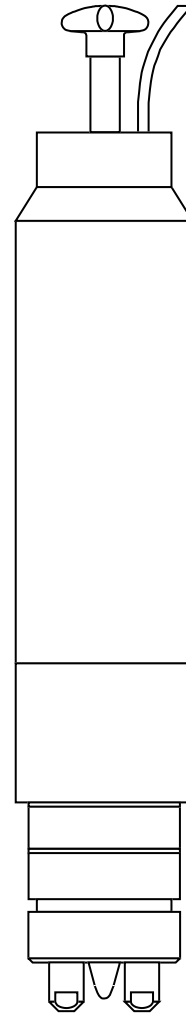
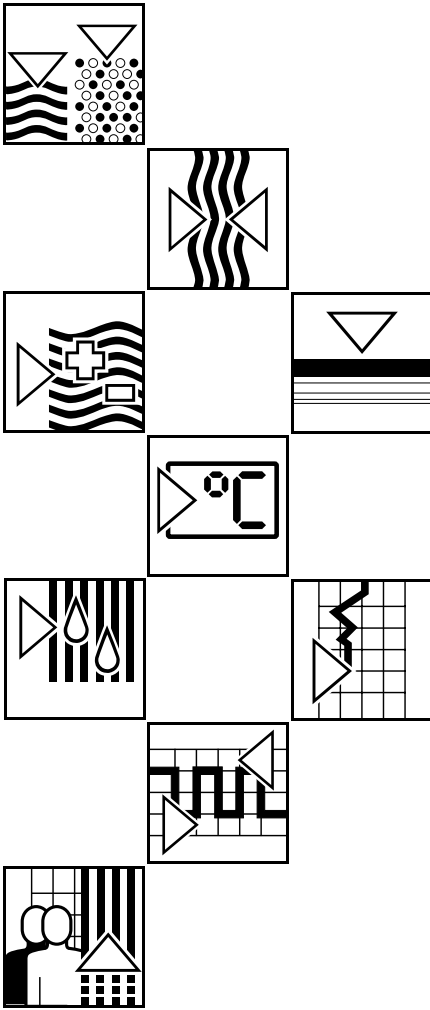


Sensopac CPA 320 pH / Redox Compact Electrode System

Operating Instructions



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1. Application

Sensopac CPA 320 is a pH / Redox compact electrode system which can be integrated directly into tanks and pipes for processing applications. The wide range of accessories and mounting fittings enables optimum use of the Sensopac sensor system, even for unusual applications.

The Sensopac pH / Redox sensor incorporates various electrodes or electrode arrangements together in one unit.

Use of an internal electrolyte bridge with dirt-repellent diaphragm, guarantees protection against "poisoning".

The Sensopac sensor can be used directly for measurement under pressure, without requiring counterpressure.

The Sensopac is fitted with a double reference electrode as standard, which enables automatic self-monitoring when a suitable pH measuring instrument (e.g. Mypex CPM 340) is used.

2. The measuring system

A complete measuring system comprises

- the pH / Redox compact electrode system Sensopac CPA 320, containing the appropriate electrodes (including cable).
- The measuring instrument (e.g. Mypex CPM 340 with one or two inputs for the measurement circuit).

For self-monitoring, where two measurement circuits are monitored by means of a differential circuit, a measuring instrument with two inputs for the measurement circuit is required.

Sensopac CPA 320 comprises a robust basic structure which can be made of plastics (PP, PVDF) or stainless steel (1.4571).

Impact-resistant bolts, incorporated into the structure, protect the electrodes. One of these bolts is made of Hastelloy C4 and serves as an equipotential bonding pin.

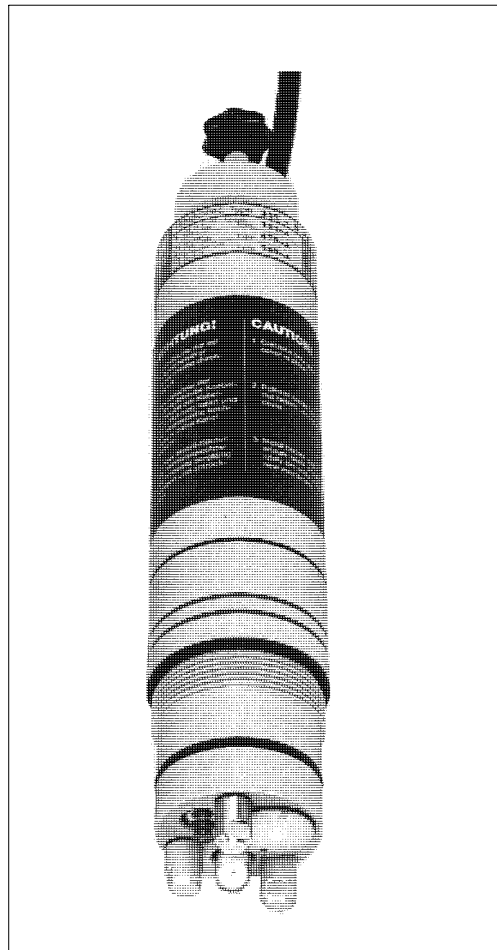


Fig. 1: Compat electrode system Sensopac CPA 320

3. Design and function

Sensopac CPA 320 comprises the following components, relevant to the measurement procedure (see figure 2):

- One pH electrode (A) which is directly immersed in the measurement solution.
- A low-resistance double reference electrode (B) with reference system B1 for the main measurement circuit and reference system B2 for the monitoring measurement circuit.
This electrode is immersed in the bridging electrolyte C.
- The bridging electrolyte (C) in a large reference chamber.
- A diaphragm cartridge (D) with dirt-repellent, blockage-free PVF diaphragm.

3.1 Operating principle

The compact pH electrode system Sensopac CPA 320 is equipped with a double reference electrode for self-monitoring.

The pH measuring system requires two independent symmetrically high-resistance inputs. The pH measuring instrument Mypex CPM 340-A2 monitors the 2 measuring circuits and signals any occurring difference in measured value.

If the self-monitoring system is not needed, the connection of a pH measuring instrument with an electrode input is sufficient. The pH instrument input should be symmetrically high-resistance.

A pH-dependant half-cell voltage in the measurement solution is detected with the pH electrode (A). The electrical contact between measurement media and bridging electrolyte C is made by way of the blockage-free dirt-repellent PVF diaphragm D. The double reference electrode B is immersed into the electrolyte.

The double reference electrode's reference system B1 supplies the constant half-cell voltage for the main measurement circuit.

The double reference electrode's reference system B2 supplies the half-cell voltage for the monitoring measurement circuit.

3.2 Self-monitoring

The B2 reference system of the monitoring measurement circuit is located directly behind a diaphragm of reference electrode B.

The B1 reference system for the main or master measurement circuit is integrated into a long cartridge with another diaphragm. Inside reference electrode B, this cartridge is surrounded by solid gel which acts as a second bridging electrolyte.

In the event of electrode "poisons" penetrating into the bridging electrolyte C, this arrangement ensures that reference system B2 is first affected by this poison, and reference system B1 of the main measuring circuit is only affected much later, if at all.

In the event of a fault, any imbalance arising between the reference potentials is detected by the Mypex measuring instrument which issues a signal.

Note:

The essential feature of this monitoring method is **that an alarm is triggered before the main measuring circuit's signal is disturbed**. At the same time, only the main measuring circuit affects the digital display and analog output of the measuring unit.

After an alarm, the bridging electrolyte must be replaced at the next opportunity. Following recalibration, the measurement procedure may then be continued under normal conditions.

The compact electrode system Sensopac CPA 320 is supplied ready for measurement, i.e. completely equipped with electrodes, including bridging electrolyte solution and measurement cable.

Each compact electrode system Sensopac CPA 320 is tested individually before delivery to ensure high quality.

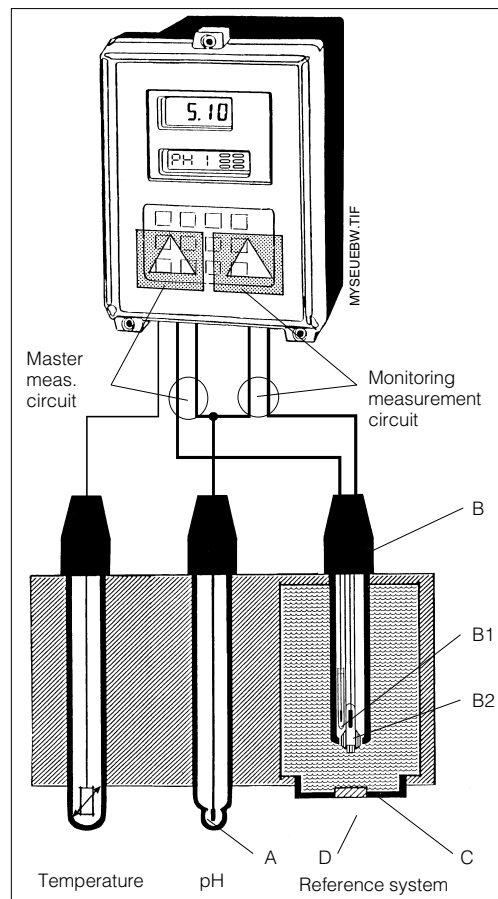


Fig. 2: Operating principle

4. Technical data

Materials

Basic structure	Polypropylene PP, polyvinylidene fluoride PVDF, stainless steel 1.4571
Seals	EPDM (standard), Viton
Potential matching pin	Hastelloy C4 (standard) or stainless steel 1.4571
Electrodes	Glass

Electrodes

pH measuring range	0 ... 13 pH with single electrode CPS 64-1AA 2GSA
Double reference electrode	CPS 12-0TD 1GSA
Internal thread for electrodes	Pg 13,5
Diaphragm cartridge	replaceable RDV-HT diaphragm, screwed into PVDF cartridge DKV-HT
Electrode seals (standard)	EPDM

Accessories supplied

Connection cable Sensopac CPA 320 (standard length)	5 m
- Varieties	10 and 15 m
KCl bridging electrolyte	CPY 4-1
Socket wrench for electrodes and diaphragm	SW 17 / spezial

