

DIAMOND POINT VIBRATING PROBES

DP120



DP130



DP140



DP150



Instruction Manual

Third revision, April 2016

Hycontrol Ltd., Larchwood House, Orchard Street,
Redditch, Worcestershire, B98 7DP, U.K.
Tel: + 44 (0)1527 406800 Fax: + 44 (0)1527 406810
E-mail: sales@hycontrol.com Website: www.hycontrol.com

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 DP120 / DP130 / DP140 / DP150 are vibration-type level control instruments that detect the minimum and 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)

- DP120:** standard model, insertion length approx. 172 mm
- DP130:** with pipe extension welded, insertion length up to 2 m
- DP140:** with pipe extension screwed, insertion length up to 4m
- DP150:** with cable extension, insertion length up to 20 m.

Function

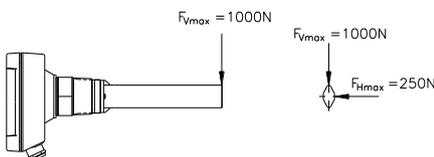
The signal from the electronic circuit of the DIAMOND POINT excites the blade of the instrument to vibrate on its resonance frequency of 285 Hz. When material covers the blade of the probe, the vibration stops. This is sensed by the electronic circuitry which forces its output to switch. When the blade gets uncovered, the vibration restarts and the output then switches back.

Technical Data

General:

- Enclosure:** Die cast aluminium (option: powder coated) protection IP66 and IP67 (IP65 for remote electronics installation) one, (optionally 2), cable gland M20x1,5
- Probe:** Stainless steel 1.4301 / AISI 304 Resonance frequency 285 Hz Extension cable DP150: polyurethane sheeted
- Connection:** Thread 1 1/2" DIN2999 (BSPT) or 1 1/2" NPT Optionally: Tri Clamp DIN 32676 for DP130
- 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 approval)
- Max. load onto extension cable DP150: 200kg
- Max. load onto vibrating blade: horizontal: 250N, vertical: 1000N



Electronics:

Wide range with relay output

- Power Supply: 20...250V AC/DC with relay output
- Relay Output: 1 pot.-free change-over contact (SPDT), (Option: DPDT)
Max. AC: 250V-AC, 8A, 2000VA, cosφ = 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: potential free, NPN or PNP type
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)

2-wire DC-Version with current output 8/16mA

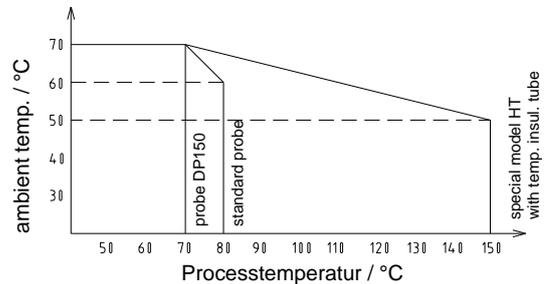
- Power Supply: 20 ... 30V-DC
- Current: Max-Alarm FH: 8mA (probe vibrating) 16mA (probe damped)
Min-Alarm FL: 8mA (probe damped) 16mA (probe vibrating)

Conversion into relay signal by ext. supply and analyzing unit DP2000AE
Power consumption: ≤ 0,5W

Max. lead diameter for power supply and output signal: 2,5 mm²

Max. allowed ambient and process temperature range:

	standard probe	probe DP150	probe-HT
Process temp.	-40...+80°C	-40...+70°C	-40...+150°C
Ambient temp. enclosure	-40...+70°C	-40...+70°C	-40...+70°C
Ambient temp. encl. ATEX	-40...+60°C	-40...+60°C	-40...+60°C



CE-Conformity

- The vibration type level sensors DIAMOND POINT DP120 / DP130 / DP140 and DP150 meet the requirements of the following regulations:
- EG-EMC-directive 2014/30/EU
 - EG-Low Voltage Directive 2014/35/EU

The following standards are applied:

