WIEGAND

MACHINERY WORLD

File 4

WIEGAND

File 1

1 Operating Instructions Evaporation Plant

2 Erection Drawings No. 763/764/765/766-303-0

3 Flow-sheet No. 513 / 515 - 302 - 0

4 Maintenance Instructions SIHI Vacuum pump

5 Maintenance Instructions Hilge Centrifugle pumps

6 Maintenance Instructions Mono pump Nezch

7 Maintenance Instructions GEA Ahlborn heat exchangers

8 Maintenance Instructions Schiele Fan

9 Maintenance Instructions Alfa Laval LKM Valves

File 2

11 Installation, Assembly & commisioning of controls

12 Parts list of control systems

13 Drawings of control systems

14 Taylol

15 Keystone

16 Valmet

17 Samson

18 Fisher Gravitrol

19 Berthold

File 3

20 Maintenance Instructions for Foxboro Instruments

File 4

21 Maintenance Instructions Bran + Lubbe pump

22 Conductivity Controller Condensate tank SPIRAX

23 Hicon Conductivity Controller Rosemount

24 pH Controller Wiegand Evap Endress&Hauser Mypex

25 Pressure Transmitter 2088G Rosemount

26 HONEYWELL APT 2000 CONDUCTIVITY TRANSMITTER

27

28

29

21

PUMPS DIVISION

BRAN+LUEBBE

Metering Pumps

Operation Manual

Com.-No.	:	51910829
Serial-No.	:	9123101
Type	:	DS50/100/W/ESP
P.O.-No.	:	962049/17/G/01
Customer	:	
Date	:	
Revision	:	

Read the instructions in this manual carefully before installing or starting the metering pump. BRAN+LUEBBE GmbH will accept no liability for damages due to non-observance of this manual.

Infomation in this manual is subject to change without notice and does not represent a commitment on the part of BRAN+LUEBBE GmbH.

Table of Contents

BRAN+LUEBBE

1

Structure, Assignments, Safety Instructions, Ordering of Spare Parts

1 Structure, Assignments, Safety Instructions, Ordering of Spare Parts

Structure of the manual

Just as the metering pump, the manual has a modular structure. Thus each manual only contains the individual information for a specific metering pump. For this reason, the pages and sections are not numbered in sequence throughout the whole document.

Easy reference has been achieved by dividing the manual into 11 main sections:

1. Structure, Assignments, Safety Instructions, Ordering of Spare Parts
2. Metering Pump
3. Assembly Groups
4. Installation
5. Operation
6. Maintenance
7. Trouble Shooting
8. Storage and Preservation
9. Parts Lists and Drawings
10. Accessories (if existing)
11. Quality Documentation (if existing)

In sections 3 "Assembly Groups", 4 "Installation" and 5 "Operation" a sequential numbering of sections may not always be adhered to. It is thus possible that section 3.3 "Pumphead" only contains section 3.3.2 "Plunger Model", since the other models treated in sections 3.3.1 are not relevant for your specific metering pump.

The page numbering in the footer is only carried out in sequence throughout a coherent section. The pages are numbered according to the example "page 2/11" (page 2 of a total of 11 pages forming a coherent section). In this way, the length of such a section can be determined. The numbering of figures and the cross-references to figures and pages are only valid within a coherent section.

For readers orientation, the right header indicates the main section, e.g. "*BRAN+LUEBBE Assembly Groups*".

The position numbers used in the descriptions (section 1 to 8) are *not* identical with the position numbers referred to in section 9 "Parts Lists and Drawings"!

Assignment of the Manual

Pump type and serial number are referred to on the cover, in section 1.1 and on the name-plate of the metering pump.

Safety Instructions

To avoid damage, please take notice of the following sections:

2 "Metering Pump"
4 "Installation"
5 "Operation"
6 "Maintenance"

Danger:
Electrical connections and maintenance must only be performed by qualified personnell

Electrical elements have to be connected according to local regulations.

In hazardous areas special regulations must be adhered to.

Spare Parts Order

Only the use of original B+L spare parts will ensure proper operation, reliability, and long service life.

To ensure accurate and prompt .parts delivery the following information must be provided when ordering parts:

- Serial number (see cover, section 1.1 or nameplate of the pump)
- Description (section 9)
- Ident. Number (section 9)

BRAN+LUEBBE Metering pump specification sheet 1.1

19.04.96 8:33:05

1	Metering pump type:	DS50/100 C/W ESP	Order no.:	962049/17/G/01
2	Dimension sheet no.:	ANNR-0574	Building no.:	
3	Job-No.:	51910829	Application:	
4	Serial no.:	0009123101		
5	Quantity:	001		Sheet no.: 001 of: 001

Process data

7	Liquid handled		Unknown	
8	Concentration	%	-	
9	Solid % / Size	mm	-	
10	Density at PT	g/cm^3	1	*
11	Viscosity at PT	m Pa s	1	*
12	Process temperature = PT	°C	20-80	
13	Ambient temperature	°C	20-40	
14	Press discharge port Pabs min/max	bar	2	11
15	Press suction port Pabs min/max	bar	1	1,2

Design

Pumphead	17	Item on dimension sheet		001	
Pumphead	18	Design (plunger, diaphragm)		Diaphragm	
Pumphead	19	Special design		-	
Pumphead	20	Plunger diameter	mm	-	
Pumphead	21	Max. capacity	l/h	35	
Pumphead	22	Stroke frequency	1/min	100	
Pumphead	23	Operat.press./set press.of relief valve	bar	10	
Pumphead	24	Valve design	suction/discharge side	Ball/Ball	
Pumphead	25	Suction valve spring pressure	bar	-	
Pumphead	26	Discharge valve spring pressure	bar	-	
Pumphead	27	Plunger packing design		-	
Pumphead	28	Lantern ring connection	DN	-	
Pumphead	29	Suction connection	DN/PN	G 3/8"	
Pumphead	30		Standard	ISO 228	
Pumphead	31	Discharge connection	DN/PN	G 3/8"	
Pumphead	32		Standard	ISO 228	
Pumphead	33	Heating jacket	DN	-	
Pumphead	34	Hydraulic fluid		-	
Pumphead	35	Air bleed valve		-	
Gear	36	Model		CG-G1-01-03-28/1	
Gear	37	Max. stroke length	mm	3	
Gear	38	Crank phase angle	°	0	
Gear	39	Stroke length adjustment 1)		SBE	
Gear	40	Stroke length feedback		-	
Gear	41	Oil quantity	l	0,5	

Pumphead

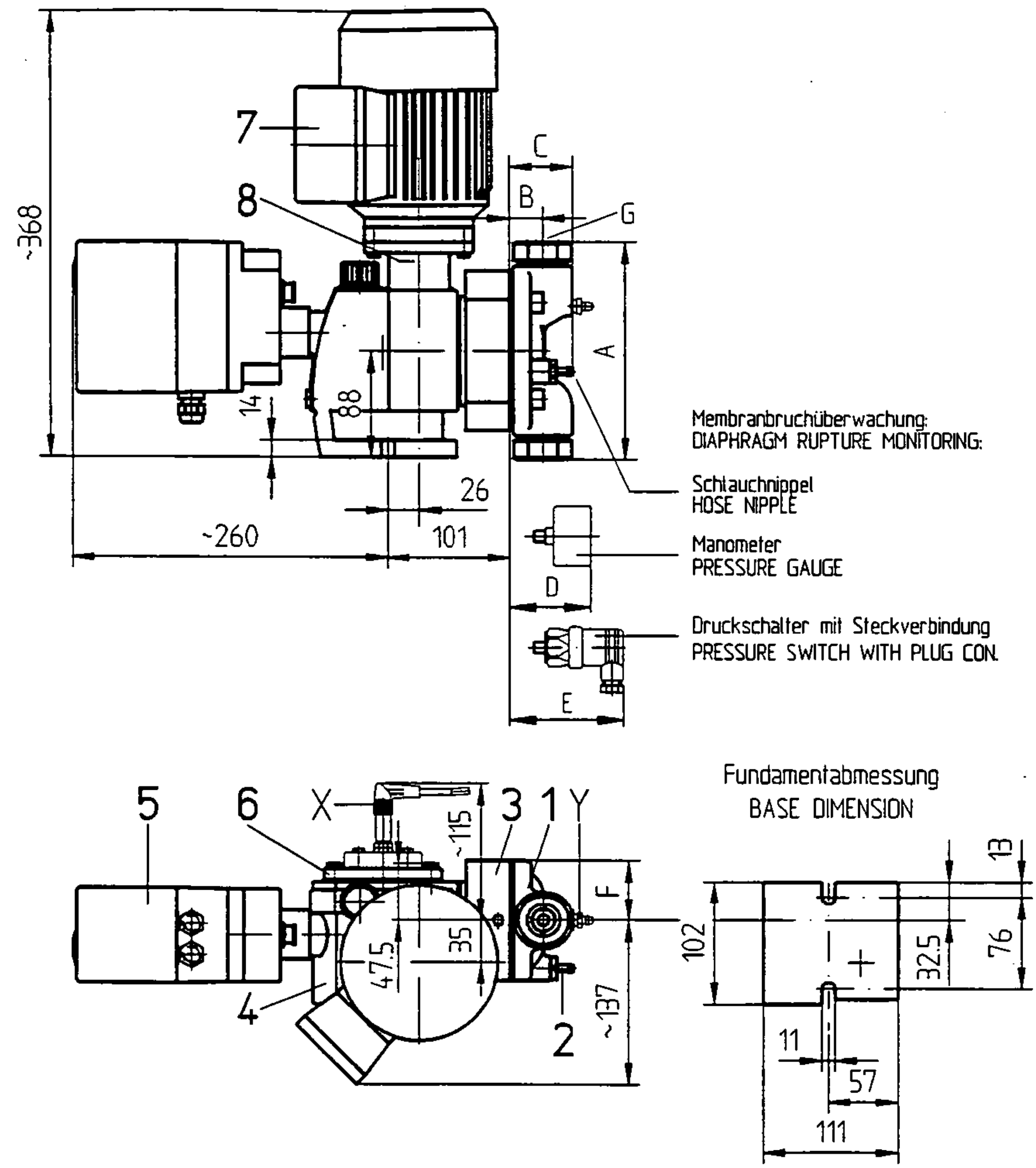
Materials	43	Housing	1.4581	
Materials	44	Plunger/diaphragm		PTFE
Materials	45	Valve housing	1.4581	
Materials	46	Valve seat	1.4571	
Materials	47	Valve-ball/-cone/-plate	1.4401	
Materials	48	Valve gasket	1.4571	
Materials	49	Plunger packing	-	
Materials	50			

Motor	51	Motor brand Brook	Current 3 phase AC	Voltage 400 V	Power 0,18 kW
Motor		Type 63 M 2 A	Frequency 50 e/s	Speed 2800 1/min	Variable speed
Motor			Pole-changing	Enclosure IP 55	Ex-Proof
Motor	52	Speed variat	Brand	Adjustment	Feedback:
Motor			Type	Range 1:	Max.Speed: 1/min

53	Mountings:	Electric Stroke Positioner
54	Accessories:	
55	Remarks:	K.A.M.25.03.96
56	Painting:	Specification No1 — Colour: Red Nr 246

1)	SH: manual at standstill	SBH: manual at standstill and operation	SBE: electric.at standstill and operation	SBP: pneum. at standstill and operation

* Details were unknown when ordered. The specified data must be kept stated limits.



Pumpenkopf PUMPHEAD	A	B	C	D	E	F	G		Gewicht WEIGHT
D 50S	148	17,5	42	60,5	87,5	39,5	Innengewinde G3/8	3/8" FEMALE	~17,2 kg
D100S	180	27	51,5	70	97	50	Innengewinde G1/2	1/2" FEMALE	~17,8 kg

Option/OPTION		
	X	Impulsgeber / PULSE GENERATOR
	Y	Entlüftungsventil / VENT VALVE

Ölmenge/OIL QUANTITY : 0,45 l

DESIGNED	D. Petersen	13. 07. 94
DRAWN	W. Naundorf	13. 07. 94
CHANGED	W. Naundorf	21. 09. 94
APPROVED	D. Petersen	22. 09. 94
RELEASED	D. Petersen	23. 09. 94

BRAN+LUEBBE

TITEL 1 DOSIERPUMPE/METERING PUMP

TITEL 2 N-G1 41

- CAD-DRAWING -

MATERIAL

IDENT-NO.

REV. 1

FORMAT	SCALE	SHEET	DRAWING NO
A4	1: 5	1/1	ANNR-0574

BRAN+LUEBBE

2

Metering Pump

2 Metering Pump

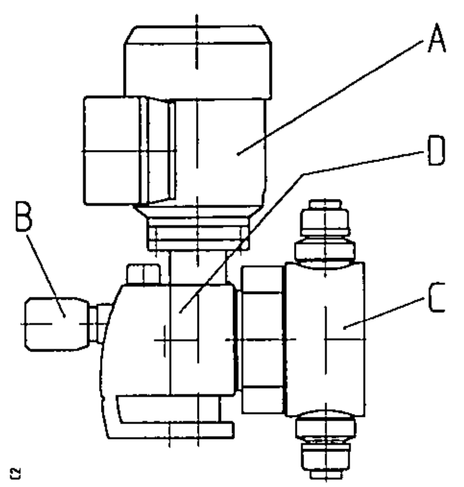
Operating Conditions

The operating conditions (lines 7 to 15) and the pump design data (lines 17 to 55) are stated in the specification sheet in section 1.1. If no operating conditions are given with the order, the operating limits are filled in by BRAN+LUEBBE and should be adhered to.

Construction of the Metering Pump

The metering pump is a reciprocating positive displacement pump. Basic components are the drive (A), the stroke length adjustment (B), the pumphead (C), and the gear unit (D) (Fig. 2.1). The functions of the components are described in section 3 (Assembly Groups).

The design of the metering pump fulfills German safety and accident prevention regulations.



A Drive C Pumphead
B Stroke Length Adjustment D Gear Unit

Fig. 2.1: Metering Pump e.g. ProCam DP100 / M-Series M1

Safety Instructions

Warning:
Exceeding the max. allowed operating pressure must be prevented by all means (e.g. using a safety valve, see section 4.3). Failure to comply with this precaution may result in personal injury and damage to the pump or related equipment.

Before starting to work on the metering pump check carefully that

- all pressurized parts (pumphead, piping) are depressurized
- the drive is disconnected from the power source
- personal protection is carried out according to local regulations
- parts being used in contact with aggressive substances are flushed before handling
- For safe operation of the bleed valve see section 3.5 (Bleed valve for product chamber).

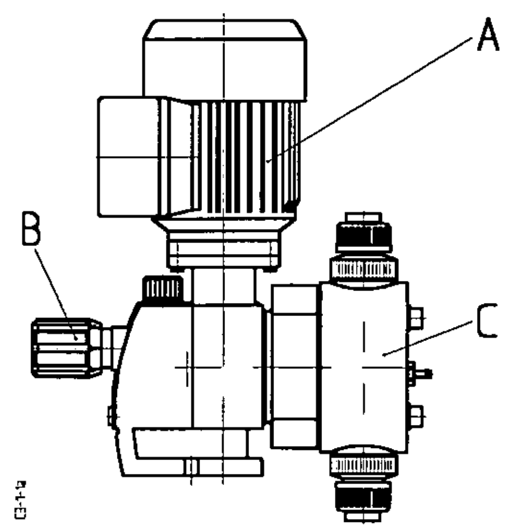
BRAN+LUEBBE

3

Assembly Groups

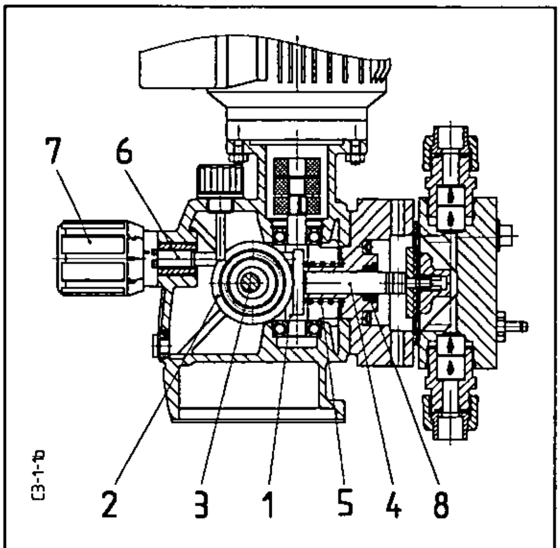
3.1 Gear Unit

3.1.1 Gear Models G1, G2, A1 and A2 for Metering Pumps ProCam / M-Series M1, M2



A Motor
B Stroke Length Adjustment
C Pump Head

Fig. 3.1: Plan View (Main Gear G1, G2)



1 Worm Shaft
2 Worm Wheel
3 Eccentric
4 Push Rod
5 Spring
6 Spindle
7 Manual Adjustment Cap
8 Gasket Ring

Fig. 3.2: Sectional View (Main Gear G1,G2)

Construction and Function

For the construction and function of models G1 and G2 see Fig. 3.1 and 3.2.

The rotary motion of the motor (A) is transmitted by the worm shaft (1) and the worm wheel (2) to the fixed eccentric (3) which shifts the push rod (4) to the front dead centre. The spring (5) shifts the push rod back to the rear dead centre. At full stroke setting the eccentric does not loose contact to the push rod. Part-stroke settings are achieved with a "lost motion device" consisting of a spindle (6), which is connected to a manual adjustment cap (7). A clockwise rotation of the spindle displaces the rear dead centre of the push rod and the eccentric temporary looses contact to the push rod. At zero setting the rear dead centre coincides with the front dead centre and consequently the push rod cannot be shifted by the eccentric.
To prevent leakage of gear fluid, the push rod is sealed with a gasket ring (8).

Suction and discharge strokes are both positive mechanical movements, but the suction stroke could be limited if the spring did not exert sufficient force to overcome the suction head.

The main gear units (G1, G2) can be connected with attachable gears (A1, A2) to drive multiple pumps. In that case it has to be ensured, that the rated load of both the electric motor and the drive unit is not exceeded. To avoid pulsation in the pipe work and overload of the pump unit, a phase displacement of the reciprocating piston movements is recommended.

If multiple pump units are ordered, the arrangement is factory assembled, the optimum phasing being preset. In case of a supplementary extension of an existing unit complete dismantling and re-phasing is necessary.

For application requiring simultanious delivery of the pump heads always refer to BRAN+LUEBBE!

Stroke Length Adjustment (B)

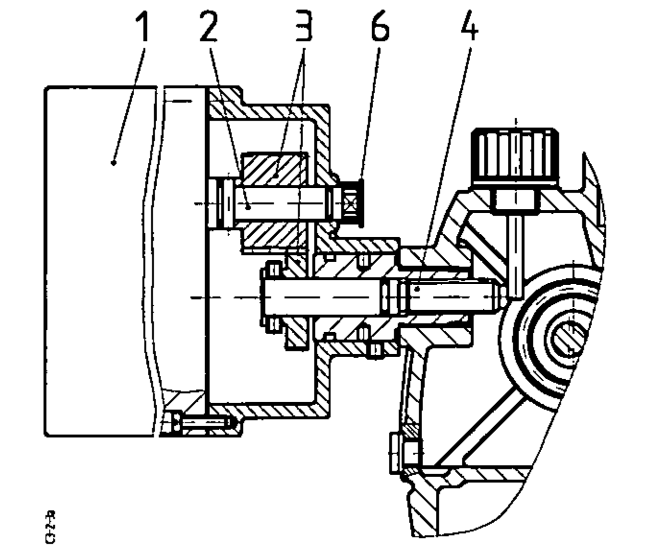
See section 3.2.

Oil Filling

Attention:
The gear units are delivered without any oil. Every gear unit has to be filled with oil prior to start-up (see section 5.1 and 5.2).

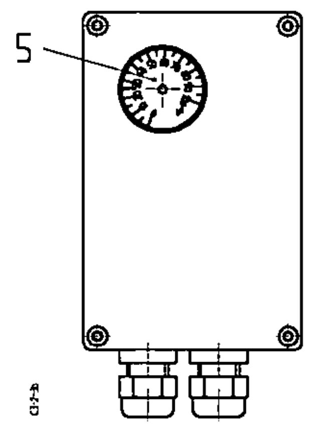
3.2 Stroke Length Adjustment

3.2.3 Electrical Adjustment at Standstill and in Operation for Gear Models G1, G2, A1 and A2



1 Actuator
2 Output Shaft
3 Spur Gear
4 Spindle
6 Protecting Cap

Fig. 3.1: Sectional View



5 Stroke Length Indicator

Fig. 3.2: Plan View of the Actuator

Construction and Function

For the construction and function of the stroke length adjustment see Fig. 3.1 - 3.3.

A rotation of the actuator's (1) output shaft (2) displaces the rear dead centre of the push rod in relation to the front dead centre via a spur gear (3) and a spindle (4). As a result, the stroke length is changed.

The stroke length in % is indicated on the stroke length indicator (5) (see Fig. 3.2).

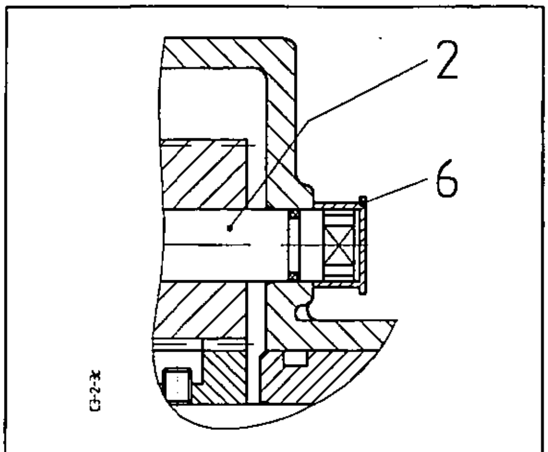
In the actuator a potentiometer measures the angle position of the output shaft and supplies a feedback signal. This can be used for a remote signal or in closed loop controls. For execution see specification sheet (Section 1.1, line 40).

The wiring diagram can be found in the housing.

Manual Emergency Adjustment (Fig. 3.3)

If malfunction of the servo motor occurs, the stroke length can be adjusted using a spanner (10mm AF).

- Cut off power supply of the actuator.
- Remove the protecting cap (6) (see Fig. 3.3).
- To adjust turn output shaft (2) using spanner (10mm AF). 8 or 15 turns at the shaft corresponds to 100% of stroke adjustment, visible on the stroke length indicator (5).



2 Output Shaft *6 Protecting Cap*

Fig. 3.3: Manual Emergency Adjustment

Integrated Position Controller

In addition, the electrical stroke length adjustment can be equipped with an automatic position controller.

Lubrication

The spur gear (3) is prelubricated with grease GP1 (in accordance with DIN51502).
Filling quantity: approx. 100 cm³

For further information see section 10, Accessories.

3.3. Pump Head

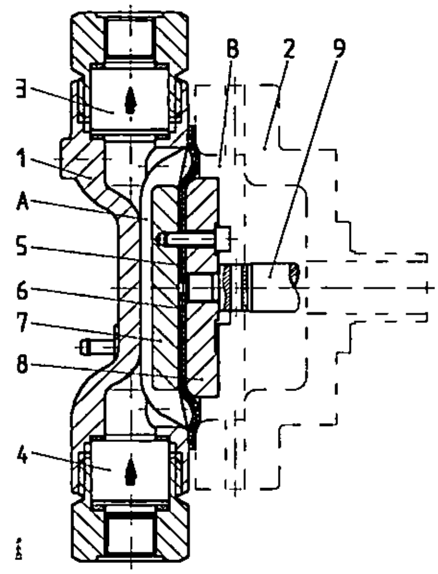
3.3.1 Diaphragm Model

Construction and Function

The double diaphragm (5, 6) clamped at the circumference between cover (1) and yoke (2) and in the centre between medium side disc (7) and atmospheric side disc (8), separates hermetically the product chamber (A) from the atmosphere (B). The eccentric drives via the push rod (9) the double diaphragm (5, 6) and transmits its movement to the liquid in the product chamber (A).

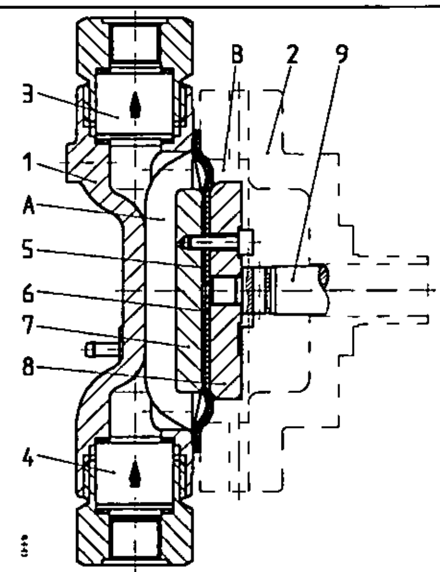
The suction (4) and discharge valves (3) are selfacting valves. They are operated by pressure differences of the product chamber (A) and the discharge and suction pressures.

- **Suction stroke:** Movement from front (Fig. 3.1) to rear dead centre (Fig. 3.2).
  During the suction stroke the difference between the suction pressure and the pressure in the product chamber (A) causes the suction valve (4) to open so that the product chamber (A) is filled with product.
- **Discharge stroke:** Movement form rear (Fig. 3.2) to front dead centre (Fig. 3.1).
  During the discharge stroke the pressure in the product chamber (A) increases until it exceeds the discharge line pressure and the opening pressure of the discharge valve (3). Then the flow medium is discharged from the product chamber (A) into the discharge line.



1 Cover | *4 Suction Valve*
2 Yoke | *5 Diaphragm*
3 Discharge Valve | *6 Diaphragm*

Fig. 3.1: Diaphragm at Front Dead Centre



7 Disc, Medium Side | *A Product Chamber*
8 Disc, Atmospheric Side | *B Atmosphere*
9 Push Rod

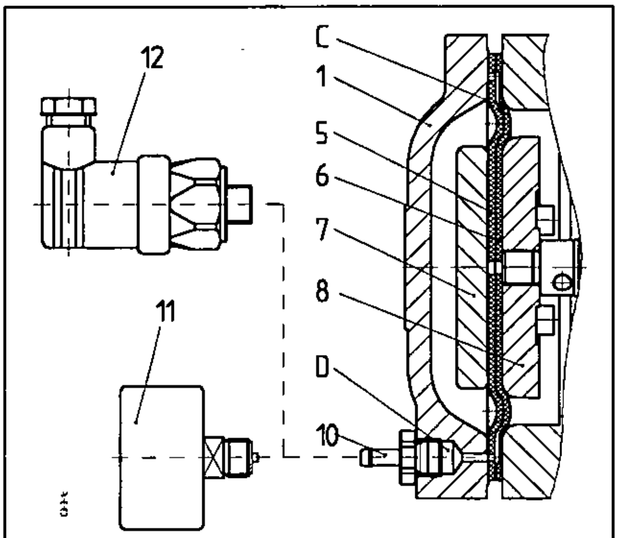
Fig. 3.2: Diaphragm at Rear Dead Centre

3.3.1.1 Double Diaphragm Assembly and Diaphragm Rupture Monitoring Device

The double diaphragm arrangement (Fig. 3.3) consists of two diaphragms (5, 6) clamped corrugation in corrugation between medium (7) and atmospheric side (8) discs.

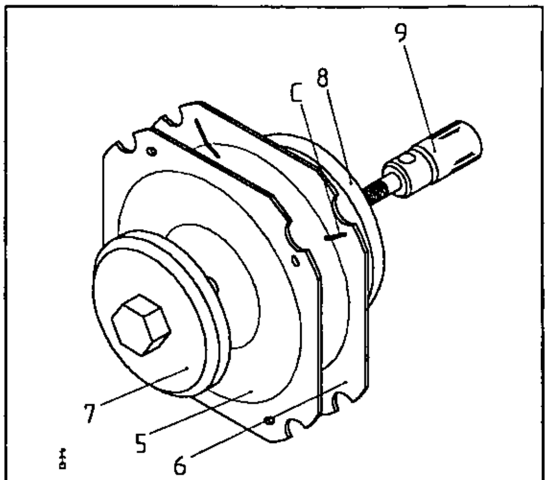
Within the mounted pump head (Fig. 3.3), a connection exists from the inner contact area between the two diaphragms through the groove (C) in the atmospheric side diaphragm (6), a bore in the medium side diaphragm (5) and the bore (D) in the cover (1) to the hose nipple (10), the pressure gauge (11) or the pressure switch (12).

Damage of the medium side diaphragm (5) results in an increase of pressure between the diaphragms, thus causes liquid escape via the hose nipple (10) into a hose or indicates pressure increase at the pressure gauge (11) or pressure switch (12). The signal of the pressure switch (12) can be used either to stop the metering pump or to have an audible signal.



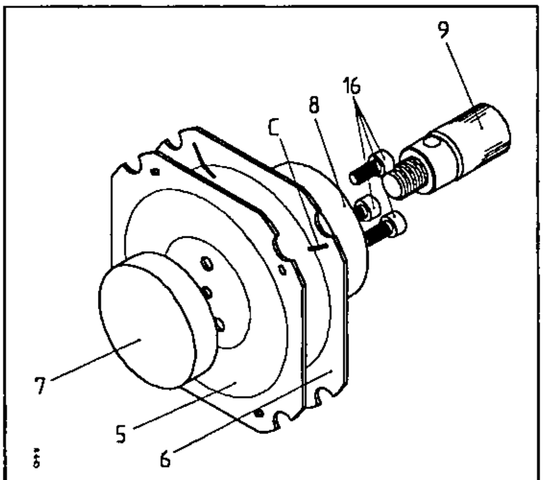
1 Cover	*10 Hose Nipple*
5 Diaphragm, Medium Side	*11 Pressure Gauge*
6 Diaphragm, Atmospheric Side	*12 Pressure Switch*
7 Disc, Medium Side	*C Groove*
8 Disc, Atmospheric Side	*D Bore*

Fig. 3.3: Diaphragm Rupture Monitoring Device



9 Push Rod

Fig. 3.4: Double Diaphragm arrangement for Pump Head (Gear Models G1 and A1)

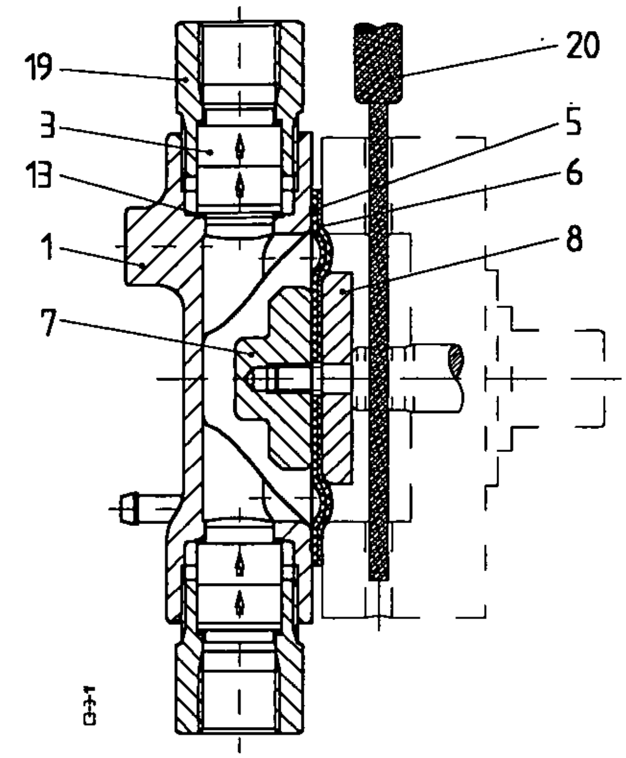


16 Screw

Fig. 3.5: Double Diaphragm arrangement for Pump Head (Gear Models G2, A2, G3, D3, G4 and D4)

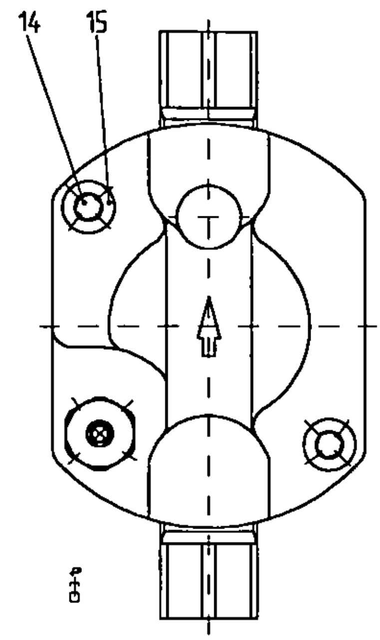
3.3.1.2 Replacement of the Diaphragm

The replacement of the diaphragm form the gear models G1 and A1 is shown in Fig. 3.6 and Fig. 3.7.
See assembly drawing PM2-01, PM2-03, PM2-08 and PM2-09 in the section 9.



1 Cover
3 Valve
5 Diaphragm
6 Diaphragm
7 Disc
8 Disc
13 Sealing
19 Pipe Connection
20 Locking pin

Fig. 3.6: Sectional View



14 Screw
15 Washer

Fig. 3.7: Plan View

Removal

Notice the safety instructions in section 2 "Metering Pump".

- Flush the pump head.
- Close the suction and discharge lines.
- Loosen the pipework.
- Extract the screws (14) uniformly and remove the cover (1).
- Set the gear to "0" mm stroke length and the rod will be in the top dead centre position.
- To prevent movement of the push rod insert a screw driver or a locking pin through the bores in the yoke and push rod (see Fig. 3.6).
- Dismantle the double diaphragm by unscrewing the disc (7).

- Remove the connected rupture monitoring device. Check and clean. Replace if damaged.

⚠ **Attention:**
In case of a diaphragm rupture the complete double diaphragm must be replaced !

⚠ **Attention:**
If both diaphragm layers are ruptured, process fluid will have entered the yoke! Please flush and clean carefully. Replace push rod, if corroded.

Assembly

- Set the gear to "0" mm stroke length.
- To prevent movement of the push rod insert a screwdriver or a locking pin through the locating bores in the yoke and push rod!
- Clean and make all concentric grooves in the cover (1) and disc (7) free of liquid!
- Relocate disc (8), double diaphragm (6, 5) and locking disc (7) consecutively. Locate the double diaphragm by inserting the screws (14).
- Tighten disc (7) to the required torque (see assembly drawing).
- Remove screws (14).
- Fit the front cover (1), relocate screws (14) and tighten to the required torque (see assembly drawing).
- Fit the diaphragm rupture monitoring device.

⚠ **Warning:**
If the pump yoke (2) is dismounted, the push rod (9) must be fixed to the yoke (2) by inserting a suitable tool (20) (screw driver or locking pin) through the locating bores in the yoke and the push rod (9). Otherwise the loaded spring inside the gear may cause personal injury.

3.4 Valves

3.4.1 Ball Model

Assignment: Pump head (Fig. 3.3).

For the valve used in the pump head see parts list and drawing in section 9.

Function

Suction and discharge valves are selfacting valves. They are operated by pressure differences between the product chamber and the suction and discharge lines respectively.

Mounting

Pay attention to the direction arrows on the valves when installing. (See Fig. 3.1 to 3.3):

- **Suction valve:** arrow points to the product chamber
- **Discharge valve:** arrow points away from the product chamber

Warning:
Incorrect installation of the valves will lead to diaphragm rupture or pump head failure, which may result in injury !

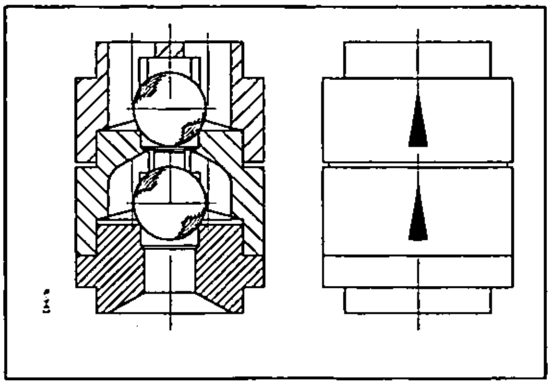


Fig. 3.1: Double Ball Valve - Sectional and Plan View

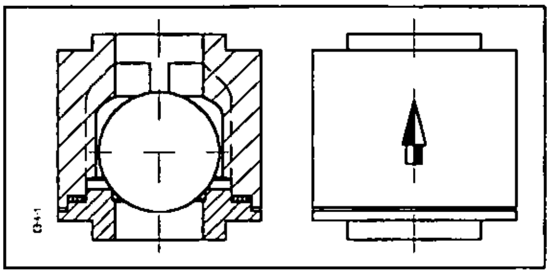


Fig. 3.2: Single Ball Valve - Sectional and Plan View

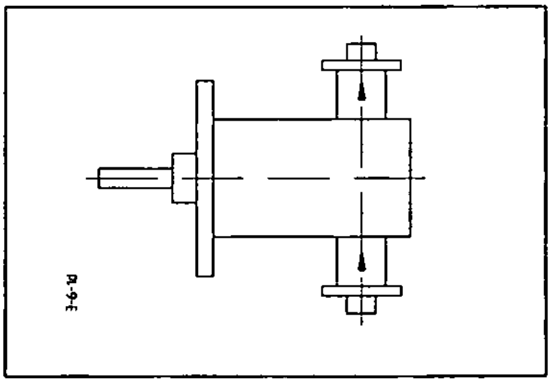


Fig. 3.3: Pump Head

BRAN+LUEBBE

4

Installation

4.1 Installation and Erection

Prior to Installation

- Check the packing of the metering pump for damage. Open the package.
- Check metering pump and accessories for external damage.

  Inform Bran+Luebbe immediately if anything is damaged!

Installation Location

If no other installation conditions are stated in the specification sheet (section 1.1), the location for installation should be dry and free of aggressive substances in the atmosphere.

The ambient temparature should range form +10°C to +40°C.

Foundation and Installation

- Choose the height of the foundation so as to facilitate easy maintenance and handling. Stroke length adjustment, stroke length indicator, oil refill, oil drain, and plunger packing should be easily accessible.
- Mount the pump *free of any strain* on its base or foundation.
- Fit pump by tightening screws in the fastening holes (see specification sheet).
- Level the push rod axis horizontally and the valve axis vertically.

Electrical connection

⚠ **Danger:**
The motor should be connected in accordance with local regulations and only by qualified personnel.
Provide overload protection or temperature sensors.

Check voltage, frequency, motor power, speed and direction of rotation (see section 5.3)

⚠ **Danger:**
Electrical elements should be connected in accordance with local regulations and by qualified personnel.
In hazardous areas special regulations must be adhered to.

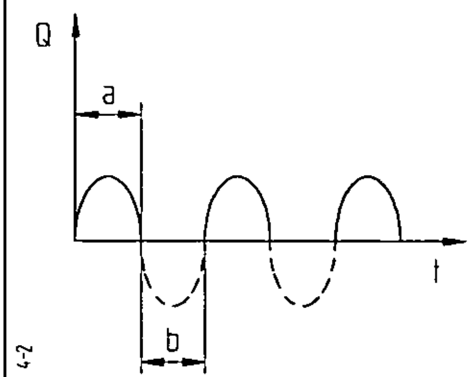
Pipework

- The piping should be free of stress and strain.
- Eliminate the pipe weight using clamps.
- Compensate for pipe expansion using fitting pipe bends.
- Connect the pipe work so as to facilitate removal of the valves and pump heads.
- Clean the pipework thoroughly prior to assembly.

4.2 Suction and Discharge Lines

Warning:
The suction and discharge lines must be properly designed and connected to the pumphead. Otherwise the pump can be seriously damaged!

The suction and discharge lines should be designed so as to prevent cavitation, excess load or excess feeding, caused by the pulsating flow of the metering pump.



Q Delivered Volume *a Discharge Stroke*
t Time *b Suction Stroke*

Fig. 4.1: Delivered Volume of a Single Pumphead

<table>
<tr><th>Prevent</th><th>Cause</th><th>Result</th><th>Remedy</th></tr>
<tr><td>Cavitation</td><td>• suction pressure falling below the vapour pressure of the product</td><td>• loud noise
• excessive valve wear
• excess load</td><td rowspan="3">• avoid high suction lifts
• keep the pipe length short
• sufficient nominal diameters
• use of pulsation dampers
• use of a pressure sustaining valve
• decrease viscosity</td></tr>
<tr><td>Excessive Load</td><td>• pressure peaks exceeding the operating pressure</td><td>• fatigue failure
• forced rupture</td></tr>
<tr><td>Excessive Discharge</td><td>• suction or discharge line too long
• suction pressure is higher than discharge pressure
• pressure sustaining valve missing</td><td>• inaccurate metering
• loud noise
• excessive valve wear</td></tr>
</table>

If required BRAN+LUEBBE will check pipework conditions. For this, the following information must be given:

Product characteristics:

- Density
- Vapour pressure at operating pressure
- Viscosity
- Settling speed, if product is a suspension

Data of installation:

- Geodetic height
- Pressures on the suction and discharge side
- Length of the pipework
- Nominal diameter
- Number of pipe bends
- Fittings
- Isometrics

4.3 Installation - Examples

4.3.1 Suction and Discharge Piping

The recommended accessories for the installation on the suction and discharge side are listed in Fig. 4.1:

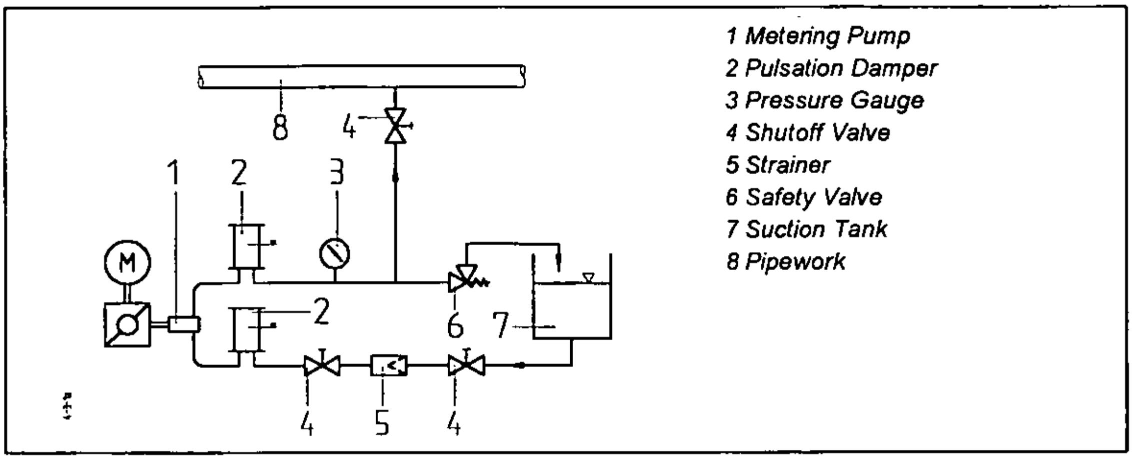


Fig. 4.1: Suction and Discharge Piping

Attention:
To avoid personal injury and damage to the pump or related equipment, we recommend to install a safety valvel

Installation of the Safety Valve (Fig. 4.2)

Aim:
Prevent overload of the pump.

Position:
Between the discharge flange and the *first* shutoff valve in the discharge line **or** behind the pulsation damper if applicable.

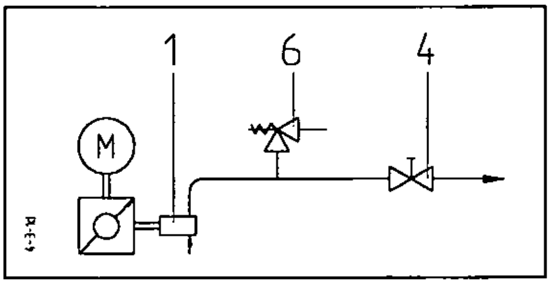


Fig. 4.2: Safety Valve

Mounting of Pulsation Dampers (Fig. 4.3)

Aim:
Metering with less pulsation;
prevent of cavitation and overload.

Position:
Just in front of the suction flange and behind the discharge flange of the pumphead.

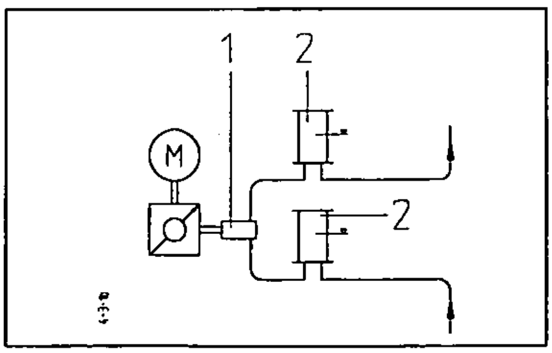
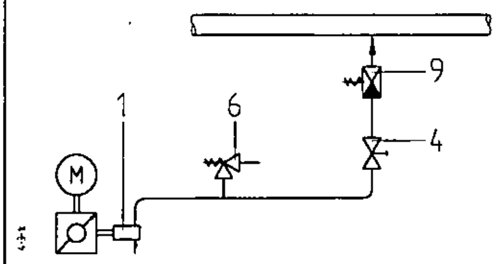


Fig. 4.3: Pulsation Damper

Installation of the Pressure Sustaining Valve (Fig. 4.4)

Aim:
Prevent of excessive discharge and excessive mass acceleration.

Position:
Vertically at the end of the discharge line.



1 Metering Pump
4 Shutoff Valve
6 Safety Valve
9 Pressure Sustaining Valve

Fig. 4.4: Pressure Sustaining Valve

Installation of a Foot Valve (Fig. 4.5)

Aim:
Prevent draining of a long suction line.

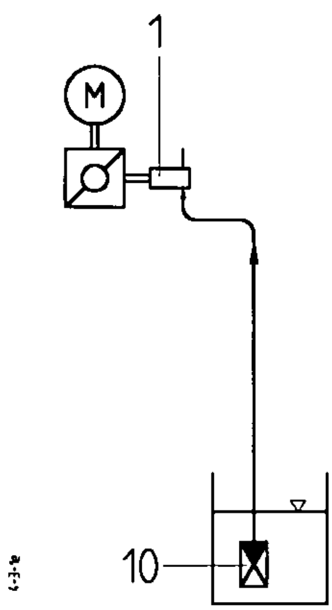
Position:
Vertically near the bottom of the reservoir.

Installation of a Surge Tank (Fig. 4.6)

Aim:
Prevent suction lift.

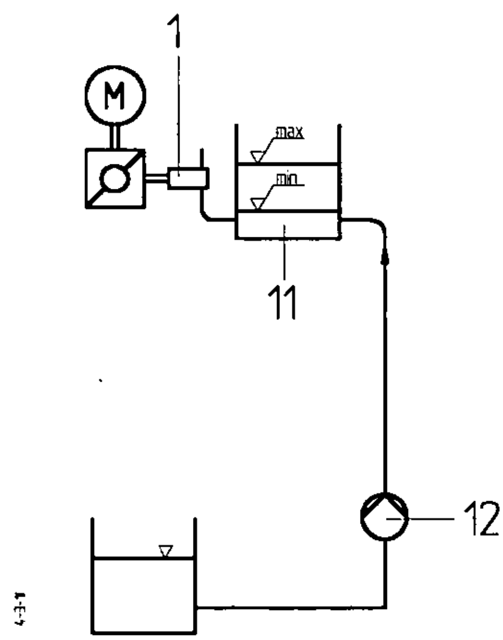
Position:
Same level as the metering pump.

Filling:
Using a feed pump (12) with max./min. control.



1 Metering Pump *10 Foot Valve*

Fig. 4.5: Foot Valve



11 Surge Tank *12 Feed Pump*

Fig. 4.6: Surge Tank

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5

Operation

5.1 Oil Filling and Oil Change

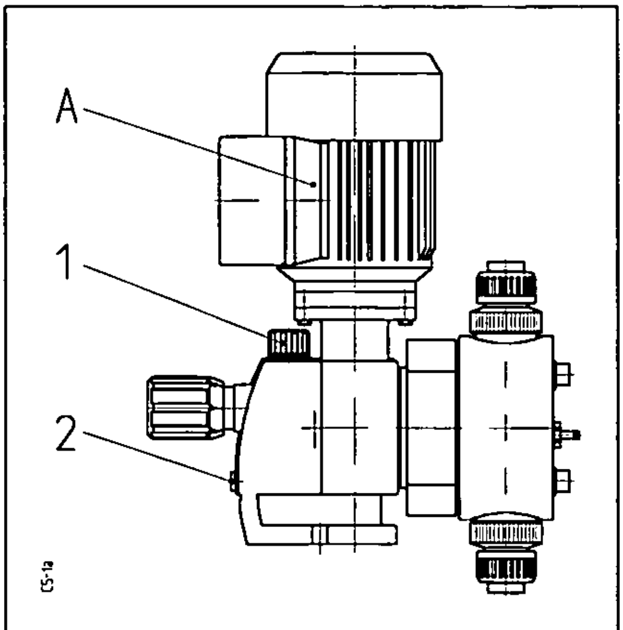
Gear Unit

Attention:
The gear units are delivered without oil.

Fill all gear units with oil before the initial start-up.

Oil quantity: see section 1.1
Oil brand: see section 5.2

For the following instructions see Fig. 5.1 and 5.2:



1 Oil Dipstick
2 Oil Drain
A Motor

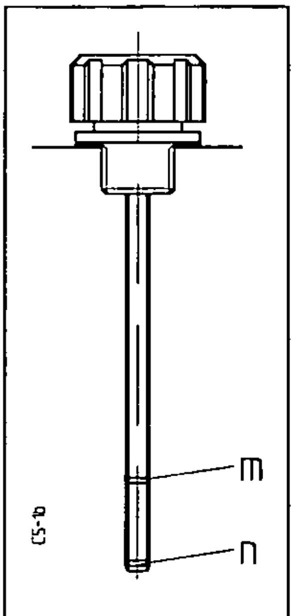
Fig. 5.1: Plan View e.g. Gear G1

First Filling

- Unscrew the oil dipstick (1).
- Fill with required amount of oil.
- Screw in the oil dipstick (1).
- Start motor (A) for a short period.

Checking the Oil Level

- Shut off the motor (A).
- Unscrew the oil dipstick (1) and wipe off the oil.
- *Screw in* the oil dipstick (1) and unscrew it again.
- The oil level should be between max. and min. (see Fig. 5.2).
- In case of an oil gauge the oil level should be visible in the middle of the gauge.



m Oil Level Max.
n Oil Level Min.

Fig. 5.2: Oil Dipstick

Oil Change

Change the oil after the first 300 hours of operation and then after every 4000 hours.

Oil Draining

Open the oil drain (2) and drain the oil.

Oil Filling

See above "First Filling".

5.2 Oil Quality for Gear Unit

At approx. 40 °C, use oils with a nominal viscosity of 80 to 150 mm²/s (c.st).

See table 5.1 below for examples of suitable oils:

Brand	**Brand Name**
ARAL	Aral Degol BG 100
BP	BP Energol GR-XP 100
ESSO	Spartan EP 100
FUCHS	Renep Compound 103
MOBIL	Mobilgear 627
SHELL	Shell Omala Oil 100
TEXACO	Meropa 100
DEA	Astron HLP 100 Falcon CLP 100
Wintershall	Ersolan 100

Table 5.1: Oil Quality for Gear Unit

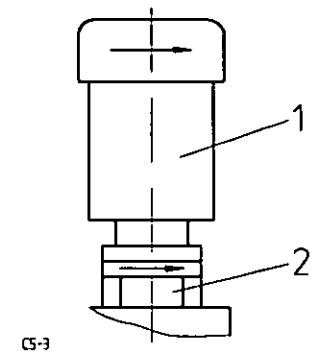
5.3 Start-up Procedure - Check List

Consider the following points before starting the metering pump:

- Check oil filling (see section 5.1).
- Readjust stroke length, if necessary, e.g. after transport (see section 3.2).
- Check if the metering pump is protected against overload. For safety valves see section 4.3.1.

Electrical connection:

- Connect drive motor (1).
- Check the direction of rotation of the drive motor (1). An arrow on the fan cover of the motor and the gear unit indicates the direction of rotation (see Fig. 5.1).



1 Motor *2 Gear Unit*

Fig. 5.1: Direction of the Motor Rotation

⚠ **Danger:**
The motor must only be connected by qualified personnel!

⚠ **Warning:**
Do not start the pump with the shutoff valves in the discharge and suction lines closed !
Do not close the shutoff valves in the discharge and suction lines when the pump is still in operation !

Start-up procedure

- Open all shutoff valves in the suction and discharge lines.
- If heating or cooling is necessary, open all shut-off valves in the supply lines.
- Make sure that there is sufficient product.
- Adjust the stroke length to "0".
- If the motor speed is variable, set motor (1) to lowest speed.
- Start drive motor.
- Slowly increase speed and stroke length to the maximum.
- If possible, operate the metering pump pressureless for good venting of the pipework.
- Check the pipework and the packing of the pump for leaks during the start-up procedure.

If the suction head is too high and the metering pump does not prime,

- increase the suction pressure or
- reduce the suction lift, see section 4.3.1.

When suction and discharge lines are filled and vented,

- slowly increase the pressure up to the operating pressure and
- adjust speed and stroke length to the required values.

5.4 Adjustment of the Capacity

The stroke length to be adjusted for a required capacity is calculated from the max. stroke length, the capacity required and the max. capacity. The max. capacity is calculated by BRAN+LUEBBE from:

- an assumed volumetric efficiency of 98 % and
- the number of strokes that result from the nominal speed of the motor.

Under normal operating conditions, it is sufficient to calculate the stroke length according to the following equation:

$$\text{stroke length (mm)} = \text{max. stroke length (mm)} \times \frac{\text{capacity required (l/h)}}{\text{max. capacity (l/h)}}$$

or

$$\text{stroke length (\%)} = 100\ \% \times \frac{\text{capacity required (l/h)}}{\text{max. capacity (l/h)}}$$

max. stroke length:	see specification sheet, section 1.1, line 37
max. capacity:	see specification sheet, section 1.1, line 21
capacity required:	given by the user of the metering pump

Example

For the example, the following values are assumed:

max. stroke length:	8 mm
max. capacity:	245 l/h
capacity required:	200 l/h

$$\text{stroke length} = 8\text{ mm} \times \frac{200}{245} = \underline{\underline{6{,}53\text{ mm}}}$$

or

$$\text{stroke length} = 100\ \% \times \frac{200}{245} = \underline{\underline{81{,}6\ \%}}$$

Under special operating conditions, however, such as

- high operating pressures and
- small diaphragm/plunger diameters,

the stroke length calculated above should be corrected since the actual capacity is dependent on operating conditions such as operating pressure, viscosity, length of suction and discharge lines, arrangement etc. Thus an exact relationship between stroke length and capacity can only be determined under operating conditions.

⇨ **In case of normal operating conditions you don't need to follow the procedure described below and can directly proceed with section 5.4.1.**

Correction of Stroke Length by Determining the Actual Capacity

To determine the actual capacity, measure

- the volume per 100 strokes and
- the actual stroke frequency.

Two ways of measuring the volume are described below:

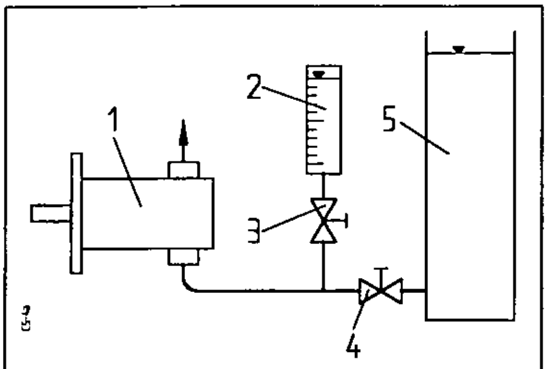
Measuring the Volume on the Suction Side (Fig. 5.1)

- Fill and vent the suction and discharge lines prior to measurement.
- Operate the pump for a short time
- Adjust the stroke length to 6,53 mm or 81,6 % as calculated in example 1.

Measurement

- Open shutoff valves (3) and (4).
- Fill up burette (2).
- Close shutoff valve (4).
- Read volume drawn from the burette (2) for 100 strokes.

  measured volume = $V_{100\ strokes}$ (cm^3)



1 Pump Head *4 Shutoff Valve*
2 Burette *5 Suction Tank*
3 Shutoff Valve

Fig. 5.1: Measuring the Volume on the Suction Side

Measuring the Volume on the Discharge Side (Fig. 5.2)

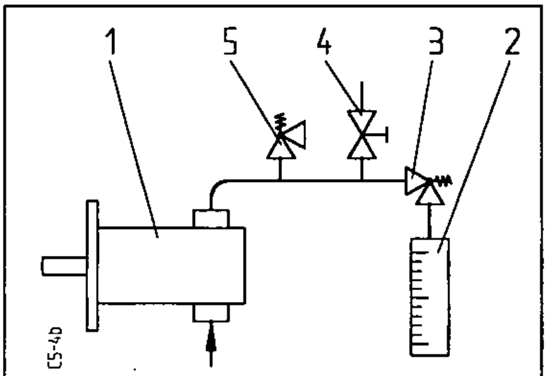
Prior to the measurement

- Fill and vent suction and discharge lines.
- Operate the pump for a short time
- Adjust the stroke length to 6,53 mm or 81,6 % as calculated in example 1.

Measurement

- Close the shutoff valve (4).
- Adjust the pressure sustaining valve (3) to the operating pressure.
- Read the quantity delivered by 100 strokes.

  measured volume = $V_{100\ strokes}$ (cm^3)



1 Pump Head *4 Shutoff Valve*
2 Burette *5 Safety Valve*
3 Pressure Sustaining Valve

Fig. 5.2: Measuring the Volume on the Discharge Side

Determining the Actual Stroke Frequency

The actual stroke frequency is needed for the calculation of the actual capacity:

- Count the actual number of strokes per minute.

Actual capacity

With the volume $V_{100\ strokes}$ (Fig. 5.1 or 5.2) and the actual stroke frequency, the actual capacity can be calculated. $V_{100\ strokes}$ is assumed to be 2150 cm^3, stroke frequency 150 strokes/min:

$$\text{actual capacity} = V_{100strokes} \times \frac{\text{actual stroke frequency} \times 60}{100 \times 1000}\ (l/h)$$

$$\text{actual capacity} = 2150 \times \frac{150 \times 60}{100 \times 1000}(l/h)$$

$$\text{actual capacity} = \underline{\underline{193{,}5\ l/h}}$$

Correction of the stroke length under operating conditions

With the actual capacity (see above) and the stroke length (see Example, page 1/4), the corrected stroke length adjustment can be calculated:

$$\text{stroke length corr.} = \text{stroke length} \times \frac{\text{required capacity}}{\text{actual capacity}}$$

$$\text{stroke length corr.} = 6{,}53\ mm \times \frac{200}{193{,}5} = \underline{\underline{6{,}75\ mm}}$$

or

$$\text{stroke length corr.} = 81{,}6\ \% \times \frac{200}{193{,}5} = \underline{\underline{84{,}3\ \%}}$$

5.4.1 Flow Rate Curve

Another way of determining the corresponding stroke length for the required capacity is to use a flow rate curve. Due to the linear pressure metering characteristics it is easy to plot the flow rate curve for your specific pump:

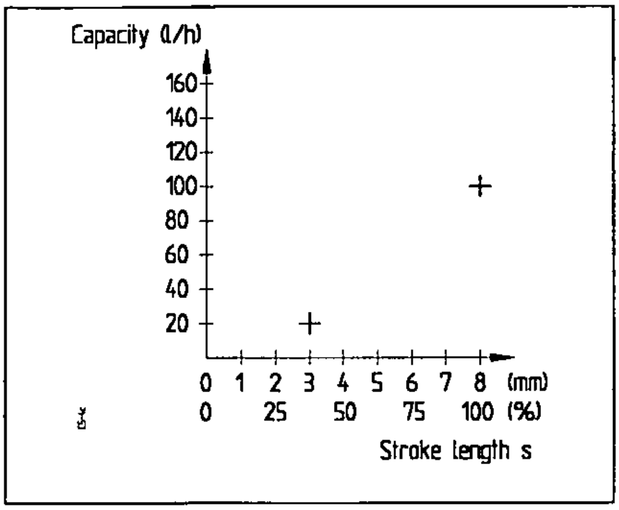
- Calculate the corr. stroke length for a required capacity, following the procedure described under 5.4. Repeat this for one further required capacity.

  The values in Table 5.1, chosen as an example, are based on a max. stroke length of 8 mm and an operating pressure of 10 bar.

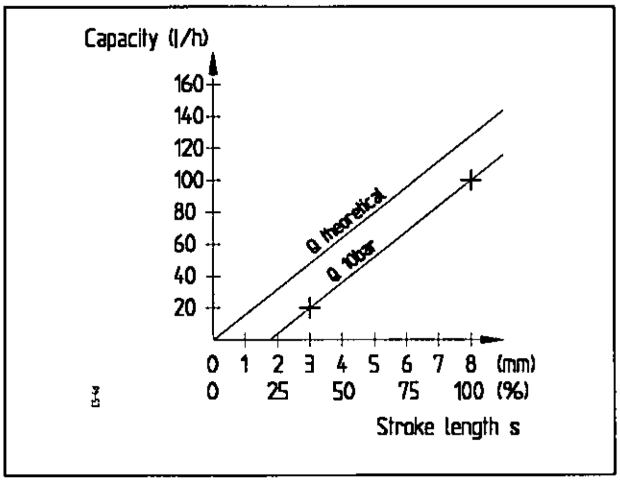
required capacity (l/h)	20	100
corr. stroke length in mm : or in % :	 3 37,5	 8 100

Table 5.1: Example

- Plot the values onto a graph showing the corrected stroke length on the x-axis against the capacity on the y-axis.



- Draw a line through the two points. The line does not meet the origin. A line meeting the origin would correspond to the optimal theoretical capacity not taking into account any operating conditions.



The flow rate curve is only valid as long as the operating conditions (e.g. operating pressure and medium used) stay the same!

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6

Maintenance

6 Maintenance

Motor

The specifications and the type of motor are stated on the specification sheet in section 1.1.

The motor is not a BRAN+LUEBBE product so the maintenance instructions of the manufacturer should be followed. These documents can be found in section 10 under "Accessories".

Gear Unit

Check the oil level weekly.

See section 5.1 for oil change.

Accessories

If any maintenance is necessary the documents can be found in section 10 under accessories.

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7

Trouble Shooting

7 Trouble Shooting

Problem	Possible Causes	Remedy
No Flow	• no voltage at the motor:	check fuses and leads
	• motor broken:	repare or replace motor
	• coupling broken:	replace the coupling and eliminate the cause of the overload
	• no product:	fill suction vessel
	• suction or discharge line shut off:	open the shut off valves
	• filter or pipe work clogged:	clean filter or pipe work
	• valves of pump head incorrectly fitted:	fit the valves correctly (note the arrows!) (see section 3.4)
	• pump valves damaged or dirty:	clean or replace pump valves
	• gas or air in the product chamber:	vent and fill product chamber
	• discharge pressure too high:	check the adjustment of the safety valve, check discharge line for length and nominal width, carry out a calculation of the pipework (see section 4.2)
	• suction lift too high:	reduce suction head and, if necessary, increase supply pressure or install a surge tank (see section 4.3.1)
	• stroke length adjustment on "0" mm:	adjust stroke length
flow rate too high	• suction pressure higher than discharge pressure:	mount pressure sustaining valve or fit stronger spring to discharge valve
	• Suction or discharge lines too long or nominal width too small:	enlarge nominal width or install pulsation damper
	• stroke length set to the wrong value:	check stroke length adjustment and, if necessary, recalculate

Problem	Possible Causes	Remedy
flow rate too small	• pump valves are dirty or damaged:	clean, replace or regrind the pump valves
	• safety valve is leaking:	clean safety valve; replace or rework damaged parts
	• safety valve in operation because of excessive pressure loss in pressure line:	enlarge nominal width or install pulsation damper
	• stuffing box is leaking:	tighten stuffing box (see section 3.3.2.1); check plunger for wear and, if necessary, replace packing
	• gas or air in the product:	increase suction pressure
	• wrong stroke length:	check and, if necessary, recalculate stroke length
	Diaphragm Pump:	
	• gas or air in product	vent product
flow rate unsteady	• impurity of the flow medium:	flush pipework; if necessary, install strainer
	• valve seat, valve ball or cone damaged:	lap or replace valve
	• varying supply pressure or viscosity:	check operating conditions

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8

Storage and Preservation

8 Storage and Preservation

For the test run in the BRAN+LUEBBE Company the metering pump is filled with oil that includes preservatives.

Before delivery the oil is drained. The inner parts of the gear unit remain covered with a protective oil film.

Warning:
During transport and later during storage the pump must be protected against moisture, salt-water, rain, sand storms, and direct sunlight.

1. Storage in dry and ventilated places

In dry and ventilated places the pump can be stored for up to 2 years without making any special arrangements.

2. Storage in places with high humidity

The metering pump must be hermetically sealed and protected against perspiration using an adequate quantity of silicate gel. Then storage of 2 years is possible.

3. Storage outdoors

In addition to point 2 there should be a protection against rain, sand storms and direct sunlight.

4. Preservation of installed metering pumps

Before start-up, the metering pump should be filled with oil of the recommended quality and the specified quantity.

If the start of operation is delayed the metering pump must be switched on for approx. 1 hour every month with a stroke length of "0" mm.

The oil must be changed at least once every year.

Change the oil again prior to the definite start of operation. Then keep to the stated oil changes.

BRAN+LUEBBE Metering pump specification sheet **1.1**

19.04.96 8:33:05

	1	Metering pump type:	DS50/100 C/W ESP	Order no.:	962049/17/G/01
	2	Dimension sheet no.:	ANNR-0574	Building no.:	
	3	Job-No.:	51910829	Application:	
	4	Serial no.:	0009123101		
	5	Quantity:	001	Sheet no.: 001 of: 001	

Process data

	7	Liquid handled		Unknown	
	8	Concentration	%	-	
	9	Solid % / Size	mm	-	
	10	Density at PT	g/cm^3	1	*
	11	Viscosity at PT	m Pa s	1	*
	12	Process temperature = PT	°C	20-80	
	13	Ambient temperature	°C	20-40	
	14	Press discharge port Pabs min/max	bar	2	11
	15	Press suction port Pabs min/max	bar	1	1.2

Design

Pumphead	17	Item on dimension sheet		001	
Pumphead	18	Design (plunger, diaphragm)		Diaphragm	
Pumphead	19	Special design		-	
Pumphead	20	Plunger diameter	mm	-	
Pumphead	21	Max. capacity	l/h	35	
Pumphead	22	Stroke frequency	1/min	100	
Pumphead	23	Operat.press./set press.of relief valve	bar	10	
Pumphead	24	Valve design suction/discharge side		Ball/Ball	
Pumphead	25	Suction valve spring pressure	bar	-	
Pumphead	26	Discharge valve spring pressure	bar	-	
Pumphead	27	Plunger packing design		-	
Pumphead	28	Lantern ring connection	DN	-	
Pumphead	29	Suction connection	DN/PN	G 3/8"	
Pumphead	30		Standard	ISO 228	
Pumphead	31	Discharge connection	DN/PN	G 3/8"	
Pumphead	32		Standard	ISO 228	
Pumphead	33	Heating jacket	DN	-	
Pumphead	34	Hydraulic fluid		-	
Pumphead	35	Air bleed valve		-	
Gear	36	Model		CG-G1-01-03-28/1	
Gear	37	Max. stroke length	mm	3	
Gear	38	Crank phase angle	°	0	
Gear	39	Stroke length adjustment 1)		SBE	
Gear	40	Stroke length feedback		-	
Gear	41	Oil quantity	l	0,5	

Pumphead

Materials	43	Housing	1.4581	
Materials	44	Plunger/diaphragm		PTFE
Materials	45	Valve housing	1.4581	
Materials	46	Valve seat	1.4571	
Materials	47	Valve-ball/-cone/-plate	1.4401	
Materials	48	Valve gasket	1.4571	
Materials	49	Plunger packing	-	
Materials	50			

Motor	51	Motor brand Brook	Current 3 phase AC	Voltage 400 V	Power 0,18 kW
Motor		Type 63 M 2 A	Frequency 50 c/s	Speed 2800 1/min	Variable speed
Motor			Pole-changing	Enclosure IP 55	Ex-Proof
Motor	52	Speed variat	Brand	Adjustment	Feedback:
Motor			Type	Range 1:	Max.Speed: 1/min

53	Mountings:	Electric Stroke Positioner
54	Accessories:	
55	Remarks:	K.A.M.25.03.96
56	Painting:	Specification No1 — Colour: Red Nr 246

1)	SH: manual at standstill	SBH: manual at standstill and operation	SBE: electric.at standstill and operation	SBP: pneum. at standstill and operation

* Details were unknown when ordered. The specified data must be kept stated limits.

19.04.96 **U**

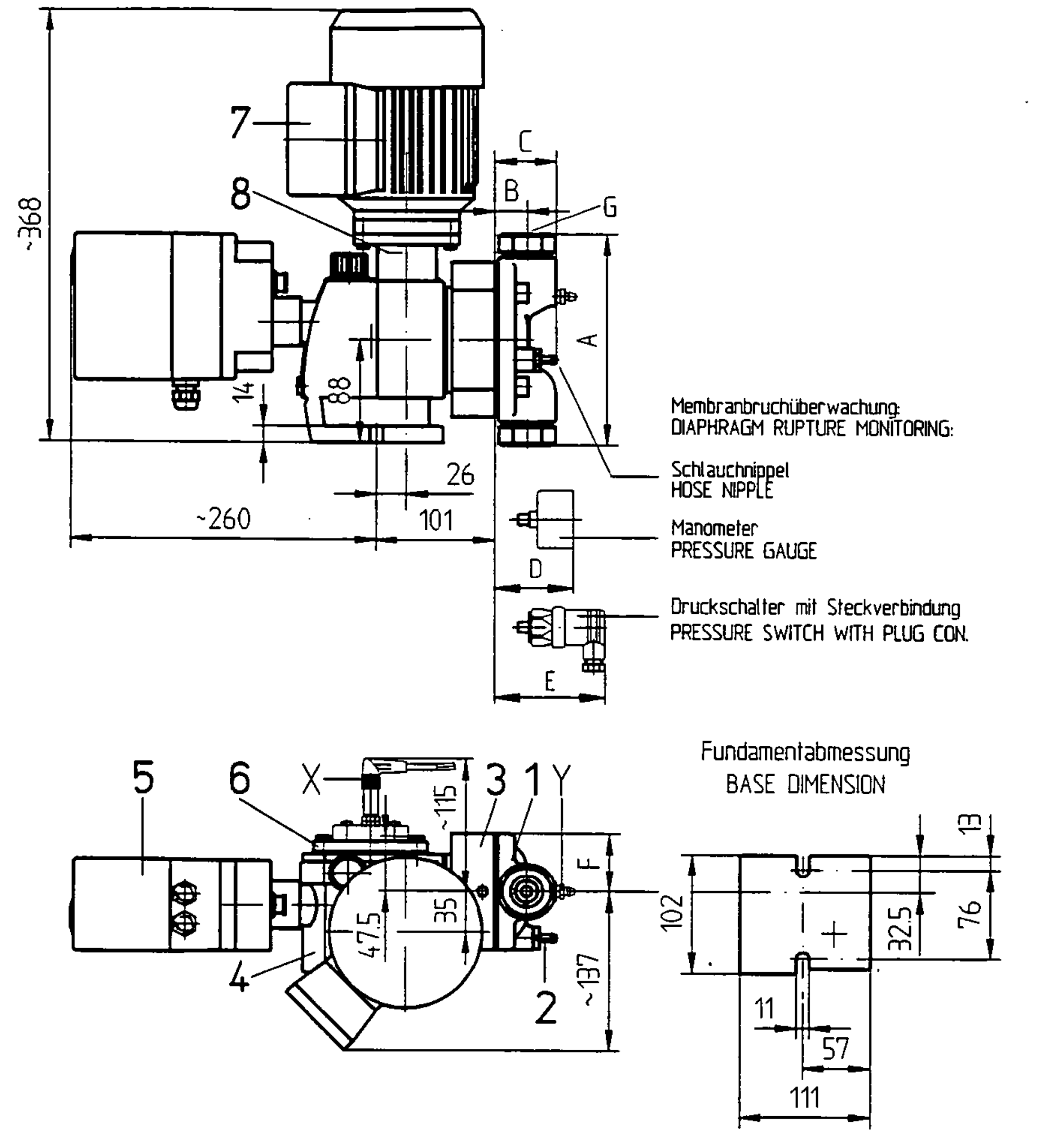
Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
001	1,000	METERING PUMP DS50/100C/W ESP	ANNR-0574			E/CE	1
003	1,000	ACCESSORIES					1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m^2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	***AUFTRAG 10 PROCAM DS50/100+ESP			1,000	9123101 -	1



Pumpenkopf PUMPHEAD	A	B	C	D	E	F	G	Gewicht WEIGHT
D 50S	148	17,5	42	60,5	87,5	39,5	Innengewinde G3/8 3/8" FEMALE	~17,2 kg
D100S	180	27	51,5	70	97	50	Innengewinde G1/2 1/2" FEMALE	~17,8 kg

Option/OPTION		
	X	Impulsgeber / PULSE GENERATOR
	Y	Entlüftungsventil / VENT VALVE

Ölmenge/OIL QUANTITY : 0,45 l

DESIGNED	D. Petersen	13. 07. 94
DRAWN	W. Naundorf	13. 07. 94
CHANGED	W. Naundorf	21. 09. 94
APPROVED	D. Petersen	22. 09. 94
RELEASED	D. Petersen	23. 09. 94

BRAN+LUEBBE

TITEL 1 DOSIERPUMPE/METERING PUMP

TITEL 2 N-G1 41

- CAD-DRAWING -

MATERIAL	IDENT-NO.	REV. 1

FORMAT	SCALE	SHEET	DRAWING NO
A4	1: 5	1/1	ANNR-0574

19.04.96 **U**

Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
100	1,000	PLATE, LABEL PROCAM	SCHI-856/4	AL	155207		1
101	1,000	PROCAM			078016SV	DS50/100 C/W ESP	1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	METERING PUMP DS50/100C/W ESP E/CE	ANNR-0574		1,000	9123101 -	1

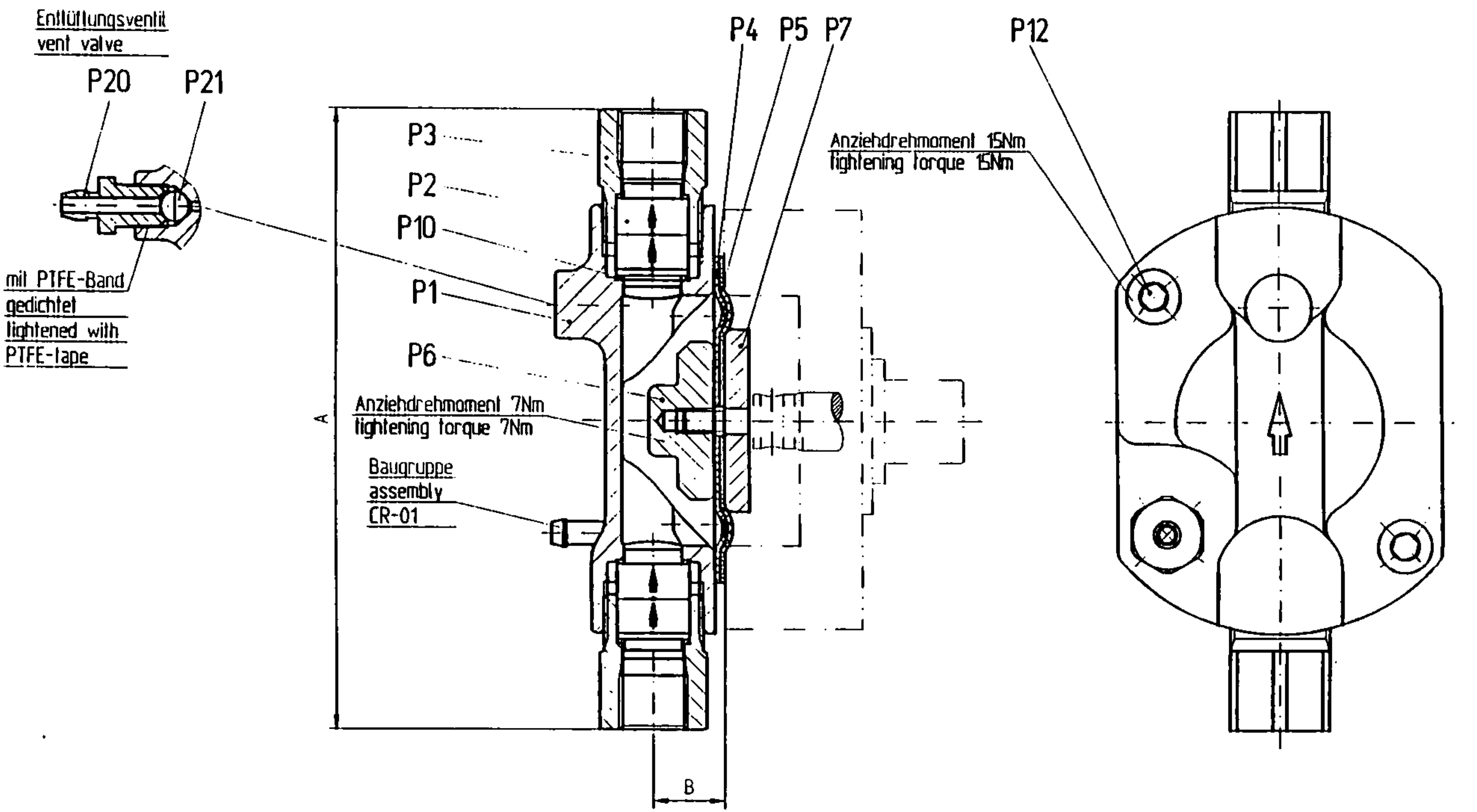
Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
001	1,000	PUMP HEAD	PM 2-01		440025S	CP-D50S-01	1
002	1,000	NIPPLE	CR-01		440022S	CR-01-A	1
003	1,000	PUMP YOKE, SPACER F.D50	CG-G1-01/4		440019S	CZ-02	1
004	1,000	GEAR BOX	CG-G1-01/4		440045S	CG-G1-01-03-28/1	1
005	1,000	ADJUSTER M.REGLER 230V	CA-4-01/2		440159S	CA-41-01-03-2	1
006	1,000	COVER	CG-G1-01/4		440015S	CX-G1-00-01	1
007	1,000	MOTOR 0,18 400V 2800 IP55	UD63SFC-2		453430	AUSF.EUROPEAN-STANDA	1
008	1,000	DRIVING UNIT F.BAUGR.63	CG-G1-01/4		440017S	CM-01	1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	PROCAM DS50/100 C/W ESP		078016SV	1,000	9123101 -	1



Pumpenkopf pumphead	A	B
50l/h	148	17.5
100l/h	180	27

DESIGNED	R. Bräuer	03. 09. 93
BRAN+LUEBBE		
DRAWN	K. Sturm	18. 08. 93
CHANGED		. .
APPROVED	R. Braeuer	03. 09. 93
RELEASED	R. Braeuer	08. 04. 94

TITEL 1 MEMBRANPUKO 50/100L/H
TITEL 2 DIAPHRAGM PUMPHEAD
- CAD-DRAWING -

MATERIAL	IDENT-NO	REV 0

FORMAT	SCALE	SHEET	DRAWING NO
A3	X: X	1/1	PM2-01

19.04.96 **U**

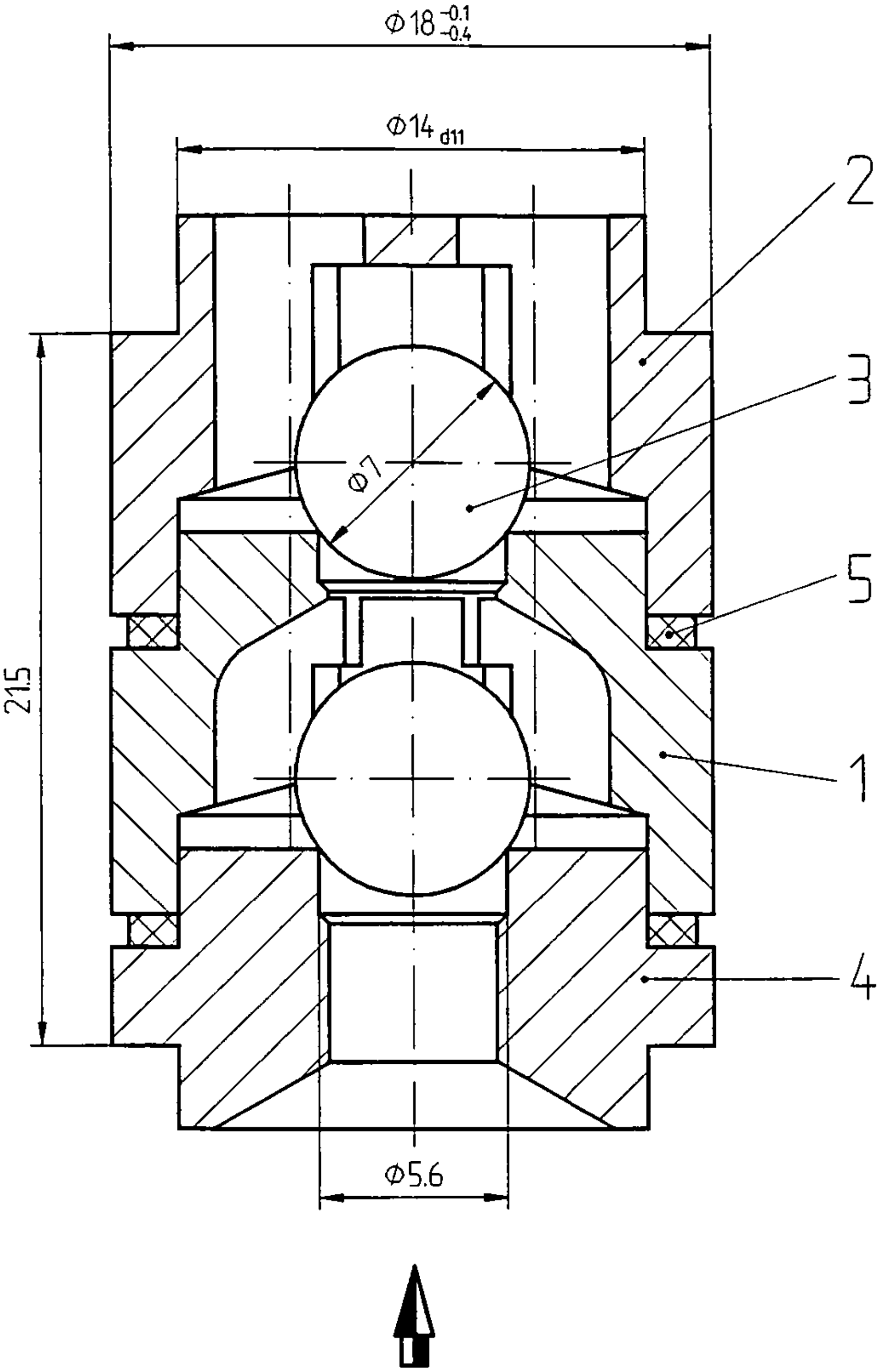
Remarks

ame KM	Date 25.03.96	Customer-No. 2000165		Order-No. 519108291000		

os.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
P1	1,000	COVER	PM 2-1/3	1.4581	320002		1
P2	2,000	VALVE	PV 18-06/1	1.4581	540039		1
P3	2,000	GLAND, SCREW CONNECTION	NI-1572	1.4571	320078		1
P4	1,000	DIAPHRAGM	PM 2-11/2	PTFE	320024		1
P5	1,000	DIAPHRAGM	PM 2-12/2	PTFE	320025		1
P6	1,000	PLATE	PM 2-19/2	1.4581	320003		1
P7	1,000	PLATE	PM 2-20	1.4571	320004		1
10	4,000	GASKET 14 X 17 X 1		1.4571	150109		1
12	2,000	SCREW, BOLT M 8 X 25	DIN 912	A 4-70	100133		1
		<<<<>>>>					

or ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m2

roducer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
ran+Luebbe GmbH	PUMP HEAD CP-D50S-01	PM 2-01	440025S	1,000	9123101 -	1



Φ14	d11	-0.050 / -0.160

DESIGNED	Bergmann	09. 09. 92

BRAN + LUEBBE

DRAWN	T. Stingemore	05. 04. 94
CHANGED	T. Stingemore	05. 04. 94
APPROVED	R. Wuestefeld	02. 05. 94
RELEASED	R. Wüstefeld	03. 05. 94

TITEL 1 KUGELVENTIL 2-FACH

TITEL 2 DOUBLE BALL VALVE

- CAD-DRAWING -

MATERIAL	IDENT-NO.	REV. 1

FORMAT	SCALE	SHEET	DRAWING NO
A4	5: 1	1/1	PV18-06

19.04.96 **U**

Remarks

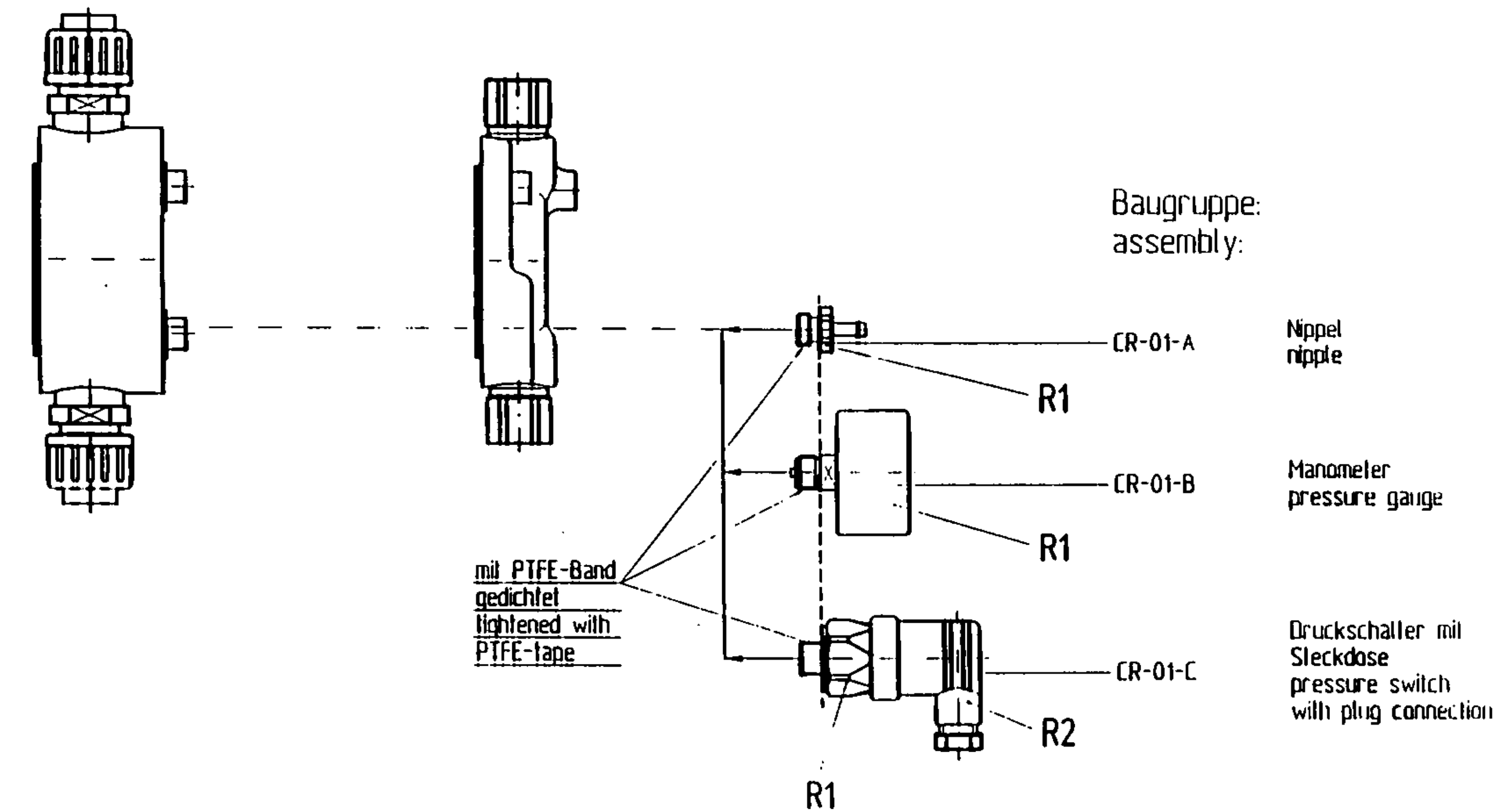
Name	Date	Customer-No.	Order-No.
KM	25.03.96	2000165	519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
001	1,000	HOUSING	PV 18-20/2	1.4581	341495		1
002	1,000	HOUSING	PV 18-21/2	1.4581	341496		1
003	2,000	BALL 7	DIN 5401	1.4401	120501		1
004	1,000	VALVE SEAT	PV 18-22/1	1.4571	341497		1
005	2,000	GASKET, SEALING		1.4571	150109		1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	VALVE	PV 18-06/1	540039S	2,000	9123101 -	1

Pumpenkopf:
pump head:



DESIGNED	R. Brauer	11. 12. 93		
BRAN+LUEBBE			TITEL 1 MEMBRANBRUCHÜBERWACHUNG	
			TITEL 2 DIAPHRAGM RUPTURE MONITO.	CAD-DRAWING -
DRAWN	K. Sturm	08. 12. 93	MATERIAL	IDENT-NO
CHANGED				REV 0
APPROVED	R. Braeuer	11. 12. 93	FORMAT A3	SCALE 1: 2
RELEASED	R. Braeuer	08. 04. 94	SHEET 1/1	DRAWING NO CR-01