4.1 Temperature and pressure

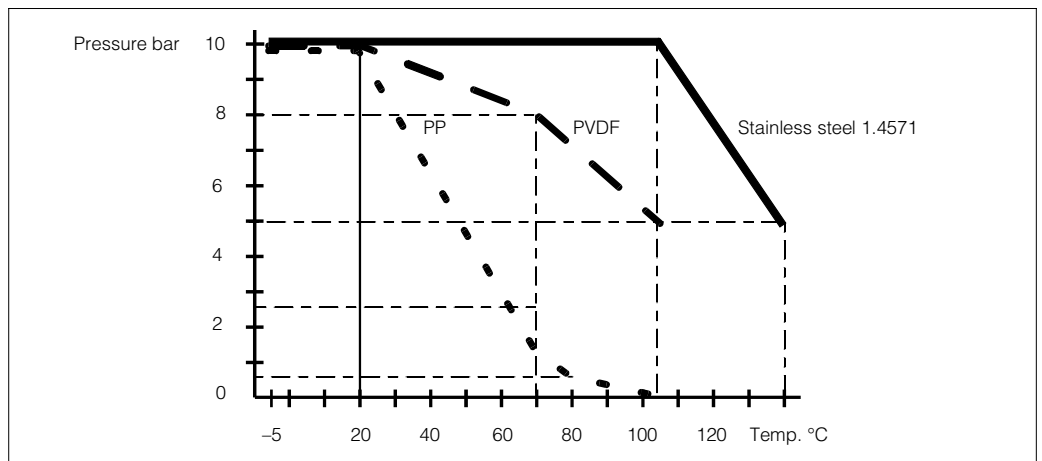


Fig. 3: Maximum permissible operating pressure in relation to material and temperature

	PP	PVDF	1.4571
-5 °C	10 bar	10 bar	10 bar
20 °C	10 bar	10 bar	10 bar
70 °C	1,5 bar	8 bar	10 bar
80 °C	0,5 bar	7 bar	10 bar
90 °C	0 bar	6 bar	10 bar
105 °C	-	5 bar	10 bar
130 °C	-	-	5 bar

5. Dimensions

The dimensions of the compact electrode system Sensopac CPA 320 structure are depicted in figure 4.

Dimensions of the built-in accessories are given in chapter 6.



Caution:

The 2" thread at the lower end of the Sensopac structure is used to secure installation adapters.

The compact electrode system Sensopac CPA 320 is always supplied with one installation adapter.

A large range of adapters is available.



Caution:

Should a Sensopac CPA 320 has been installed without an assembly adapter, remove the cable and hood before dismantling, otherwise the wiring may be damaged.

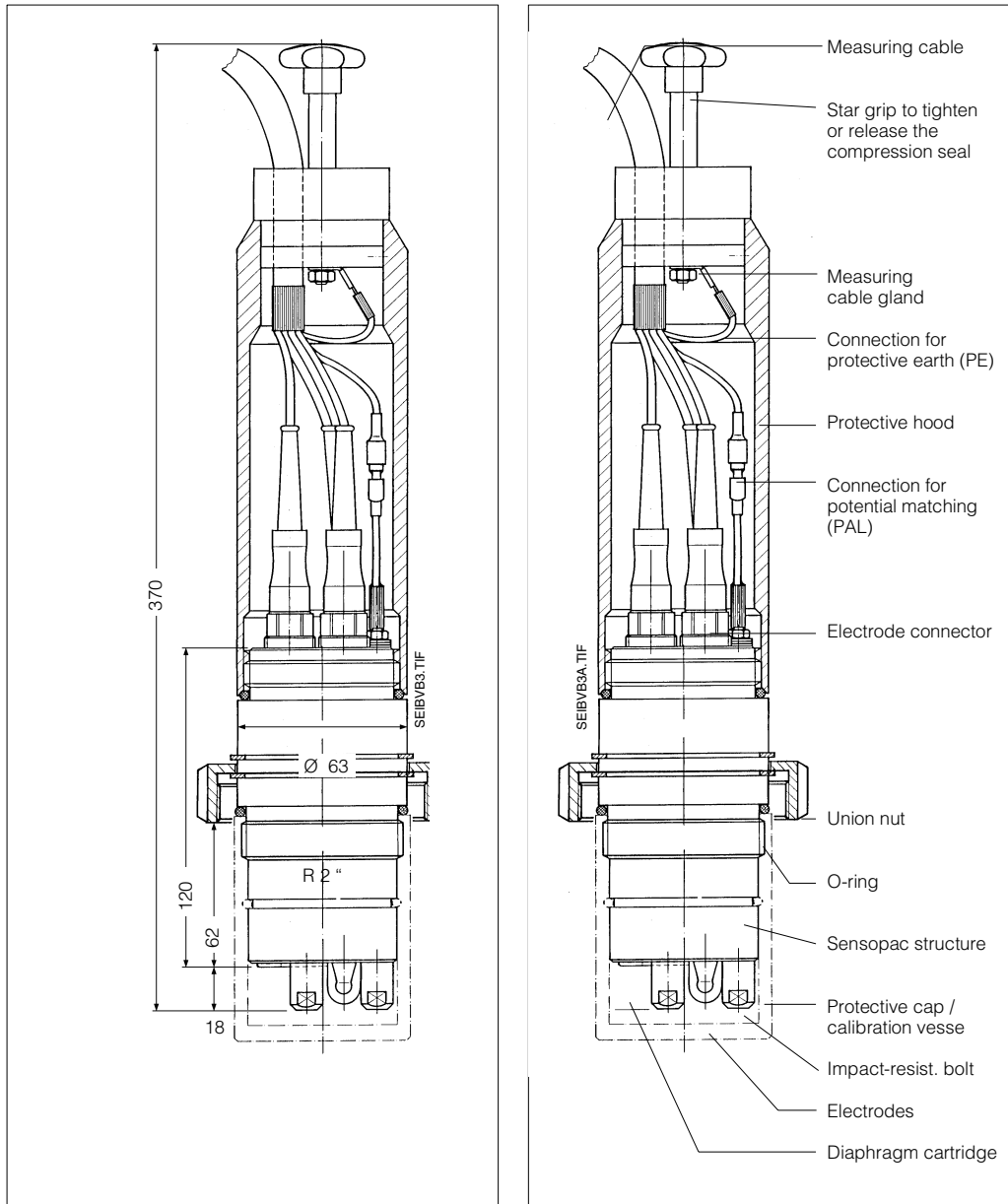


Fig. 4: Sensopac CPA 320
 (left) Dimension diagram
 (right) Component parts

6. Installation

It is essential that the compact electrode system Sensopac CPA 320 is installed correctly. If this is not the case, inaccurate or non-reproducible measurements may result.



Caution:

- **Never** install the Sensopac CPA 320 horizontal or with the hood pointing downwards! 15° above the horizontal alignment is the minimum.
- Ensure that the electrodes within the sensor have been wetted with measuring medium.
- Prevent air penetration or air bubbles in the electrode area by suitable installation. The Sensopac CPA 320 must not remain dry over a long period. Intervals of approx. 24 hours between operation are permitted in a moisture-saturated atmosphere.
- The Sensopac CPA 320 must be installed in such a way as to be easily accessible for maintenance or calibration, and / or as to be able to be removed easily.
- Installation in a bypass facilitates maintenance and calibration.

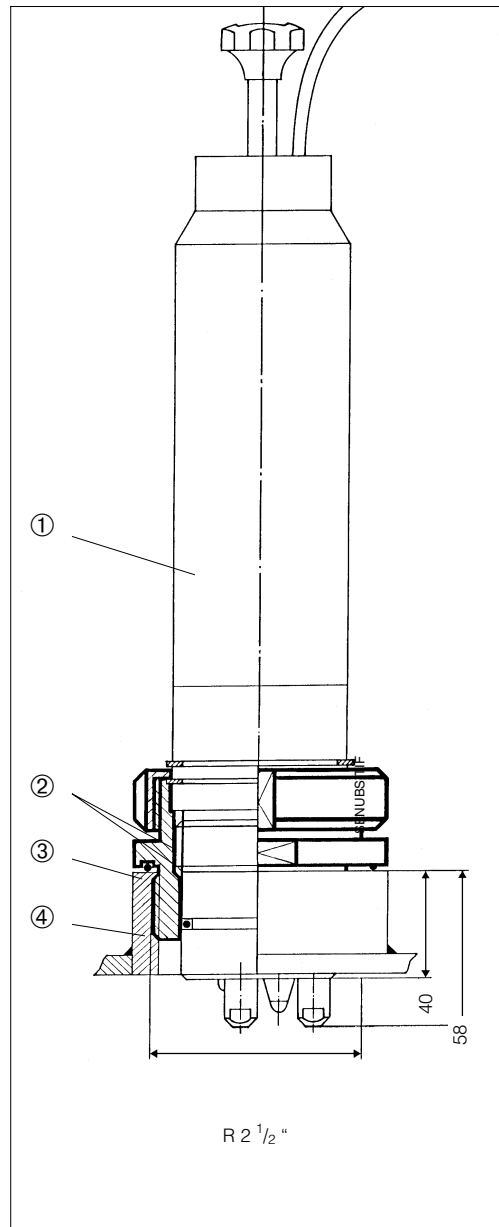
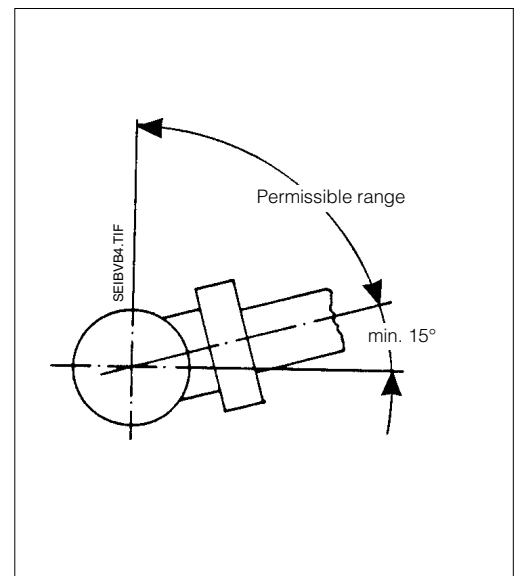


Fig. 5: Sensopac CPA 320 with UBS adapter (left)

- ① Sensopac CPA 320
- ② Circlips
- ③ Union nut
- ④ UBS adapter

Bild 6: Installation position of Sensopac CPA 320 (right)