- EN 61326-1:2013
- EN 61010 -1:2010

Approvals

Dust-Ex: The vibration type level sensors DIAMOND POINT DP120StEx / DP130StEx and DP150StEx can be used in the presence of combustible dust according to ATEX directive 2014/34/EU: equipment group II, category 1/2 D. Approved instruments do have the indices „StEx“ and a name plate with the following data:

HYCONTROL LTD		www.hycontrol.com
Orchard Street - Redditch - Worcestershire B98 7DP - ENGLAND - sales@hycontrol.com		
 	Diamond Point DP120-StEx	Power Supply: 20...250V AC/DC
	Ser.No.: xxxxxxStEx	Relay Output: max. 8A @ 250V
		Power Consumption: 3 VA
	II 1/2D Ex ta/tb IIIC T95° Da/Db	IBEXU09ATEX 1133
	Ambient temp. encl. (Zone 21): -20...+60°C Process temp. probe (Zone 20): -20...+80°C	

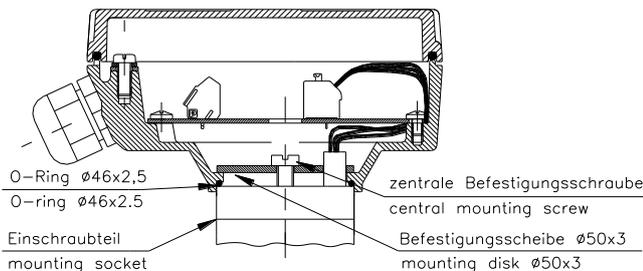
Applied standards: EN 60079-0:2012 and EN 60079-31:2014.

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

Assembling

Usually the instruments get supplied already completely assembled. In some occasions however, e.g. for easier packing and shipment, the instruments get supplied unassembled in parts: probe, enclosure with electronics and mounting socket. In this case the instruments have to be assembled according to the following description and sketch:

- Loosen the 4 screws in the cover and open the enclosure
- Loosen the 3 screws the electronics is fixed with and remove electronics
- Put O-ring $\varnothing 46 \times 2,5$ in its appropriate position at the enclosure
- Fix enclosure onto the mounting socket by means of the disk $\varnothing 50 \times 3$ and the central mounting screw, use torque 3 Nm.
- fix electronics inside the enclosure with the three screws, the cables must be located according to the sketch
- After mounting and wiring, (must be made according to the following chapters), fasten the cover firmly onto the enclosure, apply torque 3 Nm, and watch the appropriate position of the sealing in the cover!
- The cable ducts must be screwed firmly into the housing wall and tightened by means of an open end wrench, (torque 3 to 4 Nm). Cable ducts which are not used must get sealed!



IMPORTANT:

For protection IP66 and IP67 it is essential to assemble the instruments according to above description. It is very important to watch the appropriate location of the sealing and to apply the correct torques.

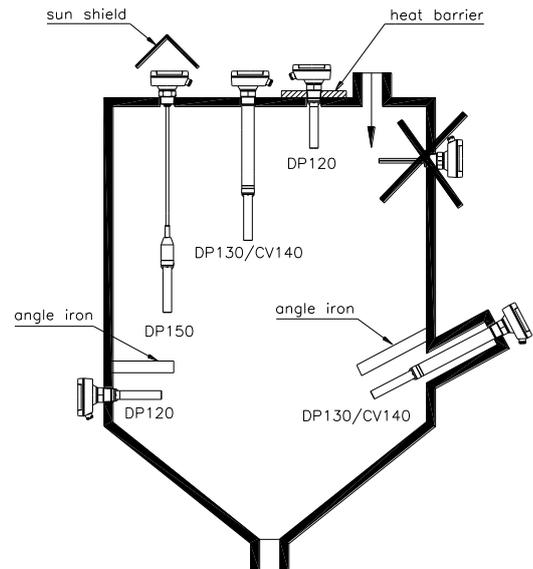
Assembling of tube extension DP140

The DP140 usually gets supplied in parts: probe, enclosure with electronics, extension cable and mounting socket. The extension tube with 1"-threads on both ends must be supplied and assembled by the customer. A detailed instruction manual on how to do this gets supplied with the instrument.