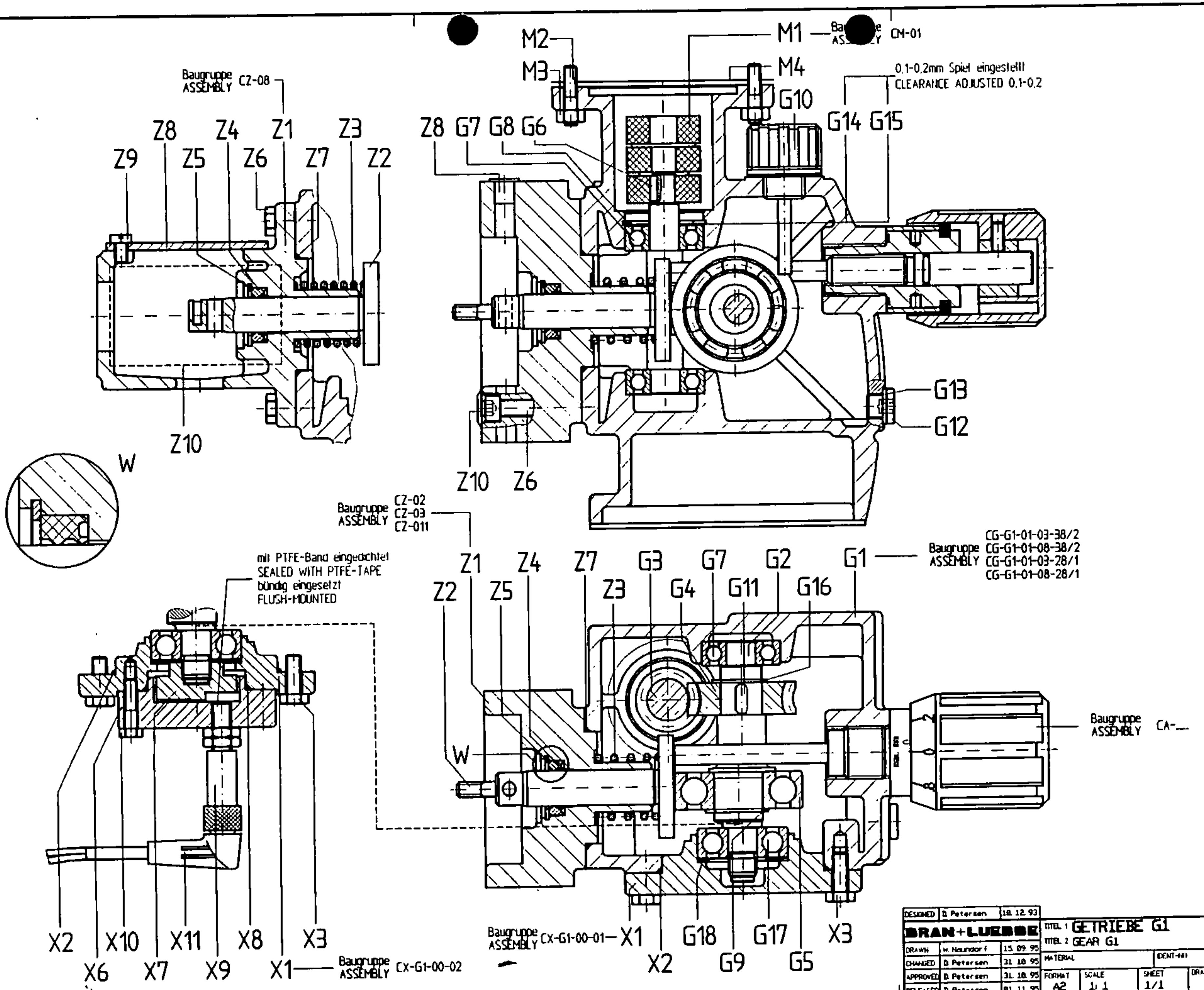
Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
R1	1,000	NIPPLE <<<<>>>>	PM 2-31	1.4571	320036		1

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m^2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	NIPPLE CR-01-A	CR-01	440022S	1,000	9123101 -	1



DESIGNED	D. Petersen	18. 12. 93		
BRAN+LUEBBE			TITEL 1 GETRIEBE G1 / TITEL 2 GEAR G1	- CAD-DRAWING -
DRAWN	W. Naundorf	15. 09. 95	MATERIAL	IDENT-NR / REV. 4
CHANGED	D. Petersen	31. 10. 95		
APPROVED	D. Petersen	31. 10. 95	FORMAT A2 / SCALE 1:1 / SHEET 1/1	DRAWING NO CG-G1-01
RELEASED	D. Petersen	01. 11. 95		

19.04.96 **U**

Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
Z1	1,000	PUMP YOKE, SPACER D50	CV-7/3	GGG 40	202040		1
Z2	1,000	TAPPET	CV-22/2	1.4034	303381		1
Z3	1,000	SPRING	CV-27/1	VD	190225		1
Z4	1,000	GROOVED RING, SLOTRING 14 X 22		AU	369608	TYP: U32I	1
Z5	1,000	RETAINING RING, CIRCLIP 24 X 1	DIN 472	ST	101758		1
Z6	2,000	SCREW, BOLT M 6 X 40	DIN 912	8.8	180045	4.000.2300.01	1
Z7	1,000	O-RING 45 X 2		NBR	152175		1
Z8	1,000	CAP		PE	170209		1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	PUMP YOKE, SPACER F.D50 CZ-02	CG-G1-01/4	440019S	1,000	9123101 -	1

19.04.96 **U**

Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
G1	1,000	HOUSING	CV-3/3	GG 20	229702		1
G2	1,000	SHAFT	CV-48/1	C 45	251032		1
G3	1,000	WORM SHAFT 28/1	CV-85	C 45	224057		1
G4	1,000	WORM WHEEL 28/1	CV-86	2.1060	223021		1
G5	1,000	BEARING 6304	DIN 625		120008		1
G6	1,000	PARALLEL KEY A 3 X 3 X 10	DIN 6885	ST 50-1K	100708		1
G7	3,000	BEARING 6201	DIN 625		120040		1
G8	1,000	RETAINING RING, CIRCLIP 32 X 1	DIN 472	FEDERST	101614		1
G9	1,000	RETAINING RING, CIRCLIP 20 X 1	DIN 471	FEDERST	101604		1
G10	1,000	SCREW, BOLT	CV-74	PA	155075		1
G11	1,000	PARALLEL KEY A 5 X 5 X 12	DIN 6885	ST 50-1K	100709		1
G12	1,000	SCREW, BOLT G 1/8"	DIN 908	A 4	100097		1
G13	1,000	SEAL RING C 10 X 14	DIN 7603	FD 12	150227		1
G14	2,000	WASHER, DISC 22X 32 X0,1	DIN 988	ST	101518		1
G15	1,000	WASHER, DISC 22X 32 X0,3	DIN 988	ST	101529		1
G16	1,000	RETAINING RING, CIRCLIP 17 X 1	DIN 471	FEDERST	101704		1
G17	1,000	BEARING 6301	DIN 625		120070		1
G18	1,000	WASHER, DISC EPL 30		FEDERST	101647	F.KUG.LG.	1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m^2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	GEAR BOX CG-G1-01-03-28/1	CG-G1-01/4	440045S	1,000	9123101 -	1

19.04.96 **U**

Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
X1	1,000	COVER	CV-8	GG 20	229705		1
X2	1,000	O-RING 66 X 2		NBR	152178		1
X3	2,000	SCREW, BOLT M 6 X 16	DIN 933	8.8	100230		1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m^2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	COVER CX-G1-00-01	CG-G1-01/4	440015S	1,000	9123101 -	1

19.04.96 **U**

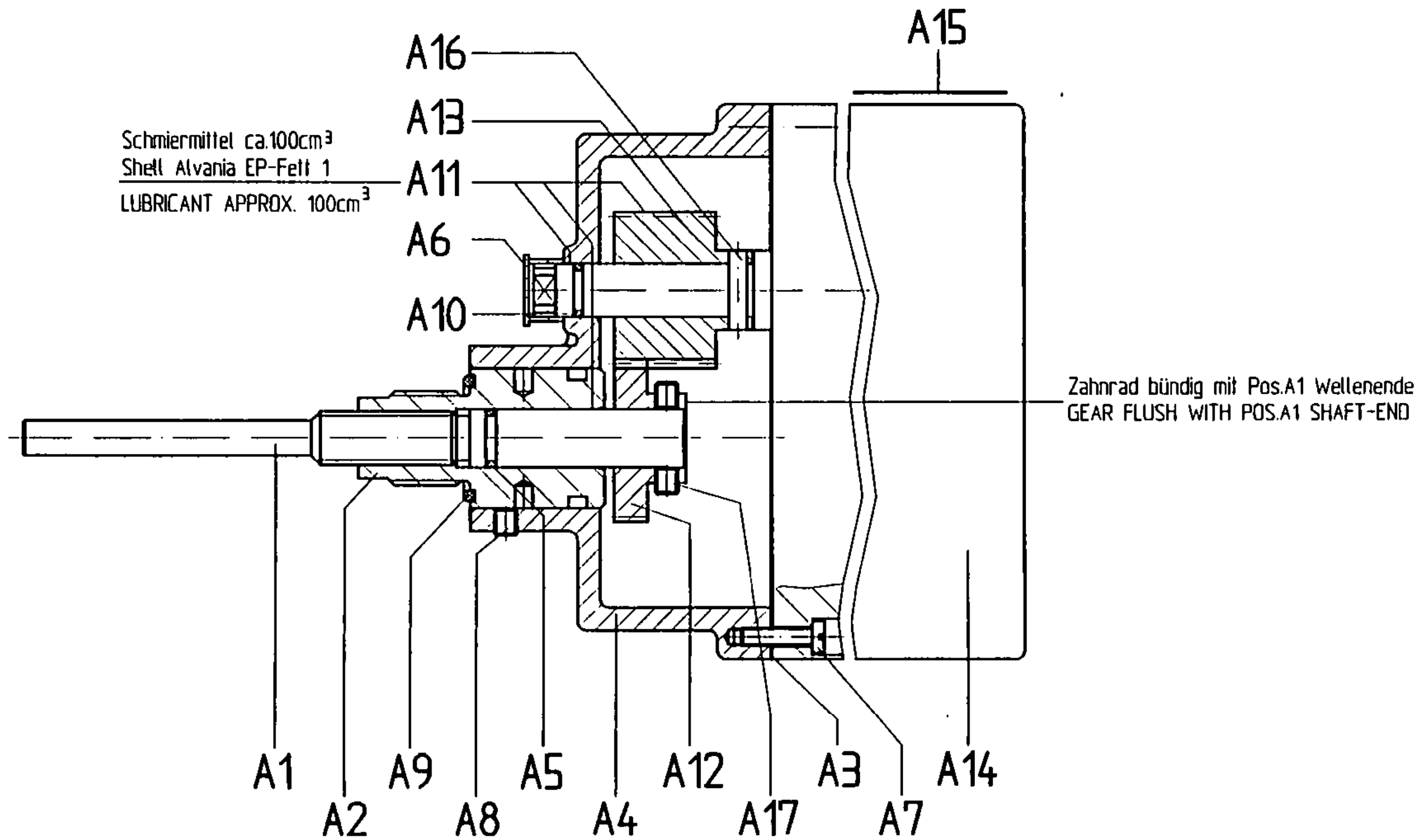
Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
M1	1,000	COUPLING		AL-H	240011	ROTEX 14 PA, M.BO.+F	1
M2	4,000	SCREW, BOLT M 5 X 16	DIN 933	8.8	100225		1
M4	1,000	GASKET, SEALING 0,25DICK	P-20/1	FD 3	150068		1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m^2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	DRIVING UNIT F.BAUGR.63 CM-01	CG-G1-01/4	440017S	1,000	9123101 -	1



DESIGNED	D. Petersen	15. 02. 94					
BRAN+LUEBBE			TITEL 1 E-VERSTELLUNG				
			TITEL 2 ELECTRIC STROKE CONT UNIT				- CAD-DRAWING -
DRAWN	W. Naundorf	15. 02. 94					
CHANGED	W. Naundorf	10. 08. 95	MATERIAL		IDENT-NO		REV. 2
APPROVED	D. Petersen	10. 08. 95	FORMAT A3	SCALE 1:1	SHEET 1/1	DRAWING NO CA-4-01	
RELEASED	D. Petersen	11. 08. 95					

19.04.96 **U**

Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
A1	1,000	SPINDLE	CV-121	C 45	201718		1
A2	1,000	GLAND, SCREW CONNECTION	CV-23/3	9SMN28K	303382		1
A3	1,000	GASKET, SEALING	CV-92	FD 3	150437		1
A4	1,000	HOUSING	CV-90/1	GG 20	229722		1
A5	1,000	RING 9,25X 1,78		NBR	152209		1
A6	1,000	CAP	TL-4-128	PE	170196		1
A7	2,000	SCREW, BOLT M 4 X 12	DIN 84	A 2	815220		1
A8	1,000	SLOTTED SCREW M 5 X 6	DIN 916	45 H	102163		1
A9	1,000	O-RING 23 X 1,5		NBR	152174		1
A10	1,000	RING 8,2 X 1,78		NBR	152208		1
A11	0,100	LUBRICANT			790015	EIMER A 5 KG	2
A12	1,000	GEAR WHEEL G1-3	CV-96/2	9SMNPB28	205114		1
A13	1,000	GEAR WHEEL G1-3	CV-95/2	9SMNPB28	205113		1
A14	1,000	DRIVING UNIT 8/ 3MM HUB M.REG	CV-94		459485	230VAC 50/60 HZ	1
A15	1,000	PLATE, LABEL	SCHI-797/1	PVC	155191	F.ELEK.ANLAGEN	1
A16	1,000	PIN 4 X 20	DIN 1481	FEDERST	102066		1
A17	2,000	SLOTTED SCREW M 5 X 6	DIN 916	45 H	102163		1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	ADJUSTER M.REGLER 230V CA-41-01-03-2	CA-4-01/2	440159S	1,000	9123101 -	1

19.04.96 **U**

Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
001	1,000	PRESSURE GAUGE 0...10,0BAR	CR-01		440023S	CR-01-B	1
002	1,000	VALVE DN10 PN10 3/8		4571/PTF	078009	TA-210	1
003	1,000	VALVE DN10 PN10 3/8		4571/PTFE	078009	EINSTELLDRUCK BAR	1
		<<<<>>>>					

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory

ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m^2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	ACCESSORIES			1,000	9123101 -	1

19.04.96 **U**

Remarks

Name KM	Date 25.03.96	Customer-No. 2000165	Order-No. 519108291000

Pos.	Quantity	Description	Drawing-No.	Material	Ident-No.	Remarks	ME
R1	1,000	PRESSURE GAUGE 0...10,0BAR G <<<<>>>>	NG 50	1.4571	600606	131.11 RÜCKSEITIG Z	1

For ordering parts: For ident-No.with alphabetic appendix Order-No is mandatory ME:1=Piece,2=Kg,3=Litre,4=Metre,5=m2

Producer	Description	Drawing-No.	Ident-No.	Quantity	Serial-No.	Page
Bran+Luebbe GmbH	PRESSURE GAUGE 0...10,0BAR CR-01-B	CR-01	440023S	1,000	9123101 -	1

BRAN+LUEBBE

9

Parts Lists and Drawings

9 Parts List

On the following pages you will find the drawings and parts lists of your device.

If you want to order supplementary parts, select the position number of the part on the corresponding drawing. Then identify the order number in the corresponding parts list.

BRAN+LUEBBE

10

Accessories

PUMPS DIVISION

BRAN+LUEBBE

Actuator with Controller
PSE 102
for ProCam /ProZet /M-Series

Operation Manual

Com.-No.	:	
Serial-No.	:	
Type	:	
P. O.-No.	:	
Customer	:	
Date	:	08/95
Revision	:	2

Read the instructions in this manual carefully before installing or starting the system. BRAN+LUEBBE GmbH will accept no liability for damages due to non-observance of this manual.

0. List of Contents

1. Brief Description

The actuator **PSE 102** with integrated controller is used for stroke length adjustment of metering pumps of the BRAN+LUEBBE ProCam /ProZet /M-Series.

According to a connected setpoint value signal the angle position of the output shaft is controlled (closed loop) and the stroke length is adjusted. The integrated controller is a three-point step controller with P-response, that is regulating the motor with three different output signals:

"Motor turns left"	=	"Increasing of the stroke length"
"Motor turns right"	=	"Decreasing of the stroke length"
"Motor stands still"	=	"Stroke length will not be changed"

The actuator supplies an output signal (actual value) which is proportional to the angle position. This signal can be given out as voltage or current signal alternatively. In addition, a relay contact is actuated when the angle position corresponding to the set-point value is reached. With the relay contact external appliances can be switched.

If the housing is opened the modes of the actuator are shown by the light-emitting diodes. In addition, two modes - automatic and manual mode - can be chosen by switching over. In automatic mode the controller controls the angle position of the output gear and the stroke length of the metering pump, as a closed loop. In manual mode these quantities can be changed by pressing two buttons ("right", "left").

The inputs of the appliance are shaded from spikes and voltage overloads. The appliance is to resistant to jamming in accordance with VDE 0843 part 4, inspection level 3. The housing of the actuator corresponds to enclosure IP55.

2. Functional Description

2.1. Actuator PSE 102

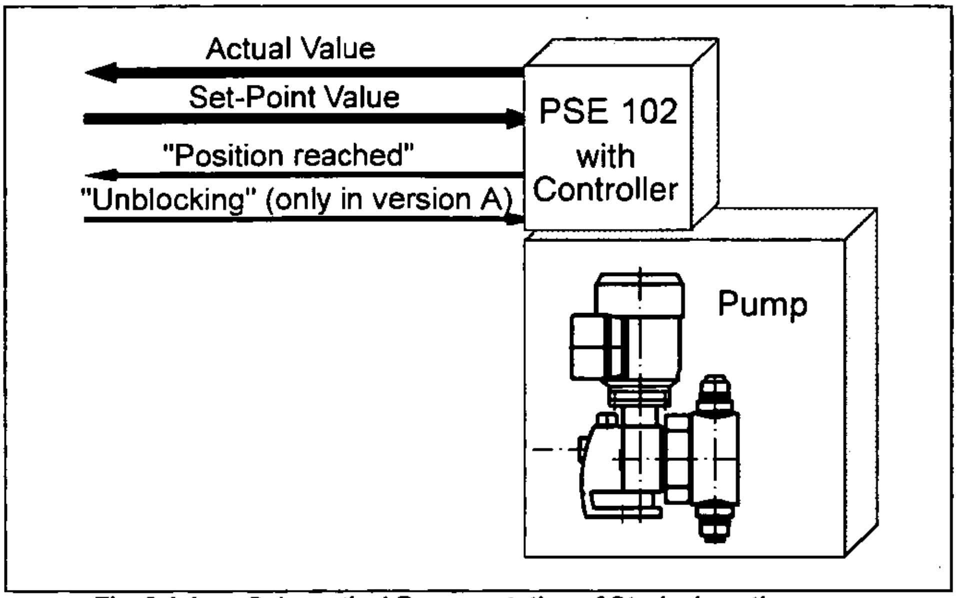


Fig. 2.1.1: Schematical Representation of Stroke Length Adjustment

The actuator PSE 102 is mounted on the metering pumps of ProCam /ProZet /M-Series (see manual).

The automatic controller of the actuator controls the angle position of the actuator's output gear in a adjusting range of 8 or 15 revolutions. In version A the controller only works if the contact at the "Unblocking" signal input is bonded.

The angle position is proportionally converted into the necessary stroke length of the metering pump.

The actual angle position and the stroke length respectively (actual value) are reported back from the PSE 102.

If the requested position of the actuator's output gear and with it the requested stroke length of the metering pump (set-point value) is reached the PSE 102 reports: "Position reached".

2.2. Automatic Control of Stroke Length Adjustment

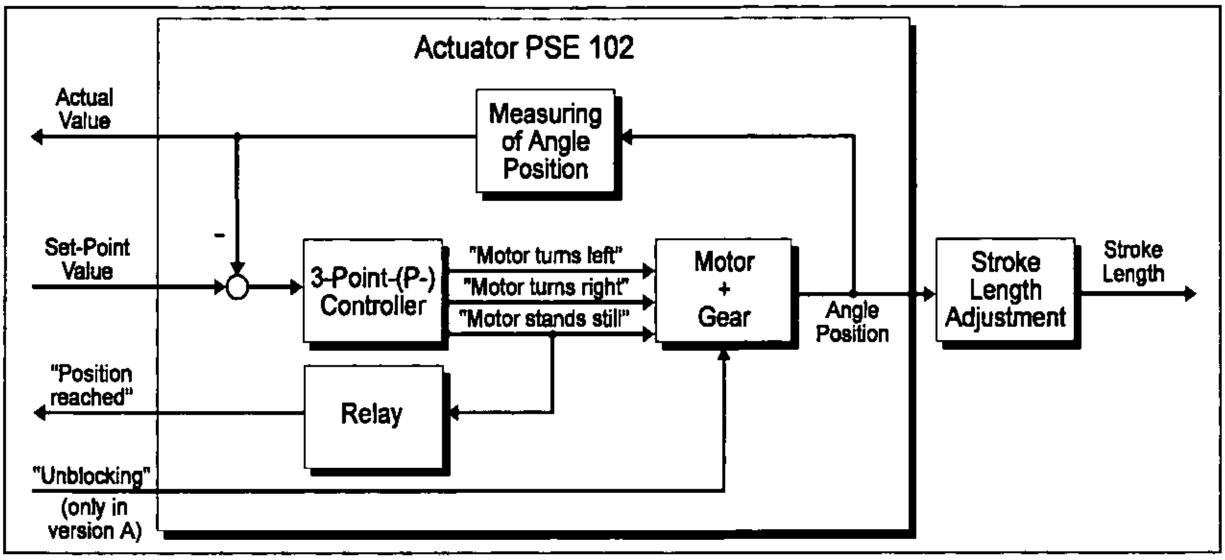


Fig. 2.2.1: Functional View of the Actuator with Automatic Control of Stroke Length (= Automatic Control of Angle Position)

In Fig. 2.2.1 the function of the automatic control as a closed loop is shown with the actuator's (PSE 102) functional view. The closed loop for the automatic control of angle position (controlled variable) and of stroke length respectively (angle position and stroke length are proportional) consists of the comparison point, the controller, the motor with the gear and the angle position sensor.

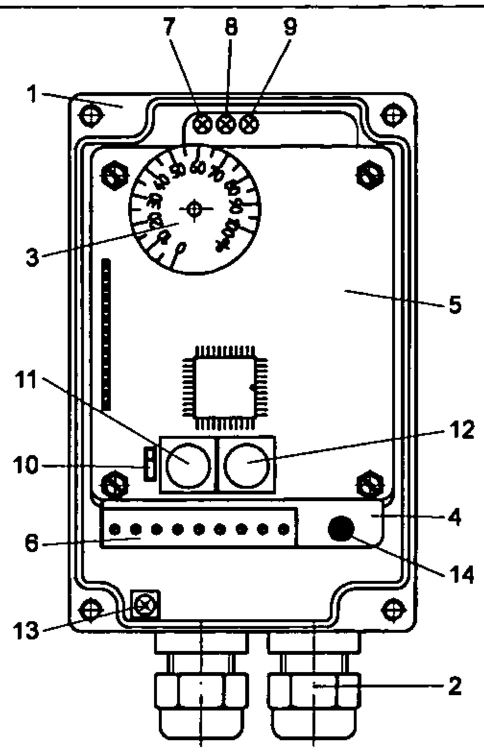
At the comparison point the given set-point value is compared with the actual value of the controlled variable. The controller uses the result (controlling difference). It is a three-point step controller with proportional response (P-response), meaning it's output signal can have three different states: "motor turns left", "motor turns right" and "motor stands still". According to these signals the motor is controlled which adjusts the angle position of the actuator's output gear via the transmission gear.

In version A the motor only turns if it is unblocked by the control signal (contact at the input of the "unblocking" signal, e.g. by connecting with a switch).

The angle position of the output gear is measured by the angle position sensor. It is transformed into an electrical signal and fed back to the comparison point. In addition, this signal is available at the actual value output.

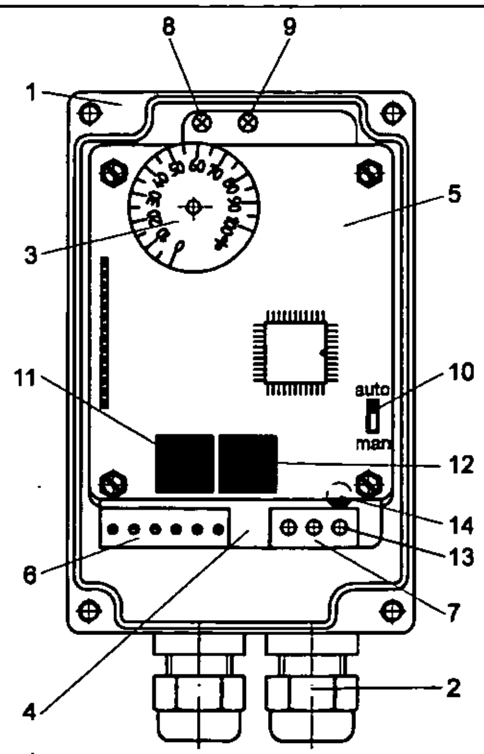
If the set-point position is reached, the output signal is - "motor stands still" -, an internal relay contact is switched. Its switching function can be used externally as "position reached". With it higher ordered controls, displays etc. can be switched.

3. Illustration of Operational Controls and Display Elements with Identifiers



1	Underpart of Housing
2	PG
3	Stroke Length Indicator
4	Lower Board
5	Upper Board
6	Terminal for Supply and Signal Wires
7	LED YELLOW = "Actuator is un-blocked"
8	LED GREEN = "Voltage Supply is available"
9	LED RED = "Position not reached"
10	Switch S1: for switch over in Manual / Automatic Mode
11	Button T1: for Decreasing of Stroke Length in Manual Mode
12	Button T2: for Increasing of Stroke Length in Manual Mode
13	Earth Terminal
14	Fuse

Fig. 3.1: Adjusting Drive PSE 102 (Version A)



1	Underpart of Housing
2	PG
3	Stroke Length Indicator
4	Lower Board
5	Upper Board
6	Terminal for Signal Wires
7	Terminal for Supply Wires
8	LED GREEN = "Voltage Supply is available"
9	LED RED = "Position not reached"
10	Switch S1: for switch over in Manual / Automatic Mode
11	Button T1 (black): for Decreasing of Stroke Length in Manual Mode
12	Button T2 (red): for Increasing of Stroke Length in Manual Mode
13	Earth Terminal
14	Fuse

Fig. 3.2: Adjusting Drive PSE 102 (Version B)

4. Specifications

Supply Voltage	230VAC (50/60Hz) 115VAC (50/60Hz) (option)
Power Input **Motor** **Control Unit**	 max. 8VA approx. 4VA
Response of the Controller	Three-point controller with P-response
Motor Control	contactless, galvanically seperated
Electrical Connection	Cable-entry max. 2x PG9 9-pole connecting box (for wire-Ø: 0,7mm)
Actual Value Sensor	10-helix-hybrid-potentiometer (1kΩ) used range 0....750Ω ± 5%, linearity 0,25%
Adjusting Range	8 or 15 revolutions = 100% stroke length
Adjustment Accuracy	±0,25%
Controller Resolution	1024 Digits
Inputs **Set-Point Value** **"Unblocking"-Signal** **(only in version A)**	 4...20mA, $R_I \leq 50\Omega$ (the input of the set-point value is galvanically separated from the supply voltage) for external closer contact input with low-pass filter characteristic opens at regulation difference < ± 1,25%
Outputs **Actual Value** **"Position reached" Function**	 4...20mA, $R_L \leq 500\Omega$ (the output of the actual value is galvanically separated from the supply voltage) one relay with potential free contact max. contact load 230VAC / 6A
Adjusting Time **8 Revolutions** **15 Revolutions**	 96/80sec (with 50/60Hz) 180/150sec (with 50/60Hz)
Resistance to Jamming	in accordance with DIN VDE 0843, part 4 inspection level 3 in IEC 801-4
Enclosure	IP55 (in accordance with DIN VDE 0470)
Ambient Temperature	max. 40°C

5. Terminal Connections

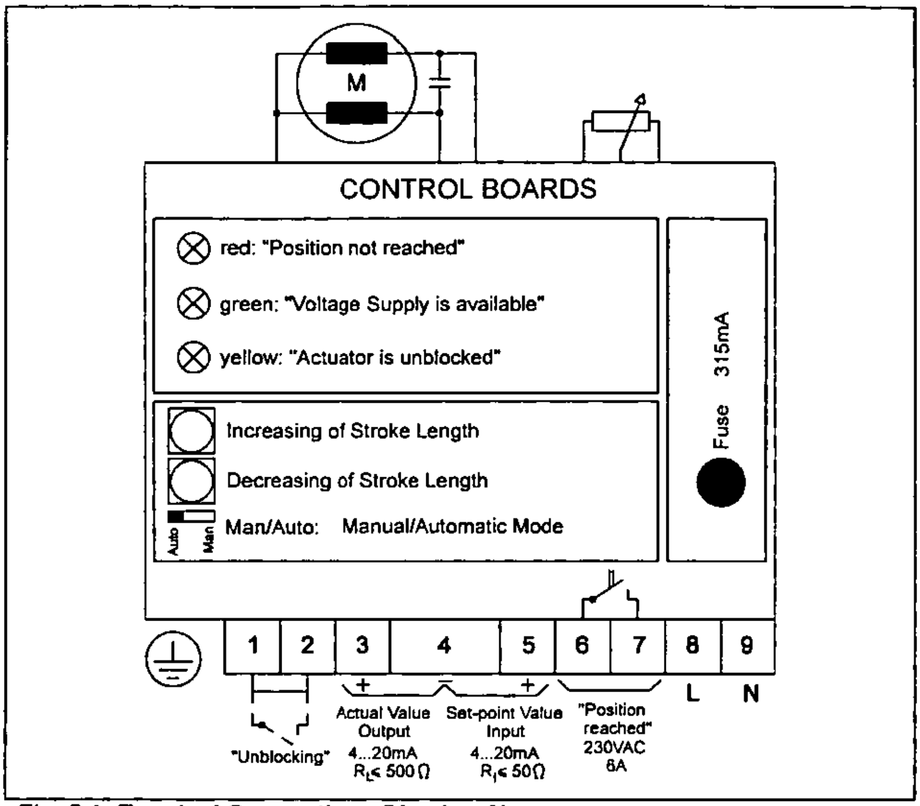


Fig. 5.1: Terminal Connections (Version A)

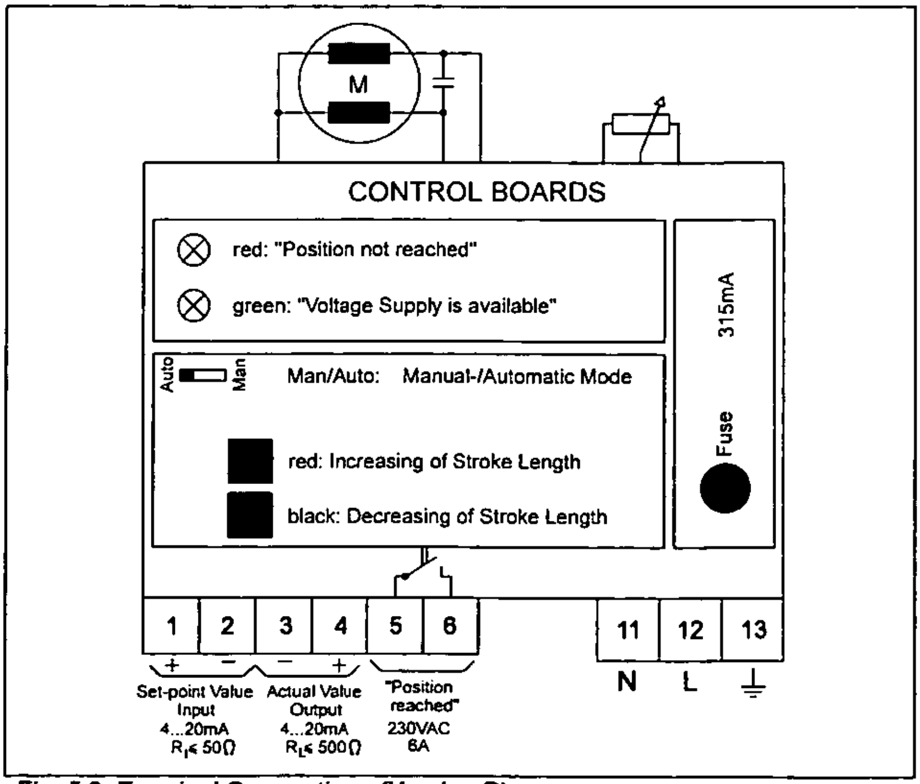


Fig. 5.2: Terminal Connections (Version B)

6. Commissioning and Operation

6.1. State at Time of Supply

In state at time of supply the actuator is preadjusted. The switch to switch over to manual / automatic mode is in automatic mode position.

6.2. Cable Entry, Wiring

Danger:
Electrical connections and maintenance must only be performed by qualified per sonnel!

Electrical elements have to be connected according to local regulations.

Two plastic screwed connection PG9 are available for cable-entry of signal and supply wires. The wiring has to be according to terminal connections in chapter 5. (see page 9).

The control unit and the supply unit of the PSE 102 are galvanically separated. With this separation higher potential differences can be utilised using increased enclosure safety.

6.3. In- and Output Signals, LEDs

In excessive parasitic induction the actuator of the version A can also be blocked to unwanted movements of the drive by the external unblocking signal (closer contact). Then the actuator is electronically switched off. Only when the contact is closed the closed loop control starts to work (in automatic mode) or the actuator can be manually adjusted by the buttons respectively (in manual mode). In state at time of supply the unblocking signal is set by a short circuit connection at the signal input. The connection is to be removed to use the input in another application.

In automatic mode the actuator PSE 102 converts the given set-point value into a proportional angle position. Then this position is transformed into a proportional stroke length by the stroke length adjustment of the metering pump. With it a set-point value of e.g. 4...20mA corresponds to a stroke length of 0...100%.

At any time the actual position of the drive (actual value) can be checked at the actual value output. For that a potentiometer with high life span is used to record the actual position. A reference voltage source supplies the potentiometer.

A relay contact is switched, when the actuator reaches the wanted set-point position, meaning the actual value is equal to the set-point value. This switching function of the relay can be externally used.

The attainment of the set-point position is internally displayed by fading out of the red LED. The further LED(s) show(s) the operation mode of the appliance. When the supply voltage is available the green LED is on. In version A when the "Unblocking" signal is set, meaning the contact is closed, the yellow LED is on.

6.4. Manual / Automatic Mode

Two operation modes of the actuator can internally be switched over by the switch S1 (for switching over to manual / automatic mode). In the lower position of the switch the appliance is in manual mode. In both operation modes the adjustment of the drive is only possible, if the "Unblocking" signal is set.

6.4.1. Manual Mode

In manual mode the actuator can be adjusted by activation of the buttons T1 and T2. The stroke length decreases by pressing button T1, it increases by pressing button T2. The adjustment of the stroke length is only possible in the range of 0 to 100% stroke length.

6.4.2. Automatic Mode

In automatic mode the controller controls the stroke length in accordance to the given set-point value. The activation of the buttons (T1 and T2) does not effect the stroke length control.

6.5. Filter Function

The analog input (actual value input) and the "Unblocking" signal input are shaded from spikes by low-pass filters and fast switching diodes. The appliances accuracy is increased by the use of a noise suppression filter in the supply wiring.

7. Housing Dimensions

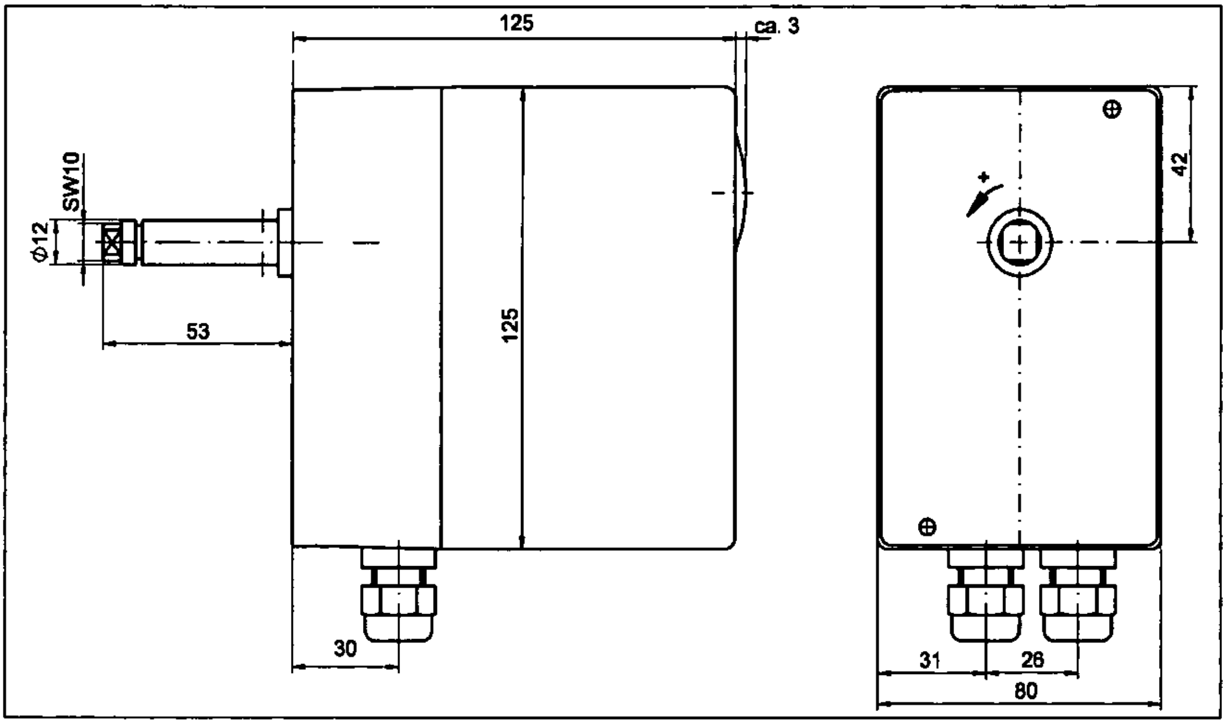


Fig. 7.1.: Housing Dimensions (mm)

INSTALLATION AND MAINTENANCE

THREE PHASE MOTORS

INSPECTION AND STORAGE

On receiving the motor inspect for damage or missing parts and report such losses to the carriers and to us, quoting the motor number, also the Consignment Note reference.
The bolts holding the motor down to the slide rails are always included with the rails. Foundation bolts are not supplied. If not used immediately, storage should be warm, dry and vibration free and before putting in service the motor winding insulation should be tested. If this reading is below one megohm move to a warm dry place for a few hours until the insulation value rises.

LIFTING

Where an eyebolt is provided with the motor, this should be screwed down until its shoulder is against the face of the yoke before being used for lifting. The motor eyebolt should be used for lifting the motor only, not additional equipement. If the motor is part of a frequency changer set, the lifting arrangement should ensure that the pull on each eyebolt is vertical

DRAIN PLUGS

Any drain plugs provided must NOT be fitted when exporting by sea.

VOLTAGE

Motors will operate without damage at any voltage in the range of 95% to 105% of rated voltage. [In the U.K. where the power supply is subject to electricity supply regulations the range shall be 94% to 106%.] For motors rated to operate over a small range of voltage the rating and specified performance relates to the mean.

WARNING

When fitting pulleys or coupling on to the motor shaft, the opposite end of the shaft should be supported in order not to damage the bearings.

HEALTH & SAFETY AT WORK ETC. ACT, 1974

It is essential this equipment is correctly installed, earthed and guarded in accordance with current regulations.

WIRING UP

The cables used should be capable of carrying the full load current of the motor (see motor nameplate) without overheating or undue voltage drop under starting conditions. Terminal screws should be tight. Slipring motors are wired up in a similar way to cage motors, care being taken to ensure that the brushes are in contact with the slip rings and that rotor resistances are connected in the 'START' position.

MOTOR CONNECTION DIAGRAM APPEARS OVERLEAF (OR IN TERMINAL BOX)

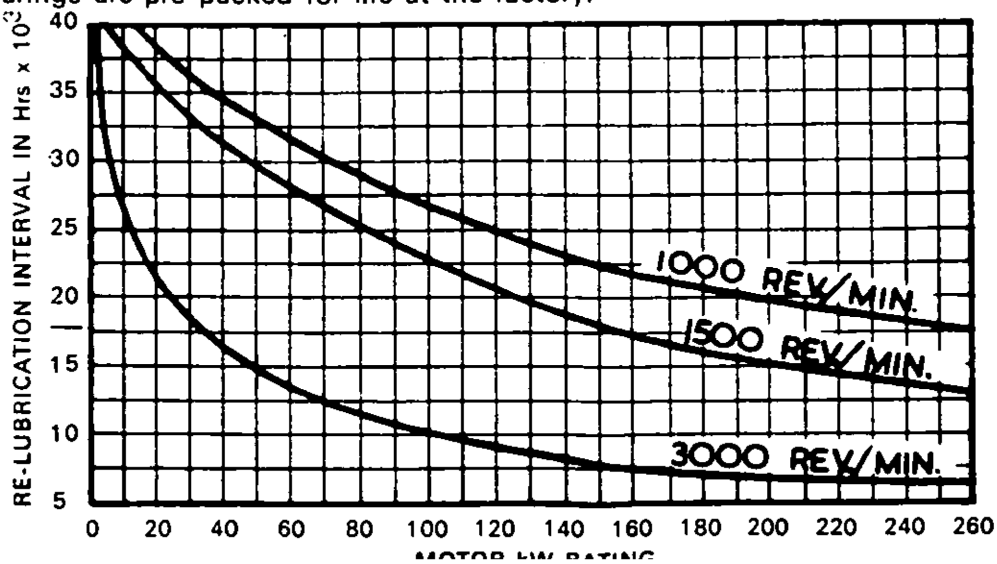
LUBRICATION

Motors equipped with Grease Fittings and Relief Plug should be re-lubricated at intervals which are dependent upon environmental and load conditions, with the following procedure being adopted while the motor is stationary.

1 Wipe clean the grease gun fitting and regions around the motor grease fittings.
2 Remove the Relief Plug.
3 Add a small quantity of grease, approximately 4 to 10 shots depending on frame size.
4 Allow motor to run for about ten minutes before re-fitting the relief plug in order that excess grease may be expelled.

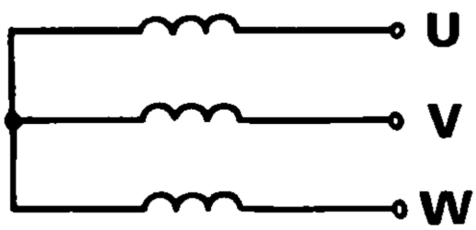
For Ball and Roller Bearings the standard grease employed is either BP Energrease LS3 or Shell Alvania R.A. but other lithium based greases of a similar consistency would be compatible.
Recommended re-lubrication intervals are as shown on the graph below, but on certain smaller motors, lubricators are omitted and bearings are pre-packed for life at the factory.

Note:
These values apply to horizontally mounted motors, therefore if vertically mounted the value should be multiplied by 0.8.
Also for every 15°C above 70°C at the bearing the re-lubrication value should be reduced by half.

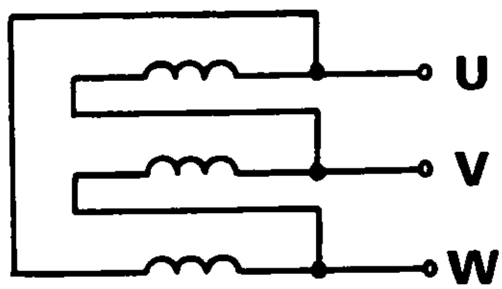


CONNECTION DIAGRAM FOR 3 PHASE SINGLE SPEED INDUCTION MOTOR

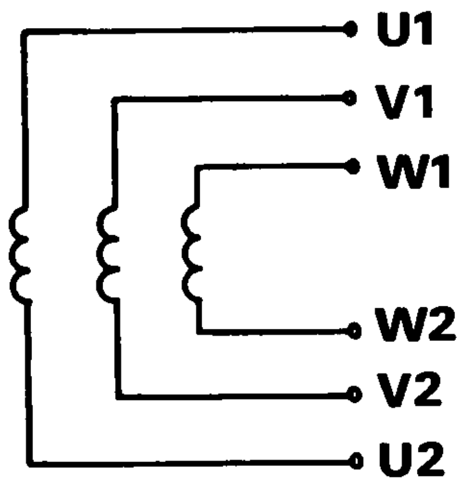
No. 1 INTERNAL STAR (Y)



No. 2 INTERNAL DELTA (Δ)



6 LEADS FOR STAR (Y) OR DELTA (Δ)



Nº3 STAR-DELTA (Y-Δ) STARTING

CONNECT ALL 6 LEADS TO
STAR-DELTA STARTER

Nº3D DIRECT-ON DELTA (Δ)

LINK W2 to U1
U2 to V1
V2 to W1
SUPPLY TO U1, V1, W1

Nº3Y DIRECT-ON STAR (Y)

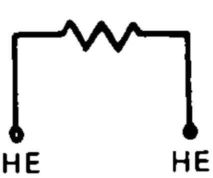
LINK W2 TO U2 TO V2
SUPPLY TO U1, V1, W1

S WOUND ROTOR. CONNECT ROTOR LEADS K, L, M TO STARTING RESISTANCE

TO REVERSE DIRECTION OF ROTATION CHANGE OVER ANY 2 SUPPLY LEADS

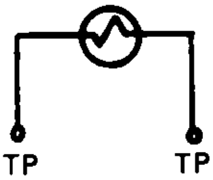
AUXILIARIES (WHEN FITTED) ARE MARKED AS SHOWN BELOW

H
HEATER



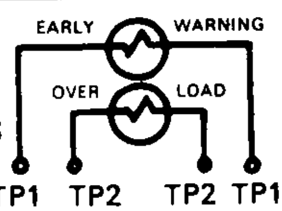
CONNECT TO SINGLE
PHASE VOLTAGE SUPPLY

T
THERMISTORS



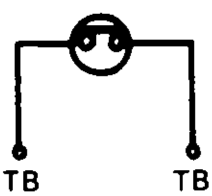
CONNECT TO THERMISTOR
CONTROL UNIT

TE
THERMISTORS



CONNECT TO THERMISTOR
CONTROL UNIT

TB
THERMOSTATS



CONNECT TO OVERLOAD
PROTECTION CIRCUIT

MAGNETIC BRAKES ARE EITHER CONNECTED INTERNALLY OR EXTERNALLY. WHEN CONNECTED EXTERNALLY THE BRAKE LEADS ARE MARKED WITH THE LETTERS BR, TWO LEADS FOR A SINGLE PHASE BRAKE AND THREE LEADS FOR A THREE PHASE BRAKE.
LEADS ARE EITHER CONNECTED ONTO MOTOR TERMINALS OR LEFT LOOSE IN TERMINAL BOX.

NOTES. REFER TO NAMEPLATE FOR SUPPLY VOLTAGE AND CONNECTION.
LETTER(S) FOLLOWING MAIN DIAGRAM No. DENOTE WOUND ROTOR OR AUXILIARIES e.g. 3YH.

SEE OVER FOR INSTALLATION INSTRUCTIONS.

BRAN+LUEBBE

11

Quality Documentation

CE DECLARATION OF CONFORMITY

MANUFACTURER Bran + Luebbe GmbH

ADDRESS Werkstr. 4

22844 Norderstedt

TELEPHONE 040/52202-0 FAX: 040/52202-444 TELEX: 2174691

WE HEREBY DECLARE THAT THE DESIGN OF THE FOLLOWING EQUIPMENT CORRESPONDS WITH THE APPROPRIATE DEFINITIONS OF THE ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR DESIGN AND CONSTRUCTION OF MACHINERY.

EQUIPMENT DESCRIPTION **Metering Pump** DS 50 /10

SERIAL NO. **91** 23 101

ORDER NO. **51** 910829

89/392/EC MACHINERY DIRECTIVE

91/368/EC MACHINERY DIRECTIVE (EXTENSION)

APPLIED HARMONIZED STANDARDS:

EN292 PART I; PART II

EN294 / EN349

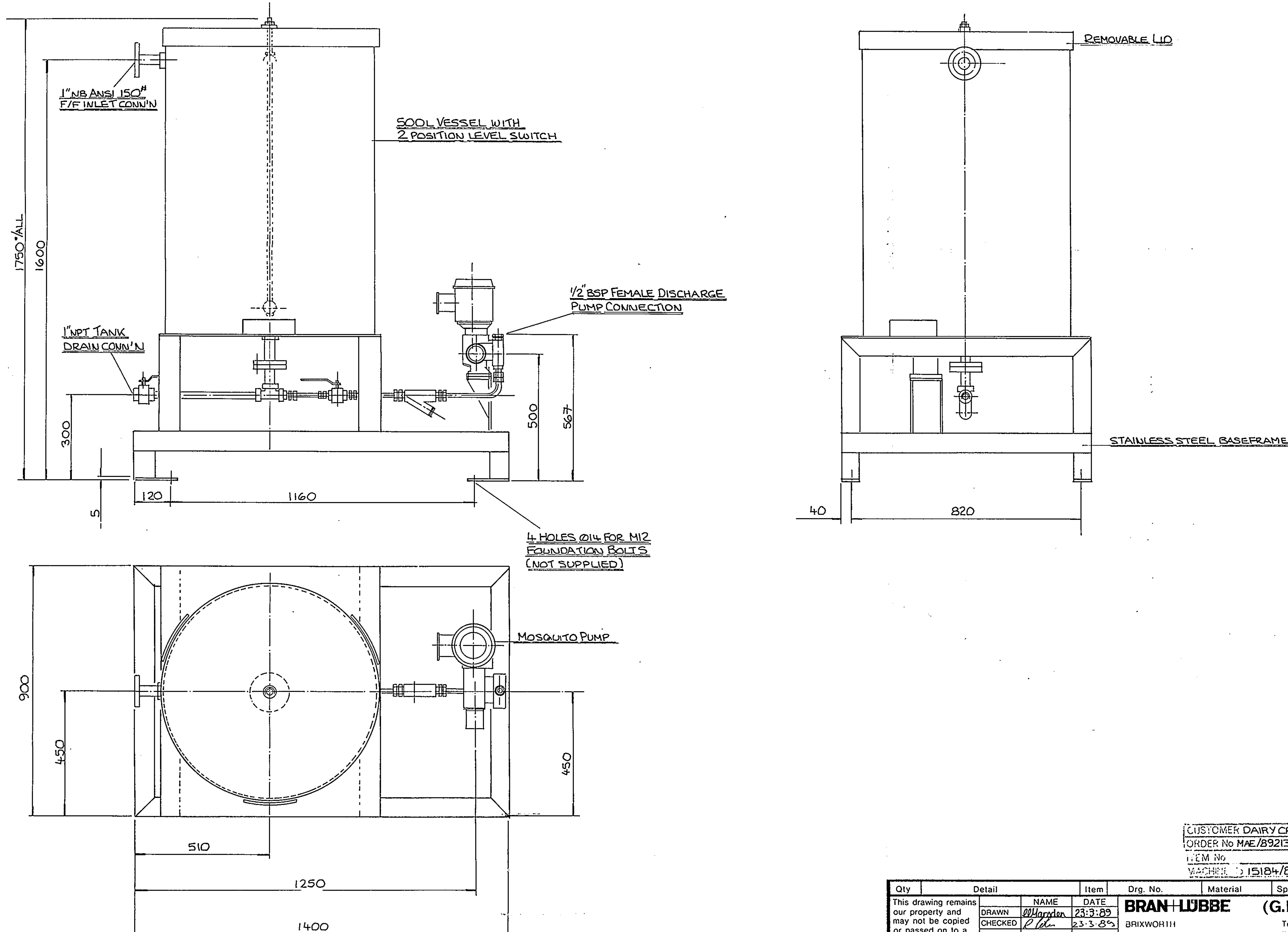
APPLIED NATIONAL TECHNICAL SPECIFICATIONS AND STANDARDS:

DIN24295

SIGNED Peter Ruiter **POSITION: PRODUCTION MANAGER** **DATE** 19. April 1996

For and on behalf of Bran + Luebbe GmbH

ec-konfe



CUSTOMER DAIRY CREST
ORDER No MAE/892131/3/G/01
ITEM No
MACHINE No 15184/89

Qty	Detail	Item	Drg. No.	Material	Specification

This drawing remains our property and may not be copied or passed on to a third party without our written permission.

	NAME	DATE
DRAWN	[signature]	23:3:89
CHECKED	[signature]	23·3·89
APPROVED		

BRAN+LÜBBE (G.B.) LTD.
BRIXWORTH
Tel Northampton 880751
Telefax 880145
Telex 311691

GENERAL ARRANGEMENT OF
MOSQUITO PUMP PACKAGE UNIT
WITH 500L TANK

SCALE 1:10

DRAWING No.	REV.
ARNR 15184	0

REV.	DATE	DRAWN	CHECKED	APPROVED	DESCRIPTION

22

spirax sarco

01242 521361

BC 3200 and BC 3210 Blowdown Controllers

Installation and Maintenance Instructions

4033450/1

IM-P403-53
AB Issue 1

Installation & Maintenance Instructions

spirax sarco

Printed in U.K.

Safety

Your attention is drawn to Safety Information Leaflet IM-GCM-10, as well as to any National Regulations concerning boiler blowdown. In the UK, guidance is given in HSE Guidance Note PM 60.

WARNING

Two connector plugs and sockets are provided on each controller, with input and output connections clearly indicated on the printed circuit board.

THE CONNECTOR SOCKET CARRYING THE MAINS INPUT IS NUMBERED 11-20, AND MUST NEVER BE CONNECTED TO THE PRINTED CIRCUIT BOARD PLUG LABELLED 1-10, AS THIS WOULD DESTROY THE EQUIPMENT AND CAUSE A RISK OF FATAL ELECTRIC SHOCK TO PERSONNEL.

Description.

The BC 3200 and BC 3210 are dual voltage controllers which monitor the conductivity of liquids, and are used with a boiler blowdown valve or condensate dump valve to monitor and control TDS levels.

The BC 3200 is wall mounted, and the BC 3210 panel mounted. As they are the same in nearly all other respects, the following information will, for clarity, refer to the BC 3200.

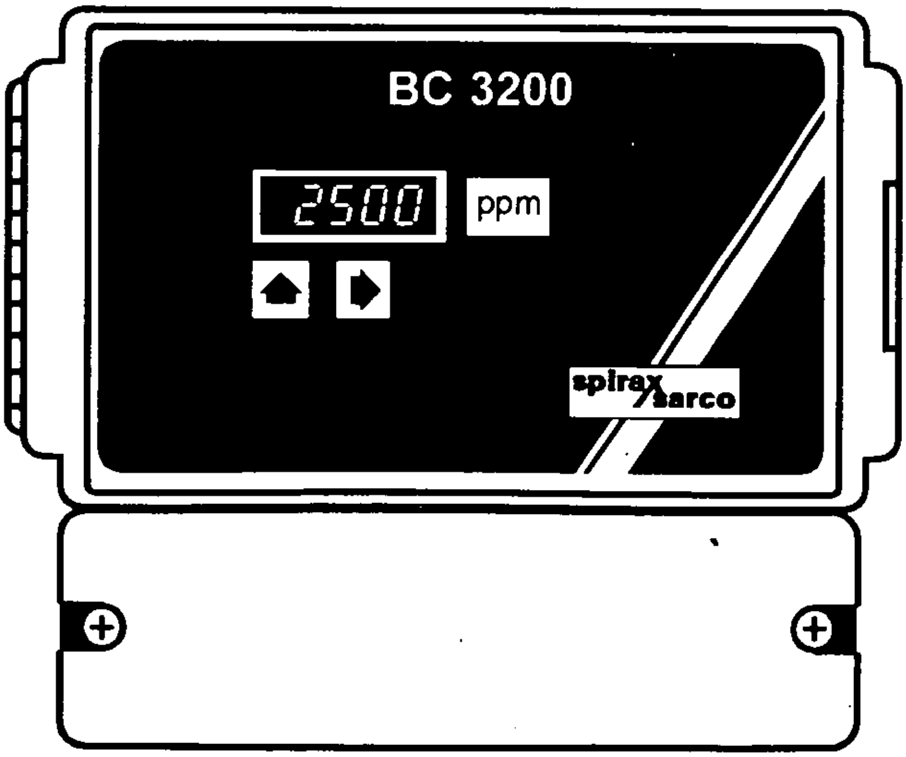
The front panel has a four digit LED display and two push buttons to select, view, and change parameters or settings. An optional lockable cover assembly is available for the BC 3210. An optional lock is available for the BC 3200.

In normal operation the display shows the actual Total Dissolved Solids (TDS) value.

Note:-

TDS is expressed in parts per million (ppm), or as a measure of conductivity in micro Siemens per centimetre, (µS/cm).

Voltage, ranges, and other operating parameters



are set on installation using internal switches.

The controller has a programmable probe conditioning circuit (Patent Applied For), which allows the system to maintain its accuracy even when some boiler scaling is taking place. It should not, however, be regarded as a substitute for adequate water treatment. The conditioning time can be adjusted.

If a two-tip probe is fitted the controller can be set to display a fault code, release an alarm relay, and/or carry out a probe conditioning cycle if the probe becomes scaled.

The controller has adjustable set point, alarm, and calibration. The set point hysteresis is adjustable, to provide a damping effect where changes of water circulation at the probe may otherwise cause over-frequent switching of the blowdown or dump valve.

Changes in circulation could be caused, for example, by boiler firing rate variations, by the feed pump operating, or by sudden changes in boiler load.

A Pt100 temperature sensor may be connected to the controller to provide temperature compensation (2%/°C). This is recommended if the boiler is working at varying pressures, or for other applications such as condensate monitoring or coil boilers, where the temperature may vary.

For smaller boilers where the capacity of the blowdown valve is relatively high compared to the boiler size, the blowdown may be set to pulsed, rather than continuous output, opening for 10 seconds, and closing for 20 seconds. This slows the rate at which the boiler water is removed so that the level is not unduly affected, avoiding the risk of triggering a low water alarm.

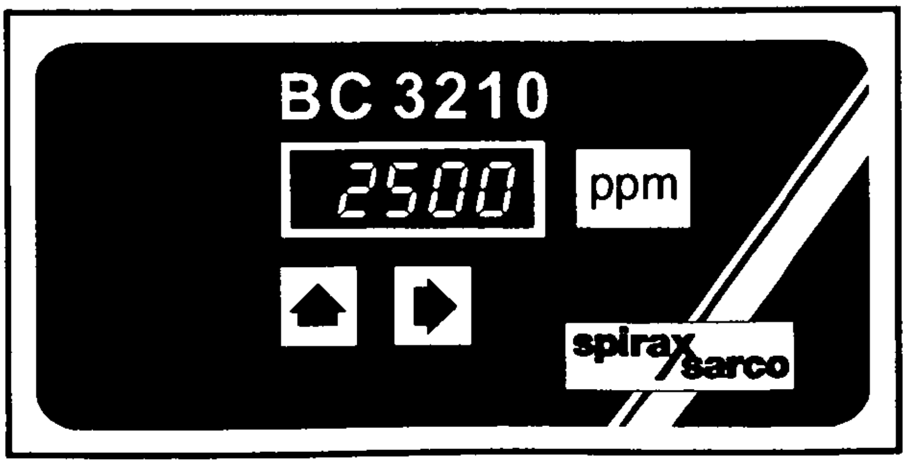
A 0-20 or 4-20mA output is provided as standard, and may be used for remote display of TDS level or as an output to a computerised management system.

A security feature can be selected which allows settings to be viewed but not adjusted, preventing unwanted or inadvertent changes being made.

The BC 3200 can be used for installations with continuous or intermittent flow past the TDS sensor. Continuous flow is chosen where the probe is mounted directly in the boiler shell, for coil boilers, or for condensate contamination detection.

Intermittent flow is used where the probe is mounted in the blowdown line.

An additional filter can be selected to increase the damping effect where the probe is fitted directly in the boiler.



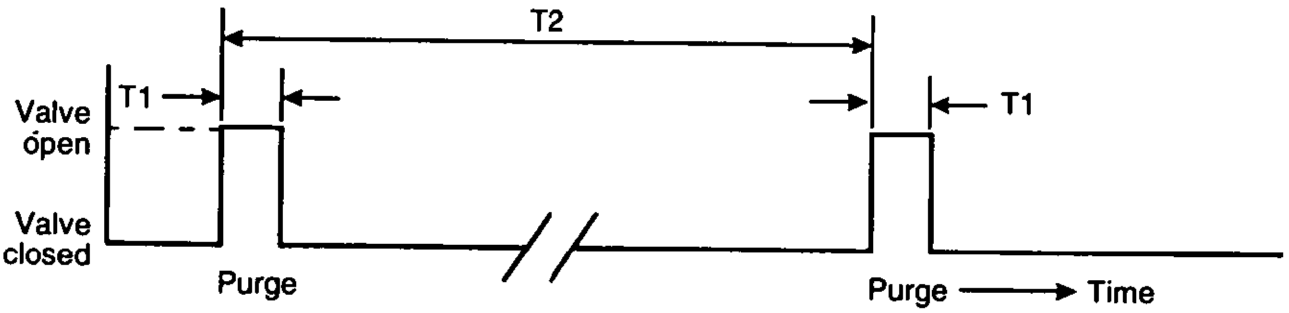
Operation

Continuous flow
The BC 3200 can be set to operate with a Spirax Sarco single tip TDS probe or a Spirax Sarco two-tip TDS probe.
For systems where the probe is in a continuous flow, the BC 3200 will open the blowdown or dump valve if the conductivity of the water exceeds a certain level (set point). When the TDS falls to the set point (less the hysteresis value), the controller will close the valve.

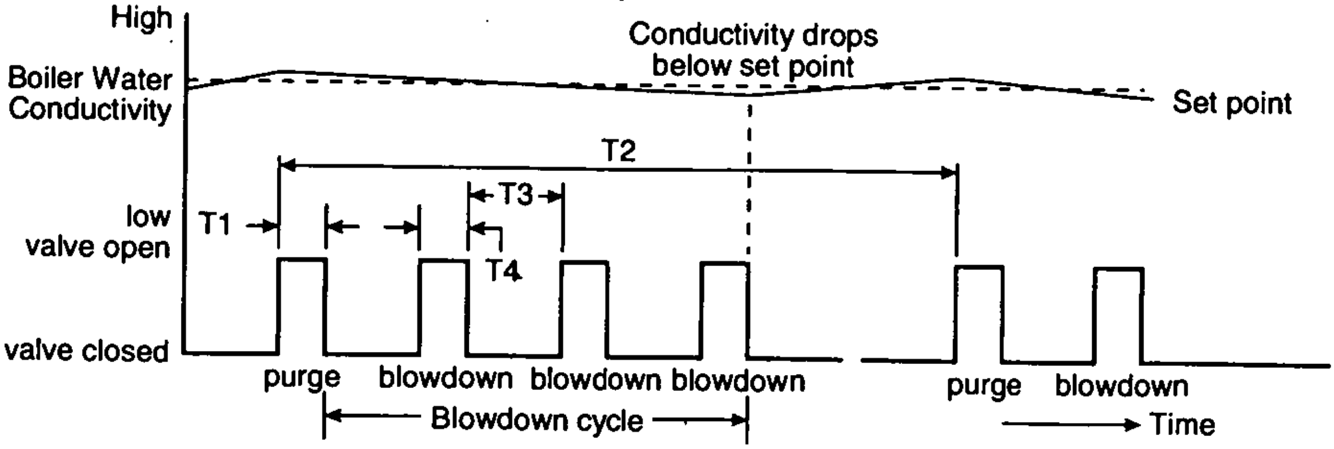
Intermittent flow (probe in blowdown line)
For systems where the sensor is mounted in the blowdown line, the controller periodically opens the blowdown valve to allow a sample of water from the boiler to pass the sensor (purge).
If the TDS is below the set point, the valve will close after the purge time has elapsed.
If the TDS level is above the set point, the blowdown valve will remain open to allow the high TDS water to be replaced by clean water from the feed tank. The valve will close when the TDS level falls to the set point (less the hysteresis value). The controller will store the TDS level in memory so that the last true value is always shown on the display and is output as the mA signal.
The diagrams show the purge time, time between purges, and conductivity control for a typical system. The purge time is adjustable for different blowdown installations, to ensure that all water from the previous sample has been removed from the system, and that the sample is at a similar temperature to the water in the boiler.
The BC 3200 may be set to purge either half an hour from the last purge, or after every half hour of boiler firing, (useful for stand-by boilers). A 'manual' purge may be carried out whenever the TDS level is displayed by pressing the '⇨' button.

Typical operation (Intermittent flow)

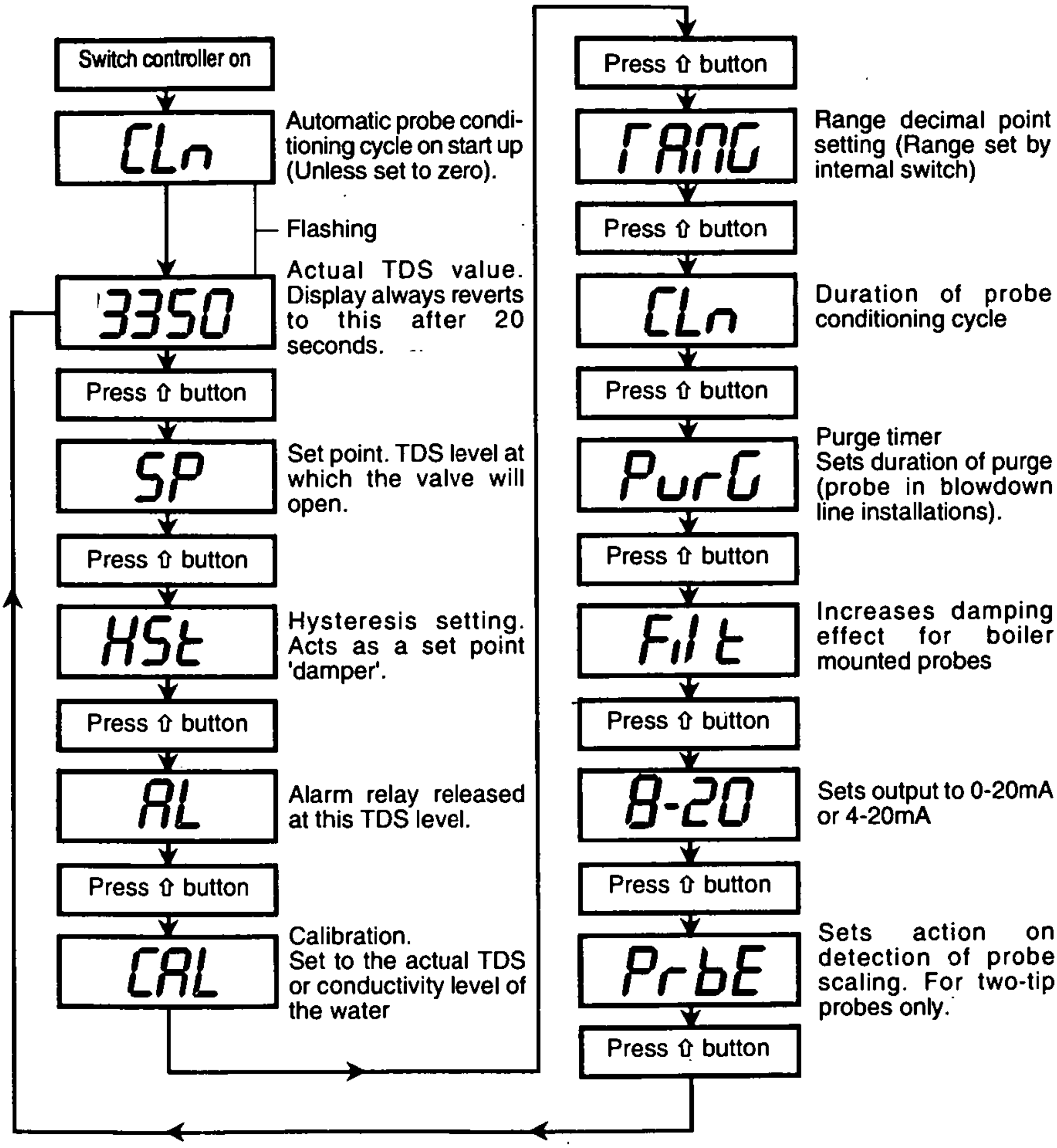
Measured Conductivity lower than the set point



Conductivity being controlled near to set point



T1	Purge time (PurG) Adjustable 0-99 seconds or 0-0.99 hour.
T2	Time between purges Every half hour or every half hour of boiler firing, depending on how controller is wired.
T3 & T4	Intermittent valve operation (if selected) Valve open 10 seconds, closed 20 seconds. If not selected, vale open continuously until TDS fails to Set Point (less hysteresis value).



Summary of display operation.
See 'Commissioning' section for full explanation of the functions, and to view/change settings.

Installation

BC 3200
The BC 3200 is designed for wall mounting using the three screw slots provided. Additional environmental protection is required if the controller has to be fitted outdoors.
Maximum ambient temperature 55°C.
Protection rating IP 65.

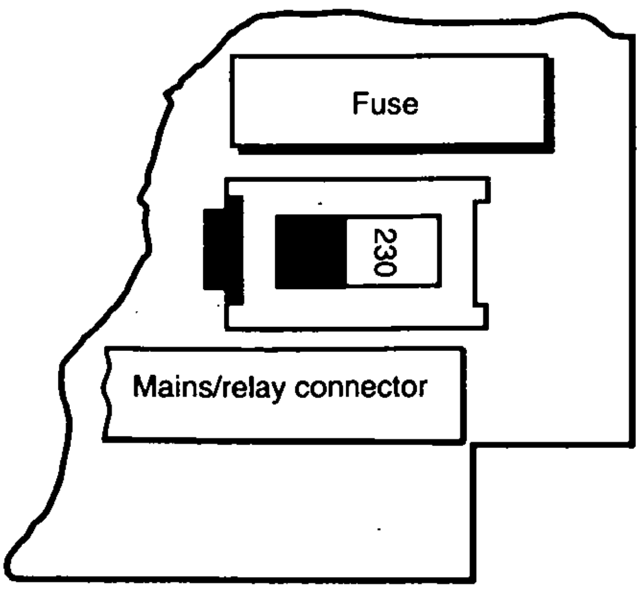
BC 3210
The BC 3210 fits into a 137 x 67mm cut-out in the boiler panel, and is retained by two clips. When the unit is in place, the clips are slotted into the sides of the case and carry retaining screws which are tightened against the back of the boiler panel.
Maximum ambient temperature 55°C.
Protection rating IP 65, but note that this only applies to the front panel.
The back of the case (inside the boiler panel) is open.

Setting up the controller

The controller is suitable for operation at the following voltages (50-60Hz):-

230V setting	198V-264V
115V setting	99V-121V
Fuse type	20mm cartridge 100mA anti-surge
Maximum power consumption	6VA

The controller is supplied set up as follows:-
- 230V mains supply
- Range 0-9990 ppm
- Single tip probe
- Temperature compensation OFF
- Continuous valve operation
- Security switch OFF



To change the switch settings

BC 3200
-Ensure that the mains supply is not connected.
-Loosen the two bottom cover retaining screws, and remove the cover.
A two-way mains switch and 8-way function switch on the printed circuit board (PCB) are fitted just behind the connector plugs.
-Set the switches to the positions shown in the diagrams for the chosen voltage and duties.
-Refit the bottom cover.
Fuse
For access to the fuse, which is next to the mains switch, loosen the four screws retaining the front panel and remove panel.
Caution:- Should you wish to remove the cabie linking the BC 3200 front panei to the main PCB, first note its orientation (pin 1 to pin 1), and that when correctly fitted, it has a 180° twist.
Incorrect fitting can cause the controller to malfunction.

BC3210
-Ensure that the mains supply is not connected.
-Unplug the two connector sockets from the back of the unit.
-Remove the four rear panel retaining screws.
-Slide out the PCB.
A two-way mains switch and 8-way function switch on the PCB are fitted just behind the connector plugs.
-Set the switches to the positions shown in the diagrams for the chosen voltage and duties.
-Refit the PCB and rear cover.
-Refit the two connector sockets.
Connectors must not be transposed; see safety warning at the start of this booklet.

Fuse
Follow the above procedure for access to the fuse, which is next to the mains switch.

Slide switch to right for 115V supply

Function switch settings

Range - switches 1, 2, and 3.
The controller is supplied set to a range of 0-9990, with switches 1 and 3 OFF, and switch 2 ON, which is suitable for most boiler TDS control applications.
For condensate return monitoring duties, or boilers working at a low TDS, it may be desired to select a lower range for greater accuracy.
To select a range of 0-999.0, set switch 1 ON, and switches 2 and 3 OFF.
To select a range of 0-99.90, set switches 1 and 2, OFF, and switch 3 ON.

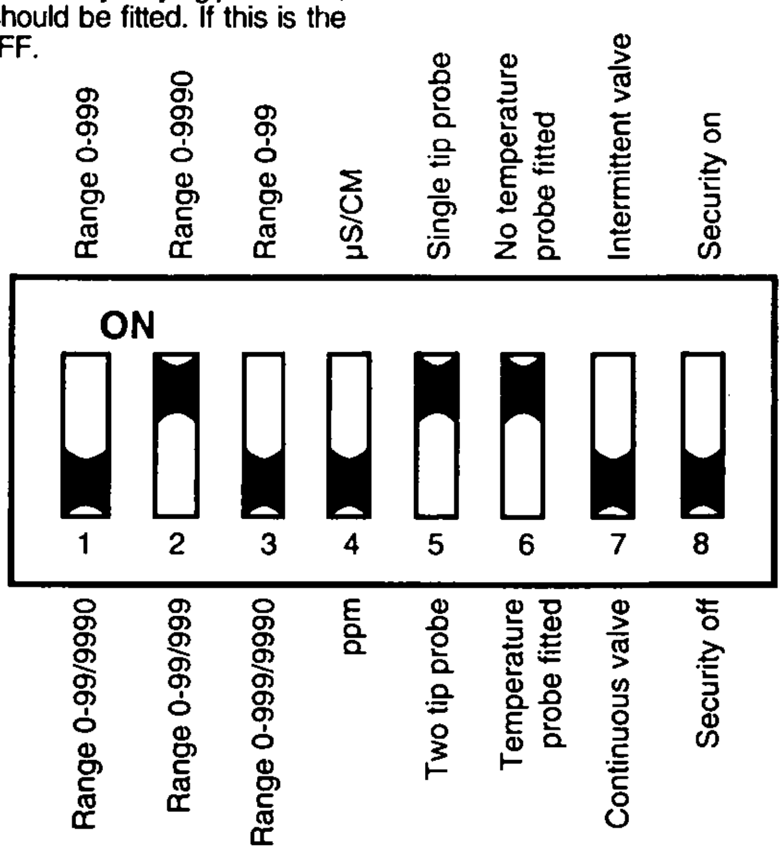
ppm or µS/cm - switch 4.
The controller is supplied set to indicate TDS in parts per million (ppm), with switch 4 OFF.
If a display in micro Siemens per centimetre (µS/cm) is required, set switch 4 to ON.

Probe type - switch 5
The controller is supplied set to work with a single tip probe, with switch 5 ON.
If a two tip (self-compensating) probe is to be used, set switch 5 to OFF.

Temperature compensation - switch 6
The controller is supplied set for use without a temperature probe, with switch 6 ON. For coil boilers, condensate monitoring, or situations where the boiler is likely to be working over widely varying pressures, a temperature probe should be fitted. If this is the case, set switch 6 to OFF.

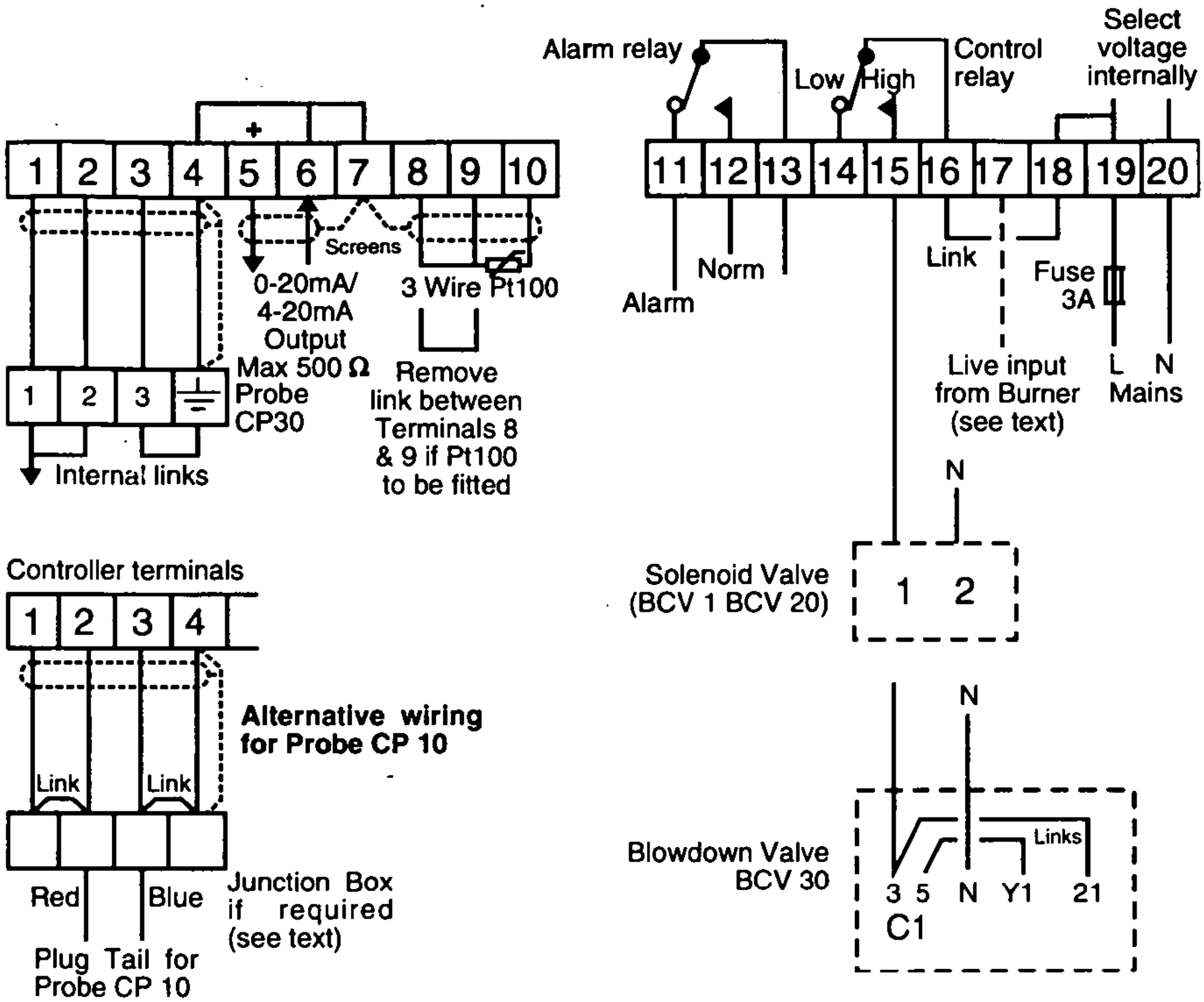
Blowdown valve operation - switch 7
This feature is suitable for use with solenoid or pneumatic valves only. It must not be used with motorised valves.
As supplied, (switch 7 OFF), the boiler blowdown (or condensate dump) valve will remain open continuously while the TDS level is too high.
For smaller boilers where the capacity of the blowdown valve is relatively high compared to the boiler size, continuous operation may lower the boiler water level significantly, perhaps even enough to trigger an alarm.
If it is felt that this situation could occur, set switch 7 to ON.
The valve will then open for 10 seconds, and close for 20 seconds, slowing the rate at which the boiler water is removed so that the level is not unduly affected.

Security feature - switch 8.
The controller is supplied with switch 8 OFF, and will allow any of the parameters to be set or changed.
To prevent unwanted or inadvertent changes being made to the settings, set switch 8 to ON.
The controller will then only allow the calibration to be changed, though the other settings can still be viewed. A manual purge can be made (if the purge timer has been set).



Shown set for 0-9990 ppm, no temperature compensation, continuous valve operation, single tip probe and with parameter security off.

Wiring diagram



Notes on the wiring diagram

The mains/relay and sensor connector sockets must not be transposed; see Safety Warning at the start of this booklet.
Recommended conductor size 1mm². The wiring connections are identified on the PCB, and further detail can be seen if the connector sockets are removed from the controller.
Labels are provided for identification of the two connector sockets.
The wiring diagram is shown with the relays in the power off position.
Relays are rated at 250Vac 3A. For safety reasons, each relay should be protected by a quick-acting fuse rated at 3A or less.
The maximum resistance of the 0/4-20mA output is 500 ohms.

Mains wiring

If different mains supplies are used for the controller power supply and the relays, ensure they are on the same phase.
The mains supply should normally be taken from the boiler panel after the control fuse. A separate mains supply may be used, but must be from the same phase, and fitted with a separate fuse (3A).
The controller additional live input from the burner (terminal 17) can be wired as follows:-
1. Where the probe is fitted in the blowdown line, (intermittent flow),and a purge is required every 30 minutes irrespective of whether the burner has fired, connect the mains supply to terminals 19 (live) and 20 (neutral) as normal, and link terminals 17 and 18.
2. Where the probe is fitted in the blowdown line and a purge is required every 30 minutes of boiler firing (cumulative), connect a live supply from the burner control to terminal 17. This supply should be live whenever the burner is firing.
3. Where the probe is fitted in the boiler, or where there is continuous flow past the probe, no purge is required, so do not connect to terminal 17.

Fit a link between terminals 16 and 18 to provide power to the control relay unless the controller is to be used for alarm only.

Probe wiring

The maximum cable length for all probes is 100m.
All cable wires must be of the same gauge.

Probe in boiler - CP 30
The probe requires a 4 core screened cable connection.
Whilst pairs of conductors are linked at the probe, the four wire connection compensates for voltage drop along the cable.

Probe in blowdown (or condensate) line - CP 10.
For most applications the 1.25m heat resisting probe cable will need to be extended using a junction box.
If not, link terminals 1 to 2, and 3 to 4.
Note that whilst pairs of conductors are linked at the junction box, the four wire connection is required to compensate for voltage drop.

Temperature probe wiring
If a temperature probe is to be used, remove link between controller terminals 8 and 9.
A three or four wire Pt100 temperature probe may be used, but should be connected as a 3 wire probe.
Note:-
For the TP 20, when the cable is to be longer than the 1.25m supplied, a junction box and three core screened cable will be needed.
Colour codes for sensor wires vary, but a three wire sensor will have two wires of one colour, and one wire of a different colour.
Connect the single wire to controller terminal 10, one of the same-coloured wires to terminal 8 and the other to terminal 9.
A four wire sensor will have two wires one colour, and two wires of another colour.
Link one of the pairs at the junction box, and connect to terminal 10.
Connect one of the remaining two wires to terminal 8, and the other to terminal 9.
A temperature sensor is also incorporated in the CP 32 two-tip probe, which is supplied with separate wiring instructions.

Commissioning

Familiarisation

This section describes how the push buttons are used, and what the display readout means. The controller is commissioned in much the same way as a digital watch, using the two push buttons on the front panel, marked '⇧ ' and '⇨'.
The'⇧' button is used to step through the various options available, and also to change settings.
The '⇨' button is used to select settings that are to be changed. The '⇨' button is also used to initiate a purge. See below.
The controller has a simple 'menu' system for setting the different functions. The items are organised as shown in the diagram, and are displayed by pressing the '⇧' button.
Setting is described in the next section.
-Switch the controller on.
The display will show 'CLn' alternating at first with the TDS value, which will be '0000'
'CLn' indicates that the controller is carrying out a probe conditioning cycle.
It does this every time the controller is switched on.
Note:-The display will always show '0000' during a probe conditioning cycle when the controller is first switched on.
Once the conditioning cycle has finished, the controller will show the actual TDS value. Once fully commissioned, the TDS value will alternate with 'bldn' when it is above the set point, with 'AL' when it is above the alarm level, and with 'PurG' when the system is carrying out a purge.
Following the diagram on page 5, press the'⇧' button to step through the items on the menu.
The display will now show 'SP', Set Point.
This allows setting of the TDS value at which the controller will open the blowdown valve (or condensate dump valve).
You will find that the display changes after 20 seconds. If this happens during familiarisation, press the '⇧' button until the required option re-appears.
Press the '⇧' button.
The display will show' HSt'. This is the set point hysteresis setting, an adjustable damping effect which stops the blowdown valve from being switched over-frequently by fluctuations in TDS level due to water circulation.
Press the '⇧' button.
'AL', the alarm setting mode, will be displayed.
The alarm is always set above the set point, and would be used to warn of a very high TDS level.
The alarm level has a fixed hysteresis of 3%.
Press the '⇧' button.
'CAL' will be displayed. This is the calibration setting, which is used to match the controller to the TDS level in the boiler.
To calibrate the controller, a sample of boiler water is taken and its TDS level found with a Conductivity Meter such as the Spirax Sarco MS 1.
Press the '⇧' button to display 'rANG', the range decimal point setting.
The range itself is set using the internal function switch.
Press the '⇧' button.
The display will show 'CLn', the probe conditioning facility mentioned in 'Description'.
This operates every 12 hours for an adjustable period of 0-99 seconds.
It uses an electrical current to restore conductivity to a TDS probe that has become scaled due to less than ideal water treatment, and though extremely useful, must not be regarded as a substitute for good water treatment.
If a probe is becoming scaled, (indicated by a need for increasingly frequent re-calibration), then scale will also be forming in the boiler. Consult a competent water treatment specialist.
Press the '⇧' button.
'PurG' is the next mode to be displayed.
It sets the purge time for installations where the probe is mounted in the blowdown line, to ensure that a 'fresh' sample at near boiler temperature has had time to pass the sensor. The time is adjustable from 0-99 seconds or 0-0.99 of an hour.
Press the '⇧' button.
The 'Filt' mode is only used when the probe is fitted directly in the boiler, and is recommended to increase the damping effect, avoiding over-frequent switching of the blowdown valve.
Press the '⇧' button.
'0-20' or '4-20' will now appear on the display, the selectable output range in mA. It may be changed if required.
Press the '⇧' button.
'PrbE', probe mode, is only used with a 2-tip probe, and sets the action to be taken by the controller on detecting a fouled probe.
Press the'⇧' button again to return to the start of the menu.
The display will show the TDS value once more.
If the TDS value is high enough to open the blowdown valve, the display will alternate with the 'bldn' message. Similarly, if the alarm value has been reached, the display will alternate between the TDS figure and 'AL'.
You can step through the menu as often as you wish by pressing the'⇧' button.

Commissioning the controller

Once familiar with the way in which the controller operates, actual commissioning may be carried out. If the display changes during commissioning (after 20 seconds), press the '⇧' button until the required option re-appears.

Set Point
The set point is the TDS value at which the blowdown or dump valve will open. The boiler manufacturer should be consulted wherever possible to specify the most suitable value.
Switch on the controller, and press the '⇧' button until 'SP' appears.
Press the '⇨' button. Four figures will appear, with the first one flashing.
Use the '⇧' button to change the first figure, then press the '⇨' button.
The second figure will flash.
Use the '⇧' button again to change the second figure, and repeat the operation for the third figure, using the '⇧' button to change it, and the '⇨' button to step to the next figure.
Notes:-
The fourth figure is always zero and cannot be changed.
If one or more of the figures is already showing the correct value, press the '⇨' button to accept it.
If the controller is only being used to provide an alarm, set the 'SP' reading to 9990.

Hysteresis
This is normally set to 5% of the Set Point value, though it can be increased to 10% or more if the valve is found to be operating over-frequently.
Example
Set Point = 3000μS/cm
Hysteresis (5% of Set Point) = 150μS/cm
The controller will open the valve at the Set Point of 3000μS/cm, and will close the valve at 2850μS/cm.
Press the '⇧' button until 'HSt' appears.
Press the '⇨' button to display four figures, with the first one flashing.
Use the '⇧' button to change the first figure and the '⇨' button to step to the next figure.

Alarm
The alarm TDS level is set in accordance with the boiler manufacturers recommendations, and must be above the Set Point Level. Press the '⇧' button to select 'AL', then the '⇨' button to display a four figure display, with the first figure flashing.
Use the '⇧' button to change the figures, and the '⇨' button to step to the next figure.
If the alarm is not used, set the 'AL' reading to 9990.

Calibration
The controller now needs to be set to give an accurate reading of the actual TDS level in the boiler. Allow the previous reading to stabilise for 30 seconds before setting the calibration.
Take a sample of the boiler water and measure its conductivity using a meter such as the Spirax Sarco MS 1.
Press the '⇧' button to select 'CAL', then use the '⇧' and '⇨' buttons to set the controller display to the boiler TDS level.
Press the '⇨' button again to return to the TDS display.

Calibration - probe in blowdown line
It is necessary to set the purge time, as described below, before calibrating the controller. Once this has been set, calibrate the controller as described above, then press the '⇨' button again which will start a purge, and complete the calibration procedure.

Notes on calibration
The boiler must be at working temperature when calibrating a system which does not have a temperature compensation probe.
If the 'CAL' setting is selected again after calibrating the controller, the controller will display a figure different to the one expected.
This figure is used as part of the diagnostic procedure (described in 'Fault Finding').
Calibration should be checked at regular intervals to ensure optimum performance.

Range decimal point
The range is set using the internal range switches.
Select 'rANG' and use the buttons to position the decimal point.

Probe conditioning time
The probe conditioning circuit (Patent Applied For) operates automatically every 12 hours, and also whenever the unit is switched on.
Thus, a 'manual' probe conditioning cycle can be carried out if required by switching the controller off, then on again.
The duration of the conditioning cycle is adjustable up to 99 seconds, but a typical setting would be 20 seconds, increasing if scaling on the probe (and in the boiler) were causing frequent re-calibration to be needed.
Set the duration to zero if the feature is not required.
Select 'CLn' and use the buttons to adjust the duration.

Purge time
This is set to zero if the probe is installed in the boiler.
Where:-
-The probe is installed in the blowdown line
-A quick-acting (solenoid) valve is used
-The sensor is installed close to the boiler
a purge time of 10 seconds is sufficient to ensure that blowdown water at boiler temperature reaches the sensor.
Where a slow opening blowdown valve is used, or where there is rather long or large bore pipework upstream of the sensor, a longer purge time will be required.
To find the purge time:-
Press the '⇧' button until 'PurG' is displayed, then select an initial purge time of 99 seconds.
Allow the blowdown pipework to cool for a minimum of 15 minutes, then, with the controller in normal working mode, (TDS displayed), press the '⇨' button to start a purge cycle.
Note the time taken for the display to stabilise (approximately).
This is the minimum required purge time.
Reset the purge time if required.