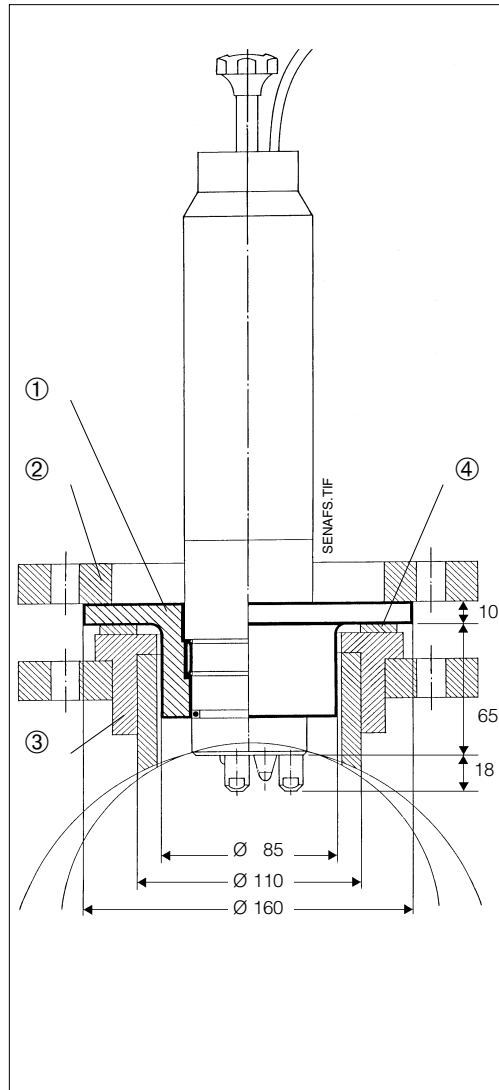
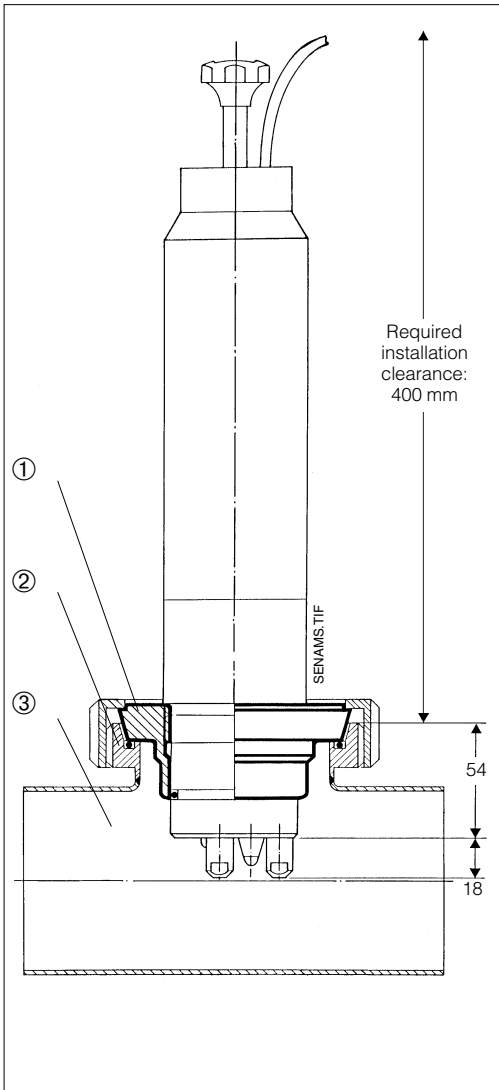


Fig. 7: Sensopac CPA 320 with AMS adapter (for foodstuff application)

- ① AMS adapter
- ② Threaded connectors DN 80, DIN 11851
- ③ T piece, short; DN 80, DIN 11852

Fig. 8: Sensopac CPA 320 with AFS adapter for flange installation

- ① AFS adapter in PP
- ② PP flange with steel insert, DN 100, ND 10
- ③ Nipple fitting PP, DN 100
- ④ Flat packing DN 100

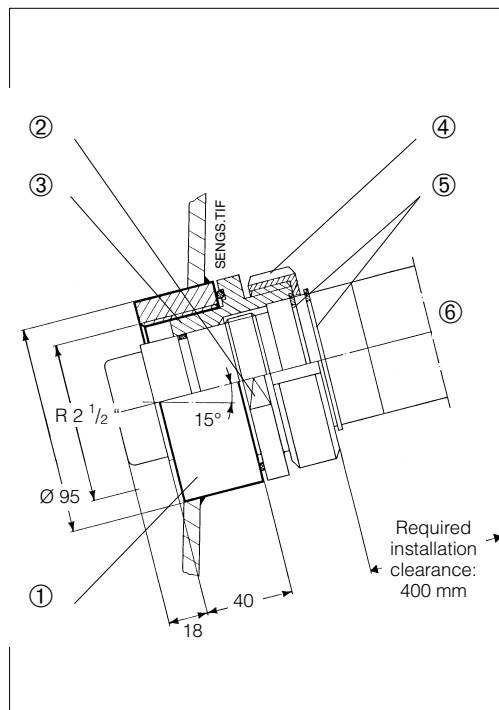
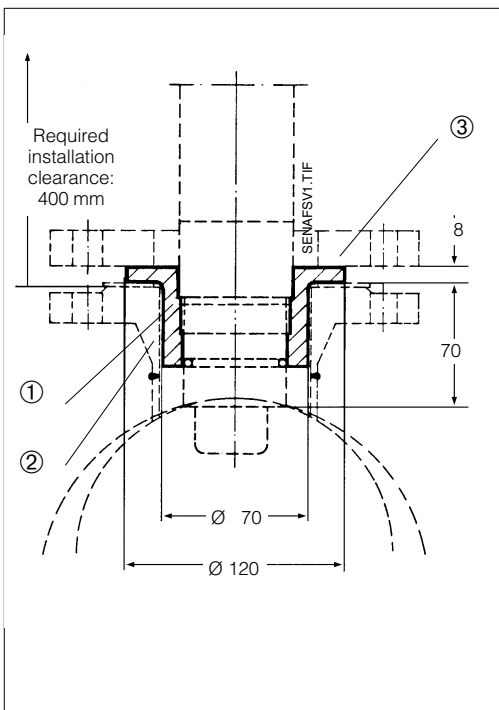


Fig. 9: AFS-V adapter, stainless steel (1.457) for flange mounting of Sensopac CPA 320

- ① AFS adapter
- ② Welding neck flange NW 80, ND 16, DIN 2633
- ③ Flange NW 80, ND 16, DIN 2576, material: PP

Fig. 10: Screwed socket GS or GS-V for Sensopac CPA 320 for welded mounting

- ① Screwed socket GS, GS-V material: PP oder 1.4571
- ② Width across flats SW 95
- ③ UBS
- ④ Slotted union nut NW 50, DIN 11851, material: 1.4401
- ⑤ Circlips
- ⑥ Sensopac CPA 320

Fig. 11: Flow probe holder CPA 250-S00 for installation of Sensopac CPA 320

- ① Flow probe holder CPA 250-S00 material: PP, PVDF
- ② Compact electrode system Sensopac CPA 320
- ③ Slotted union nut NW 50 DIN 11851; material: 1.4401
- ④ Piece clamp with central fastening hole
- ⑤ Pipe DA 32 DN 25
- ⑥ NP screw nipple, R 1" material: PP, PVDF
- ⑦ O-ring, material: EPDM
- ⑧ Plug R 1" material: PP, PVDF

Caution:
Always install the Sensopac CPA 320 so that the electrodes remain wet during long intervals in operation!

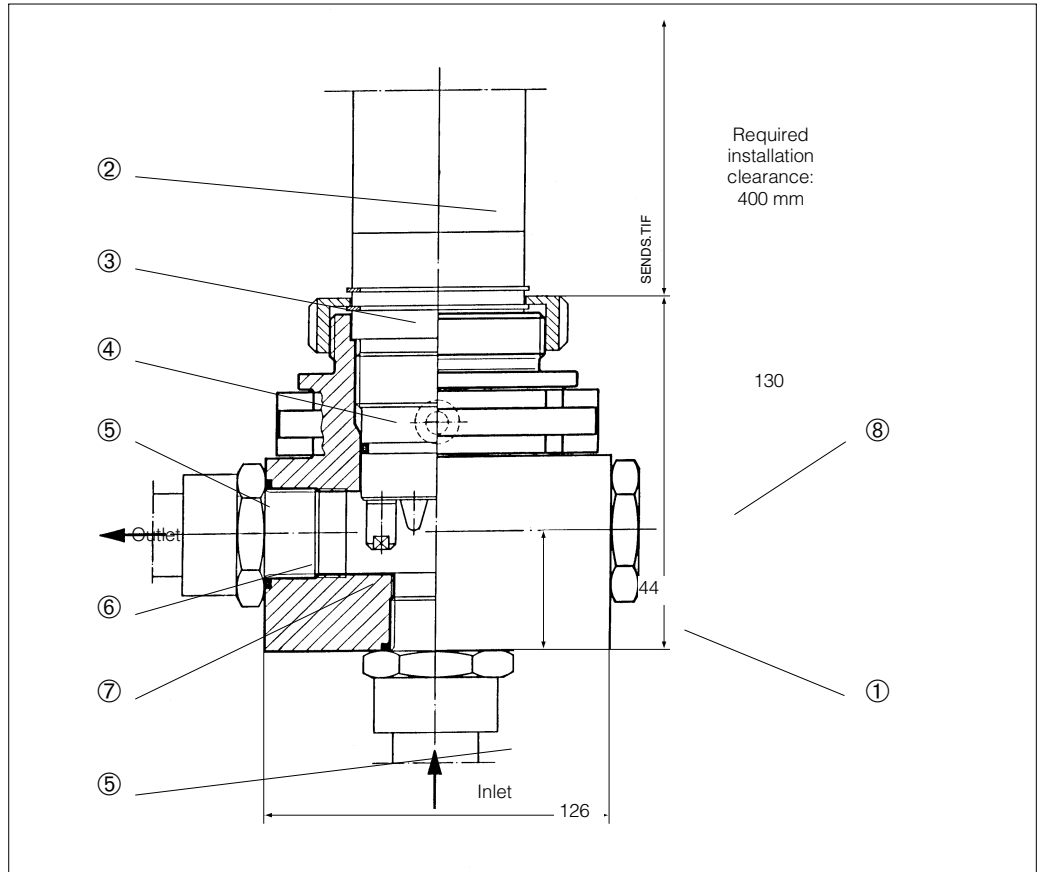
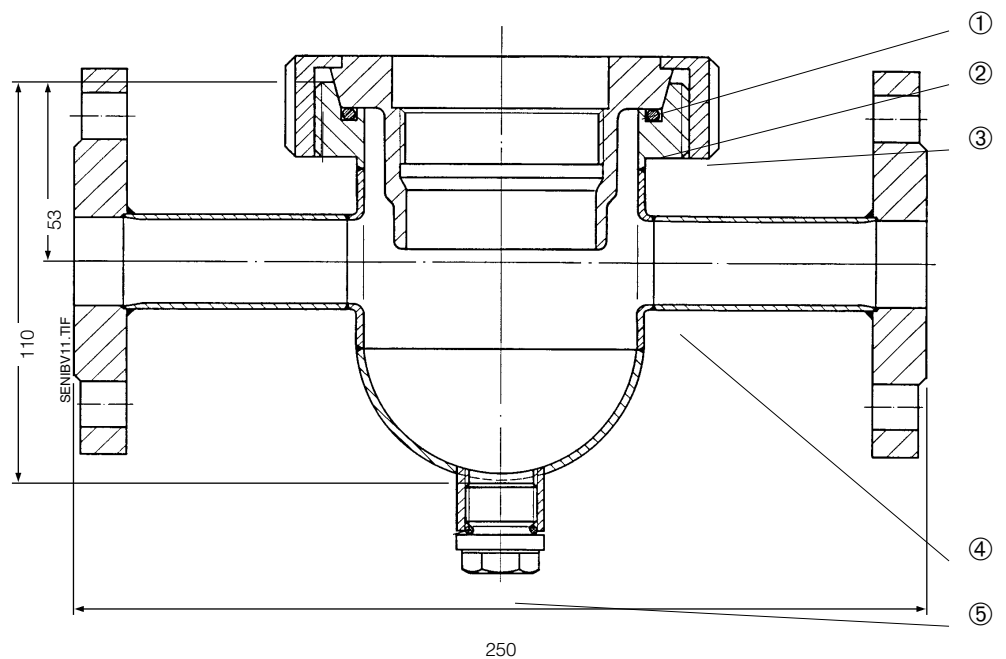