Mounting

The following has to be considered when mounting the DIAMOND POINT, (also see the following sketch):

- The switching point of the DIAMOND POINT 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. At very light materials like Styrofoam the material must cover the vibrating blade completely in order to damp its vibration.



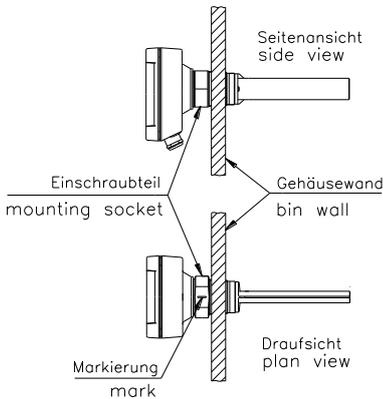
- The DIAMOND POINT must not be mounted in or near the filling curtain of the bin. The filling stream could damage the probe.
- In order to keep the ambient temperature of the PCB within the allowed range of -40 to $+70^\circ\text{C}$, (-20 to $+60^\circ\text{C}$ for ATEX-models), the housing should be protected from direct sunlight by installing a sun shield.
- A heat barrier has to be installed between the enclosure and the bin wall in cases the temperature of the material inside the bin exceeds 70°C . Instead it also is possible to install the electronics in a separate enclosure apart from the bin or to use a temperature insulating tube which must be mounted between mounting socket and enclosure, (see chapter *Special Models*).
- In cases where continuous vibrations of the bin are present, the electronics must be installed in a separate housing apart from the vibrations, (not available for models with ATEX approval).

Side Mounting

- Side mounting is possible for DP120. Also DP130 and DP140 can be mounted from the side if the extensions are not too long and the extension tubes get supported adequately.
- For side mounting screw the DIAMOND POINT into the bin wall with the blade pointing slightly downwards (approx. 20°) so that material does not rest on the blade.
- If it is not possible to install the instrument at an area apart from the filling curtain a protection shield, for example an angle steel with side length approx. 50mm, must be installed approx. 150mm over the blade. This is also necessary for low level detection in order to protect the probe against falling material.
- The DIAMOND POINT gets 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, (like Teflon tape), must be applied onto the thread.

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

- 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.



Top Mounting

Top mounting is possible for all models of the DIAMOND POINT. The DP150 is designed for top mounting only. Top mounting is made according to the descriptions in chapter *Side Mounting*.

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, proceed as follows:

- Remove the cover of the housing
- Use a screw driver to loosen the screw in the centre of the PCB
- Turn the housing into the correct position so that the cable glands are pointing downwards
- Tighten the screw in the centre of the PCB, torque 3 Nm
- Close the cover of the housing.

Wiring

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

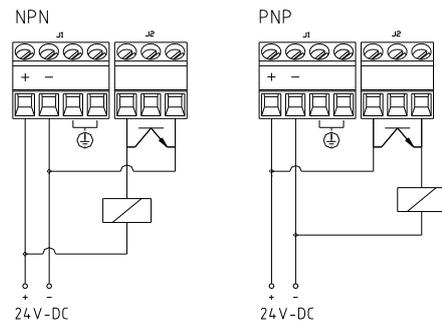
Safety Guidelines:

- 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 DIN 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 $\geq 50V$ 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 getting in touch with the output terminals and vice versa, (which might be possible in case of an error, e.g. brake of a wire).