Notes
When the blowdown valve is closed the TDS display will not be updated until the next purge.
To initiate a purge at any time in order to update the display press '⇨'.
If the display does not stabilise, set 'PurG' to 0.10 hours (six minutes) and repeat.

Filter
This feature is set to OFF if the probe is installed in the blowdown line.
If the probe is installed directly in the boiler, select 'Filt', then ON. This will increase the damping effect on the probe output, helping to stabilise the display against boiler water TDS fluctuations.

0-20 or 4-20mA
This sets the controller output to suit the two current loop standards in common use. Press the '⇧' button to select (note that the display may show either setting), and the '⇨' button to set the display flashing, then the '⇧' button to change from 4-20mA to 0-20mA or vice versa.

Probe scale detect feature
This feature is only available when a two-tip probe is installed.
It selects the action taken by the controller to a probe with too high a resistance, caused, for example, by scaling.
Select 'PrbE', then press the '⇨' button to select one of the following:-
0. - No action.
This setting is selected where a single tip probe is used.

'1' -If the probe is scaled then the interval between probe conditioning cycles will change from 12 hours to 10 seconds until the probe is clean.

'2' - Alarm relay released, and the display will show 'Flt 1'.

'3' - Alarm relay released, display shows 'Flt 1', and probe conditioning circuit is activated 'continuously'.
Note:-
Certain probe or wiring faults will also trigger the probe scale detect feature.

Maintenance

No special servicing or maintenance of the controller is necessary. In many countries, including the UK, legal regulations are in force concerning boiler blowdown. In particular, attention is drawn to the danger of working on a shut-down boiler whilst other boilers are operating. General guidance for the UK is given in Health and Safety Executive Guidance Note PM 60.

Fault Finding

Many faults that occur on commissioning are found to be due to incorrect wiring or setting up, so we recommend that a thorough check is first carried out should there be a problem.

Malfunctions during service can be due to a build-up of scale on the probe, usually caused by inadequate water treatment.
Note:-If this is the case, scale will also be present in the boiler , and a competent water treatment company should be consulted to avoid the possibility of serious boiler damage.

The controller has several features which can be used as an aid to fault diagnosis.

If a two-tip probe is fitted, the controller can be programmed to automatically start an extended probe conditioning cycle on detection of scaling, as well as to sound an alarm and display a fault code. 'Fit 1'. This is described in 'Commissioning'.

A decimal point will also appear in front of the 'PurG' display if the burner input is live, i.e. the burner is on.

The controller will display 'Flt 2' if any of the settings have become corrupted, and will instead use the following default, or 'emergency' settings:-

'CLn' and 'PurG'	0
'SP'	3000
'HSt'	300
'AL'	5000
'CAL'	3000
Output	4-20mA
'Filt'	OFF
Probe scale detect	0

The probe condition can be checked without removing it from the boiler.
The figure shown on the display when 'CAL' is selected can be used to calculate an approximation of the probe cell constant, an indication of probe condition. We will call this figure the probe factor:-

Press the '⇧' button to display 'CAL' then the '⇨' button to display a figure.
1500 divided by this figure gives the probe factor, which should be between 0.2 and 0.6, with range decimal point set to 9990.
Ignore the decimal point for other settings.

Example:-
'CAL' is 4140.

$$\frac{1500}{4140} = 0.362$$

Probe factor of 0.362 indicates that the probe is in good condition. A lower probe factor represents a more conductive probe.

'CAL' is 1880.

$$\frac{1500}{1880} = 0.798$$

Probe factor of 0.798 is too high, indicating a scaled probe.

Notes

If temperature compensation is not fitted, the probe factor range will be wider. See table:-

		Acceptable probe factor
Temperature compensation fitted		0.2 - 0.6
No temp. comp.		
Boiler temp:-	100°C	0.4 - 1.1
	150	0.3 - 0.8
	200	0.2 - 0.6
	238	0.18 - 0.5

The upper limit for the 'CAL' display is 8190.
If this is approached it is probably because:-

-No link fitted between terminals 8 & 9 when temperature compensation not used.

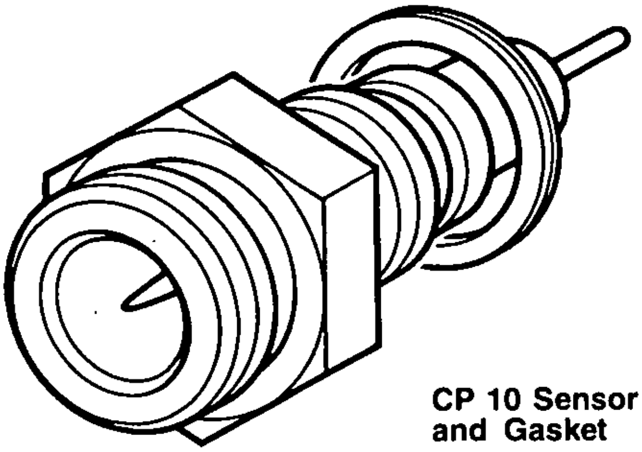
-Wiring incorrect.

-Function switches incorrectly set.

The lower limit for the 'CAL' display is 480.
If this figure is approached it is probably because of:-
-Incorrect wiring.
-Function switches set incorrectly.
-Probe scaled.
If either of these limits are reached it will not be possible to calibrate the controller to the desired value.

CP10 Sensor
Installation and Maintenance Instructions

Description
The CP10 sensor is a conductivity probe specified for use in total dissolved solids (TDS) and conductivity control systems.
It is a sealed unit consisting of a central titanium pin, ceramic insulator and stainless steel body.
The sensor is threaded ⅜" BSP parallel for mounting in a sensor chamber, and has a 24mm AF hexagon. It is supplied with an S-type stainless steel gasket.
Electrical connection is via an IP65 connection (supplied separately).



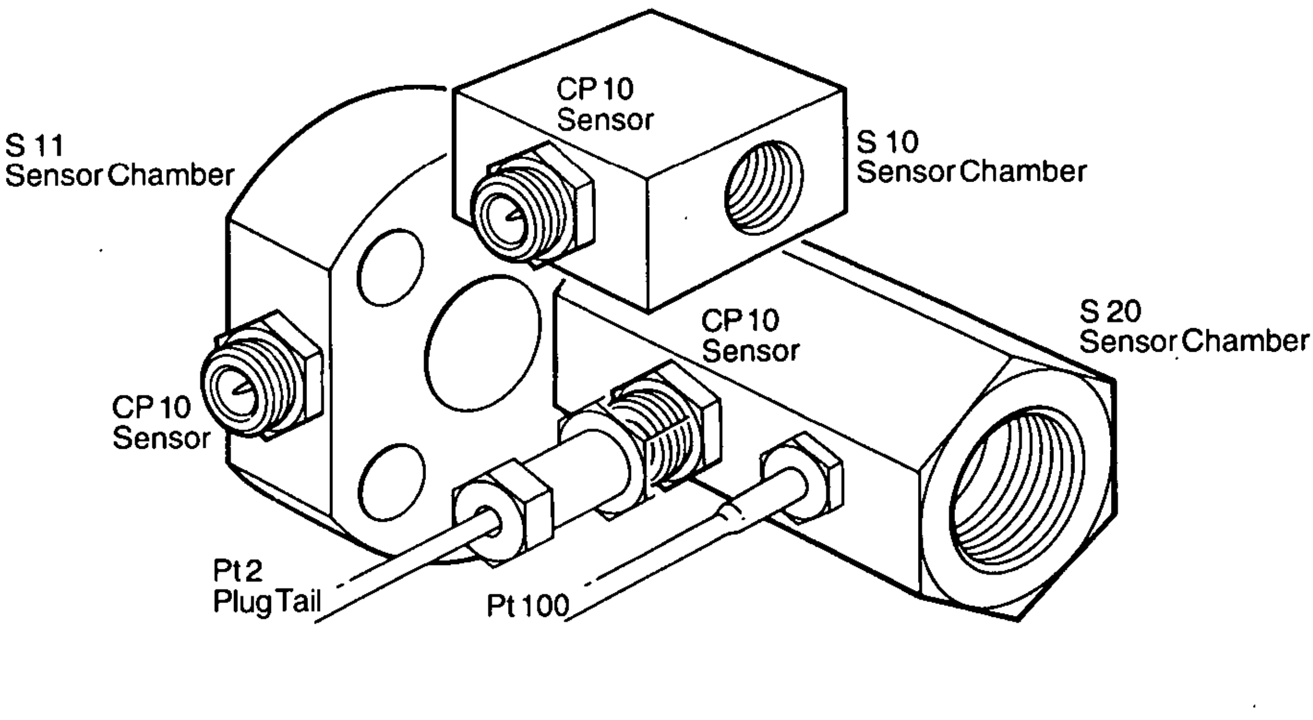
CP 10 Sensor and Gasket

Limiting conditions
Body design PN40
Maximum pressure/temperature 32 bar g at 239°C
Maximum cold hydraulic test pressure 60 bar g

Installation
Fit the gasket and screw the sensor into the side of the sensor chamber so that the sensor is horizontal. Tighten to a torque of 50-56 Nm.
Note:
We do not recommend PTFE tape on the threads, but a graphited or copper based sealing compound may be used to aid subsequent removal.

Maintenance (Annually)
Isolate the system (or with the system empty) remove the sensor and clean the metal pin with fine emery cloth and the insulator with a bristle brush or cloth. Inspect for damage or pitting and refit using a new gasket, part no: 0957191 (Pack of 10) or replace as necessary. (Order as CP10 part no:4030100).
Re-tighten to 50-56 Nm.

Typical Installations:



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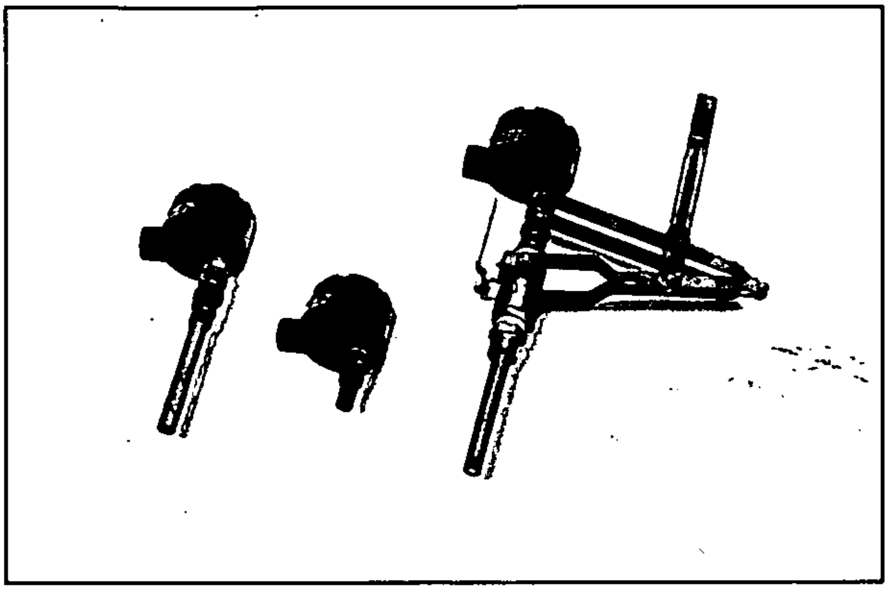
23

Instruction Manual
P/N 5100140
November 1995

Models 140, 141, 142

Conductivity Sensor Assemblies



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MODEL 140, 141, 142 CONDUCTIVITY SENSOR ASSEMBLIES

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

SECTION 1.0
INSTALLATION

1.1 INSTALLATION. This section describes installation procedures to be followed when installing the Model 140, 141, or 142 Sensor.

1.2 RECEIVING INSPECTION. Inspect the shipping container for any shipping damage. If damage is evident, notify the carrier immediately.

If the container appears undamaged, open it and inspect the sensor for damage. If the sensor appears undamaged, proceed to the next section.

Select the appropriate installation instructions for the Model sensor received.

1.3 MECHANICAL INSTALLATION.
1.3.1 Model 140 Sensor Installation. The sensor is installed in either a one-inch weldalet or pipe tee. Refer to Figure 1-1 for part nomenclature and installation information. Install the sensor as follows:

1. Make sure that the distance between the sensor and analyzer/transmitter is within the limits specified in Figure 1-6.
2. Remove plastic shipping cap from the tip of the sensor.
3. Install the Valve Body Fitting in to the Weldalet or Tee as illustrated. (Figures 1-1). Use TEFLON pipe tape on the pipe threads.
4. Position the entire unit for easy access to the Ball Valve Handle, and to the sensor compression fitting hex nuts.
5. Make sure the Retraction Damper Assembly is secured to the Ball Valve Assembly and the J-Box with the four Socket Head, stainless steel screws. Screws should be firmly seated on their shoulders.

WARNING
The stainless steel socket head screws must not be replaced with other screws. Should the screws become lost, or damaged, replace them with part number 22612-00.

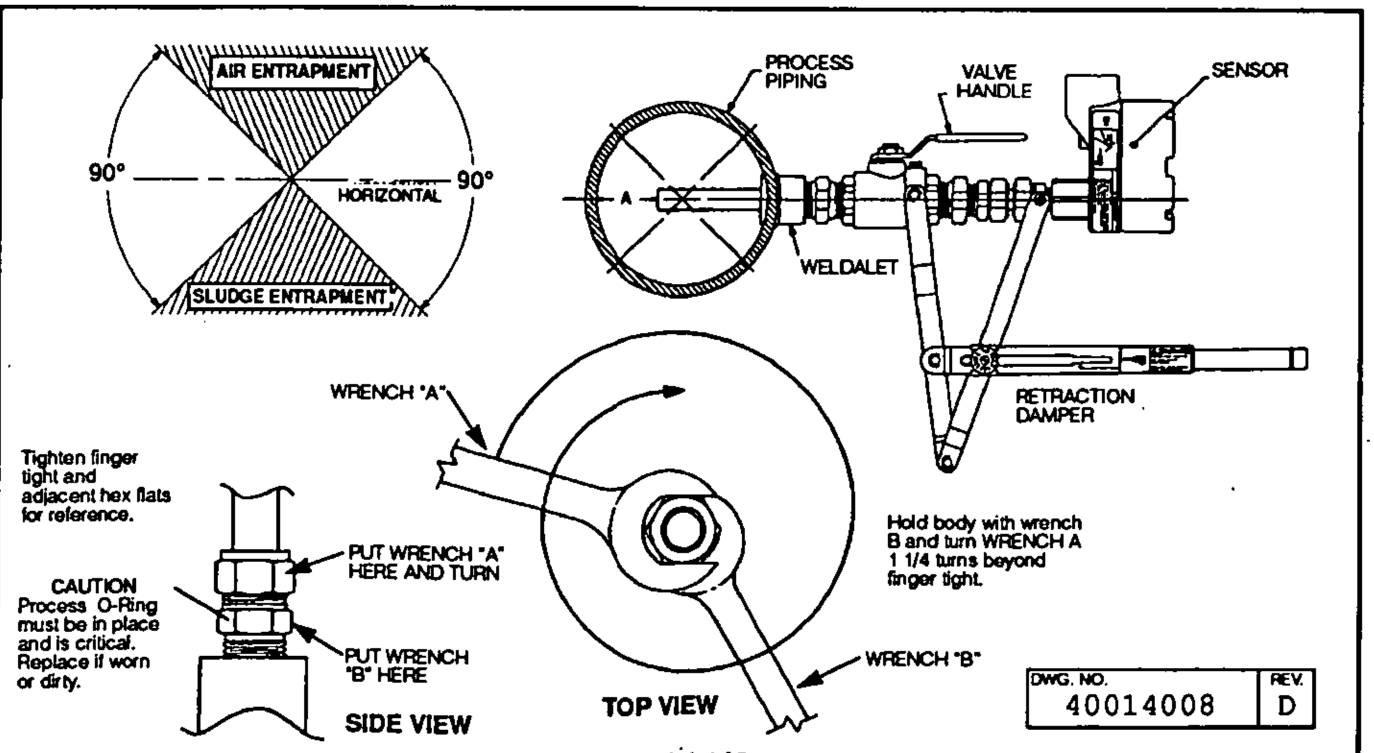


FIGURE 1-1. Model 140 Installation

6. Make sure Ball Valve is in the full open position.
7. Finger tighten the sensor compression fitting. Do not overtighten as you now need to press the sensor into the process pipe.
8. Set the sensor tip about 1 inch from the far wall of the process piping. See dimension A in Figure 1-1.
9. Tighten the compression fitting on the sensor to hold sensor tip in position. See insert on Figure 1-1 for proper compression fitting tightening instructions.

1.3.2 Model 141 Sensor Installation. This sensor may be installed into a 3/4 inch weldalet in the top or side of a vessel, on in a one inch pipe Tee in a flowing process line.

Install Sensor as follows:

1. Make sure that the distance between the sensor and analyzer/transmitter is within the limits specified in Figure 1-6.
2 Remove the plastic shipping cap from the tip of the probe.
3. Install the Model 141 Sensor into the 3/4inch weldalet or pipe Tee (See Figure 1-2). Use TEFLON thread tape on the pipe threads.

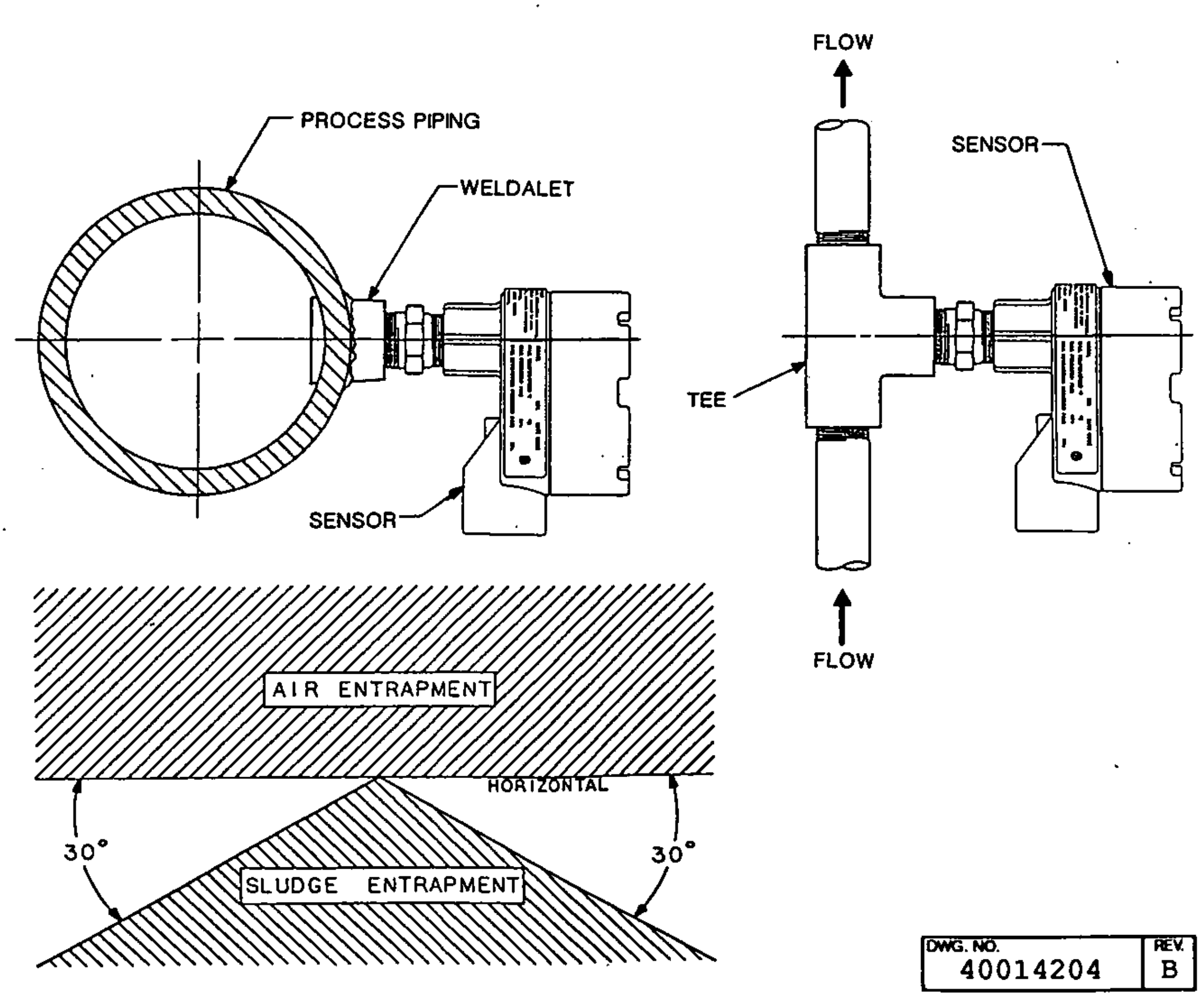


FIGURE 1-2. Model 141 Installation

1.3.3 Model 142 Sensor Installation. This sensor may be installed in a 3/4inch weldalet in the top or side of a vessel, or in a one-inch pipe Tee in a flowing process line.

install as follows:

1. Make sure that the distance between the sensor and analyzer/transmitter is within the limits specified in Figure 1-6.
2. Remove the plastic shipping cap from the tip of the probe.
3. Install sensor into the 3/4inch weldalet or pipe Tee (See Figure 1-3). Use TEFLON thread tape on the pipe threads. DO NOT tighten the sensor compression fitting until the sensor is correctly positioned.
4. Loosen sensor compression fitting and position sensor in Tee as illustrated in Figure 1-3. Tip of sensor must be a minimum of one-inch from any opposing wall.
5. Tighten sensor compression fitting in the same manner as illustrated for the Model 140 sensor compression fitting (Figure 1-1).

1.4 ELECTRICAL INSTALLATION. All 140 series sensors are wired internally to the J-Box terminal strip. Make sure the sensor has been installed within the distance between the sensor and analyzer/transmitter specified in Figure 1-6.

1.4.1 Standard Cable. 4 and 8 conductor cable installation for Rosemount P/N 9200197 and 9200104 cables are shown in Figures 1-4 and 1-5.

1.4.2 Custom Cable. Custom RFI suppressing cable (Rosemount P/N 9200266) wiring diagram is illustrated in Figure 1-5.

When conduit is attached directly to the sensor's junction box, a sufficient length of flexible conduit should be used to allow the sensor to be moved.

Install the cover on the J-Box making sure that the gasket is properly seated.

The sensor is now ready for operation. Please refer to the analyzer/transmitter manual for instrument calibration procedures.

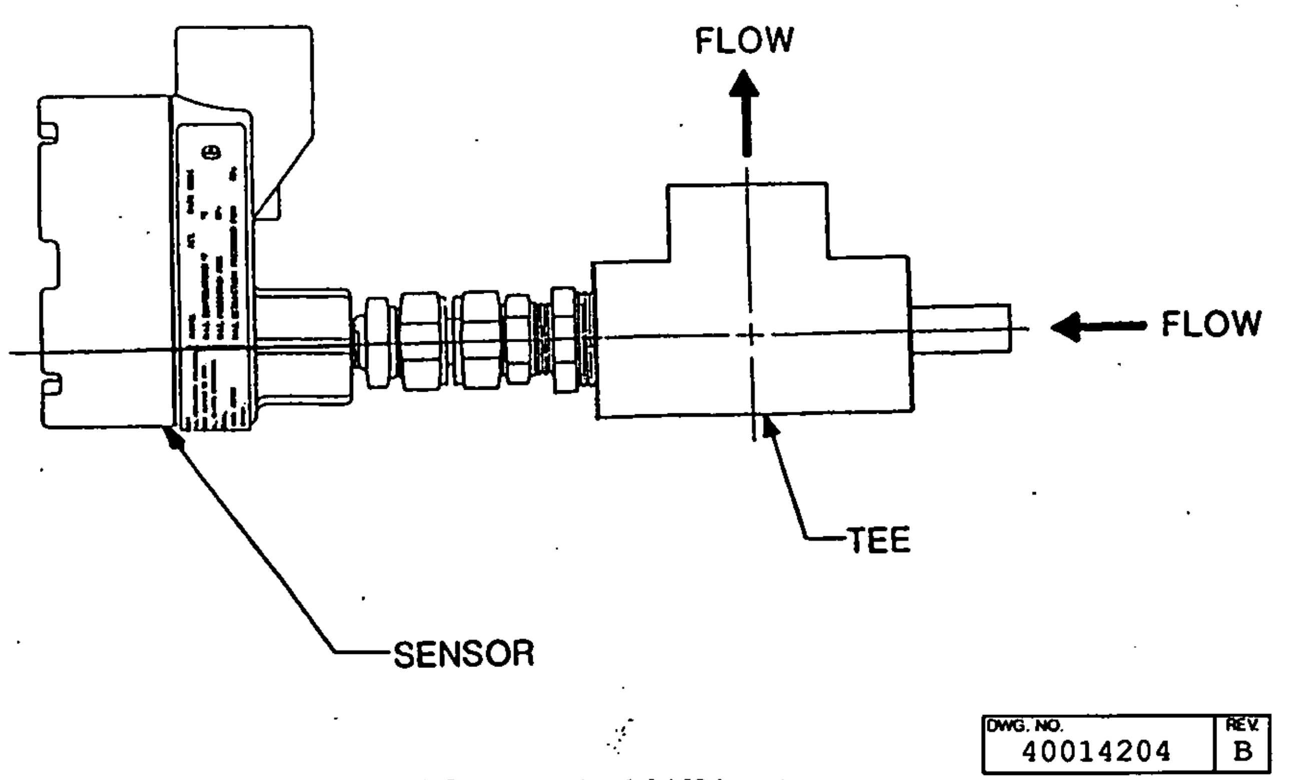


FIGURE 1-3. Model 142 Installation

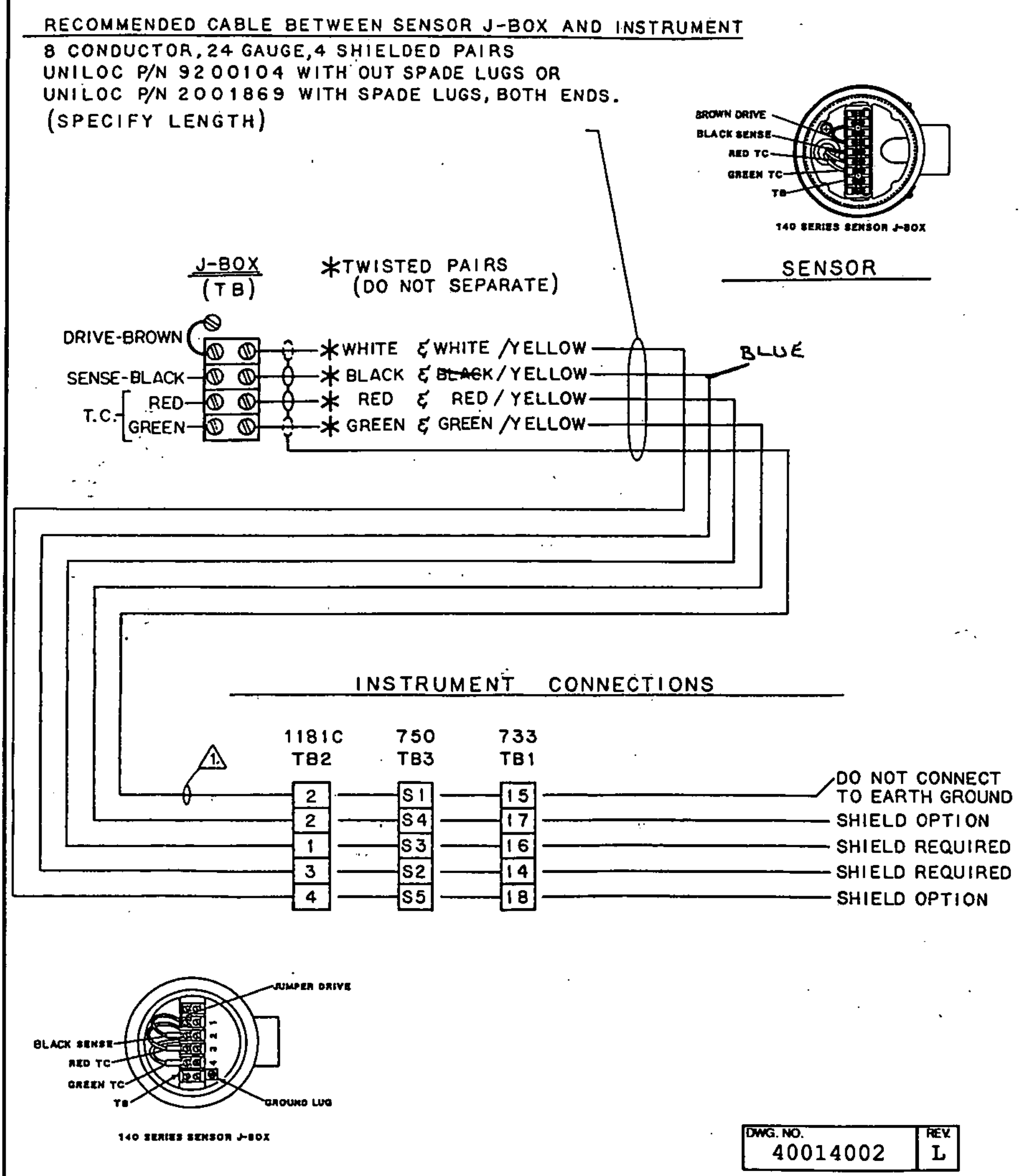


FIGURE 1-4. Wiring Diagram. J-Box to Analyzer/Transmitter 4 and 8 Conductor

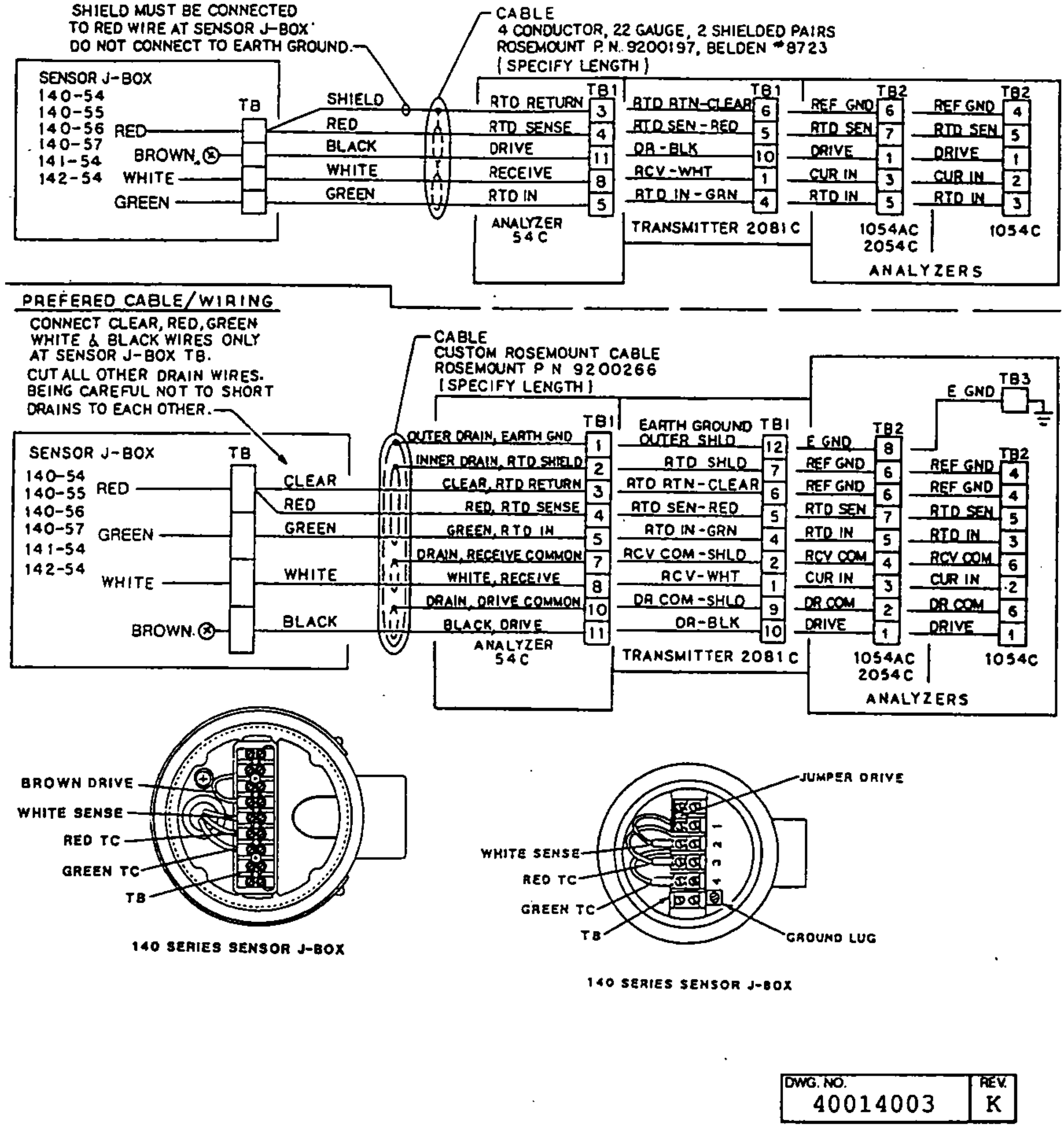
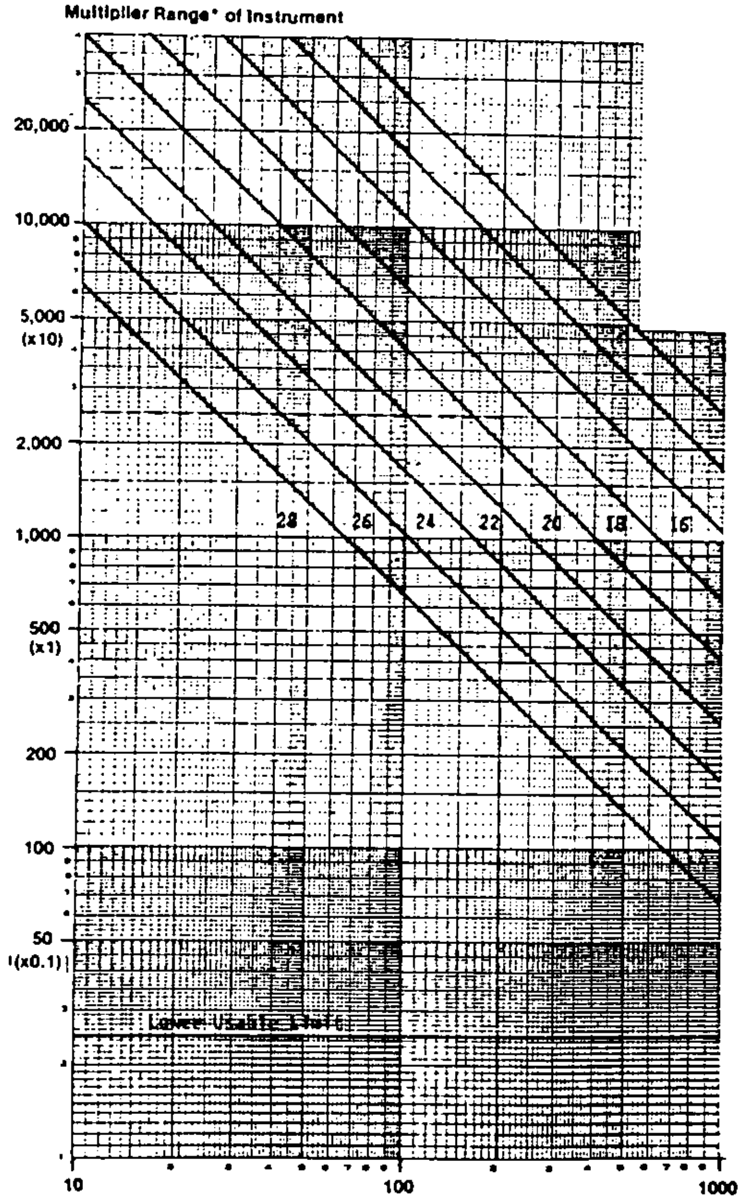


FIGURE 1-5. Wiring Diagram; J-Box to Analyzer/Transmitter Custom Cable P/N 9200266

This graph provides the minimum wire gauge from sensor to transmitter required to hold error, caused by series resistance of the cable, to less than 2% at full scale. This applies to the Models 750, 733, 1181C conductivity analyzers used in the temperature range of 0-100°C with any probe constant.



DISTANCE IN FEET FROM SENSOR TO INSTRUMENT

Example:

Instrument: Model 1181C
Multiplier Range: 10,000
Range Factor: 0.5
Required Instrument to Sensor Distance:
200 feet

1. Select the point on vertical axis which is the product of the Multiplier Range and Range Factor: 0.5 x 10,000 = 5,000.

2. Select 200 feet on horizontal axis.

3. These lines intersect to indicate a minimum gauge wire of 16.

Model 1054C/1054AC/ 1054BC/2054C analyzer to sensor distance limit is 200 feet with standard cable (8 connector 24 AWG. 4 shielded pair).

Do not exceed 1,000 feet without consulting factory. Observe proper shielding regardless of wire size or distance.

* Multiplier Range X Range Factor for Model 750, 733 & 1181C.

FIGURE 1-6. Cable Requirement for Sensor to Instrument Wiring

SECTION 2.0
MAINTENANCE

2.1 GENERAL. This section describes the maintenance required to keep the Models 140, 141 and 142 Conductivity Sensors in good operating condition. Maintenance should be performed to insure the accuracy of your conductivity measurements. The following procedures should be performed by qualified technicians using good shop practices. Refer to the appropriate sensor maintenance instructions.

2.2 MODEL 140. Remove the sensor as follows:

> **WARNING**
> The system pressure must be less than 100 psl.

> **WARNING**
> System pressure may cause the sensor to blow out with great force. Make sure the following steps are performed carefully.

1. Make sure the Retraction Damper restraint is securely fastened to the Valve Body and J-Box compression fitting (See Figure 2-1).
2. Push in on the sensor J-Box and slowly loosen the sensor compression fitting (reversing the sensor tightening procedure illustrated in Figure 1-1).
3. When the sensor compression fitting is completely unscrewed, slowly ease the sensor out until the retraction release button rest firmly against the top of the link slide stop slot.
4. Close the ball valve completely.

> **CAUTION**
> Before removing the sensor, make sure the ball valve is fully closed.

5. Pull the retraction release button and retract the sensor from the ball valve assembly. The sensor may now be positioned for inspection, cleaning or replacement

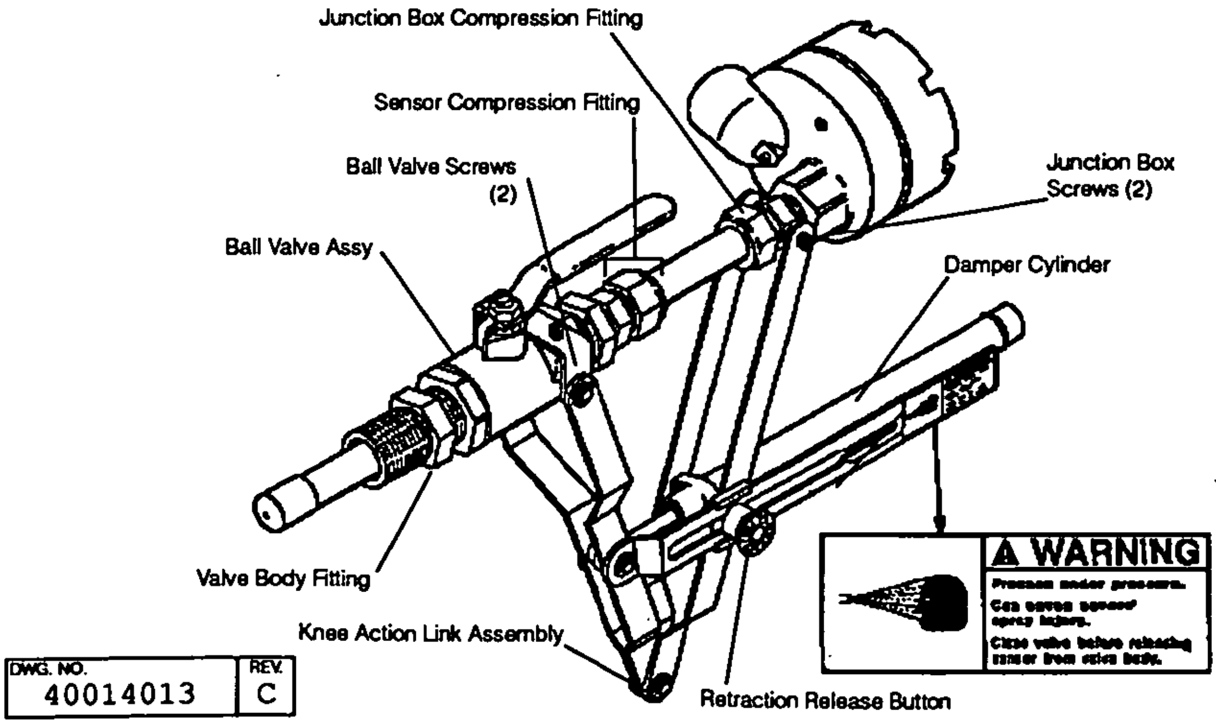


FIGURE 2-1. Model 140 Retraction Damper Restraint System

2.2.1 Temperature Compensation Check. To insure that the temperature compensation circuit is operation satisfactorily, perform the following check:

1. With the the instrument leads disconnected, connect an ohmmeter across the green and red leads of the sensor.
2. The temperature in Table 2-1 should produce the corresponding resistance readings. If process temperature is not known, remove the sensor from process. Have a thermometer next to the probe tip to indicate the temperature.
3. If the temperature compensation element does not respond accurately the sensor should be replaced.

2.2.2 Metallic Electrode Check. The sensor may be checked for electrode stability and operating condition by performing the following check:

1. With the sensor removed from the sensor system and instrument leads disconnected, connect an ohmmeter across the black and white leads of the sensor.
2. Clean the tip of the probe with a 10% solution of nitric acid or mild solvent. Rinse thoroughly with distilled or deionized water and then dry completely.
3. With the probe dry and clean, the resistance should read from 10 megohms to an excess of 100 megohms. The sensor will be operational with a reading as low as 10 megohms, but its service life may not be long. It should be checked and the reading recorded weekly and, if the deterioration continues, the sensor should be replaced.
4. Continuity Check: Measure resistance from TB-1 to outer electrode and TB-2 to center electrode. Both should be zero ohms (see Figure 2-2).

NOTE

Make sure the tip of the probe is dry, other wise the reading could be affected by any moisture on the tip.

2.2.3 Retraction Damper Restraint Check. The integrity of this system, will become compromised if it is allowed to blow out against the link slide stop. In the event that a blowout occurs, replace the Retraction Damper Restraint System with a new assembly. Parts may be ordered from Rosemount Analytical (see Section 4.0 Replacement Parts).

TABLE 2-1. T.C. Element Temperature vs. Resistance

PT 100 T.C. Element[1]	
TEMPERATURE	RESISTANCE
0°C	**100.00 ohms**
10°C	103.90 ohms
20°C	107.70 ohms
25°C	**109.62 ohms**
30°C	111.67 ohms
40°C	115.54 ohms
50°C	119.40 ohms
60°C	123.24 ohms
70°C	127.07 ohms
80°C	130.89 ohms
90°C	134.70 ohms
100°C	**138.50 ohms**
110°C	142.29 ohms
120°C	146.06 ohms
130°C	149.82 ohms
140°C	153.58 ohms
150°C	**157.31 ohms**
160°C	161.04 ohms
170°C	164.76 ohms
180°C	168.46 ohms
190°C	172.16 ohms
200°C	**175.84 ohms**

[1]PT 100 used with standard and high temperature sensors. Compatible with Models 54C/1054A C/ 1054B C and 2054C.

10K Ohms T.C. Element[2]			
TEMPERATURE	RESISTANCE	TEMPERATURE	RESISTANCE
0°C	29.49K	80°C	1458ohms
10°C	18.89K	90°C	1084ohms
20°C	12.26K	100°C	816.8ohms
25°C	10.0K	110°C	623.5ohms
30°C	8194ohms	120°C	481.8ohms
40°C	5592ohms	130°C	376.4ohms
50°C	3893ohms	140°C	297.2ohms
60°C	2760ohms	150°C	237.0ohms
70°C	1990ohms	-	-

100K Ohms T.C. Element[2]			
TEMPERATURE	RESISTANCE	TEMPERATURE	RESISTANCE
0°C	371.4K	80°C	8.35K
10°C	214.5K	90°C	6.45K
20°C	128.0K	100°C	4.54K
25°C	100.0K	110°C	3.24K
30°C	78.7K	120°C	2.38K
40°C	49.8K	130°C	1.78K
50°C	32.4K	140°C	1.35K
60°C	21.6K	150°C	1.01K
70°C	13.8K	160°C	0.77K

[2]10K used with standard sensors. 100K used with high temperature sensors (Option 14). Both are compatible with Models 1181C, 733, and 750.

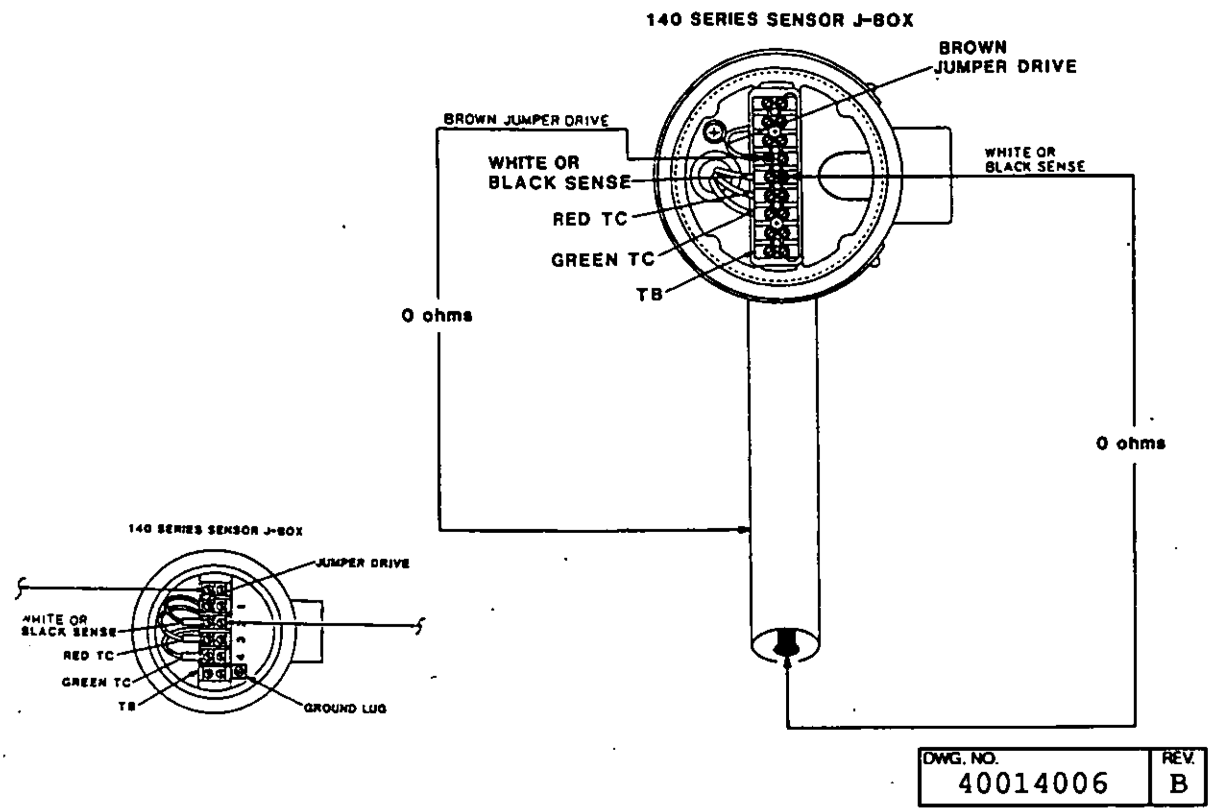


FIGURE 2-2. Sensor Continuity Check

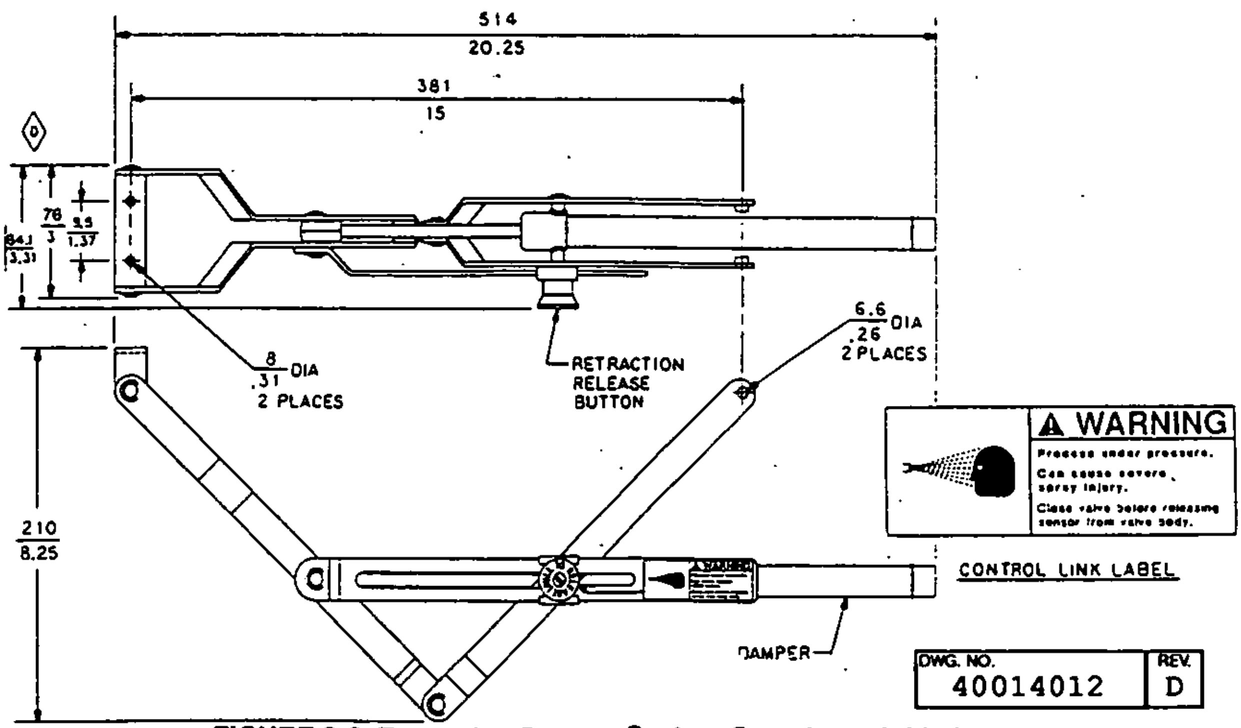


FIGURE 2-3. Retraction Damper System Open Length Limit

2.2.4 Sensor Insertion. Insert the sensor into the ball valve as follows:

> **CAUTION**
> Make sure process o-ring is clean, lubricated and in place before installing sensor. Replace if worn.

1. Ensure that the "Retraction Damper" restraint system is firmly secured at both ends, attaching the valve and the sensor.

2. DO NOT open the ball valve.

> **WARNING**
> **The system pressure must be less than 100 psi.**

3. Carefully push the sensor into the ball valve. The retraction release button must rest firmly at the top of the link slide stop slot.

> **CAUTION**
> Do not push past this point. Damage to the sensor could result.

> **WARNING**
> **If the sensor comes free of the valve, refer to Figure 2-1 and verify that the valve and associated fittings are as shown. Do not proceed until the sensor is correctly restrained.**

4. Slowly open the valve.

> **WARNING**
> **Stand clear of the sensor.**

5. Insert the sensor up to the process fitting and turn the sensor compression fitting until it is finger tight.
6. Position the entire sensor for easy access to the ball valve handle, sensor compression fitting hex nuts and sensor J-Box wiring terminals.
7. Tighten sensor compressing fittings.

> **CAUTION**
> If initial installation of the sensor, turn the nut an additional 1-1/4 turns. If a **reinstallation,** turn no more than 1/4 to 1/2 additional turns!

2.3 MODEL 141. Make sure the system pressure is shut off and remove the sensor as follows:

> **WARNING**
> Process flow or pressure must not be present.

1. Unscrew the sensor at the pipe fitting or weldalet.
2. Clean the tip of the probe with a 10% solution of nitric acid, or other mild cleaning solvent
3. Check the temperature compensation element as instructed in Paragraph 2.2.1.
4. Check the metallic electrode as instructed in Paragraph 2.2.2.
5. Install the sensor into process fitting. Use TEFLON tape on the pipe threads.

2.4 MODEL 142. Make sure the system pressure is shut down and remove the sensor as follows:

> **WARNING**
> Process flow or pressure must not be present.

1. Loosen the process fitting and slowly slide the sensor from the pipe fitting of weldalet.
2. Clean the tip of the probe with a 10% solution of nitric acid, or other mild cleaning solvent.
3. Check the temperature compensation element as Instructed in Paragraph 2.2.1.
4. Check the metallic electrode as instructed in Paragraph 2.2.2.
5. Install the sensor by sliding the probe into process fitting and position the probe as in the original installation.

> **CAUTION**
> Make sure the probe is in the same position as originally installed. The probe takes a permanent set and could be weakened if set is adjacent to original set.

6. Tighten sensor compression fitting 1/4 to 1/2 turn after finger tight. Refer to Figure 1-2.

SECTION 3.0
PARTS LIST

3.1 GENERAL. Individual components for the Models 141 and 142 are not replaceable. One complete sensor should be stocked as a spare. Please refer to the ordering information in Section 1, page 4 of this manual.

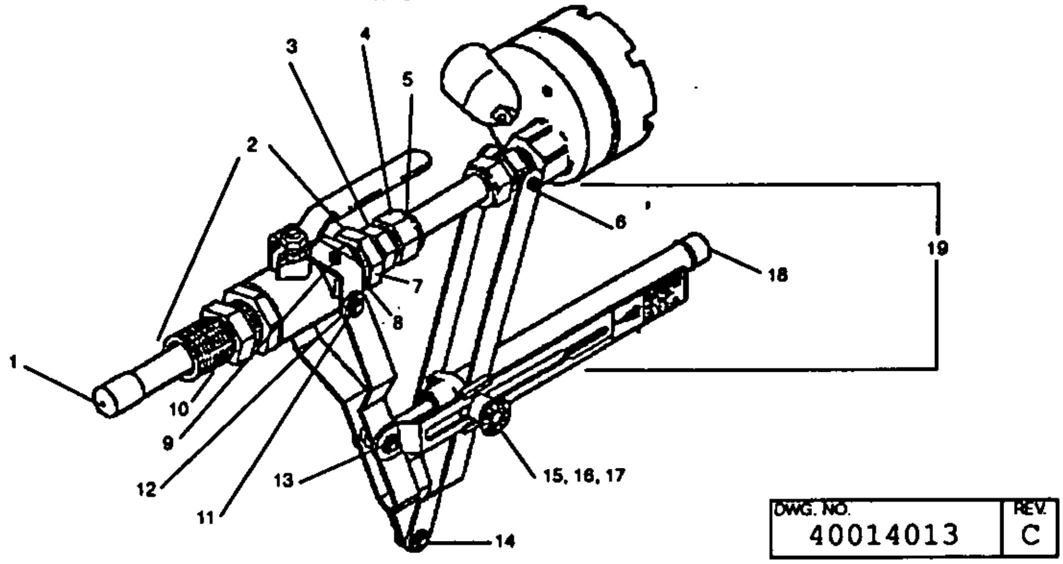


FIGURE 3-1. Conductivity Sensor Assembly, Model 140

MODEL 140 REPLACEMENT PARTS			
ITEM	**P/N**	**CODE**	**DESCRIPTION**
1	140-04	04	Sensor and J-box with 0.2 constant, w/replacement ferrule, 10K TC
1	140-06	06	Sensor and J-box with 1.0 constant, w/replacement ferrule, 10K TC
1	140-05[1]	05	Sensor and J-box with 0.2 constant, high temp construction, 100K TC
1	140-07[1]	07	Sensor and J-box with 1.0 constant, high temp construction, 100K TC
1	140-54[1]	54	Sensor and J-box with 0.2 constant, PT100 TC
1	140-55[1]	55	Sensor and J-box with 0.2 constant, high temp construction, PT100 TC
1	140-56[1]	56	Sensor and J-box with 1.0 constant, PT100 TC
1	140-57[1]	57	Sensor and J-box with 1.0 constant, high temp construction, PT100 TC
2	2001861	18	Kit, 316 SST ball valve
3	9300160	All	Connector Male S.S. 3/4" OD Tube x 3/4" MPT (included in item 2)
4	3001882	All	Kit, 3/4-inch 316 SST for process fitting (included with item 1)
5	9310063	All	Ferrule, 3/4-inch 316 SST for process fitting connector (included with item 1)
6	22612-00	All	Screws Shoulder (2 each)
7	9550102	All	O-ring, 2-018 Viton[2] (included with item 2)
8	9300123	All	Bushing 1 MPT x 3/4 inch 304 S.S. (included in item 2)
9	9560316	All	10-24 X .38 Screws (2)
10	9300148	All	Process Connection - Hex Nipple 1 inch MPT 304 S.S. (included in item 2)
11	33266-00	All	Pin-Clevis-.260
12	9560300	All	Ring, Retainer
13	33266-02	All	Pin Clevis-.885
14	33266-00	All	Pin Clevis-.510
15	9160392	All	Spring
16	9560299	All	Screw, shoulder
17	33265-00	All	Knob-Release
18	9160390	All	Retraction Damper only
19	23539-00	All	Retraction Damper kit

[1]Sensors come without replacement ferrule and nut. Ordering a replacement ferrule and nut with spare sensor is recommended.
[2]Registered U.S. Pat. Office for du Pont's fluorocarbon elastomer.

SECTION 4.0
DESCRIPTION AND SPECIFICATIONS

- HIGH TEMPERATURE 316 SS AND PEEK CONSTRUCTION operates up to 200°C (392°F).
- MODEL 140 RETRACTABLE SENSOR installs through a one-inch ball valve.
- INCLUDES ALL INSTALLATION HARDWARE.
- RUGGED CAST ALUMINUM WEATHER PROOF JUNCTION BOX provides easy access to field wiring.
- MEASUREMENT RANGES FROM 0-1 uS/cm to 0-20,000 uS/cm.
- NO CARBON ELECTRODES.

4.1 FEATURES AND APPLICATIONS.

The Rosemount Analytical Models 140, 141, and 142 Conductivity Sensors are designed for measuring conductivity in high temperature and pressure applications. A choice of cell constants allow measurements in low to medium conductivity level samples. The sensor's corrosion resistant 316 stainless steel construction and ability to be inserted directly into a process line or through the side of a vessel make them rugged and easy to install and maintain.

The Model 140 Retractable Conductivity Sensor simplifies sensor installation and maintenance because it can be removed from a pressurized line or vessel without shutting down or using bypass sample lines. The sensor's measuring electrodes is inserted into process through a 1 inch ball valve and a Viton[1] process seal. To retract the sensor, a retaining nut is loosened, the sensor backed out of the process and the ball valve closed.

The standard Model 140 operates up to 150°C. High temperature options (Codes 05, 07, 55, or 57) must be selected to measure up to 200°C. The choice of a 0.2 or 1.0 cell constant allows conductivity measurements up to 20,000 microsiemens/cm with the Rosemount Analytical Models 54C, 1054A C, 1054B C, 2054 C, 1181C and 2081C.

The Model 141 Insertion Sensor measures conductivity in high temperature, high pressure applications. The standard Model 141 is constructed of 316 stainless steel and Kel-F[2] and can operate at temperatures up to 150°C. An optional high temperature version (Code 14) can operate at temperatures up to 200°C and is constructed of 316 stainless steel and PEEK. The choice of a 0.2 or 1.0 cell constant allows conductivity measurements up to 20,000 microsiemens/cm with the Rosemount Analytical Models 54C, 1054A C, 1054B C, 2054C, 1181C, 2081C and 733.

The Model 142 Low Conductance Insertion Sensor measures low conductivity solutions at high temperatures and pressures. The standard Model 142 is constructed of 316 stainless steel and Kel-F, and can operate at temperatures up to 150°C. An optional high temperature version (Code 14) can operate at temperatures up to 200°C and is constructed to 316 stainless steel and PEEK. The choice of a 0.01 or 0.1 cell constant allows measurement ranges from 0-1 microsiemens/cm and up to 0-2,000 microsiemens/cm with the Rosemount Analytical Models 54C, 1054A C, 1054B C, 1181C, 2081C, 733.

[1] A registered trademark of E. I. du Pont de Nemours and Company.
[2] A registered trademark of 3M Company.

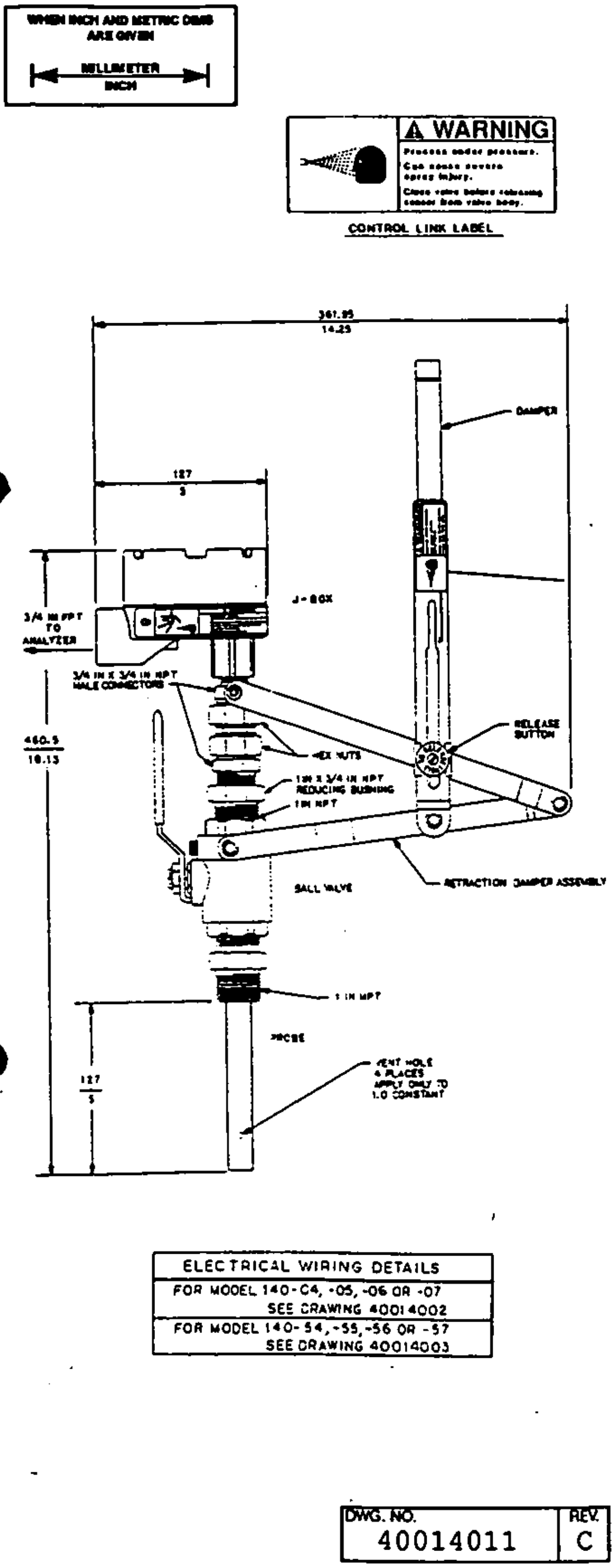


FIGURE 4-1. Model 140 Mounting Dimensions

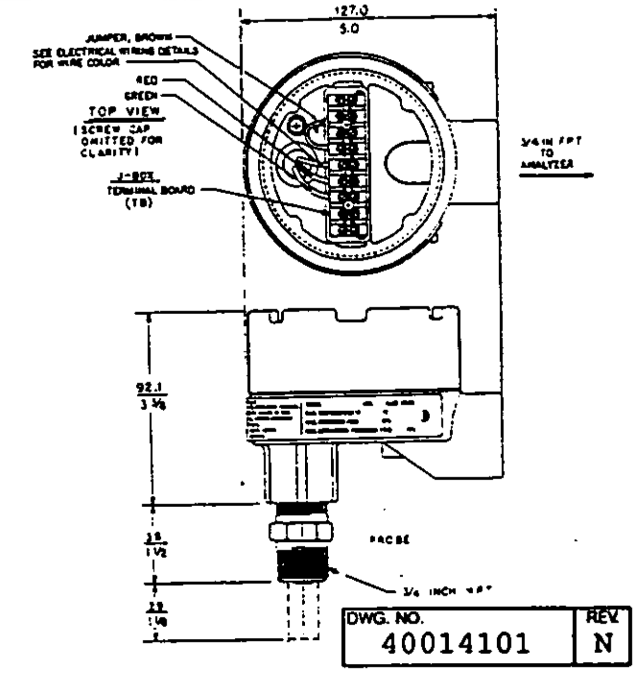


FIGURE 4-2. Model 141 Mounting Dimensions

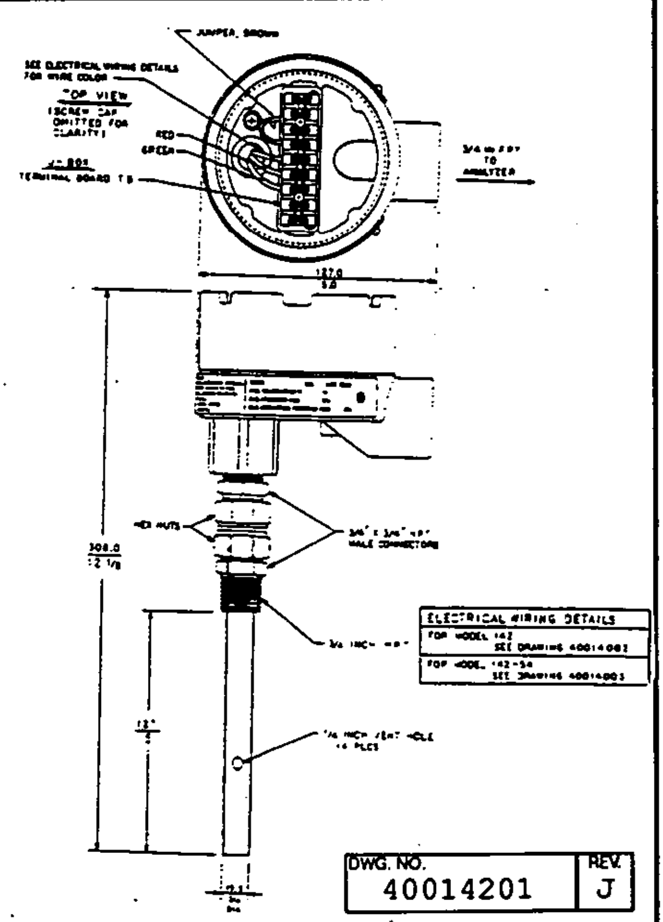
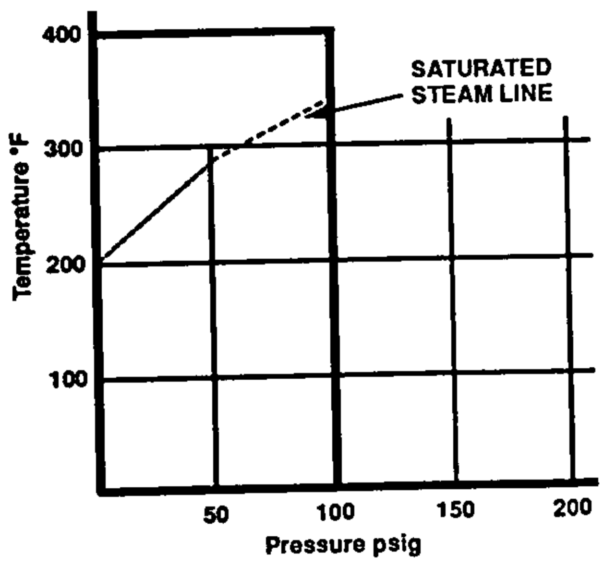


FIGURE 4-3. Model 142 Mounting Dimensions

SPECIFICATIONS	MODEL 140	MODEL 141	MODEL 142
Cell Constant	0.2 and 1.0	0.2 and 1.0	0.01 and 0.1
Maximum Temperature	Standard: 150°C (302 °F) @ 100 psig (689.5 KPa) High Temp: 200°C (392°F) @ 100 psig (689.5 KPa)	Standard: 150°C (302 °F) @ 250 psig (1723.7 KPa) High Temp: 200°C (392°F) @ 250 psig (1723.7 KPa)	Standard: 150°C (302 °F) @ 250 psig (1723.7KPa) High Temp: 200°C (392°F) @ 250 psig (1723.7KPa)
Maximum Pressure	See Graph	See Graph	See Graph
Compensation Temperature	Codes 04, 06, 54, 56: 0 to 150°C (32 to 302°F) Codes 05, 07, 55, 57: 100 to 200°C (212 to 392°F)	Standard: 0 to 150°C (32 to 302°F) High Temp: 100 to 200°C (212 to 392°F)	Standard: 0 to 150°C (32 to 302°F) High Temp: 100 to 200°C (212 to 392°F)
WETTED MATERIALS Electrodes and Insulators	316 Stainless Steel. Kel-F[1] for standard temp. PEEK for high temp.	316 Stainless Steel. Kel-F[1] for standard temp. PEEK for high temp.	316 Stainless Steel. Kel-F[1] for standard temp. PEEK for high temp.
O-Rings	VITON[2]	VITON[2]	VITON[2]
Sensor Body	316 Stainless Steel	316 Stainless Steel	316 Stainless Steel
Junction Box	Cast Aluminum	Cast Aluminum	Cast Aluminum
Weight/Ship Weight	5 lbs/6 lbs (2.26/2.72 kg)	2 lbs/3 lbs (0.9/1.4 kg)	4 lbs/5 lbs (1.9/2.3 kg)

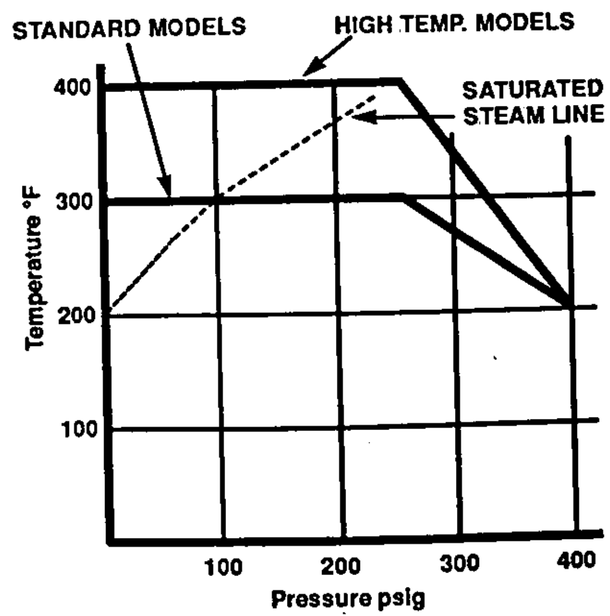
[1] A registered trademark of 3M Company.
[2] A registered trademark of E. I. du Pont de Nemours and Company

TABLE 4-1A. MODEL 140 Maximum Pressure



High temperature T.C. element required (instrument T.C. range must be compatible.

TABLE 4-1B. MODELS 141 and 142 Maximum Pressure



4.2 ORDERING INFORMATION.

The Model 140 Retractable Conductivity Sensor: Designed for insertion through a one inch ball valve. Materials of construction include 316 SS electrodes with Kel-F[1] insulator for low temperature service up to 150°C, or PEEK insulator for high temperature service up to 200°C. Standard features include a cast aluminum NEMA 7D junction box, optional 316 SS ball valve, and a choice of cell constants of either 0.2 or 1.0.

MODEL	
140	RETRACTABLE CONDUCTIVITY SENSOR (6 lbs./2.7 kg)

CODE	GROUP I FOR USE WITH MODELS 1181C (Required selection - one only from Group I or II)
04	0.2 cell constant
05*	0.2 cell constant, high temperature construction
06	1.0 cell constant
07*	1.0 cell constant, high temperature construction

CODE	GROUP II FOR USE WITH MODEL 54C, 1054A C, 1054B C, 2054C & 2081C
54	0.2 cell constant
55	0.2 cell constant, high temperature construction
56	1.0 cell constant
57	1.0 cell constant, high temperature construction

CODE	OPTIONS (Required Selection)
18	316 SS ball valve (2 lbs./1 kg)

140	04	54	18	EXAMPLE

NOTES:
*Instrument must be supplied with 100°-200°C temperature compensation range.
[1] Registered Trademark of 3M Company.

The Model 141/142 Insertion Conductivity Sensor: Designed for high pressure, high temperature service. The Model 141 Sensor cell constants of 0.2 and 1.0 are suitable for measurements up to 20,000 microsiemens/cm. The Model 142 Sensor cell constants of 0.1 and 0.01 provide low level conductivity measurements. The sensors are constructed to operate up to 150°C. To operate between 100°C and 200°C, the high temperature option (Code 14) must be selected. The sensors do not come with interconnecting cable. The cable must be ordered separately.

MODEL	
141/142	INSERTION CONDUCTIVITY SENSOR

CODE	CELL CONSTANT (Required Selection)
01	0.01 supplied with junction box, stainless steel tag (specify marking) (Model 142 only)
03	0.1 supplied with junction box, stainless steel tag (specify marking) (Model 142 only)
04	0.2 supplied with junction box, stainless steel tag (specify marking) (Model 141 only)
06	1.0 supplied with junction box, stainless steel tag (specify marking) (Model 141 only)

CODE	TEMPERATURE (Required Selection)
13	Standard construction for operation up to 150°C
14*	High temperature construction for operation between 100°C and 200°C

54	For use with Model 54C, 1054A C, 1054B C, 2054C & 2081C

141	06	13	54	EXAMPLE

*Model 1181C must be supplied with 100° to 200°C temperature compensation range. Instrument must have compatible T.C. circuit.

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1-800-654-7768

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ROSEMOUNT ANALYTICAL

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SECTION 5.0
RETURN OF MATERIAL

5.1 GENERAL. To expedite the repair and return of instruments, proper communication between the customer and the factory is important. A return material authorization number is required. Call 1-800-654-7768 or 714 863-1181. The "Return of Materials Request" form is provided for you to copy and use in case the situation arises. The accuracy and completeness of this form will affect the processing time of your materials.

5.2 WARRANTY REPAIR. The following is the procedure for returning products still under warranty.

1. Contact the factory for authorization.
2. Complete a copy of the "Return of Materials Request" form as completely and accurately as possible.
3. To verify warranty, supply the factory sales order number or the original purchase order number. In the case of individual parts or sub-assemblies, the serial number on the mother unit must be supplied.
4. Carefully package the materials and enclose your "Letter of Transmittal" and the completed copy of the "Return of Materials Request" form. If possible, pack the materials in the same manner as it was received.

IMPORTANT

Please see second section of "Return of Materials Request Form". Compliance to the OSHA requirements is mandatory for the safety of all personnel. MSDS forms and a certification that the instruments have been disinfected or detoxified are required.

5. Send the package prepaid to:

   Rosemount Analytical Inc.
   2400 Barranca Parkway
   Irvine, CA 92714

   Attn: Factory Repair

   Mark the package: Returned for Repair

   RMA # ____________

   Model No. ____________

5.3 NON WARRANTY REPAIR.

1. Contact the factory for authorization.
2. Fill out a copy of the "Return of Materials Request" form as completely and accurately as possible.
3. Include a purchase order number and make sure to include the name and telephone number of the right individual to be contacted should additional information be needed.
4. Do Steps 4 and 5 of Section 5.2.

NOTE

Consult the factory for additional information regarding service or repair.

RETURN OF MATERIALS REQUEST

·IMPORTANT!
This form must be completed to insure expedient factory service.

CUSTOMER

FROM:	RETURN	BILL TO:
____________	____________	____________
____________	____________	____________
____________	____________	____________

NOTICE TO SENDER

CUSTOMER/USER MUST SUBMIT MATERIAL SAFETY SHEET (MSDS) OR COMPLETE STREAM COMPOSITION, AND/OR LETTER CERTIFYING THE MATERIALS HAVE BEEN DISINFECTED AND/OR DETOXIFIED WHEN RETURNING ANY PRODUCT, SAMPLE OR MATERIAL THAT HAVE BEEN EXPOSED TO OR USED IN AN ENVIRONMENT OR PROCESS THAT CONTAINS A HAZARDOUS MATERIAL **ANY OF THE ABOVE THAT IS SUBMITTED TO ROSEMOUNT ANALYTICAL WITHOUT THE MSDS WILL BE RETURNED TO SENDER C.O.D.** FOR THE SAFETY AND HEALTH OF OUR EMPLOYEES. WE THANK YOU IN ADVANCE FOR COMPLIANCE TO THIS SUBJECT.

SENSOR OR CIRCUIT BOARD ONLY:
(Please reference where from in MODEL / SER. NO. Column)

1. PART NO. ____________ 1. MODEL ____________ 1. SER. NO. ____________
2. PART NO. ____________ 2. MODEL ____________ 2. SER. NO. ____________
3. PART NO. ____________ 3. MODEL ____________ 3. SER. NO. ____________
4. PART NO. ____________ 4. MODEL ____________ 4. SER. NO. ____________

REASON FOR RETURN

PLEASE CHECK ONE:

☐ REPAIR AND CALIBRATE
☐ EVALUATION
☐ REPLACEMENT REQUIRED? ☐ YES ☐ NO
☐ DEMO EQUIPMENT NO. ____________
☐ OTHER (EXPLAIN) ____________

DESCRIPTION OF MALFUNCTION:

____

REPAIR STATUS

WARRANTY REPAIR REQUESTED:

☐ YES-REFERENCE ORIGINAL ROSEMOUNT ANALYTICAL ORDER NO. ____________
CUSTOMER PURCHASE ORDER NO. ____________
☐ NO-PROCEED WITH REPAIRS-INVOICE AGAINST P.O. NO. ____________
☐ NO-CONTACT WITH ESTIMATE OF REPAIR CHARGES: LETTER ☐ ____________
PHONE ☐ ____________

NAME ____________ PHONE ____________
ADDRESS ____________
____________ ZIP ____________

RETURN AUTHORITY FOR CREDIT ADJUSTMENT [Please check appropriate box(s)]

☐ WRONG PART RECEIVED
☐ DUPLICATE SHIPMENT
☐ RETURN FOR CREDIT
☐ REPLACEMENT RECEIVED
REFERENCE ROSEMOUNT ANALYTICAL SALES ORDER NO. ____________
RETURN AUTHORIZED BY: ____________
WARRANTY DEFECT ____________

24-6047

Rosemount Analytical Inc.
2400 Barranca Parkway
Irvine, CA 92714 USA
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Fax: (714) 474-7250

ROSEMOUNT® ANALYTICAL

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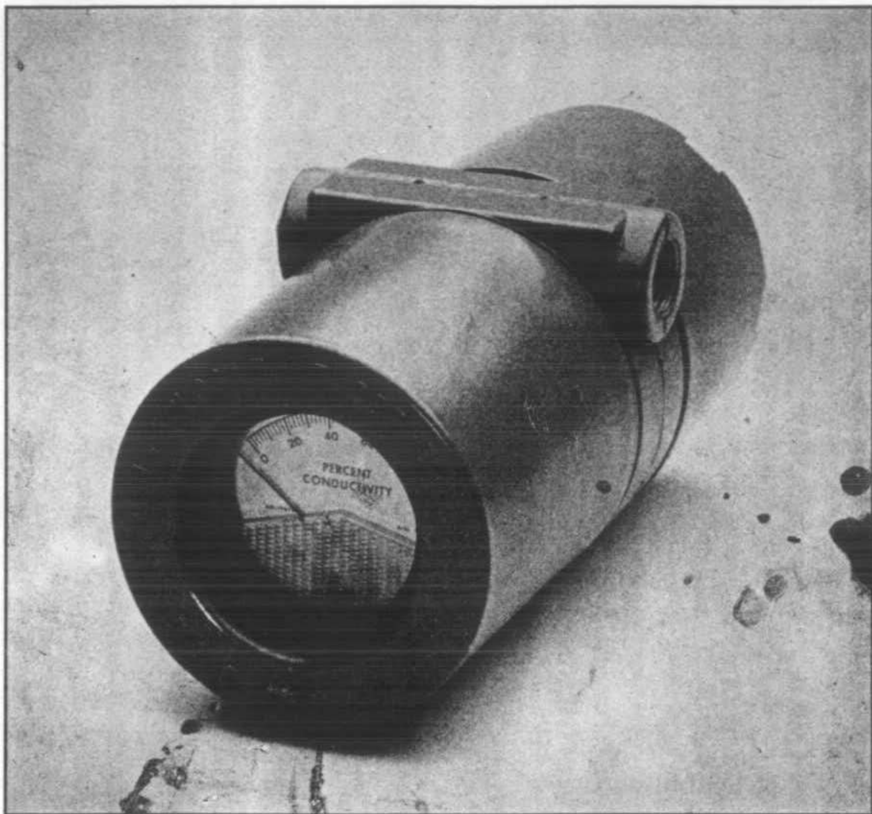
Instruction Manual
P/N 5101181C
February 1996

Model 1181C E96-61658

Two-Wire Transmitter



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MODEL 1181C
TWO-WIRE TRANSMITTER

TABLE OF CONTENTS

1.2 PERFORMANCE SPECIFICATIONS

Power Supply Requirements: See Figure 1-2

Lift Off Voltage:

Blind & Analog: 10 VDC
Digital: 12.5 VDC

Maximum Operating Power: 40 milliwatts

Output: Isolated 4-20 mA into 700 ohms at 24 VDC (blind & analog)
Isolated 4-20 mA into 575 ohms at 24 VDC (digital)

Input/Output Isolation: 600 VDC

Accuracy: 1.0% of full scale (±2.0% for X20,000 range)

Stability: ±1.0%/month, non-cumulative

Digital Display Accuracy: 0.1% RDG +1 count

Repeatability: ±0.5% of full scale

Temperature Coefficient: 0.1% per °C full scale

Relative Temperature: -30 to +70°C (-22 to 158°F)

Ambient Humidity: 0 to 99% RH

Temperature Compensation: Automatic, 5 to 85°C (standard)
50 to 150°C (Code 08)
100 to 200°C (Code 09)
See Maximum Operating Temperature chart for use with X10,000 internal range select position.

T.C. Slope: 0 to 4%/°C (continuously adjustable)

Internal Range Select: X100, X1000, X10000

Range Factor: X0.5, X1.0, and X2.0

External Zero: 20-turn potentiometer, ±7% full scale

Internal Coarse Span: ±20% full scale

EMI/RFI: EN50081-1
EN50082-2 CE

1.3 PHYSICAL SPECIFICATIONS

Enclosure: NEMA 4X, weatherproof and corrosion-resistant.
NEMA 7 B, explosion proof

Approvals/Area Classification:

EXPLOSION-PROOF

FM: Class I, Groups B, C, & D, Division 1
Class II, Groups E, F, & G, Division 1
Class III, Division 1

CSA: Class I, Groups C & D, Division 1
Class II, Groups E, F, & G, Division 1
Class III, Division 1 Encl 4, Factory Sealed
Class I, Groups A, B, C, & D, Division 2

Intrinsic Safety:

FM: Class I, II,& III, Division 1
CSA: Class I, Division 1 Encl 4,Temp Code T4, Groups A, B, C, & D
BASEEFA: EEx ia IIB T4, TAMB = 55° C
SAA: Class I, Zone O/Ex ia IICT5

Display: Blind (Code 02)
Analog: plug in, 90°, 2.5 inch diameter
1181C: single scale, 0-100%
1181T: single scale, 0-100%
Digital: 3½ digit LCD, adjustable range in engineering units

Recommended Cable: Transmitter to power supply: Two-wire (shielded), Belden 8760 or equivalent, P/N 9200001.

Weight/Shipping Weight:
1181C:
Blind: 1.8 kg/2.25 kg (4 lbs./5 lbs.)
Digital/Analog: 2.48 kg/2.93 kg (5.5 lbs/6.5 lbs.)

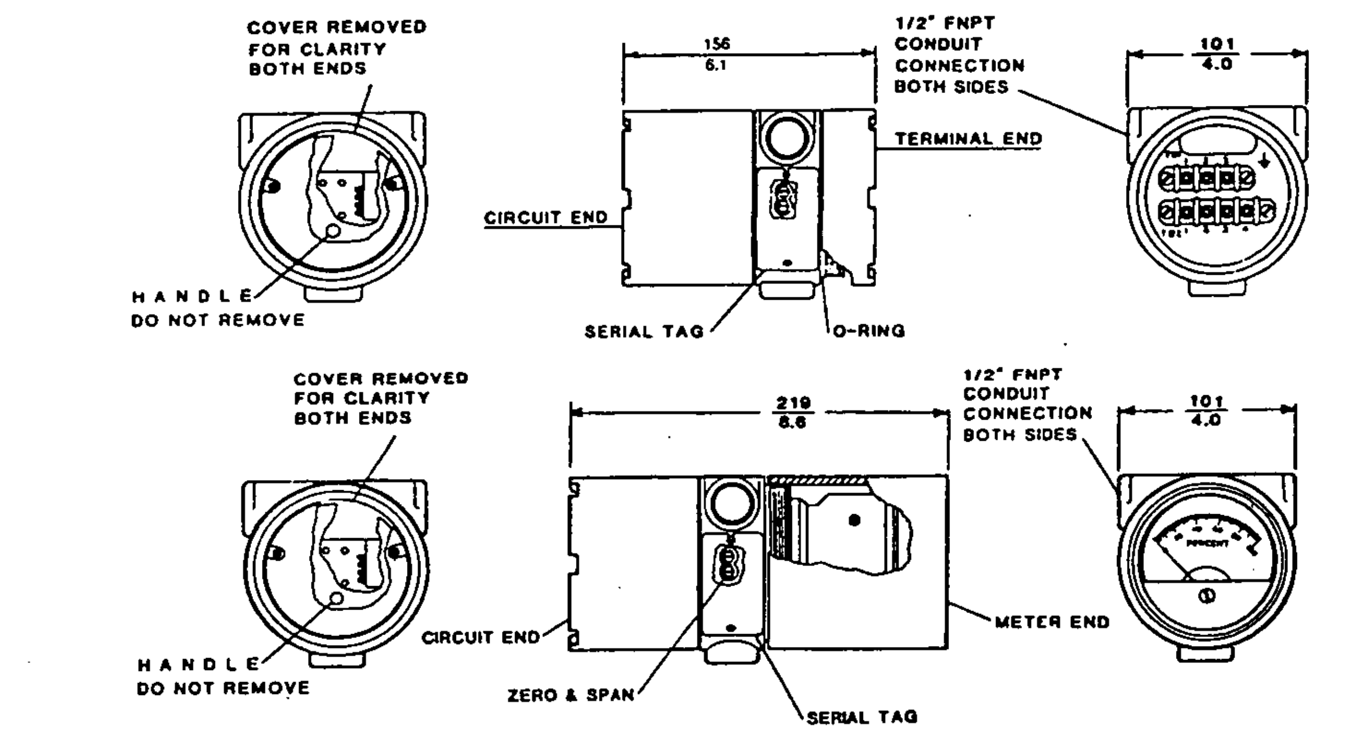


FIGURE 1-1. Mounting and Dimensional Drawing

1.4 ORDERING INFORMATION

The Model 1181C Two-Wire Transmitter is housed in a corrosion-resistant, NEMA 7B explosion-proof. 4X weatherproof, corrosion resistant enclosure and includes all circuitry necessary for measurement and transmission of an isolated 4-20 mA signal. The transmitter may be selected with or without an analog or digital display, or as a blind unit.

MODEL
1181C TWO-WIRE TRANSMITTER

CODE	DISPLAY (Must select one)
01	FM and CSA approved analog indication, 0-100% (6.5 lbs.)
02	Blind, no indication (5.0 lbs.)
03	FM and CENELEC approved analog indication 0-100% (6.5 lbs.)
06	FM, CSA, & CENELEC approved digital indication, 0-100% (6.5 lbs.)

CODE	TEMPERATURE COMPENSATION (Must select one)
08	Automatic T.C. range, 50°C-150°C
09	Automatic T.C. range, 100°C-200°C (requires high temp. T.C. element in sensor)
10	Automatic T.C. range, 5°C-85°C

CODE	OPTIONS
07	Two-inch pipe/wall mounting bracket (1.0 lb.)
11	Stainless steel nameplate (specify marking)

CODE	AGENCY APPROVALS (Not available with digital display)
67	FM approved, intrinsically safe (approved safety barrier required), and explosion-proof.
69	CSA approved, intrinsically safe (approved safety barrier required), and explosion-proof.
73	CENELEC approved, intrinsically safe (approved safety barrier required), and explosion-proof.

1181C	01	10	11	67

NOTE: Recommended cable from +24 volt DC power supply to Model 1181 is Belden P/N 8760 or order P/N 9200001 (bare); $10.00 plus $1.00/ft. Specify length.