Fig. 12: Flow probe holder CPA 250-S13 for installation of Sensopac CPA 320

- ① Adapter for Sensopac CPA 320 (included in the scope of delivery)
- ② EPDM O-ring
- ③ Union nut
- ④ Welding neck flange DN 25, PN 16, connection as per DIN 2501
- ⑤ Drain plug



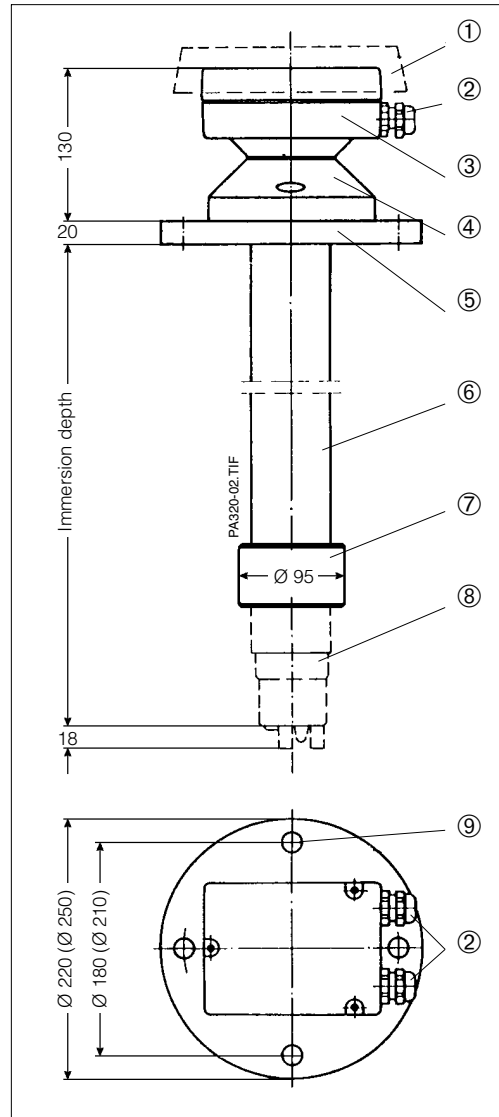
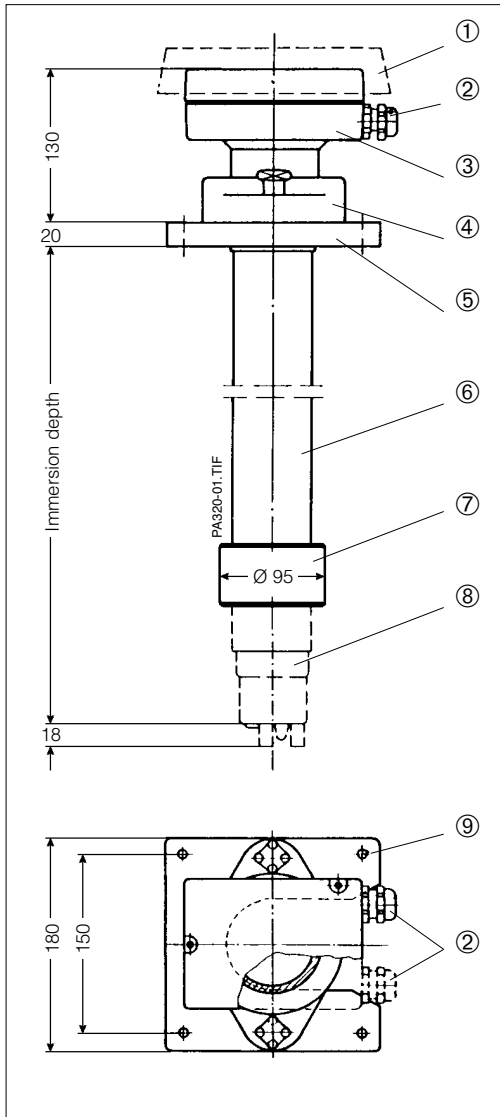


Fig. 13: Immersion assembly CPA 110-S for installation of Sensopac CPA 320

- ① Weather protection cover
- ② Pg 16 cable gland
- ③ Assembly head
- ④ Oval flange
- ⑤ Mounting plate
- ⑥ PP or PVDF immersion tube
- ⑦ Threaded connection for mounting Sensopac CPA 320
- ⑧ Sensopac CPA 320 body
- ⑨ 4 mounting holes Ø 18 mm

Fig. 14: Immersion assembly CPA 120-S for installation of Sensopac CPA 320

- ① Weather protection cover
- ② Pg 16 cable gland
- ③ Assembly head
- ④ Threaded fitting
- ⑤ DN 100 or DN 125 flange
- ⑥ PP or PVDF immersion tube
- ⑦ Threaded connection for mounting Sensopac CPA 320
- ⑧ Sensopac CPA 320 body
- ⑨ 4 mounting holes Ø 18 mm

Note:
Diameter values in brackets are only valid when using the Chemoclean cleaning system.

7. Electrical connections

The compact electrode system Sensopac CPA 320 is supplied complete with prefabricated connecting cable. The electrode plugs are connected with conventional screw plugs. Ensure that the cable is not stretched by twisting.

**Caution:**

When connecting the Sensopac connecting cable with another coaxial cable, e.g. CPK 6, always remove the black semiconductor layer between internal insulation and coaxial shield.

It is advisable to use a two-circuit measuring instrument of type Mypex CPM 340-A2, as the standard versions of the compact electrode system Sensopac CPA 320 are equipped with a double reference electrode or with 2 pH electrodes.

These instruments, together with the Sensopac CPA 320 and special electrodes, are also available in a version for use in explosion-hazard areas.

The relevant connection diagrams are shown in figures 17 and 18, the basic cable assignments for both versions of the Sensopac cable are shown in figures 15 and 16.

Figure 19 shows connection of the Sensopac CPA 320 to a single-circuit measuring instrument Mypex CPM 340-A1.

**Caution:**

Please note the different connection variants for the 2 different Sensopac models (double reference electrode with temperature sensor or double pH measurement) as well as for symmetrically high-resistance instruments and standard models.

7.1 Cable assignment of the Sensopac measuring cable

7.1.1 Sensopac with double reference system and one pH single electrode

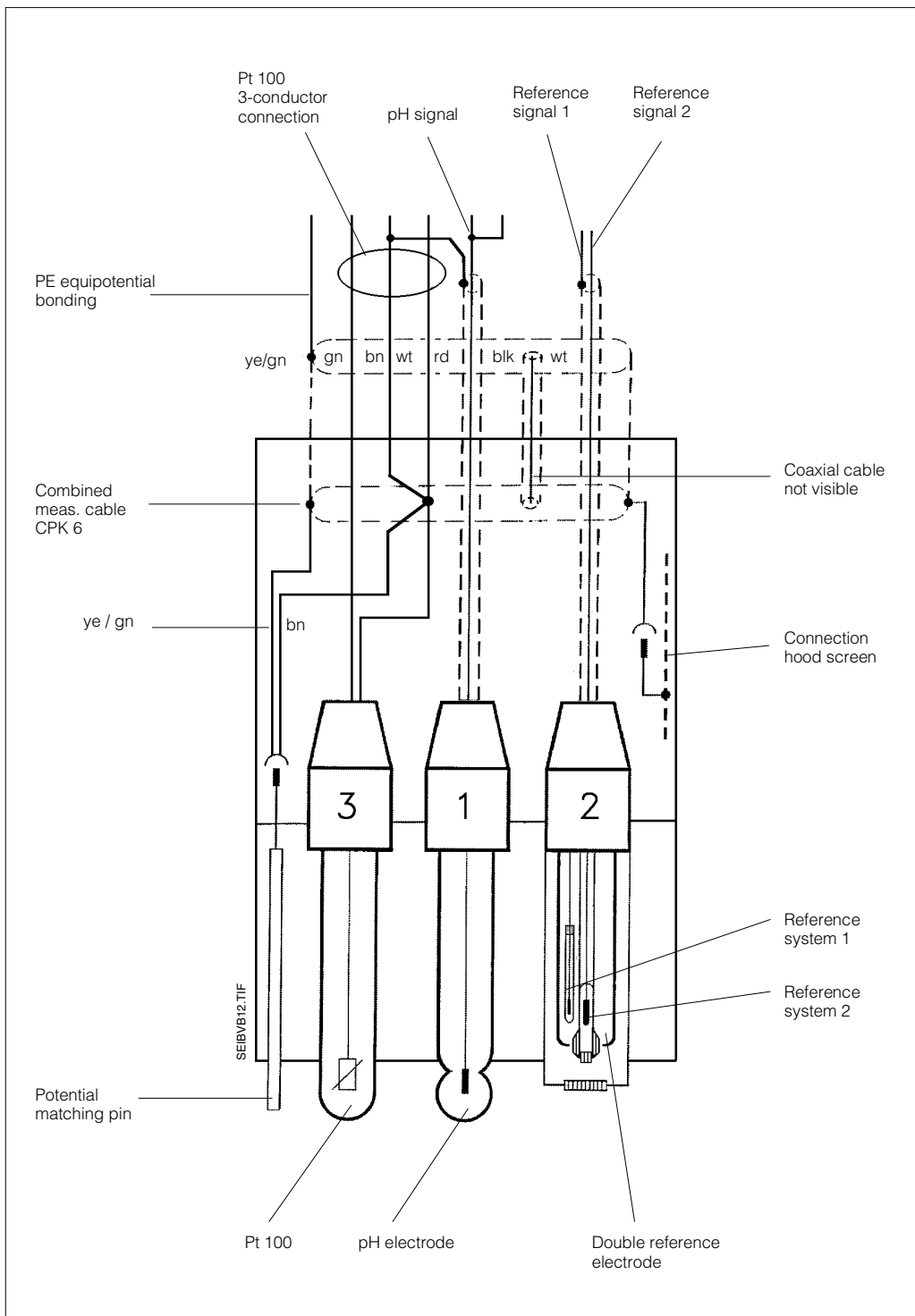


Fig. 15: Cable assignment for the Sensopac CPA 320 with double reference system and one pH single electrode