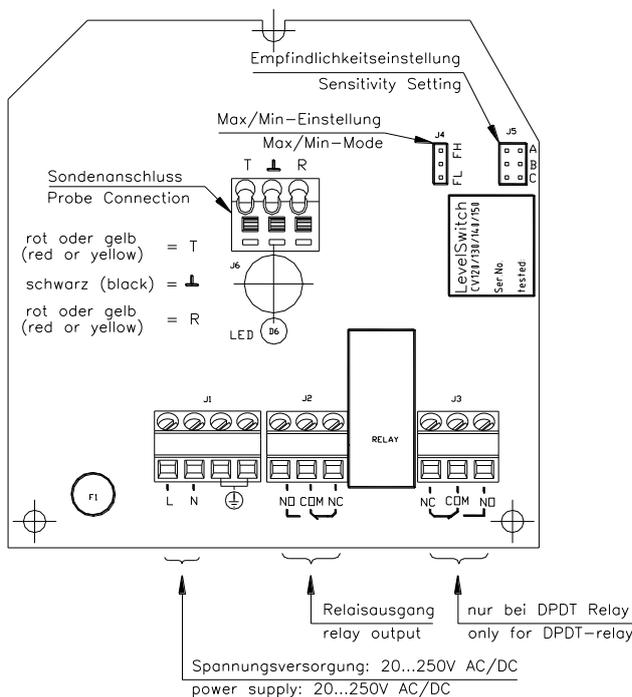
24V-DC with transistor output

Depending on the wiring the transistor output can be either PNP or NPN type, see sketch.

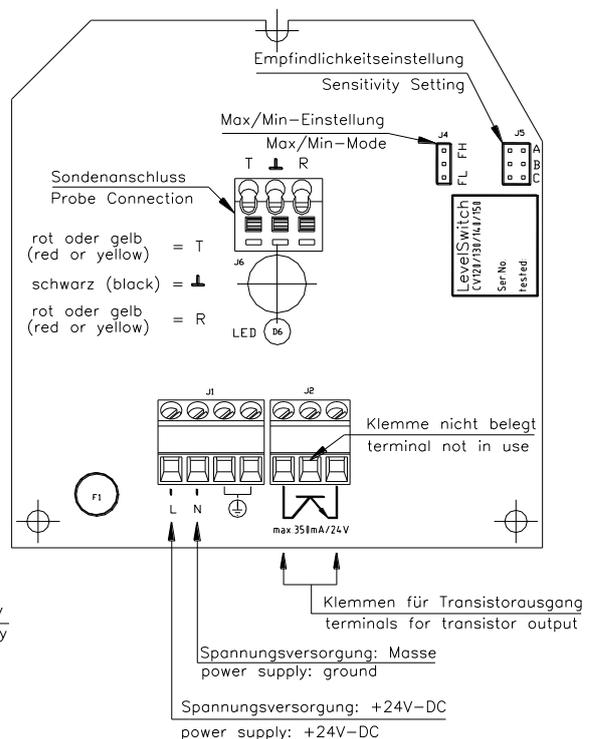
The transistor output is potential free. Therefore instead of the supply voltage also other voltages can be switched onto the load. The max. switching power of 20W and the max. current of 350mA have to be considered.



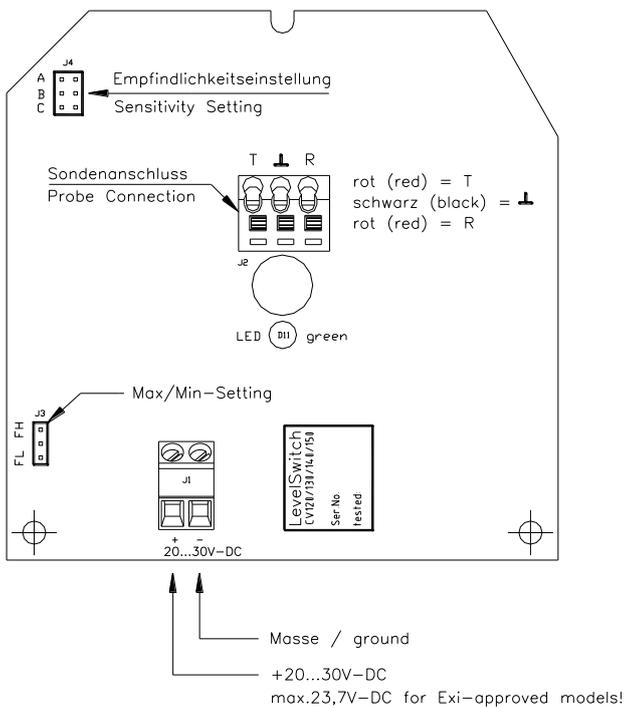
Wide Range Power supply with Relay Output



