we recommend cleaning the vibrating blade of the instrument periodically. If the instruments are exposed to corrosive atmosphere they must be inspected periodically regarding corrosion of probe and enclosure in order to ensure the protection of the instruments.

Dimensions


102
114
~28
76
50
cable glands M20x1,5
for cable ∅7...13mm
1-1/2"EN10226
or 1-1/2"NPT
290
214
170
155
16
29
DP220


102
114
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46
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cable glands M20x1,5
for cable ∅7...13mm
1-1/2"EN10226
or 1-1/2"NPT
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L=200...2000mm
DP230
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diamand shaped
vibrating blade
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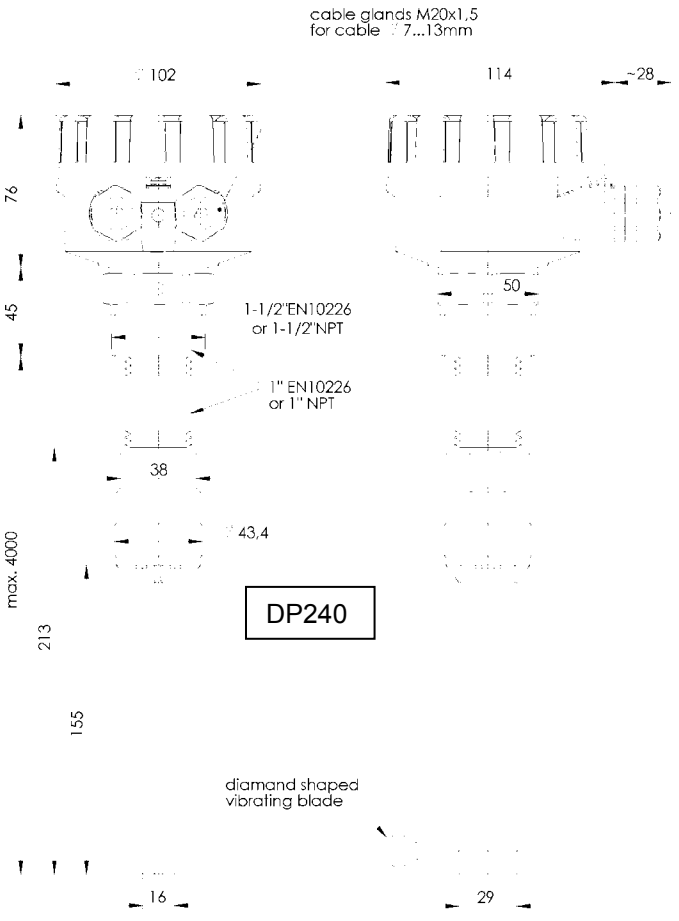
29


cable glands M20x1,5
for cable ∅7...13mm
102
114
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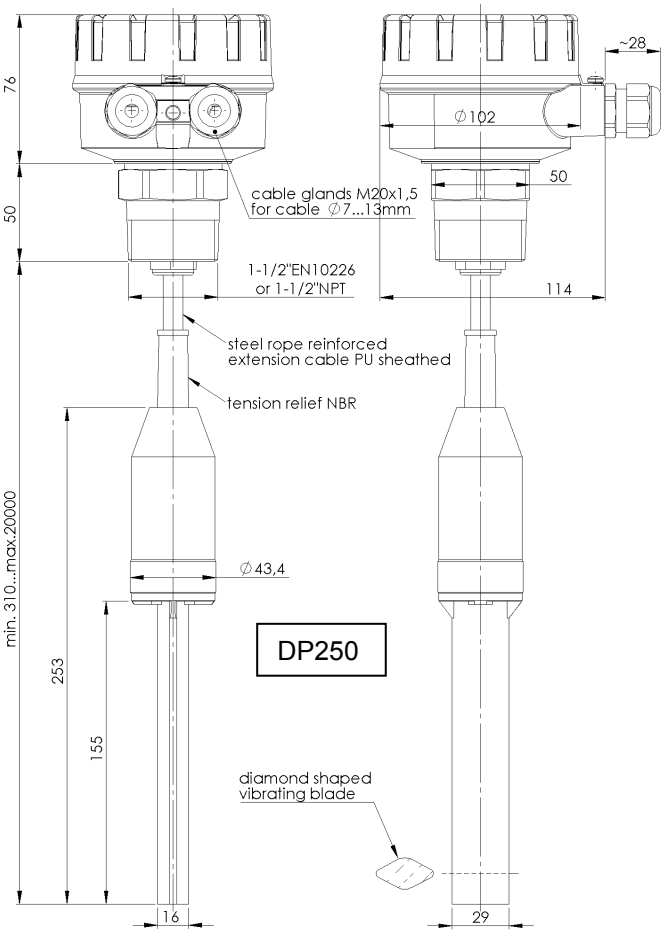
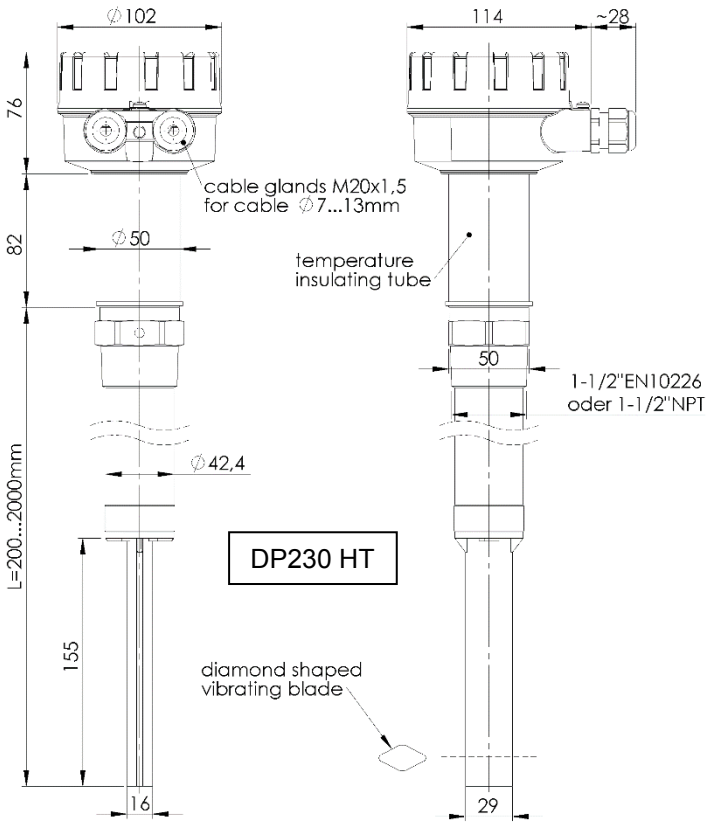
76
45
50
1-1/2"EN10226
or 1-1/2"NPT
1" EN10226
or 1" NPT
38
43,4
max. 4000
213
155
DP240
diamand shaped
vibrating blade
16
29