7.1.2 Sensopac with double reference system and two pH single electrodes

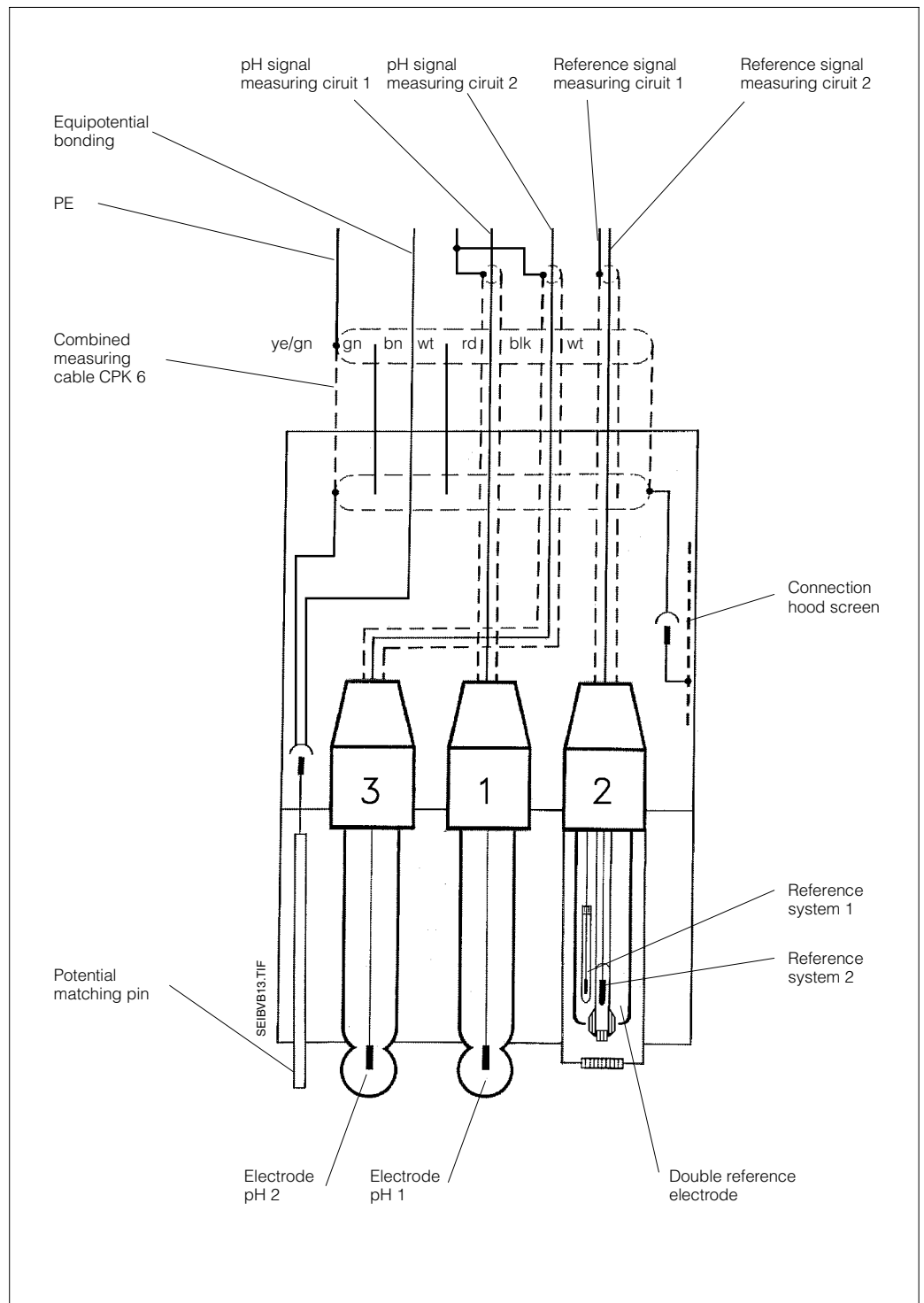


Fig. 16: Cable assignment for Sensopac CPA 320 with double reference system and two pH single electrodes

7.2 Connection of two-circuit pH measuring instruments
Mypex CPM 340-A2 / CPM 340-Z2

7.2.1 Sensopac with double reference system and one pH single electrode

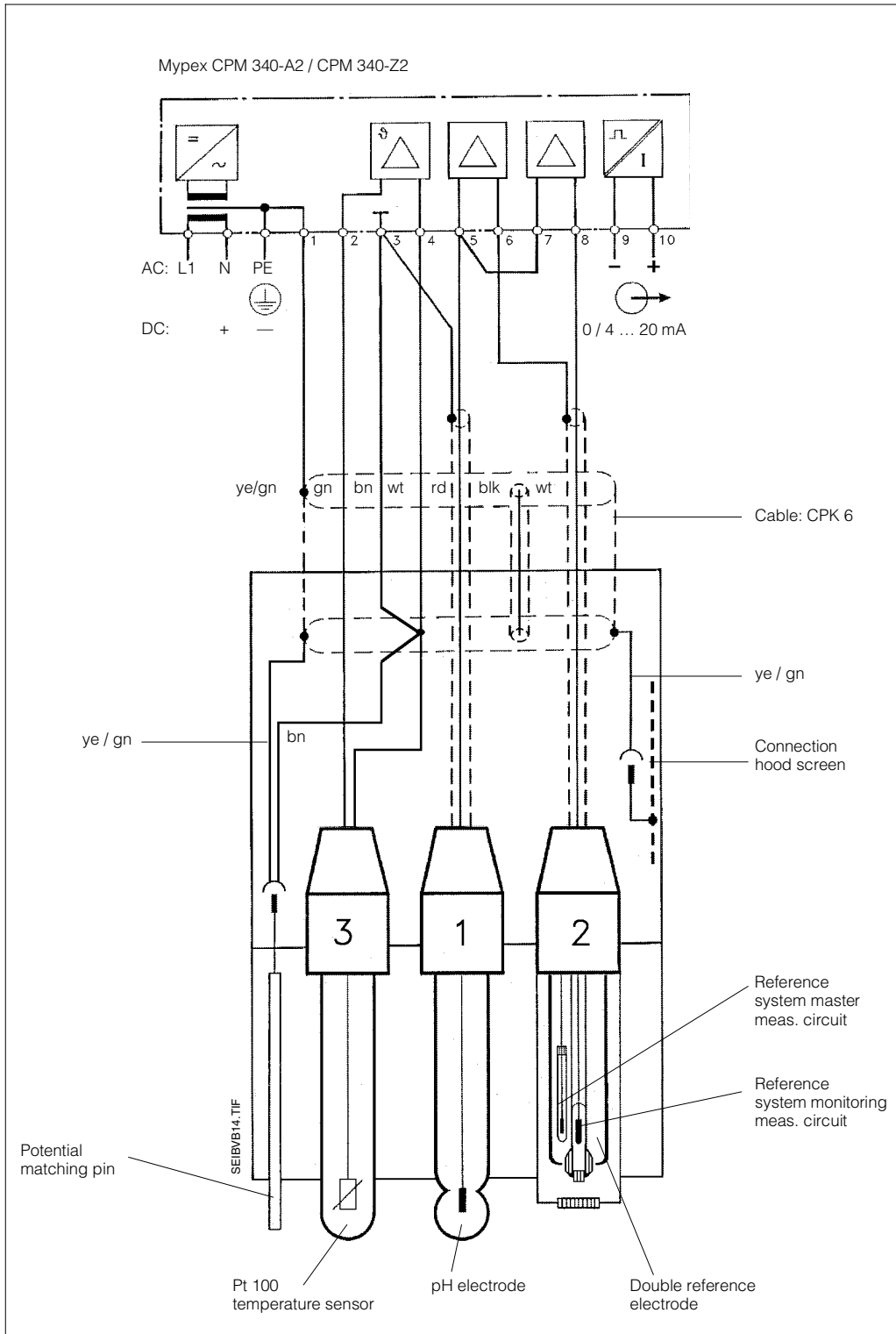


Fig. 17: Connection of Sensopac CPA 320 with double reference electrode to Mypex CPM 340-A2 / Mypex CPM 340-Z2