Power Supply 24V-DC with Transistor Output



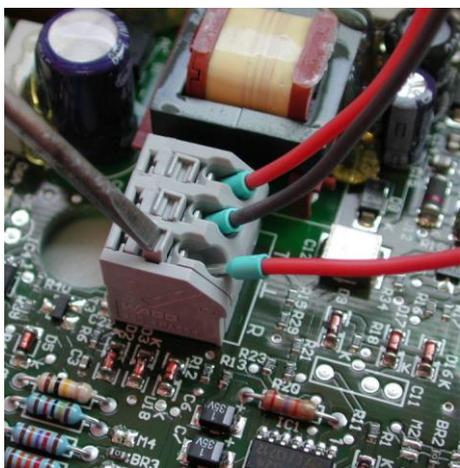
2-wire DC-version with 8/16mA current output



For models without approval power supply and signal conversion can be performed by the DP2000AE or any other suitable DC supply with current sensing capability. In this case the maximum technical data have to be considered.

Probe Connection:

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.



Adjustment

Sensitivity:

Selectable by jumper

- Pos. A: Use this setting only for very light material 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, transistor blocked, I=16mA when the blade is covered by material.

Failsafe low: jumper in position FL:

The relay is de-energized, transistor blocked, I=16mA when the blade is free, (not covered by material).

Output signals alarm as well at power failure.

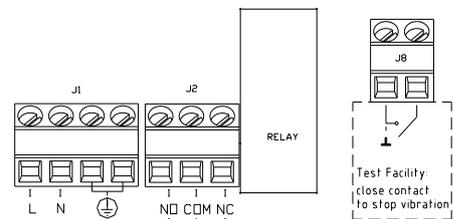
If power fails the LED is off.

Minimum-Alarm				Maximum-Alarm			
Relay-Ausgang	Transistor-Ausgang	Strom-Ausgang	Relay-Ausgang	Transistor-Ausgang	Strom-Ausgang		
 LED on leuchtet	 LED on leuchtet	 LED off aus	 LED on leuchtet	 LED on leuchtet	 LED off aus		
 LED flashes blinkt	 LED flashes blinkt	 LED on leuchtet	 LED flashes blinkt	 LED flashes blinkt	 LED on leuchtet		

Options

Function test to be performed when probe is vibrating:

Close contact of clamp J8, the vibration stops and the output switches accordingly. Open contact, the probe restarts to vibrate, the output signal switches back. For installation use a standard pushbutton and connect it to the clamp J8 by a shielded cable. Use the screen of the cable for ground, (left clamp of J8). The pushbutton can be installed up to 500m away from the electronics but the resistance of the cable should not exceed 100 Ohms /km.



Further options:

- Externally visible LED for output status
- Double pole relay
- Second cable gland
- Enclosure powder coated
- Process connection Tri Clamp for DP130

Special Models

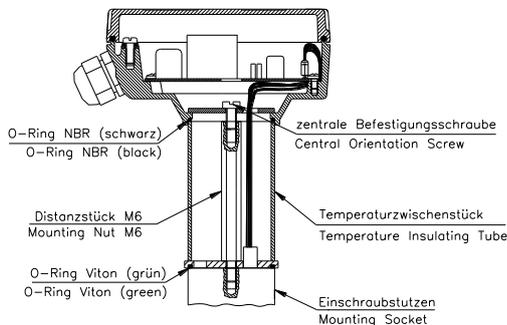
Special model for high temperatures:

Available for DP120, DP130 and DP140. These models can be used for process temperatures up to 150°C.

Important: the instruments have got the same outlook as the standard instruments, therefore they are marked with labels „Special Model HT“ and the serial numbers of probes and electronics do have the indices „-HT“. **Special model probes must only be used together with the according special model electronics and vice versa!** In order to ensure that the max. ambient temperature of the electronics, (70°C, resp. 60°C for ATEX-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 following chapters).