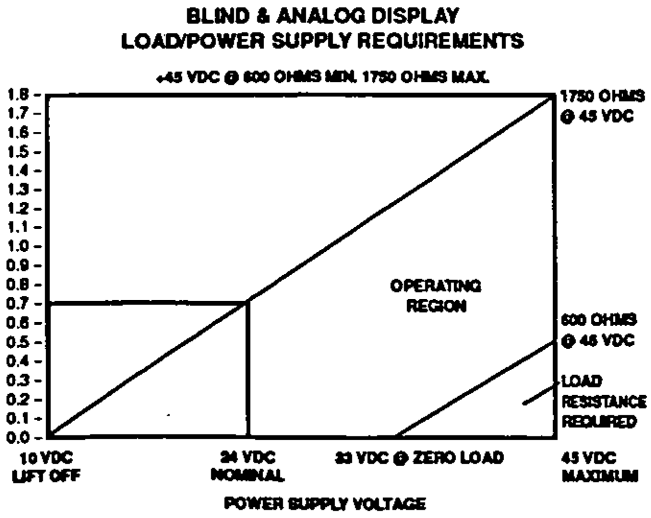


FIGURE 1-2. Power Supply Voltage

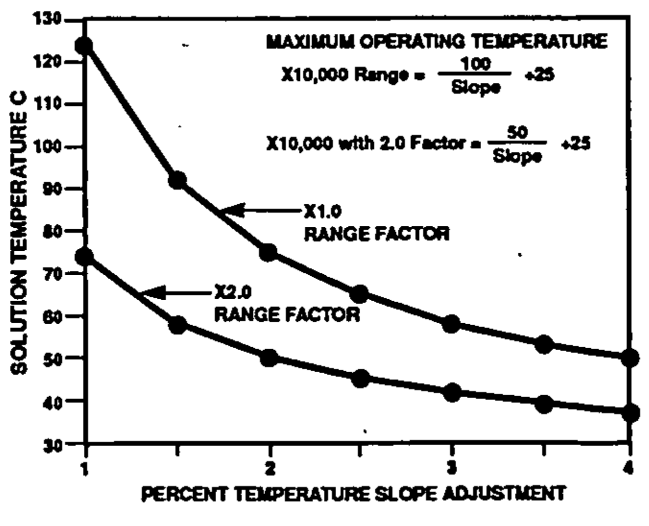


FIGURE 1-3. Temperature Slope Adjust
(10,000 Range Multiplier)

SECTION 2.0
INSTALLATION

2.1 GENERAL. The transmitter may be installed in harsh environmental locations. The transmitter should, however, be located to minimize the effects of temperature gradients and temperature fluctuations, and to avoid vibration and shock.

2.2 MECHANICAL INSTALLATION. Two threaded mounting holes are located in the bottom of the transmitter housing.These holes are provided for mounting to a flat surface or for attaching the transmitter to the pipe mounting bracket (see Figure 2-1).

NOTE

If the transmitter is mounted in a vertical position, the sensor leads should come into the top of the housing and the power leads should come into the bottom of the housing.

2.3 ELECTRICAL INSTALLATION. The transmitter has ½-inch conduit openings, one on each side of the housing. One opening is for the power signal wiring, and the other is for the input wiring from the sensor.

NOTE

On models with analog indication, make sure the meter wiring is securely connected after the signal input wiring have been attached.

2.3.1 Sensor input wiring terminals are located on the side of the housing designated TERM SIDE on the serial label, and are the lower set of terminals (TB2). Remove the end cap from the TERM SIDE of the housing to gain access to the terminals (see Figure 2-2).

2.3.2 Conduit connections on the transmitter housing should be sealed or plugged (using a sealing compound) to avoid accumulation of moisture in the housing. If the connections are not sealed, the transmitter should be mounted with the electrical housing downward for draining.

2.3.3 The transmitter case shall be grounded. Power supply regulation is not critical. Even with a power supply ripple of one volt peak-to-peak, the ripple in the output signal would be negligible.

NOTE

For best EMI/RFI protection, the power supply/signal cable should be shielded and enclosed in an earth grounded rigid metal conduit. Connect the cable shield to the transmitter's grounding terminal near TB1 (see Fig. 2-2).

The sensor cable should also be shielded. This shield should be grounded to the transmitter's grounding terminal or grounded to the transmitter's enclosure via an appropriate metal cable gland/grounding fitting.

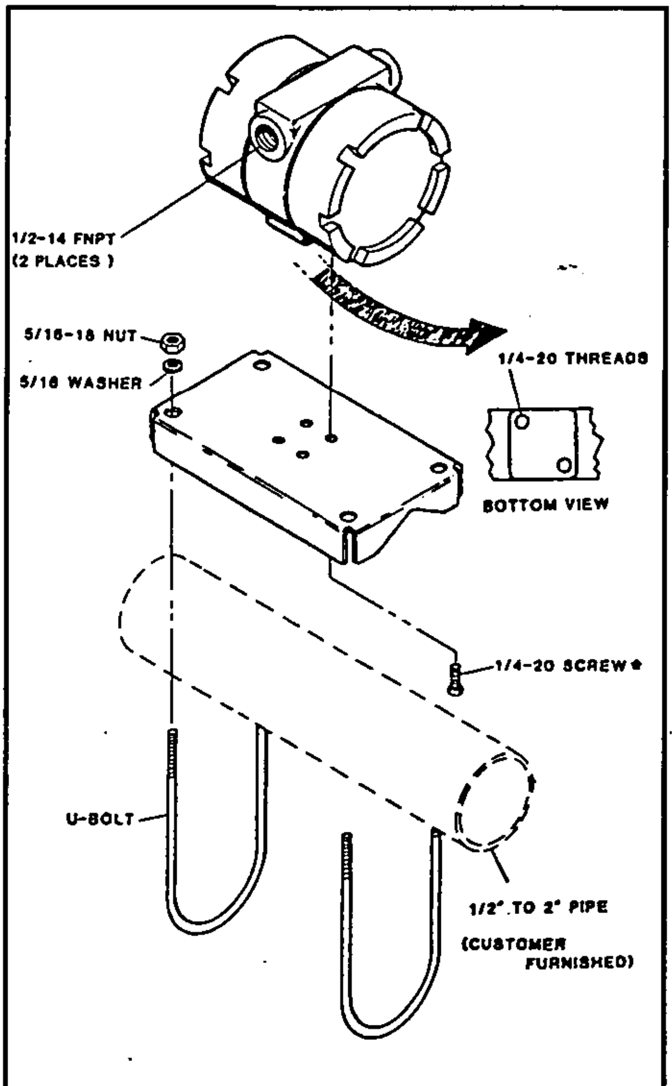
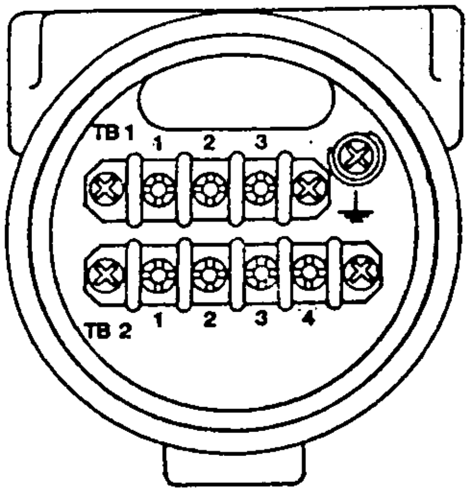


FIGURE 2-1. Transmitter Mounting Details



TB1-1 LOOP SIGNAL (POWER SUPPLY + VdC
TB1-2 METER (+) RED
TB1-3 METER (-) BLACK & LOOP SIGNAL (4-20) mA OUTPUT)
TB2-1 T.C. (RED)
TB2-2 T.C. (GREEN & SHIELD)
TB2-3 PROBE COMMON (BLACK)
TB2-4 PROBE DRIVER (WHITE)

TB2 connects to sensors Model 110, 112, 140, 141, 142, 150, and 160

FIGURE 2-2. Transmitter Wiring Details

2.4 HAZARDOUS LOCATIONS-EXPLOSION-PROOF INSTALLATIONS. In order to maintain the explosion proof rating for the installed transmitter, the following conditions must be met:

1. The transmitter enclosure covers must be on hand tight and the threads must not be damaged.

NOTE
These covers seat on o-rings which serve to provide a dust proof enclosure for Class II and Class III installations.

2. Explosion proof "Y" fittings must be properly installed and plugged with a sealing compound to prevent explosive gases from entering the transmitter. CSA has determined that the transmitter housing is "Factory Sealed". Installation of "Y" fittings and the use of sealing compound is not required for CSA approved Explosion Proof installations.

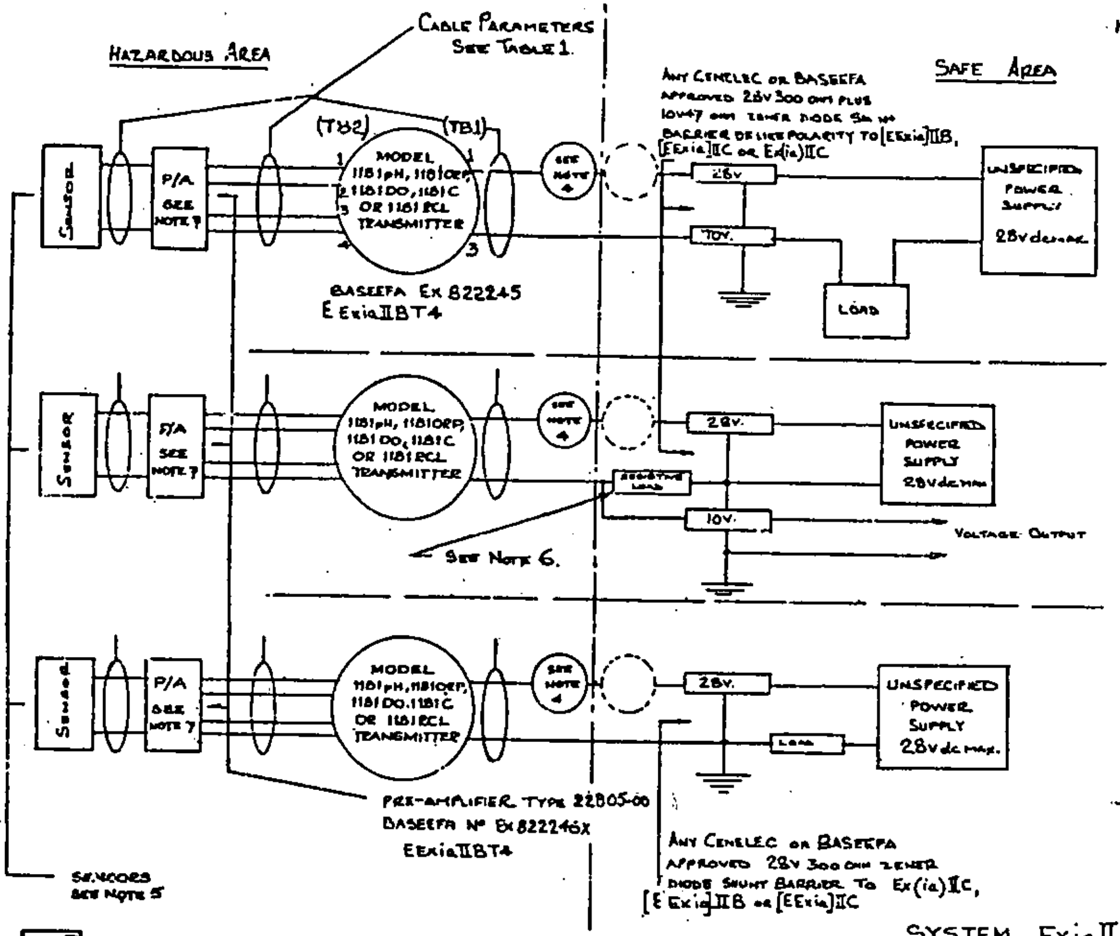
NOTE
Do not install sealing compound until all field wiring is complete.

CAUTION
Sealing compound must be installed prior to applying power to the transmitter.

3. If one of the conduit connections on the housing is not used, it must be closed with a threaded metal plug with at least five threads engaged.
4. The serial tag cover on the external ZERO and SPAN adjustments must be in place.
5. Explosion proof installation must be in accordance with drawing number 1400155 (see Figure 2-14).
6. Due to the nature of the measurement, sensors cannot be designed to meet explosion proof certification. If the sensors must be installed in hazardous area locations, Rosemount Analytical Inc. recommends that an intrinsically safe system be installed.

2.5 HAZARDOUS LOCATIONS-INTRINSICALLY SAFE INSTALLATIONS. To secure and maintain intrinsically safe installation for the appropriate approval agency, the following conditions must be met:

1. Code 73 must be specified when ordering CENELEC/BASEEFA units. Installation must be performed in accordance with Drawing Number 1400143 (see Figure 2-3, 4 & 5).
2. Code 69 must be specified when ordering CSA (Canadian Standards Association) units. Installation must be performed in accordance with Drawing Number 1400125 (see Figure 2-6).
3. Code 67 must be specified when ordering F.M. (Factory Mutual) units. Approved "Entity" Installation must be accordance with Drawing Number 1400153 (see Figure 2-11, 12 and 13). Approved "Loop" installation must be In accordance with Drawing Number 1400128 (see Figure 2-7, 8, 9 and 10).



NOTES.

1. THE INSTALLATION MUST CONFORM TO THE REQUIREMENTS OF BS5345 PART 4 1977.

2. THE CIRCUIT AT THE SUPPLY TERMINALS (TB1) OF THE MODEL 1181 TRANSMITTER MUST BE CAPABLE OF WITHSTANDING AN A.C. TEST VOLTAGE OF 500 VOLTS RMS WITH RESPECT TO EARTH OR FRAME OF THE APPARATUS FOR A PERIOD OF ONE MINUTE WITHOUT BREAKDOWN.
THE PRE-AMPLIFIERS AND SENSORS NEED NOT MEET THE 500 VOLT INSULATION REQUIREMENT DUE TO THE ELECTRICAL ISOLATION BETWEEN SIGNAL AND SUPPLY TERMINALS (TB2), (TB1) OF THE TRANSMITTER.

3. UNSPECIFIED SAFE AREA APPARATUS MUST NOT BE SUPPLIED FROM OR CONTAIN UNDER NORMAL OR ABNORMAL CONDITIONS A SOURCE OF POTENTIAL EXCEEDING 250 VOLTS r.m.s. OR 250 VOLTS d.c.

4. OPTIONAL 4-20mA METER MAY BE MOUNTED IN EITHER THE SAFE OR HAZARDOUS AREA AND MUST HAVE A MINIMUM DEGREE OF PROTECTION OF IP20 AND BE APPROVED TO AT LEAST EExiaIIBT5 OR ExiaIIBT5.

5. SENSORS SHALL MEET THE REQUIREMENTS OF SIMPLE APPARATUS AS DEFINED IN BS5345 Pt.4 1977 PARA. 6.3.3 AND SHALL HAVE A MINIMUM PROTECTION OF IP20.

6. THE RESTIVE LOAD WHEN CONNECTED TO THE HAZARDOUS AREA TERMINALS MUST HAVE A DEGREE OF PROTECTION TO AT LEAST IP20.

7. PRE-AMPLIFIERS ARE ONLY REQUIRED WHEN USED IN CONJUNCTION WITH MODELS 1181pH & 1181ORP TRANSMITTERS

8. THE CAPACITANCE AND INDUCTANCE OR INDUCTANCE/RESISTANCE (L/R) RATIO OF THE HAZARDOUS AREA CABLES FOR EACH INSTALLATION SHOWN ON THIS SHEET MUST NOT EXCEED THE VALUES SHOWN IN TABLE 1.

C

TABLE 1
MAXIMUM CABLE PARAMETERS

GAS GROUP	CAPACITANCE	INDUCTANCE	L/R RATIO
IIB	0.16 μF	3.0 mH	165.0 μH/Ω
IIA	0.71 μF	8.0 mH	440.0 μH/Ω

SYSTEM ExiaIIB BASEEFA Nº Ex82248

REDRAWN FROM
DWG. NO. 6-012-C002
SHEET 1 OF 3, REV. E

DWG. NO.	REV.
1400143	C

FIGURE 2-3. Installation of 1181 Series for Intrinsically Safe Operation (1 of 3)

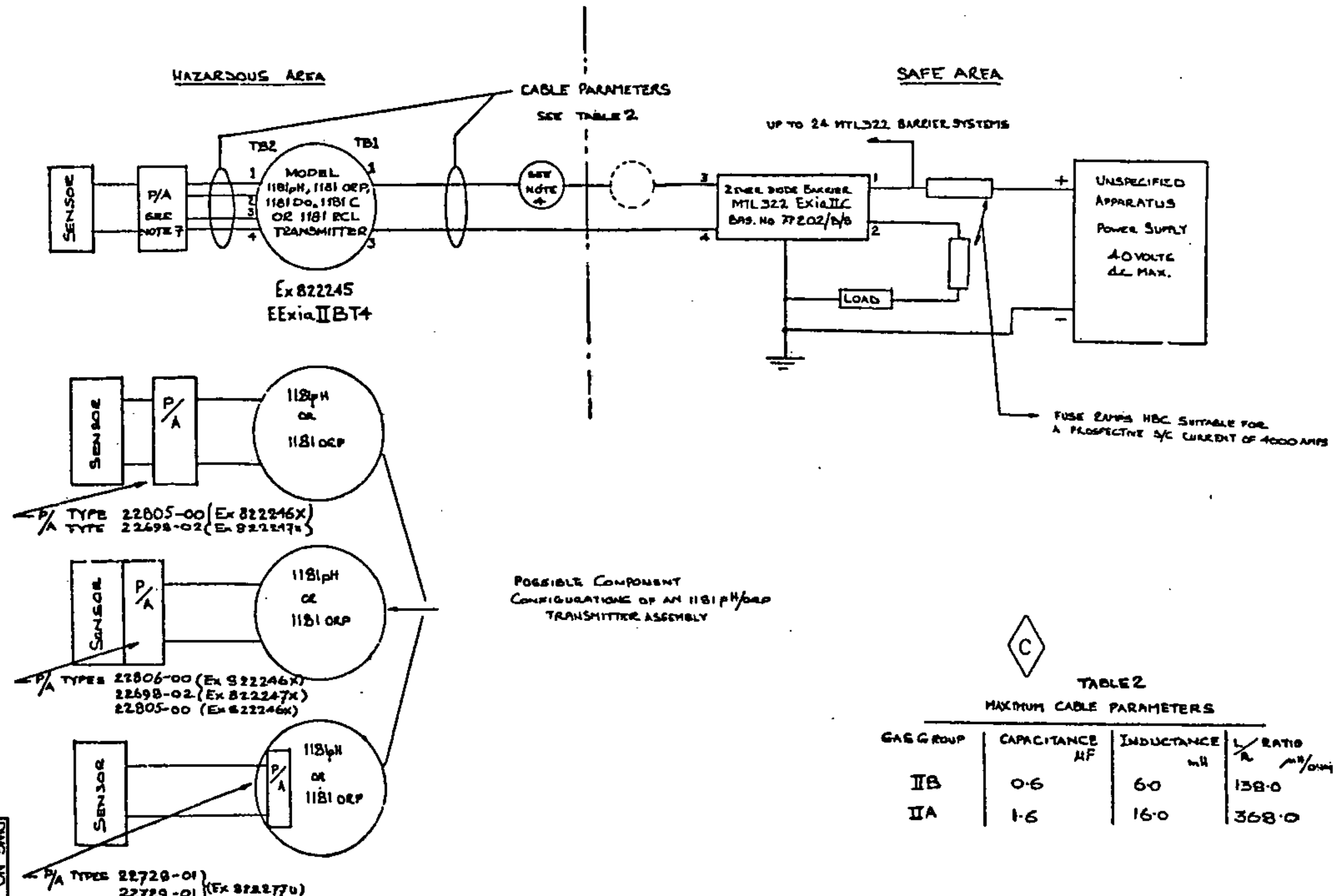


TABLE 2
MAXIMUM CABLE PARAMETERS

GAS GROUP	CAPACITANCE µF	INDUCTANCE mH	L/R RATIO µH/ohm
IIB	0·6	6·0	138·0
IIA	1·6	16·0	368·0

REDRAWN FROM
DWG. NO. 6-012-C002
SHEET 2 OF 3, REV. E

DWG. NO.	REV.
1400143	C

FIGURE 2-4. Installation of 1181 Series for Intrinsically Safe Operation (2 of 3)

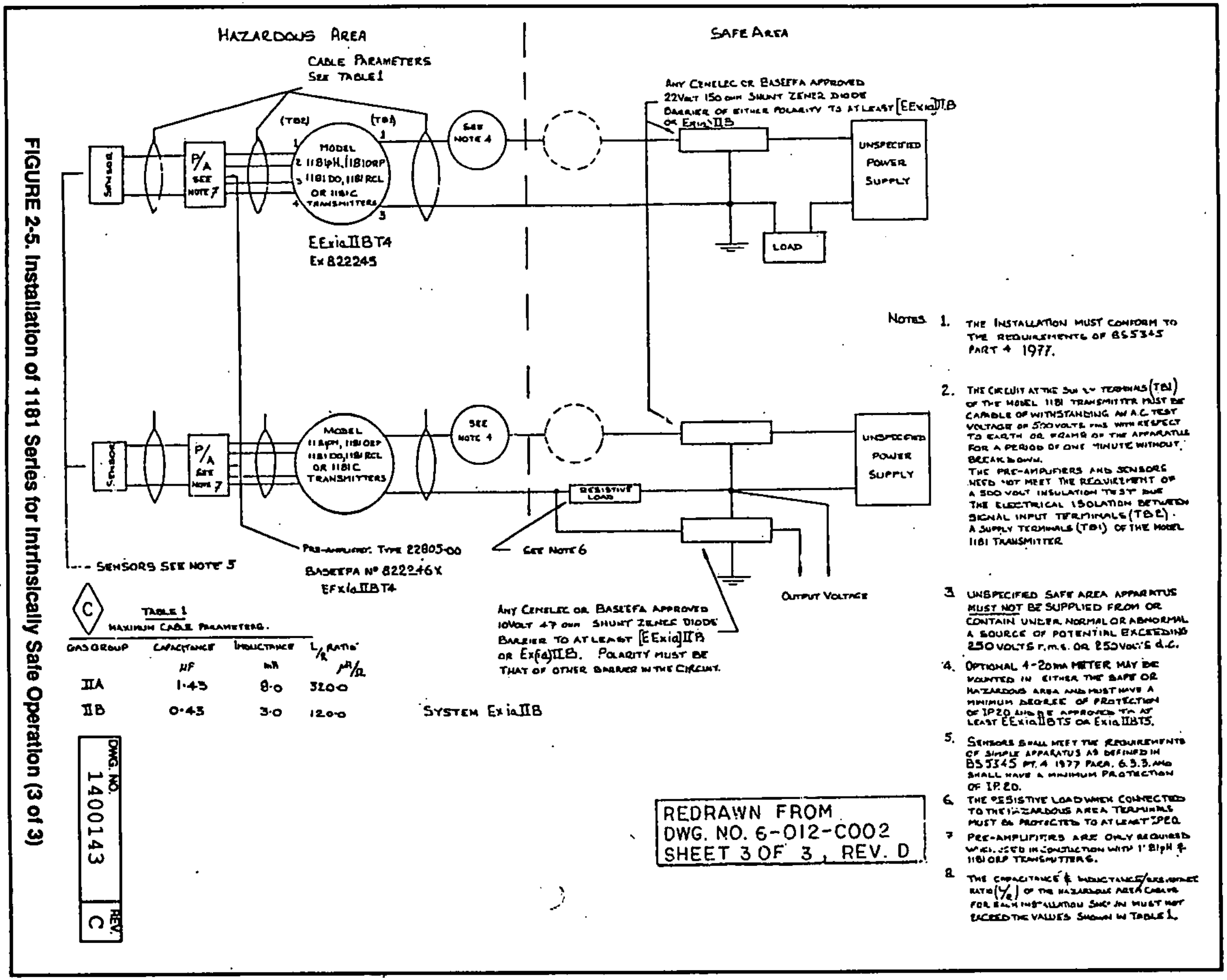
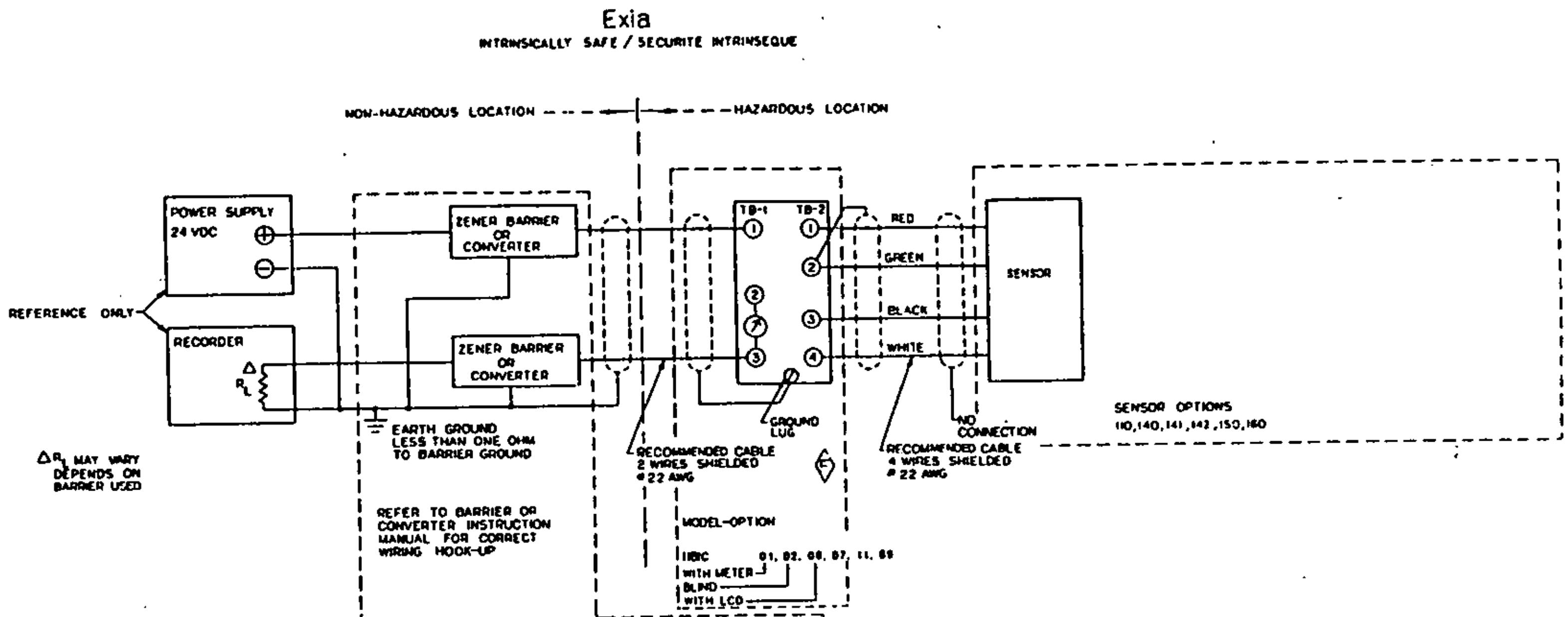


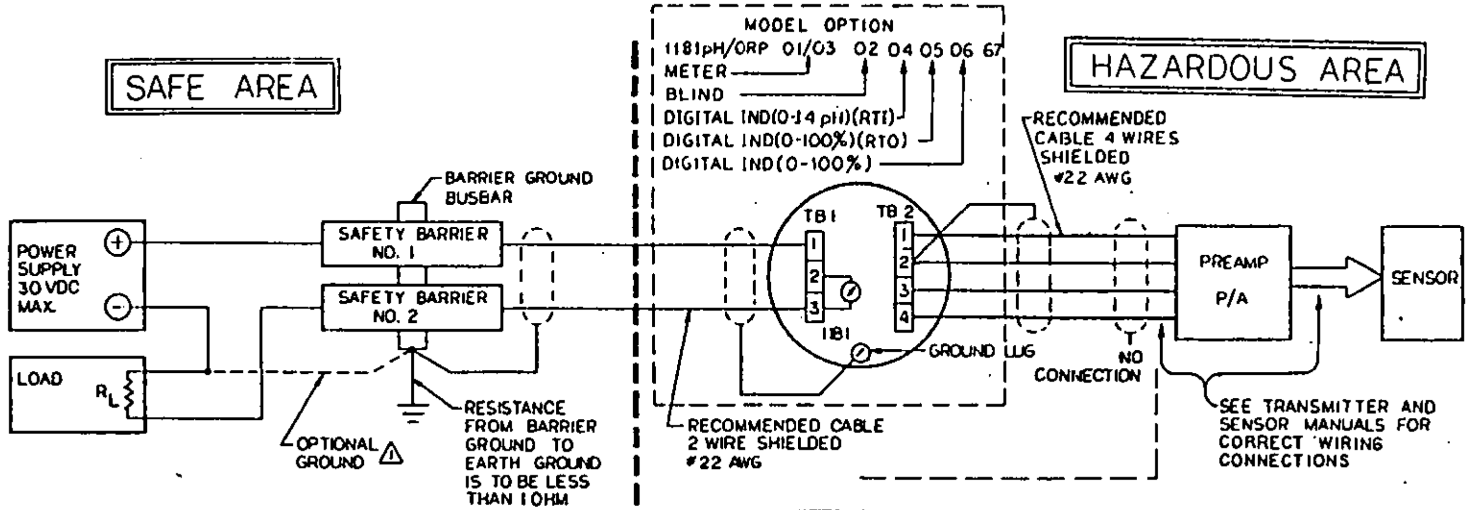
FIGURE 2-5. Installation of 1181 Series for Intrinsically Safe Operation (3 of 3)



DEVICE	PARAMETERS	APPROVED FOR CLASS I	SENSOR OPTIONS
ZENER BARRIER	30V OR LESS, 330Ω OR MORE 28V OR LESS, 300Ω OR MORE 22V OR LESS, 180Ω OR MORE	DIVISION 1 GROUPS A,B,C,& D DIVISION 2 GROUPS A,B,C,& D	110, 140 141, 142 150, 160
	30V OR LESS, 120Ω OR MORE	DIVISION 1 GROUPS C & D DIVISION 2 GROUPS C & D	
FOXBORO SPEC 200 OR MICROSPEC CONVERTERS 2AI-12V-CGB, 2AI-13V-CGB 2AS-12I-CGB, 2AS-13I-CGB 3A4-12D-CGB, 3AD-13I-CGB 3A2-12D, 3A2-13D, 3F4-120A		DIVISION 1 GROUPS B,C,& D	

DWG. NO.	REV.
1400125	F

FIGURE 2-6. Schematic System 1181C, CSA



2 RECOMMENDED BARRIER

MANUFACTURER	BARRIER NO. 1	BARRIER NO. 2	GROUPS
1 STAHL	8903/51-200/050/70	8901/33-092/000/79	A-6
MTL	DUAL BARRIER MTL-188, MTL-188R		C-G
MTL	DUAL BARRIER MTL-322		A-G
4 TAYLOR	1130F F21000	1130F F21000	C-G
4 TAYLOR	5850 FL81200	5850 FL81200	C-G
4 TAYLOR	5851 FL81200	5851 FL81200	C-G
FOXBORO	2A1-12V FGB		A-G
FOXBORO	2A1-13V FGB		A-G
FOXBORO	2AS-131 FGB		A-G
FOXBORO	3A2-12D CS-E/FGB-A		A-G
FOXBORO	3A2-13D CS-E/FGB-A		A-G
FOXBORO	3A4-12DACS-E/FGB-A		A-D
FOXBORO	3F4-12DA1ACS-E/FGB-A		A-D

SENSOR	MODEL NO.
pH	300, 319, 320B, 320HP, 328, 381, 385, 395, 399
ORP	300, 330B, 381, 385, 395, 399

POSSIBLE CONFIGURATION TRANSMITTER – P/A – SENSOR	P/A PART NO.	SENSOR MODELS
1181 pH/ORP — P/A — SENSOR	2002587 2002586 22698-02	ALL SENSORS
1181 pH/ORP P/A — SENSOR	22729-01 22728-01	ALL SENSORS
1181 pH/ORP — P/A SENSOR	2002588 22698-02 22941-00	ALL SENSORS

J

DWG. NO.	REV.
1400128	J

4 PROCESS AUTOMATED BUSINESS INC SUB. COMBUSTION ENGINEERING INC. (FORMERLY TAYLOR INSTRUMENTS).

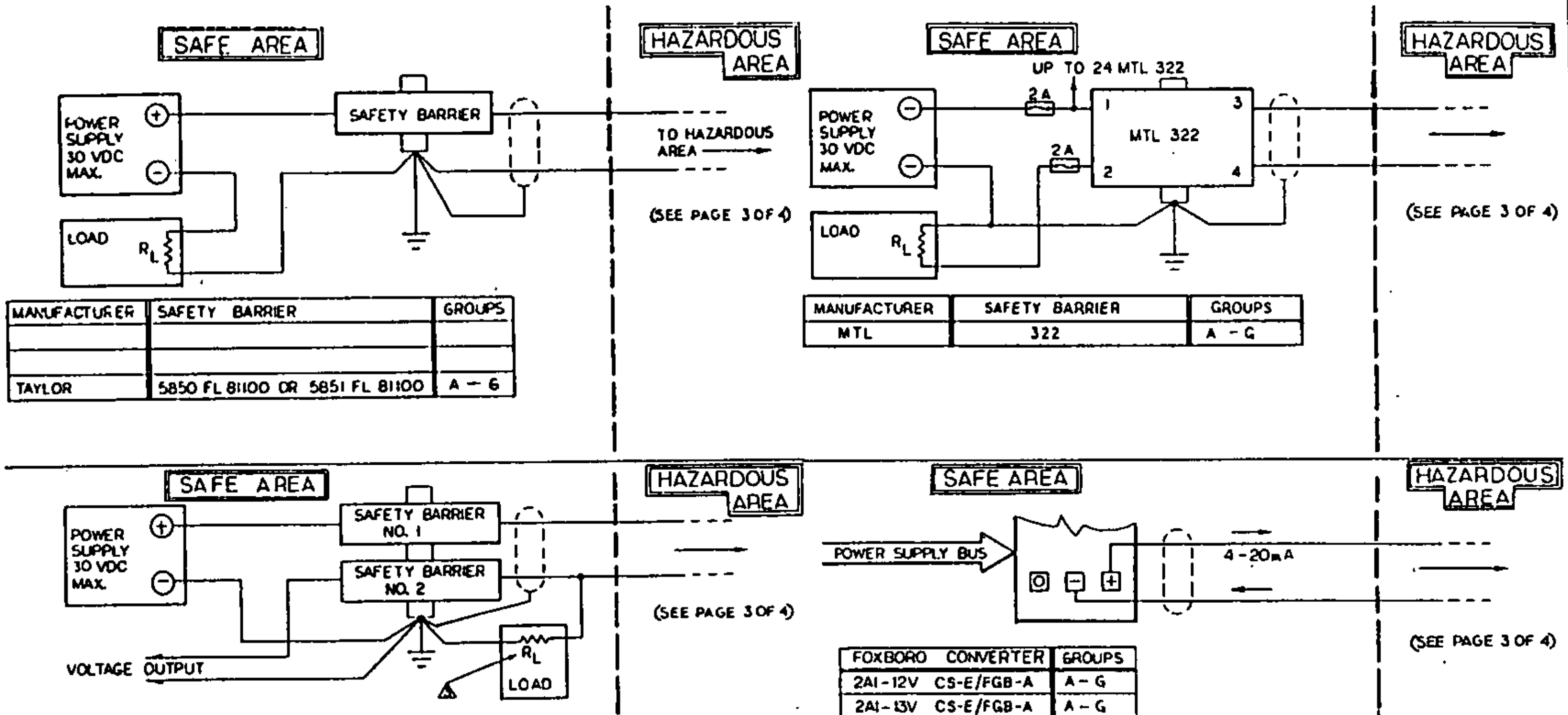
3. *NO CHANGE WITHOUT FM APPROVAL.*

2 ALWAYS REFER TO SAFETY BARRIER (OR CONVERTER) INSTRUCTION MANUALS FOR CORRECT WIRING CONNECTIONS

1 WHEN THIS OPTIONAL GROUND IS USED, USE THE APPROPRIATE BARRIER COMBINATION.

NOTES: UNLESS OTHERWISE SPECIFIED

FIGURE 2-7. Schematic, System FM I.S. Approved 1181 (1 of 4)



MANUFACTURER	SAFETY BARRIER	GROUPS
TAYLOR	5850 FL 81100 OR 5851 FL 81100	A – 6

MANUFACTURER	SAFETY BARRIER	GROUPS
MTL	322	A – G

MANUFACTURER	BARRIER NO. 1	BARRIER NO. 2	GROUPS
MTL	DUAL BARRIER: MTL-188 OR MTL-188R		A – 6
TAYLOR	5850 FL 81200	5850 FL 81200	C – 6
TAYLOR	5851 FL 81200	5851 FL 81200	C – 6

△3 NOT NEEDED IF MTL-188R IS USED.

FOXBORO CONVERTER	GROUPS
2A1-12V CS-E/FGB-A	A – G
2A1-13V CS-E/FGB-A	A – G
2AS-131 CS-E/FGB-A	A – G
3A2-12D CS-E /FGB-A	A – G
3A2-13D CS-E /FGB-A	A – G

DWG. NO.	REV.
1400128	J

FIGURE 2-8. Schematic, System FM I.S. Approved 1181 (2 of 4)

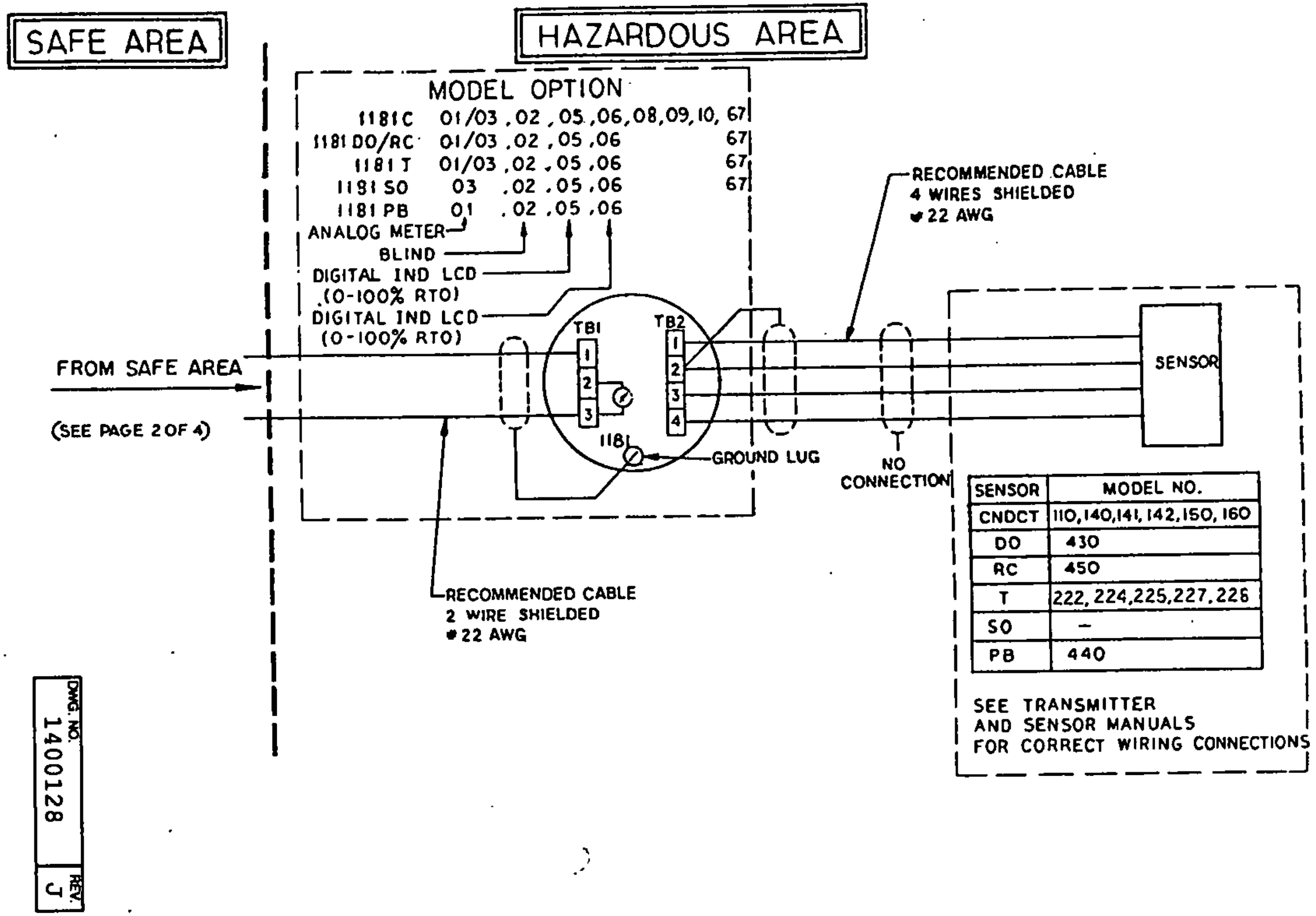


FIGURE 2-9. Schematic, System FM I.S. Approved 1181 (3 of 4)

BASIC WIRING GUIDE FOR INTRINSIC SAFETY APPLICATIONS

I. BARRIER INSTALLATION

A. THE BARRIER MUST BE MOUNTED IN A SAFE AREA AND PROTECTED BY AN ADEQUATE ENCLOSURE WITHIN WHICH THE TEMPERATURE MUST NOT EXCEED THE MAXIMUM OPERATING TEMPERATURE OF THE BARRIER(S).

B. BARRIER'S GROUND MUST BE WITHIN ONE OHM OF THE TRUE EARTH GROUND.

C. THE GROUND WIRE MUST BE CAPABLE OF CARRYING THE MAXIMUM POSSIBLE FAULT CURRENT(S). THIS GROUND WIRE MUST NOT BE SMALLER THAN 14 AWG. AND IT MUST BE MAINTAINED FREQUENTLY.

II. SAFE AREA WIRING

A. A CLEARANCE DISTANCE OF AT LEAST 2 INCHES (50mm) BETWEEN THE INTRINSICALLY SAFE AND NONINTRINSICALLY SAFE TERMINALS MUST BE MAINTAINED.

B. APPARATUS CONNECTED TO NON INTRINSICALLY SAFE TERMINALS OF BARRIER MUST NOT BE SUPPLIED FROM OR CONTAIN A SOURCE OF POTENTIAL EXCEEDING 250 VDC OR 250 VAC rms (360V PEAK) WITH RESPECT TO EARTH.

C. NONINTRINSICALLY SAFE WIRING MUST BE SEPARATED FROM INTRINSICALLY SAFE WIRING BY ACCEPTABLE MEANS, PREFERABLY RACEWAY.

D. POWER SUPPLY CONNECTED TO THE NONINTRINSICALLY SAFE TERMINALS MUST BE ISOLATED FROM THE LINE VOLTAGE BY A DOUBLE WOUND TRANSFORMER. THE PRIMARY WINDING OF THE TRANSFORMER MUST BE PROTECTED BY AN APPROPRIATELY RATED FUSE OF ADEQUATE BREAKING CAPACITY.

III. HAZARDOUS AREA WIRING

A. ONLY THE CONDUCTORS CONNECTED TO THE INTRINSICALLY SAFE TERMINALS OF THE BARRIER MAY ENTER THE HAZARDOUS AREA. THE ABOVE INTRINSICALLY SAFE CONDUCTORS:

1. MUST NOT BE INTERCONNECTED TO ANY OTHER CIRCUIT, INCLUDING BARRIER-PROTECTED CIRCUITS NOR SHARE EARTH RETURN CABLES WITH THEM.
2. MUST NOT SHARE ANY ELECTRICAL CONNECTOR WITH CABLES CONNECTED TO NONINTRINSICALLY SAFE TERMINALS.
3. ARE NOT REQUIRED TO BE SHIELDED. HOWEVER, IF THERE IS A SHIELD, THE SHIELD MUST BE GROUNDED AT THE BARRIER GROUND BUSBAR.
4. SHOULD BE MARKED EITHER BY WRITING OR BY COLORING BRIGHT BLUE.
5. MUST BE INSULATED FROM EARTH AND CAPABLE OF WITHSTANDING A TEST VOLTAGE OF 500 Vrms TO EARTH.

B. FOR MULTIPLE BARRIERS WIRING.

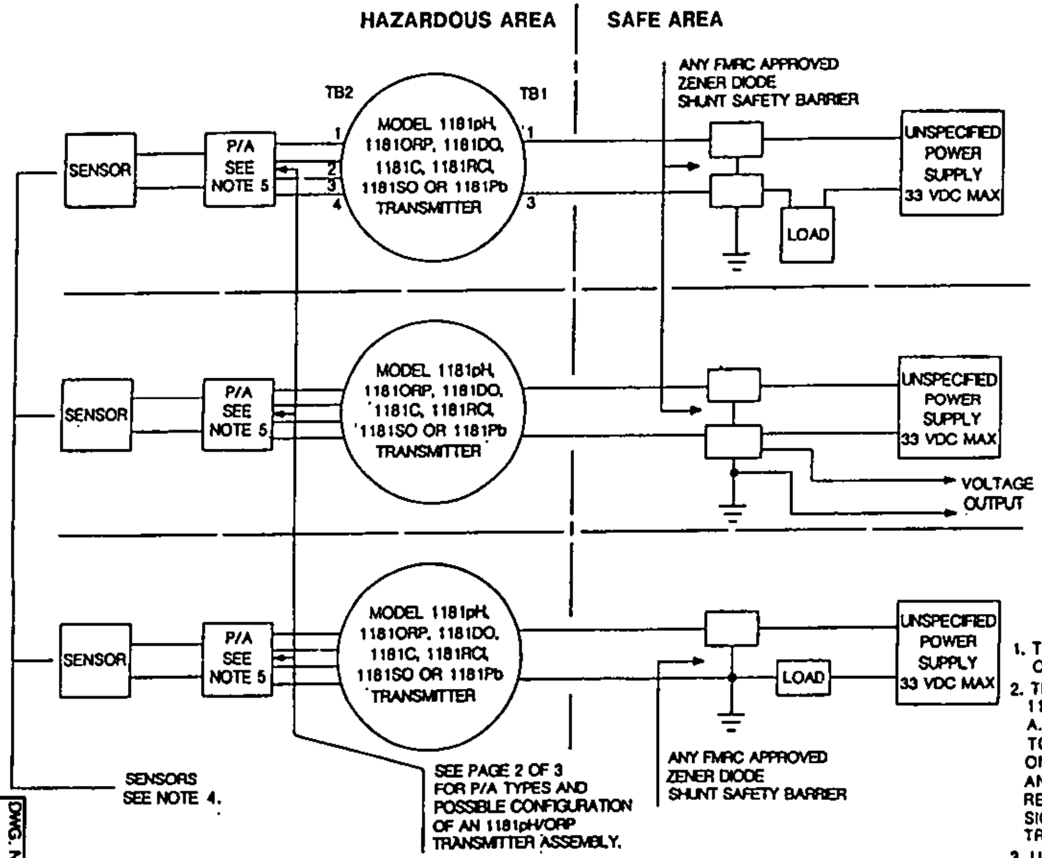
1. DIFFERENT INTRINSICALLY SAFE WIRINGS OF THE SAME INTRINSICALLY SAFE SYSTEM SHALL NOT BE RUN IN THE SAME CABLE, UNLESS AT LEAST 0.25 mm THICKNESS INSULATION IS USED ON EACH CONDUCTOR AND BOTH WIRES OF EACH CIRCUIT ARE RUN AS A TWISTED PAIR.
2. DIFFERENT INTRINSICALLY SAFE SYSTEMS SHALL NOT BE RUN IN THE SAME MULTICONDUCTOR CABLE.

DWG. NO.	REV.
1400128	J

FIGURE 2-10. Schematic, System FM I.S. Approved 1181 (4 of 4)

1181 ENTITY PARAMETERS - SUPPLY/SIGNAL TERMINALS 1 & 3				
MODEL NO.	V max (vdc)	I max (mA)	Ci (uf)	Li (mH)
1181pH/ORP	33	230	0.08	0.15
1181C	33	230	0.08	0.15
1181DO/RCl	33	230	0.08	0.15
1181SO/Pb	33	230	0.08	0.15

1181 ENTITY PARAMETERS - SENSOR TERMINALS 1, 2, 3 & 4 GROUPS A & B				
MODEL NO.	Voc max (vdc)	Isc max (mA)	Ca max (uf)	La max (mH)
1181pH/ORP	11.8	12.5	1.0	200.0
1181C	11.8	20.5	1.0	80.0
1181DO/RC	11.8	6.9	1.0	600.0
1181SO/Pb	11.8	6.6	1.0	700.0



DWG. NO.	REV.
1400153	D

PREAMPLIFIER ENTITY PARAMETERS				
PART NUMBER	V max (vdc)	I max (mA)	Ci (uf)	Li (mH)
22698-02	16	16	0.6	0
22941-00	16	16	0.6	0
22729-01	16	16	0.6	0
22728-01	12.5	16	0.024	0

D

1. THE INSTALLATION MUST CONFORM TO THE REQUIREMENTS OF FMRC.
2. THE CIRCUIT AT THE SUPPLY TERMINALS (TB1) OF THE MODEL 1181 TRANSMITTER MUST BE CAPABLE OF WITHSTANDING AN A.C. TEST VOLTAGE OF 500 VOLTS rms WITH RESPECT TO EARTH OR FRAME OF THE APPARATUS FOR A PERIOD OF ONE MINUTE WITHOUT BREAKDOWN. THE PRE-AMPLIFIERS AND SENSORS NEED NOT MEET THE 500 VOLT INSULATION REQUIREMENT DUE TO THE ELECTRICAL ISOLATION BETWEEN SIGNAL AND SUPPLY TERMINALS (TB2), (TB1) OF THE TRANSMITTER.
3. UNSPECIFIED SAFE AREA APPARATUS MUST NOT BE SUPPLIED FROM OR CONTAIN UNDER NORMAL OR ABNORMAL CONDITIONS A SOURCE OF POTENTIAL EXCEEDING 250 VOLTS rms OR 250 VOLTS dc.
4. SENSORS SHALL MEET THE REQUIREMENTS OF SIMPLE APPARATUS AS DEFINED BY FMRC. THEY CAN NOT GENERATE NOR STORE MORE THAN 1.2V 0.1A, 25mW or 20uJ.
5. PRE-AMPLIFIERS ARE ONLY REQUIRED WHEN USED IN CONJUNCTION WITH MODELS 1181pH & 1181ORP TRANSMITTER.

FIGURE 2-11. Installation of 1181 Series XMTRS for I.S. Operation and Entity Parameters-FMRC(1 of 3)

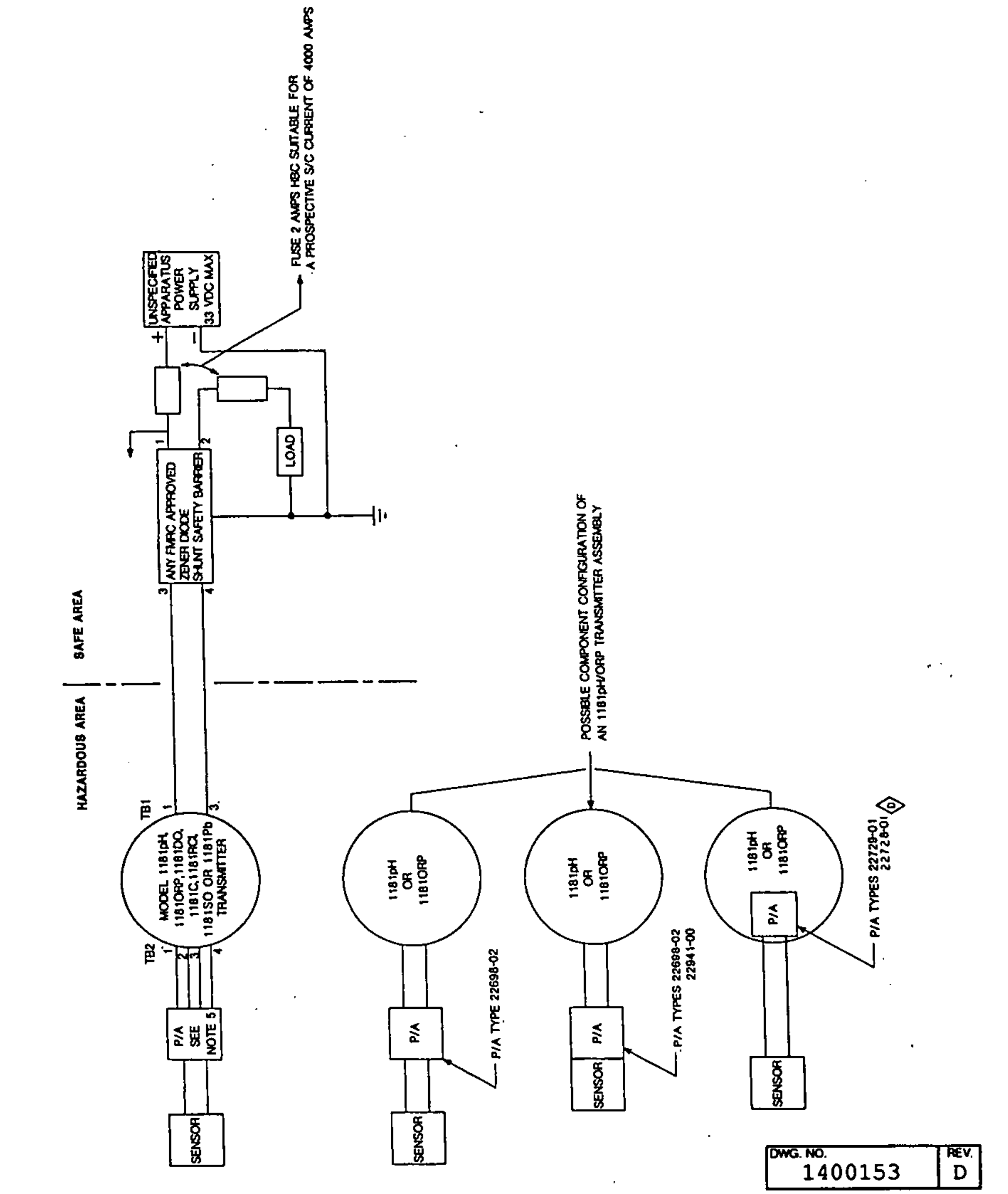
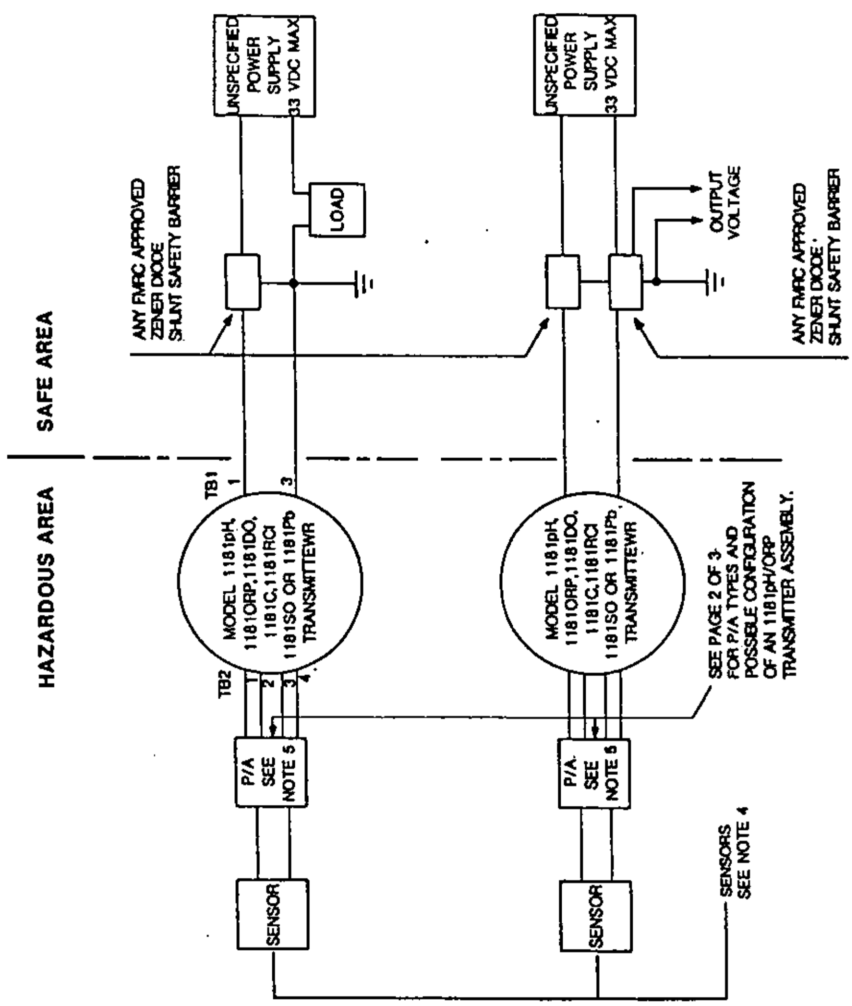


FIGURE 2-12. Installation of 1181 Series XMTRS for I.S. Operation and Entity Parameters-FMRC(2 of 3)



DWG. NO.	REV.
1400153	D

FIGURE 2-13. Installation of 1181 Series XMTRS for I.S. Operation and Entity Parameters-FMRC(3 of 3)

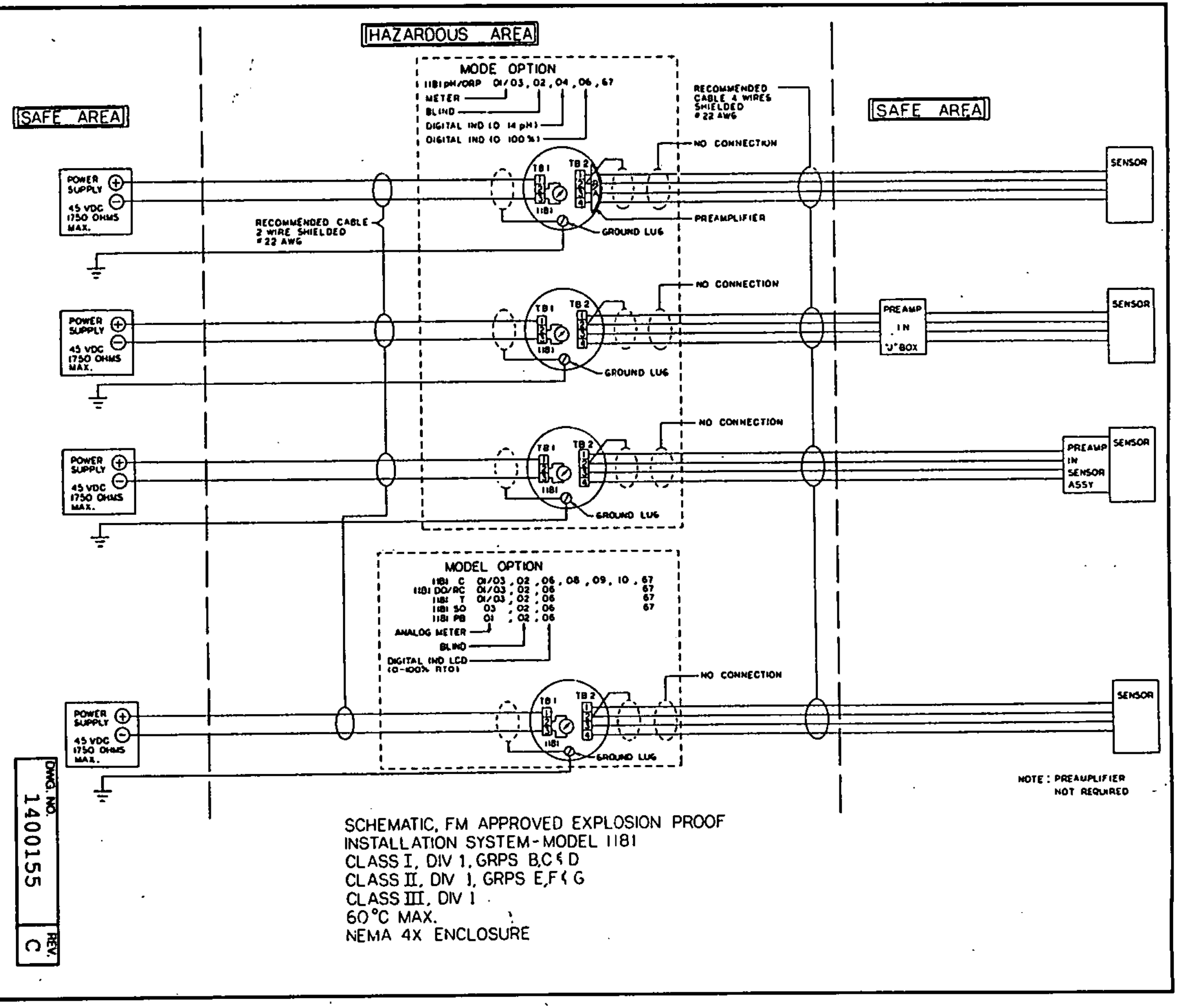


FIGURE 2-14. Schem, System FM Explosion-Proof 1181

SECTION 3.0
START-UP AND CALIBRATION

3.1 START-UP. The following start-up procedure shall be performed after the transmitter has been Installed as described in Section 2.0. The sensor must be wired, however, it may be practical to install the sensor after calibration is complete (refer to Paragraph 3.2). See Figure 3-1 for location of controls and switches.

3.2 IN—SITU CALIBRATION BY GRAB SAMPLE ANALYSIS. This is the preferred method of calibrating the Model 1181C Transmitter.

1. Install an ammeter capable of indicating 4-20 mAdc between TB1-2 (+) and TB1-3 (–). If Code 01 or 03 has been specified, remove the meter leads from TB1 (see Figure 2-2).
2. Set the RANGE MULTIPLIER and RANGE FACTOR switches. Find the sensor probe constant in the left hand column of Table 3-1 and follow this row to the desired full scale conductivity column. On top of this column are the desired RANGE FACTOR SWITCH and RANGE MULTIPLIER SWITCH settings. Set the Model 1181C Transmitter switches to these settings (see Figure 3-1).

EXAMPLE:
With a sensor probe constant of 1.0 and a desired full scale conductivity of 2000 µS/cm, the RANGE FACTOR SWITCH setting = X 2 and the RANGE MULTIPLIER SWITCH setting = X 1,000.

3. With the conductivity sensor in the air (not in solution), and the power applied to the transmitter, adjust the external ZERO (R23) to 4 mA (0% analog meter indication). If the sensor has been installed and is in solution, disconnect the probe drive lead (white) from TB2-4. Adjust the external ZERO for a 4 mA indication. Interconnecting sensor cables of 100 feet or low conductivity measurement ranges require either removal of the sensor from the process (in air), or the probe drive lead (white) disconnected from the sensor. After completing this adjustment, reconnect the probe drive lead (white) to TB2-4.
4. If the process temperature is not expected to vary more than 5 to 10°C, set the temperature SLOPE ADJUST (R124) at 2%/°C (average). If the process varies more than 10 °C, follow the TWO POINT CALIBRATION procedure (see Paragraph 3.4).

TABLE 3-1.
SWITCH SETTINGS / PROBE CONSTANT vs. FULL SCALE CONDUCTIVITY

Probe Constant	RANGE MULTIPLIER SWITCH								
	x100			x1,000			x10,000		
	RANGE FACTOR SWITCH								
	x.5	x1	x2	x.5	x1	x2	x.5	x1	x2
	MICROMHOS (FULL SCALE)								
0.01	0.5	1	2	5	10	20	50	100	200
0.1	5	10	20	50	100	200	500	1000	2000
0.2	10	20	40	100	200	400	1000	2000	400
0.5	25	50	100	250	500	1000	2500	5000	10000
1.0	50	100	200	500	1000	2000	5000	10000	20000
2.0	100	200	400	1000	2000	4000	10000	20000	40000
5.0	250	500	1000	2500	5000	10000	25000	50000	100000
10.0	500	1000	2000	5000	10000	20000	50000	100000	200000
20.0	1000	2000	4000	10000	20000	40000	100000	200000	400000

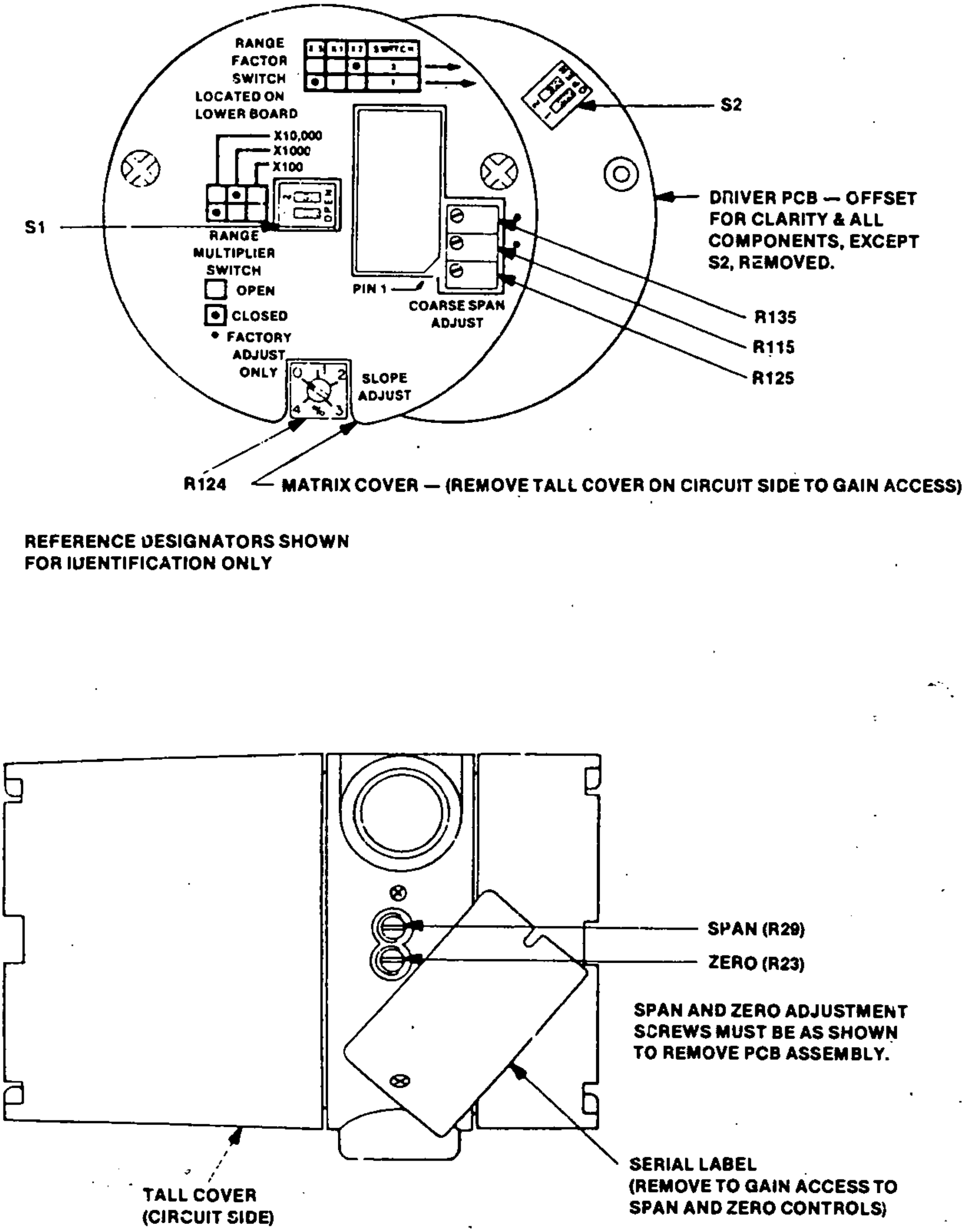


FIGURE 3-1. Controls and Switches Location Diagram

5. Give the Model 1181C Transmitter a measurement input as follows:
   a. With the sensor installed in the process and in service, record the ammeter indication as seen at the transmitter.
   b. Obtain a grab sample and let it cool to ambient temperature.
   c. Measure the conductivity of the grab sample with a calibrated and temperature compensated conductivity analyzer.
6. Adjust the external SPAN (R29) to mid position (20-turn potentiometer).
7. Adjust the internal COARSE SPAN ADJUST (R125) until the transmitter mA output agrees with the measured value of the grab sample.

$$\text{mA output} = \left(\frac{\text{Conductivity S}}{\text{Conductivity F.S.}}\right) \times 16+4$$

Where: Conductivity S is the conductivity of the grab sample and Conductivity F.S. is the full scale sensitivity of the transmitter.

EXAMPLE: If the measured range or full scale sensitivity of the transmitter is 0-2000 μS/cm, and the value of the conductivity solution is known to be 1800 μS/cm, then:

$$\text{mA output} = \left(\frac{1800}{2000}\right) \times 16+4 = 18.4 \text{ mA}$$

NOTE

On initial start-up, or if a new sensor is installed, follow steps 6,7 and 8 for calibration adjustments. Any further calibration required with the same sensor is done with external SPAN (R29) only.

8. Adjust external SPAN (R29-standardize) for fine tuning of the current output. If the indicated conductivity has changed between the time the initial conductivity measurement was recorded and the grab sample was taken, the correct conductivity may be determined as follows:
   a. Multiply the present indication by the ratio of the initial conductivity indication to the laboratory conductivity indication.
   b. This is represented by the following formula:

$$C_T = C_2 \frac{C_L}{C_1}$$

Where: CT = Adjust SPAN to this value (true conductivity)

C_L = Conductivity determined by laboratory analysis

C_1 = Conductivity reading of grab sample when taken

C_2 = Conductivity reading just prior to adjusting SPAN

3.3 CALIBRATION USING A CONDUCTIVITY STANDARD OR PROCESS GRAB SAMPLE

1. Perform steps 1,2,3 and 4 as explained in Section 3.2 above.
2. Place the Sensor in a container filled with a Conductivity Standard or Process Sample.

NOTE

All sides of the sensor should be at least one sensor diameter from the walls of the sample container. Insure no air bubbles are trapped at the sensor tip.

3. Perform steps 6 and 7 in Section 3.2.
4. Adjust external SPAN (R29 Standardize) for fine tuning of the current output.

3.4 TWO POINT CALIBRATION. If the process temperature is expected to vary more than 10 °C, adjust the SLOPE ADJUSTMENT as follows:

1. Place the sensor in a beaker of process grab sample.

NOTE

All sides of the sensor should be at least one sensor diameter from the walls of the sample container. Insure no air bubbles are trapped at the sensor tip.

2. Elevate the process grab sample temperature 50 to 75 °C.
3. Allow the temperature to stabilize. Note the transmitter mA output.
4. Cool the process grab sample beaker to room temperature by using a room temperature bath.
5. Allow the temperature to stabilize. Set the SLOPE ADJUSTMENT (R124) so the mA output is the same as it was at the elevated temperature (see step 3 above).

NOTE

Typical Slope Values are as follows:

Acids: 1.0-1.6% / °C	Salts: 2.2-3.0% / °C
Bases: 1.8-2.2% / °C	Neutral: 2.0% / °C

6. Perform steps 5 through 8 in Section 3.2 above to complete the calibration.

3.5 ELECTRONIC BENCH CHECK

1. Set up the 1181C Transmitter as shown in Figure 3-2.

NOTE

Each resistance box and the transmitter must be grounded to TB2-2 as shown in Figure 3-2.

2. Select and set the RANGE MULTIPLIER and RANGE FACTOR switch settings by performing step 2 of Section 3.2 above.
3. Set the SLOPE ADJUST (R124) to 2% (see Figure 3-1). Set the Temperature and the Conductivity Decade Resistance Boxes according to the appropriate equation listed below:

1181C

Temp. Module	RTEMP.	RCOND
5-85°C	10K Ω	$\text{Rcond.} = \frac{\text{Probe Constant}}{\text{F.S. Conductivity}} \times 1{,}000{,}000$
50-150° C	817 Ω	$\text{Rcond.} = \frac{0.4 \times \text{Probe Constant}}{\text{F.S. Conductivity}} \times 1{,}000{,}000$
100-200° C	1K Ω	$\text{Rcond.} = \frac{0.3 \times \text{Probe Constant}}{\text{F.S. Conductivity}} \times 1{,}000{,}000$

NOTE

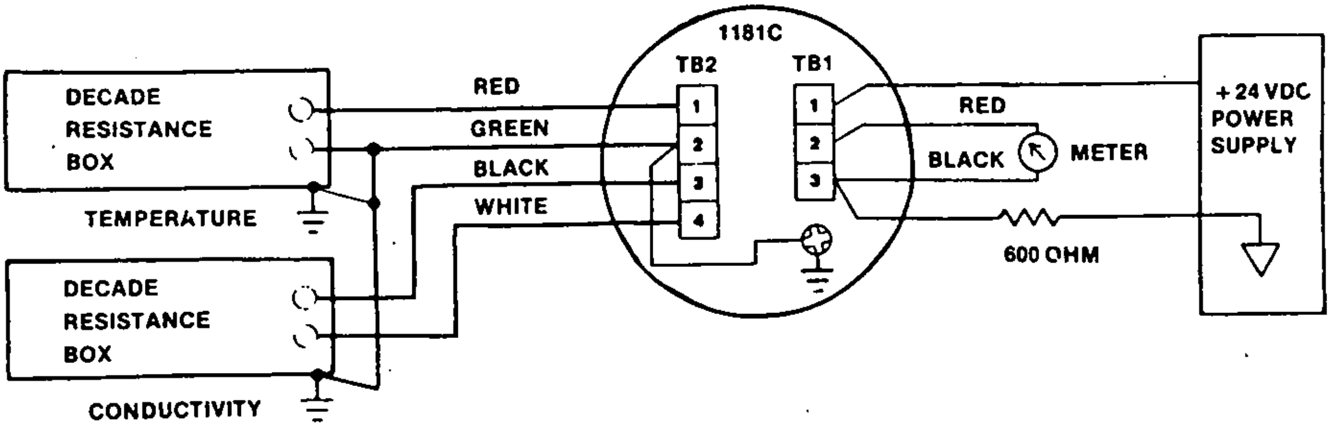
Full scale conductivity is in microsiemens.

4. Adjust COARSE SPAN ADJUST (R125) for a transmitter output of 20.00 mA.
5. Multiply Rcond. by two and adjust the CONDUCTIVITY DECADE RESISTANCE BOX to this value. The 1181C Transmitter output should be 12.00mA ±0.16mA (±0.32 mA @ X 10,000 RANGE MULTIPLIER).

EXAMPLE:

Using a sensor with a probe constant of 1.0, a Model 1181C Transmitter with Temp. Module of 5°-85°C and a desired full scale (F.S.) conductive range of 2000 µS/cm, then,

RANGE FACTOR SWITCH SETTING	= X 2
RANGE MULTIPLIER SWITCH SETTING	= X 1000
Rtemp. resistance input	= 10K Ω
Rcond.(Full Scale) resistance input	= 500 Ω
Rcond. X2 (50% Full Scale) resistance input	= 1000 Ω



GROUND BOTH DECADE RESISTANCE BOXES AND THE TRANSMITTER TB2-2.

FIGURE 3-2. Electronic Bench Check Set-Up

3.6 START-UP: LCD. The LCD (liquid crystal display) is factory set for 000.0 reading at 4 mA to 100.0% at 20 mA. If this range is sufficient for the intended application, no further adjustment to the display is necessary. The standard procedures included in this manual should be followed for proper instrument start-up and calibration (see the start-up and calibration section of this instruction manual).

If a range other than the factory set range, or testing of the LCD module are required, observe the following procedures. They are divided into two sections: (3.7) Testing the LCD module by itself, and (3.8) Testing the LCD module as an integral part of the 1181 instrument.

3.7 LCD: MODULE ONLY. The object of the procedure is to test and/or calibrate the LCD module for a range other than the factory set range of 0-100%.

3.7.1 Testing Equipment (see Figure 3-3).

A. DC power supply (Hewlett Packard 5217A or equivalent) P1

B. Digital DC current meter (Fluke 8050A or equivalent) M1

C. 2.5K, .25W +5% resistor (RL)

3.7.2 Set-Up. The LCD module under test is connected in series with an adjustable DC power supply P1, a 2.5K ohm, 0.25 kw, ±5% resistor and a digital current meter M1 (see Figure 3-3).

3.7.3 Calibration

1. Adjust the voltage output of P1 so that the current meter M1 reads 4.000 mA. Then, adjust Zero pot (R8) on the LCD module until it displays 000 (see Figure 3-4).
2. Refer to Table 3-2. Determine the requirements and corresponding parameters for this application.
3. Adjust power supply P1 so that the current meter M1 reads 20.000 mA. Adjust the Span pot (R4) of the LCD module until it displays the "total span" of this application (see Table 3-2).
4. Reduce power supply P1 until meter M1 reads 4.00 mA. Confirm that the LCD module still displays 000. If not, readjust the LCD module following steps 1 through 4.
5. According to the "Decimal Point Setting" column of Table 3-2, set switch S1 for this application (see Figure 3-4).
6. Refer to Table 3-2. Adjust the Zero pot (R8) for the desired reading at 4 mA. Adjust the power supply P1 for an output of 20.00 mA and confirm that the reading coincides with the value in Table 3-2. If it does not, then readjust the LCD module following Steps 1 through 6.
7. Adjust P1 to read 12.000 mA. The LCD module should display the "reading at 12 mA" (see Table 3-2).

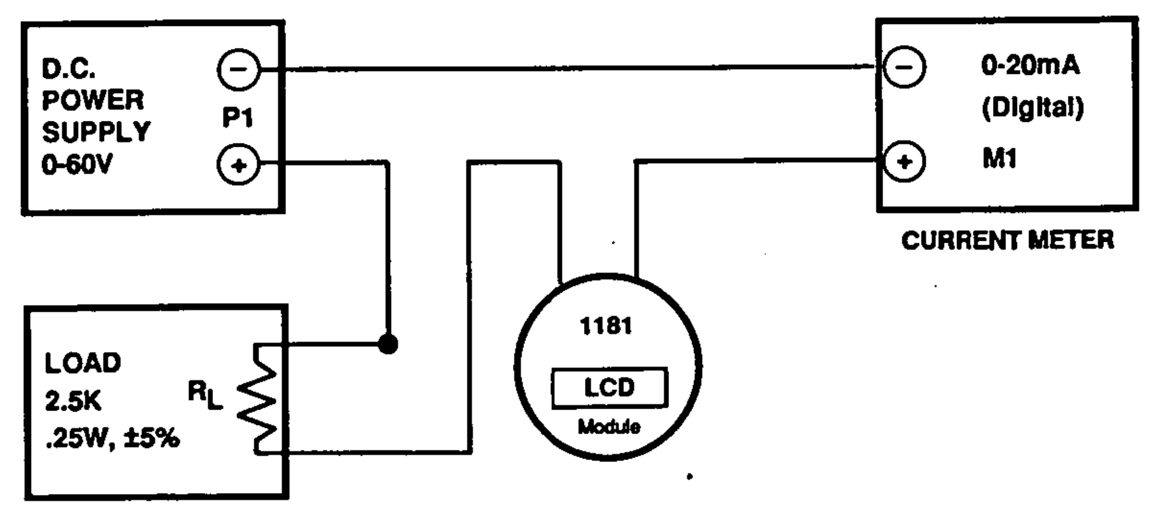


FIGURE 3-3. LCD Module Set-Up Wiring

TABLE 3-2. Requirements/Corresponding Parameters

REQUIREMENTS		CORRESPONDING PARAMETERS				
Application	Range	Reading at 4 mA	Reading at 12 mA	Reading at 20 mA	Total Span	Decimal Point Setting
Cond.	0-1 umho	+0.000	+0.500 ±0.02	+1.000	1000 counts	Turn on No. 1 of S1
Cond.	0-100 umho	+00.0	+50.0 ±0.02	+100.0	1000 counts	Turn on No. 3 of S1
Cond.	0-1000 umho	+000	+500 ±0.02	+1000	1000 counts	All Off at S-1
Cond.	0-10,000 umho	+0.00	+5.00 ±0.02	+10.00	1000 counts	Turn on No. 2 of S1

Since the unit cannot display numbers more than + 1999 (or + 1.999m + 19.99, + 199.9), instead it will display + 1 followed by three blank digits to indicate the situation of "overflow" when the input exceeds the upper limit of the range. Therefore, if you wish the unit to read + 2000 (or + 2.000, + 20.00, + 200.0), you may adjust the unit so that the display barely overflows.

8. Example of illustrating the test procedure from steps 1 through 8.

EXAMPLE 1:

Application Requirements:

- Conductivity with range from 0 umho to 500 umho

TEST PROCEDURE:

1. Set the input current (the reading on M1) to 4.000 mA. Adjust R8 until the LCD module reads 000.
2. Set the input current to 20.000 mA. Adjust R4 until the LCD module reads 500.
3. Set the input current back to 4.000 mA. Confirm that the LCD module still displays 000.

3.7.4 End of LCD Module Test/Calibration.

3.8 LCD: WITH 1181 C

NOTE

If you are retrofitting an LCD to an existing 1181, refer to Figures 3-6 and 3-7 before starting the test procedure to assure that the transmitter PCB is modified properly.

3.8.1 Test Equipment

A. D.C. power supply capable of 30V at 50 mA (Hewlett Packard 6216A or Model 515 or equivalent).

B. D.C. voltmeter (Fluke 8050A or equivalent).

C. Two resistor decade boxes or 1181C test fixture.

3.8.2 Set Up. The 1181C with LCD RTO (refer to output) installed is connected to the power supply and decade resistance boxes (see Figure 3-5).

3.8.3 Calibration Be certain that the 1181C has been calibrated per Section 3.0 of this manual.

1. Turn on power supply and adjust to 24 ±.5V and observe that display is functioning. Turn on No. 3 of S1 (see Figure 3-4).
2. Set temperature slope pot for 0% and the Temperature Resistance Decade Box for 10K. Use standard temperature range module (5°C to 85°C) in 1181 C.
3. Using Table of Equivalent Resistances (Table 3-3), set the 1181C Range Multiplier and Range Factor switches to the desired conductivity range. Set Conductivity Resistance Decade Box for the corresponding value in Table 3-3 of 10% F.S. and adjust the Zero pots on the 1181 C and the LCD display for 3.37 ±.096V on M1 and 10.0 ±digit on the display.

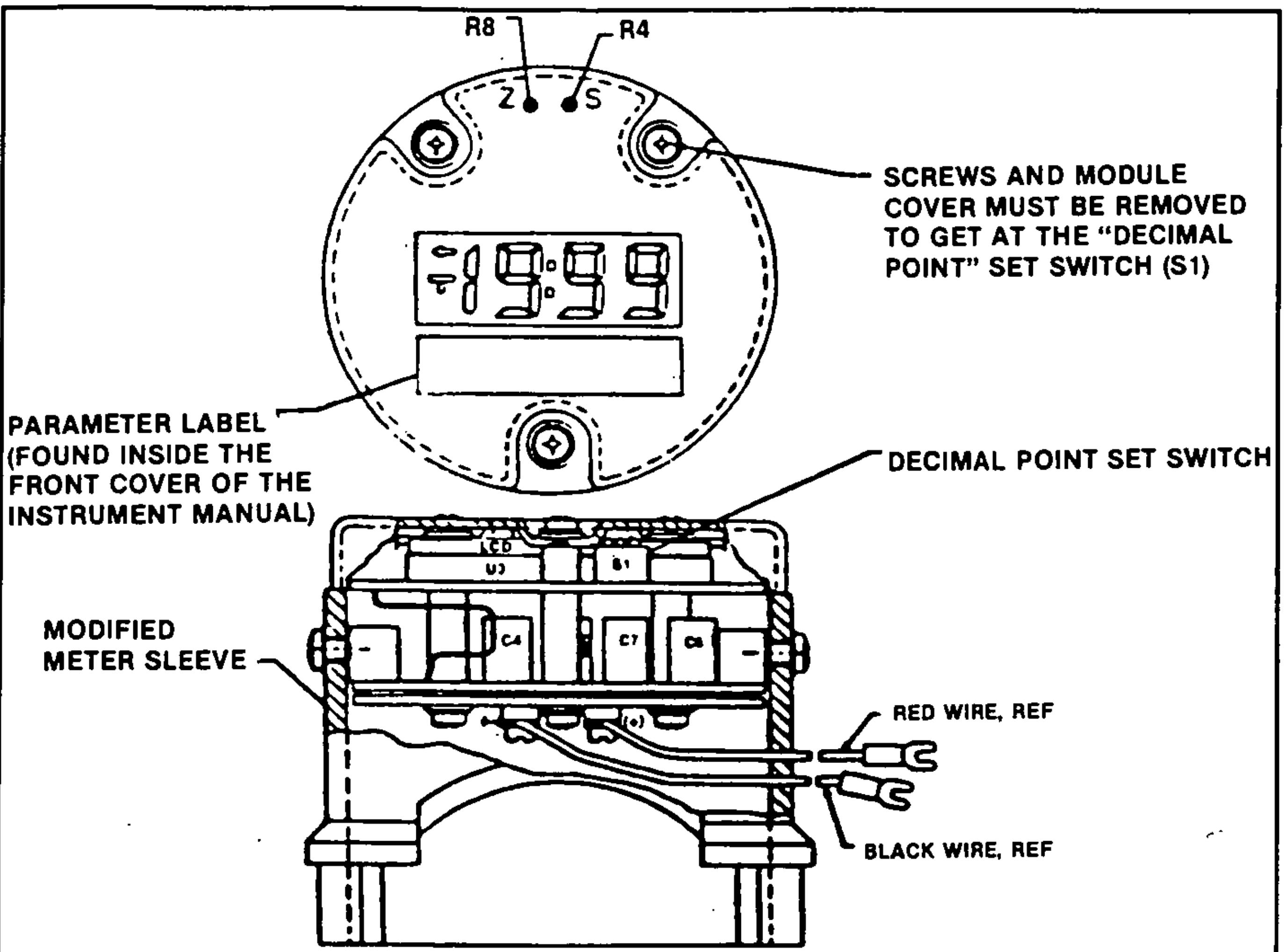


FIGURE 3-4. LCD Calibration

4. Now using the 100% F.S. value for the conductivity decade resistor, set the Span pots on the 1181 C and LCD display for 12.0 ±.096V on M1 and 100.0 ±1 digit on the display.
5. Set conductivity resistor for 50% F.S. and observe that the M1 display reads 7.2 ±.096V and LCD display reads 50.0 ±1 digit*.
6. If standard temperature range (5°C to 85°C) is selected, this concludes the test. If higher temperature is used, proceed with following procedures.
7. 50° TO 150°C RANGE CONDUCTIVITY:
Set the 1181C for 1000 umho full scale range (see Table 3-3). Set slope for 2%, and set the Conductivity Resistance Decade Box for 556Ω and Temperature Resistance Decade Box for 2339Ω. Unit should read ±10% full scale. Set slope for 4%, set Conductivity Resistance Decade Box to 179Ω and Temperature Resistance Decade Box to 297Ω. The unit should read ±10% of full scale output display.
8. 100° TO 200°C RANGE CONDUCTIVITY:
Set the 1181C for 1000 umho full scale range (see Table 3-3). Set slope for 2% and, set Conductivity Resistance Decade Box to 370Ω and Temperature Resistance Decade Box to 3291Ω. Unit should read ±10% of full scale. Set slope for 4% and, set Conductivity Resistance Decade Box to 139Ω and set Temperature Resistance Decade Box to 470Ω. The output should read ±10% of full scale display.

3.8.4 End of 1181C LCD Module Test & Calibration.

*On higher conductivity ranges, 2% error is allowed.

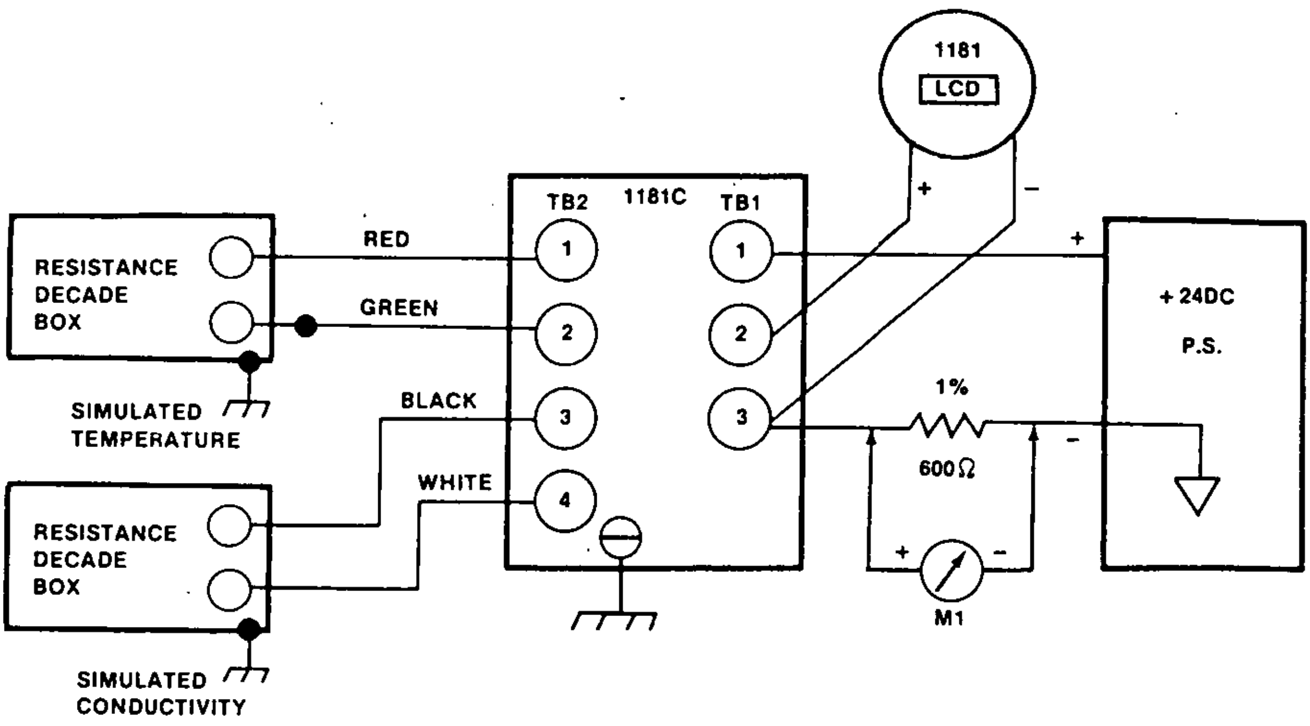


FIGURE 3-5. LCD Unit Test Wiring

TABLE 3-3.
Table of Equivalent Resistances

Range (umhos fs)	1181C Range Multiplier Switch S1	1181C Range Factor Switch S2	100% F.S. ohms	50% F S. ohms	10% F.S. ohms
50	x 100	x .5	20KΩ	40KΩ	200KΩ
100	x 100	x 1	10KΩ	20KΩ	100KΩ
200	x 100	x 2	5KΩ	10KΩ	50KΩ
500	x 1000	x .5	2KΩ	4KΩ	20KΩ
1000	x 1000	x 1	1KΩ	2KΩ	10KΩ
2000	x 1000	x 2	500Ω	1KΩ	5KΩ
5000	x 10,000	x .5	200Ω	400Ω	2KΩ
10000	x 10,000	x 1	100Ω	200Ω	1KΩ
20000	x 10,000	x 2	50Ω	100Ω	500Ω

If you are **retrofitting** a LCD to an **existing** 1181, you must assure that the instrument transmitter board is properly modified. There are two versions possible. If you have a P/N 22795-02 PCB, you simply move the jumper from the W5 position to the W6 position (or omit it entirely). If your PCB is P/N 22795-01, you must clip and remove the diode CR11. Refer to Figures 3-6 and 3-7.