7.2.2 Sensopac with double reference system and two pH electrodes

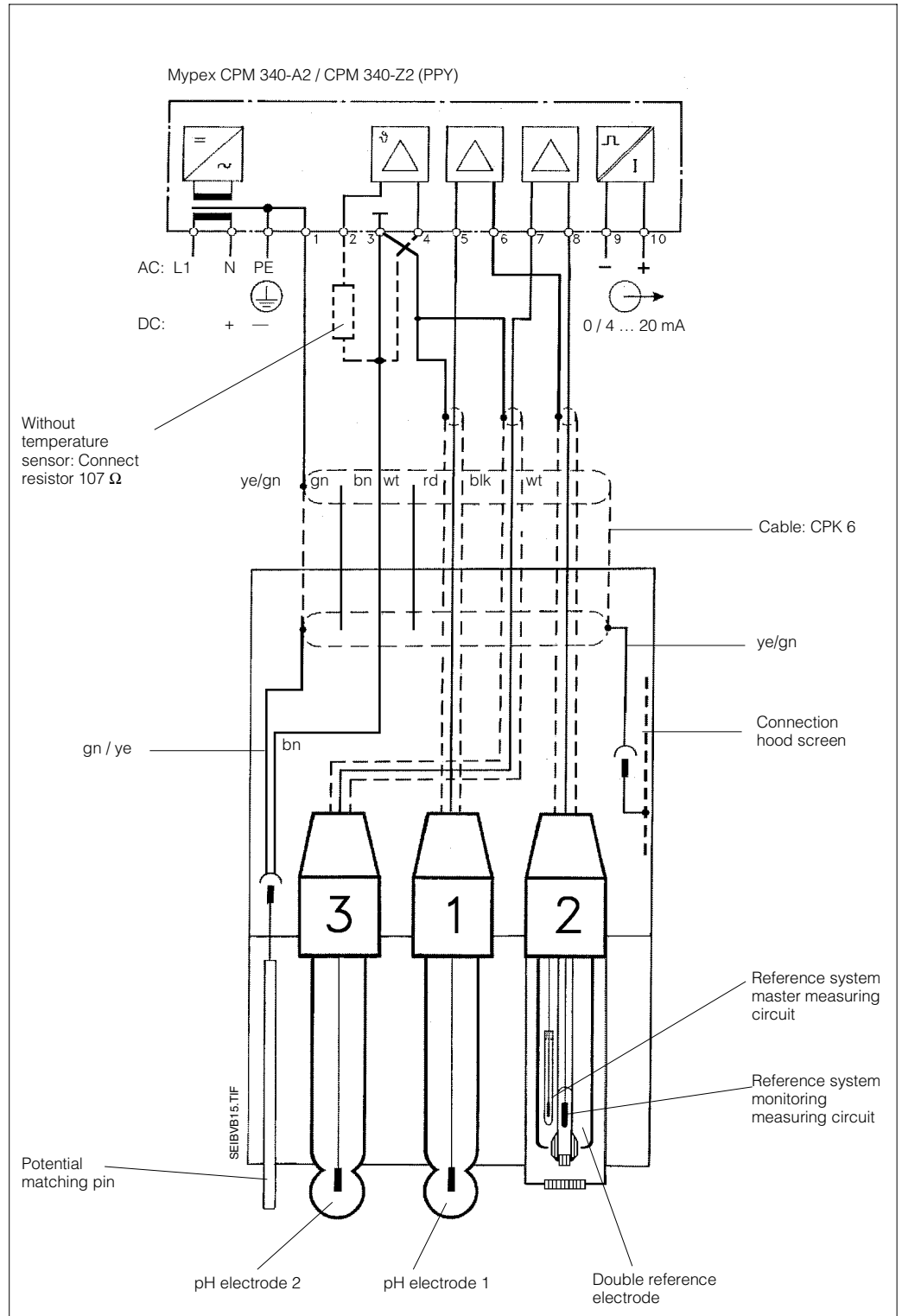


Fig. 18: Connection of Sensopac CPA 320 with two pH electrodes to Mypex CPM 340-A2 / Mypex CPM 340-Z2

7.3 Connection to single-circuit pH measuring instruments
Mypex CPM 340-A1 / CPM 340-Z1

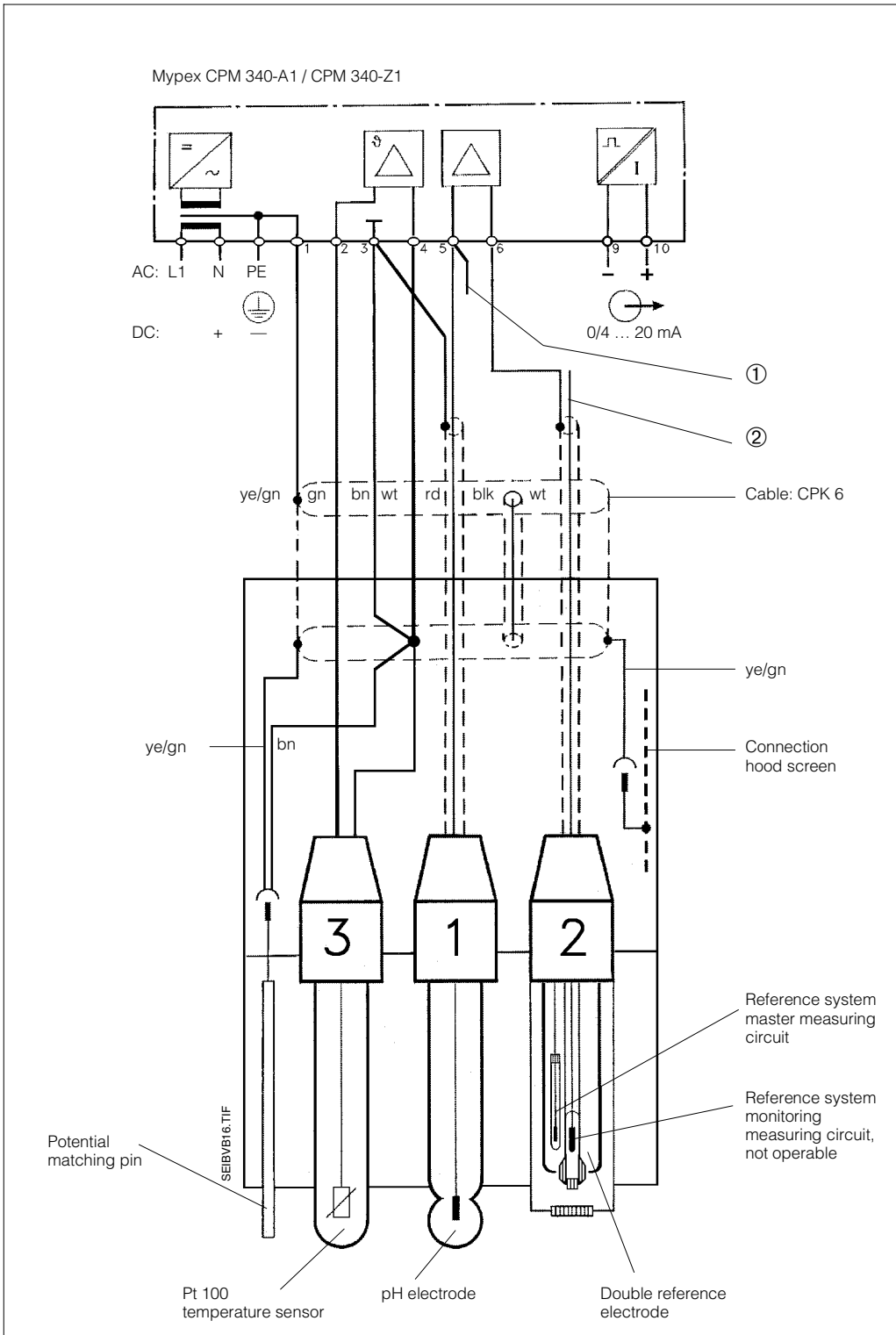


Fig. 19: Connection of Sensopac CPA 320 with double reference electrode to Mypex CPM 340-A1 / Mypex CPM 340-Z1

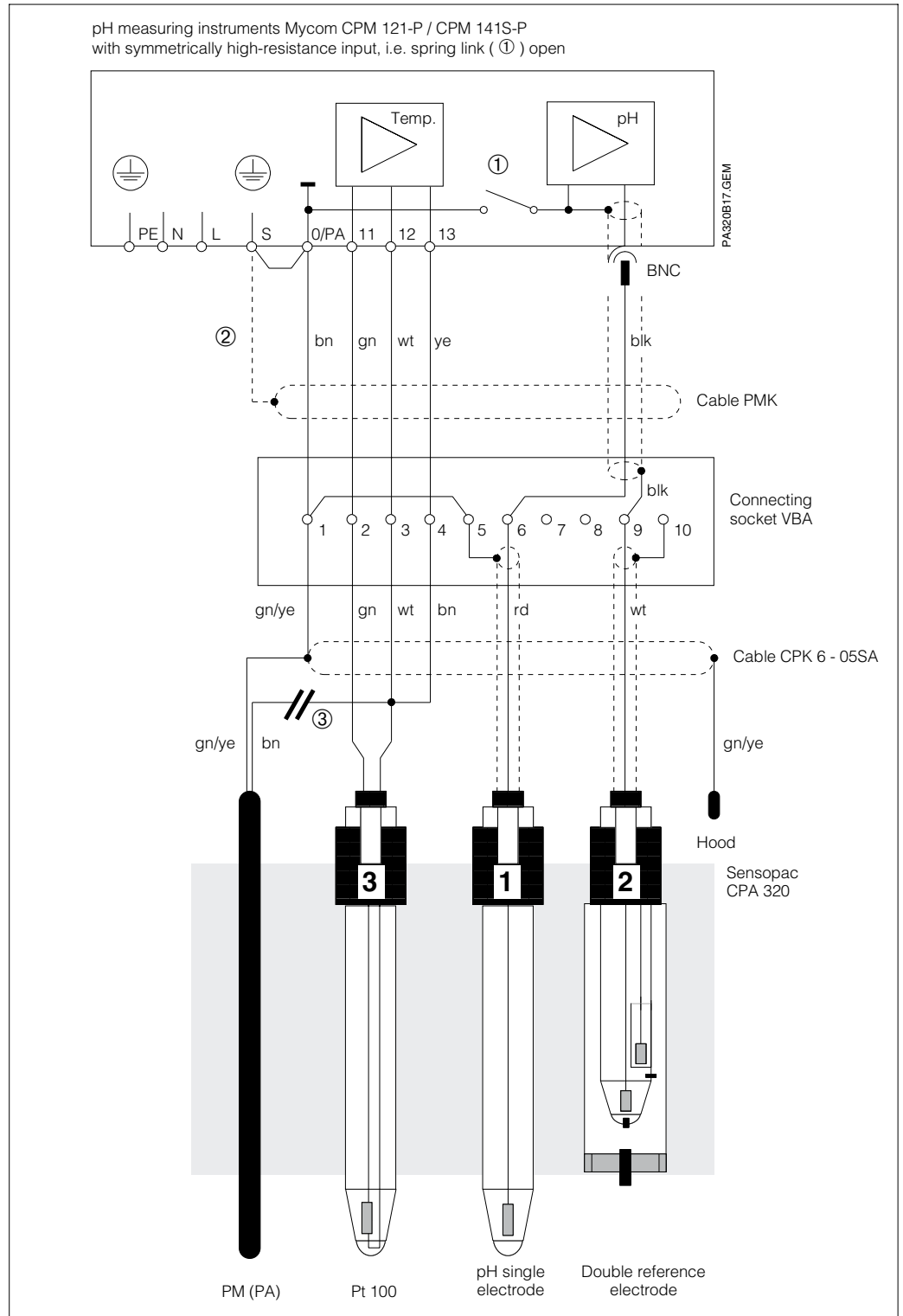
Caution:

- ➔ Always cut off this wire at the end sleeve!
- ⚠ The wire has to be insulated and must **not** be connected!