Temperature Insulating Tube (see sketch):

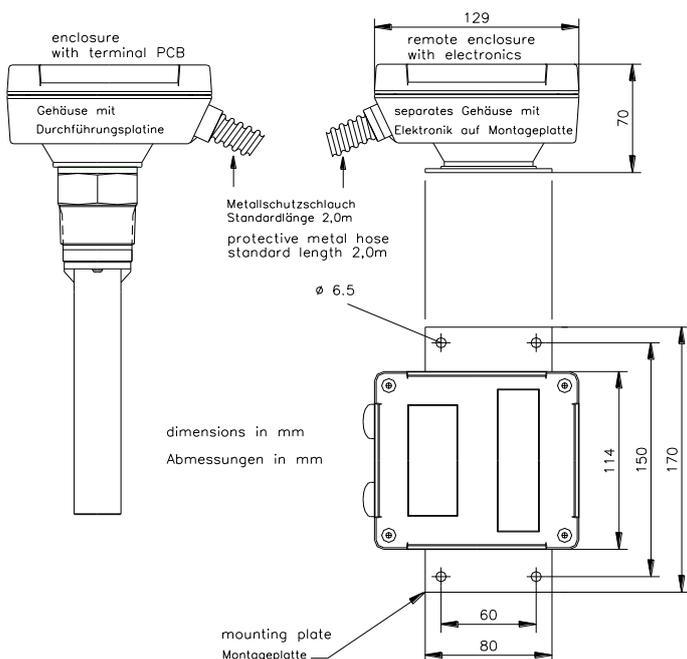
The temperature insulating tube consists of a stainless steel tube $\varnothing 50\text{mm}$ which is welded onto a stainless steel plate. The tube gets fixed onto the mounting socket of the probe by means of a 80mm long mounting nut M6. The enclosure gets fixed onto the tube by means of a washer $\varnothing 50 \times 3$ and a screw M6x12. The green O-ring sealing, (special material Viton), must be located between mounting socket and tube and the black standard O-Ring must be located between tube and enclosure. Use torque 3 Nm for the screwing of mounting nut and screw M6x12.



Remote Electronics Installation

(Not available for models with ATEX approval!)
 The drawing shows a remote electronics installation of the DP120. Remote electronics installation is also possible for DP130, DP140 and DP150. If the temperature outside the bin near the bin wall exceeds the maximum ambient temperature of the PCB, (70°C), it is necessary to install the PCB in a remote enclosure apart 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 at a place apart from the vibrations.

PCB and probe get 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 which is screwed between the remote enclosure and the enclosure that contains the terminal PCB is protecting 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 protection IP65 both connections of the metal hose have to be tightened firmly (torque 3 to 4 Nm).



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. A standard probe is driven by a special electronics. This model also has three sensitivity settings ABC but even Pos. C is more sensitive than Pos. A of the standard model.

Spare Parts

The following spare parts are available:

- vibrating probe
- electronics
- enclosure
- mounting socket (for DP140 only)