76
50
~28
∅102
50
cable glands M20x1,5
for cable ∅7...13mm
1-1/2"EN10226
or 1-1/2"NPT
114
steel rope reinforced
extension cable PU sheathed
tension relief NBR
min. 310...max.20000
∅43,4
253
155
DP250
diamond shaped
vibrating blade
16
29


∅102
114
~28
76
cable glands M20x1,5
for cable ∅7...13mm
82
∅50
temperature
insulating tube
50
1-1/2"EN10226
oder 1-1/2"NPT
L=200...2000mm
∅42,4
DP230 HT
155
diamond shaped
vibrating blade
16
29

Safety Guidelines

Safety guidelines for use of the vibrating level switches DP220StEx / DP230StEx / DP250StEx in the presence of combustible dust.

General:

The vibrating level switches DP220StEx / DP230StEx / DP250StEx can be used in the presence of combustible dust according to *ATEX directive 2014/34/EU* or *UKEX SI 2016 No. 1107 (as amended)*: equipment group II, category 1/2 D or 1/3 D for remote electronics installation.

Note: - DP240 is **NOT** ATEX or UKEX approved.

Marking of approved instruments according to ATEX directive 2014/34/EU or UKEX SI 2016 No. 1107 (as amended):

On the enclosure of the vibrating level switches DP220StEx / DP230StEx / DP250StEx is a nameplate showing the following data:

e.g:
DP220 StEx with wide range power supply, standard unit, (no high temp)

or

e.g:
DP220-HT StEx with wide range power supply, high temperature unit

or

e.g:
DP220-REM StEx
Remote electronics with wide range power supply, standard unit, (no high temp)

xxxx = Notified or Approved body number for Quality Assurance Notification.

Categories and allowed Zones of the components:

Component	Category	EPL Equipment Protection Level	Can be used in Zone
Probe	1 D	Da	20, 21 or 22
Enclosure with PCB	2 D	Db	21 or 22
Remote Electronics Installation	3 D	Dc	22

Protection according to EN 60079-0 and EN60079-31:

- protection by dust-tight enclosure IP6X
- limited surface temperatures of the apparatus

Maximum surface temperatures:

Zone	Type	Max. permissible temperature	Max. surface temperature at failure	Heat up due to failure
Zone 20	DP220/DP230	80°C	80°C	0 K
(probe)	DP250	70°C	70°C	0 K
	High temperature version	150°C	150°C	0 K
Zone 21/22	Enclosure with PCB	60°C	95°C	+35 K*

*35K maximum heat up of the enclosure surface results in a 25K heat up of the electronics at failure and an additional 10K due to heat conduction via the probe in cases where the process temperature is higher than 60°C.

Special guidelines for installation, set up and maintenance of apparatus in the presence of combustible dust:

- Installation, set up and maintenance must be performed in conjunction with the instruction manual and by qualified technical personnel only.
- Local governing regulations and standards must be followed.
- The enclosure must only be opened when power supply on all wires has been switched off.
- Before opening the enclosure dust deposits must be removed and dust clouds must be avoided.
- In order to maintain the protection by dust-tight enclosure it is essential that assembling of the instruments must be performed according to the descriptions in the instruction manual. Special care must be taken that all sealings and sealing planes are not to be damaged and that all sealings sit in its appropriate position. All screws must be fastened by applying the torques according to the instruction manual.