7.4 Connection to pH measuring instruments Mycom CPM 121-P / CPM 141S-P

When connecting the compact electrode system Sensopac CPA 320 to the pH measuring instruments Mycom CPM 121-P or CPM 141S-P, it is advisable to use instrument versions with symmetrically high-resistance signal input.

Figure 20 shows the relevant connection diagram.



7.5 Connection to pH measuring instruments
Liquisys CPM 220 / CPM 240

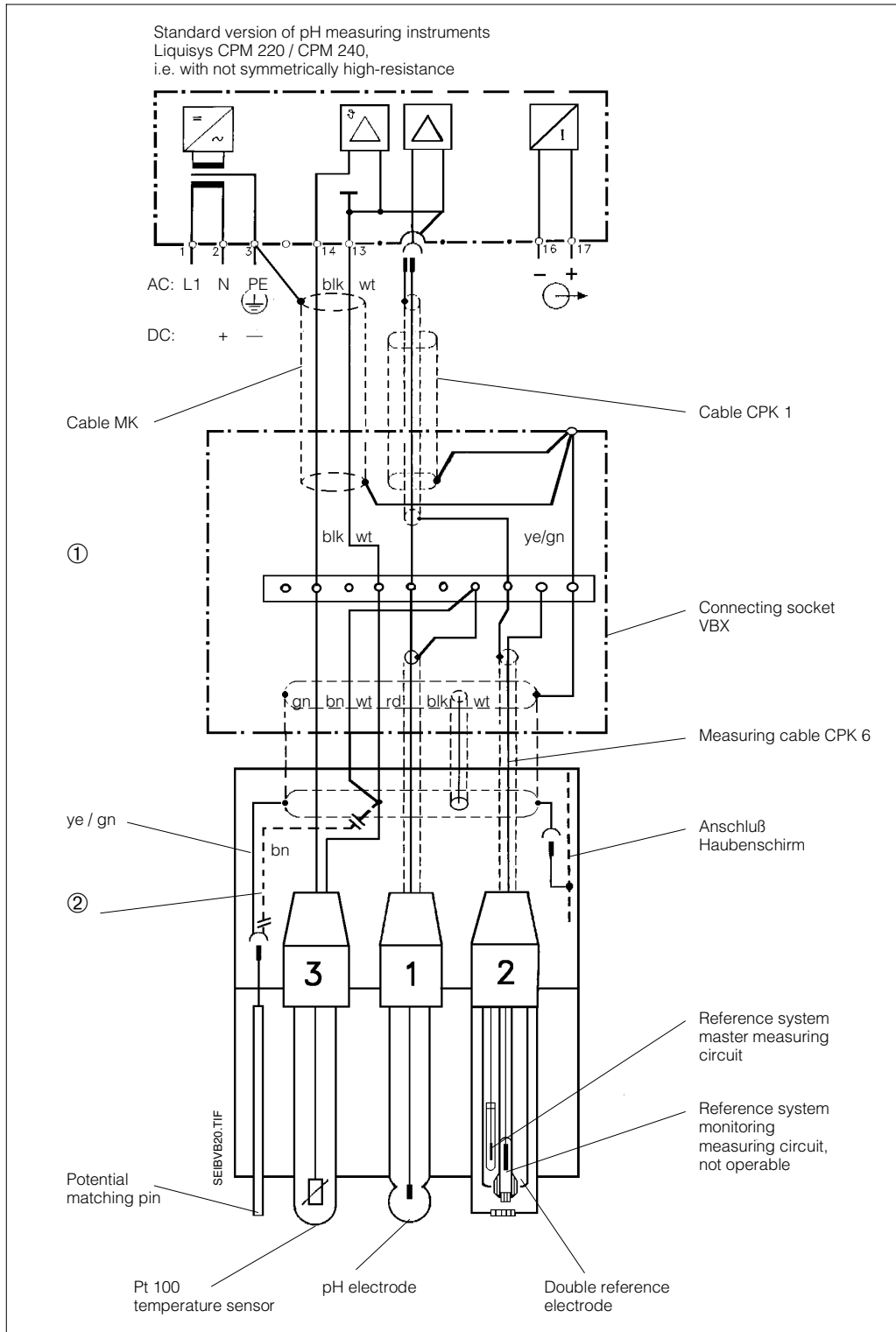


Fig. 21: Connection of Sensopac CPA 320 to standard version of pH measuring instrument CPM 120, i.e. with not symmetrically high-resistance

Caution:

- ① When connecting the coaxial cable, always remove the black semiconductor layer between internal installation and coaxial screen!
- ② Always cut off and insulate brown wire!

8. Calibration

Regular calibration is necessary to guarantee exact, reproducible pH measurement using the compact electrode system Sensopac CPA 320. The calibration frequency mainly depends on the operating conditions and on the required measuring accuracy.

It is advisable to calibrate relatively often to begin with, e.g. once a week. If the results show that no or only negligible deviations occur within the calibration intervals, the intervals between calibration can be increased accordingly.



Caution:

The sensor must be cleaned before calibration.

If a pH measuring electrode does not demonstrate sufficient sensitivity (slope), in spite of conscientious cleaning and functioning reference system, replace the electrode.

8.1 Calibration procedure

- Make sure that the sensor is not subjected to pressure from the medium (apart from when used with the interchangeable fitting WS). Undo the union nut and remove the Sensopac CPA 320.
- Remove any contamination on the electrode and diaphragm, then rinse thoroughly with water.

Note: The cleaning procedure is described in detail in chapter 9.
- Always check the sensor for visible damage, such as electrode breakage. It is possible that the PVF diaphragm may be discolored by the medium, without this affecting its functioning capability. The measurement will only fail when the diaphragm is completely blocked. A detailed description of replacing the diaphragm is given in chapter 10.4. Replace any damaged components if necessary.
- Two buffer solutions are usually used for calibration which have pH values three pH units apart from one another. On a long-term basis, weakly acid buffer solutions, e.g. pH 4, are considerably more stable than alkaline buffer solutions whose values may alter due to absorption of carbon dioxide. Carry out calibration according to the operating instructions of the pH measuring instrument used. For calibration, immerse the compact electrode system Sensopac CPA 320 into the buffer solution so that the electrodes are completely wetted. The screw-on protective cap, supplied with Sensopac CPA 320, is very suitable for this.



Caution:

- The electrodes must not be calibrated individually, outside the Sensopac structure.
- The protective hood must not be removed during calibration.

9. Cleaning

Measurement errors may be caused by contamination:

- Deposits on the pH-sensitive electrode glass (sluggish and less slope)
- Heavily contaminated and blocked diaphragm (slow response and unstable, fluctuating measured values)

The electrodes must be kept clean to guarantee accurate measurement. The electrodes must be cleaned:

- before calibration
- at regular intervals during operation. This regular cleaning may be automatically carried out using the Chemoclean spray-cleaning system (see chapter 9.4)

9.1 Manual cleaning

All components wetted by the measuring medium, including the impact-resistant bolts and lower side of the Sensopac structure, must be cleaned.

Light deposits may be removed by dipping the component into a suitable cleaning solution and stirring.

Heavy deposits may be removed with a soft brush and a suitable cleaning agent.

Persistent, adhesive deposits can be dissolved by leaving to soak in a cleaning solution over a longer period.



Caution:

Never use abrasive materials or scouring powder for cleaning. These may damage the electrodes.

Rinse the system through thoroughly with water after cleaning. Demineralized or distilled water may be used for rinsing if available. Smaller quantities of buffer solutions are also suitable if the same buffer is subsequently used for calibration.

Insufficient rinsing may easily result in faulty calibration and/or measurement, above all between changing the buffer solution.

9.2 Automatic cleaning

It is possible to use a spray-cleaning system for automatic cleaning during measurement operation.

A spray head type CPR 3 (for CPA 110-S or CPA 120-S) made of Hastelloy C4 material is available for automatic cleaning, as well as the required connection components. The CPR 3 spray head may also be retrofitted when adapter components AMS, UBS, GS, DS are used (see chapter 9.4). The spray head is suitable for both water under applied pressure as well as for diluted cleaning agents.

If connected to a public water supply, the cleaning system must be separated from the supply system by a line separator.

9.3 Selecting the cleaning agents

The cleaning agent is selected according to the type of deposit. The most frequent types of deposits and suitable cleaning agents are compiled in the following table:

Type of deposit	Cleaning agent
Grease, oil	detergent
Lime deposits or metal hydroxides	5 to 10 % hydrochloric acid or aminosulphuric acid
Sulphide deposits (e.g from sewage treatment)	Mixture of 5 to 10 % hydrochloric acid with 1 % proportion of Titrplex (EDTA)
Protein deposits (e.g from biological residues)	Cleaning agents with enzyme content in an acid solution (e.g. HCl 10 % + Pepsin) or enzyme conditioning in alkaline cleaning media



Caution:

- Rinse thoroughly after cleaning!
- To be on the safe side after alkaline cleaning, the electrodes should be left to soak in a solution of pH 4 for 5 to 10 minutes.