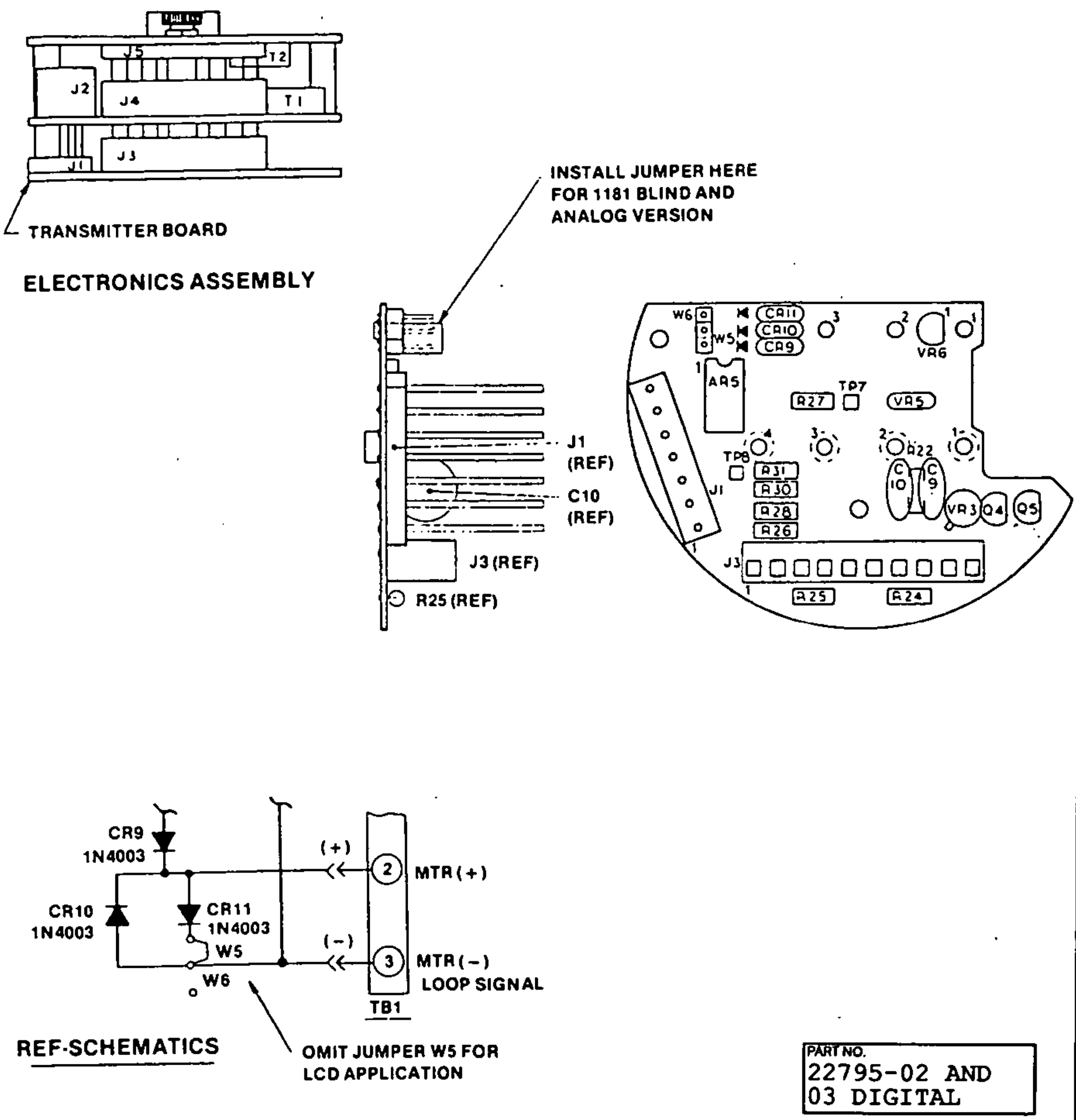
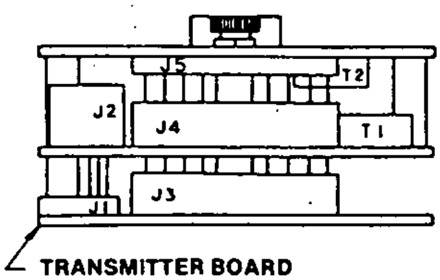
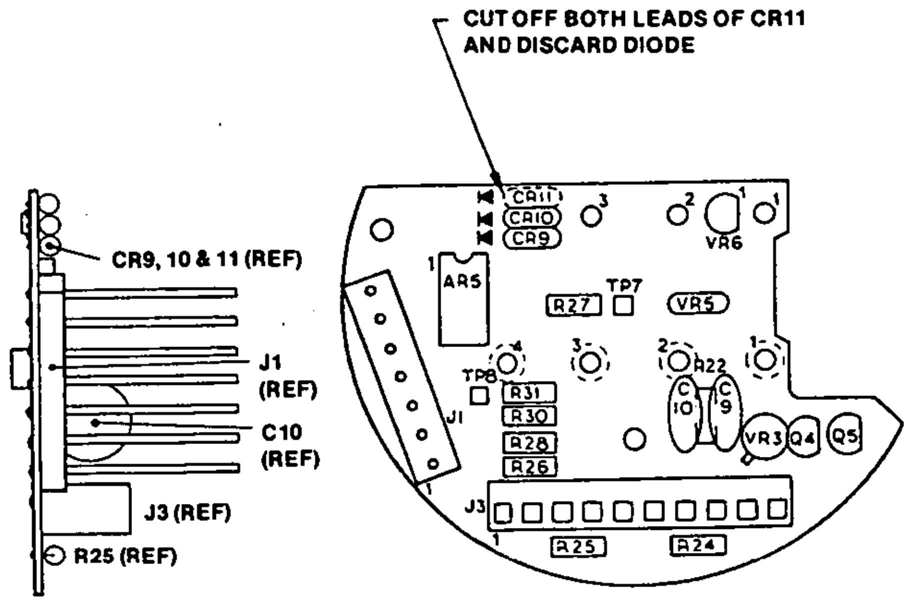
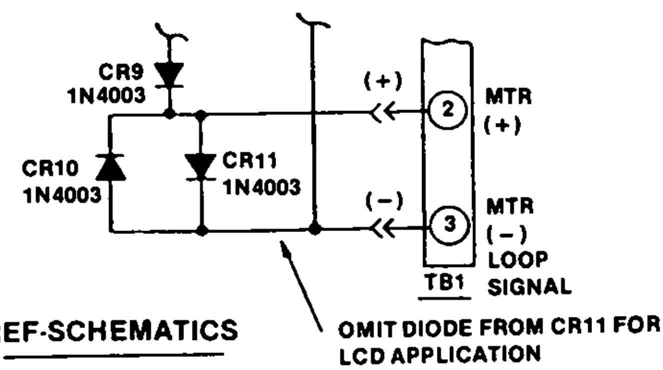


FIGURE 3-6. Transmitter Board



ELECTRONICS ASSEMBLY





REF-SCHEMATICS

PART NO.
22795-01

FIGURE 3-7. Transmitter Board

SECTION 4.0
THEORY OF OPERATION

4.1 GENERAL. This section provides a simplified theory of operation for the transmitter and also includes a flow diagram of the electronic circuitry (see Figure 4-1).

4.2 LIFT-OFF VOLTAGE. The transmitter lifts off approximately 10 volts from the loop current to power the electronics. The voltage dropped across VR1 provides for the system voltage. Upon start-up, a voltage potential must be established across VR1 to power the power supply (P.S.) module. To establish this voltage, a starting current is generated by current diode CR1 (Q1 and Q2 are off during start-up). Once the power supply module is started, power is provided for ARI and then Q1 and Q2 are switched on to regulate the current loop current.

4.3 POWER SUPPLY MODULE. The power supply module on the loop-side switches at 10K Hz to provide ±5 volts power for the sensor-side power supply module, and -5 volts power for the loop-side module. The power supply module also provide modulator and demodulator chopping signals. On the sensor-side, the 10K Hz is divided down to provide a 625 Hz square wave signal for the driver amplifier and the range factory attenuator. The driver amplifier, in turn, powers one electrode (of the sensor probe) while the other electrode measures the current as a result of the conductivity of the solution. This current is then peak detected and scaled to match the internal range multiplier switch. This scaled output is directly proportional to the absolute conductivity of the solution at 25°C.

4.4 TEMPERATURE COMPENSATION CIRCUIT. The conductivity of a solution varies with temperature change. Change in temperature is sensed at the conductivity cell and is automatically corrected to a reference temperature of 25°C. The temperature slope varies among solutions and is manually compensated by the 0-4% temperature SLOPE ADJUST control. If normal operation is to be expected in the 10 to 50°C range, and if the conductivity is between 0.5 micromhos and 5.0 micromhos at 25°C, one would expect reasonably accurate temperature compensation. The errors rapidly increase to multiples of ten and greater as the conductivity at 25°C drops below 0.5 micromhos and as the temperature goes below 10°C or above 50°C.

4.5 OUTPUT SIGNAL. After the signal is corrected for temperature, it is then modulated across the isolation transformer and receiver by amplifier ARI, where it is generated as a current proportional to the modulated signal plus four milliamps. Diode CR2 protects against reverse current flow, and CR3 and CR4 are meter diodes.

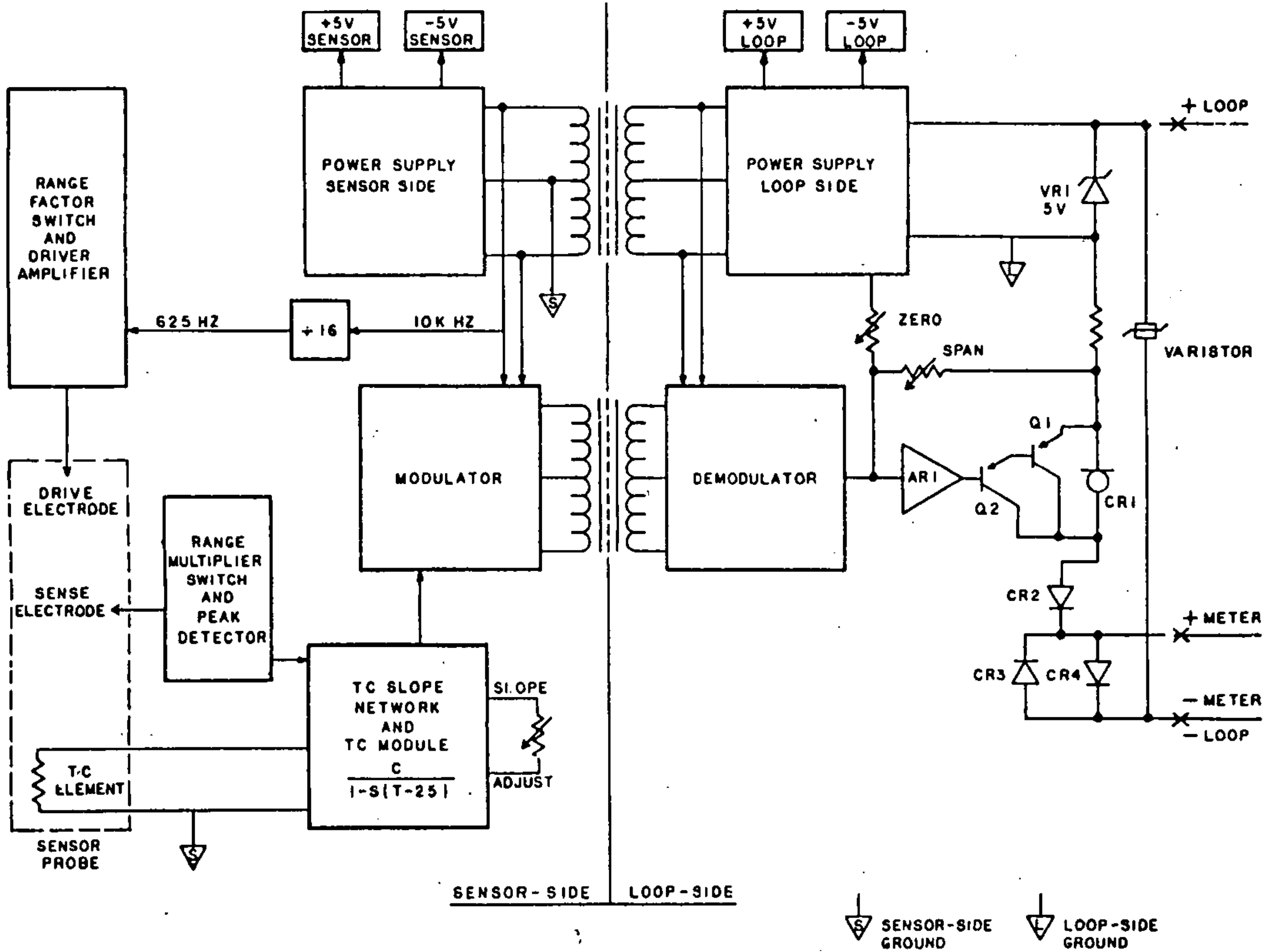


FIGURE 4-1. Simplified Block Diagram

SECTION 5.0
MAINTENANCE AND TROUBLESHOOTING

5.1 GENERAL. This section provides the maintenance and troubleshooting instructions for the Model 1181C Two-Wire Transmitter. This transmitter has no moving parts and requires a minimum of maintenance. Procedures for standardizing and calibrating the transmitter are given in Section 3.0, and generally will be the only operation-type "maintenance" required to keep the transmitter in good operating condition. If the transmitter is suspected of having a problem, refer to the following paragraph, 5.2, Troubleshooting, and proceed as instructed to correct the problem.

5.2 TROUBLESHOOTING. In the event of a failure, refer to Table 5-1 to find the defective component.

TABLE 5-1. Troubleshooting

Trouble	Probable Cause	Remedy
There is no loop current.	Voltage from power supply too low or is not present.	Correct power supply voltage by installing proper load resistor (see Fig. 1-2).
	Loop polarity is not correct.	Correct loop polarity (see Fig. 2-2).
	Open circuit or defective connection in current loop wiring.	Repair current loop wiring or connection.
	Power PCB defective.	Replace power PCB (Item 7, Fig. 6-1).
	Transmitter PCB defective.	Replace transmitter PCB (Item 6, Fig. 6-1).
Indication does not respond to solution conductivity.	Wiring from TB2 connected wrong, connection loose or wiring defective.	Correct wiring condition, tighten connections or repair defective wiring.
	RANGE FACTOR or RANGE MULTIPLIER switches not set for solution conductivity. Make sure probe constant is considered (refer to Table 3-1).	Set RANGE FACTOR and/or RANGE MULTIPLIER switches as Instructed in Paragraph 3.1.1.
Loop current does not indicate to simulated conductivity (with decade resistance box connected). Refer to Electronic Bench Check, Paragraph 3.5.	PCB connections loose or defective.	Secure PCB connections by tightening screws that secure boards, or replace PCB if connector defective.
	Driver and/or signal conditioning PCB's defective.	Remove driver (Item 8, Figure 6-1) and signal conditioning (item 9, Figure 6-1) PCB's and if indication is approximately 12 mA either/or both PCB's are defective. Replace either/or both PCB's and recheck loop current.
	Power and/or transmitter PCB's defective.	Replace boards.

5.3 MAINTENANCE. Disassemble or reassemble the Model 1181 C as follows:

5.3.1 Disassembly Procedure. Remove the power to the transmitter prior to disassembly. Follow the steps below to disassemble the transmitter (refer to Figure 6-1 for item numbers).

1. Remove covers (1 and 18) or meter housing (19). If damaged, remove and discard O-rings (2) from housing (3).
2. Loosen screws retaining serial label to housing, and then rotate the serial label approximately 90 degrees to gain access to ZERO and SPAN adjustment screws (4).
3. Align the external ZERO and SPAN adjusting screws (4) so the slots are horizontal, pointing end cap to end cap (see Figure 3-1).
4. In circuit side of housing (3), remove circuit board retaining screws, washers and matrix cover (10). The matrix cover is secured to screws with nylon split washers. Remove the screws in equal increments so the matrix cover is not damaged.
5. Pull straight out on the signal conditioning board assembly (9) to remove circuit boards from housing (3).
6. To separate individual boards, remove the retaining screw located on the terminal side of the transmitter board (6).
7. Remove each printed circuit board assembly by pulling straight out from their respective connectors.

5.3.2 Reassembly Procedure (see Figure 6-1).

1. Assemble the circuit board assemblies (6, 7, 8, 9) by first aligning the connectors with the respective pins, and then pushing straight in. Install screw which holds circuit board assemblies together.
2. Align the ZERO and SPAN adjusting screws (4) on the housing (3) to the horizontal position, slots pointing end cap to end cap (see Figure 3-1).
3. Align the ZERO (R23) and SPAN (R29) potentiometers located on the power circuit board (7) to the horizontal position, with blades pointing to PCBs (6 and 8, see Figure 6-3).
4. Place circuit board assemblies (6, 7, 8, 9) into housing by first aligning the connector pins with the terminal receptacles in the base of the housing (3) and then pushing straight in on the signal conditioning board (9).
5. Install the matrix cover (10) and secure with screws and washers. The matrix cover is secured to screws with nylon split washers. Install the screws in equal increments so the matrix cover is not damaged.
6. Inspect the thread connections on housing (3) to make sure five undamaged threads will fully engage for explosion proof requirements.
7. If removed, install O-rings (2) on housing (3).
8. Install the covers (1, 18) or meter housing (19) on transmitter housing (3).
9. Apply power to the transmitter and perform the appropriate calibration procedure as instructed in paragraphs 3.2 and 3.3.

5.4 TEMPERATURE MODULE REPLACEMENT. The temperature module (Item 11, Figure 6-1) is a plug-in assembly which can be replaced without removing the printed circuit boards. If the need arises to replace the temperature compensator module, proceed as follows (refer to Figure 6-1 for item numbers):

NOTE

The module is available in three temperature ranges; 5 to 85°C, 50 to 150°C and 100 to 200°C. The temperature sensing element of the conductivity sensor must agree with the temperature range of the temperature module; otherwise, the indication will not be representative of the solution being measured.

The Model 1181C must be electronically recalibrated if the 50-150°C or 100-200°C temperature module is replaced with a 5-85°C temperature module. Likewise, the Model 1181C must also be electronically recalibrated if the 5-85°C temperature module is replaced with a 50-150°C or 100-200°C temperature module.

1. Remove or shut down power to the transmitter.
2. Remove cover (Item 18) from the circuit side of the transmitter.
3. Pull straight out on the old temperature module (Item 11).
4. Orient the new module with the cutcorner (pin 1) adjacent to the COARSE SPAN ADJUST potentiometer; and then, making sure the pins are aligned with the socket, push the module straight in.
5. Install cover (Item 18) on the circuit side of the transmitter, making sure the O-ring (Item 2) is not defective, and that a minimum of five threads are engaged.
6. Restore power to the transmitter, and perform the Calibration Procedure in Section 3.2 or 3.3.

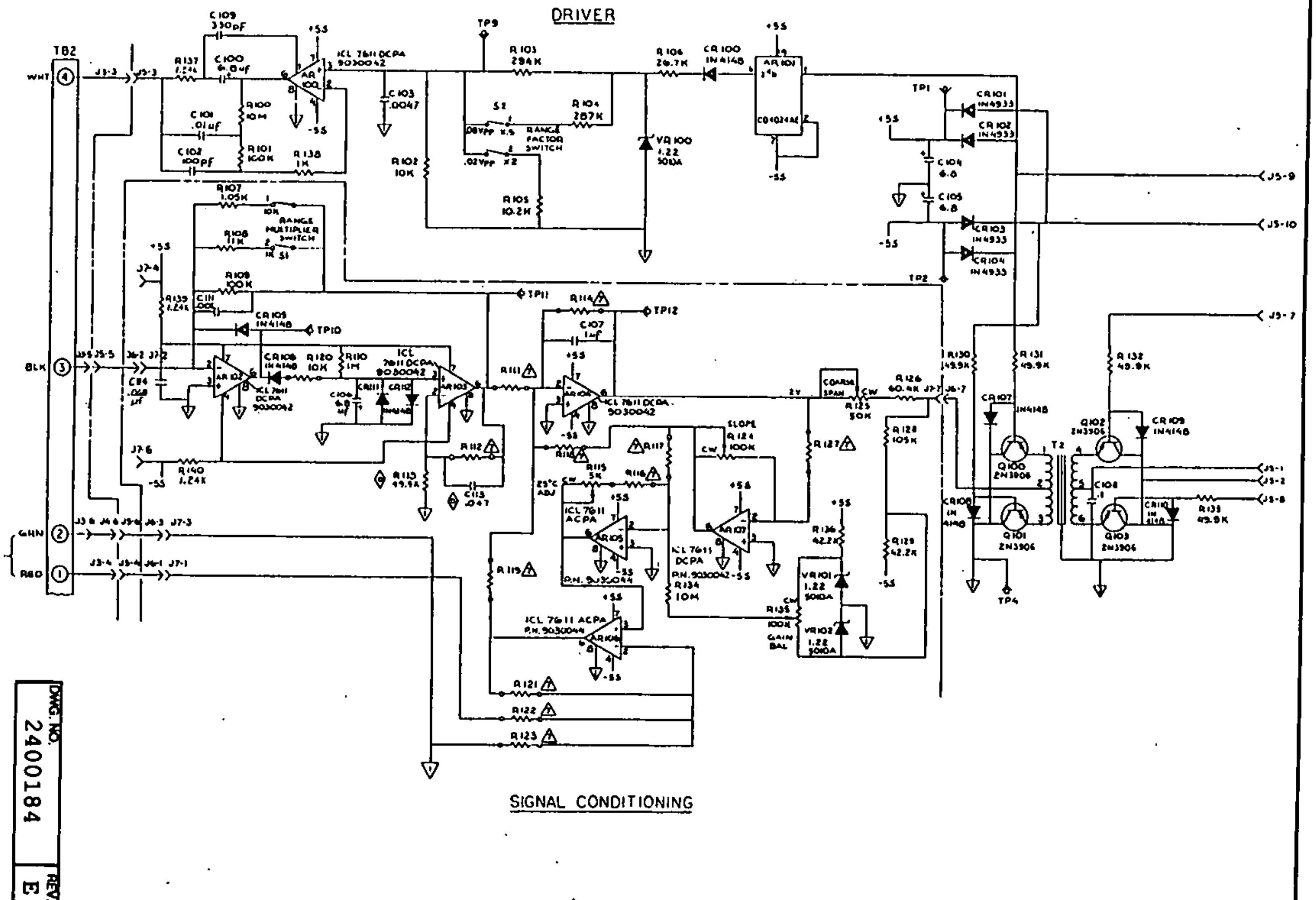
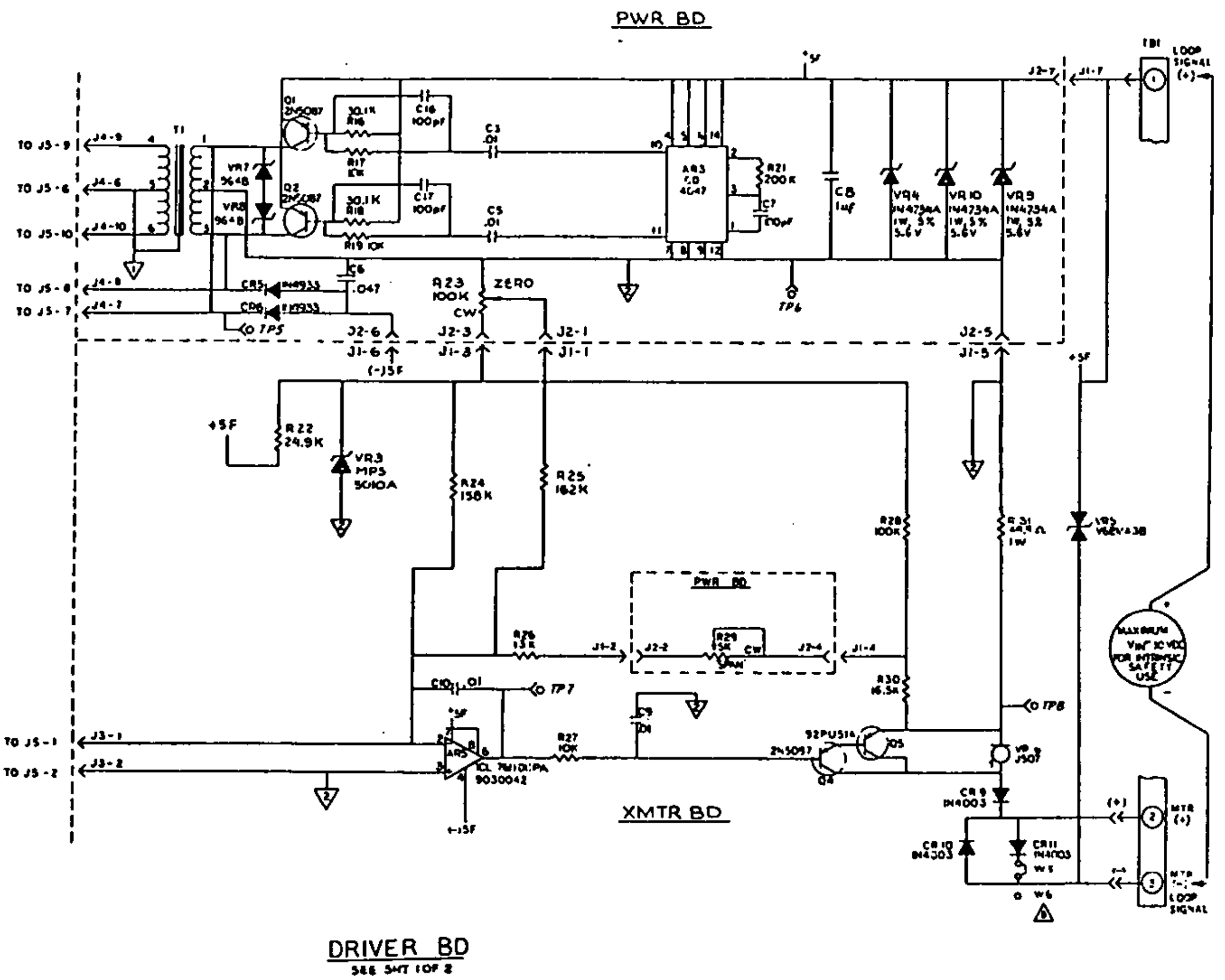


FIGURE 5-1. Schematic 1181CNDT, CSA (1 of 2)



RESISTOR VALUES FOR T.C. CIRCUIT			
	22788-00 5°-85°C	22788-01 50°-150°C	22788-02 100°-200°C
REF. DES	VALUE	VALUE	VALUE
R127	110K	100K	100K
R116	97.6K	97.6K	97.6K
R123	5.49K	866Ω	750Ω
R122	3.65K	681Ω	787Ω
R121	3.92K	887Ω	1.05K
R119	12.1K	12.1K	12.1K
R117	200K	200K	200K
R118	12.1K	12.1K	12.1K
R114	121K	121K	121K
R112	301K	301K	301K
R111	12.1K	12.1K	12.1K

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FIGURE 5-2. Schematic 1181CNDT, CSA (2 of 2)

SECTION 6.0
PARTS LIST

6.1 GENERAL. The following are the parts lists and illustrations for identifying the parts and assemblies of the Model 1181C Two-Wire Transmitter.

TABLE 6-1. Replacement Parts List

Item #	Part Number	Description	Qty.
1	3002425	Cover (for Blind Model)	1
2	2002604	O-Ring Kit	1
	Consists of: 9550136	O-Ring	12
3	2002528	Housing	1
4	2002598	Adjustment Screw Kit	1
5	2002605	O-Ring Kit	1
	Consists of: 9550137	O-Ring	12
6	22795-02	Transmitter PCB - Blind/Analog	1
	22795-03	Transmitter PCB - LCD	1
7	22796-00	Power PCB	1
8	22798-01	Driver PCB	1
9	22789-01	Signal Conditioning PCB (w/o T°C)	1
	22790-03	Signal Conditioning PCB (5-85°C)	1
	22790-04	Signal Conditioning PCB (50-150°C)	1
	22790-05	Signal Conditioning PCB (100-200°C)	1
10	22804-00	Matrix Cover Kit	1
11	22788-00	Temperature Module Assy, 5 to 85°C	1
	22788-01	Temperature Module Assy, 50 to 150°C	1
	22788-02	Temperature Module Assy, 100 to 200°C	1
12A	23122-00	LCD Assy, 0-100% (Code 06)	1
12B	9170163	Meter (Code 01)	1
	9170167	Meter (Code 03)	1
13		Meter Sleeve (Code 06)	1
14	32955-00	Plate, Meter Mounting (Code 01/03)	1
15	32996-00	Insulator, Meter Screen (Code 01/03)	1
16	32997-00	Retainer Meter (Code 01/03)	1
17	32961-00	STD-OFF, Terminal (Code 01/03)	1
18	3002468	Cover, Tall (PCB Side)	1
19	2002518	Meter Cover Kit	1
20	2002603	O-Ring Kit	1
	Consists of: 9550135	O-Ring	12
21	2002600	Window Kit	1

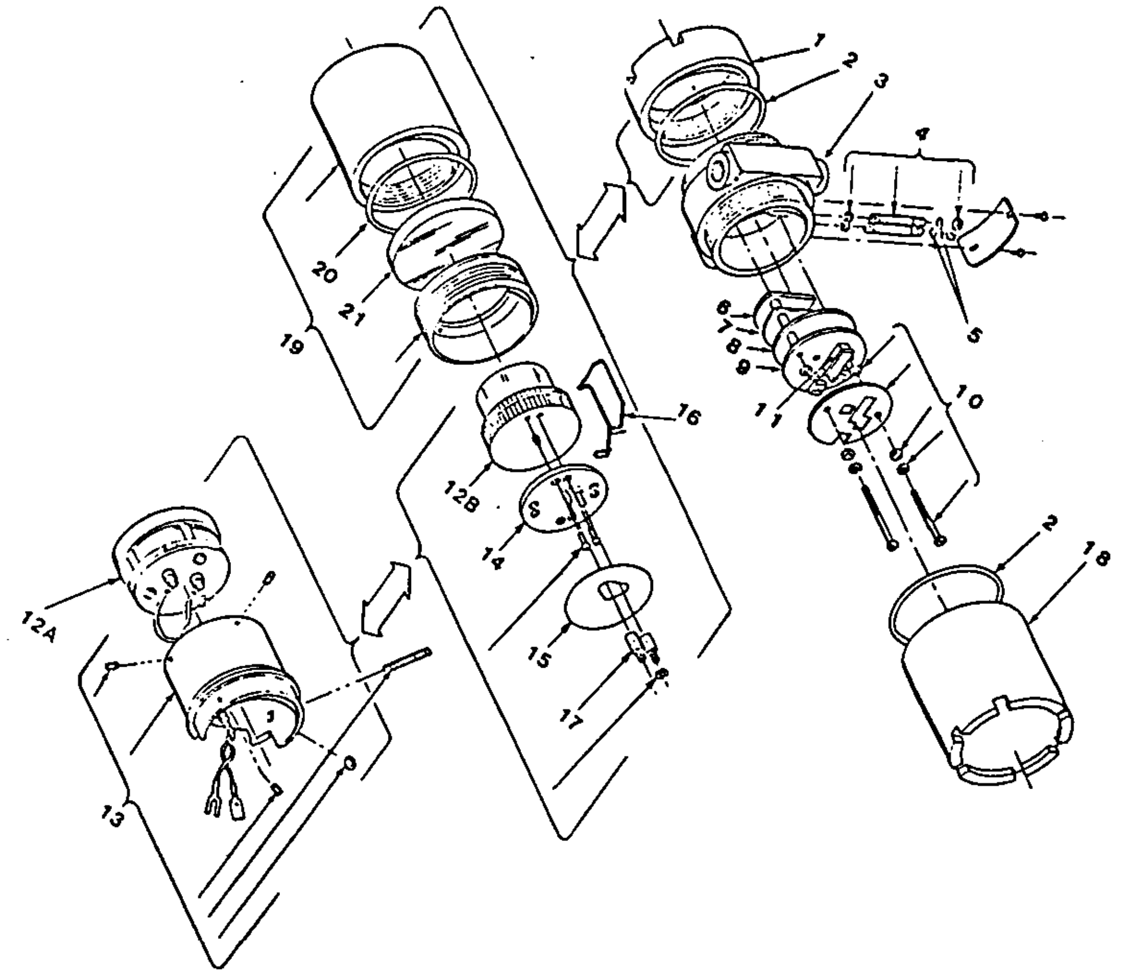


FIGURE 6-1. Model 1181C Two-Wire Transmitter

TABLE 6-2. S-Assy, Electronics

			ITEMS			
			6	7	8	9
Display	Part No.	Description	PCB XMTR	PCB PWR	DRIVER	SIG CND
	22930-00	5-85°C				22790-03
LCD RTO	22930-01	50-150°C	22795-03			22790-04
	22930-02	100-200°C		22796-00	22798-01	22790-05
	22930-03	5-85°C				22790-03
BLIND & ANALOG	22930-04	50-150°C	22795-02			22790-04
	22930-05	100-200°C				22790-05

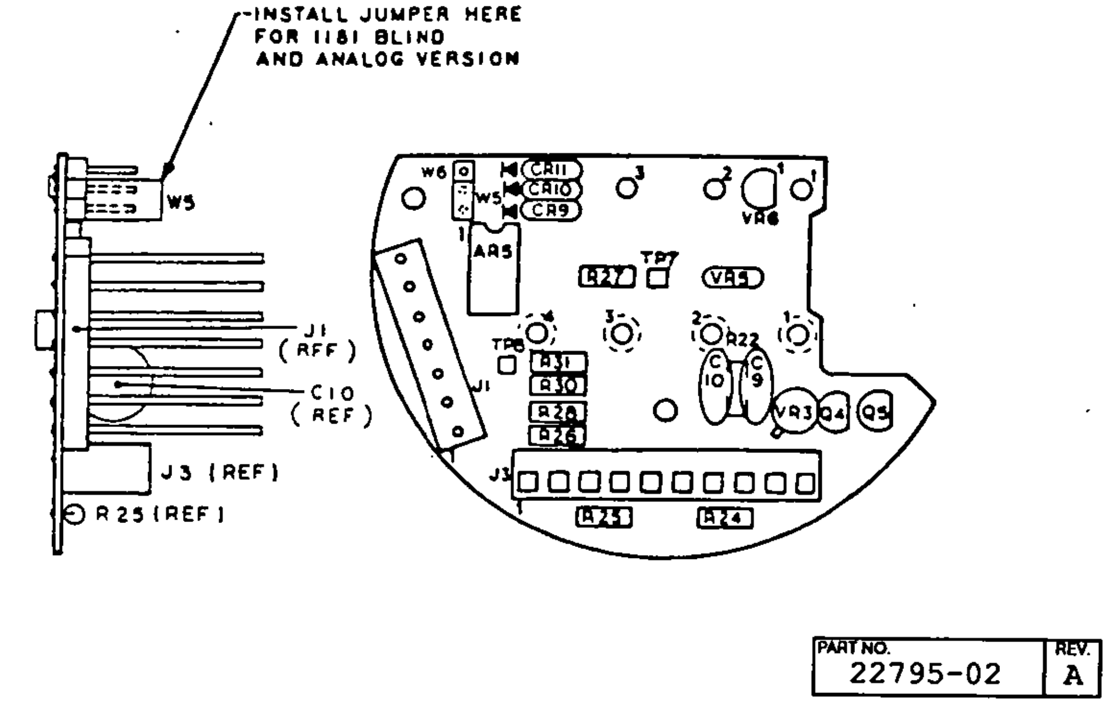


FIGURE 6-2. Transmitter PCB

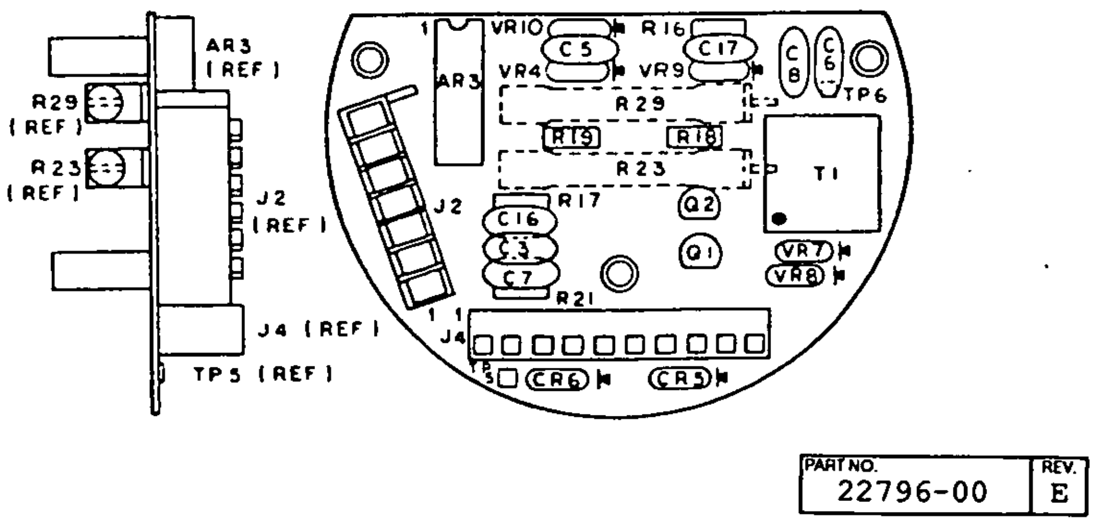


FIGURE 6-3. Power PCB

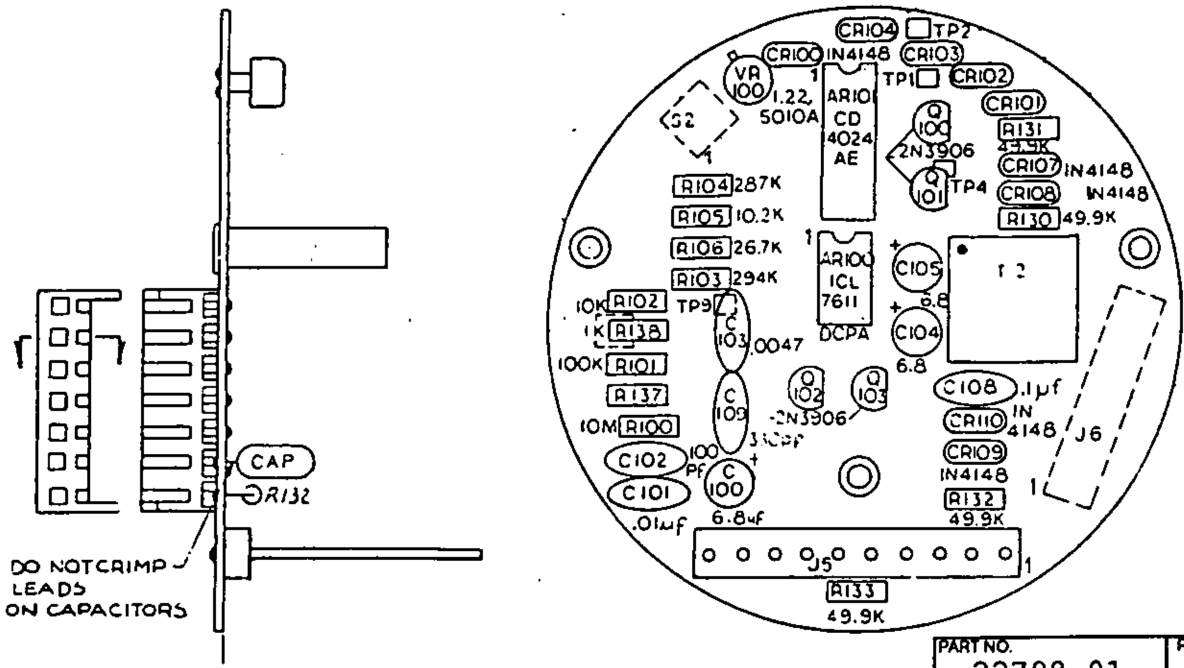


FIGURE 6-4. Driver PCB

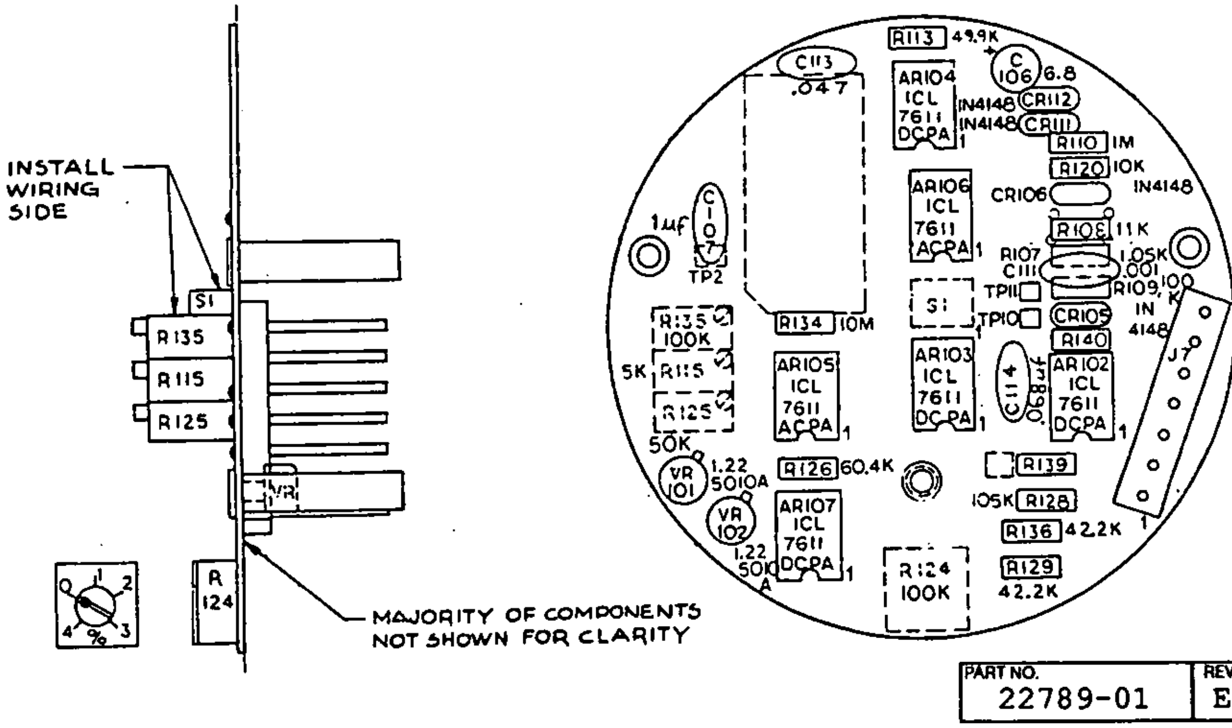


FIGURE 6-5. Signal Conditioning PCB

SECTION 7.0
RETURN OF MATERIAL

7.1 GENERAL. To expedite the repair and return of instruments, proper communication between the customer and the factory is important. A return material authorization (RMA) number is required. Call 1-800-654-7768 or 714 863-1181. Th "Return of Materials Request" form is provided for you to copy and use in case the situation arises. The accuracy and completeness of this form will affect the processing time of your materials.

7.2 WARRANTY REPAIR. The following is the procedure for returning instruments still under warranty.

1. Contact the factory for authorization.
2. Complete a copy of the "Return of Materials Request" form as completely and accurately as possible.
3. To verify warranty, supply the factory sales order number or the original purchase order number. In the case of individual parts or sub-assemblies, the serial number on the mother unit must be supplied.
4. Carefully package the materials and enclose your "Letter of Transmittal" and the completed copy of the "Return of Materials Request" form. If possible, pack the materials in the same manner as it was received.

IMPORTANT

Please see second section of "Return of Materials Request Form". Compliance to the OSHA requirements is mandatory for the safety of all personnel. MSDS forms and a certification that the instruments have been disinfected or detoxified are required.

5. Send the package prepaid to:

   Rosemount Analytical Inc.
   2400 Barranca Parkway
   Irvine, CA 92714

   Attn: Factory Repair

   Mark the package: Returned for Repair RMA#

   Model No. ____

7.3 NON WARRANTY REPAIR. Contact Factory For Authorization

1. Contact the factory for authorization.
2. Fill out a copy of the "Return of Materials Request" form as completely and accurately as possible.
3. Include a purchase order number and make sure to include the name and telephone number of the right individual to be contacted should additional information be needed.
4. Do Steps 4 and 5 of Section 7.2.

NOTE

Consult the factory for additional information regarding service or repair.

.16
84
64
1280
13.44
4
17.44.

24

959747

INSTRUMENT MYPEX-pH

from manufac. no. 4000

ph/redox measurement
operating instructions
115 253 - 1002

E+H conducta

A member of the Endress+Hauser group

1. Microprocessor control

On traditional pH measurement instruments all parameters are set by using switches and potentiometers. The microprocessor offers the possibility of program selection as desired. This makes the instrument much more versatile and offers a wider range of functions (electrode monitoring, semi-automatic calibration etc.).

All operating steps and settings for commissioning the instrument are entered via the keyboard on the front.

Operation of the MYPEX measuring instrument is made easier by the dialogue mode.

The status display (lower display) indicates the program step. By using the input keyboard the operator can move through the program as desired, acknowledge values or enter new ones.

2. Principles of operation

The MYPEX measuring instrument can be optimally matched to the measuring point requirements. Example: choice of measuring range, limit value setting, output signal allocation and range allocation etc.

2.1 Electrode calibration

The calibration program with buffer (BUC) or numeric calibration (NUC) can be directly called up. As an option there is a 3-digit code protection.

2.2 Sensor data inquiry is at a touch of a key

2.3 Menu for measuring parameters

contains all settings which determine the instrument function. These parameters are usually retained after the initial calibration. Access is protected with a 4-digit code.

2.4 Basic settings are established in a separate area.

Access is obtained by backspacing from the measuring parameter section (pressing [↑ -/0] for longer than 4 sec).

The menu for the measuring parameters (2.3) and for the basic settings (2.4) is further divided into ROUTINES.

These routines are built up according to the functions; i.e. they each contain all the steps necessary to define a particular function. E.g. the routine "Set Output" contains all the steps necessary for determining the signal output.

The menu configuration allows direct access to each function. When delivered the instruments are set at preset values.

3. Condensed programming instructions

3.1 Quick calibration

Access to calibration is protected with a code ex factory (switch S5 in Appendix IV, Page 35, point 27.2 is "ON")

Procedure [Cal 9] then code input (at the factory set at [1] [1] [1]

Set S5 at "OFF" and all is needed is to press key [Cal 9]

For customers who are used to previous operating models a third possibility remains: [E] + code [1] [1] [1]

3.2 Sensor data inquiry

For inquiry press [SENSOR DATA 6]

Continue pressing the same key or automatic return after 9 sec.

3.3 Measuring parameters and basic setting Access via a 4-digit access code

[E] + [2] [2] [2] [2]

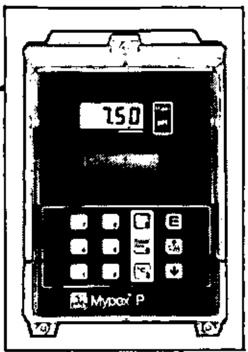
3.4 The menu

The procedure is shown in Figure 1.
The menu level is easily recognisable by a dark measuring value display and the changing status display.
3 keys are important in the menu level:

= Advance [↓]

= Return [↑ -/0]

= Entry into a routine [E]



SENSOR DATA 6 → 10 seconds
Sensor data display
(△1/2, zero point and slope
pH value of second circuit)

°C 3 →
5 second display of
the temperature in °C

CAL 9 → CODE 1 1 1

E → CODE 2 2 2 2

BASIC SETTING

VERS ⟲ DATE	E →	Software version date VERSION DATE	a
CAL ⟲ TEMP	E →	Temperature calibration CALIBRATE TEMPERATURE	b
SET ⟲ ALRM	E →	Alarm modes SET ALARMS	c

FUNCTION DETERMINATION

SET ⟲ FCTN	E →	Function switch-over SET FUNCTION	* Master cir. * ATC - MTC * BUC - NUC	d
SET ⟲ BUFF	E →	Set buffers SET BUFFERS	PAR - SER	e
SET ⟲ OUTP	E →	Allocation of signal output SET OUTPUT		f
SET ⟲ DELT	E →	Delta setting SET DELTA		g
SET ⟲ LIMT	E →	Setting of value extremes SET LIMITS		h

MEAS

Stop for *** electrode insertion or fault signal display (3 minutes) **

CALIBRATION PROGRAMS
(Keyboard monitoring 15 min.)**

Electrodes - calibration with puffer CALIBRATE ELECTRODES (BUC)	Numeric calibration NUMERIC CALIBRATION (NUC)

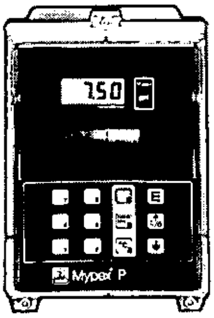
* Can be dispensed with on inputting the 3 digit code, if the internal switch is correspondingly set. (see 27.2)

** When not advanced after time period has elapsed, measuring mode with previous calibration is taken up.

*** When not advanced after 15 min. take up of measuring mode with new calibration

**** Longer pressing in routine SET FCTN results in jump into the basic setting level

⟲ Alternate display



CAL ⟷ TEMP

CALIBRATE TEMPERATURE

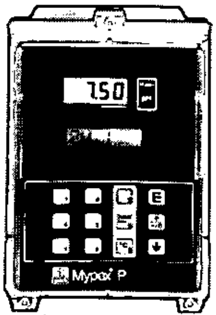
Basic setting ROUTINE b

In this routine you can:

Calibrate the Pt 100 temperature measuring circuit.

	DISPLAY	FUNCTION	POSSIBLE INPUTS
1	Mypex pH TCAL	TEMPERATURE CALIBRATION Calibrate Pt 100 temperature measuring circuit. One point calibration	Pt 100 calibration 1. Connect Pt 100 simulator and/or immerse Pt 100 in a liquid with a known temperature (below 30°C) 2. Input temperature value e.g. 25°C [2] [5] [E] 3. Press ENTER key
			Advance into menu without calibration [↓] MENU

NOTE:
The MYPEX instrument compares the measured temperature and the keyboard input. Calibration faults or inputs over 30°C are not accepted by the instrument.



SET ⟷ FCTN

SET FUNCTION

SET FUNCTION
Master circuit
Temperature compensation
calibrated

Measuring parameters ROUTINE d

In this routine you can:

1. Choose master circuit on two-circuit instruments (displayed electrode)
2. Switch temperature compensation: auto/manual
3. Choose calibration value

Step	DISPLAY	FUNCTION	POSSIBLE INPUT	Key
1	1 (Mypex pH) MAST	MASTER CIRCUIT Select master circuit (1 or 2, continuous display) (only for two-circuit inst.)	Circuit switch-over e.g. switch-over from circuit 1 to circuit 2	2 E
			Measuring left in circuit displayed	↓

Select between automatic temperature compensation and manual temperature compensation.

Set input appears first as static display.

Example with ATC as preset parameter.

Step	DISPLAY	FUNCTION	POSSIBLE INPUT	Key
2	(Mypex pH) ATC	Automatic temperature compensation AUTOMATIC TEMPERATURE COMPENSATION Select autom. temperature compensation	Retain automatic temperature compensation (continue with step 4)	E
			Manual temperature compensation required?	↓
	(Mypex pH) MTC ?	Manual temperature compensation MANUAL TEMPERATURE COMPENSATION Select manual temperature compensation	Switch to manual temperature compensation	E
			Return to automatic temperature compensation	↓
3	0 (Mypex pH) MTMP	Input temperature which should be compensated for. NOTE: if manual compensation, TMP symbol continuously lit in display!	Input new value e.g. 22°C: permiss. range: -50%...+150°C	2 2 E
			Retain value displayed	↓

SET ⟲ OUTP

SET OUTPUT

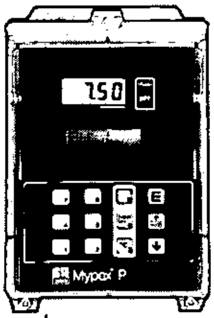
Measuring parameters ROUTINE f

In this routine you can:

1. Allocate the output current to the measuring mode
2. Switch over the output current range
   (0 - 20mA/4 - 20mA)
3. Dampen signal output

	DISPLAY	FUNCTION	POSSIBLE INPUT
1	0.00 (Mypex pH) OR L	Initial Signal Output OUTPUT RANGE LOW The initial output range is set between two points: the initial value is the pH value, which equals 0 or 4mA	Input new value e.g. pH 2.00 = 0/4mA Permiss. range: -2.00 to 14.00 pH Preset value: 0.00 pH [2] [↑ -/0] [↑ -/0] [E] Retain previous value [↓]
2	14.00 (Mypex pH) OR H	Final Signal Output OUTPUT RANGE HIGH The second value determines the limit of the pH transmission range, equalling 20mA.	Input new value e.g. pH 12.00 (range 2 - 12 pH) Permiss. range: -2.00 to 14.00 pH Preset: 14.00 pH [1] [2] [↑ -/0] [↑ -/0] [E] Retain previous value [↓]
3		Select output 0 - 20mA or 4 - 20mA Set input appears as static display.	Example with "0-20mA" as preset parameter
	(Mypex pH) 0 - 20	Output 0 - 20MA	Retain 0 - 20mA (continue with step 4) [E] 4 - 20mA required? [↓]
	(Mypex pH) 4 - 20	4 - 20mA? Output 4 - 20mA required?	Switch over to 4-20mA (continue with step 4) [E] Return to 0 - 20mA [↓]
4	19.99 (Mypex pH) MA/S	mA/s The output signal can be dampened. The max. alteration speed is given in mA/s.	Input new value, e.g. 5.00mA/s (produces an output alteration from 0 to 20mA in 4 sec. [5] [↑ -/0] [↑ -/0] [E] Permiss. range: 0.05....19.99mA/s Preset: 19.99mA/s Retain previous value MENU [↓]

NOTE:
1. The larger pH value can also be allocated to the initial signal output (0 or 4mA) and the smaller pH value to the final signal output. (Reverse mode)
2. Instrument signals "ERRD" when difference (OR H - OR L) is smaller than 1.00 pH. Repeat input.
3. With alarm decoder connected exceeding or falling short of the current output leads to P1 closing.



SET ⇄ LMT

SET LIMIT

Measuring parameters ROUTINE h

In this routine you can:

Preset the minimum and maximum limits

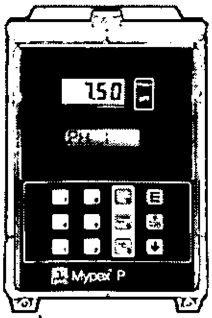
	DISPLAY	FUNCTION	POSSIBLE INPUT
1	0.00 (Mypex pH)	MIN Min. pH limit	Input new value e.g. pH 3.52 [°C/3] [5] [2] [E] Permiss. range: -2.00 to 14.00 pH Preset value: 0.00 pH
	MIN		Retain previous value [↓]
2	14.00 (Mypex pH)	MAX Max. pH limit	Input new value e.g. pH 11.2 [1] [1] [2] [↑/-/0] [E] MENU Permiss. range: -2.00 to 14.00 pH Preset value: 14.00 pH
	MAX		Retain previous value [↓] MENU

NOTE:
1. Instrument signals "ERRD" when
   - input parameter difference 0.01 pH
   - the larger pH value is allocated to the MIN value and the smaller to the MAX value.

   Repeat input with [↓]

2. With alarm decoder connected,

   contacts P2, P3 in MMA mode,
   P2 in DMA mode are closed on
   reaching, exceeding or falling short of the limits.



CALIBRATION PROGRAM II:

NUMERIC CALIBRATION

Call with key from measuring mode [Cal 9]

With code safeguard: [Cal 9] + [1] [1] [1]

Numeric calibration (NUC selected)
(Buffer calibration s. S. 13)

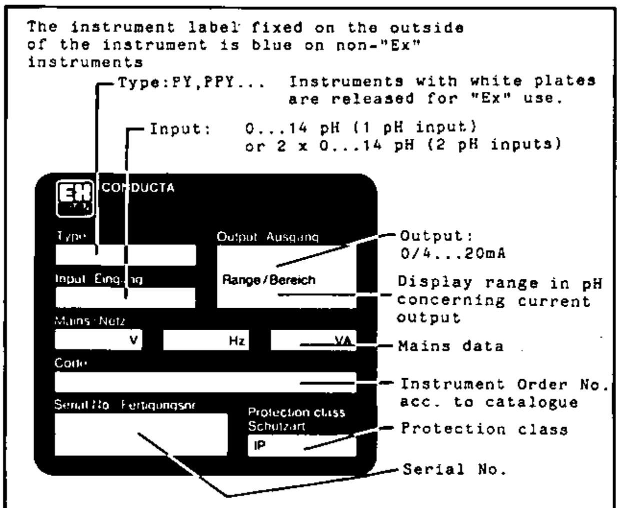
	DISPLAY	FUNCTION	POSSILBE INPUT
1	0.00 (Mypex pH) OFFS	OFFSET - "Input" (Emergency calibration) If a measuring fault occurs all measuring values can be shifted by inputting a corrective value. Temporary emergency calibration until new calibration.	Emergency calibration necessary e.g. value is pH 0.45 too high. Corrective value -0.45 is input. Then jump into menu. [↑/-10] [4] [5] [E] Emergency calibration not necessary. [↓]
2	58.3 (Mypex pH) SLP 1	Slope Electrode 1 SLOPE 1 Slope of electrode 1 is displayed in mV/pH. (Flashing decimal value)	Input new slope e.g. 57.4mV/pH at 25°C [5] [7] [4] [E] Permiss. range: 30...70mV/pH Preset value: 58.2mV/pH or the value determined at the last wet calibration Retain value displayed [↓]
3	7.00 (Mypex pH) ZER 1	Zero Point Electrode 1 ZERO 1 Zero point of electrode 1 is displayed in pH.	Input new value e.g. pH 7.12 [7] [1] [2] [E] Permiss. range: -2.00 to 14.00 pH Preset value: 7.00 pH or the value determined at the last wet calibration Retain value displayed [↓]
4	59.0 (Mypex pH) SLP 2	Slope Electrode 2 SLOPE 2 Slope of electrode 2 is displayed in mV/pH. (Flashing decimal value) Only for two-circuit instr.!	Input new slope e.g. 49 at 25°C Range as in 2 [4] [Cal 9] [↑/-10] [↑/-10] [E] Retain value displayed [↓]
5	7.00 (Mypex pH) ZER 2	Zero Point Electrode 2 ZERO 2 Zero point of electrode 2 is displayed in pH. Only for two-circuit instruments!	Input new value e.g. pH 7.15 [7] [1] [5] [E] Range as in 3 Retain value displayed [↓]

18. MYPEX versions

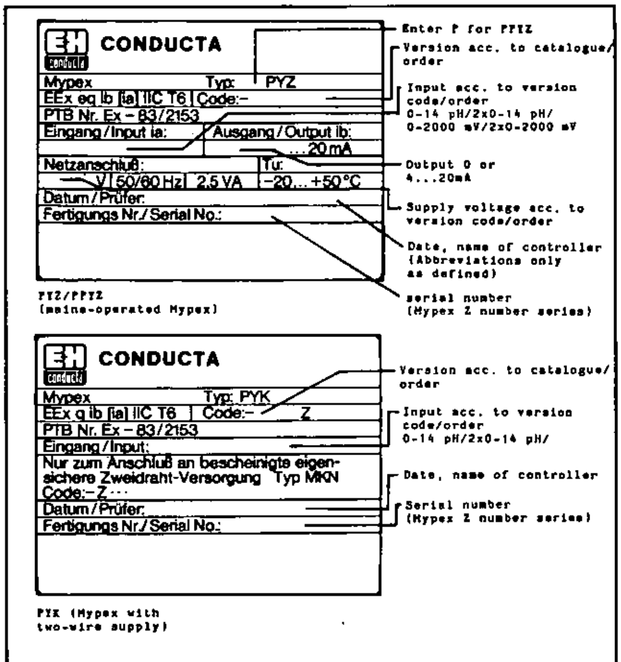
All types - as per order - are delivered in one of the following versions. The version is given in the "code" column on the instrument's label:

- pH measurement, DIN version with manual and automatic temperature compensation ... ...-0...
- mV measurement (absolute) ±1100mV ... ...-5...
- mV measurement (relative 0-100%) ... ...-6...
- mV measurement ±1999mV ... ...-7...

Auxiliary supply and output are indicated on the instrument label. All other operating parameters are programmed on the instrument.



MYPEX Instrument Label - Non-"Ex" Instruments



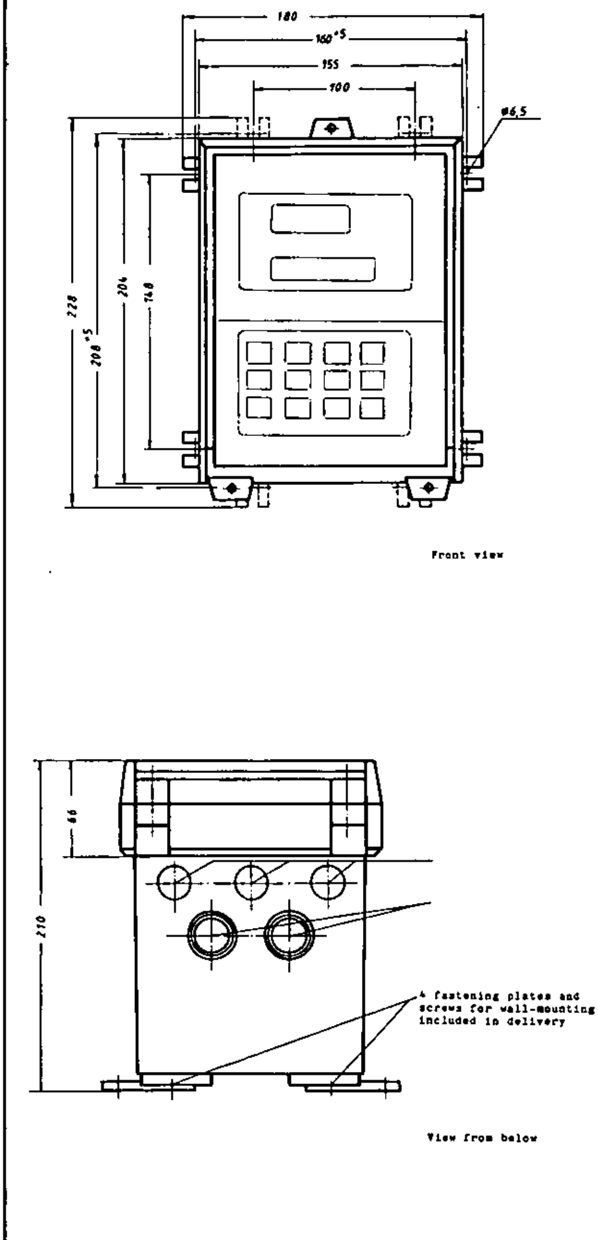
MYPEX Instrument Label - "Ex" instruments

MYPEX pH MEASURING INSTRUMENT

19. Mounting/dimension figure

The instrument can be mounted on the wall or on a pipe (mast) (see illustrations). The wall-mounting brackets are included in the delivery. The mast-mounting kit must be ordered separately. Order number 100 547-0000.

A corresponding VA 3 hood is required as weather protection for outdoor mounting, order number 100 550-0000. This is fastened directly to the instrument and can used for both wall and mast-mounting.



Dimension figure
MYPEX pH process meter

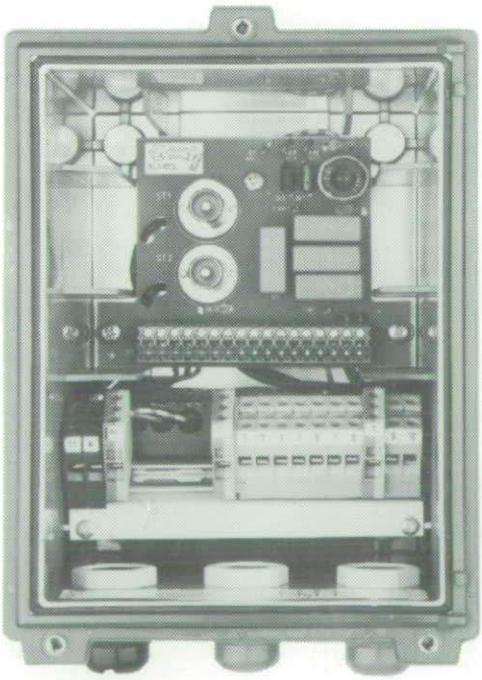
Fault signals:

M1/M2	measurement below/above selected measuring range ends	1/2	sensor difference greater than selected (only for two-circuit instruments)
SP1/SP2	measurement below/above limits	E (in digital display)	display range exceeded/fallen short
TMP	temperature < -50°C or > 150°C		

MYPEX - PH
OPERATING INSTRUCTIONS
115 253 - 1002

1.
Loosen retained allen bolts and tilt the front cover down. Pull out connection plug and remove front cover.

2.
The entire signal processor is detachable. A possible power supply unit - powder-filled in "Ex"-versions - remains in the housing behind the terminal strip.

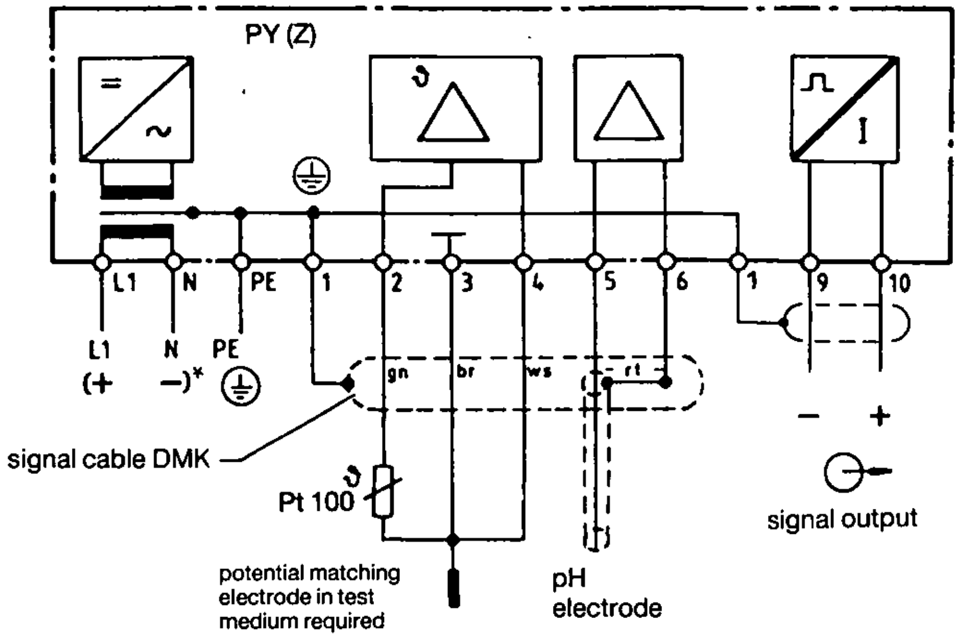


3.
After removal of the signal processor the connection terminals are accessible.

4.
After loosening the 4 fastening screws all function modules are accessible.

20. Connection diagrams for instruments PY, PYZ, PPY, PPYZ

Industrial measuring instrument PY or PYZ
with one pH/mV input and one temperature input.
- symmetric high impedance pH input



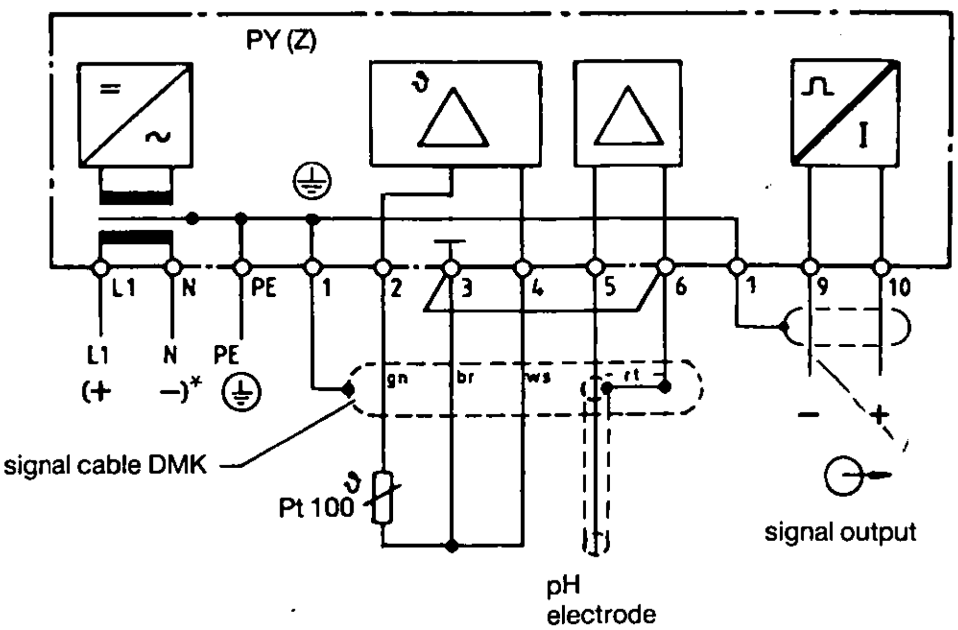
*connections with 24 V =

- Caution:
  As the instrument's pH measuring input has symmetric high impedance, a metrological potential matching to the test medium must be carried out.

Industrial measuring instrument PY or PYZ

with one pH/mV input and one temp. input

- pH input asymmetrically connected
- pH inputs asymmetrically connected for standard electrodes (pH-signal high impedance, reference signal low impedance)

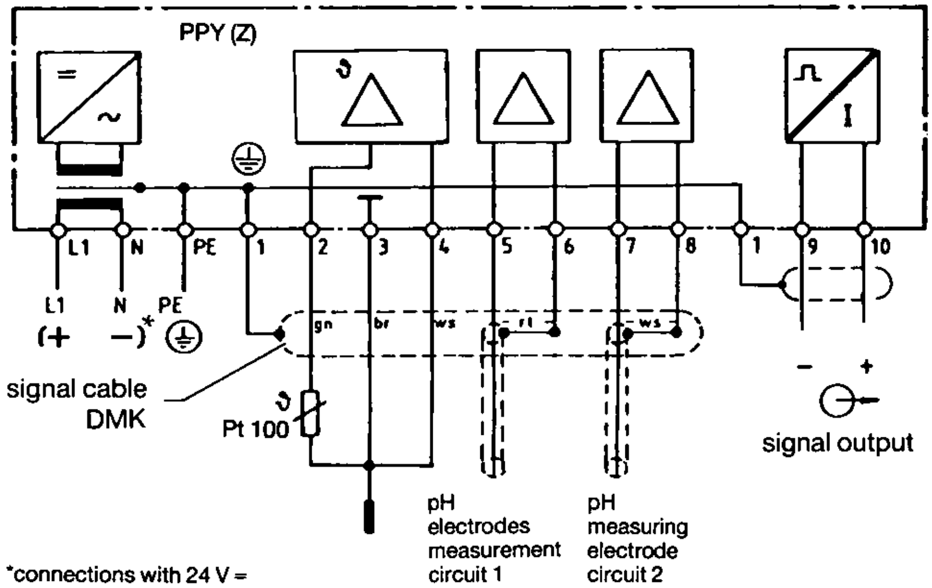


*connections with 24 V =

Connection diagrams for instrument combinations see equivalent for MKN, MKD, XDR.

Note for connection of the electrodes within the assemblies, also Zone 0, see appendix 3.

Industrial measuring instrument PPY or PPYZ
with two pH/mV inputs,
- symmetric high impedance, one temperature input



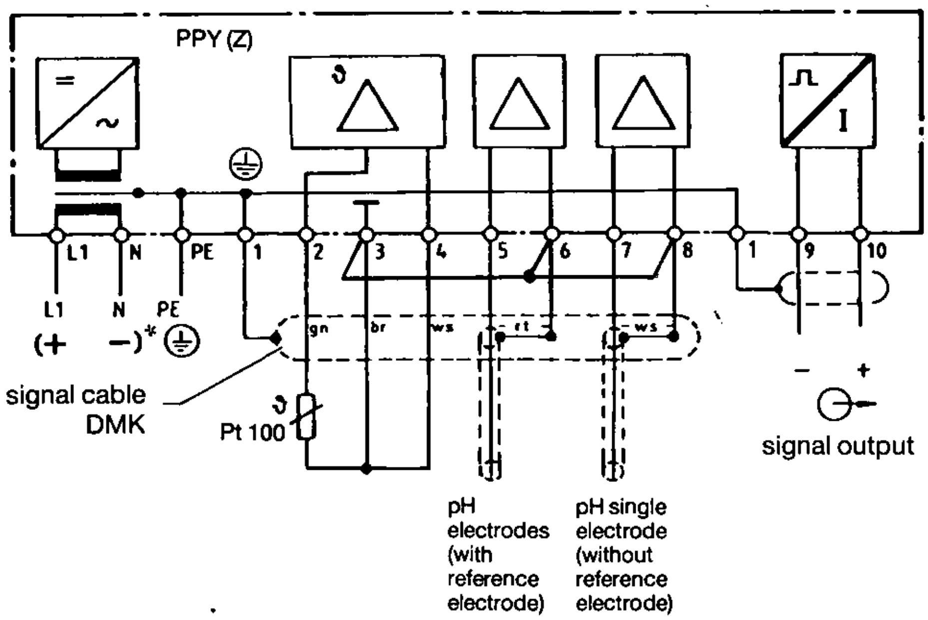
*connections with 24 V =

- Note:
  As the instruments' pH measuring inputs have symmetric high impedance, a metrological potential matching to the test medium must be carried out.

Industrial measuring instrument PPY or PPYZ

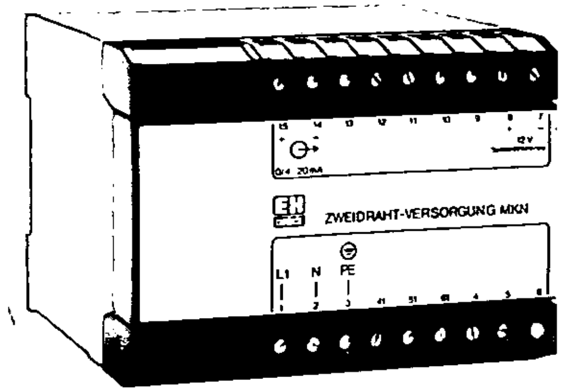
with two pH/mV inputs and one temp. input

- pH inputs asymmetrically connected
- pH input asymmetrically connected for standard electrodes (pH-signal high impedance, reference signal low impedance)



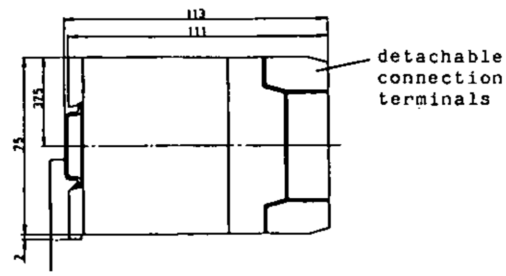
*connections with 24 V =

21. Two-wire supply unit MKN



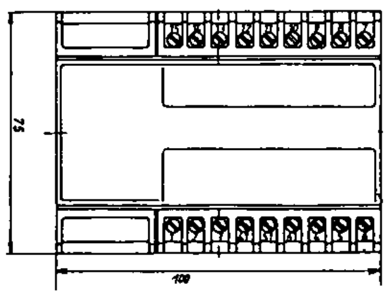
Two-wire supply MKN

Side view



Standard rail (rail) 35 x 7.5 mm
EN 50022

Top view



Dimension figure MKN

21.1 Use

The MKN two-wire supply unit is a component of the MYPEX instrument combinations for MYPEX pH process meters without integral power supply.

21.2 Function

The MKN supply unit is connected to the MYPEX instrument (version PYK or PPYK without power supply) via a twin-core cable.

The MYPEX instrument is supplied via this twin-core cable.

Simultaneously the measuring signal, transmitted without interference from the MYPEX instrument as a result of the PFM technique (Pulse Frequency Modulation), is transformed into an output current 0 or 4 - 20mA.

If the 2-wire cable shortcircuits or breaks set parameters and calibration data are retained. The supply output of the two-wire supply goes to 0 mA; there is no damage to the instrument.

21.3 Mounting/dimension figure

Supply unit MKN is designed for mounting in the control room, always outside the "Ex" area.

Mounting can be with screws or by snapping onto a 35 mm rail according to European Standard EN 50022.

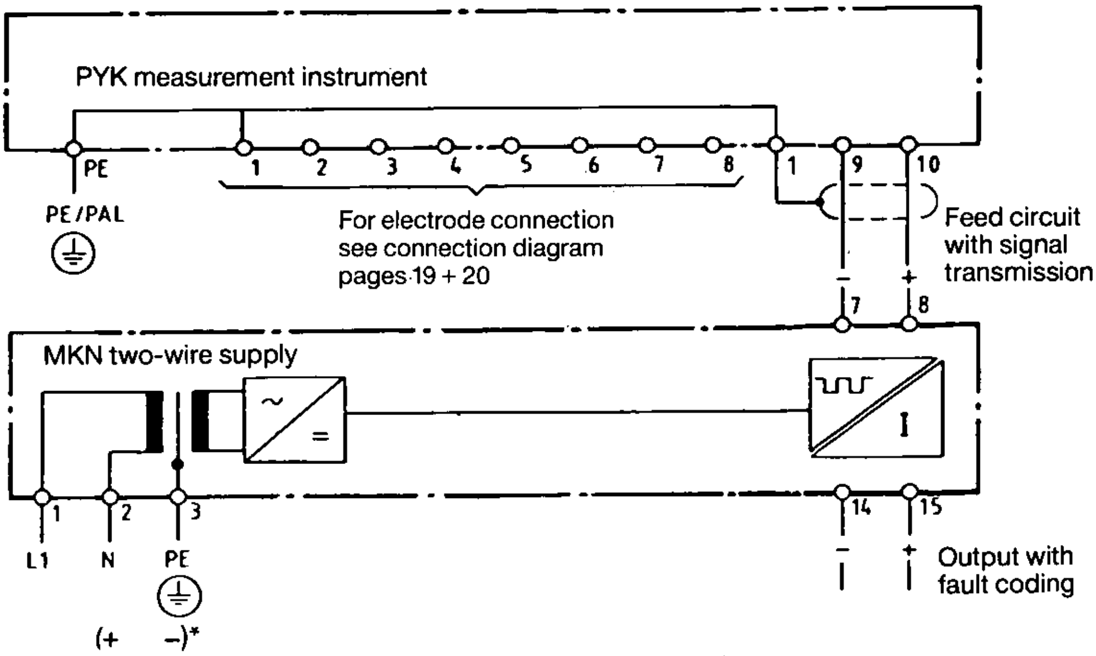
The unit is connected by means of screw terminal blocks on the front, which in turn are joined to the instrument by plugging in (contact blade rail).

There is a protective casing IP 65 available for single mounting outside the switch cabinet.

21.4 Connection

The electrical commissioning occurs together with the MYPEX measuring instrument. Therefore attention should be given to Pages 23 and 24 of these instructions; for connection to alarm decoder MKD also Pages 28 and 29.

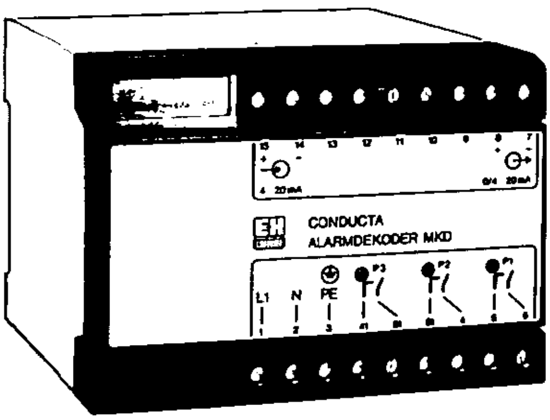
On "Ex" versions the feed circuit is intrinsically safe to the MYPEX instrument.



* Connection at 24 V =

Connection diagram for instrument combinations PY-K or PYZ-K with one pH/mV input as well as PPY-K or PPYZ-K with two pH/mV inputs, in two-wire version with separate two-wire supply unit MKN.

22. Alarm decoder MKD



Alarm decoder MKD

22.1 Use

Alarm decoder MKD is a component of the MYPEX instrument combination for signalling faults and when the limits are exceeded as detected by the MYPEX instrument.

It is either directly connected to the MYPEX instrument or, if available, to two-wire supply MKN.

22.2 Function

Faults detected by the MYPEX instrument are combined into three group alarms and transmitted encoded on the measurement value output signal.

Alarm decoder MKD decodes these group alarms and thereby switches 3 potential-free contacts.

The pick up of the group alarm contact, allocated to the respective priority stage, occurs immediately a fault signal appears (when Delta is exceeded after the delay time programmed in the MYPEX).

The fault pulses are "sent" from the MYPEX instrument every 5 sec. The "deletion", i.e. the drop out of the respective switch contact occurs after approx. 10 sec.

Priority stage 1 faults supersede priority stage 2 or 3 faults; only the highest of the actual priority stages is active.
Priority and setting see Routine C, Page 7

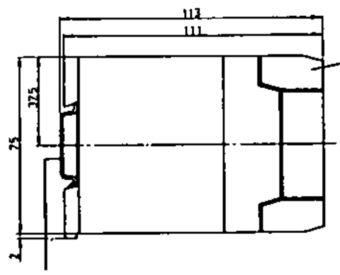
With a line break or short circuit of the signal output circuit, the supply output falls to 0 mA even when supply output 4-20mA is selected.

22.3 Mounting/dimension figure

The instrument is designed for mounting in the control room, always outside the "Ex" area.

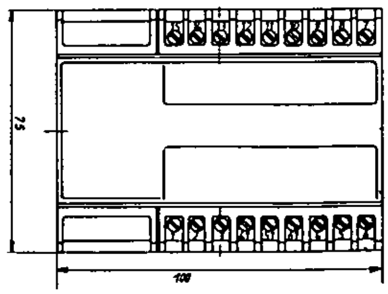
Mounting can be with screws or by snapping onto a 35 mm rail according to European Standard EN 50022.
There is a protective casing SGH (IP 65) available for single mounting outside the switch cabinet.

Side view



Standard rail 35 x 7.5 mm
EN 50022

Top view

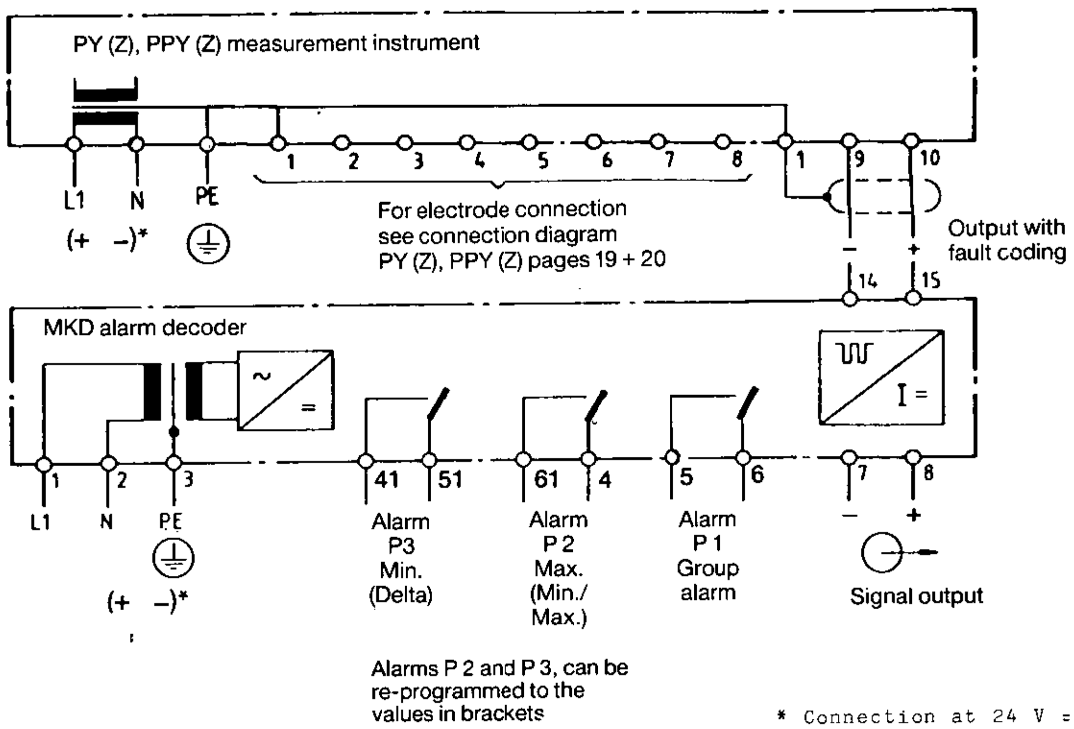


Dimension figure MKD

22.4 Connection MKD to MYPEX without MKN

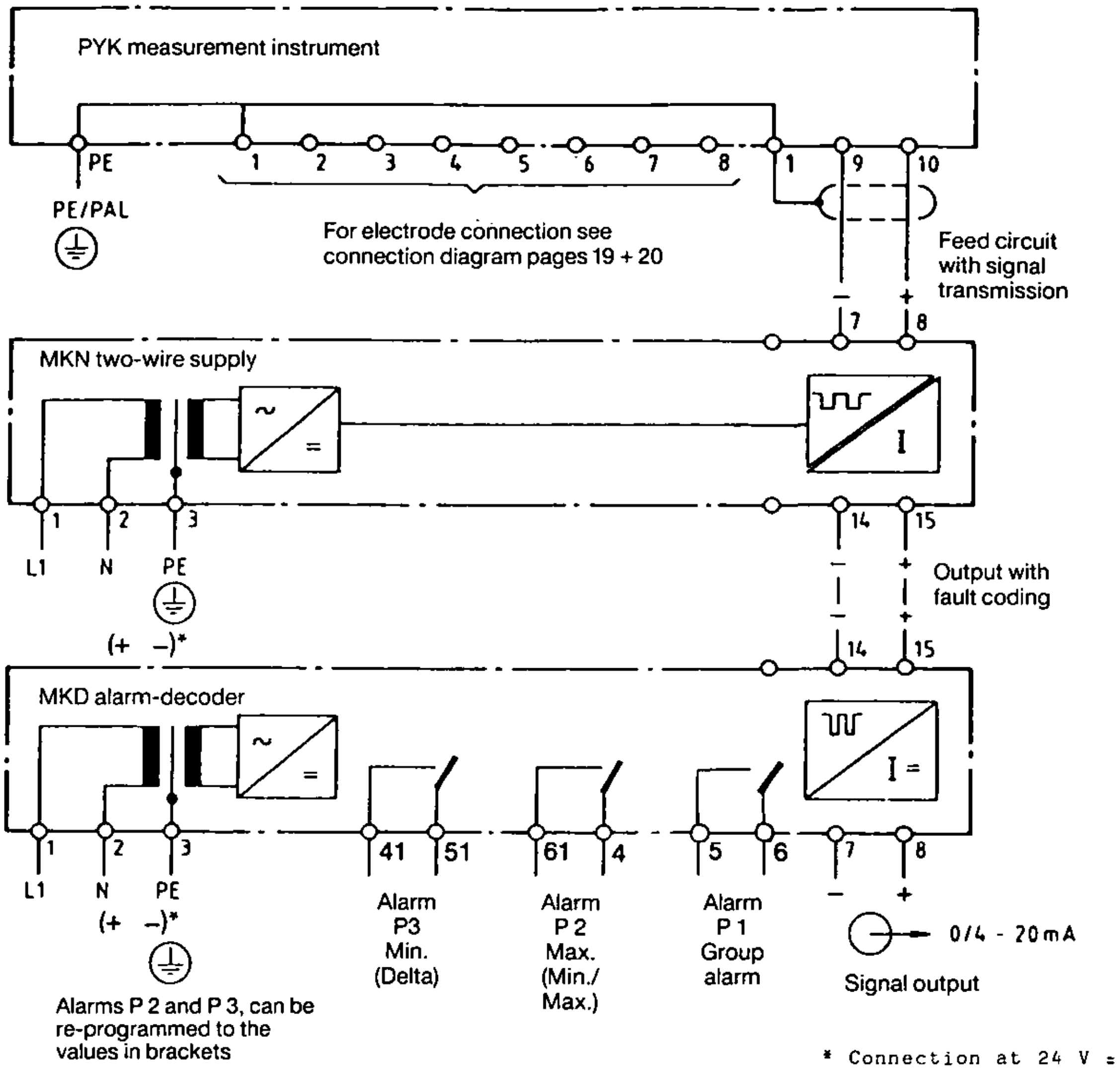
The electrical commissioning occurs together with the MYPEX measuring instrument.

On "Ex" versions terminals 14/15 are intrinsically safe, also s. Appendix 1 for "Ex" use



Connection diagram for instrument combinations PY-D or PYZ-D with one pH/mV input as well as PPY-D or PPYZ-D with two pH/mV inputs with separate alarm decoder MKD for decoding the digital alarm signals.

22.5 Connection MKD to MYPEX with MKN



Connection diagram for instrument combinations PY-KD or PYZ-KD with one pH/mV input as well as PPY-KD or PPYZ-KD with two pH/mV inputs, with separate two-wire supply unit MKN and alarm decoder MKD.