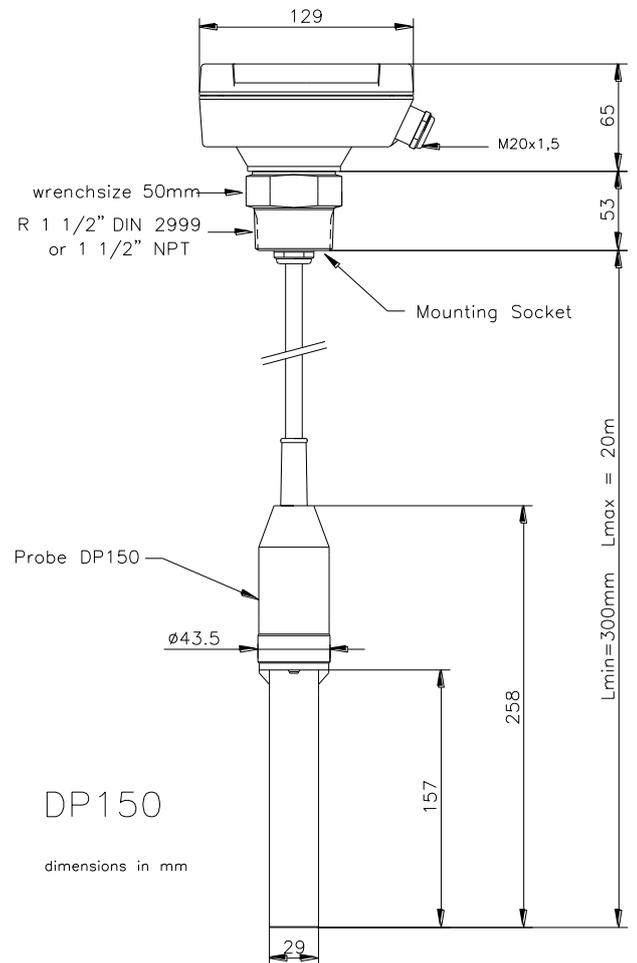
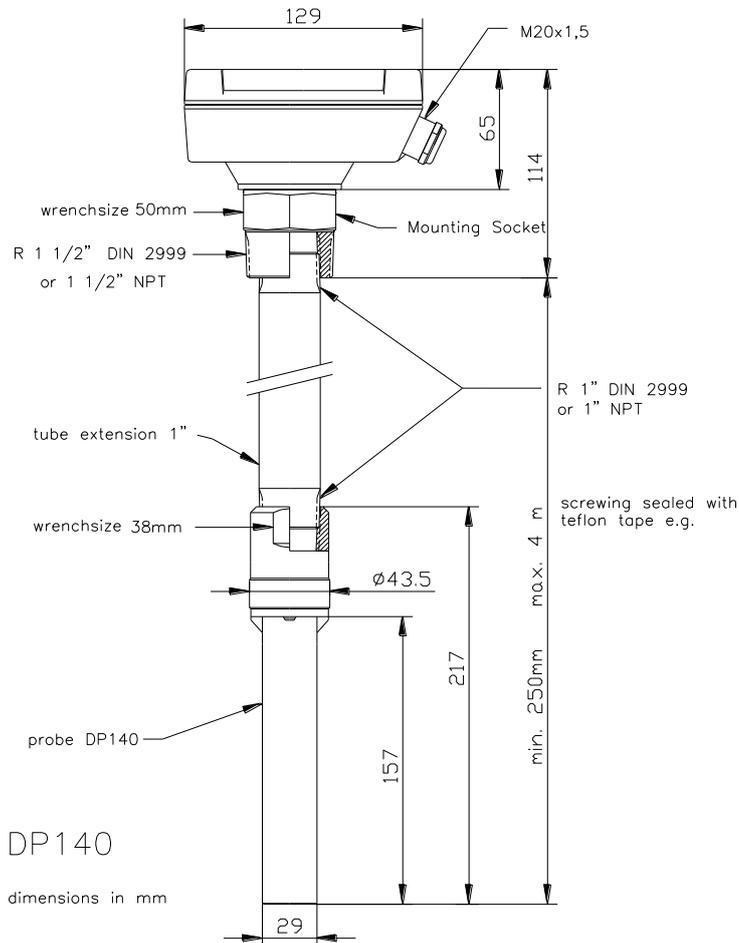
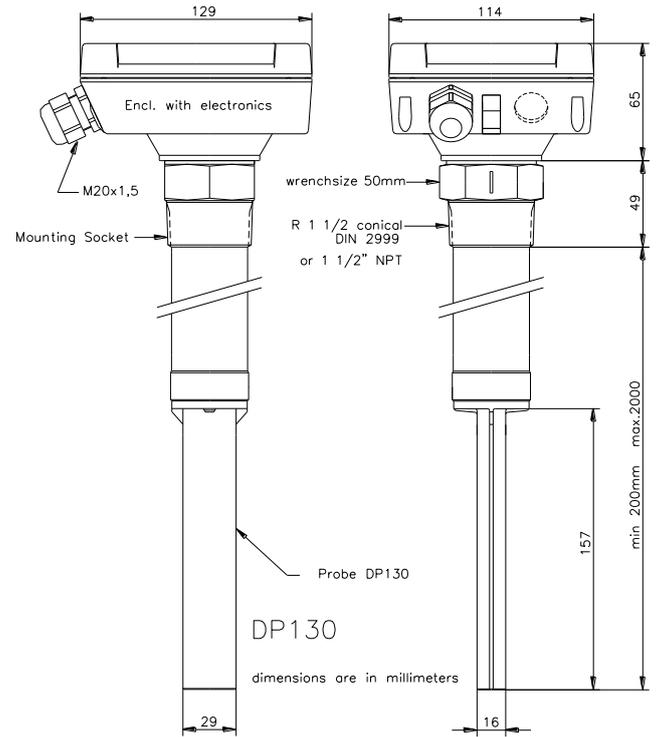
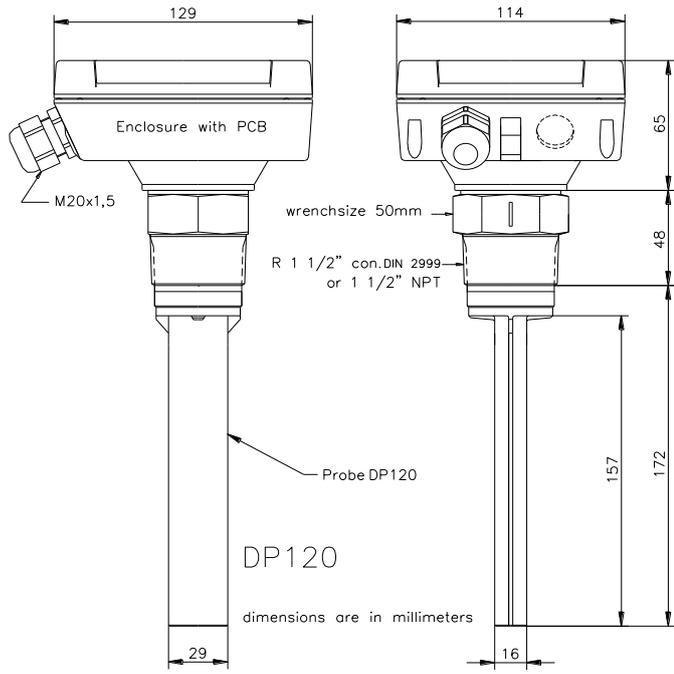
Contact the distributor who has supplied you with this instrument for spare parts or contact Hycontrol directly.