9.4 Cleaning system CPR 3

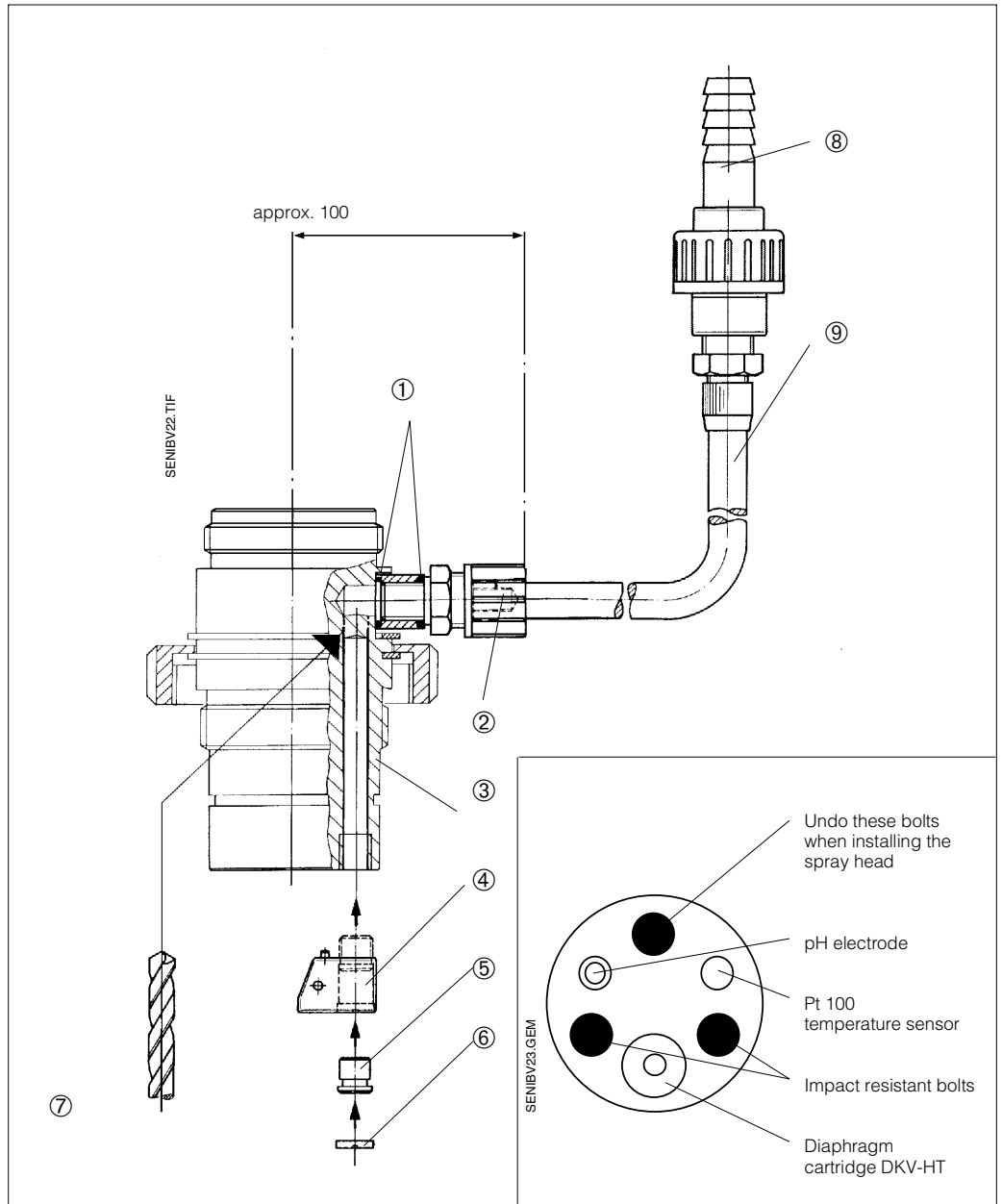


Fig. 22: Installation of cleaning system CPR 3 and connection fitting

- ① EPDM O-rings
- ② Remove sealing plug
- ③ Sensopac structure
- ④ Spray head
- ⑤ Threaded sleeve
- ⑥ Sealing screw
- ⑦ Through-bore with Ø 8 mm with retrofitting the cleaning system CPR 3
Clean and debur afterwards
- ⑧ Nominal diameter 10 mm
- ⑨ PE hose

Fig. 23: Mounting position of cleaning system CPR 3 (right)

The spray head of the Chemoclean cleaning system CPR 3 may be retrofitted to the compact electrode system Sensopac CPA 320. Following steps are necessary:

- Unscrew the impact-resistant bolt (Fig. 23)
- Drill out the predrilled connection channel (Fig. 22).
Remove any chips and debur. Otherwise there is the risk that the spray nozzles will block.
- Mount the spray head.
- Mount the connection fitting.



Caution: Once the cleaning system has been fitted, there is a risk that the medium will be discharged. For this reason, either connect the cleaning system completely or fit a sealing plug into the appropriate connection fitting.

10. Electrodes

10.1 pH electrodes

Single pH electrodes with Pg 13.5 threads may be inserted into station "1" of the Sensopac.

In case of double pH measurement, position "3" may be occupied by a single pH electrode.

If automatic temperature compensation is required, the temperature sensor must be installed separately, outside near the Sensopac, and connected to the measuring instrument. Observe the temperature during calibration.

Faulty electrodes must be replaced, e.g. in case of visual mechanical damage, hairline fractures, inadequate slope.

10.2 Replacing the electrodes

- Remove the compact electrode system Sensopac CPA 320.
- Loosen the black star nut on the Sensopac's measuring cable gland. The complete compression seal is pulled out of the protective hood with the star nut. When pulling out, carefully guide approx. 10 cm of measuring cable downwards through the compression seal.
- Now unscrew the protective hood, making sure that the measuring cable is not twisted.
- Disconnect the individual electrode plugs from the electrodes to be replaced, and remove them.
- The 17 mm socket wrench supplied is used to unscrew the electrodes to be replaced.
- When replacing the reference electrode, the bridging electrolyte must also be replaced.

When the reference electrode is screwed in again, excess electrolyte must be displaced to guarantee that the reference chamber is completely full.

Caution:

Make sure that no electrolyte or moisture can penetrate into the electrode heads or cable connectors.

- Insert the replacement electrode and continue in reverse order.

10.3 Double reference system

The double reference system mounting position "2" (see chapter 3) consists of the double reference electrode CPS 13-OTD 1GSA, inserted into the reference chamber filled with electrolyte. The reference chamber is sealed off from the measuring medium by a diaphragm cartridge.

The master pH measuring circuit and its associated tapping system in the double reference electrode are extensively protected against the ingress of foreign ions. If "poisoning" occurs, the monitoring reference system is affected first. The reference system should then be replaced at the next opportunity.

Necessary procedures in the event of a difference signal at the double measurement transducer (delta signal):

- Replace the bridging electrolyte in the reference chamber
- Should this first measure be inadequate, replace the double reference electrode.



Caution: The reference chamber must always be completely filled with electrolyte.

The bridging electrolyte is poured in through the electrode aperture, i.e. with built-in diaphragm cartridge DKV-HT. There must be no air bubbles.

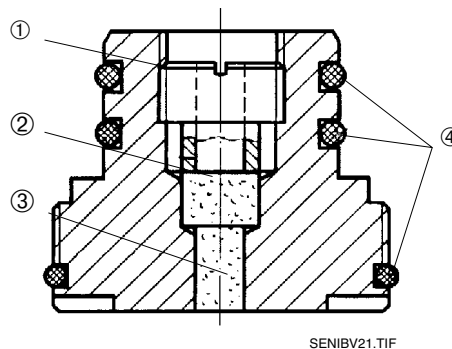


Fig. 24: Diaphragm cartridge DKV-HT

- ① Cartridge
- ② Banjo bolt
- ③ RDV-HT diaphragm
- ④ EPDM O-rings

10.4 The diaphragm of the reference system

The diaphragm DKV which separates the electrolyte area from the measuring medium may be replaced if necessary in the event of a blockage, for example.

The DKV-HT type is required for high-temperature applications.

Replacing the diaphragm

- Remove the Sensopac CPA 320.
- Remove the reference electrode as described in chapter 10.2.
- Using the socket wrench (pin side), undo the diaphragm cartridge.
- Clean the reference chamber carefully and rinse out afterwards with demineralized water. Small quantities of the KCl electrolyte solutions CPY 4-1 or CPY 4-3 (for high-temperature are also suitable for rinsing).
- The RDV-HT diaphragm in the DKV-HT diaphragm cartridge is replaceable. Using a screwdriver, remove a banjo bolt on the inner side of the cartridge (see figure 24) and press out the diaphragm insert towards the inside. Once the new diaphragm insert has been installed, proceed in reverse order.
- Press the new diaphragm cartridge into the electrolyte chamber and tighten using the special wrench.
- Fill the reference chamber with fresh KCl electrolyte solutions CPY 4-1 or CPY 4-3 (if required). When the reference electrode is screwed in again, excess electrolyte must be displaced to guarantee that the reference chamber is completely filled.

Caution:

Make sure that no electrolyte penetrates into the electrode heads or connection plugs.

- Reconnect the numbered electrode plugs and replace the protective cover. Recalibrate before installing the Sensopac CPA 320 into the measuring position.

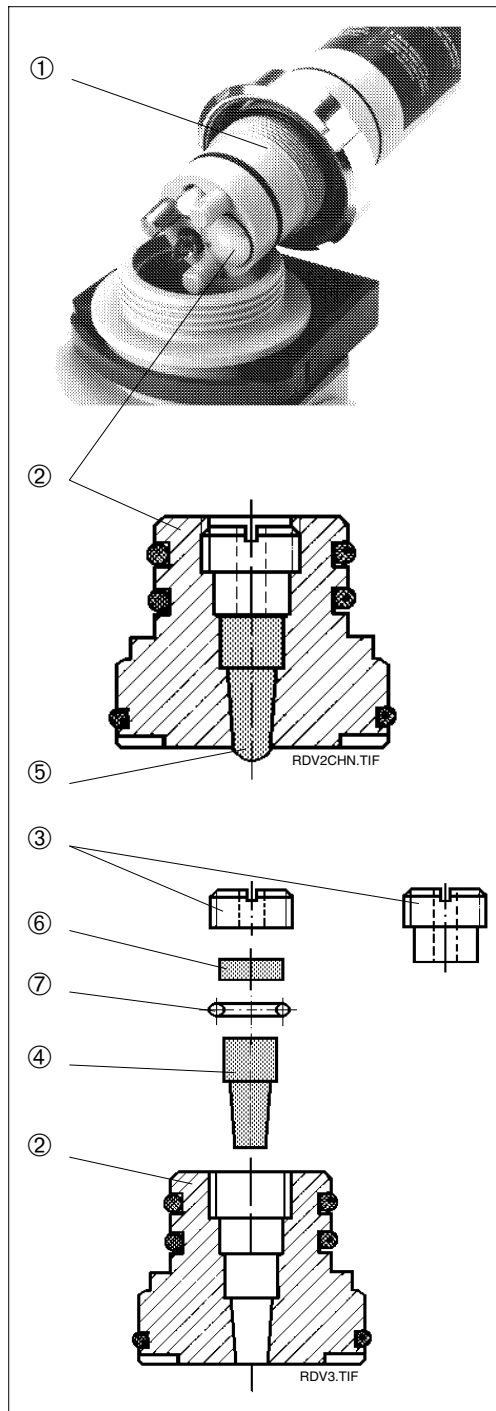


Fig. 25: Change of replacement diaphragm RDV-HT

- ① Sensopac CPA 320
- ② Diaphragm cartridge
- ③ Locking bolt
- ④ Diaphragm
- ⑤ Diaphragm point
- ⑥ Ceramics disk
- ⑦ O-ring

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