24. APPENDIX I

pH measurement in "Ex " area with MYPEX

Instruments marked with letter Z (as per certificate) in their type number are manufactured and approved according to the harmonized European conditions (CENELEC) for "Electrical equipment for hazardous locations". A copy of the PTB conformity certificates is attached (at the end of these instructions).

There are comprehensive standards and regulations for erection and operation; in the FRG these include:

- Regulations for electrical installations in hazardous locations" (Elex V).
- Regulations for flammable liquids" (VbF).
- Instrument safety law" (GSG)
- BG-Chemie explosion guide lines" (EX-RL)
- UVV: Electrical installations and equipment

The MYPEX pH process meter built according to the "Ex" regulations can be installed in Zone 1.

The measuring electrodes (measuring circuits) suitable for the instrument can also be used in Zone 1 without permission as they themselves are intrinsically safe due to the electrical characteristics.

Measuring electrodes for use in Zone 0 must always be "ex" approved, The currently approved electrodes are the Conducta types with the extra letter Z; e.g. 303 Z, 203 Z, 505 Z etc. Further electrodes can be found in the attached conformity certificate.

Only instruments with an intrinsically safe input circuit may be connected to the "Ex" version (series Z) MYPEX measuring instrument.

For instrument combinations P (P)YZ-K and P (P)YZ-D the accessory instruments (two-wire supply unit MKN, alarm decoder MKD) are equipped with an intrinsically safe input circuit.

Regulator/alarm decoder XDR has no intrinsically safe input and therefore cannot be directly connected to a PYZ or PPYZ.

In this case the 2-wire supply version (P(P)YZ-KDR) should be selected or a separate safety barrier inserted.

25. APPENDIX II

Technical data MYPEX

Indication range pH	0.00 - 14.00 pH
Indication range mV	± 1999 mV or 0 - 100 % or ± 1000 mV
Temperature indication range	- 50 ... + 150°C
Indication accuracy	0.1 %, ± 1 digit
Measurement display	LCD, 3 1/2 digit digit height appr. 13 mm
Status display	LCD, 4 digit, alpha symbols, digit height appr. 9 mm, additionally 6 signal fields for fault signals
Fault signals M1/M2	selected measuring range exceeded/fallen short
SP1/SP2	Limit exceeded/fallen short
TMP	Temperature < -50°C or > 150°C
1/2	Sensor difference greater than selected (only for two-circuit instruments)
Measurement input for pH/mV measurement	symmetric high impedance max. 2 pH input circuits or max. 2 mV input circuits
Input impedance	2 x 10^{12} ohm per measuring circuit
Input leakage current	0.2 pA type.
Temperature input	Pt 100, three cable connection - 50 ... + 150°C
Zero point range shift	
pH measuring range	0 - 14 pH
mV measuring range	± 1999 mV or 0 - 100 % or ± 1000 mV
Slope range pH	30 ... 60 mV/pH
Temperature compensation	automatic with Pt 100 - 50 ... + 150°C
Manual temperature compensation, if mounted	- 5 ... + 130°C
Signal output	0 - 20/4 - 20mA switchable per software galv. isolation
Max. load	600 ohm
Compound output error	± 0.5 %
Insulation voltage between input and output circuits	1500 V =
Keyboard	sealed keyboard, 12 keys, protection class IP 65
Supply	
Power supply (s. instrument label)	24, 48, 110, 120, 220, 240 V, 50/60 Hz, 24 V =
Power consumption	approx. 2.5 VA (2.5W)
Power supply via remote supply (-K)	see technical data type MKN
Ambient temperature range	- 20 ... + 55°C (50°C in "Ex")
Housing	polycarbonate weather and impact-resistant plastic
Front cover	Transparent polycarbonate
Protection class	IP 65
"Ex" protection class:	
only for versions with suffix Z (certificate in Appendix)	EEx eq ib (ia) IIC T6 or EEx q ib (ia) IIC T6 for instruments with 2-wire remote power supply
Dimensions	115 x 220 x 210 mm W x H x D
Weight	approx. 3 kg
Cable entrance	3 x Pg 13.5
Connections	Terminals max. section 2.5 mm
Fastening	wall fastening
Accessories (to be ordered separately)	Accessory set for mast mounting Order no. 100 547-0000 Sun protection cover Order no. 100 550-0000

Technical data MKN

2-wire feed circuit

Output voltage	12 V =
Output current	70 mA
permissable length of cable	2000 m
Signal output galv. isolated	0-20/4-20 mA
Load	max. 4000 ohm
Power supply (s. instrument label)	24, 48, 110, 120, 220, 240 V, 50/60 Hz, 24 V =
Power consumption MKN	Approx. 2.5 VA (2.5 W)

"Ex" protection class for corresponding instrument combinations (Type ... Z) (Conformity certificate EEx ib IIC in Appendix)

Housing	100 mm wide compact housing in light ABS plastic
Mounting	on mounting plate or EN 50022 mounting rail
Terminals	removable terminal blocks, non-interchange-able, 2 x 9 poles
Core sizes	1 x 2.5 mm² or 2 x 1.55 mm²
Without terminals	Plate plug 0.8 x 63 according to DIN 46 244
Dimensions	100 x 75 x 110 mm (W x H x D)
Weight	approx. 0.5 kg
Protection class	Housing IP 40 Terminals IP 20

Technical data MKD

Input signal range	0-20/4-20 mA
permissible length of cable	between MYPEX and MKD - 2000 m
Input load	100 ohm
Signal output	0-20/4-20 mA
Load	Max. 500 ohm
Alarm outputs	3 alarms, each with 1 potential-free contact Max. switching voltag 250 V Max. switching current 3 A Max. switching load 550 VA
Power supply (s. instrument label)	24, 48, 110, 120, 220. 240 V, 50/60 Hz, 24 V =
Power consumption MKD	approx. 3.5 VA (3.5 W)

"Ex" protection class for corresponding instrument combinations (type ...Z) (Conformity certificate EEx ib IIC in Appendix)

Housing	100 mm wide compact housing in light ANS plastic
Mounting	on mounting plate or EN 50022 mounting rail
Terminals	removable terminal blocks, non-interchange-able, 2 x 9 poles
Core sizes	1 x 2.5 mm² or 2 x 1.55 mm²
Without terminals	Plate plug 0.8 x 63 according to DIN 46 244
Dimensions	100 x 75 x 110 mm (W x H x D)
Weight	approx. 0.5 kg
Protection class	Housing IP 40 Terminals IP 20

CONNECTION EXAMPLES

26. APPENDIX III

Value transmitters and accessories for pH/Redox

Immersion and Flow Assemblies

Generally standard electrodes are used for measured value monitoring.

This also applies for measurements in "Ex" Zone 1.

As both the MYPEX pH process meter's pH inputs are of symmetric high impedance, the installation of a potential matching cable (PAL) and a corresponding contact pin to the medium contact is required.

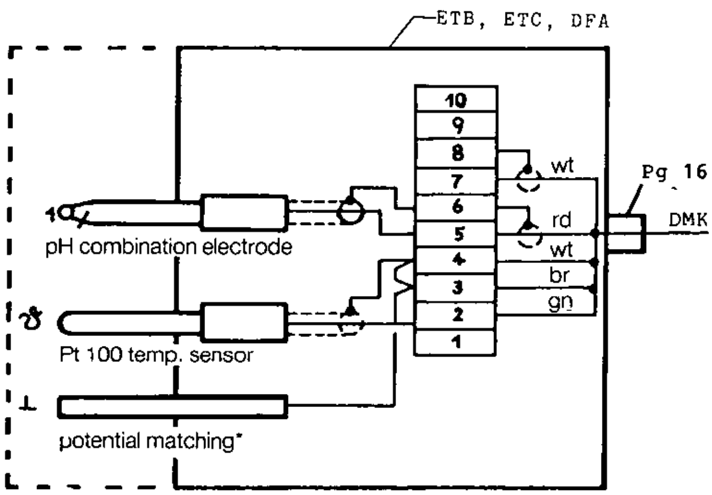
For this reason the assemblies are equipped with a corresponding stainless steel pin, which forms the medium contact.

Should low impedance reference electrodes be used the potential matching cable and contact pin are not required. However a bridge between frame terminal (terminal 3) and reference electrode connection (terminals 6 and 8) must then be provided on the MYPEX instrument. For this see connection diagrams for PY (Z) and PPY (Z). This mode of operation is principally concerned with purely supplementary equipment of instruments where nothing further should and can be altered on the existing measuring sensors. For new configurations advantage should be taken of the symmetric high impedance measurement:

On fouling or blockage of the reference electrode's diaphragm essentially little impairment of the measuring results in comparison to low impedance operation. Trouble-free measuring in ion-poor media (superpure water).

pH measurement with
1 pH combination electrode 303
1 Pt 100 temperature sensor 505

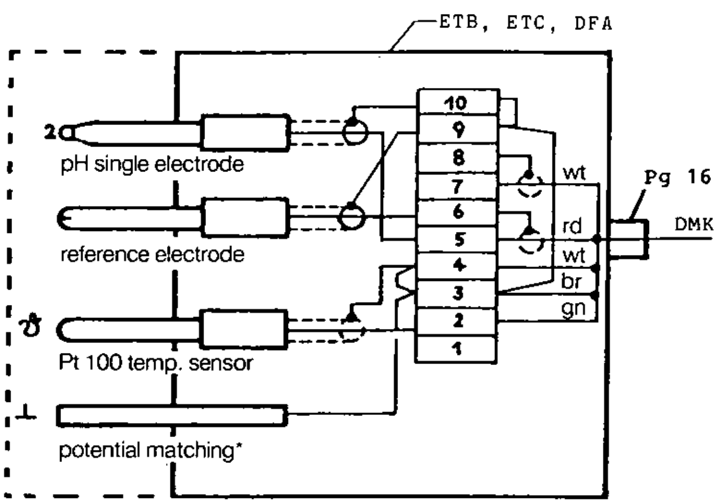
* Potential matching required with symmetric high impedance inputs



Electrode connections
in probe holders ETB, ETC, DFA

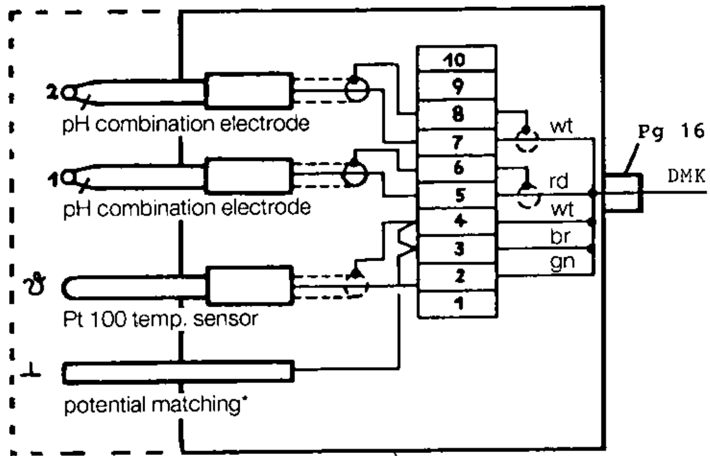
pH measurement with
1 pH single electrode 311
or 315
1 reference electrode 403
1 Pt-100 temperature sensor 505

*Potential matching required with symmetric high impedance inputs



Electrode connections
in probe holders ETB, ETC, DFA

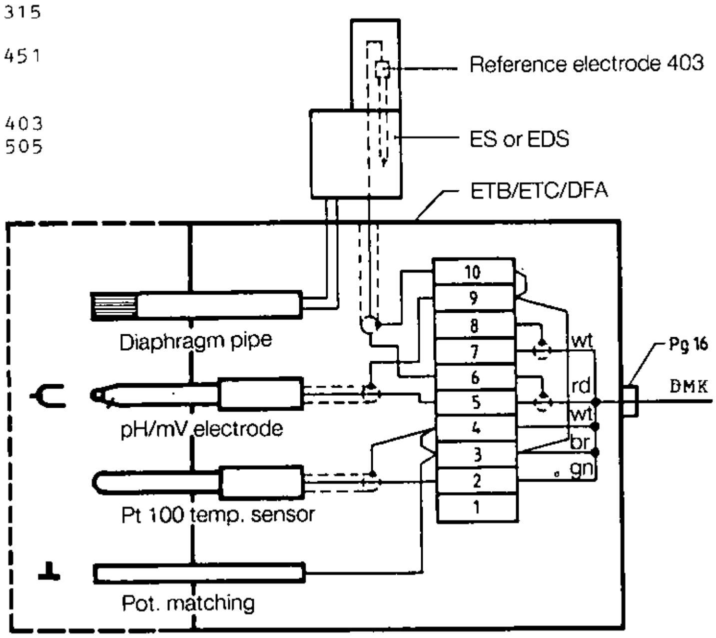
pH double measurement with
2 pH combination electrodes 303
1 Pt 100 temperature sensor 505



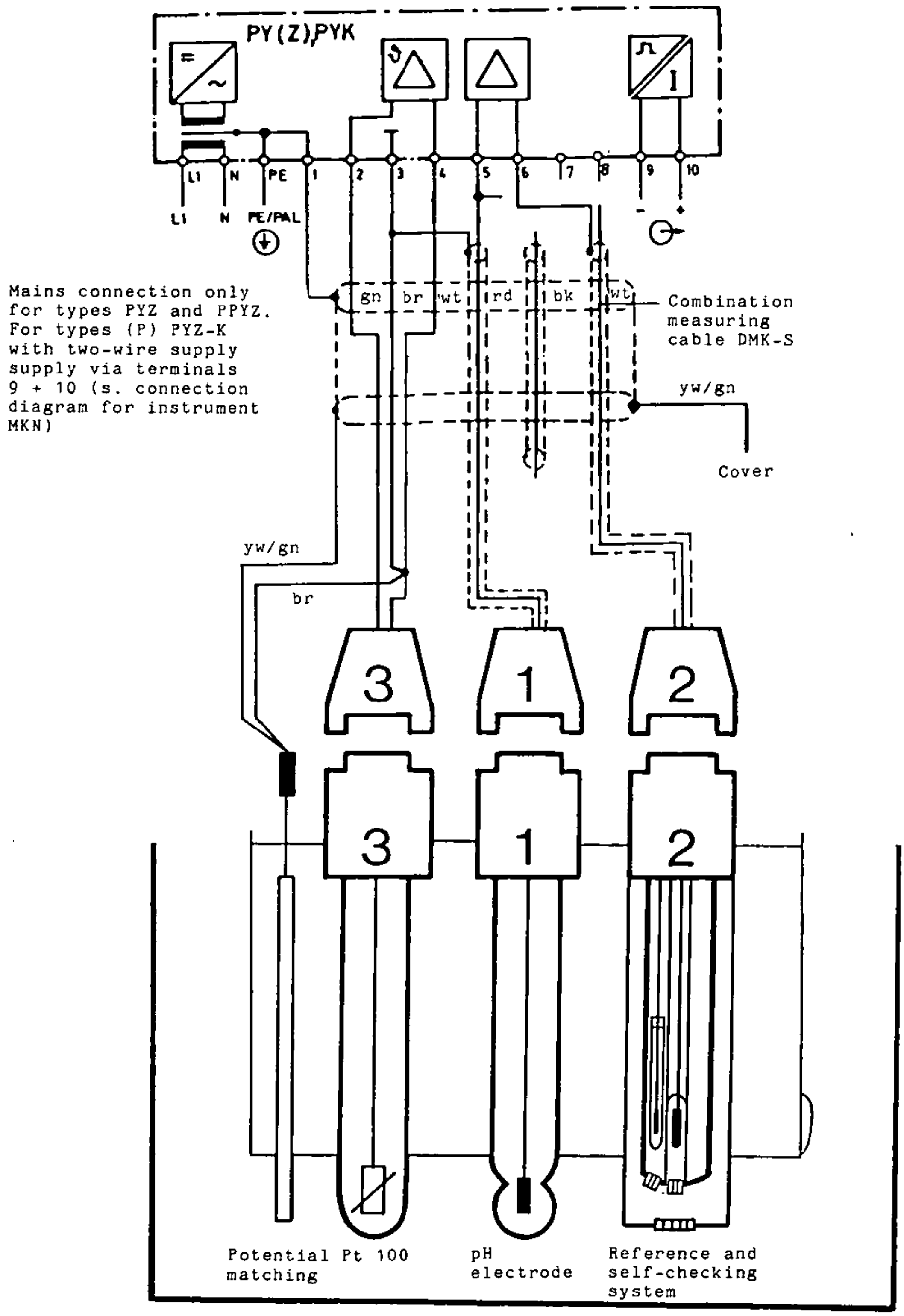
*Potential matching
required with
symmetric high
impedance inputs

Electrode connections
in probe holders ETB, ETC, DFA

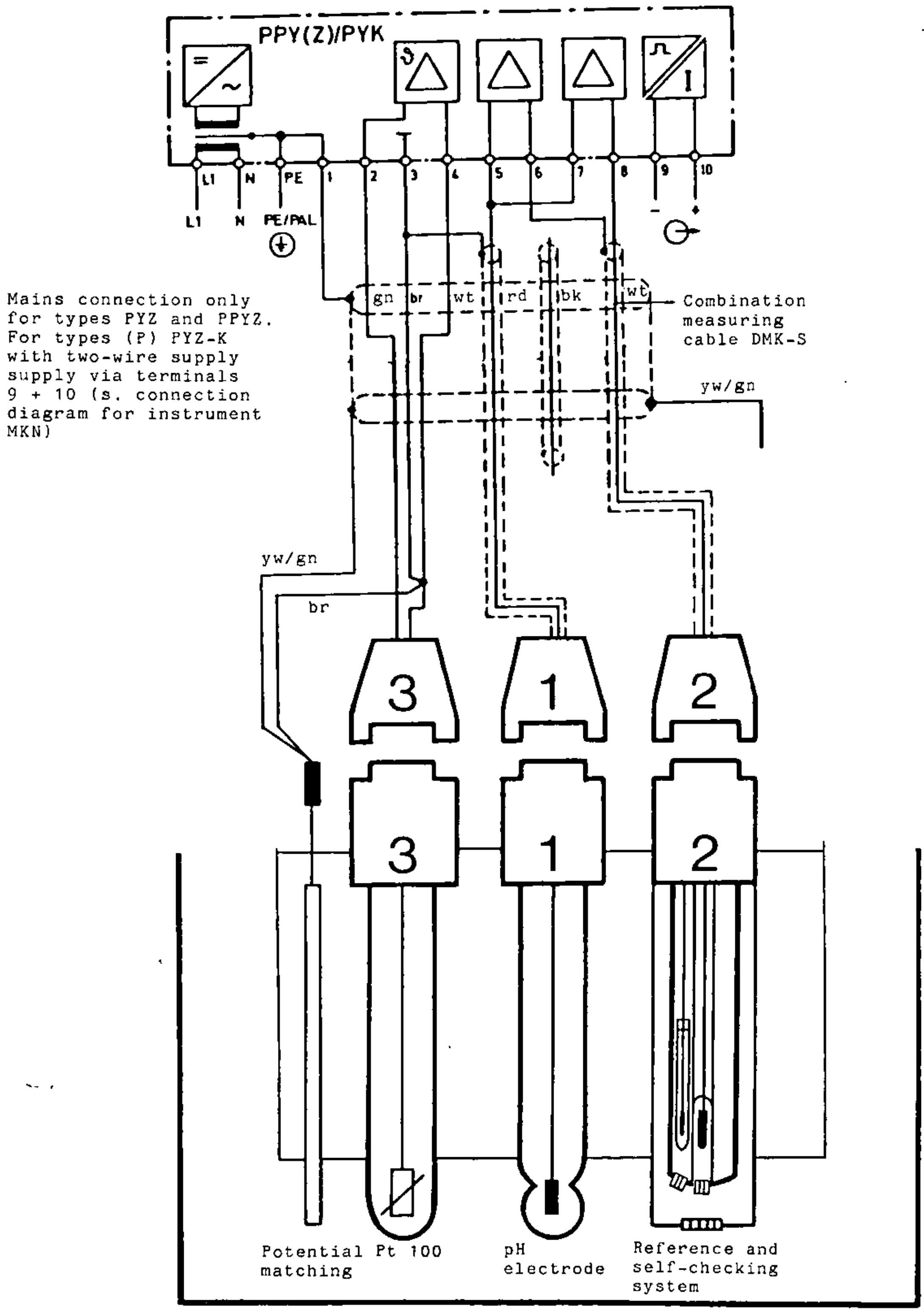
pH measurement with 311
pH combination electrode 315
or
diaphragm pipe 451
in conjunction with electrolyte
bridge set ES or EDS
reference electrode 403
Pt-100 temperature sensor 505



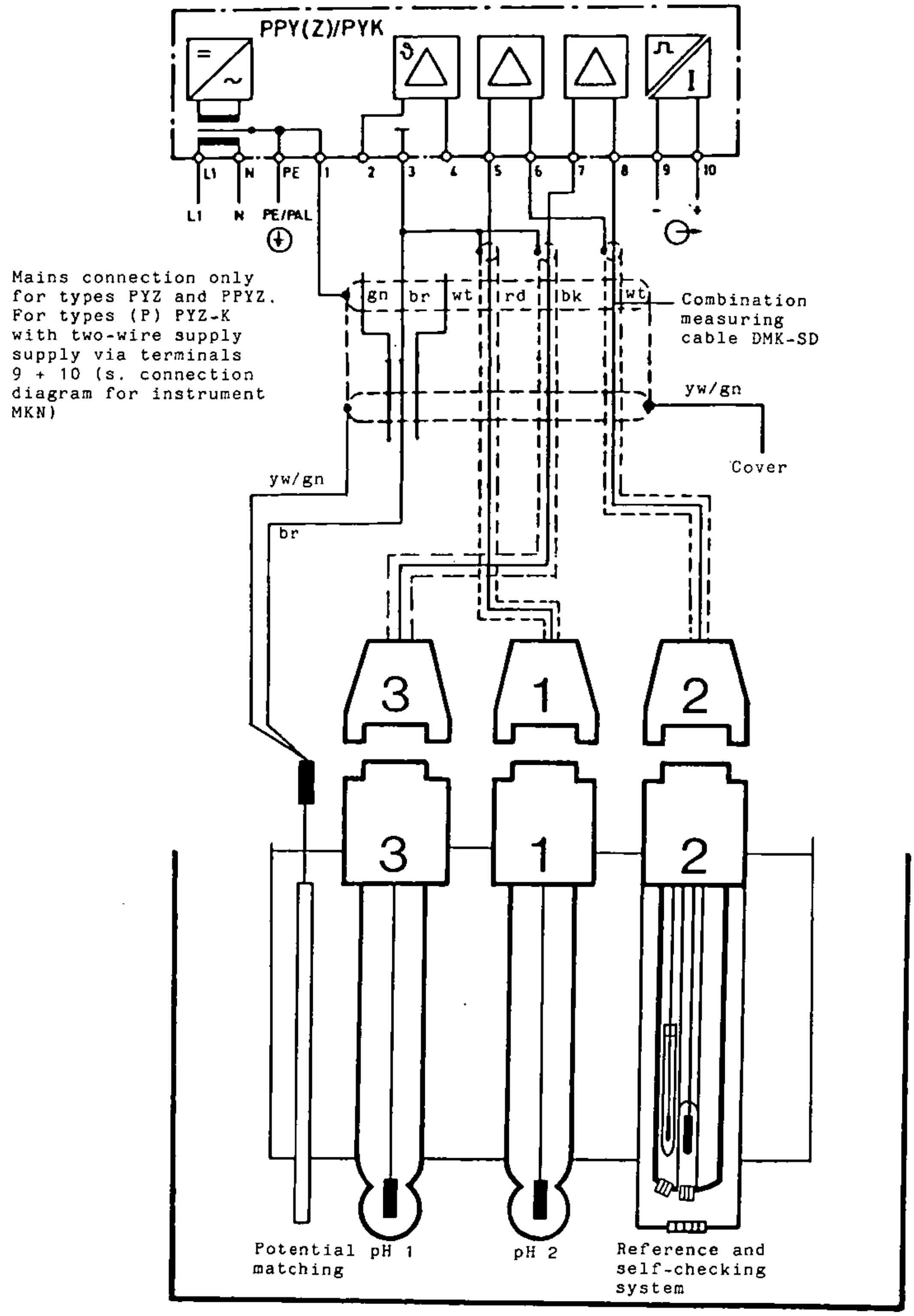
Electrode connections in conjunction with a
salt bridge system



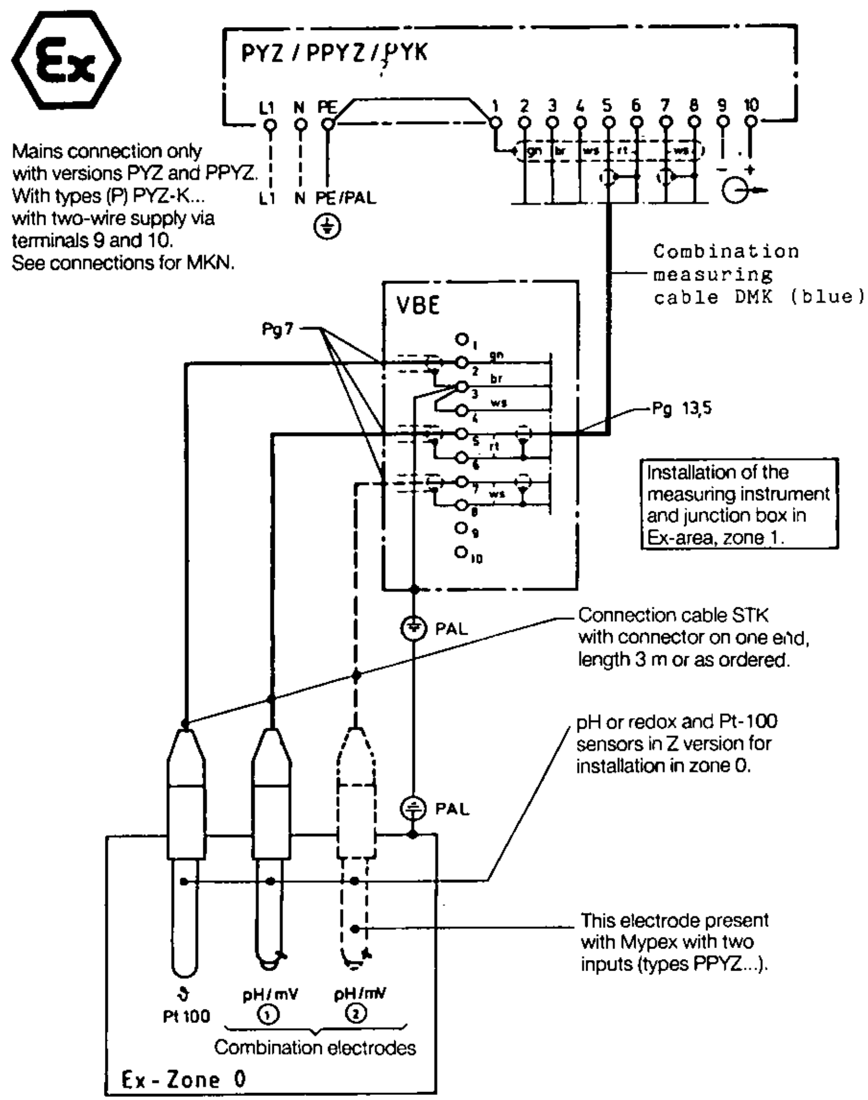
Connection diagram: Sensopac/Mypex PY(Z), PYK (1 measuring circuit)



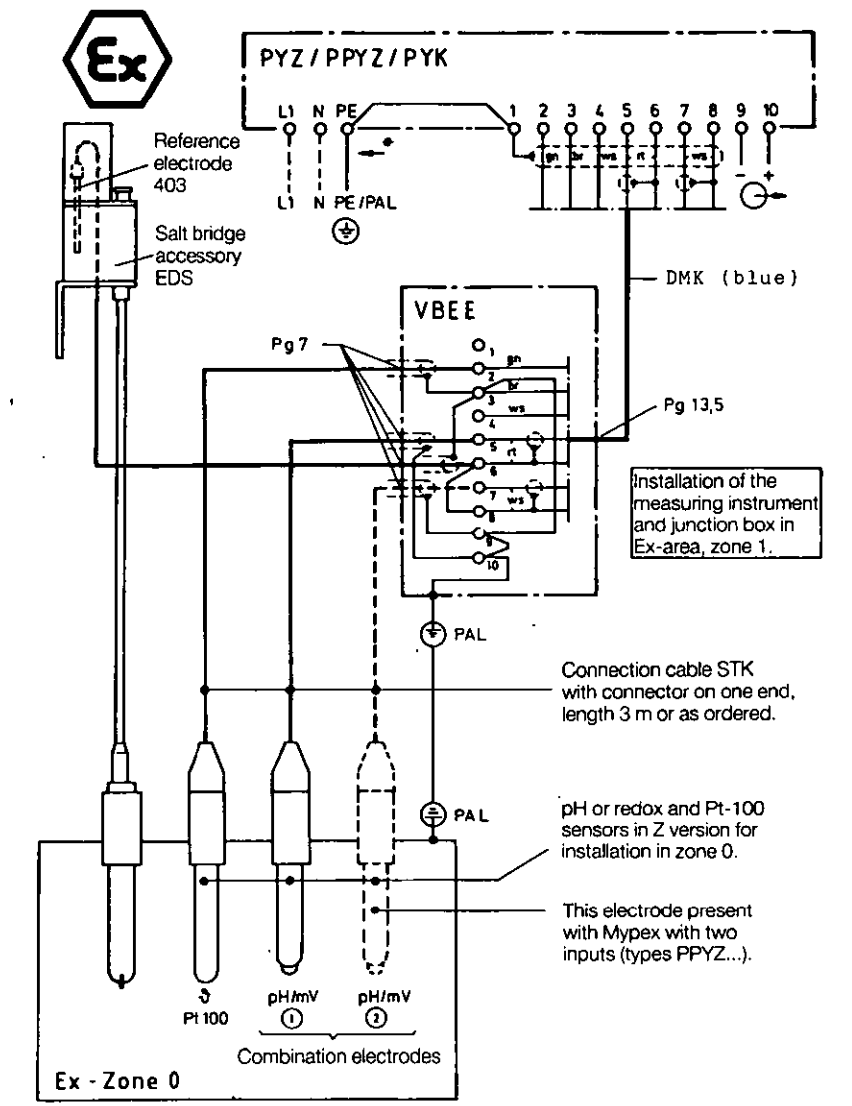
Connection diagram: Sensopac/Mypex PPY(Z), PYK (2 meas. circuits)



Connection diagram: Sensopac with two independent pH-meas. circuits/ Mypex PPY(Z), PYK (2 meas. circ.)



Electrode connection
for application in Ex-Zone 0



Electrode connection
for application in Ex-Zone 0
with electrolyte bridge system

Mains connection only
with versions PYZ and PPYZ.
With types (P) PYZ-K...
with two-wire supply via
terminals 9 and 10.
See connections for MKN.

27. APPENDIX IV

27.1 Code number selector for console keyboard

Entry authorization to the instrument is by inputting a selected code number at the console keyboard. The "large" access authorizes the presetting of all freely selectable parameters and is obligatory when the instrument answers with pH...1, or pH...2 - simultaneously the version date (e.g. 3.87) can be seen in the upper display. The "small" access authorizes the calibration of the méasuring circuits or the input of a corrective value.

Alteration of the code number, S1...S3

The "programming" of the code number to be input later at the console keyboard is via a coding switch on processor module MYP.

pH/mV signal processor MPX with its individual plug-in modules is shown in Figure 10.

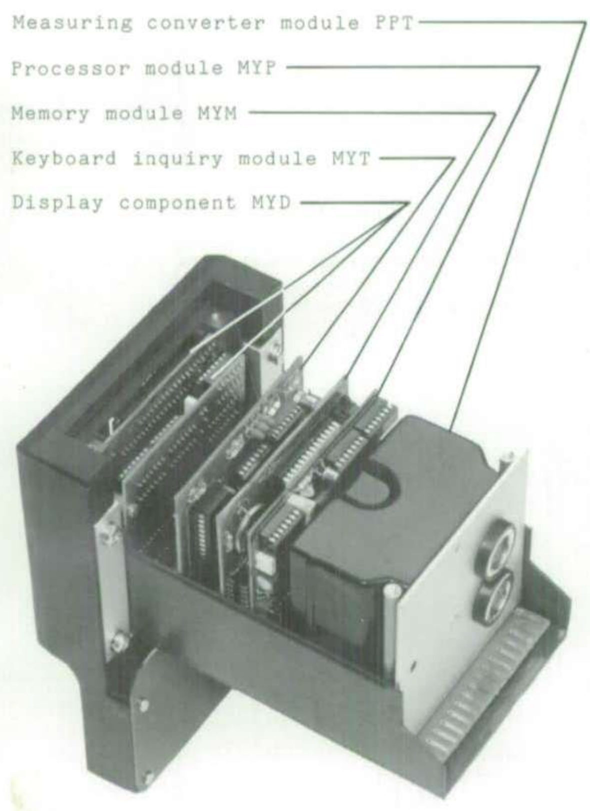


Figure 10
MPX pH/mV signal processor in open state
Plug-in module arrangement

Presetting at the coding switch			Code numbers at the console keyboard	
S1	S2	S3	Access "large"	Access "small"
off	off	off	E 4560	E 147
on	off	off	E 1236	E 258
off	on	off	E 4569	E 369
on	on	off	E 1452	E 159
off	off	on	E 7530	E 357
on	off	on	E 2222	E 111
off	on	on	E 4567	E 123
on	on	on	E 5824	E 729

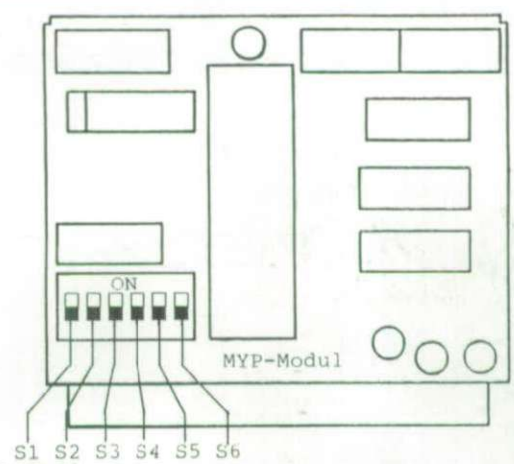


Figure 38
Code switch for entry code selection on MYP-Module

27.2 Function definition, S4...S6

S1 S2 S3 S4 S5 S6

One-circuit instrument ("ON")
Two-circuit instrument ("OFF")

pH: calibration without ("OFF") with ("ON") access code

Redox: percent display ("ON") absolute display ("OFF")

Switching Redox ("ON") pH ("OFF")

Establishing the access code according to tables; access "small" only for calibration

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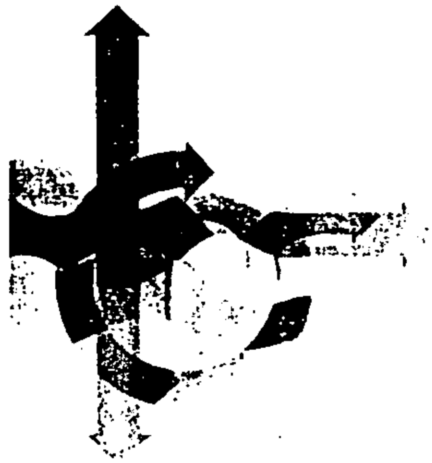

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115 629 - 1000

TABLE OF CONTENTS

1. APPLICATION

SENSOPAC is a pH/redox sensor system, comprising a number of electrodes grouped together to form a single sensor unit. Designed to operate under high pressures and temperatures, this sensor system is ideally suited to applications in the process sector.

The unit is protected against contamination by an integral electrolyte bridge. The reference system is sealed, and is suitable for operation under pressure, without external application of counter pressure.

SENSOPAC electrode systems incorperate a double reference system for automatic self-checking in conjunction with a suitable pH meter.

2. MEASURING SYSTEM

The complete measuring system comprises:

- The SENSOPAC multi electrode system, complete with electrodes.

- A measuring instrument with one or two symmetric high inpedance inputs. For self-checking the instrument must have two inputs and a facility for monitoring a difference between the two electrode circuits, eg. MYPEX process pH meters.

The SENSOPAC multi-electrode system is available in different materials of construction and with a range of different electrodes, see the technical data for details.

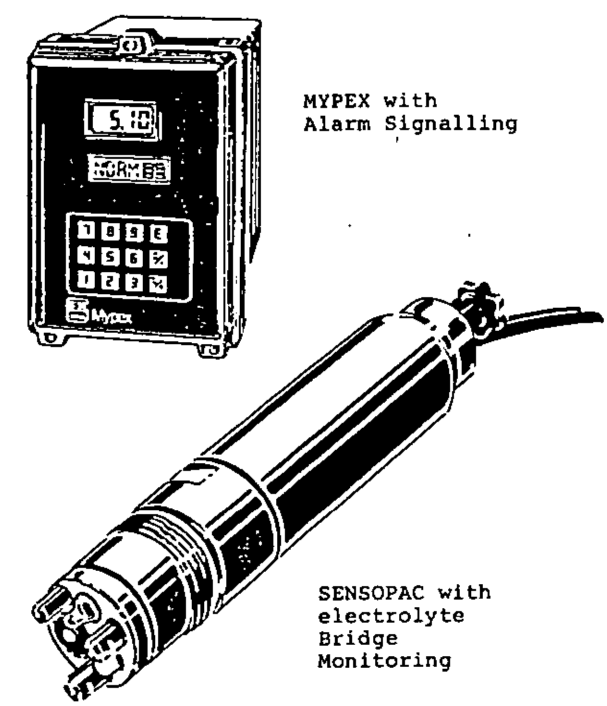


Figure 1
SENSOPAC self-checking

3. OPERATING PRINCIPLE

Principle of the Sensopac pH Sensor System

Sensopac comprises the following measurement-related components:

- A a pH electrode immersed directly in the measured solution
- B a low-impedance double reference electrode located in the brigde electrolyte C, with reference B1 for the master circuit and reference B2 for the monitor circuit
- C The bridge electrolyte in a large reference chamber
- D a fouling-resistant PVD diaphragm

Operating Principle

pH electrode (A) generates a half-cell voltage dependent on the pH of the medium. The fouling-resistant PVD-diaphragm assures electrical contact betweeen the medium and the bridge electrolyte (C), in which the double reference electrode (B) is immersed.

The reference system B1 of the double reference electrode provides the constant half-cell voltage for the master measuring circuit.

The reference system B2 of the double reference electrode provides the half-cell voltage for the monitor circuit.

Self-Checking

Both reference systems of the double reference electrode are located behind two seperate diaphragms (with respect to the brigde elctrolyte (C)).

The monitor reference system B2 has a small volume and is filled with a liquid electrolyte.

The master reference system B1 has a larger volume and is filled with a solid electrolyte gel.

Furthermore, this reference system B1 is located in a long capsule which is fitted with a further diaphragm at the top end.

This construction ensures that any interference ions which enter the electrolyte C can, in the worst case, only contaminate reference B2, leaving the measurement reference B1 practically free from contamination.

The most important feature of this self-checking method is that an alarm is given before there is any drift on the measuring circuit itself.

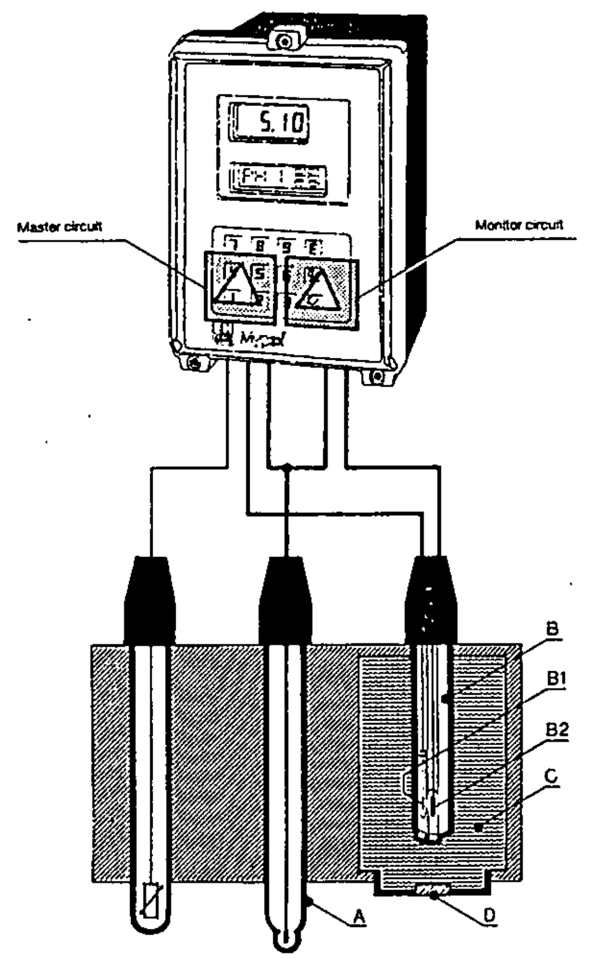


Figure 2
Operating principle

pH-electrode (A) delivers a voltage signal which is proportional to the pH of the measuring solution. Reference electrode (B1) delivers a constant voltage which is virtually independent of the condition of both measured solution and electrolyte bridge. Measurement is made by measuring the voltage difference between electrodes (A) and (B1). This is the "master" circuit.

The monitoring reference electrode (B2) is immersed into the bridge electrolyte and delivers a constant voltage. The monitor electrode produces a signal which is equivalent to reference electrode (B1). The system is checked by a second measurement circuit, measuring the signal difference between electrodes (A) and (B2). This is the "monitor" circuit. Under normal conditions both master and monitor circuits receive the same electrode signals and show the same reading.

Self-checking:

Since both the reference electrode (B1) and monitor electrode (B2)operate on the same principle, they are both susceptible to poisoning by the same types of ion. The reference and monitor systems are however differently designed so that ion diffusion does not take place at the same rate in both systems.

The monitor electrode (B2) is protected from poisoning by the electrolyte bridge and the diaphragm on the underside of the electrode.

The reference electrode (B1) is protected by the bridge electrode, the diaphragm at the bottom of the electrode, and additionaly by a long gel-filled, path, topped with an additional diaphragm in the reference cartrige. The additional protection of the reference electrode (B1) ensures that poisoning effects are severely retarded with respect to the monitor electrode (B2).

If interference, ions are present these will affect the monitor electrode (B2) long before any damage can occur to the reference system (B1).

In case of contamination the monitor signal will drift and a difference will occur between monitor and reference systems. This difference is used to initiate a contamination alarm.

An important feature of this self-checking system is that the contamination alarm is initiated before measurement is affected.

The electrolyte should then be changed at the next convenient opportunity to continue measurement under normal conditions.

SENSOPAC electrode systems are supplied, ready to measure, complete with electrodes, reference electrolyte and measuring cable. Each electrode system is individually tested to guarantee high quality performance.

4. TECHNICAL DATA

Materials of construction

body	polypropylene, PVDF or 1.4571
seals	EPDM (standard) or viton
potential matching pin	titanium or 1.4571
electrodes	glass

Temperature and pressure ratings:	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 (for sterilisation)**	-	-	5 bar

* Not for versions with pH-electrode type 316-A
** Not for versions with pH electrode type 311-A

pH measuring range	0 - 13 pH with electrode type 311-A 0 - 14 pH with electrode type 316-A
Electrode mounting threads	PG 13,5
cable length	standard 5 m option 15 m
Diaphragm	PVD diaphragm in PVD casing
Seals	standard EPDM option Viton

Accessiories supplied:

Reference electrolyte type 836	100 ml
Electrode + Diaphragm key	SW 17

5. DIMENSIONS

SENSOPAC multi-electrode systems are always supplied with one of a wide range of mounting adaptors. The threaded boss on the SENSOPAC body is intended for fitting these adaptors, and should not be used for direct mounting of the multi-electrode system.

WARNING!

SENSOPACS installed without a mounting adaptor have to be unscrewed for removal whenever calibration is required - risk of damage to connection cable!

Figure 3 shows the dimensions of the SENSOPAC body. For dimension of the mounting adaptors see INSTALLATION.

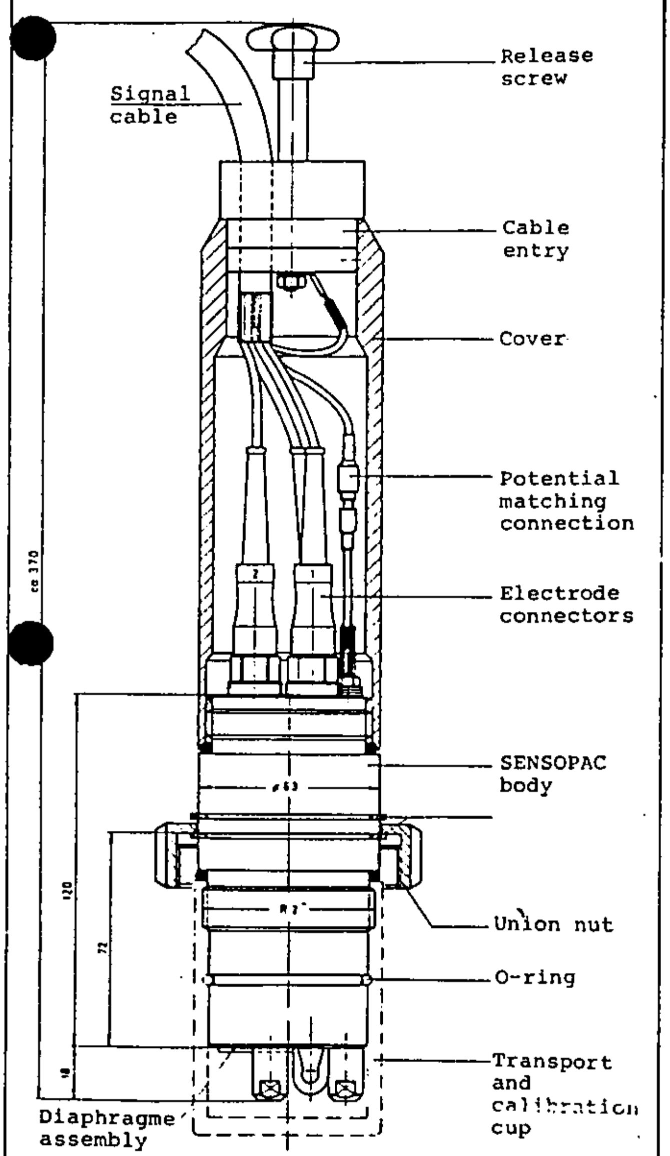


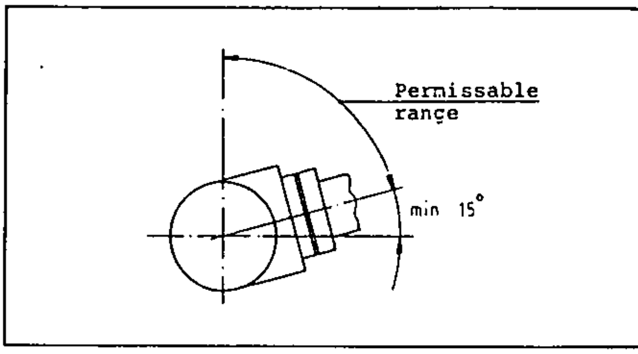
Figure 3

6. INSTALLATION & MOUNTING ADAPTORS

This section gives important information for correct mounting of the SENSOPAC multi-electrode system. If the system is not mounted correctly measurement may be inaccurate and unreliable.

Some general points:

- Never install horizontally, minimum 15 degrees from horizontal!



- Make sure flow past electrodes is representitive!
- Avoid air entrapment around the electrodes by inserting well under liquid surface!
- Electrodes must never dry out, eg. during breaks in production, mount in a position where liquid is always present.
- Ensure system is accessible for calibration without major interference with process! Eg. install in by-pass with isolating valves.

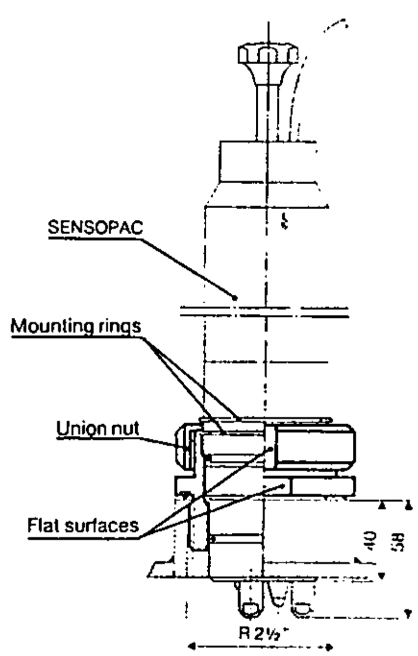


Figure 4
SENSOPAC with adapter UBS

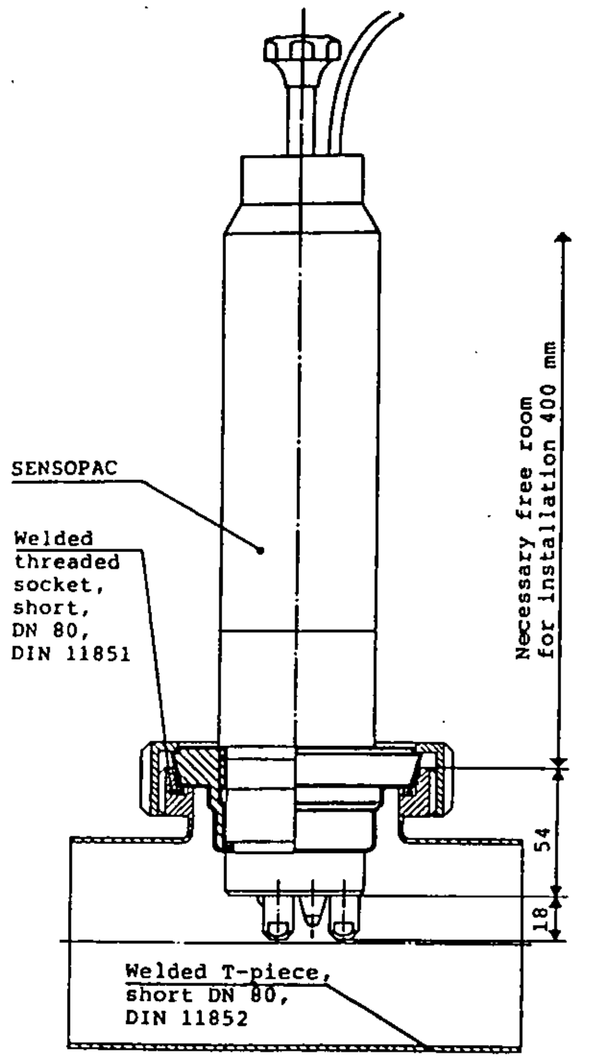


Figure 5
SENSOPAC with adapter AMS

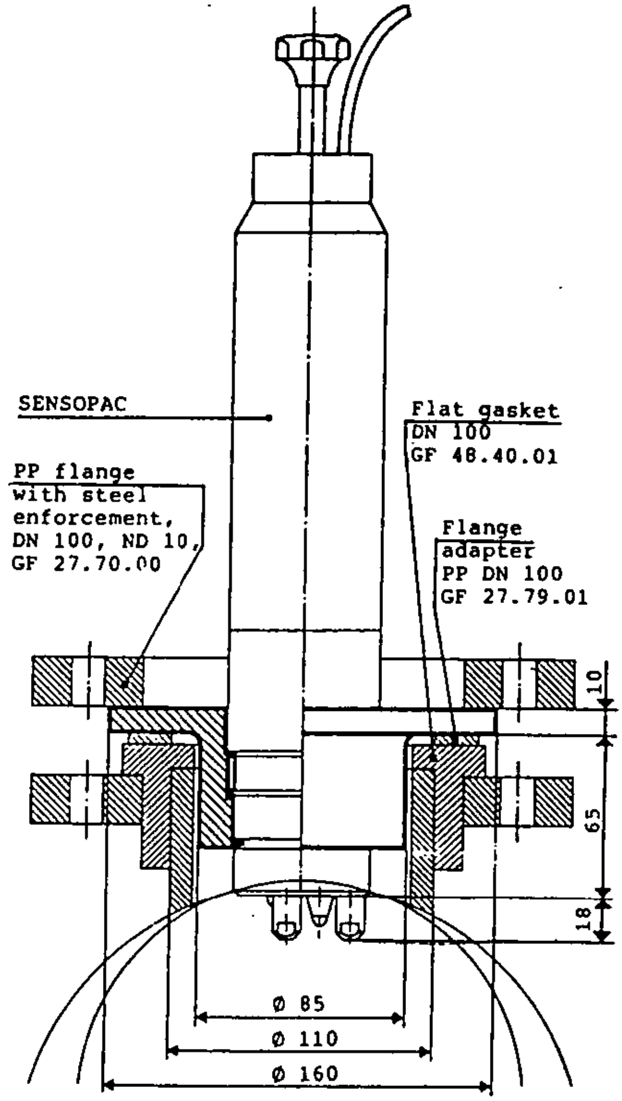
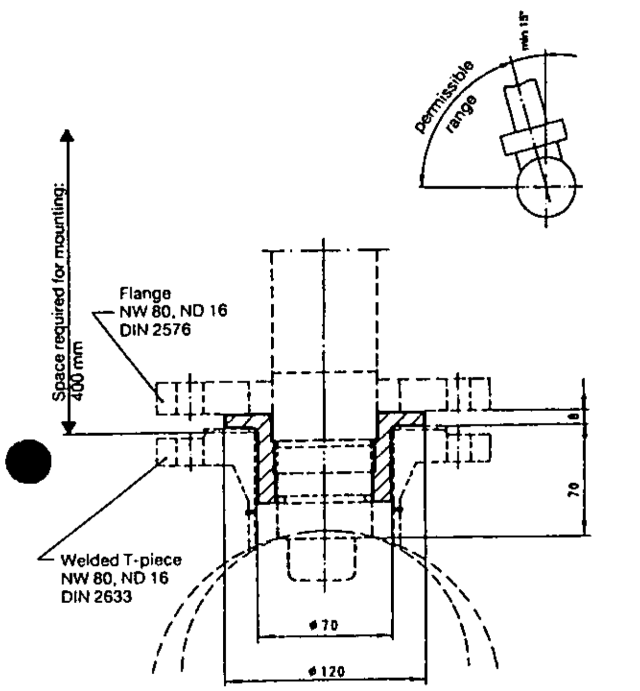
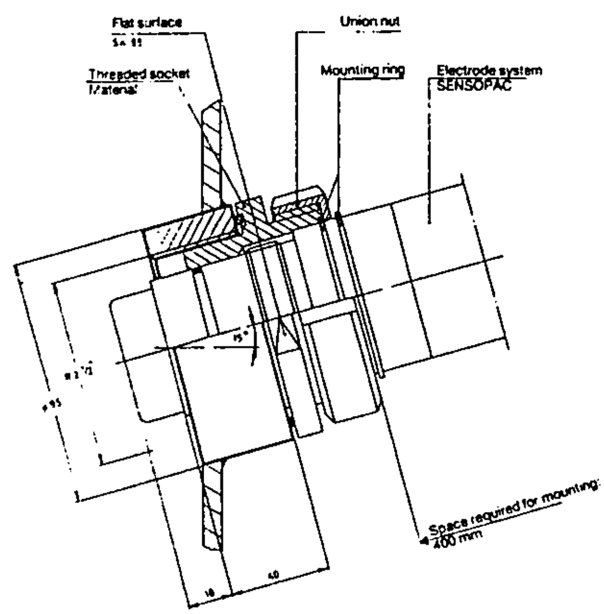


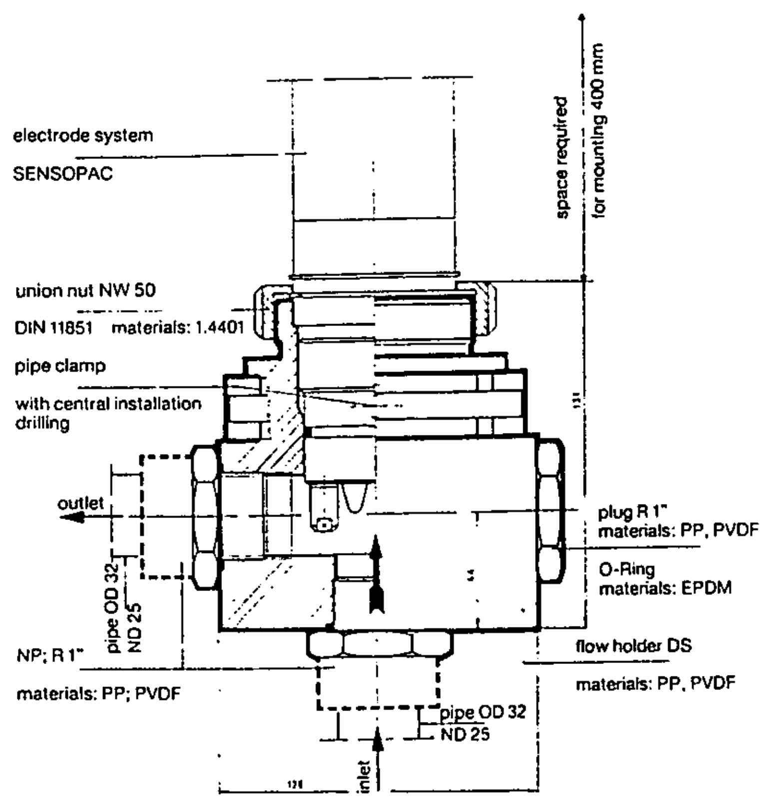
Figure 6
SENSOPAC with adapter AFS



Adapter AFS-V, version 1.4571, NW 80, for flange mounting SENSOPAC



Threaded sockets GS, GS-V for SENSOPAC, to be welded



Flow holder DS for installation of SENSOPAC

7. CONNECTIONS

SENSOPAC multi-electrode systems are fitted with a dual reference system for self-checking. To take advantage of this feature the pH meter used must have two measurement inputs and a facility for comparing two electrode signals to check for a difference, eg. Conducta MYPEX series process pH meters.

If self-checking is not required, a pH meter with one input only may be used.

SENSOPAC multi-electrode systems are supplied complete with factory-prepared measuring cables. The electrode connectors must be screwed firmly onto the electrode heads using the threaded ring.

Connections on the SENSOPAC itself are shown in figure 12.

Connections on SENSOPAC with two pH electrodes see figure 13.

Connections to MYPEX pH meters see figure 14 and 15.

Connections to Conducta PW... and PV... series meters see figure 16.

Connections to Conducta PX... series meters see figure 17.

Take care not to strain the leads by twisting. A dessicant bag is also supplied with the measuring system. This should be placed under the protective cover to avoid moisture deposits around the electrode connection heads.

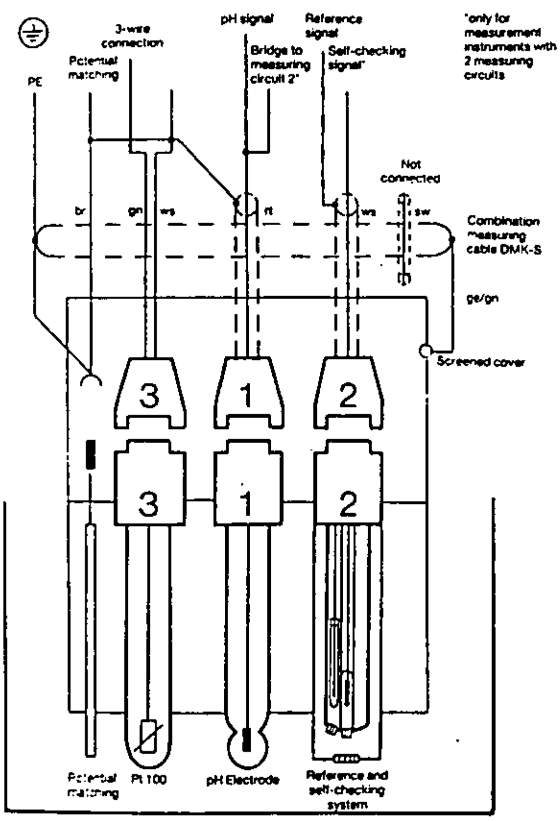


Figure 12
SENSOPAC connections Standard version with reference monitoring

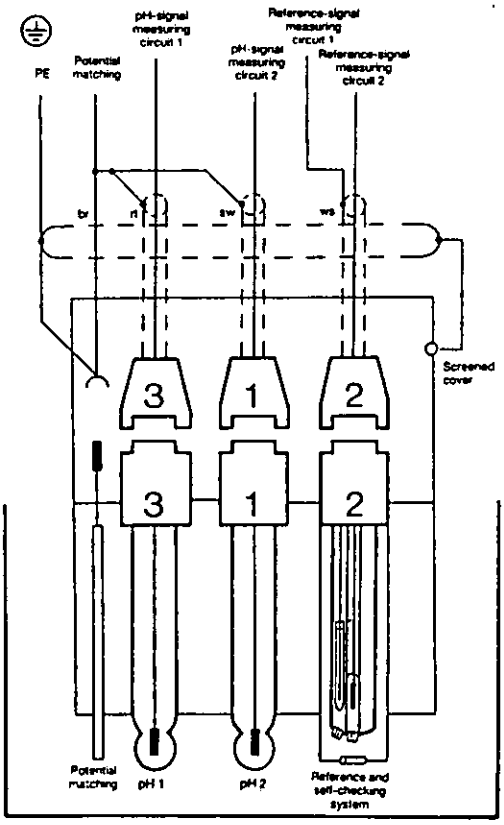


Figure 13
Connections SENSOPAC with dual pH electrodes

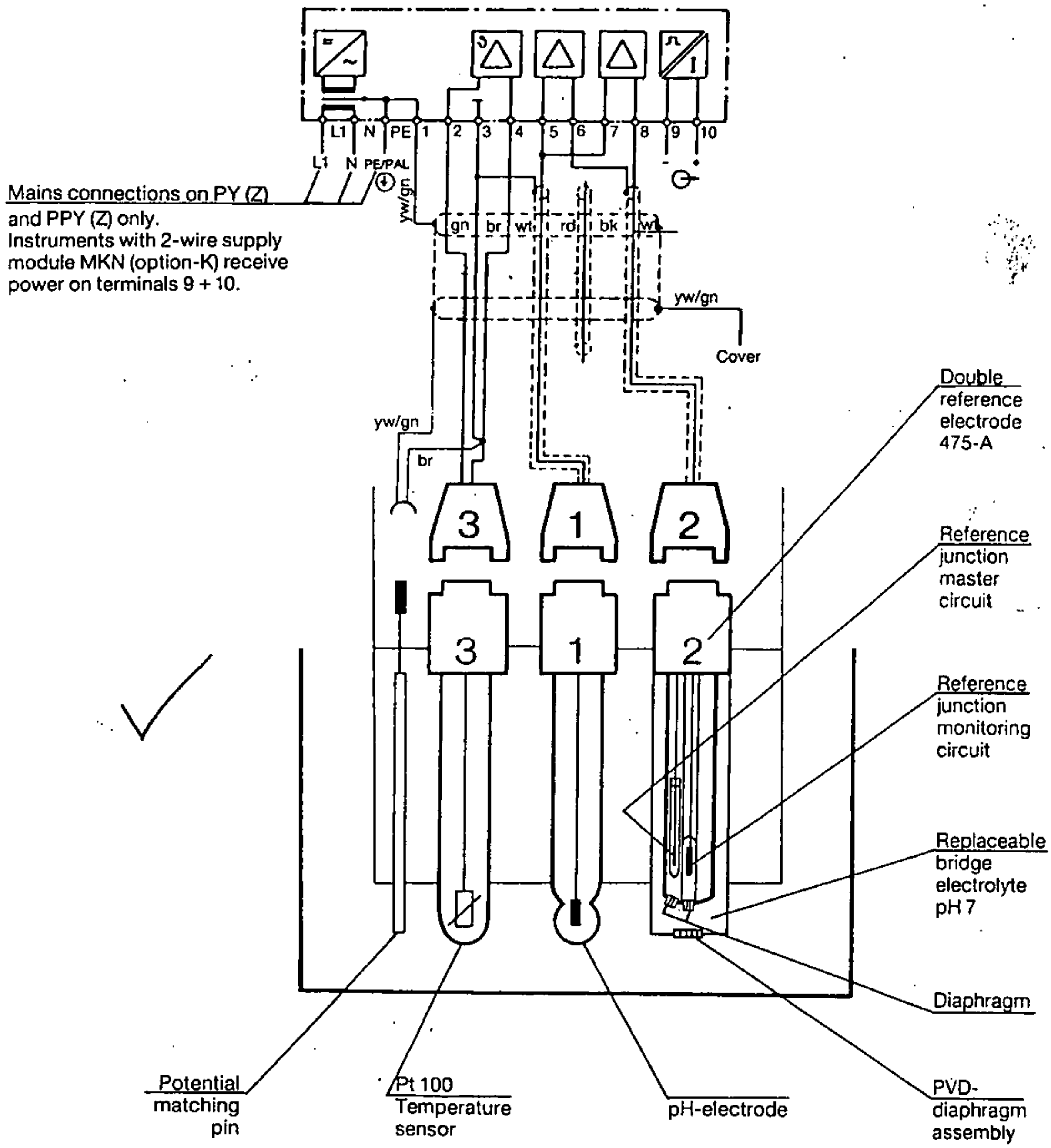


Figure 14
Connections SENSOPAC-
MYPEX series instruments

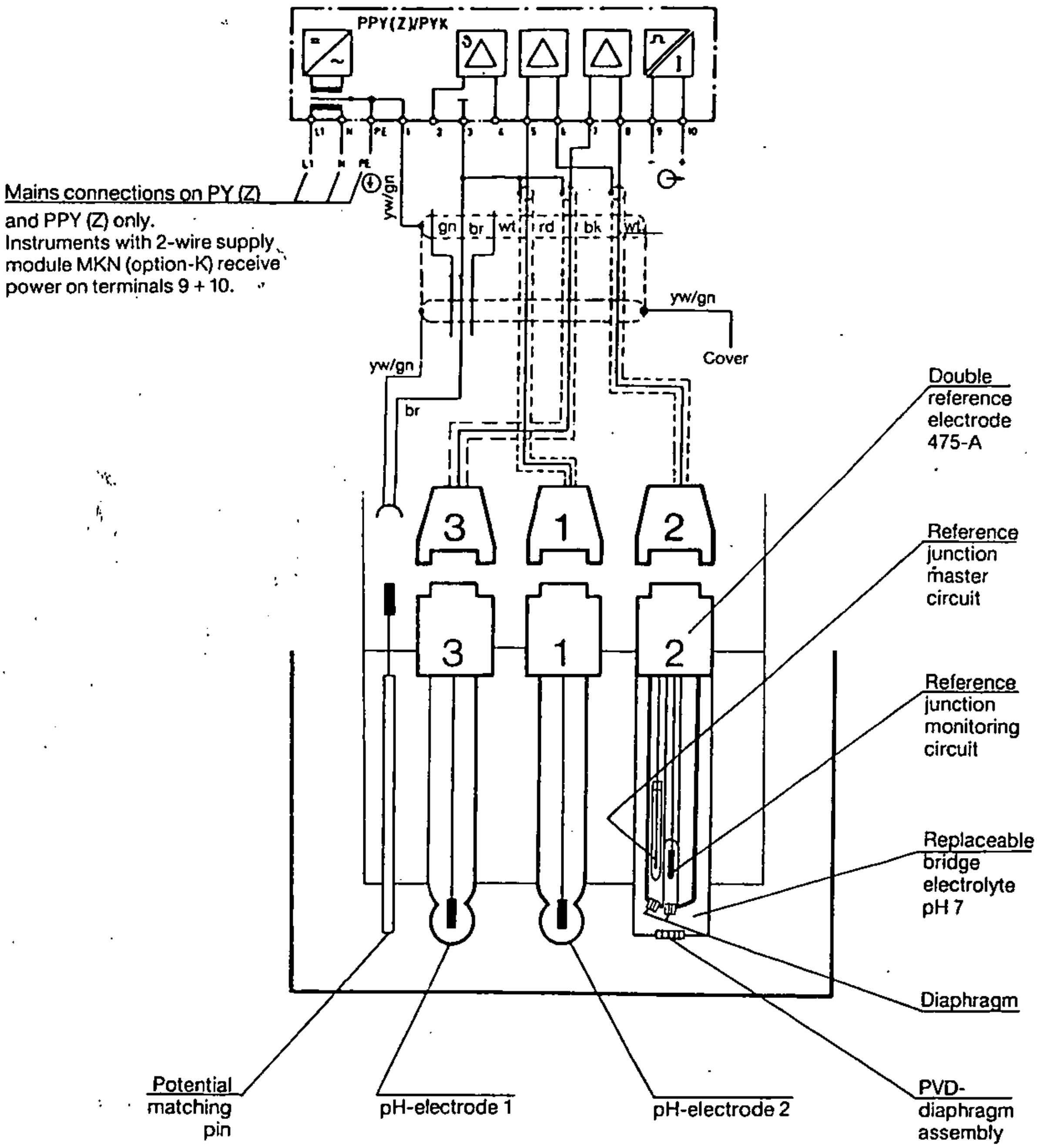


Figure 15
Connections SENSOPAC
DOUBLE pH-VERSION
MYPEX series instruments

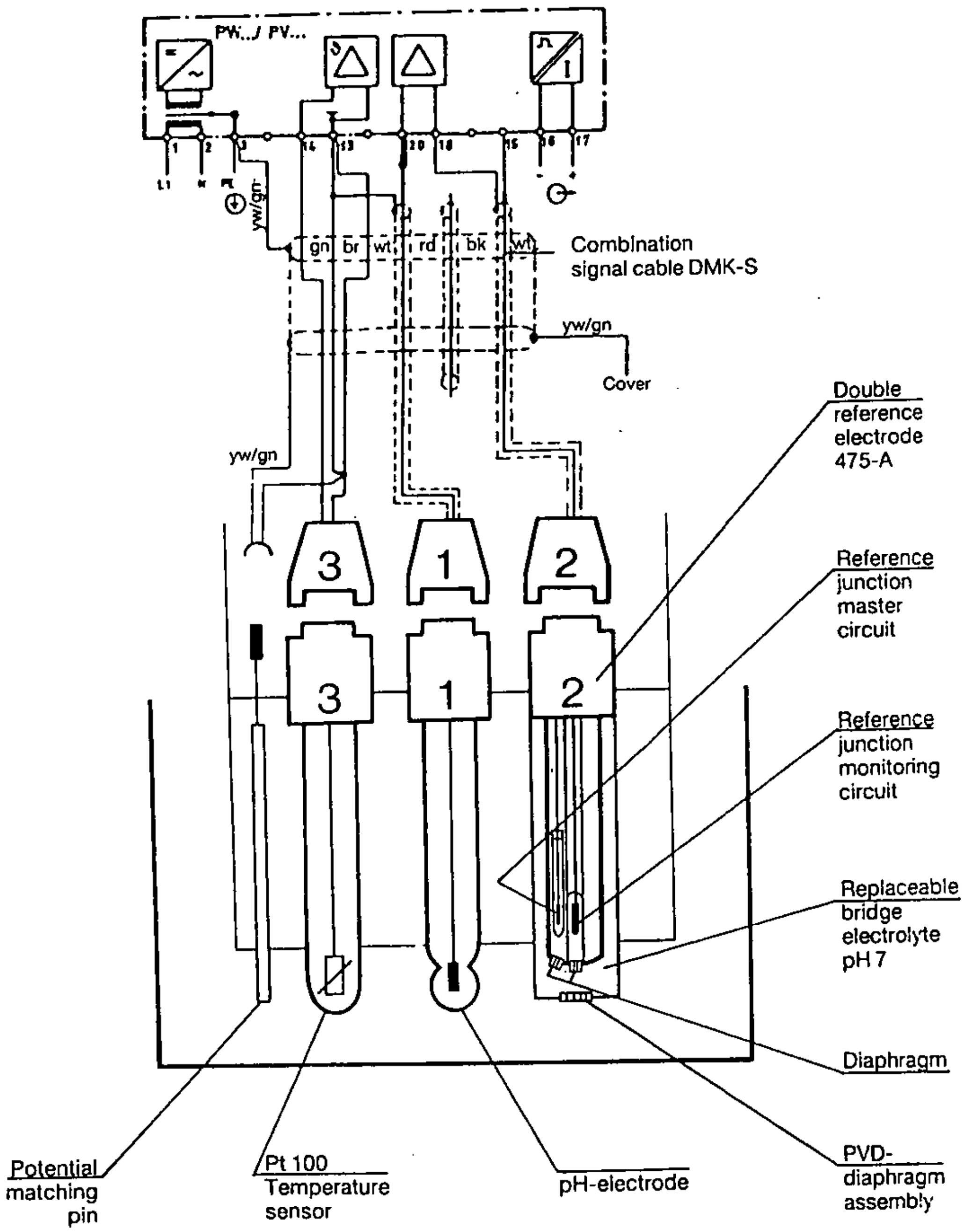


Figure 16
Connections SENSOPAC-PW + PV series instruments

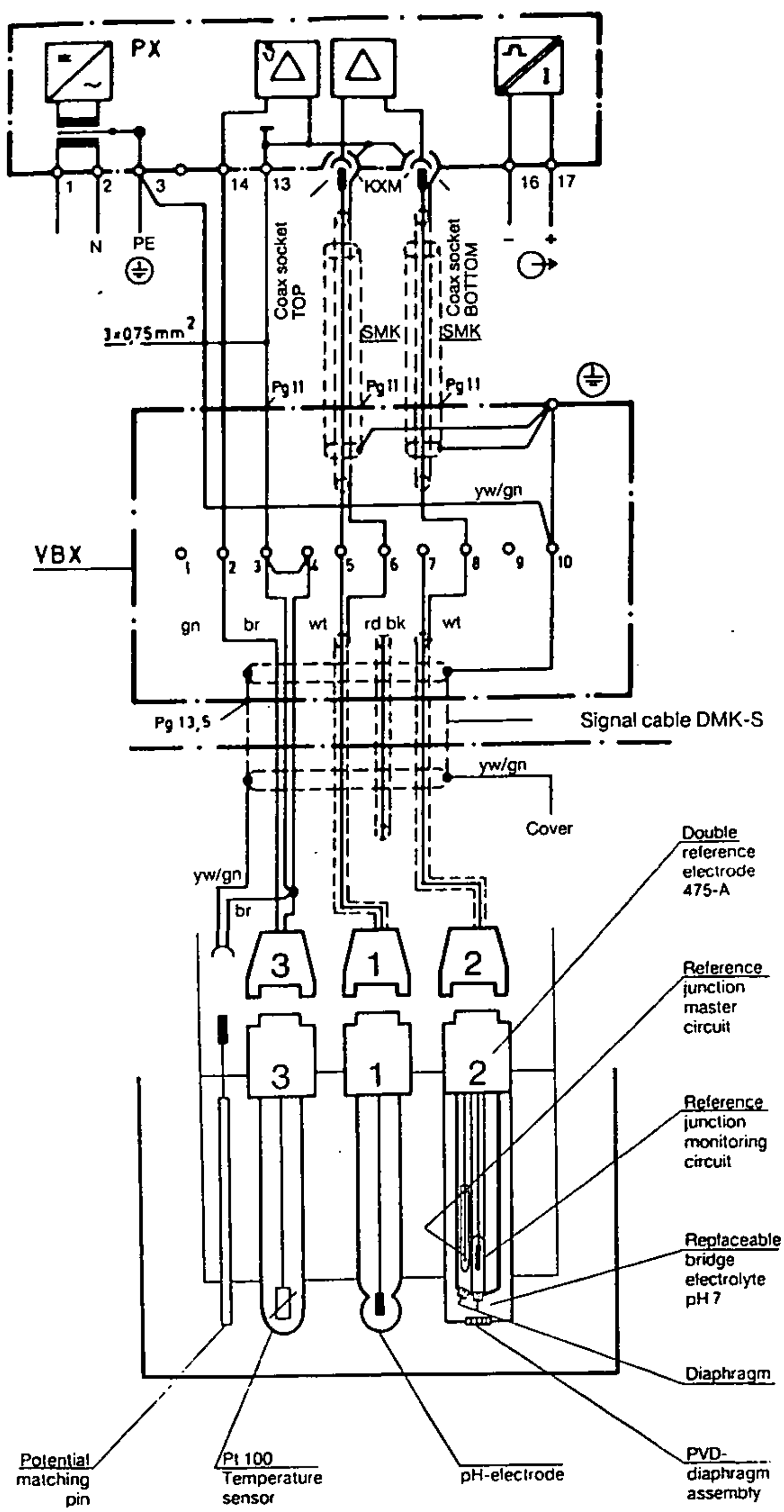


Figure 17
Connections SENSOPAC-PX
series instruments

8. CALIBRATION

Regular calibration is essential to ensure accurate and reliable measurement with the SENSOPAC multi-electrode system. The running time between calibration is dependent on the process conditions and the degree of accuracy required. When first starting operation frequent calibration is recommended, eg. weekly. If measurement is still within the required accuracy the time between calibration may be gradually increased.

In addition to ensuring accuracy, routine calibration is a good opportunity to inspect the system and carry out maintenance work, such as cleaning.

Calibration procedure:

1. Ensuring that the system is not under pressure (except where retractable holder WS is used), release the mounting fitting and remove the SENSOPAC multi-electrode system.
2. Clean the electrodes and lower part of the body and then rinse thoroughly. Cleaning is described in detail in section 9.
3. Visually inspect the system for damage, eg. broken electrodes the diaphragm may become heavily coloured by adsorption of measuring fluid. This will not affect the measurement unless the diaphragm is totally blocked and insulated. Replace any parts which are damaged.
4. Using the buffer solutions required for the pH instrument, calibrate according to the instructions for the pH meter. Dip the complete SENSOPAC assembly into the buffer solutions - <u>do not remove the individual electrodes for calibration</u>.

NOTE:

The protective cover should not be removed during calibration!

9. CLEANING

Measurement errors can be caused by fouling:

- Build-up on the pH-sensitive electrode glass (poor response and loss in sensitivity).
- Heavy fouling of the diaphragm (poor response time and unstable measurement).

To ensure correct measurement the electrode system must be cleaned regularly.

Cleaning should be carried out:

- Before every calibration.
- If required, at routine intervals during operation. This regular cleaning can be automated using the CHEMOCLEAN spray cleaning system.

9.1 Manual Cleaning

All wetted parts, including the protective pins and underside of the SENSOPAC body, should be cleaned.

Light deposits may be removed by immersion in a suitable cleaning fluid, gently swirling if necessary.

Heavy deposits may be removed by brushing gently with a soft brush soaked in a suitable cleaning fluid. Persistent deposits should be removed by prolonged soaking in the cleaning fluid.

WARNING!

Never use abrasive cleaning materials! These may destroy the measuring parts!

After cleaning the system must be rinsed thorougly, preferably with distilled or deionised water. Insufficient rinsing may lead to a false measurement or calibration.

9.2 Automatic Cleaning

Cleaning during operation may be automated using a spray cleaning system.

Spray head type CC-KS is available and can be mounted retrospectively if required.

This spray head is suitable for spraying with water under pressure or diluted chemicals.

<u>The spray cleaning system must be isolated from the mains water supply by a suitable pipe separator.</u>

9.3 Selection of Cleaning Agents

The choice of cleaning agent will be determined by the nature of the buildup. The most common forms of deposit and suitable cleaning agents are shown in the table below:

NATURE OF DEPOSIT	CLEANING AGENT
Fat, grease, oil	Detergent
Lime deposits or metal hydroxides	10 % Hydrochlor ic acid
Sulphide deposits (eg. effluent treatment)	Mixture of 10 % Hydrochlorid acid and saturated thiocarbam ide
Protein deposits (eg. foods)	10 % Hydrochlor ic acid + saturated pepsin

Note:

Rinse well after cleaning!

The electrodes can be reactivated, if required, by immersion in a mixture of 10 % hydrochloric acid and 50 g/l ammonim fluoride.

Handle solution with great care - do not store in glass container!

10. REPLACEMENT OF ELECTRODES

To replace electrodes follow the procedure shown below:

1. Remove the SENSOPAC multi-electrode system as for calibration.
2. Release the knurled screw at the top of the protective cover, and gently pull the cable entry assembly outward until it hangs freely on the cable.
3. Unscrew the protective cover, taking care not to twist the connection cable.
4. Unscrew and remove the cable connector head from the electrode(s) to be replaced.
5. Using the key provided, unscrew and remove the electrode(s) to be replaced.
6. If changing the reference electrode, the bridge electrolyte should also be replaced.
7. Fit a replacement electrode, following the reverse procedure.

11. REPLACEMENT OF DIAPHRAGM

To replace the diaphragm follow the procedure shown below:

1. Remove the SENSOPAC multi-electrode system as for calibration.
2. Following the instructions shown for electrode replacement, remove the reference electrode.
3. Using the key provided, unscrew the diaphragm assembly and remove.
4. Thoroughly rinse the reference chamber preferably with distilled or deionised water.
5. Thoroughly dry the reference chamber and diaphragm mounting threads.
6. Place the diaphragm assembly and tighten into place.
7. Fill the reference chamber with fresh electrolyte and replace the reference electrode. Electrolyte should overflow from the chamber as the electrode is tightened.
8. Reconnect the electrodes, replace the protective over and then recalibrate the system before beginning measurement with the new diaphragm.

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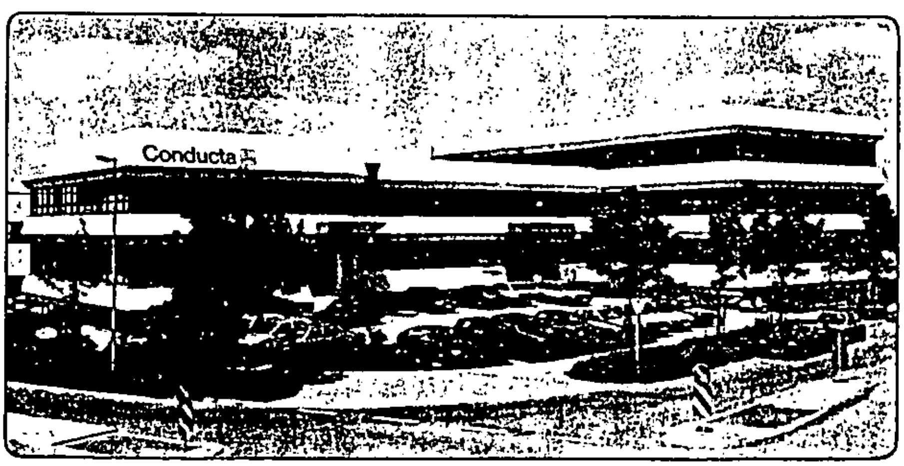

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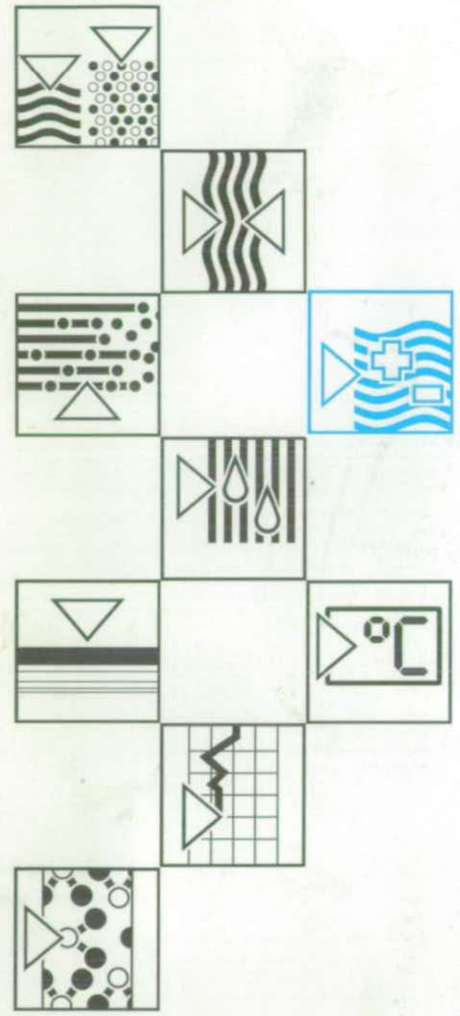
sensopac

CPA 320 pH / Redox compact electrode system

Installation and operating instructions



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BE1PA320.CHP

Contents

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

BE4PA320.CHP

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.

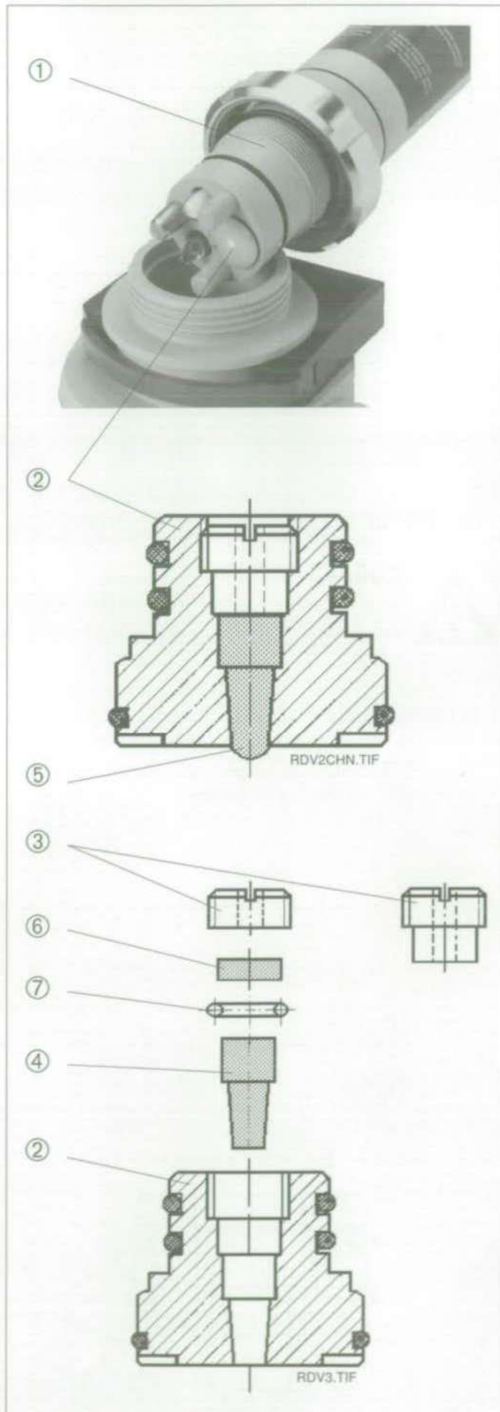


Fig. 25: Change of replacement diaphragm RDV-HT

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

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.

BE1PA320.CHP

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 briding 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 monitores the 2 measuring circuits and signals any occuring 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.

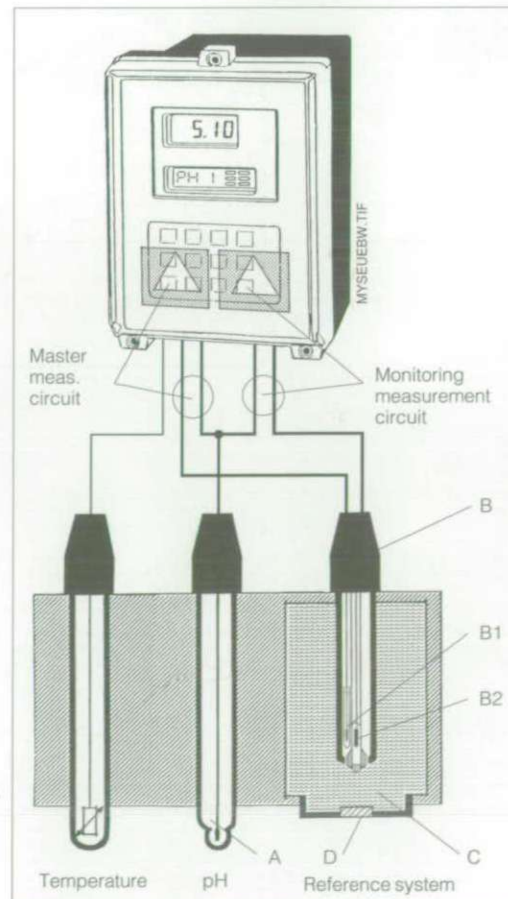


Fig. 2: Operating principle

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

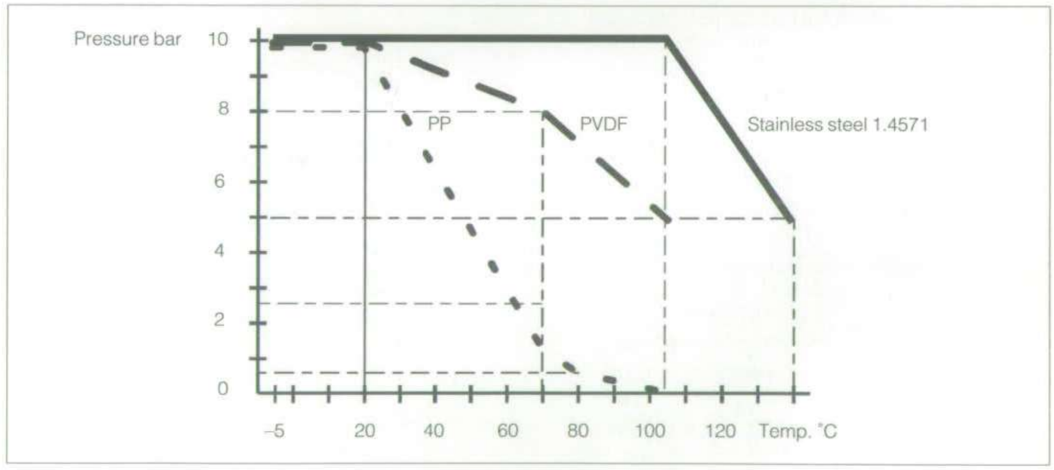


Fig. 3: Maximum permissible operating pressure in relation to material and temperature

	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

BE4PA320.CHP

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 13-0TD 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 ingression 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.