Spare parts must be mounted by qualified personal 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 are a little bit sticky we recommend to clean the vibrating blade of the instrument in certain periods of time. If the instruments are exposed to corrosive atmosphere they must be inspected in certain periods of time regarding corrosion of probe and enclosure in order to ensure the protection of the instruments.

Dimensions





Safety Guidelines

Safety guidelines for use of the vibrating level switches DP120StEx / DP130StEx / DP150StEx in the presence of combustible dust.

General:

The vibrating level switches DP120StEx / DP130StEx / DP150StEx can be used in the presence of combustible dust according to ATEX directive 2014/34/EU: equipment group II, category 1 / 2 D.

Marking of approved instruments according to directive 2014/34/EU:

On the enclosure of the vibrating level switches DP120StEx / DP130StEx / DP150StEx is a nameplate showing the following data:

HYCONTROL LTD Orchard Street - Redditch - Worcestershire B98 7DP - ENGLAND - sales@hycontrol.com www.hycontrol.com	
	Diamond Point DP120-StEx Ser.No.: xxxxxxStEx
	II 1/2D Ex ta/tb IIIC T95° Da/Db IBExU09ATEX 1133 Ambient temp. encl. (Zone 21): -20..+60°C Process temp. probe (Zone 20): -20..+80°C
	Power Supply: 20...250V AC/DC Relay Output: max. 8A @ 250V Power Consumption: 3 VA

e.g:

DP120 StEx with wide range power supply, standard unit, (no high temp)

Categories and allowed Zones of the components:

Component	Category	can be used in Zone
Probe	1 D	20, 21 or 22
Enclosure with PCB	2 D	21 or 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	max. permissible amb. temperature	max. surface temperature at failure	heat up due to failure
Zone 20	80°C for standard units	80°C for standard	0 K
	70°C for DP150	70°C for DP150	0 K
	150°C for high temperature (= process temp.)	150°C for high temp	0 K
Zone 21	60°C	95°C	+35 K

The 35K maximum heat up of the enclosure surface results on 25K heat up of the electronics at failure and additional 10K due to heat conduction via the probe in cases 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.