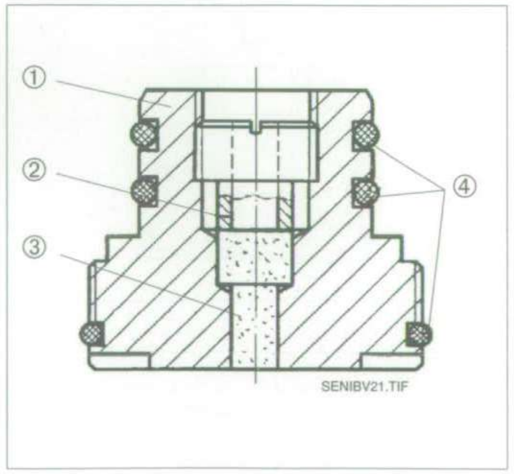


Fig. 24: Diaphragm cartridge DKV-HT

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

9.4 Cleaning system CPR 3

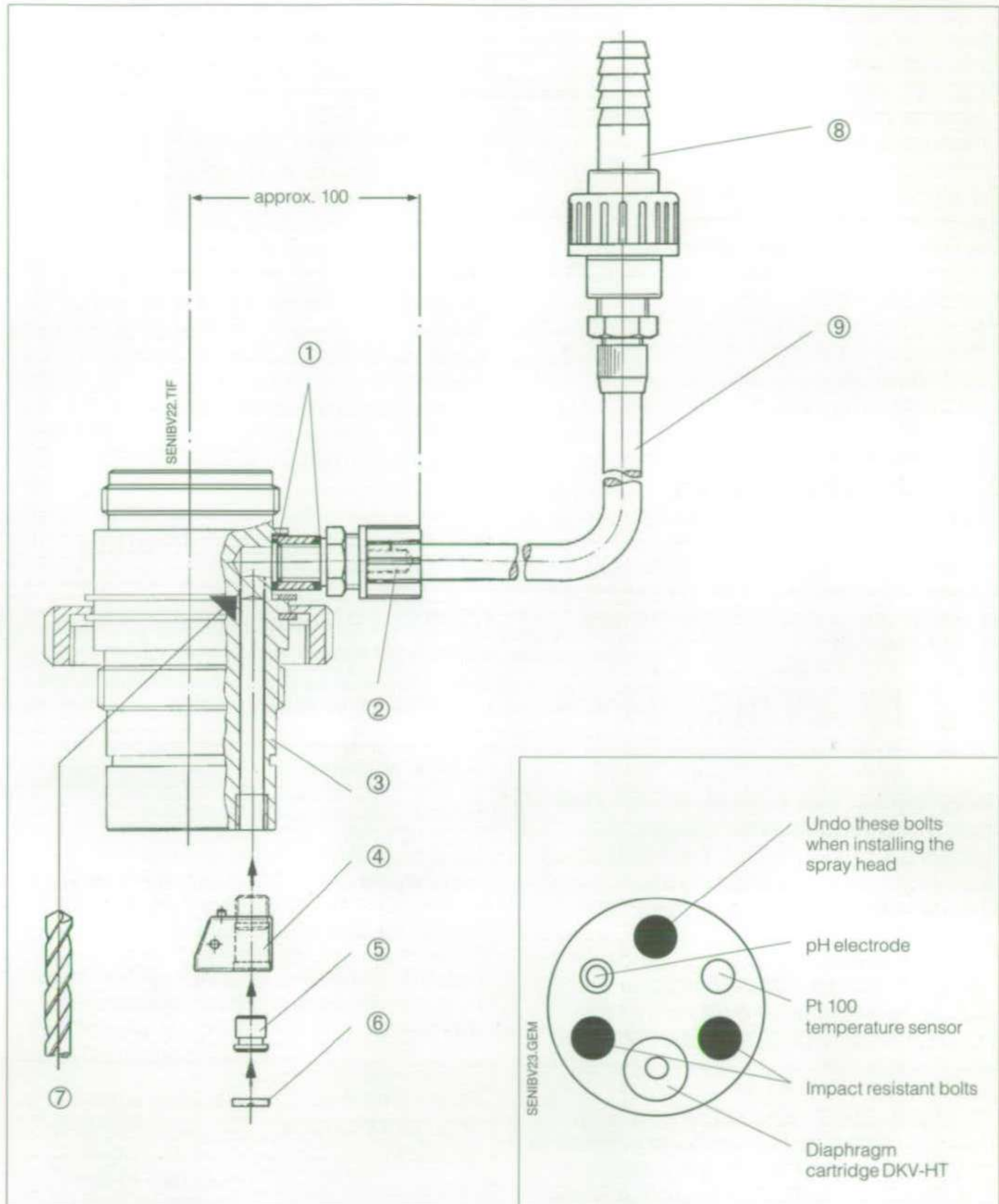


Fig. 22: Installation of cleaning system CPR 3 and connection fitting

① EPDM O-rings
② Remove sealing plug
③ Sensopac structure
④ Spray head
⑤ Threaded sleeve
⑥ Sealing srew
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: (right) Mounting position of cleaning system CPR 3

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.

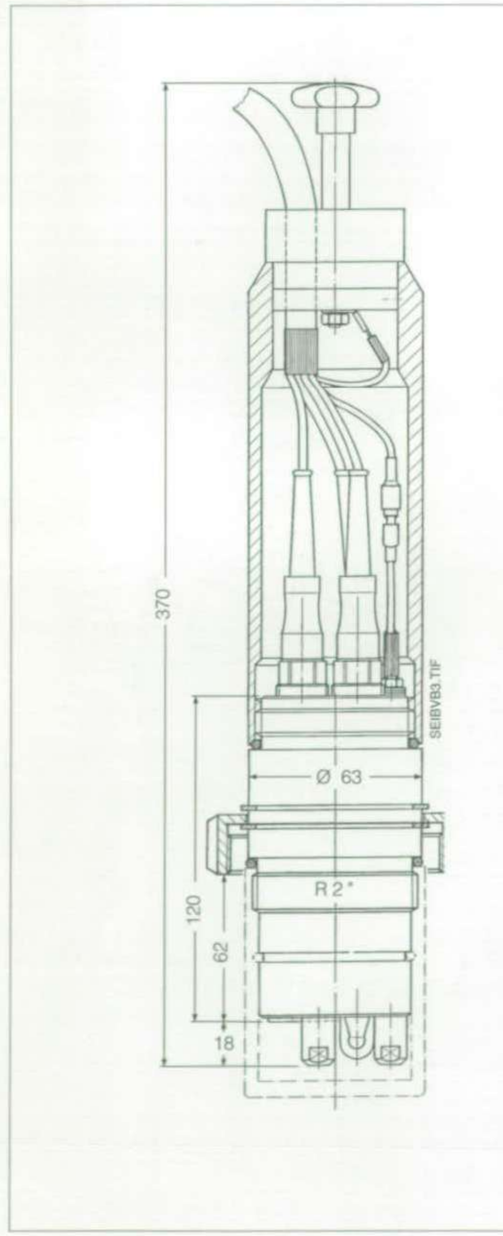
5. Dimensions

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.



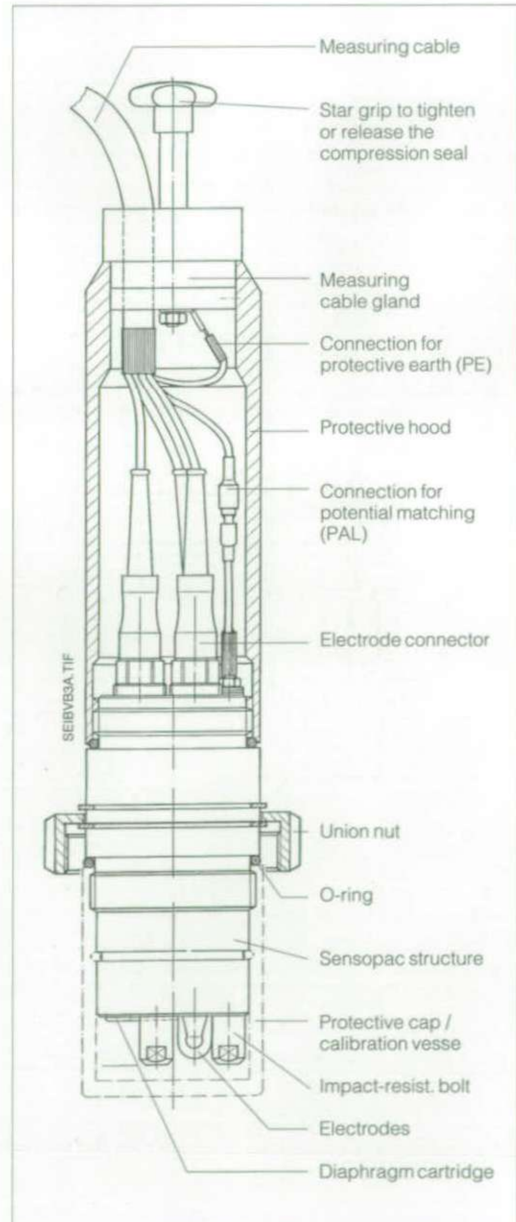


Fig. 4: Sensopac CPA 320
(left) Dimension diagram
(right) Component parts

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.

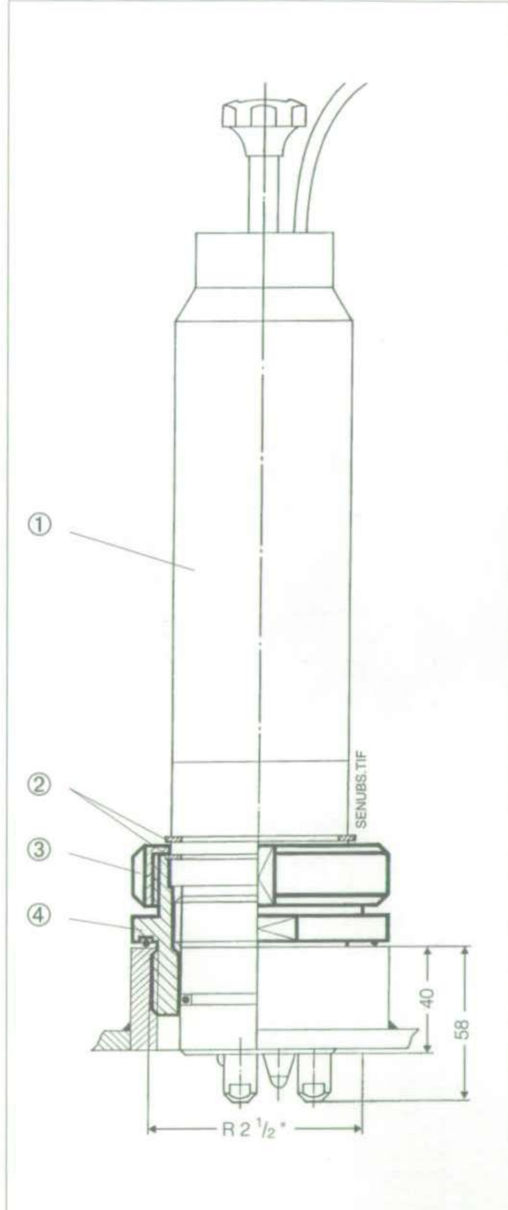


Fig. 5: (left) Sensopac CPA 320 with UBS adapter

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

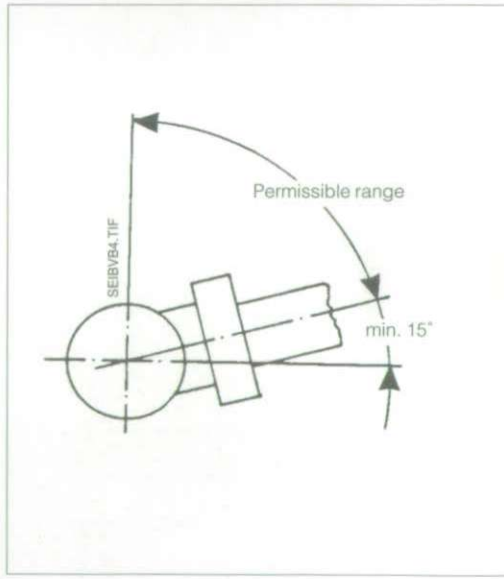


Bild 6: (right) Installation position of Sensopac CPA 320

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 Titriplex (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.

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 electrodes 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.

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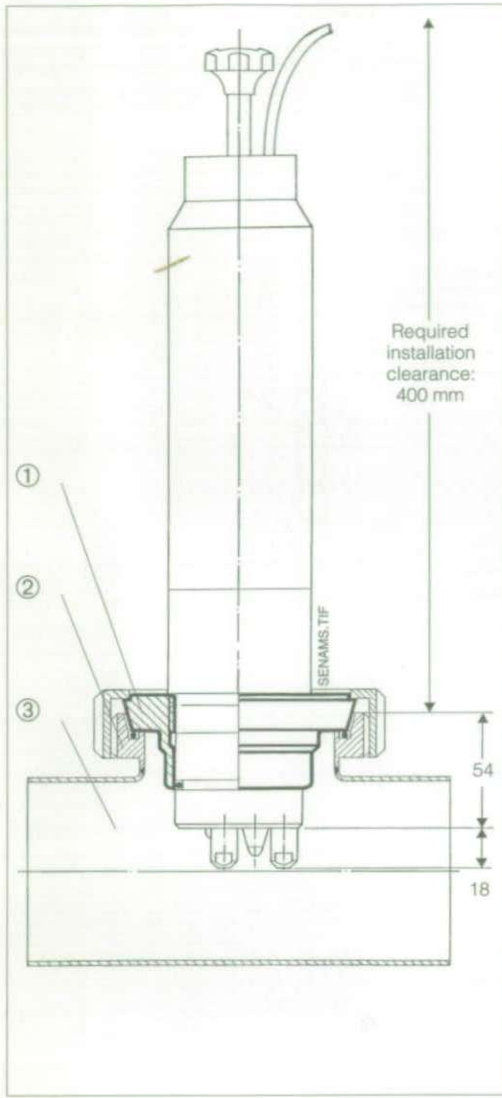


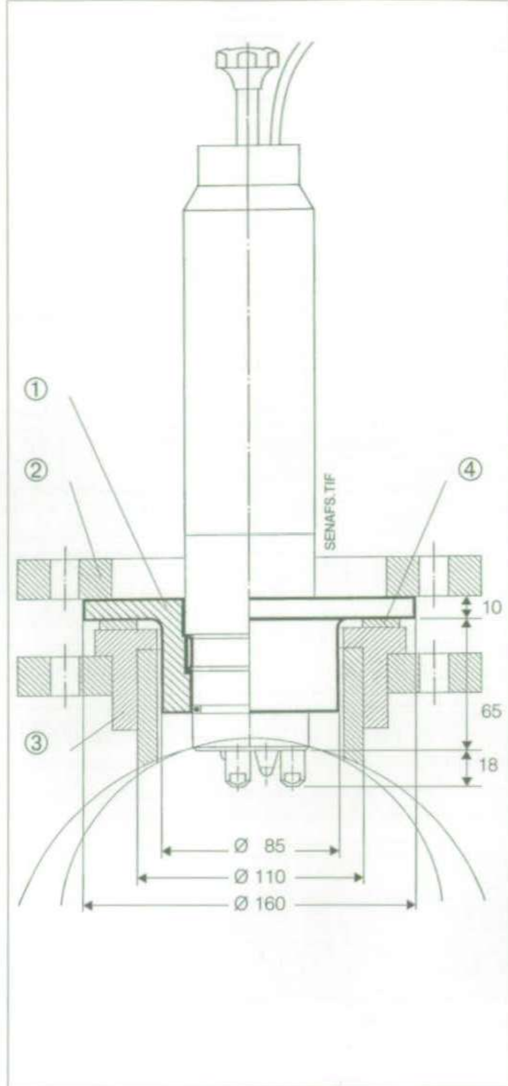
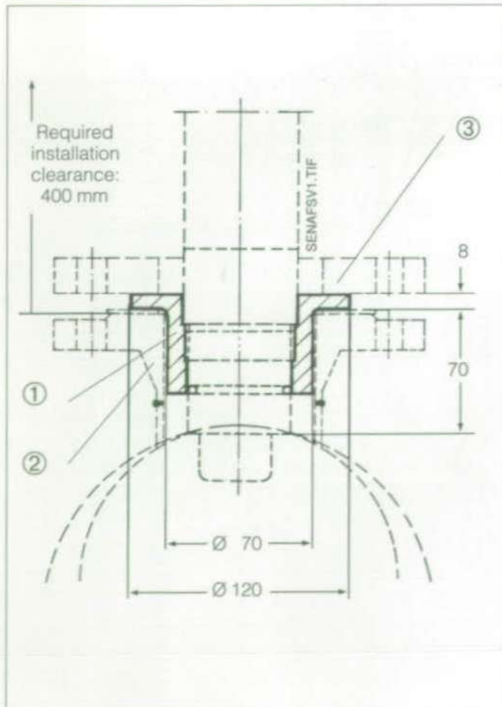


Fig. 7: (left) Sensopac CPA 320 with AMS adapter (for foodstuff application)

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

Fig. 8: (right) 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



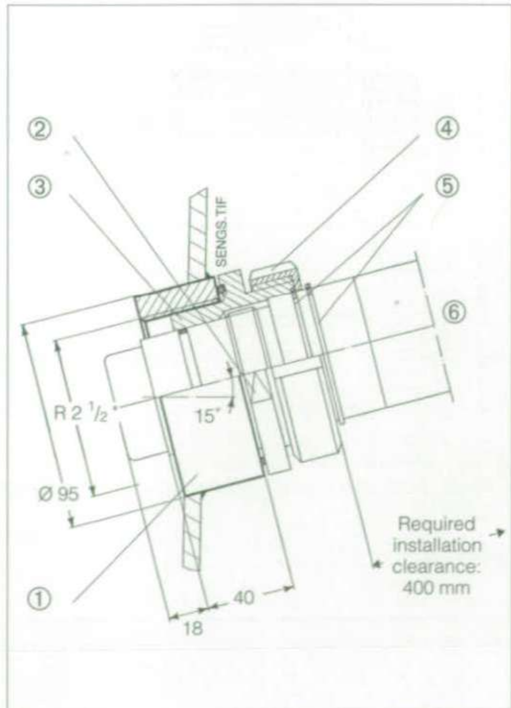


Fig. 9: (left) AFS-V adapter, stainless steel (1.457) for flange mounting of Sensopac CPA 320

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: (right) Srewed socket GS or GS-V for Sensopac CPA 320 for welded mounting

① Srewed 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

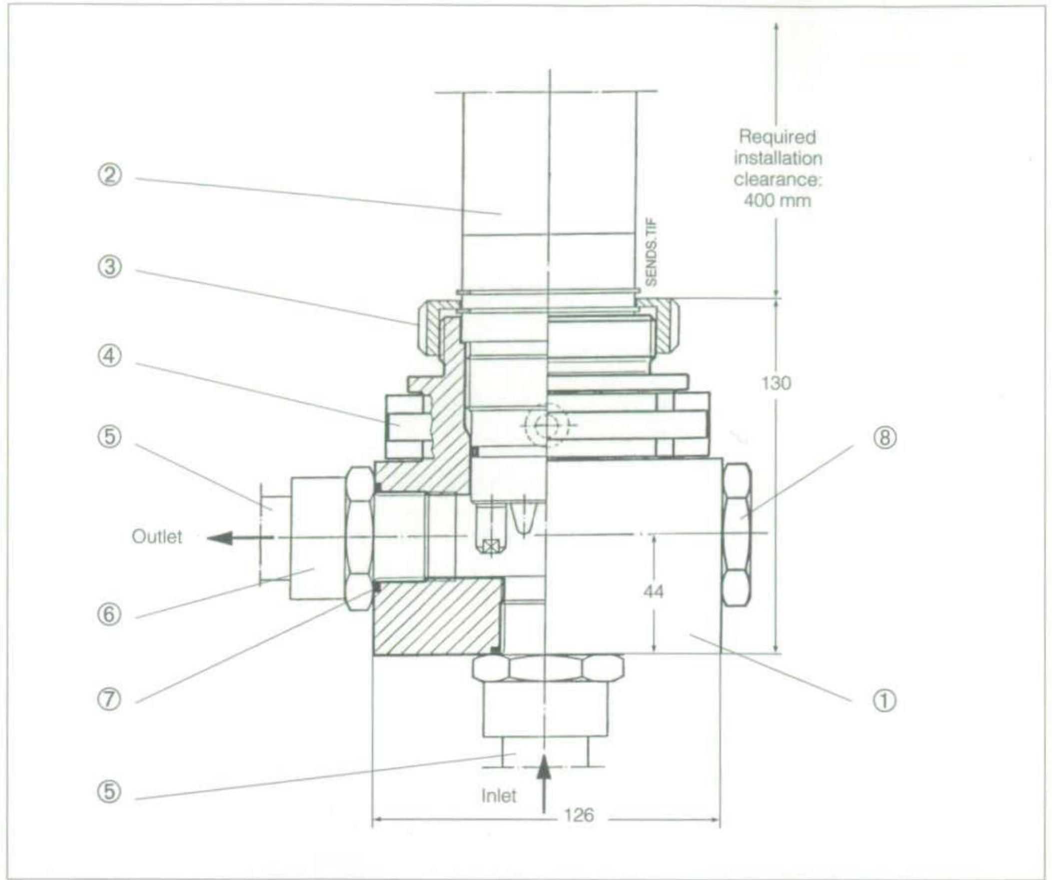


Fig. 11: Flow probe holder CPA 250-S00 for installation of Sensopac CPA 320

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!

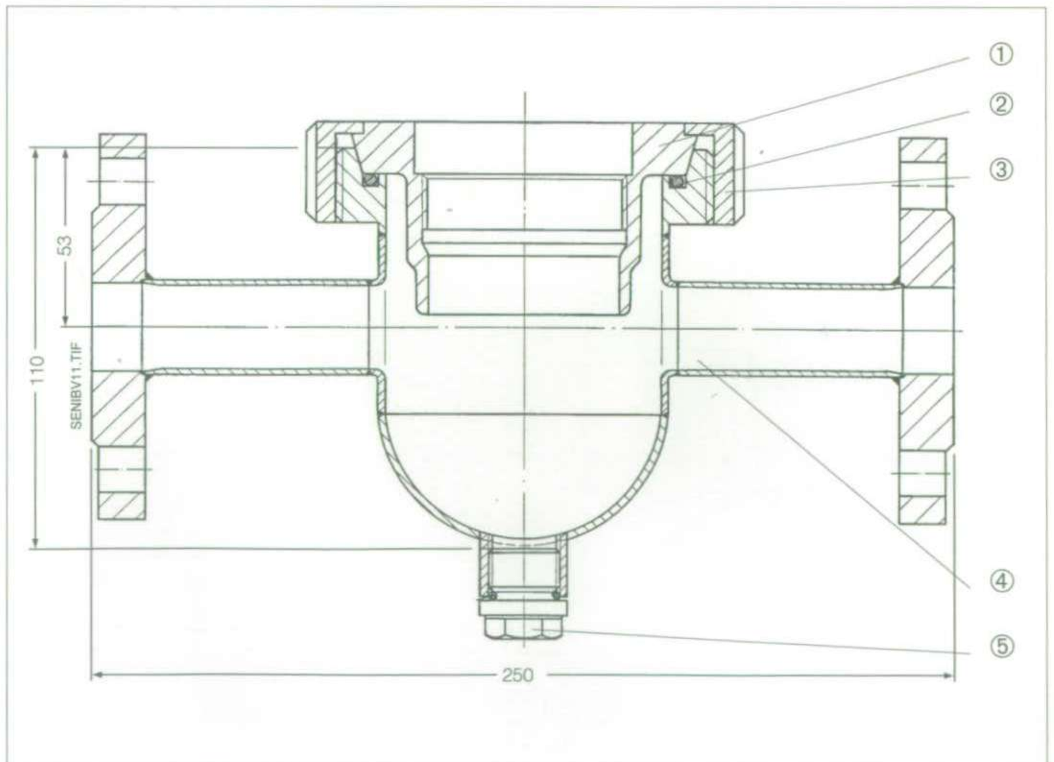


Fig. 12: Flow probe holder CPA 250-S13 for installation of Sensopac CPA 320

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

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

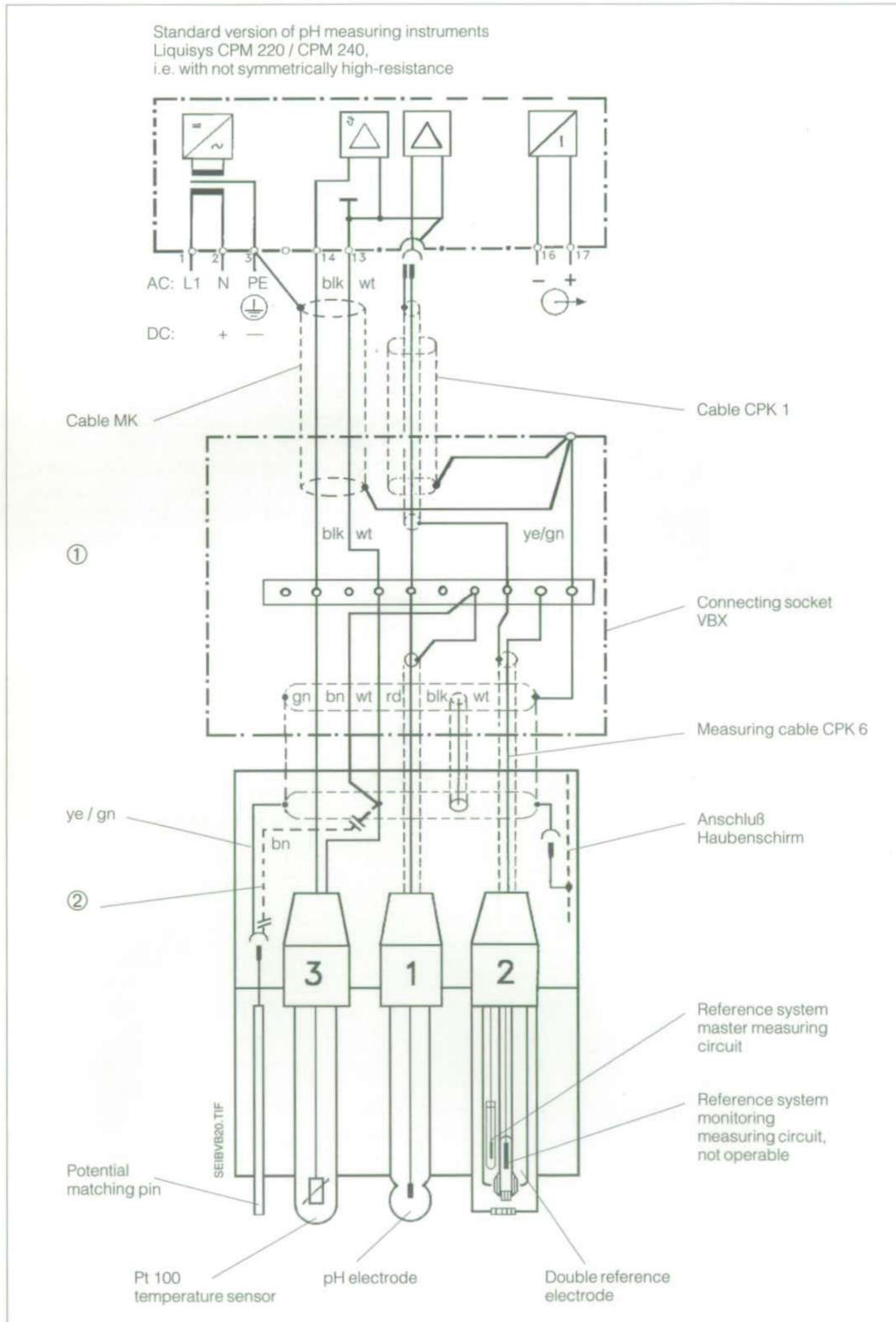


Fig. 21: Connection of Sensopac CPA 320 to standard version of pH measuring instrument CPM 120, i.e. with not symmetrically high-resistance

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!

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.

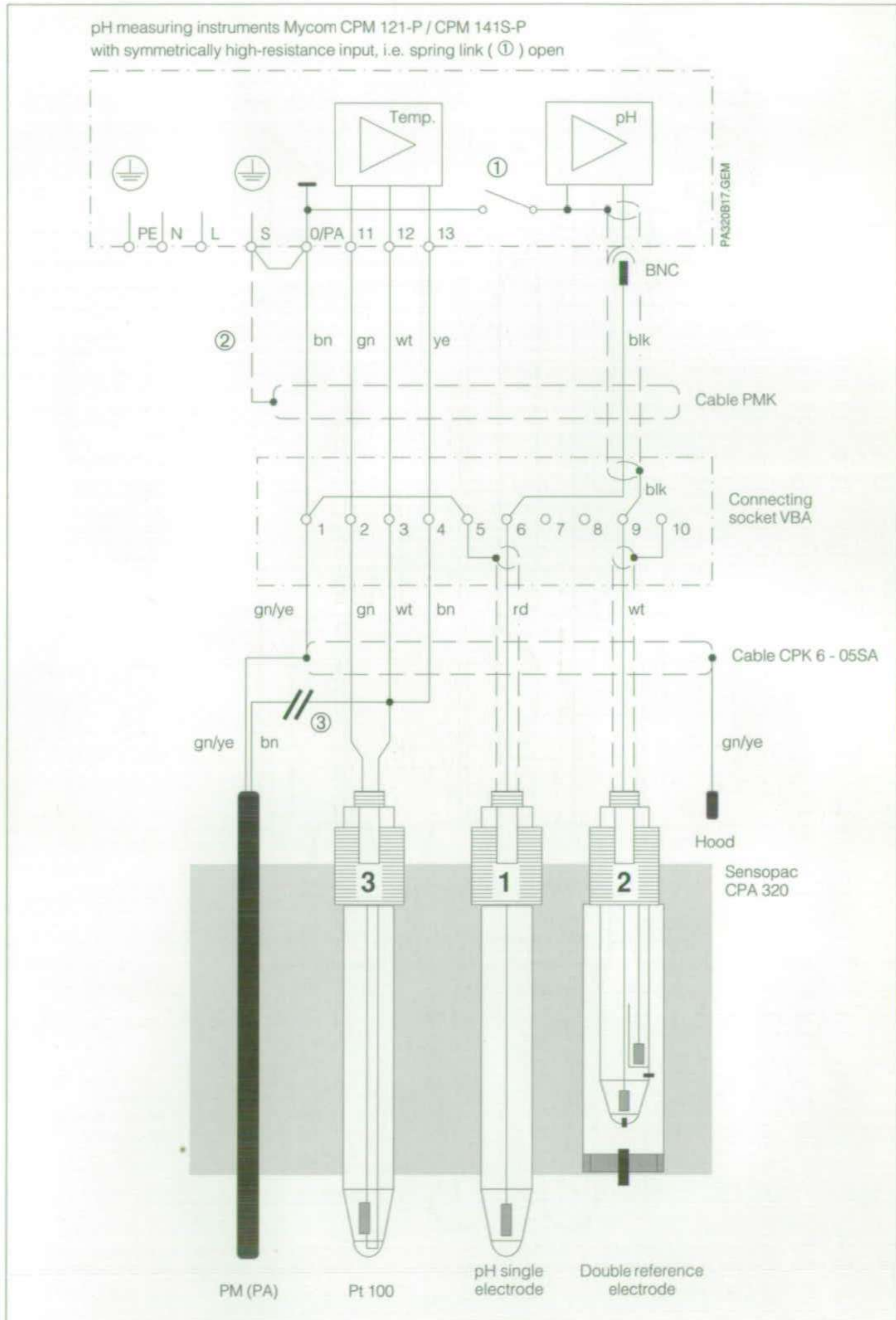


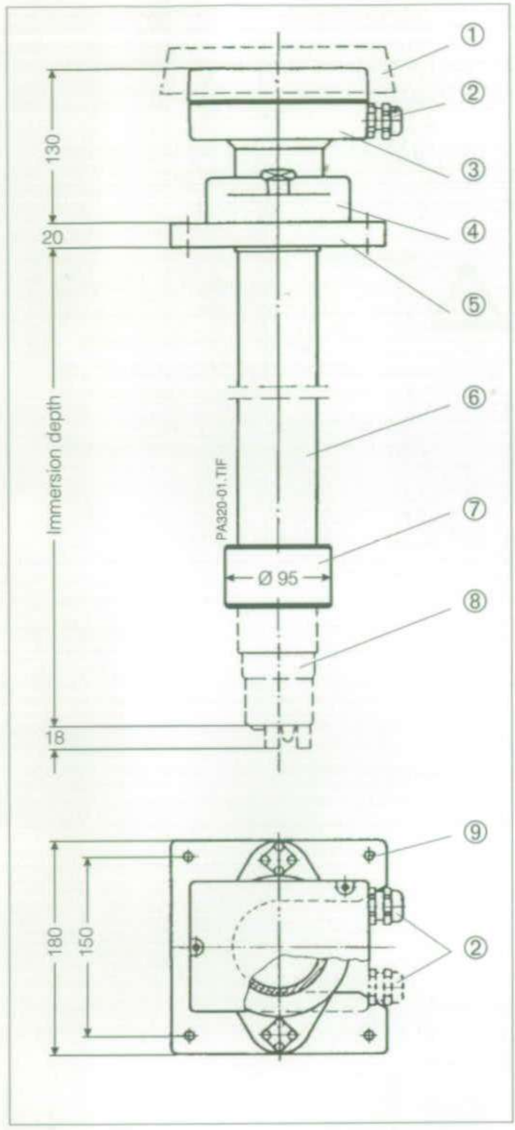
Fig. 20: Connection of Sensopac CPA 320 to pH measuring instruments Mycom CPM 121-P / Mycom CPM 141S-P with symmetrically high-resistance input

Notes concerning Mycom:

① Spring link open
② Connection is made via strain relief clamp

Caution:

③ Always cut off brown wire and insulate both wire ends.



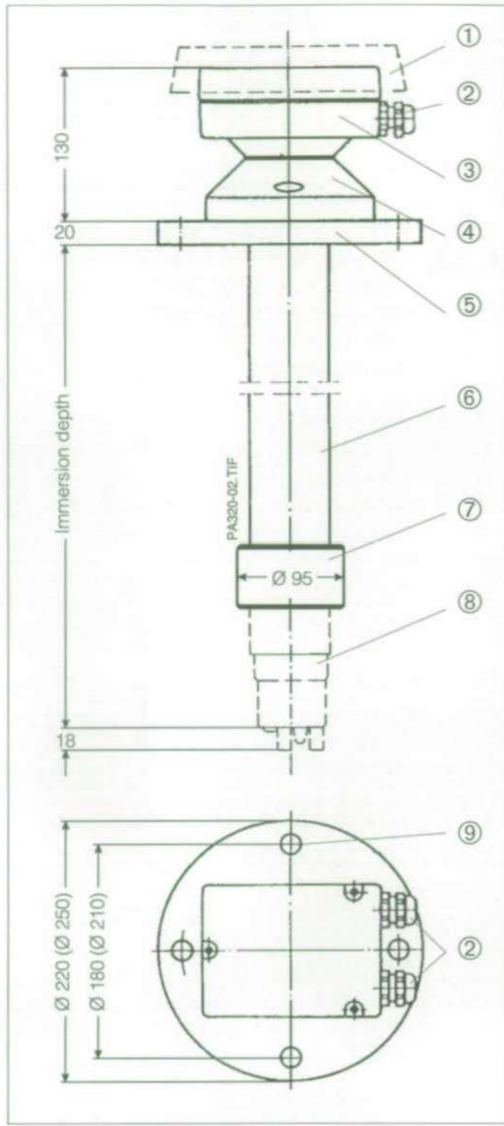


Fig. 13: (left) Immersion assembly CPA 110-S for installation of Sensopac CPA 320

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: (right) 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.

BE3PA320.CHP

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

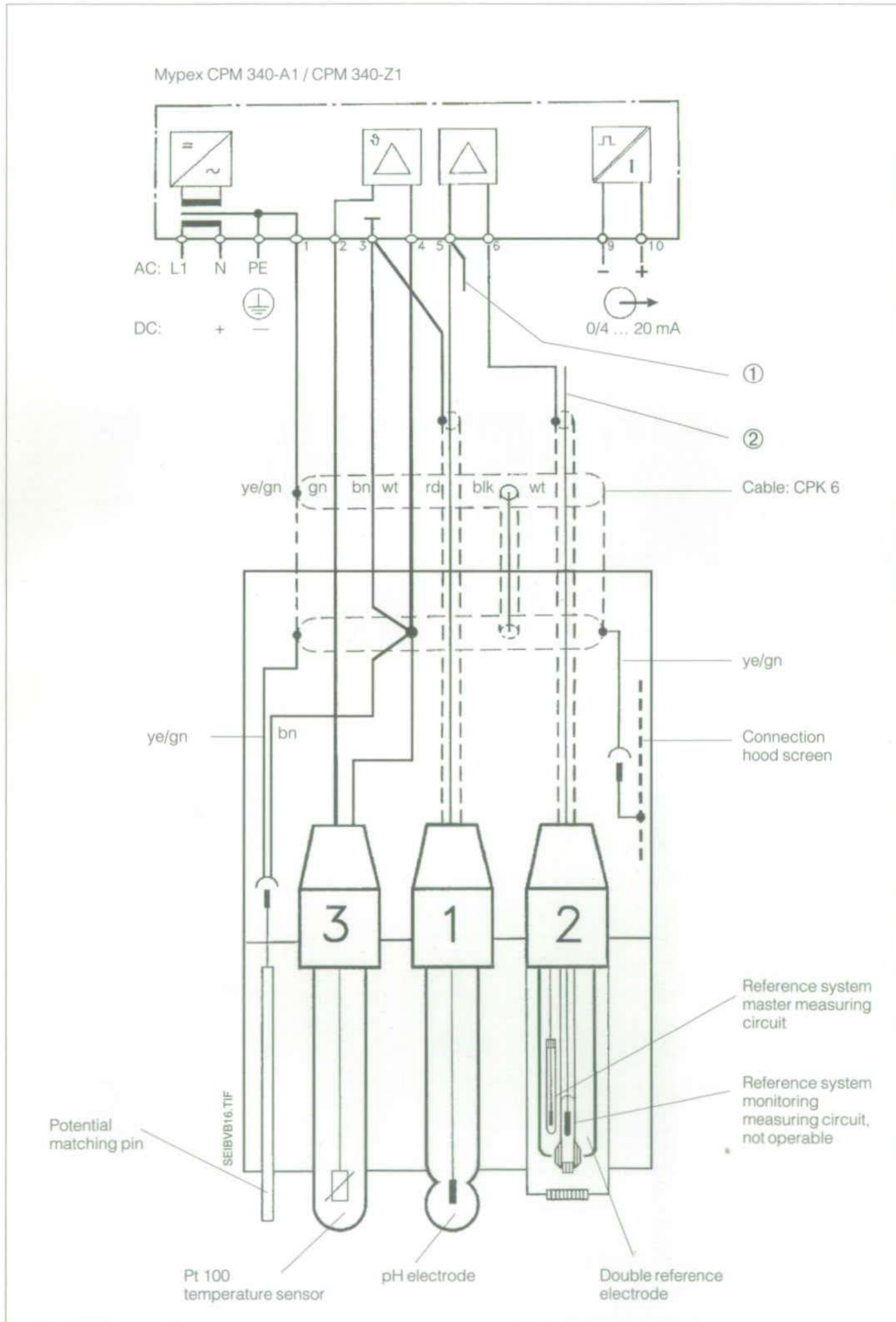


Fig. 19: Connection of Sensopac CPA 320 with double reference electrode to Mypex CPM 340-A1 / Mypex CPM 340-Z1

Caution:
① Always cut off this wire at the end sleeve!
② The wire has to be insulated and must **not** be connected!

7.2.2 Sensopac with double reference system and two pH electrodes

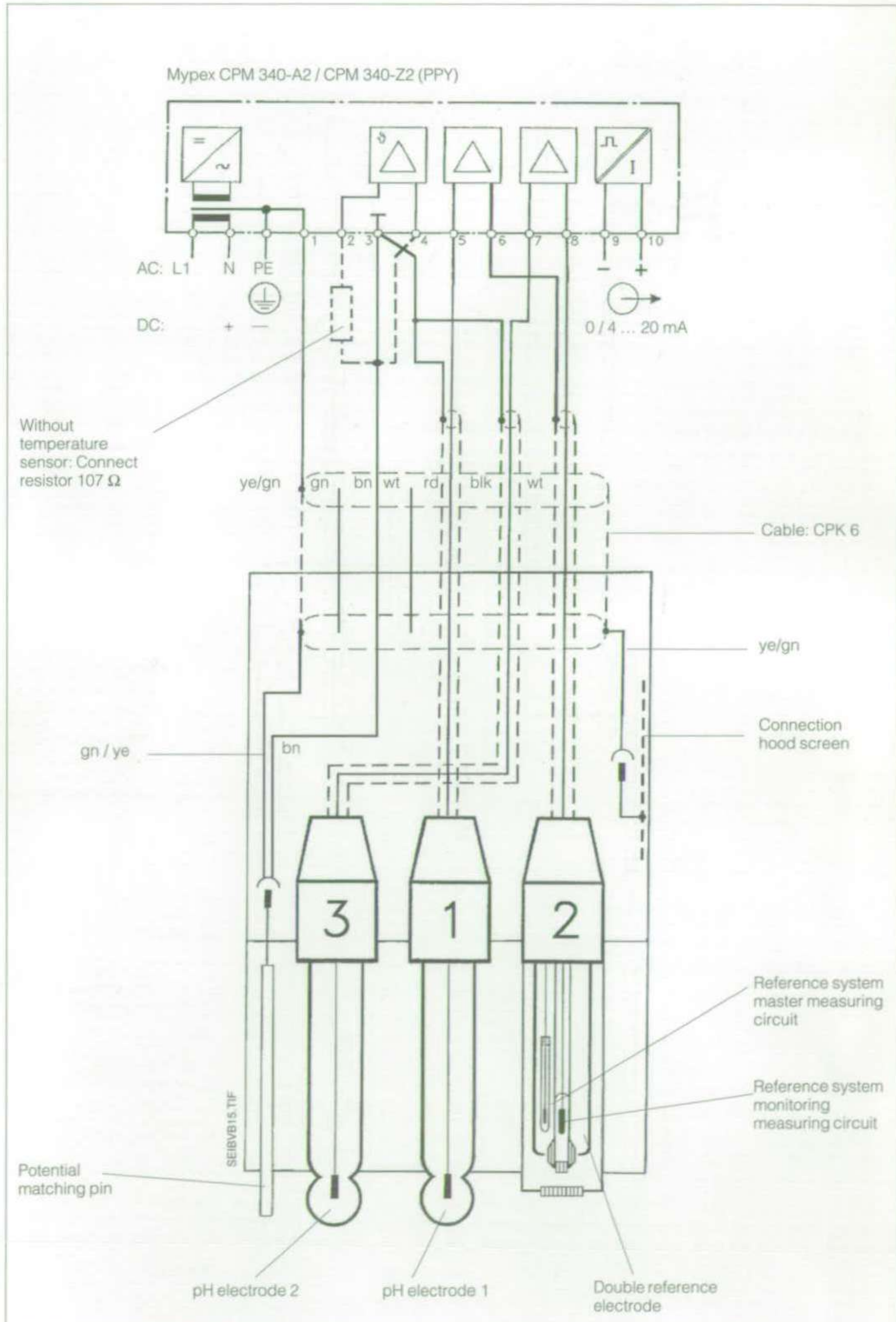


Fig. 18: Connection of Sensopac CPA 320 with two pH electrodes to Mypex CPM 340-A2 / Mypex CPM 340-Z2

BE3PA320.CHP

7.1 Cable assignment of the Sensopac measuring cable

7.1.1 Sensopac with double reference system and one pH single electrode

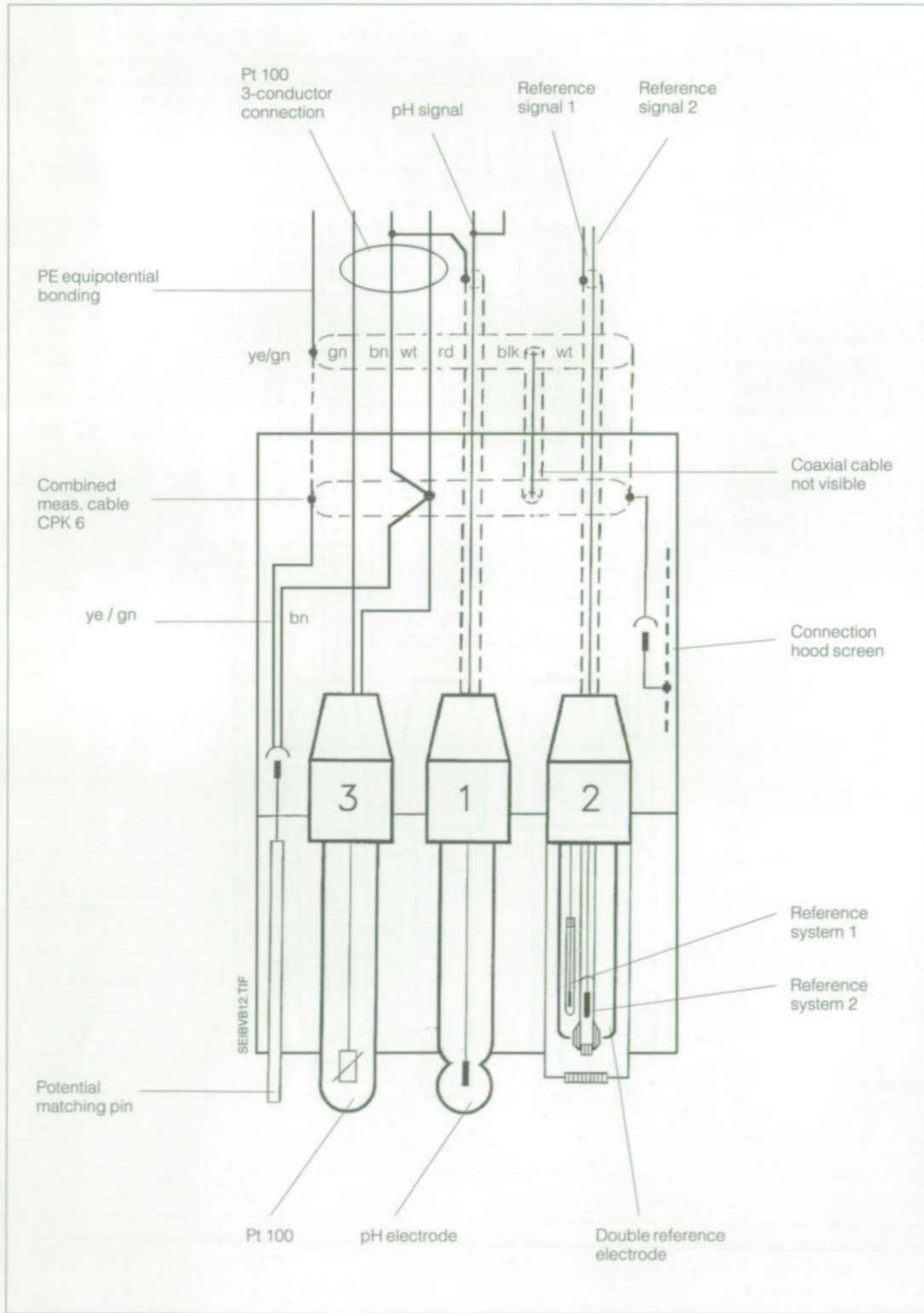


Fig. 15: Cable assignment for the Sensopac CPA 320 with double reference system and one pH single electrode

7.1.2 Sensopac with double reference system and two pH single electrodes

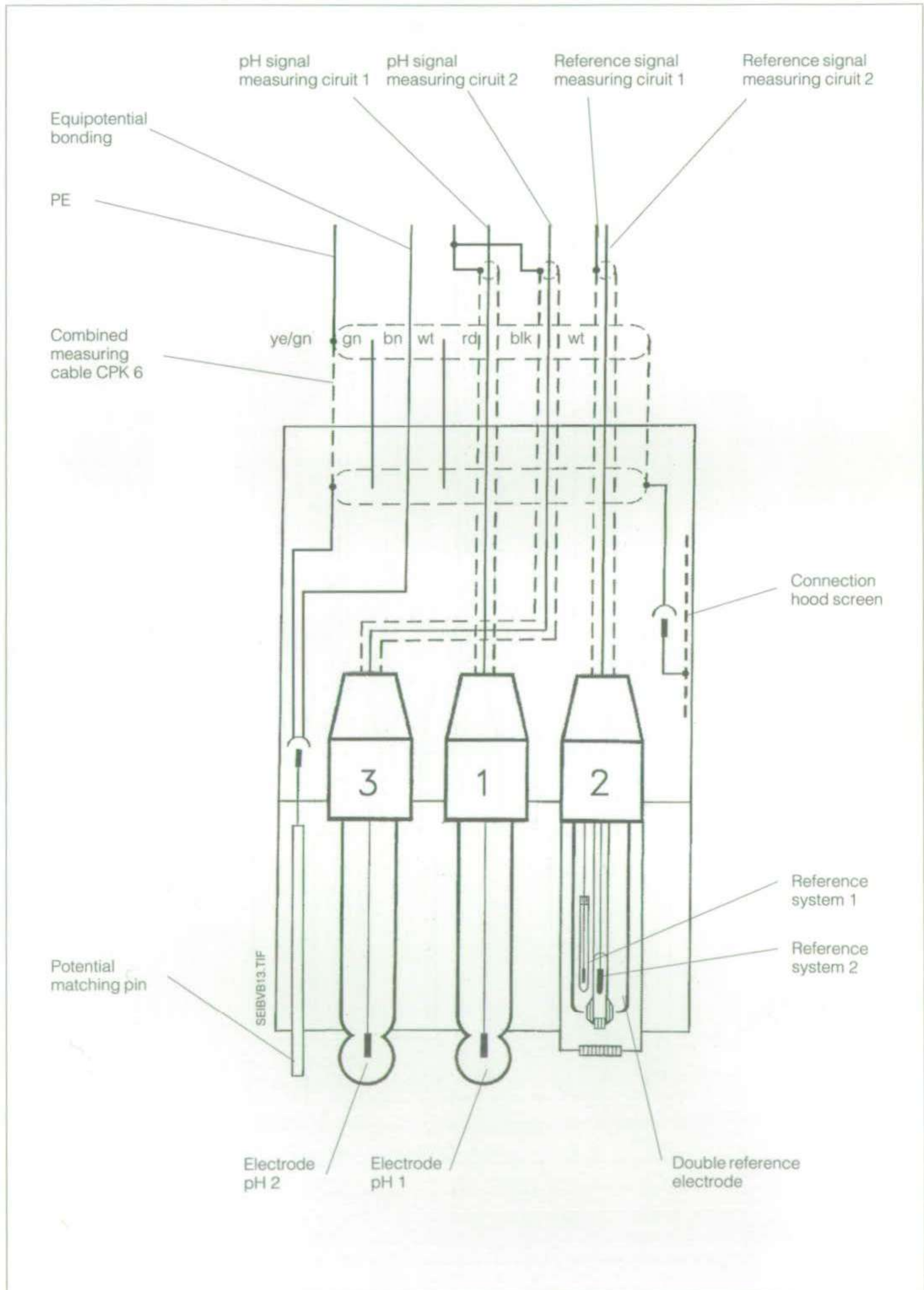


Fig. 16: Cable assignment for Sensopac CPA 320 with double reference system and two pH single electrodes

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

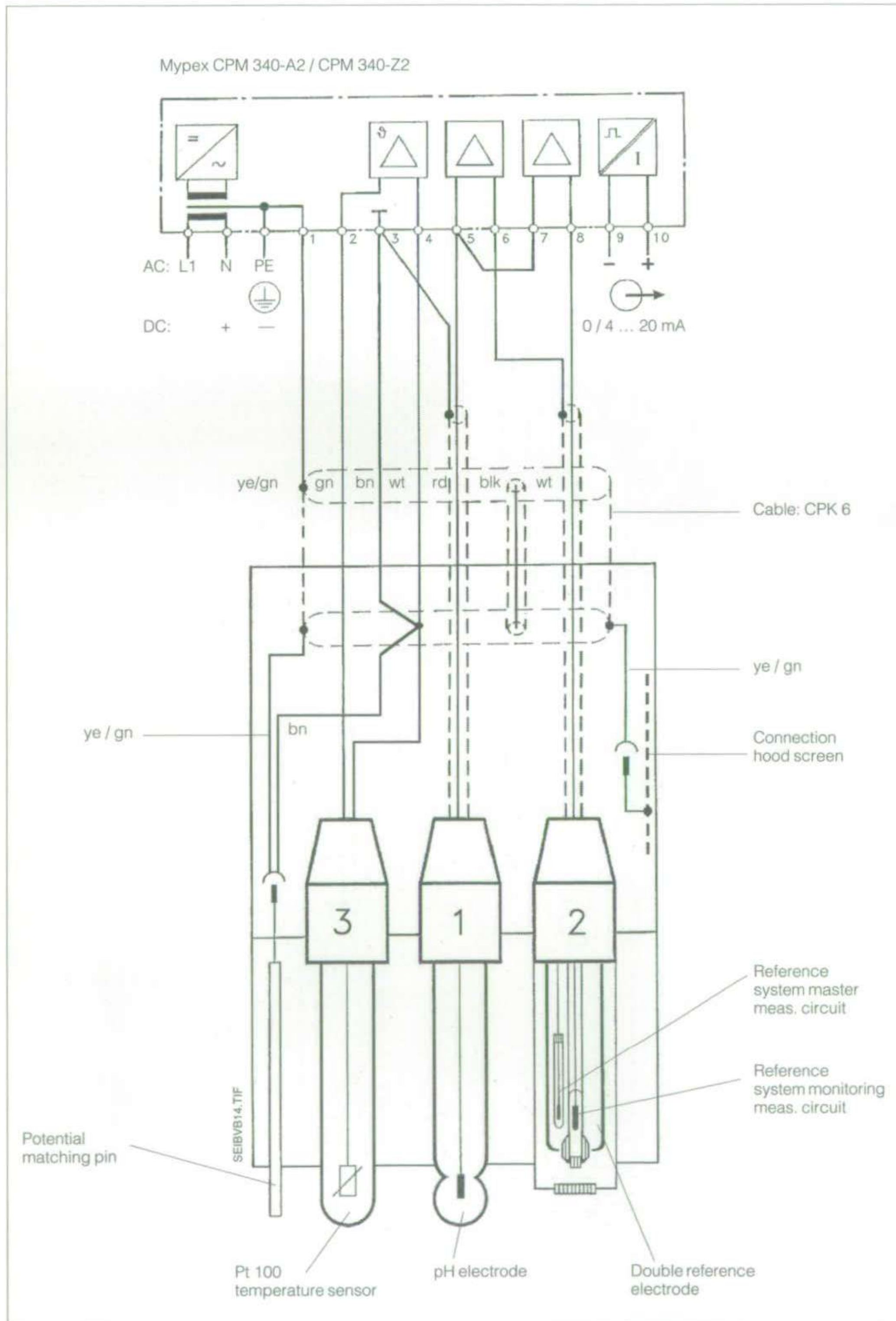


Fig. 17: Connection of Sensopac CPA 320 with double reference electrode to Mypex CPM 340-A2 / Mypex CPM 340-Z2

25

26

Honeywell

APT2000 Series 2-Wire Contacting Conductivity Transmitters User Manual

70-82-25-95
Revision 2 – 05/04

67077

Copyright and Notices

Warranty/Remedy

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyers' sole remedy and is **in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular**

purpose. Specifications may change without notice.
The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for this use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

About This Document

Abstract

This document provides information specific to the APT2000CC Transmitter.

Contacts

World Wide Web

The following lists Honeywell's World Wide Web sites that will be of interest to our customers.

Honeywell Organization	WWW Address (URL)
Corporate	http://www.honeywell.com
Industrial Measurement and Control	http://www.honeywell.com/imc

Telephone

Contact us by telephone at the numbers listed below.

	Organization	Phone Number
United States and Canada	Honeywell	1-800-423-9883 Tech. Support
		1-888-423-9883 Q&A Faxback (TACFACS)
		1-800-525-7439 Service

Address

Honeywell Industrial Measurement and Control, 1100 Virginia Drive, Fort Washington, PA 19034

Contents

Contents

Safety information

Be sure to read and observe the following instructions!

The device has been designed in accordance with the state of the art and complying with the applicable safety regulations. When operating the device, certain conditions may nevertheless lead to danger for the operator or damage to the device.

Caution!
Commissioning may only be carried out by trained experts. Whenever it is likely that protection has been impaired, the device shall be made inoperative and secured against unintended operation.

The protection is likely to be impaired if, for example:
- the device shows visible damage
- the device fails to perform the intended measurements
- after prolonged storage at temperatures above 70 °C
- after severe transport stresses

Before recommissioning the device, a professional routine test in accordance with EN 61010-1 must be performed. This test should be carried out by the manufacturer.

Caution!
Before commissioning it must be proved that the device may be connected with other equipment.

The Transmitter shall not be used in a manner not specified by this manual.

Safety information

Safety precautions for installation

- Be sure to observe the stipulations of EN 60079-10 / EN 60079-14 during installation.
- The **APT2000CC-H-00 Transmitter** is approved for operation in safe locations and in DIV 2 hazardous locations (USA/Canada only).
- The **APT2000CC-H-IS Transmitter** is approved for operation in hazardous locations DIV 1 (USA/Canada) / Zone 1 (Europe).
  The measuring inputs of the APT2000CC-H-IS Transmitter may be led into Zone 0 (Europe).
  However, be sure to observe the national regulations concerning Zone 0 applications. The Transmitter itself is not approved for operation in Zone 0!

Connection to supply units

- **APT2000CC-H-00**: Before connecting this Transmitter to a supply unit,make sure that its output voltage cannot exceed 30 V DC.
  Do not use alternating current or mains power supply!
- **APT2000CC-H-IS**: This Transmitter may only be connected to an explosion-proof power supply unit (for input ratings refer to annex of EC-Type-Examination Certificate).
  Before commissioning it must be made sure that the connections to other equipment such as power supply unit and cables are intrinsically safe.

Note for cleaning in a hazardous location

To protect against electrostatic discharge, the device may only be cleaned with a damp cloth in hazardous locations.

Intended use

The APT2000CC is used for measurement of electrical conductivity and temperature in liquids. Fields of application are: biotechnology, chemical industry, environment, food processing, water/ waste-water treatment.
The rugged molded enclosure can be fixed into a control panel or mounted on a wall or at a post.
The protective hood provides additional protection against direct weather exposure and mechanical damage.
The Transmitter has been designed for Honeywell 2-electrode sensors.

- Never use the **APT2000CC-H-00** for measurements in hazardous locations.
- The **APT2000CC-H-IS** is approved for operation in hazardous locations.

Trademarks

The following names are registered trademarks. For practical reasons they are shown without trademark symbol in this manual.

HART® is a registered trademark of the HART Communication Foundation.

Sensocheck
Sensoface
GainCheck

EC DECLARATION OF CONFORMITY

CE

The following product,

APT 2000 CC Transmitter

is in compliance with the provisions of the following EC Directives and/or standards.

Low Voltage Directive:	**73/23/EEC**
Standard:	EN 61010-1 / VDE 0411 Teil 1: 2002-08
EMC Directive:	**89/336/EEC**
Standard:	DIN EN 61326 / VDE 0843 Teil 20: 2002-03
Explosion protection :	**94/9/EG**
Standard :	EN 50014 : 1997 EN 50020 : 1994

Furthermore it complies with the provisions of the German law on electromagnetic compatibility of devises (EMVG) of September 18, 1998.

Manufacturer: Honeywell International, Inc.
525 East Market Street
York, PA 17405 USA

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person based within the EU, is identified below.

Honeywell IM&C
1100 Virginia Drive
Fort Washington, PA 19034

S.A. Arcara

Sam Arcara
Director
Industrial Measurement & Control Enginiering
Issue Date: 18 OCT. 20 04

Conformity with FDA 21 CFR Part 11

In their directive "Title 21 Code of Federal Regulations, 21 CFR Part 11, Electronic Records; Electronic Signatures" the US American health agency FDA (Food and Drug Administration) regulates the production and processing of electronic documents for pharmaceutical development and production.
This results in requirements for measuring devices used for corresponding applications. The following features ensure that the measuring devices of the APT2000CC Series meet the demands of FDA 21 CFR Part 11:

Electronic Signature
Access to the device functions is regulated and limited by individually adjustable codes – "Passcodes" (for Passcode Editor see Page 52, overview of factory settings on back of manual). This prevents unauthorized modification of device settings or manipulation of the measurement results. Appropriate use of these passcodes makes them suitable as electronic signature.

Audit Trail
Every (manual) change of device settings can be automatically documented. For that purpose, each change is marked by a "Configuration Change Flag", which can be interrogated and documented via HART communication. Then the changed device settings/parameters can also be retrieved and documented via HART communication.

TÜV CERT

Translation

(1) **EC-TYPE EXAMINATION CERTIFICATE**

(2) Equipment or Protective System intended for use in potentially explosive atmospheres - **Directive 94/9/EC**

(3) EC-Type Examination Certificate Number

TÜV 99 ATEX 1500

(4) Equipment or Protective System: Analytical process transmitter Typ APT2000CC-*-IS

(5) Manufacturer: Honeywell Inc.

(6) Address: USA - Fort Washington PA 19034, 1100 Virginia Drive

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV Hannover/Sachsen-Anhalt e.V., TÜV Certification Body N° 0032 in accordance with Article 9 of the Council Directive 94/9/EC of March 23, 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report N° 99/PX25990.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014:1997 **EN 50 020:1994**

(10) If the sign "X" is placed after the certification number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment or protective system. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment or protective system.

(12) The marking of the equipment or protective system shall include the following:

Ex II 2 (1) G EEx ib [ia] IIC T6

TÜV Hannover/Sachsen-Anhalt e.V.
TÜV CERT-Zertifizierungsstelle
Am TÜV 1
D-30519 Hannover

Hannover, 1999-11-17

Head of the Certification Body

TÜV NORD

[illegible]

This certificate may only be reproduced without any change, schedule included. Excerpts or changes shall be allowed by the TÜV Hannover/Sachsen-Anhalt e.V.

page 1/3

(13) **SCHEDULE**

(14) EC-TYPE EXAMINATION CERTIFICATE N° TÜV 99 ATEX 1500

(15) Description of equipment or protective system

The Analytical process transmitter Typ APT2000CC-*48 is used for the recognition and processing of electrochemical quantities.

The maximum permissible ambient temperature is 55°C.

Electrical data

Current loop .... in type of protection "Intrinsic Safety" EEx ib IIC
(terminals 10, 11)
only for the connection to a certified intrinsically safe circuit
with the following maximum values:
U_i = 30 V
I_i = 100 mA
P_i = 0.9 W
effective internal capacitance C_i = 20 nF
effective internal inductance L_i = 0.2 mH

Conductivity measuring loop ..... in type of protection "Intrinsic Safety" EEx ia IIC
(terminals 1, 2, 3, 4, 5)
Maximum values:
U_o = 10 V
I_o = 145 mA
P_o = 145 mW
R_i = 34.5 Ω
Characteristic: linear
effective internal capacitance C_i = 5 nF
The effective internal inductance is negligibly small.

max. permissible external capacitance C_o = 3 µF
max. permissible external inductance L_o = 1 mH

Temperature measuring loop .... in type of protection "Intrinsic Safety" EEx ia IIC
(terminals 7, 8)
Maximum values:
U_o = 5 V
I_o = 3.5 mA
P_o = 5 mW
R_i = 1500 Ω
Characteristic: linear
effective internal capacitance C_i = 250 nF
The effective internal inductance is negligibly small.

max. permissible external capacitance C_o = 100 µF
max. permissible external inductance L_o = 1 H

page 2/3

EP (Terminal 9) — for the connection to the equipotential bonding system

The current loop is safely separated from the conductivity measuring loop and the temperature measuring loop up to a voltage of 60 V. The conductivity measuring loop and the temperature measuring loop are galvanically connected.

(16) Test documents are listed in the test report No. 99/PX25990.

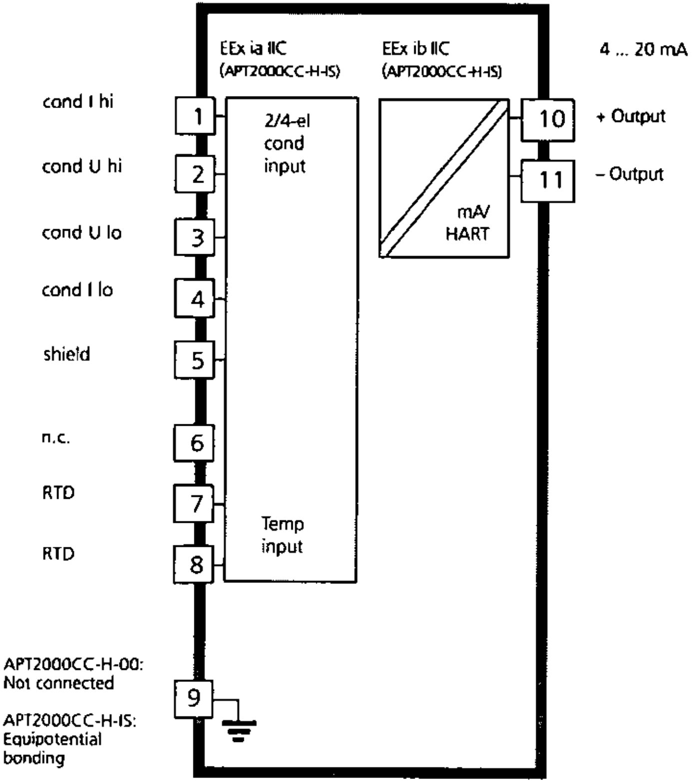
(17) Special condition for safe use

none.

(18) Essential Health and Safety Requirements

no additional ones

Overview of APT2000CC

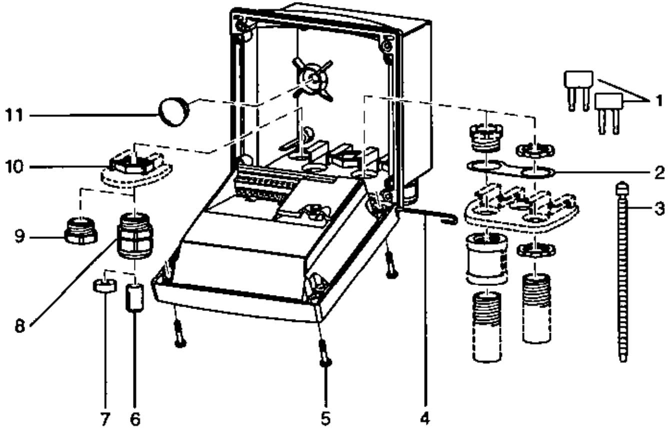


Assembly

Packing list

Check the shipment for transport damage and completeness. The package should contain:

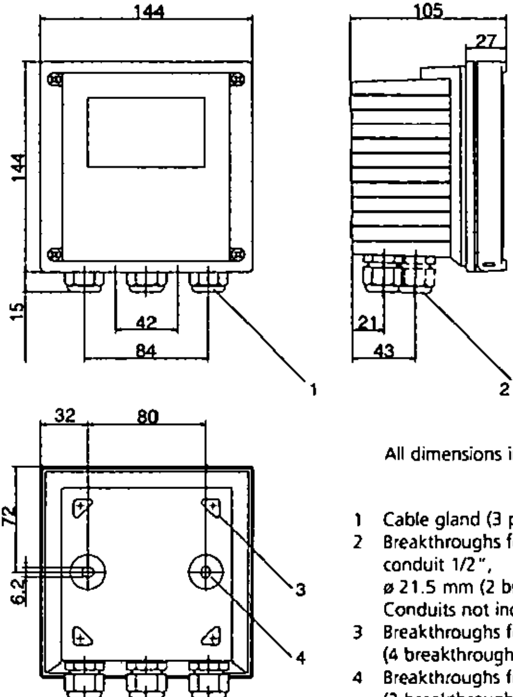
- Front unit of APT2000CC
- Lower case
- Bag containing small parts
- Instruction manual
- Specific test report



1 Jumper (2 piece)
2 Washer (1 piece), for conduit mounting: place washer between enclosure and nut
3 Cable ties (3 pieces)
4 Hinge pin (1 piece), insertable from either side
5 Enclosure screws (4 pieces)
6 Sealing inserts (1 piece)
7 Rubber reducer (1 piece)
8 Cable glands (3 pieces)
9 Filler plugs (3 pieces)
10 Hexagon nuts (5 pieces)
11 Sealing plugs (2 pieces), for sealing in case of wall mounting

Fig. 1: Assembling the enclosure

Mounting plan

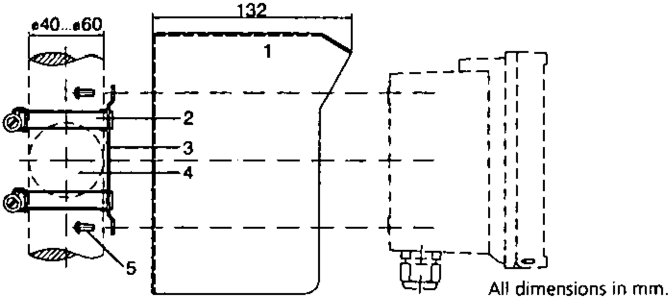


All dimensions in mm.

1 Cable gland (3 pieces)
2 Breakthroughs for cable gland or conduit 1/2",
ø 21.5 mm (2 breakthroughs)
Conduits not included!
3 Breakthroughs for pipe mounting (4 breakthroughs)
4 Breakthroughs for wall mounting (2 breakthroughs)

Fig. 2: Mounting plan

Pipe mounting, panel mounting



1 51205989-001 protective hood (if required)
2 Hose clamps with worm gear drive to DIN 3017 (2 pieces)
3 Pipe-mount plate (1 piece)
4 For vertical or horizontal posts or pipes
5 Self-tapping screws (4 pieces)

Fig. 3: 51205988-001 pipe-mount kit

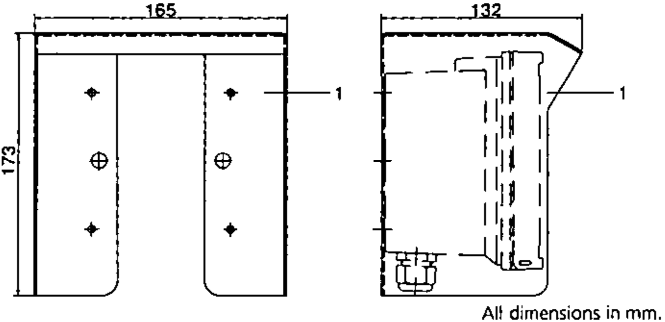
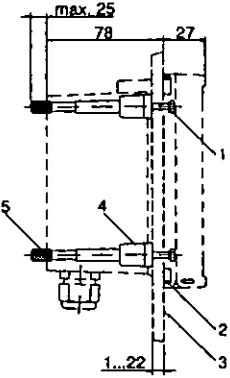


Fig. 4: 51205989-001 protective hood for wall and pipe mounting



1 Screws (4 pieces)
2 Gasket (1 piece)
3 Panel
4 Span pieces (4 pieces)
5 Threaded sleeves (4 pieces)

Panel cutout 138 x 138 mm
(DIN 43700)

All dimensions in mm.

Fig. 5: 51205990-001 panel-mount kit

Installation and connection

Information on installation

- Installation may only be carried out by trained experts in accordance with this instruction manual and as per applicable local and national codes.
- Be sure to observe the technical specifications and input ratings.
- Be sure not to notch the conductor when stripping the insulation.
- When commissioning, a complete configuration must be carried out by the system administrator.

Connection to supply units

- **APT2000CC-H-00**: Before connecting this device to a supply unit, make sure that its output voltage cannot exceed 30 V DC. Do not use alternating current or mains power supply!

- **APT2000CC-H-IS**: This device may only be connected to an explosion-proof power supply unit (for input ratings refer to annex of EC-Type-Examination Certificate).

Division 2 wiring

FM

The connections to the Transmitter must be installed in accordance with the National Electric Code (ANSI-NFPA 70) Division 2 hazardous (classified) location non-incendive wiring techniques.

Terminal assignments

Terminals: suitable for single wires/flexible leads up to 2.5 mm² (AWG 14).

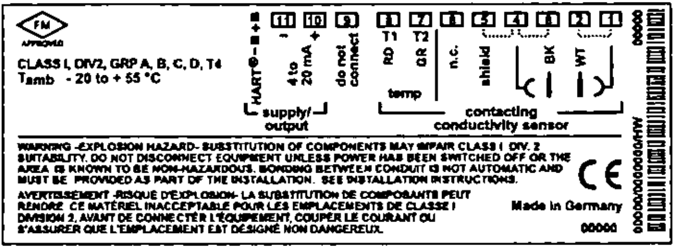


Fig. 6: Terminal assignments of APT2000CC-H-00 Transmitter
Class 1, Div 2, Group A, B, C, D, T4

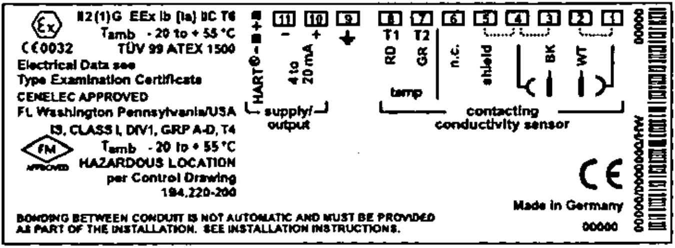


Fig. 7: Terminal assignments of APT2000CC-H-IS Transmitter
IS, Class I, Div 1, Group A, B, C, D, T4
II 2(1) G EEx ib [ia] IIC T6

Cable preparation

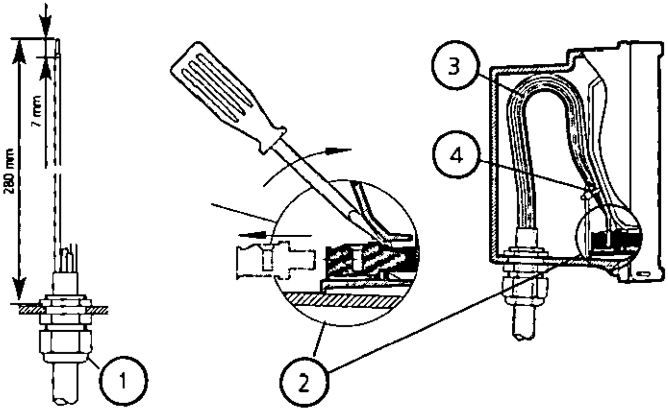


Fig. 8: Information on installation, cable preparation

1 Recommended stripping lengths for multi-core cables

2 Pulling out the terminals using a screwdriver (also see **6**)

3 Cable laying in the Transmitter

4 Connecting lines for loop current

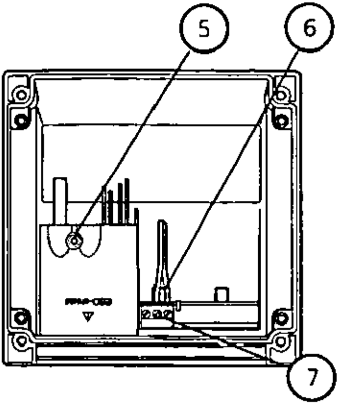


Fig. 8a: Information on installation, rear side of Transmitter

5 Cover for sensor and temperature probe terminals
6 Area for placing the screw-driver to pull out the terminals
7 Connection of handheld terminal

APT2000CC

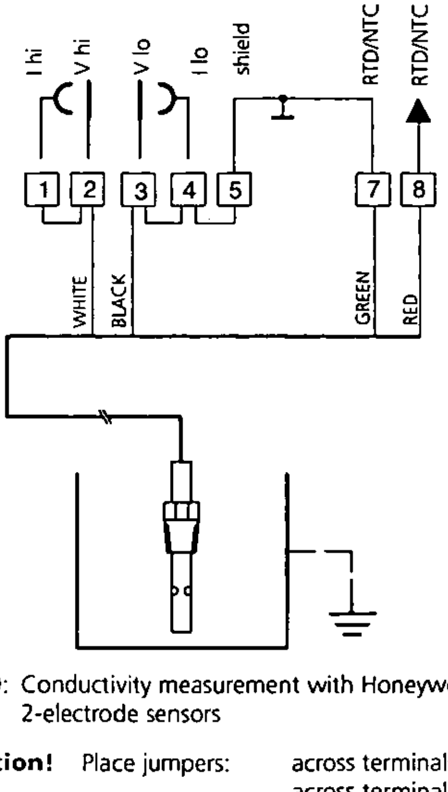


Fig. 9: Conductivity measurement with Honeywell 2-electrode sensors

Caution! Place jumpers: across terminals 1 and 2
across terminals 3 and 4
across terminals 4 and 5

User interface and display

User interface

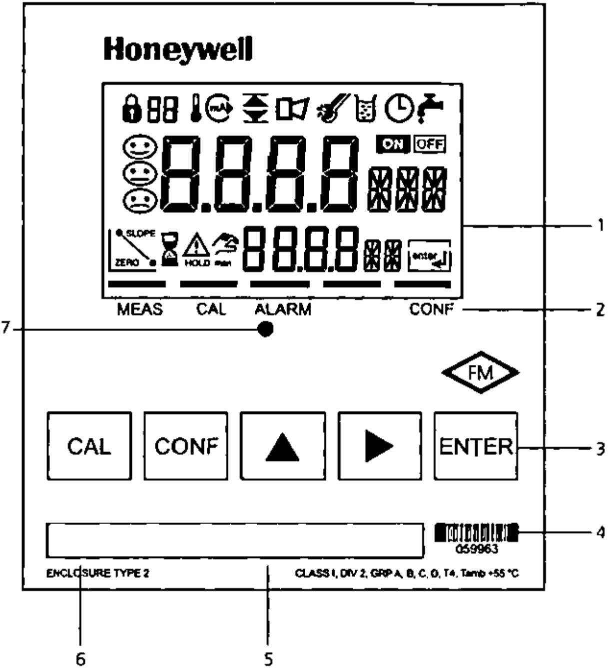


Fig. 10: Front view of Transmitter

1 Display
2 Mode indicators (no keys), from left to right:
  - Measuring mode
  - Calibration mode
  - Alarm
  - Wash contact (APT4000CC only)
  - Configuration mode
3 Keypad
4 Coding
5 Rating plate
6 Model designation
7 Alarm LED

Display

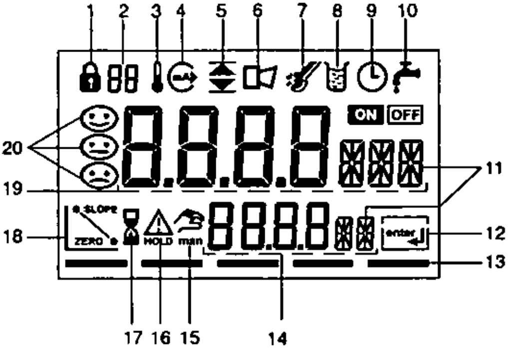


Fig. 11: Display of Transmitter

1 Passcode entry
2 Display of measured variable*
3 Temperature
4 Current output
5 Limit values
6 Alarm
7 Sensocheck
8 Calibration
9 Interval/response time
10 Wash contact*
11 Measurement symbol
12 Proceed with **ENTER**
13 Bar for identifying the device status, above mode indicators from left to right:
   - Measuring mode
   - Calibration mode
   - Alarm
   - Wash contact* (APT4000CC only)
   - Configuration mode
14 Lower display
15 Manual temp specification
16 Hold mode active
17 Waiting time running
18 Electrode data
19 Main display
20 Sensoface

* Not in use

Operation: Keypad

CAL	Start, end calibration
CONF	Start, end configuration
▶	Select digit position (selected position flashes)
▲	Edit digit
ENTER	• Calibration: Continue in program sequence • Configuration: Confirm entries, next configuration step • Measuring mode: Display output current

CAL ➤ ENTER	Cal Info, display of cell constant
CONF ➤ ENTER	Error Info: Display of last error message
▶ + ▲	Start GainCheck device self-test

Safety functions

Sensocheck, Sensoface sensor monitoring
Sensocheck continuously monitors the sensor and lines. Sensocheck can be switched off (Configuration, Pg 51).

Sensoface provides information on the conductivity sensor condition. Significant sensor polarization effects or an excessive cable capacitance are indicated.

GainCheck device self test
A display test is carried out, the software version is displayed and the memory and measured value transfer are checked.

Start GainCheck device self-test: [▶] + [▲]

Automatic device self-test
The automatic device self-test checks the memory and measured-value transfer. It runs automatically in the background at fixed intervals.

Safety functions

Hold mode

Display:

The Hold mode is a safety state during configuration and calibration. The loop current is frozen (Last) or set to a fixed value (Fix).
If the calibration or configuration mode is exited, the Transmitter remains in the Hold mode for safety reasons. This prevents undesirable reactions of the connected peripherals due to incorrect configuration or calibration. The measured value and "HOLD" are displayed alternately. The Transmitter only returns to measuring mode after **ENTER** is pressed and 20 seconds have passed.

Configuration mode is also exited automatically 20 minutes (timeout) after the last keystroke. The Transmitter returns to measuring mode.
Timeout is not active during calibration.

Behavior of output signal:

Last: The loop current is frozen at its last value. Recommended during short configuration procedures. The process should not change decisively during configuration. Changes are not noticed with this setting!

Fix: The loop current is set to a value that is noticeably different from the process value in order to signal the control system that the Transmitter is being worked at.

For configuration see Pg 47.

Outputs

Current output / Loop current

The loop current is controlled by the process variable selected in the configuration.
The current start and end can be set to represent any desired value. To check connected peripherals (e.g. limit switches, controllers), the loop current can be manually specified (see Pg. 37).

HART communication

The APT2000CC-H-... Transmitter can be remote-controlled via HART communication. It can be configured using a handheld terminal or from the control room. Measured values, messages and device identification can be downloaded at any time. This allows easy integration also in fully automatic process cycles.

A list of the HART commands can be found in the "APT2000CC Transmitter-Specific Command Specification": http://content.honeywell.com/ipc/faq

Alarm

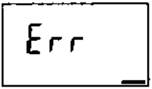
The alarm delay is configurable.
Error messages can also be signaled by a 22 mA loop current (see Configuration, Pg 51).

The alarm LED on the front panel can be configured as follows:

HOLD off:	Alarm: LED flashing
HOLD on:	Alarm: LED on. HOLD: LED flashing.

Configuration

In the Configuration mode you set the device parameters.

Activate	CONF	Activate with **CONF**
		Enter passcode "1200"* Edit parameter with ▸ and ▴, confirm/continue with **ENTER**. (End with **CONF**, then **ENTER**.)
Hold	HOLD  HOLD icon	During configuration the Transmitter remains in the Hold mode for reasons of safety. The loop current is frozen (at its last value or at a preset fixed value, depending on the configuration). Sensoface is off, mode indicator "Configuration" is on.
Input errors		The configuration parameters are checked during the input. In the case of an incorrect input "Err" is displayed for approx. 3 s. The incorrect parameters cannot be stored. Input must be repeated.
End	CONF ENTER	End with **CONF**. The measured value and Hold are displayed alternately, "**enter**" flashes. End Hold mode with **ENTER**. The display shows the measured value. The output current remains frozen for another 20 s (HOLD icon on, "hourglass" flashes).

* Factory setting, for passcode editing see Pg 52

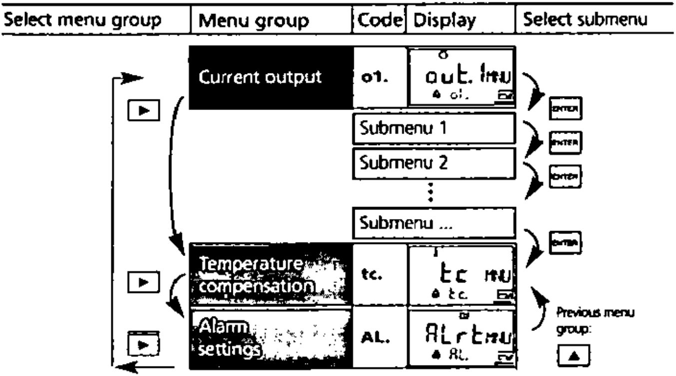
Menu structure of configuration

The configuration steps are assigned to different menu groups:
- Current output (code: o1.)
- Temperature compensation (code: tc.)
- Alarm settings (code: AL.)

With the arrow keys you can jump between the individual menu groups. Each menu group contains menu items for setting the parameters.

Example:
"o1." is displayed with all menu items of the "Current output" menu group.

Pressing **ENTER** accesses the submenus. The values are edited using the arrow keys. Pressing **ENTER** confirms/stores the settings.
Return to measurement: Press **CONF**. Press **ENTER** to confirm safety prompt. After 20 sec the Transmitter will be in measuring mode again.



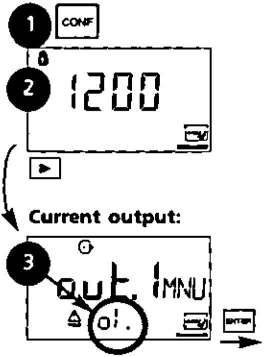
Overview of configuration steps

Code	Menu	Selection / Default
out1	**Current output**	**(Factory setting bold print)**
o1.CELL	Sensor selection	**2-electrode**, 4-electrode
o1.UnIT	Select measured variable	µS, **mS/cm**, S/m, MΩ·cm, SAL, %, USP
o1.CoNC	Select solution (Conc), see Pg 38 Codes:	**NaCl** | HCl | NaOH | H_2SO_4 | HNO_3 **-01-** | -02- | -03- | -04- | -05-
o1.CHAR	Characteristic linear / logarithmic (not for SAL, Conc, USP)	**LIN** / LOG
o1.4mA	LIN: Enter current start	xxxx (**000.0 mS**)
o1.20mA	Enter current end	xxxx (**100.0 mS**)
o1.4mA	LOG: Enter current start	in decades: 0.001 ... 1000 mS (**0.100 mS**)
o1.20mA	Enter current end	in decades: 0.001 ... 1000 mS (**100.0 mS**)
o1.FtME	Time constant of output filter	xxxx SEC (**0000 SEC**)
o1.FAIL	22 mA signal for error messages	ON / **OFF**
o1.HoLD	Signal behavior during HOLD	**Last** / Fix
o1.FIX	Fix: Enter fixed value	xxx.x mA (**021.0 mA**)
tc	**Temperature compensation**	
tc.UnIT	Select temperature unit	**°C** / °F
tc.rTD	Select temperature probe	Pt100/Pt1000/NTC30/**NTC8.55**
tc.	Select temperature compensation (not for SAL)	**OFF**/LIN/NLF (natural waters)/ -01- FCT (NaCl traces) -02- FCT (HCl traces) -03- FCT (NH3 traces)
tc.lin	Lin: Enter temperature coefficient	xx.xx %/K (**02.00 %/K**)
ALrt	**Alarm settings**	
AL.SnSO	Select Sensocheck	ON / **OFF**
AL.dLY	Enter alarm delay	0000 ... 0600 SEC (**0010 SEC**)
AL.LED	LED in HOLD mode	ON / **OFF**

Code	Parameter	Factory setting	Individual setting
o1.CELL	Sensor type	2-EL	
o1.UnIT	Measurement unit	mS/cm	
o1.CoNC	Concentration	NaCl	
o1.CHAR	Characteristic (LIN/LOG)	LIN	
o1.4mA	Current start	000.0 mS	
o1.20mA	Current end	100.0 mS	
o1.FtME	Filter time	0000 SEC	
o1.FAIL	22mA signal	OFF	
o1.HoLD	Hold behavior	LAST	
o1.FIX	Fix current	021.0 mA	
tc.UnIT	Unit °C / °F	°C	
tc.rTD	Temp probe	NTC 8.55	
tc.	Temperature compensation	OFF	
tc.LIN	TC process medium	02.00 %/K	
AL.SnSO	Sensocheck	OFF	
AL dLY	Alarm delay	0010 SEC	
AL.LED	LED in HOLD mode	OFF	

Configuration

Current output: Select sensor type.



1. Press **CONF** key.
2. Enter passcode **1200***.
3. Select **Current output** menu group using arrow keys. All items of this menu group are indicated by the code "o1."
4. Press **ENTER** to select menu, edit with arrow keys (see Pg 35). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**

- Select sensor
- Select measured variable
- Select solution (Conc)
- Select characteristic (LIN/LOG)
- Enter current start
- Enter current end
- Set output filter
- 22 mA in the case of error
- Signal behavior during HOLD

5 CONF ENTER

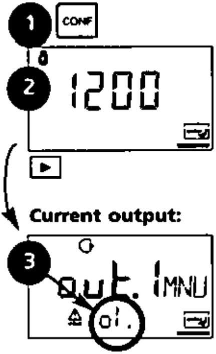
* Factory setting, for passcode editing see Pg 52

Code	Display	Action	Choices
o1.		Select configuration (Press **CONF.**)	
	 After correct input a welcome text (CONF) is displayed for approx. 3 sec.	Enter passcode "1200*" (Select position with ▸ key and edit number with ▴ key. When the display reads "1200", press **ENTER** to confirm.)	
		The Transmitter is in HOLD mode (HOLD icon is on).	
		Select 2-electrode sensor Proceed with **ENTER**	**2-EL** (2-EL/ 4-El)

Note: Characters represented in gray are flashing and can be edited.

* Factory setting

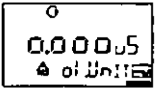
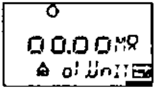
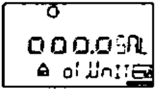
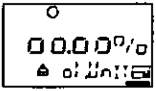
Current output: Select measured variable



1. Press **CONF** key.
2. Enter passcode **1200***.
3. Select **Current output** menu group using arrow keys. All items of this menu group are indicated by the code "o1."
4. Press **ENTER** to select menu, edit with arrow keys (see Pg 37). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**

- Select sensor
- **Select measured variable**
- Select solution (Conc)
- Select characteristic (LIN/LOG)
- Enter current start
- Enter current end
- Set output filter
- 22 mA in the case of error
- Signal behavior during HOLD

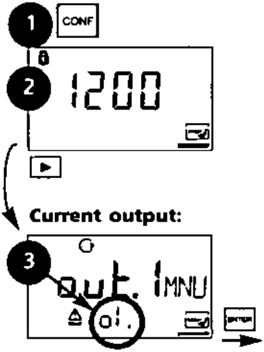
* Factory setting

Code	Display	Action	Choices
o1.		Select measured variable:	**000.0 mS**
		Select with ▸ arrow key Proceed with **ENTER**	(0.000 µS 00.00 µS 000.0 µS 0000 µS 0.000 mS 00.00 mS 000.0 mS 0.000 S/m 00.00 S/m 00.00 MΩ 0.00 SAL 00.00 % USP)
	 	Conductivity: • 0.000 ... 9.999 µS/cm • 00.00 ... 99.99 µS/cm • 000.0 ... 999.9 µS/cm • 0000 ... 9999 µS/cm • 0.000 ... 9.999 mS/cm • 00.00 ... 99.99 mS/cm • 000.0 ... 999.9 mS/cm • 0.000 ... 9,999 S/m • 00.00 ... 99.99 S/m	
		Resistivity: • 00.00 ... 99.99 MΩ·cm	
		Salinity (SAL): • 0.0 ... 45.0 ‰ (0 ... 35 °C)	
		Concentration (Conc): • 0.00 ... 9.99 % by wt	
		USP: • 00.00 ... 99.99 µS/cm	

Note: Characters represented in gray are flashing and can be edited.

Output 1

Concentration measurement: Select process solutions



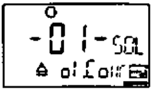
1. Press **CONF** key.
2. Enter passcode **1200***.
3. Select **Current output** menu group using arrow keys. All items of this menu group are indicated by the code "o1."
4. Press **ENTER** to select menu, edit with arrow keys (see Pg 39). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**

- Select sensor
- Select measured variable
- Select solution (Conc)
- Select characteristic (LIN/LOG)
- Enter current start
- Enter current end
- Set output filter
- 22 mA in the case of error
- Signal behavior during HOLD

4 ENTER

5 CONF ENTER

* Factory setting

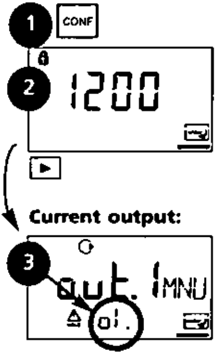
Code	Display	Action	Choices
o1.	 	Only with 000.0 % you can select the process solution: Select with ▸ arrow key **-01**-NaCl (0.00 ... 9.99 % by wt) (0 ... 100 °C) **-02**-HCl (0.00 ... 9.99 % by wt) (0 ... 50 °C) **-03**- NaOH (0.00 ... 9.99 % by wt) (0 ... 100 °C) **-04**-H_2SO_4 (0.00 ... 9.99 % by wt) (0 ... 110 °C) **-05**-HNO_3 (0.00 ... 9.99 % by wt) (0 ... 50 °C) Proceed with **ENTER**	**-01-SOL** (-01-SOL -02-SOL -03-SOL -04-SOL -05-SOL)

Concentration measurement

For the solutions listed above, the Transmitter can determine the substance concentration from the measured conductivity and temperature values in % by wt. The measurement error is made up of the sum of measurements errors during conductivity and temperature measurement and the accuracy of the concentration curves stored in the Transmitter, see Pg 80 et seq.
We recommend to calibrate the Transmitter together with the sensor, preferrably in the same conductivity range as measured later. For exact temperature measurement, you should perform a temperature probe adjustment. For measuring processes with rapid temperature changes, a separate temperature probe with fast response should be used.

Configuration

Output current. LIN characteristic. Current start / end



1. Press **CONF** key.
2. Enter passcode **1200***.
3. Select **Current output** menu group using arrow keys. All items of this menu group are indicated by the code "o1."
4. Press **ENTER** to select menu, edit with arrow keys (see Pg 41). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**

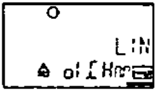
ENTER

- Select sensor
- Select measured variable
- Select solution (Conc)
- Select: LIN characteristic
- Enter current start
- Enter current end
- Set output filter
- 22 mA in the case of error
- Signal behavior during HOLD

4 ENTER

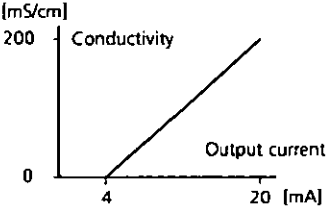
5 CONF ENTER

* Factory setting

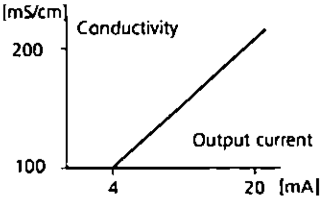
Code	Display	Action	Choices
o1.		Select output characteristic Select with ▸ arrow key Proceed with **ENTER** (Step omitted for % (Conc) or SAL)	**LIN** (LIN / LOG)
	 	With LIN selected: • Enter current start (lower end of scale). Select with ▸ key, edit number with ▴ key, proceed with **ENTER**. • Enter current end (upper end of scale). Proceed with **ENTER**	**000.0 mS** (depending on selected range) **100.0 mS** (depending on selected range)

Assignment of measured values: current start and current end

Example 1: Range 0...200 mS/cm

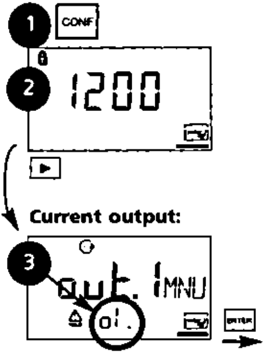


Example 2: Range 100...200 mS/cm
Advantage: Higher resolution in range of interest



Configuration

Output current. LOG characteristic. Current start / end



1. Press **CONF** key.
2. Enter passcode **1200***.
3. Select **Current output** menu group using arrow keys. All items of this menu group are indicated by the code "o1."
4. Press **ENTER** to select menu, edit with arrow keys (see Pg 43). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**

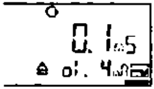
ENTER

- Select sensor
- Select measured variable
- Select solution (Conc)
- **Select: LOG characteristic**
- **Enter current start**
- **Enter current end**
- Set output filter
- 22 mA in the case of error
- Signal behavior during HOLD

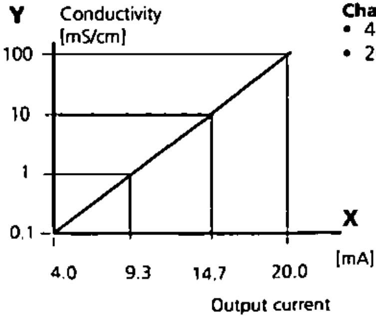
4 ENTER

5 CONF ENTER

* Factory setting

Code	Display	Action	Choices
o1.		With **LOG** selected: • Enter lower end of scale (= current start) Select with ▸ key, edit number with ▴ key, proceed with **ENTER.**	**0.1 mS** (depending on selected range)
		• Enter upper end of scale (= current end) Select with ▸ key, edit number with ▴ key. Proceed with **ENTER**	**100 mS** (depending on selected range)

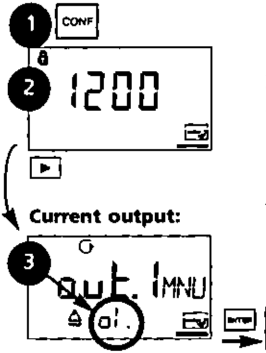
Example: Measurement range over 3 decades



Characteristic:	**LOG**
• 4 mA	0.1 mS/cm
• 20 mA	100 mS/cm

Configuration

Output. Time constant of output filter



1. Press **CONF** key.
2. Enter passcode **1200'**.
3. Select **Current output** menu group using arrow keys. All items of this menu group are indicated by the code "o1."
4. Press **ENTER** to select menu, edit with arrow keys (see Pg 45). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**

- Select sensor
- Select measured variable
- Select solution (Conc)
- Selection: LOG characteristic
- Enter current start
- Enter current end
- **Set output filter**
- 22 mA in the case of error
- Signal behavior during HOLD

* Factory setting

Code	Display	Action	Choices
o1.		Time constant of output filter Default setting: 0 s (inactive). To specify a time constant: Select with ▸ key, edit number with ▴ key, proceed with **ENTER**	**0 sec** 0 ... 120 sec

Time constant of output filter (attenuation)

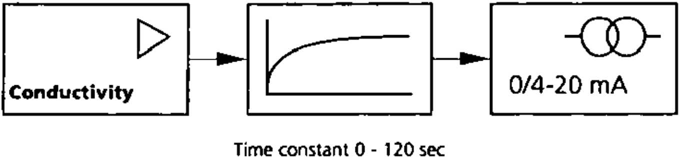
To smoothen the current output, a low-pass filter with adjustable filter time constant can be switched on. When there is a jump at the input (100 %), the output level is 63 % after the time constant has been reached.

The time constant can be set from 0 to 120 sec.

If the time constant is set to 0 s, the current output follows the input.

Note:

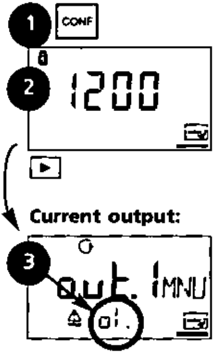
The filter only acts on the current output, not on the display!



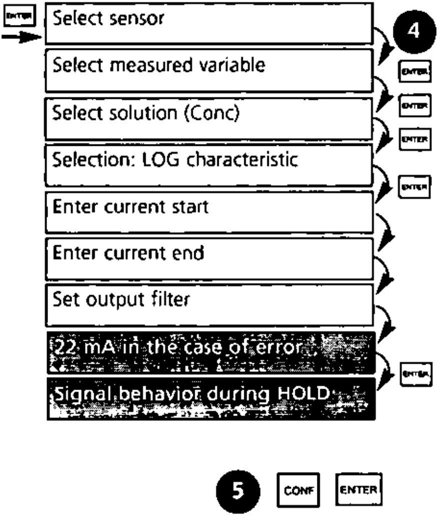
Time constant 0 - 120 sec

Configuration

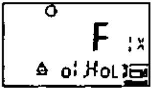
Output. Output current during Error and HOLD.



1. Press **CONF** key.
2. Enter passcode **1200***.
3. Select **Current output** menu group using arrow keys. All items of this menu group are indicated by the code "o1."
4. Press **ENTER** to select menu, edit with arrow keys (see Pg 47). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**

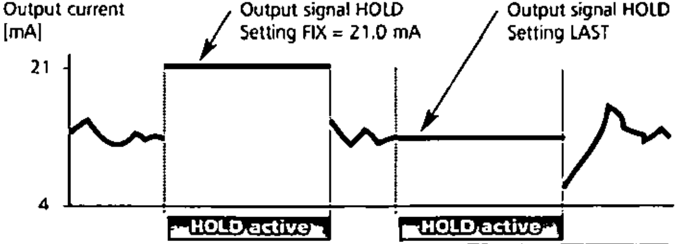


* Factory setting

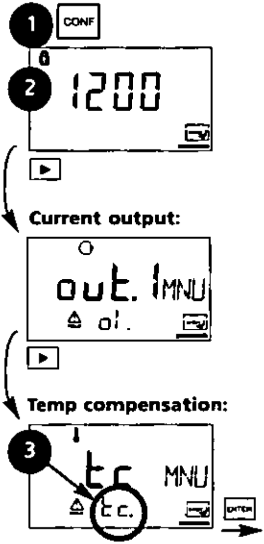
Code	Display	Action	Choices
o1.		22 mA signal for error message Select with ▸ key Proceed with **ENTER**	**OFF** (OFF / ON)
		Output signal during HOLD **LAST:** During HOLD the last measured value is maintained at the output **FIX:** During HOLD a value (to be entered) is maintained at the output Select with ▸ key Proceed with **ENTER**	**LAST** (LAST / FIX)
	 	Only with FIX selected: Enter current which is to flow at the output during HOLD Select position with ▸ key and edit number with ▴ key. Proceed with **ENTER**	**021.0 mA** (04.0 ... 22.0 mA

Output signal during HOLD:

(see Pg 28)



Temperature compensation



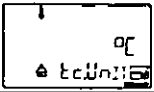
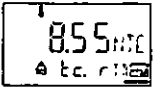
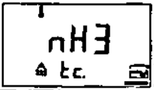
1. Press **CONF** key.
2. Enter passcode **1200***.
3. Select **Temperature compensation** menu group using arrow keys. All items of this menu group are indicated by the code "tc."
4. Edit with arrow keys (see Pg 49). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**

Select °C/°F

Select temperature probe

Select temperature compensation

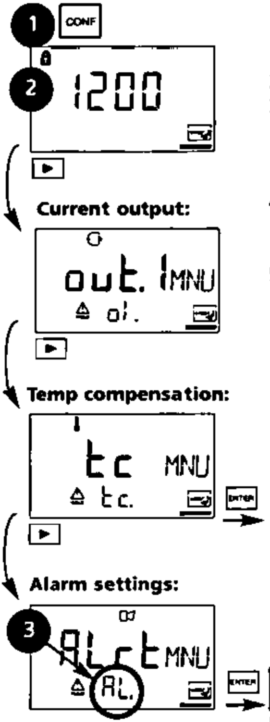
* Factory setting

Code	Display	Action	Choices
tc.		Specify temperature unit Select with ▸ arrow key Proceed with **ENTER**	**°C** (°F)
		Select temperature probe Select with ▸ arrow key Proceed with **ENTER**	**NTC8.55** **(PT100,** **PT1000,** **NTC30)**
	     	Temp compensation selection (not for USP, CONC, SAL) **OFF:** Temperature compensation switched off. Select with ▸ key, proceed with **ENTER** **LIN:** Linear temperature compensation with entry of temperature coefficient and reference temperature. **nLF:** Temperature compensation for natural waters to EN 27888 **NaCl (nACL):** Temperature compensation for ultrapure water with NaCl traces **HCl (HCL):** Temperature compensation for ultrapure water with HCl traces **NH_3 (nH3):** Temperature compensation for ultrapure water with NH_3 traces	**OFF** (OFF LIN nLF nACL HCL nH3)
		Only with linear temperature compensation (**LIN**) selected: Enter temperature coefficient*. Select position with ▸ key, edit number with ▴ key. Proceed with **ENTER**	**02.00%/K** (XX.XX %/K)

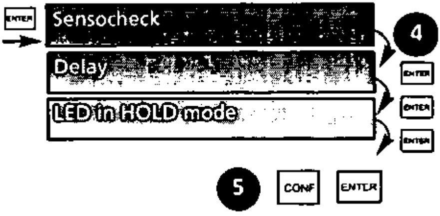
* Reference temperature 25 °C

Configuration

Alarm settings



1. Press **CONF** key.
2. Enter passcode **1200***.
3. Select **Alarm settings** menu group using arrow keys. All items of this menu group are indicated by the code "AL."
4. Press **enter**to select menu, edit with arrow keys (see Pg 51). Confirm (and proceed) with **ENTER**.
5. End: Press **CONF**, then **ENTER**



* Factory setting

<table>
<tr><th>Code</th><th>Display</th><th>Action</th><th>Choices</th></tr>
<tr><td rowspan="3">AL.</td><td></td><td>Select Sensocheck
(Continuous monitoring of sensor properties)
Select with ▸ key.
Proceed with ENTER</td><td>OFF
(ON / OFF)</td></tr>
<tr><td></td><td>Alarm delay
Select with ▸ key,
edit number with ▴ key,
proceed with ENTER</td><td>0010 s
(xxxx s)</td></tr>
<tr><td></td><td>LED in HOLD mode
Select with ▸ key, proceed with ENTER

LED in HOLD mode:<table><tr><th>Configuration</th><th>Alarm</th><th>HOLD</th></tr><tr><td>ON</td><td>on</td><td>flashes</td></tr><tr><td>OFF</td><td>flashes</td><td>off</td></tr></table></td><td>OFF
(ON / OFF)</td></tr>
</table>

Passcodes according to FDA 21 CFR Part 11

Access to the device functions can be protected with adjustable passcodes if required.
<u>If such a protection is not required, you should use the preset passcodes.</u>

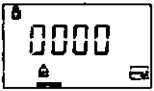
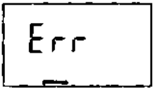
To call up passcode editor:
Press **CONF** key and enter Administrator passcode (Factory setting:**1989**).

Display	Action	Remark
	1. Press **CONF** key. 2. Enter Administrator passcode (**1989**): Welcome text is displayed	This text is displayed for approx. 3 s
	**"Cal Info"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **0000**
	**"Cal - Input of cell constant"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **1100**
	**"Cal - with cal solution"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **0110**
	**"Product calibration"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **1105**
	**"Temp probe adjustment"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **1015**

Display	Action	Remark
	**"Error Info"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **0000**
	**"Configuration"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **1200**
	**"Sensor monitor"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **2222**
	**"Current source"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **5555**
	**"Administrator passcode"** Edit: Arrow keys Proceed with: **ENTER** Cancel: **CONF**	Default setting: **1989** **Caution!** If you have lost the Administrator passcode, the Passcode Editor cannot be called up! Please consult our technical support!
	• **"NO" to cancel new Administrator passcode** Proceed with **ENTER** (old passcode) Cancel: **CONF** (old passcode)	
	• **"YES" to take over new Administrator passcode** Select "YES" with arrow keys. Accept with **ENTER** (new passcode) Cancel: **CONF** (old passcode)	

Calibration

Calibration adjusts the device to the sensor.

Activate	CAL	Activate with **CAL**
		Enter passcode*: • 1100 Entry of cell constant • 0110 With calibration solution • 1105 Product calibration • 1015 Temp probe adjustment Select with ▶ key, edit number with ▲ key, proceed with **ENTER** key (End with **CAL + ENTER.**)
Hold During calibration the Transmitter remains in the Hold mode.	 HOLD icon	The loop current is frozen (at its last value or at a preset fixed value, depending on the configuration), Sensoface is off, mode indicator "Calibration" is on.
Input errors		The calibration parameters are checked during the input. In the case of an incorrect input "Err" is displayed for approx. 3 s. The incorrect parameters cannot be stored. Input must be repeated.
End	CAL ENTER	End with **CAL**. **Safety prompt:** The measured value and Hold are displayed alternately, "**enter**" flashes. Press **ENTER** to end the Hold mode. The measured value is displayed. The output current remains frozen for another 20 sec (HOLD icon on, "hourglass" flashes).

* Factory setting, for passcode editing see Pg 52

Information on calibration

Calibration adapts the Transmitter to the conductivity sensor. Calibration can be performed by:

- Input of cell constant (e.g. for ultrapure-water sensors)
- Determining the cell constant with a known calibration solution
- Sampling (product calibration)
- Temperature probe adjustment

Note:

- All calibration procedures must be performed by trained personnel.
- During the calibration procedure the temperature must be kept constant.
- Incorrectly set parameters may go unnoticed, but change the measuring properties.

Particularly with stray-field sensors the cell constant can strongly vary when the sensor is mounted in restricted space. In that case, the cell constant should be determined with the sensor mounted using a calibration solution or by a reference measurement at the product.

Calibration by input of cell constant

Input of cell constant with simultaneous display of the uncompensated conductivity value and the temperature

Display	Action	Remark
	Press **CAL** key, enter passcode 1100* Select with ▸ key, edit number with ▴ key, proceed with **ENTER**	Transmitter is in the Hold mode. If an invalid passcode is entered, Transmitter returns to measuring mode.
	Ready for calibration	Display (3 s)
   	Enter the PRODUCT of the Cell Constant and Cell Calibration Factor found on the sensor. i.e. Constant 0.01 x Factor 1.07. **Enter 0.0107.** Select with ▸ key, edit number with ▴ key. A change in the cell constant also changes the conductivity value. Press **ENTER** to confirm cell constant.	The lower display shows the conductivity value. (When there has not been an entry for 6 sec, the lower display alternately shows the conductivity and temperature value.)

* Factory setting

Display	Action	Remark
	The Transmitter now displays the conductivity and temperature.	Safety prompt
	The measured value is shown in the main display alternately with "Hold"; "enter" flashes. End calibration with **ENTER**.	After end of calibration, the outputs remain in Hold mode for approx. 20 sec.

Calibration with calibration solution

Input of temperature-corrected value of calibration solution with simultaneous display of cell constant

Display	Action	Remark
	Press **CAL** key, enter passcode 0110* Select with ▸ key, edit number with ▴ key, proceed with **ENTER**	Transmitter is in the Hold mode. If an invalid passcode is entered, Transmitter returns to measuring mode.
	Ready for calibration Dismount and clean sensor	Display (3 sec)
	Immerse sensor in calibration solution. Determine the temperature-corrected conductivity value of the calibration solution from the corresponding table (see Pg 78 et seq.).	When there has not been an entry for 6sec, the lower display alternately shows the cell constant and temperature value.
 	Enter value of calibration solution. Select with ▸ key, edit number with ▴ key. Press **ENTER** to confirm the calibration data.	The cell constant and temperature are alternately displayed in the lower display during the input.

* Factory setting

Display	Action	Remark
	The determined cell constant is displayed. Confirm with **ENTER**.	
	Clean sensor and re-place it in the process. The Transmitter now displays the conductivity and temperature. The measured value is shown in the main display alternately with "Hold"; "enter" flashes. End calibration with **ENTER**.	Safety prompt After end of calibration, the outputs remain in Hold mode for approx. 20 sec.

Notes :
(also see Pg 55)

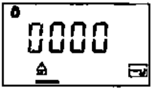
- Be sure to use known calibration solutions and the respective temperature-corrected conductivity values. (see "Calibration solutions" Pg 78 et seq.).
- During the calibration procedure the temperature must be kept constant.
- For a good mass transfer, the solution should be stirred.

Product calibration

Calibration by sampling

For product calibration the measured variable is used as configured: Conductivity (µS/cm, mS/cm, S/m), resistivity (MΩ·cm). During product calibration the sensor remains in the process. The measurement is only interrupted briefly.
Calibration is without TC correction.

Procedure: During sampling the currently measured value is stored in the Transmitter. The Transmitter immediately returns to measuring mode. The calibration mode indicator flashes and reminds you that calibration has not been terminated.
The sample is measured in the lab or directly on the site using a portable meter. To ensure an exact calibration, the sample temperature should correspond to the measured process temperature. The sample value is then entered in the Transmitter. The new cell constant is calculated from these two values. If the sample is invalid, you can take over the value stored during sampling. In that case the old calibration values are stored. Afterwards, you can start a new product calibration.

Display	Action	Remark
	Product calibration step 1: Press **CAL** key. Enter passcode 1105*. (Press ▸ key to select position, enter number using ▲ key, confirm with **ENTER**)	If an invalid passcode is entered, Transmitter returns to measuring mode.
		Display (approx. 3 sec)
	Take sample and store value. Proceed with **ENTER**	The sample is measured in the lab or directly on the site.

* Factory setting

Display	Action	Remark
	Measuring mode: From the flashing CAL mode indicator you see that product calibration has not been terminated.	While the sample value is determined, the Transmitter is in measuring mode.
	<u>Product calibration step 2:</u> When the sample value has been determined, call up the product calibration once more (**CAL**, passcode 1105*).	Display (approx. 3 sec)
	Enter lab value. The new cell constant is calculated.	
	The new cell constant is displayed. Confirm with **ENTER**.	New calibration: Press **CAL**.
	The measured value is shown in the main display alternately with "Hold"; "enter" flashes. End with **ENTER**.	Safety prompt. After end of calibration, the outputs remain in Hold mode for approx. 20 sec.

* Factory setting

Temp probe adjustment

Display	Action	Remark
	Activate calibration (Press **CAL**. Enter passcode 1015*.) Select with ▸ key, edit number with ▴ key, proceed with **ENTER**.	Wrong settings change the measurement properties! If an invalid passcode is entered, Transmitter returns to measuring mode.
	Ready for calibration	Transmitter is in the Hold mode. Display for approx. 3 sec
	Measure the temperature of the process medium using an external thermometer. Enter measured temperature value: Select with ▸, edit number with ▴, proceed with **ENTER**. End adjustment with **ENTER**. HOLD will be deactivated after 20 sec.	Default: Value of secondary display.

Measurement

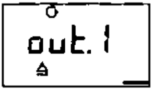
Display	Remark
	In the measuring mode the main display shows the configured process variable (conductivity, concentration, resistivity, salinity), the lower display shows the temperature. During calibration you can return to measuring mode by pressing the **CAL** key, during configuration by pressing **CONF** and then **ENTER** (waiting time for measured-value stabilization approx. 20 sec).

* Factory setting

Entry/display	Remark
ENTER  	**Display of output currents** Press **ENTER** while in measuring mode. For 5 sec, the secondary display shows the output current instead of the temperature
CAL 0000*  	**Display of calibration data (Cal Info)** Press **CAL** while in measuring mode and enter passcode 0000*. The current cell constant is shown in the main display. After 20 sec the Transmitter returns to measuring mode (immediate return at pressing **ENTER**).
CONF 2222*  	**Sensor monitor** for validation of sensor and complete measured-value processing. Press **CONF** while in measuring mode and enter passcode 2222*. The measured resistance is shown in the main display, the measuring temperature in the lower display. Press **ENTER** to return to measurement.
CONF 0000*  	**Display of last error message (Error Info)** Press **CONF** while in measuring mode and enter passcode 0000*. The last error message is displayed for approx. 20 sec. After that the message will be deleted (immediate return to measurement at pressing **ENTER**).

* Factory setting

Diagnostics functions

Entry/display	Action / Remarks
CONF 5555*  	**Specify output current** for testing the connected peripherals • Press **CONF**, enter passcode 5555* The output current indicated in the main display can be modified. Select with ▸ key, edit number with ▴ key, proceed with **ENTER**. The actually measured current is shown in the secondary display. The Transmitter is in Hold mode. Press **CONF**, then **ENTER** to return to measurement (Hold remains active for another 20 sec).

Cleaning

To remove dust, dirt and spots, the external surfaces of the device may be wiped with a damp, lint-free cloth. A mild household cleaner may also be used if necessary.

* Factory setting

Operating state	Out	LED	Time out
Measurement	▒	▒	
Cal Info (**CAL**) 0000	▒	▒	20 s
Error Info (**CONF**) 0000	▒	☐	20 s
Calibration (**CAL**) 1100	■	▨	
Temp adjustment (**CAL**) 1015	■	▨	
Product cal 1 (**CAL**) 1105	▒	▨	
Product cal 2 (**CAL**) 1105	■	▨	
Configuration (**CONF**) 1200	■	▨	20 min
Sensor monitor (**CONF**) 2222	☐	▨	20 min
Current source (**CONF**) 5555	☐	▨	20 min

Explanation:

☐ active

■ as configured (Last/Fix or Last/Off)

▨ LED flashes during HOLD (configurable)

Error messages (error codes)

Error	Display	Problem Possible causes	Red LED	Out 1 (22 mA)
ERR 01	Measured value flashes	**Sensor** • Wrong cell constant • Measurement range violation • SAL > 45 ‰ • Sensor connection or cable defective • USP limit exceeded	x	x
ERR 02	Measured value flashes	**Unsuitable sensor** Conductance range > 3500 mS	x	x
ERR 98	"Conf" flashes	**System error** Configuration or calibration data defective. Completely reconfigure and recalibrate the device. Memory error in device program	x	x
ERR 99	"FAIL" flashes	**Factory settings** EEPROM or RAM defective This error message only occurs in the case of a total defect. The Transmitter must be repaired and recalibrated at the factory.	x	x
ERR 03	🌡	**Temperature probe** Open or short circuit Temperature range exceeded	x	x

Error	Symbol (flashes)	Problem Possible causes	Red LED	Out 1 (22 mA)
ERR 11		**Current output** Current below 3.8 mA	x	x
ERR 12		**Current output** Current above 20.5 mA	x	x
ERR 13		**Current output** Current span too small / too large	x	x
ERR 33		**Sensocheck**: Wrong or defective sensor / Polarization effects at the sensor / cable too long or defective / plug defective	x' Sensoface active see Pg 69	x
		Temperature outside conversion tables (TC, Conc, SAL)	independent of Sensoface	

Sensoface

(Sensocheck must have been activated during configuration.)

The little smiley in the display (Sensoface) provides information about the sensor condition (defects, maintenance required, cable capacitance too high).
It alerts to significant sensor polarization or excessive cable capacitance e.g. caused by an unsuitable cable or a cable that is too long. The permitted calibration ranges and the conditions for a friendly, neutral, or sad Sensoface are summarized in the following chart. Additional icons refer to the error cause.

Sensocheck
Continuously monitors the sensor and its wiring.
Sensocheck can be switched off. Critical values make the Sensoface "sad" and the corresponding icon flashes:

The Sensocheck message is also output as error message Err 33. The red LED is lighted, the output current is set to 22 mA (when configured correspondingly). Sensocheck can be switched off during configuration (then Sensoface is also disabled). Exception: After a calibration a Smiley is always displayed for confirmation.

Note:
The worsening of a Sensoface criterion leads to the devaluation of the Sensoface indicator (Smiley becomes "sad").
To reset the Sensoface indicator, the defect must be remedied and the Transmitter be calibrated.

Display	Problem	Status
	Sensor defect	Wrong or defective sensor Significant polarization of sensor Excessive cable capacitance (also see error message Err 33, Pg 67).
	Temperature error	Temperature outside range for TC, conc, SAL

Note:
When very fast response times (t_{90}) are required, e.g. when **detecting separation layers**, Sensocheck should be switched off (see "Specifications" Pg 74).

USP function

According to the "USP" directive (U.S. Pharmacopeia), Section 645 "Water Conductivity", the conductivity of pharmaceutical waters can be monitored online. To do so, the conductivity is measured without temperature compensation and is compared with limit values (see "Temperature/conductivity table as per USP" on Pg 71).
The water is usable if the conductivity is below the USP limit. For higher conductivities, further test steps must be performed according to the directive.

If the measured value exceeds the USP limit, ERR01will be displayed (see Pg 66).

Configuration

out1 \ 01.UnIT menu group:
When USP function has been selected, the measurement range is fixed to 00.00 ... 99.99 µS/cm.
Temperature compensation is switched off.
Temperature is monitored (see Pg 37).

Temperature/conductivity table as per USP

Temp in °C	Conductivity in µS/cm	Temp in °C	Conductivity in µS/cm
0	0.6	55	2.1
5	0.8	60	2.2
10	0.9	65	2.4
15	1.0	70	2.5
20	1.1	75	2.7
25	1.3	80	2.7
30	1.4	85	2.7
35	1.5	90	2.7
40	1.7	95	2.9
45	1.8	100	3.1
50	1.9		

Product line and accessories

Devices	Order No.
Conductivity Transmitter with HART communication for application in safe areas or hazardous locations DIV 2 (USA/Canada only)	APT2000CC-H-00
Conductivity Transmitter with HART communication for application in hazardous locations DIV 1 (USA/Canada) / Zone 1 (Europe)	APT2000CC-H-IS

Mounting accessories	Order No.
Pipe-mount kit	51205988-001
Panel-mount kit	51205990-001
Protective hood	51205989-001

Further accessories

HART test socket, integrated in Pg cable gland	51205991-001

Specifications

Conductivity input	Input for 2-electrode sensors	
Effective range	Conductivity	0.2 µS · c ... 200 mS · c
Ranges *	Conductivity	0,000 ... 9.999 µS/cm
		00.00 ... 99.99 µS/cm
		000.0 ... 999.9 µS/cm
		0000 ... 9999 µS/cm
		0.000 ... 9.999 mS/cm
		00.00 ... 99.99 mS/cm
		000.0 ... 999.9 mS/cm
		0.000 ... 9.999 S/m
		00.00 ... 99.99 S/m
	Resistivity	00.00 ... 99.99 MΩ·cm
	Concentration	0.00 ... 9.99 % by wt
	Salinity	0.0 ... 45 ‰ (0 ... 35 °C)
	USP	00.00 ... 99.99 µS/cm
Measurement error [1,2,3]	< 1 % meas. val. +0.4 µS · c	

Concentration determination

Operating modes *

-01- NaCl 0,00 ... 9.99 % by wt (0 ... 100 °C)
-02- HCl 0,00 ... 9.99 % by wt (0 ... 50 °C)
-03- NaOH 0,00 ... 9.99 % by wt (0 ... 100 °C)
-04- H_2SO_4 0.00 ... 9.99 % by wt (0 ... 110 °C)
-05- HNO_3 0.00 ... 9.99 % by wt (0 ... 50 °C)

See graphs in the Appendix Pg 80 and following

Sensor standardization

Operating modes

- Input of cell constant with simultaneous display of conductivity and temperature
- Input of onductivity of calibration solution with simultaneous display of cell constant and temperature
- Product calibration
- Temperature probe adjustment

Adm. cell constant 00.0050 ... 19.9999 cm^{-1}

Sensor monitoring		
Sensocheck	Polarization detection and monitoring of cable capacitance	
Sensoface	Provides information on the sensor condition (Sensocheck)	
Sensor monitor	Direct display of measured values from sensor for validation (resistance / temperature)	
USP function	Water monitoring in the pharmaceutical industry (USP)	
Temperature input [*]	Pt100 / Pt1000/ NTC 30 kΩ / NTC 8.55 kΩ (Betatherm) 2-wire connection, adjustable	
Ranges	NTC 8.55 kΩ	-10 ... +130 °C (+14 ... +266 °F)
	NTC 30 kΩ	-20 ... +150 °C (-4 ... +302 °F)
	Pt100/Pt1000	-20 .. +200 °C (-4 ... +392 °F)
Resolution	0.1 °C / 1 °F	
Measurement error [1,2,3]	0.5 K (< 1K for Pt100; < 1K for NTC > 100°C)	

Temperature compensation [*]

(Reference temp 25 °C)	**(OFF)**	none
	(Lin)	Linear characteristic 00.00 ... 19.99 %/K
	(NLF)	Natural waters to EN 27888
	(nACL)	Ultrapure water with NaCl traces (0...120°C)
	(HCL)	Ultrapure water with HCl traces (0...120°C)
	(nH3)	Ultrapure water with NH_3 traces (0...120°C)

Specifications

Loop current	4 ... 20 mA floating
Supply voltage	14 ... 30 V
Measured variable *	Conductivity, resistivity, concentration, or salinity
Characteristic	Linear or logarithmic
Overrange *	22 mA in the case of error messages
Output filter *	Low-pass, filter time constant 0 ... 120 sec
Measurement error [1)]	< 0.3 % current value + 0.05 mA
Start/end of scale	As desired within range
Min. span	LIN: 5 % of selected range LOG: 1 decade
Current source function	3.8 mA ... 22 mA
HART communication	Digital communication by FSK modulation of loop current, reading of device identification, measured values, status and messages, reading and writing of parameters, start of product calibration, signaling of configuration changes according to FDA 21 CFR Part 11
Display	LC display, 7-segment with icons
Main display	Character height 17 mm, unit symbols 10 mm
Secondary display	Character height 10 mm, unit symbols 7 mm
Sensoface	3 status indicators (friendly, neutral, sad Smiley)
Status indication	4 mode indicators "MEAS", "CAL", "ALARM", "config"
	18 further icons for configuration and messages
Alarm indication	Red LED in case of alarm or HOLD, user defined
Keypad	5 keys: **[CAL] [CONF] [▶] [▲] [ENTER]**

* User-defined
1) To IEC 746 Part 1, at nominal operating conditions
2) ± 1 count
3) Plus sensor error

Service functions	
Current source	Loop current specifiable 3.8 ... 22.00 mA
Device self-test	Automatic memory test (RAM, FLASH, EEPROM)
Display test	Display of all segments
Last Error	Display of last error occurred
Sensor monitor	Display of direct, uncorrected sensor signal (resistance/temperature)
Passcodes	Modifiable according to FDA 21 CFR Part 11 "Electronic Signatures"
Data retention	Parameters and calibration data > 10 years (EEPROM)
EMC	EN 61326
Emitted interference:	Class B (residential area) Class A
Immunity to interference:	Industry
Explosion protection	
(APT2000CC-H-IS)	II 2 (1) G EEx ib [ia] IIC T6
FM:	FM IS, Cl.1, Div1, Group A,B,C & D T4 NI, Cl.1, Div2, Group A,B,C & D T4
Nominal operating conditions	
Ambient temperature	–20 ... +55 °C
Transport/Storage temp	–20 ... +70 °C
Supply voltage	14... 30 V
Enclosure	Molded enclosure made of PBT (polybutylene terephtalate)
Color	Bluish gray RAL 7031
Assembly	• Wall mounting • Pipe mounting: Ø 40 ... 60 mm, □ 30 ... 45 mm • Panel mounting, cutout to DIN 43 700 Sealed against panel
Dimensions	H 144 mm, B 144 mm, T 105 mm
Ingress protection	IP 65/NEMA 4X (USA, Canada: indoor use only)
Cable glands	3 breakthroughs for cable glands M20x1.5, 2 breakthroughs for NPT 1/2" or Rigid Metallic Conduit
Weight	Approx. 1 kg

Calibration solutions

Potassium chloride solutions

(Conductivity in mS/cm)

Temperature	Concentration *		
[°C]	0.01 mol/l	0.1 mol/l	1 mol/l
0	0.776	7.15	65.41
5	0.896	8.22	74.14
10	1.020	9.33	83.19
15	1.147	10.48	92.52
16	1.173	10.72	94.41
17	1.199	10.95	96.31
18	1.225	11.19	98.22
19	1.251	11.43	100.14
20	1.278	11.67	102.07
21	1.305	11.91	104.00
22	1.332	12.15	105.94
23	1.359	12.39	107.89
24	1.386	12.64	109.84
25	1.413	12.88	111.80
26	1.441	13.13	113.77
27	1.468	13.37	115.74
28	1.496	13.62	
29	1.524	13.87	
30	1.552	14.12	
31	1.581	14.37	
32	1.609	14.62	
33	1.638	14.88	
34	1.667	15.13	
35	1.696	15.39	
36		15.64	

* Data source: K. H. Hellwege (Editor), H. Landolt, R. Börnstein: Zahlenwerte und Funktionen ..., volume 2, part. volume 6

Sodium chloride solutions

(Conductivity in mS/cm)

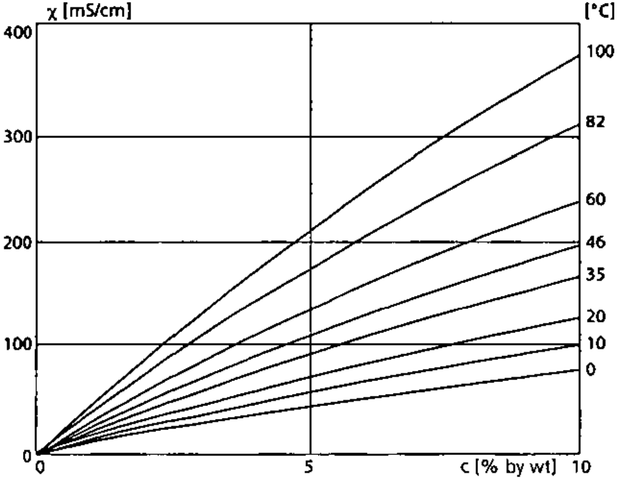
Temperature [°C]	Concentration 0.01 mol/l *	0.1 mol/l *	saturated **
0	0.631	5.786	134.5
1	0.651	5.965	138.6
2	0.671	6.145	142.7
3	0.692	6.327	146.9
4	0.712	6.510	151.2
5	0.733	6.695	155.5
6	0.754	6.881	159.9
7	0.775	7.068	164.3
8	0.796	7.257	168.8
9	0.818	7.447	173.4
10	0.839	7.638	177.9
11	0.861	7.831	182.6
12	0.883	8.025	187.2
13	0.905	8.221	191.9
14	0.927	8.418	196.7
15	0.950	8.617	201.5
16	0.972	8.816	206.3
17	0.995	9.018	211.2
18	1.018	9.221	216.1
19	1.041	9.425	221.0
20	1.064	9.631	226.0
21	1.087	9.838	231.0
22	1.111	10.047	236.1
23	1.135	10.258	241.1
24	1.159	10.469	246.2
25	1.183	10.683	251.3
26	1.207	10.898	256.5
27	1.232	11.114	261.6
28	1.256	11.332	266.9
29	1.281	11.552	272.1
30	1.306	11.773	277.4
31	1.331	11.995	282.7
32	1.357	12.220	288.0
33	1.382	12.445	293.3
34	1.408	12.673	298.7
35	1.434	12.902	304.1
36	1.460	13.132	309.5

* Data source: Test solutions calculated according to DIN IEC 746-3

** Data source: K. H. Hellwege (Editor), H. Landolt, R. Börnstein: Zahlenwerte und Funktionen ..., volume 2, part. volume 6

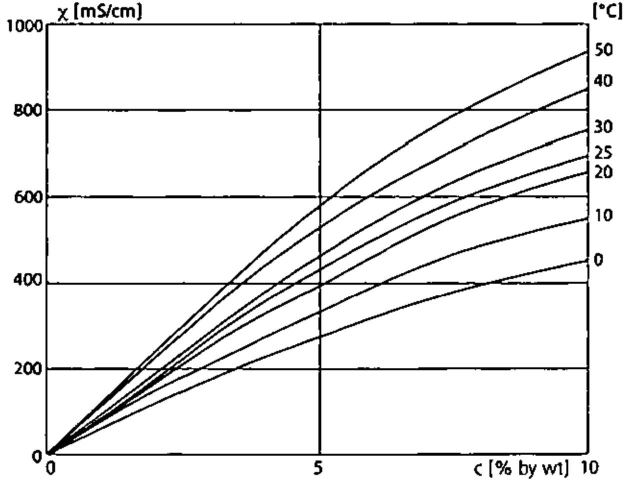
Concentration curves

-01- Sodium chloride solution NaCl



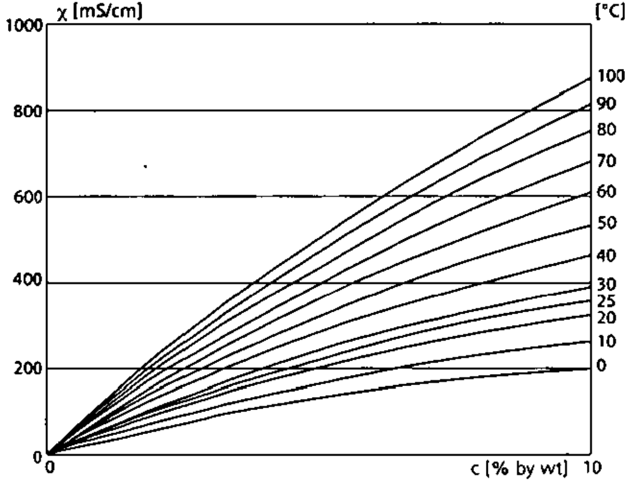
Conductivity in dependence on substance concentration and process temperature for sodium chloride solution (NaCl)

-02- Hydrochloric acid HCl



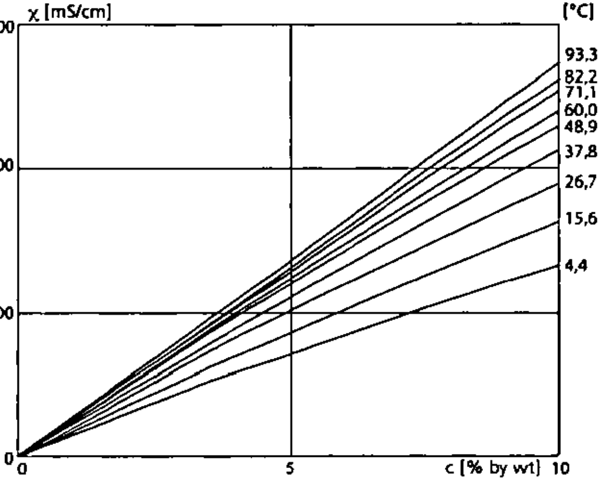
Conductivity in dependence on substance concentration and process temperature for hydrochloric acid (HCl)
Source: Haase/Sauermann/Dücker; Z. phys. Chem. New Edition, Vol. 47 (1965)

-03- Sodium hydroxide solution NaOH



Conductivity in dependence on substance concentration and process temperature for sodium hydroxide solution (NaOH)

-04- Sulphuric acid H_2SO_4

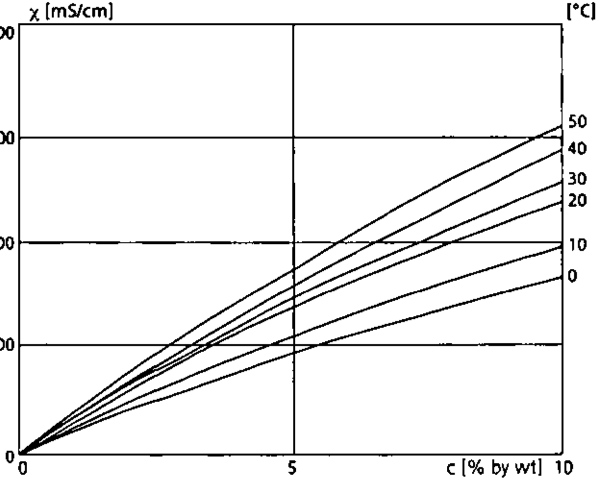


Conductivity in dependence on substance concentration and process temperature for sulfuric acid (H_2SO_4)

Source: Darling; Journal of Chemical and Engineering Data; Vol. 9 No. 3, July 1964

Concentration curves

-05- Nitric acid HNO_3



Conductivity in dependence on substance concentration and process temperature for nitric acid (HNO_3)

Source: Haase/Sauermann/Dücker; Z. phys. Chem. New Edition, Vol. 47 (1965)

Division 2 wiring

FM The connections to the Transmitter must be installed in accordance with the National Electric Code (ANSI-NFPA 70) Division 2 hazardous (classified) location, non-incendive wiring techniques.

8 7 6 5

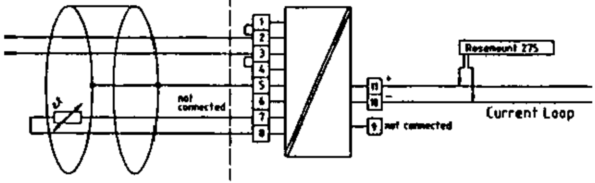
F E D C B A

Measurement Loop
Hazardous Area Location

IS Class I, Division 1, Groups A, B, C, D
IS Class II, Division 1, Groups E, F, G
IS Class III, Division 1
IS Class I, Zone 0, Group IIC

Hazardous Location Class I, Div 1

2-Wire Transmitter (intrinsically safe apparatus)
APT2000CC-D-IS and APT2000CC-H-IS
IS, Class I, Division 1, Groups A, B, C, D, T4 @ 55°C; Type 2
Class I, Zone 1, IIC, T4 @ 55°C; Type 2



Conductivity-Measuring Loop

Entity Parameters: Terminals 1, 2, 3, 4, 5, and 6
V_t, U_o = 10 V; I_t, I_o = 143 mA; P_{max}, P_o = 357 mW
Class I, Division 1, Groups A & B   Class I, Zone 1, IIC
C_a, C_o = 3 µF; L_a, L_o = 1.6 mH
Class I & II, Division 1, Groups C & E   Class I, Zone 1, IIB
C_a, C_o = 9 µF; L_a, L_o = 7 mH
Class I, II, III Division 1, Groups D, F & G   Class I, Zone 1, IIA
C_a, C_o = 24 µF; L_a, L_o = 13 mH

Temp-Measuring Loop

Entity Parameters: Terminals 7 and 8
V_{oc}, U_o = 5 V; I_{sc}, I_o = 3 mA; P_{max}, P_o = 4 mW
Class I, Division 1, Groups A & B   Class I, Zone 1, IIC
C_a, C_o = 2000 µF; L_a, L_o = 1 H
Class I & II, Division 1, Groups C & E   Class I, Zone 1, IIB
C_a, C_o = 6000 µF; L_a, L_o = 1 H
Class I, II, III Division 1, Groups D, F & G   Class I, Zone 1, IIA
C_a, C_o = 16000 µF; L_a, L_o = 1 H

Entity Parameters: Terminals 10 and 11

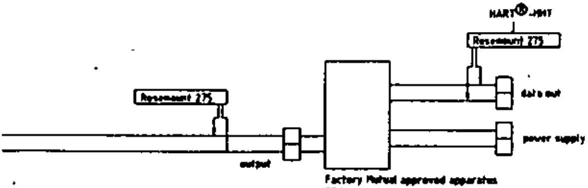
V_{max}, U_i = 30 V C_i = 32.4 nF
I_{max}, I_i = 100 mA L_i = 240 µH
P_{max}, P_i = 0.8 W

Entity Parameters: Terminals 1, 2, 3, 4, 5, 6, 7 and 8

V_t, U_o = 10 V; I_t, I_o = 146 mA; P_t, P_o = 365 mW
Class I, Division 1, Groups A & B   Class I, Zone 1, IIC
C_a, C_o = 3 µF; L_a, L_o = 1.6 mH
Class I & II, Division 1, Group C   Class I, Zone 1, IIB
C_a, C_o = 9 µF; L_a, L_o = 7 mH
Class I, II, III Division 1, Group D   Class I, Zone 1, IIA
C_a, C_o = 24 µF; L_a, L_o = 13 mH

Non-Hazardous Location

Transmitter Power Supply
(associated apparatus)



NOTES :

1: $V_{max}, U_i \geq V_{oc}, V_t$, or U_o $I_{max}, I_i \geq I_{sc}, I_t$, or I_o $P_{max} \geq P_o$
$C_i + C_{cable} \leq C_a$ or C_o $L_i + L_{cable} \leq L_a$ or L_o

2: Installation must be in accordance with the National Electrical Code (ANSI/NFPA 70) and ANSI/ISA RP12.6 in US, Canadian Electric Code (Can3-HA 21) in Canada.

3: Associated apparatus must be FMRC and CSA Approved and must be used in an FMRC and CSA Approved configuration. Use of the Rosemount Model 275 Communicator in Zones is not an FMRC Approved configuration. The control drawing for the associated apparatus must be followed when installing this equipment.

4: Control equipment connected to the associated apparatus must not use or generate more than 250 V

5: The intrinsically safe equipment connecting to 1, 2, 3, 4, 5, 6 and 7, 8 must be FMRC and CSA Approved or be simple apparatus (a device which will neither generate nor store more than 1.2 V, 0.1 A, 25 mW or 20 µJ)

6: No revisions to drawing without prior FMRC and CSA Approval.

7: Use of the Rosemount Model 275 Communicator is FM Approved for Division use only, see note 3. When using the Rosemount Model 275 Communicator in the loop between the associated apparatus and the APT2000CC-H-IS 2-Wire Transmitter, the maximum loop inductance must be less than the marked La of the associated apparatus to account for the Isc from the Model 275 Communicator. Refer to the Rosemount Installation Drawing 00275-0081 to determine the allowable loop inductance

8: The Rosemount Model 275 Communicator is not approved by CSA for use in the entity concept. For CSA application the Rosemount Model 275 Communicator must only be used on the non-hazardous side of the barrier/transmitter power supply.

Version Honeywell

Maßstab	1:1
Benennung	control drawing APT2000CC-0-IS, APT2000CC-H-IS
Zeichnungsnummer	194.220-200

Nr.		Datum	
3	product approval CSA	11.07.00	
2	Failsafe ...	30.06.00	
1	Entity Parameters	05.06.00	

Glossary

Conductance Conductance G [S] = 1 / R [Ω]

Conductivity Conductivity χ [S/cm] = G [S] · c [1/cm]

Conductivity sensor 2-electrode sensors can be connected.
The cell constant of the sensor in use must be entered or be determined using a calibration solution taking account of the temperature.
A special device variant (APT2000TC) is provided for electrodeless sensors.

Salinity Salt content of water
Measure of the total dissolved salts in a solution or in seawater [‰]

Temperature coefficient With temperature compensation activated, the measured value is calculated to the value at the reference temperature (25 °C) using the temperature coefficient.

Temperature compensation	Calculates the measured conductivity value for a reference temperature.

Index

Passcodes (Factory settings)

The passcodes allow fast access to the functions

Calibration

Key+passcode		Description	Page
CAL	0000	**Cal info**	63
CAL	1100	**Calibration:** Entry of cell constant	56
CAL	0110	**Calibration:** Calibration solution	58
CAL	1105	**Product calibration**	60
CAL	1015	**Temp probe adjustment**	62

Configuration

Key+passcode		Description	Page
CONF	0000	**Error Info** Display last error and erase	66
CONF	1200	**Configuration**	30
CONF	2222	**Sensor monitor** Display resistance and temp	63
CONF	5555	**Current source** Specify output current	64

Passcode editor

Key+passcode		Description	Page
CONF	1989	**Administrator passcode** Changing the passcodes	52

Honeywell

APT4000 Series 4-Wire Contacting Conductivity Transmitters

70-82-03-45
3/01

Specification

Overview

The Honeywell Analytical Process Transmitter (APT) 4000 Series transmitter continuously measures conductivity, resistivity and salinity in industrial processes within the power, chemical, pharmaceutical, pulp and paper, and water quality industries.

The APT4000's NEMA 4X/IP65-rated enclosure is specifically designed to meet the measurement needs of Class I, Division 2 (non-incendive) and general-purpose areas. The transmitter can be used with Honeywell conductivity cells or electrically compatible sensors. The transmitter has a universal (20-253 V ac/dc, 45-65 Hz) power supply with one 4-20 mA output, two high/low alarm relays, a diagnostic relay, and a wash relay.

Software (USP24) can be used on-line for monitoring the conductivity of purified water or water-for-injection in the pharmaceutical industry.

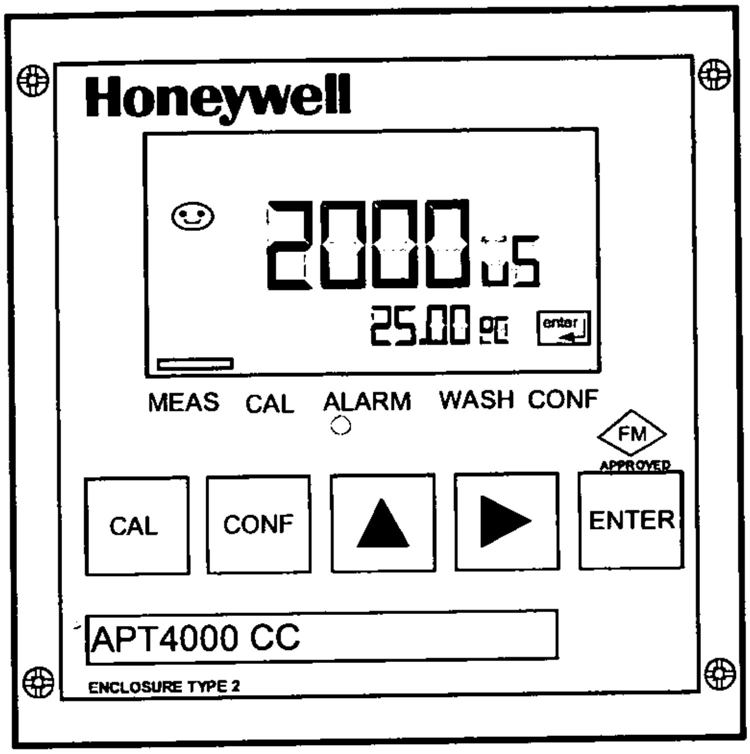


Figure 1—APT4000CC Transmitter

Description

The Honeywell APT4000 series of transmitters offers the widest available selection of advanced features in a reliable and economical instrument.

Reliability First

The advanced features of the APT4000 transmitter guarantee complete reliability. The APT4000 continuously monitors sensor and transmitter electronics and immediately displays diagnostic information at the onset of a problem. If an error or diagnostic is found, the transmitter will indicate the appropriate error code or pictograph (see Figure 2), blink a red LED and adjust the error current to 22 mA if desired. A manual loop-back check is available to test the integrity of the 4-20 mA output.

Quick Problem Assessment

The APT4000 has a large front display for quick recognition of process parameters and diagnostics even at a distance. Only the APT4000 employs *visual feedback* to quicken setup and maintenance times and to minimize errors made during calibrations. Visual feedback refers to pictograph type characters that appear on the display both to prompt and respond to operator and process changes.

Pictograph type characters also appear during problem conditions to report diagnostics for easy trouble-shooting. There is even a Sensoface® pictograph that provides constant feedback to the operator on whether or not there is a problem with the cell. These easily learned and recognized symbols make the APT4000 an easy-to-use instrument in any language.

Foolproof Calibrations

Each Honeywell conductivity cell comes supplied with one of four sensor factors (0.01, 0.1, 1.0, and 10). The lower cell constants are used for low conductivity water or resistivity measurements, while the higher ones are used for higher conductivity water or salinity measurements. Calibration of the cells is easy by either utilizing a factory-determined calibration factor or performing a simple one-point calibration.

Works with a Variety of Cells

Inputs to the APT4000 Series include all Honeywell conductivity cell types with appropriate temperature compensator and cell constant. These include the 4973 pure water cells, 4974 sanitary cells, 4905 general-purpose cells, and the 4909 insertion/removal cells. In addition, a wide variety of other manufacturers' conductivity cells are compatible.

Fully Certified

Area certification for the ATP4000 is FM Class I, Div. 2, Groups A-D (non-incendive). Each transmitter comes standard with CE.

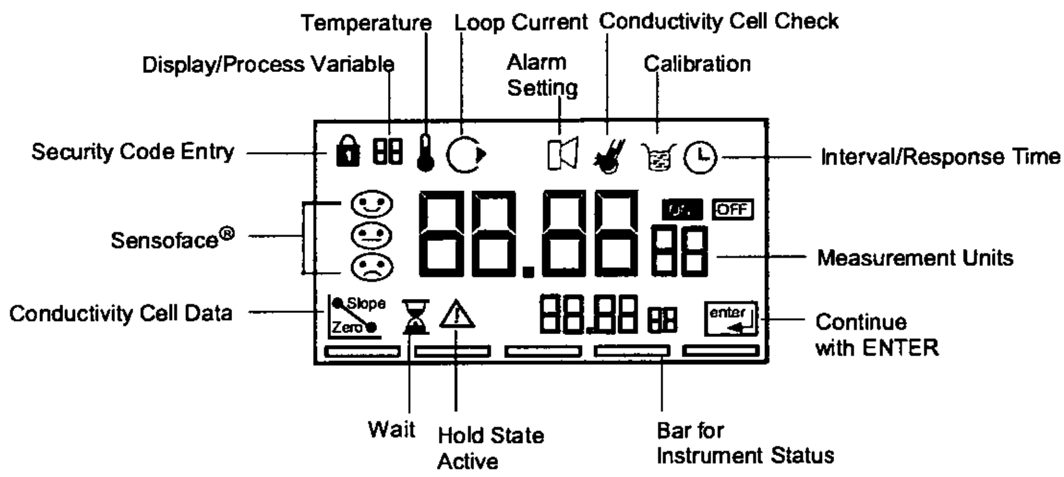


Figure 2—APT4000CC Display Features

Features

- Large display with easy-to-read 0.75 inch measured value
- Simple operator interface with basic pictographs
- Application in Class I, Division 2 or General Purpose areas
- Continuous diagnostics for monitoring calibration, cell health, and transmitter self-test
- Manual loopback check for integrity of 4-20 mA output
- NEMA 4X, IP65 plastic enclosure
- USP24 software allows on-line water conductivity monitoring
- Wall, pipe or panel mounting
- Easy installation with pre-assembled empty enclosure and plug-in terminals
- Optical alarm with relay contact
- Quick Response Time (less than five seconds per step change)
- Dedicated high/low alarm relay

Applications

The APT4000CC transmitter is designed to meet the measurement needs of a number of industries, including:

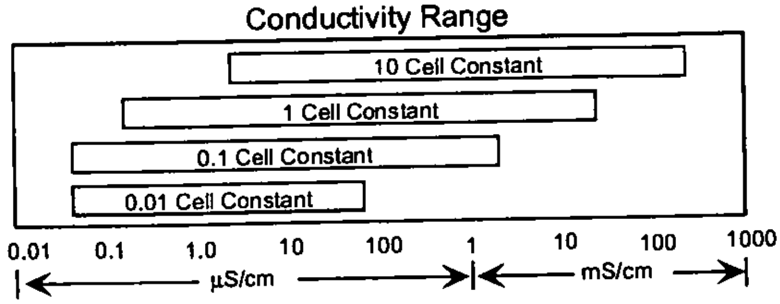
- Pharmaceutical
- Water Quality
- Metals
- Power
- Chemical
- Pulp and Paper

Specifications

Conductivity Input (Refer to Figure 3)	
Display Range	(0.2 µS/cm * Cell Constant) to (1000 mS/cm * Cell Constant)
Accuracy	Less than 1% of Measured Value or ± (0.4 µS/cm * Cell Constant), whichever is greater
Step Change Response Time	Less than 5 seconds
Process Variable/Range	0.000 to 9.999 µS/cm, 00.00 to 99.99 µS/cm, 000.0 to 999.9 µS/cm, 0000 to 9999 µS/cm 0.000 to 9.999 mS/cm, 00.00 to 99.99 mS/cm, 000.0 to 999.9 mS/cm 0.000 to 9.999 MΩ-cm, 00.00 to 99.99 MΩ-cm, 000.0 to 999.9 MΩ-cm
Salinity	0.0 % to 45.0 % (0 °C to 35 °C)
Diagnostics	
Sensocheck	Polarization detection and monitoring of cable capacitance (can be switched off)
Sensor Standarization	- Entry of cell calibration factor with display of conductivity and temperature - Temperature probe adjustment
Sensoface	- Provides information on the electrode state via Sensocheck - Monitors asymmetry potential, slope, and response time during calibration
USP24 Software	Software for on-line water conductivity monitoring in the pharmaceutical industry
Temperature Input	
Range	*8550 Ω Thermistor:* –10.0 °C to +130.0 °C (–14 °F to +266 °F) *Pt100/1000 Ω RTD:* –20.0 °C to +150.0 °C (+4 °F to +302 °F)
Resolution	0.1 °C or 1 °F
Accuracy	< 0.5 K
Temperature Compensation	Automatic Compensation using Pt 100 Ω or 1000 Ω RTD, 8550 ΩThermistor, or manual adjust
Display	LCD display 76 mm x 48 mm dimensions (3" x 1 7/8"), 7-segment *Cond Value:* character height 17 mm (.66") , meas. symbol 10 mm (.4") *Temperature:* character height 10 mm (.4"), meas. symbol 7 mm (.33") Sensoface with three states, 5 status bars, 16 pictographs / symbols, Red Alarm LED Security protection with four-digit mode codes to access calibration and configuration options
Supply/Output	
Output Current	0 mA or 4 mA to 20 mA current loop, 10 V floating
Supply Voltage	20 V to 253 V ac/dc, 45 Hz to 65 Hz, 2 VA / 1.5 W
Overrange	22 mA for error messages
Current Error	< 0.3 % of current value +0.05 mA
Current Source	3.80 mA to 22.0 mA
Output Characteristic	Linear or Logarithmic
Minimum Span	*LIN:* 5% of the selected range *LOG:* 1 decade

Alarms/Relays	
Contacts	*Alarm minimum contact:* SPST N/O (Hysteresis 0.2% of measured range) *Alarm maximum contact:* SPST N/O (Hysteresis 0.2% of measured range) *Diagnostic contact:* SPST N/C *Wash contact:* SPST N/O
Maximal Current/Voltage	*AC:* < 250 V / < 3A / < 750 VA *DC:* < 30 V/ < 3A / < 90 W
Physical	
Enclosure	Plastic enclosure made of PBT (polybutylene terephthalate) bluish-gray RAL 7031
Mounting	Wall, Pipe, or Panel Mount
Dimensions	*Height:* 144 mm (5.67") *Width:* 144 mm (5.67") *Depth:* 105 mm (4.13")
Protection	NEMA 4X, IP65
Cable glands	3 breakthroughs for Pg 13.5 2 breakthroughs for NPT 1/2" or Rigid metallic conduit
Weight	Approximately 1 kg (2.2 lb.)
Area Certifications / Compliances	
Area Certification	Zone 2 (USA) FM: NI, Class I, Division 2, Groups A-D, T4
Data Retention	Parameters and calibration data > 10 years (EEPROM)
RFI Suppression / Immunity to ESD	To EN 50 081-1 and EN 50 081-2
Ambient Conditions	*Operation/Environmental temperature:* (T4) –20 °C to +55 °C (–4 °F to +131 °F) (T6) –20 °C to +40 °C (–4 °F to +104 °F) *Transport and Storage temperature:* –20 °C to +70 °C (–4 °F to +158 °F)

Conductivity Range



Resistivity Range

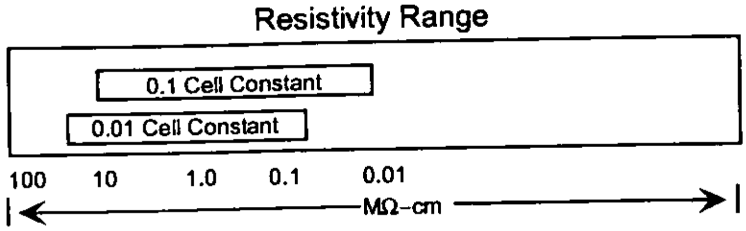


Figure 3—Optimal Cell Constant for Conductivity or Resistivity Ranges

Model Selection Guide

Reference 51-52-16-73

Instructions

- APT4000 Transmitter Offers:
  - Power Requirements - Universal, 20 to 253V AC/DC 45 to 65 Hz
  - Standard - NEMA 4X, IP65
  - Standard Approvals:
    - General Purpose; also FM Class I, Div 2, Groups A-D
  - Standard - All models CE Compliant
  - High/Low Alarm Relays
  - Three mounting types: **(must be ordered separately)**
    - Panel Mount Kit
    - Pipe/Wall Mount Kit
    - Protective Hood (requires Pipe/Wall Mount Kit)
- Select the desired key number. The arrow to the right marks the selection available.
- Make one selection from Tables using the column below the proper arrow.
  A dot (•) denotes unrestricted availability.

Key Number _ _ _ _ _ _ _ _ _ _ - I: _ _ _

KEY NUMBER

Description of Measurement Type	Selection	Availability		
pH/ORP	APT 4000 PH	↓		
Toroidal (Electrodeless) Conductivity	APT 4000 TC		↓	
Contacting Conductivity	APT 4000 CC			↓

TABLE I - Optional Equipment

User's Manual	English	E _ _	•	•	•
Future		_ 0 _	•	•	•
Future		_ _ 0	•	•	•

NOTE: Mounting kit not included with APT4000.

Accessory Parts	Part Number
Mounting Kits:	
Panel Mounting Kit	51205990-001
Pipe/Wall Mounting Kit	51205988-001
Protective Hood (requires pipe/wall kit)	51205989-001
Instruction Manual - pH	70-82-25-103
Instruction Manual - Toroidal (Electrodeless) Conductivity	70-82-25-104
Instruction Manual - Contacting Conductivity	70-82-25-105

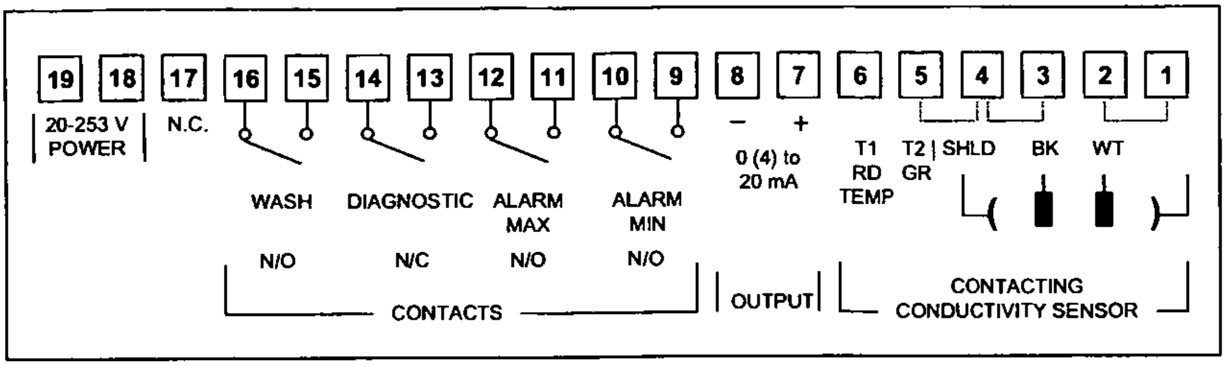


Figure 4—APT4000CC Terminal Assignments

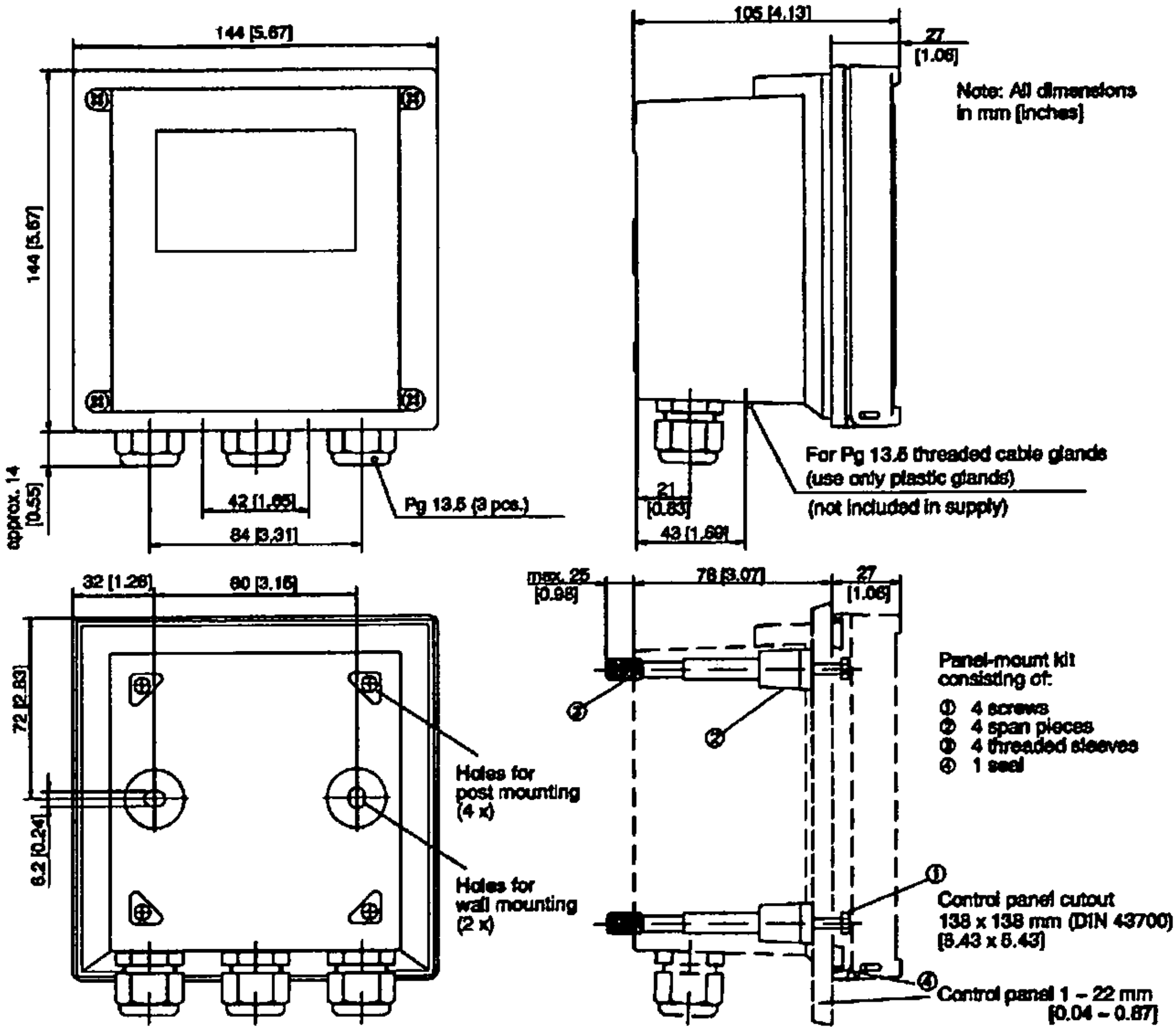


Figure 5—Dimension Drawing for APT4000 and P/N 51205990-001 Panel Mounting Kit

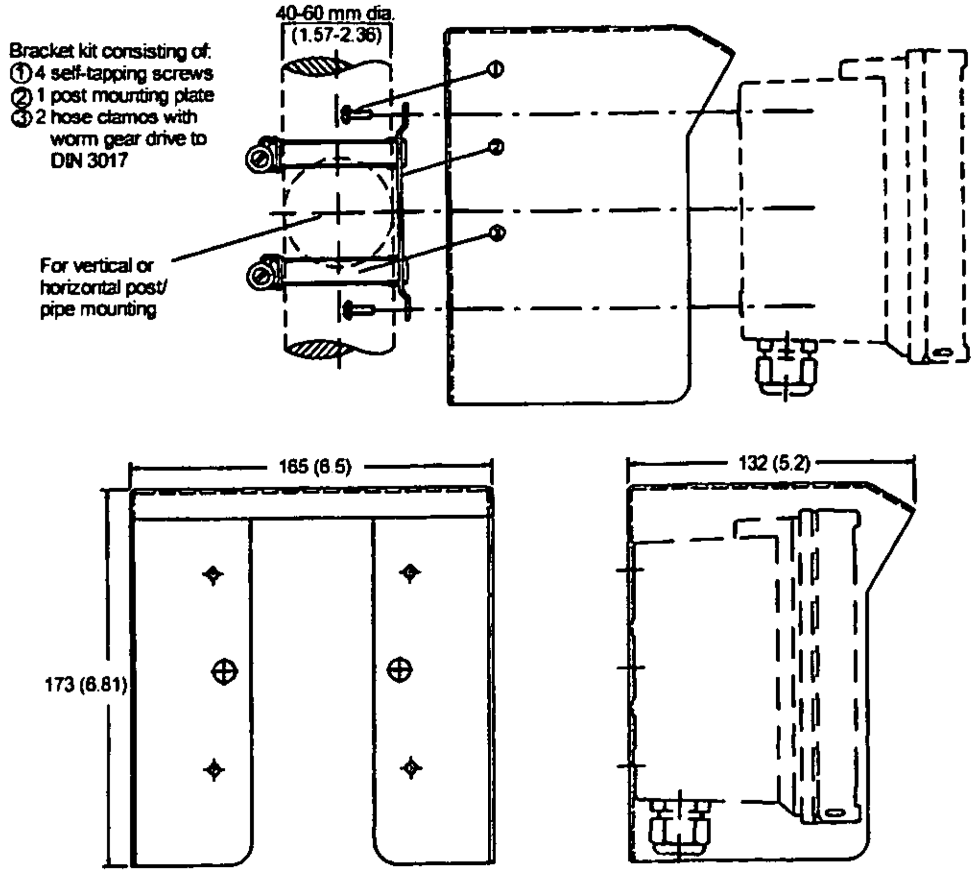


Figure 6—Dimension Drawing for APT4000 with Wall or Pipe Mounting

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyer's sole remedy and is **in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose**. Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

For more information, contact Honeywell sales at (800) 343-0228.

Honeywell

Sensing and Control
Honeywell
11 West Spring Street
Freeport, IL 61032

Industrial Electrolytic Conductivity Cells

Specification

Main Overview

The specification of an Electrolytic Conductivity Cell requires careful consideration of the following factors:

1. Appropriate Cell Constant, determined by the analyzer or recorder used. See instrument range table.
2. Chemical resistance.
3. Physical nature of mounting; insertion, immersion, flow through, insertion/removal and laboratory type.
4. Temperature/pressure rating required.
5. Integral automatic temperature compensator. Determined by the analyzer or recorder used. See instrument range table under electrolytic conductivity Reference Section if 9782 is not used.

Appropriate Cell Constant - Reference Information
The choice of cell constant is determined by the measuring instrument and its range.

What is a cell constant? The cell constant describes the cell's geometry. It is the length between electrodes divided by the effective sample area between them. The standard 1 cm^{-1} constant cell can be visualized as 2 plates of 1 cm^2 area spaced 1 cm apart. Other cell constants have different length/area ratios.

Applying the cell constant to the measured resistance/conductance converts it to resistivity/conductivity - a property of the fluid independent of the measuring apparatus and sample size.

Why a variety of cell constants? A variety of cell constants is needed to measure the complete range of electrolytic solutions from less than 1. 0 ohms-cm to greater than 18 megohms-cm.
For accuracy, the measured resistance must be at a level that will give the best sensitivity for the measuring circuit. At very low measured resistance polarization effects and leadwire resistance could affect accuracy. This is avoided by choosing a cell constant which will raise the measured resistance to an acceptable level. At very high resistance values, leadwire capacitance can affect the accuracy. This is avoided by selecting a cell that will lower the measured resistance to an acceptable level.

To measure high purity water, a low cell constant is specified which lowers the measured resistance. Conversely, sulfuric acid may have a specific resistance of 1.0 ohm-cm; therefore, a 50 constant cell should be used to raise the measured resistance to 50 ohms.

Hazardous Locations
All industrial electrolytic conductivity cells manufactured by Honeywell meet requirements for Class 1, Div. 2, Group A, B, C and D for operation in hazardous locations. Div. 1 requirements of intrinsic safety are met with the 7079-17 Transmitter and Barriers.

Selection Guide for Conductivity Cells and Compensators
4973 Should be quoted whenever possible for constants 0.01 to 10 cm^{-1}.

When measuring deionized water where the cell has the potential of being exposed to regeneration acids and bases, the 4973 Cell with its titanium electrodes and rapid temperature response are preferred. If a 4905 cell is used, the platinum electrodes are best, but the nickel electrodes are suitable (and should be bid in a competitive situation.)

4905 Widest choice of cell constant - should be quoted on all applications where 4973 is not applicable and for replacements.

4909 Should be quoted when cell removal is required without disturbing the process.

4800 Series Should be quoted for concentrated sulfuric acid, and other strong acid or base applications where the 4973 or 4905 type cells are not compatible because of corrosion resistance.

Physical Nature of Mounting
Proper mounting of a cell is as important as any other parameter. A cell improperly installed may not give an accurate indication of the true process conditions. Careful consideration should be given to the mounting.

Insertion Cell can be mounted directly in process stream. Location should be in rapid fluid motion and in a position which will prevent sediment accumulation. Also suitable for lab use.

Immersion Cell can be mounted over a tank or open trough. The cell should be completely immersed to avoid a false indication of high resistivity (low conductivity) or incomplete temperature compensator immersion.

Flow Cell assembly can be placed directly in process fluid line or bypass sample line. The cell should be completely immersed and positioned to prevent accumulation of sediment to avoid false indication of high resistivity (low conductivity).

Insertion/Removal cell can be removed at pressures 50 psi or less without disturbing the process.

4973 and 4974 Series Overview

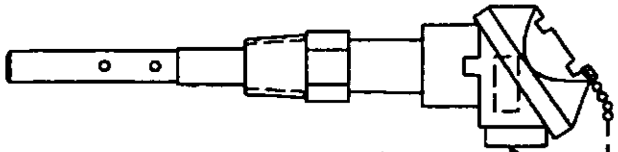
These cells are ruggedly constructed for reliable, continuous measurement of electrolytic conductivity in industrial water processes at temperatures up to 140°C and pressures up to 250 psig.

The cells feature polyethersulfone (PES) construction for high-corrosion resistance, with electrodes of titanium (for 0.01 and 0.1 cell constants) and high-density graphite (for 1.0 and 10.0 cell constants).

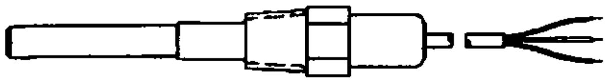
For *insertion* applications, the 3/4" NPT male thread permits permanent installation in a pipe or tank; the cell can also be used as a laboratory dip-type for batch sampling.

For *flow* applications, the cell can be installed directly into a process stream, or used with a separately ordered 3/4" pipe tee in a by-pass stream. The cells have been designed to keep the electrodes and the temperature compensator immersed in the stream flow, ensuring that the cell will respond quickly and accurately to changes in both solution concentration and temperature.

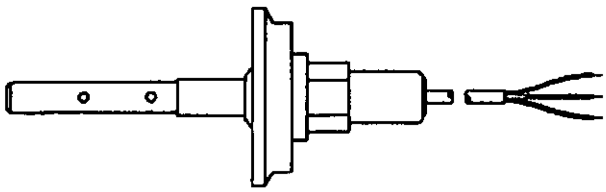
For *sanitary clean-in-place (CIP)* piping systems, the 4974 cells include standard 1 1/2" or 2" CIP fittings suitable for food and beverage, pharmaceutical and cosmetic, or biotechnology industries.



4973 Cell with 0.01 or 0.1cm^{-1} constant, titanium electrodes, and aluminum junction box head.



4973 Cell with 0.01 or 0.1cm^{-1} constant, graphic electrodes, and Teflon guard.



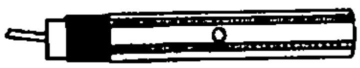
4974 Cell with 1 1/2" sanitary CIP fitting

Specifications

4973/4974	
Automatic Temperature Compensator	Supplied on all cells
Cell Constant	0.01, 0.1, 1.0, and 10 cm^{-1}
Maximum Temperature Limit	4973: 140°C (284°F) at rated pressure 4974: 130°C (266°F) at rated pressure, may be further limited by CIP gasket and clamp type
Maximum Pressure Limit	4973: 1724 kPa (250 psig) at rated temperature 4974: 1034 kPa (150 psig) at rated temperature, may be further limited by gasket and clamp type
Insertion	4973 cells: 3/4" NPT male thread for schedule 40 and 80 pipe 4974 cells: 1 1/2" or 2" sanitary CIP fitting
Insertion Depth	89 mm (3 1/2") for 1, 10, and 0.01 constants from solution end of 3/4" NPT male thread 64 mm (2 1/2") for 0.1 constant

Wetted Parts	Cell body: PES (polyethersulfone) Electrodes: 0.01 and 0.1 constant, titanium; 1.0 and 10.0 constant, high-density graphite with Teflon guard. 4974 series also includes food grade silicone rubber and polished 316 S.S.
Electrical Connections	Integral PVC-covered nonshielded 18-gage cable, 2.1 m (7') or 6.1 m (20') long, as specified. If more than 20' are required, specify the junction box head and the required length of extension cable (head has 1/2" NPT conduit connection). For a separate junction box, specify part number 31316260, and appropriate length of cable.
Weight	4973: 0.2 kg (0.5 lb.) 4974: 0.4 kg (1 lb.)

Flow Chambers for 4973



31079198

31055919

Flow Chambers (ordered separately) used with 4973 Cell for Sample Stream Measurements

055919	Max. flow: 5 gpm at 40 psig Material: PES Max. Pressure: 200 psig at 25°C Max. Temperature: 140°C at 5 psig Dimensions: 38 mm x 222 mm (1 1/2" x 8 1/4") Sample Inlet: ¾" NPTM Sample Outlet: ¾" NPTF Cell Port: ¾" NPTF
31079198	Max. flow: 750 cc/min. Material: 316 stainless steel Max. Pressure: 200 psig (1378 kPa) Max. Temperature: 140°C Dimensions: 38 mm (1 1/2") dia. X 114 mm (4 1/2") Sample Inlet: 1/8" NPTF Sample Outlet: 1/8" NPTF Cell Port: ¾" NPTF

4905 Series Cells Overview

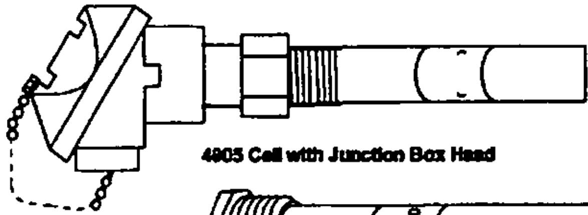
Constructed of PES for high corrosion resistance, 4905 Series cells can be supplied with either nickel or platinum electrodes, and will provide continuous reliable measurements at temperatures up to 140°C at pressures up to 250 psi.

For insertion applications, the 1" NPT male thread permits installation in a pipe or tank, for flow applications, the cell can be installed directly into a process stream, or used with a separately ordered 276127 Flow Chamber in a bypass stream.

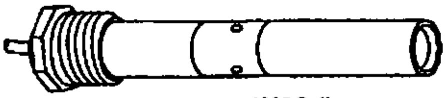
For immersion applications, ½" rigid or flexible plastic pipe can be threaded into the top of the cell: up to 6' (1.8m) for a 7' cable, up to 19' (5.8m) for the 20' cable.

Specifications

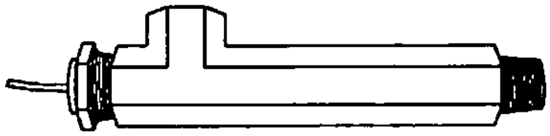
4905 Series Cell	
For high corrosion resistance, the 4905-Series Cells can be supplied with either nickel or platinum electrodes.	
Application	
Insertion	The 1" NPT male thread permits installation in a pipe or tank; the cell can also be used as a laboratory dip-type for batch sampling.
Immersion	1/2" rigid or flexible plastic pipe can be threaded into the female thread on the top of the cell. Up to 1.8 m (6') for the 7' cable, up to 5.8 m (19') for the 20' cable.
Flow	The cell can be installed directly into a process stream, or used with a separately ordered 276127 Flow Chamber in a bypass stream.
Flow Velocity	Maximum 10 ft./sec (3.0 m/sec)
Specifications	
Cell Constants	0.01, 0.1, 1.0, 5, 10, 20, 25, and 50 cm^{-1}
Electrode Material	Nickel or platinum, as specified. Constants 5 and higher are platinized.
Leadwire	Tefzel-covered 18-gage cable 7' or 20' long, as specified in Table IV. If more than 20' is required, select either the cast aluminum junction box head option in Table IV or select the 20' option in Table IV and the separate 31316260 cast iron junction box and additional length of leadwire as necessary.
Electrical Connections	3 or 4 leads when integral Automatic Temperature Compensator is selected, 2 leads without A.T.C.
Pressure	250 psig @ 140°C (284°F) maximum
Temperature	140°C (284°F) maximum continuous (the temperature limit for the A.T.C. accuracy may be lower than the cell's material-of-construction temp. limit).
Mounting	1" NPT male
Insertion Depth	114 mm to 175 mm (4.5" to 6.9") depending on cell constant; 112 mm or 224 mm (4.4" or 8.8") additional depth available on special order.
Overall Length	Approximately 152 mm to 203 mm (6" to 8") without junction head. Approximately 254 mm to 311 mm (10" to 12 ¼") with junction head.
Wetted Materials	Cell: polyethersulfone Electrodes: Nickel or platinum
Weight	Approximately 0.45 kg (1 lb.)



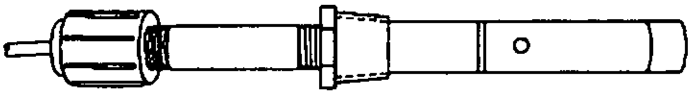
4905 Cell with Junction Box Head



4905 Cell



4905 Cell in 31276127 Flow Housing



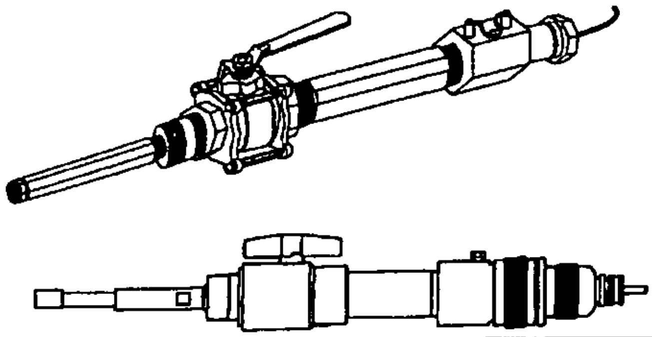
4905 Cell for Immersion, with Plastic Extension Pipe (Supplied by User)

276127 Flow Chamber	
Specifications	
Pressure	200 psig maximum @ 25°C (77°F)
Temperature	140°C (284°F) maximum @ atmospheric pressure
Flow	2 gpm @ 40 psig and atmospheric discharge
Dimensions	38 mm (1 ½") octagon x 222mm (8 ¾") long Sample Inlet: ¾" NPTM Sample Outlet: ¾" NPTF Cell Port: 1.0" NPTF

4909 Series Cells Overview

4909 Cell Assemblies, available in 316 Stainless Steel or CPVC Plastic, allow insertion or removal of the cell without interruption to the process. Two safety features, a restraining mechanism and an internal safety stop, provide protection to an operator for safe cell removal at pressures up to 50 psig with caution. The plastic removal device is equipped with a purge port to flush out any accumulated debris to aid in easy insertion or removal of the cell.

4909 Series Cell	
Specifications	
Cell Constants	0.01, 0.1, 1.0, 5, 10, 20, 25, and 50 cm^{-1}
Electrode Material	Nickel or platinum, as specified. Constants 5 and higher are platinized.
Flow Velocity	Maximum 5 ft./sec (1.5 m/sec)
Leadwire	Tefzel-covered 18-gage cable 7' or 20' long, as specified in Table IV. If more than 20' is required, select either the cast aluminum junction box head option in Table IV or select the 20' option in Table IV and the separate 31316260 cast iron junction box and additional length of leadwire as necessary.
Electrical Connections	3 or 4 leads when integral Automatic Temperature Compensator is selected, 2 leads without A.T.C.



Top: 4909 SS Insertion/Removal Cell Assembly
Bottom: 4909 CPVC Plastic Insertion/Removal Cell Assembly

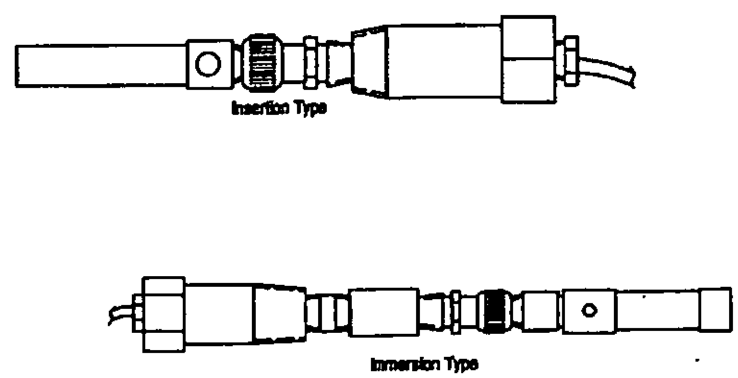
Specifications for 4909 316 SS Assembly	
Pressure	1379 kPa (200 psig) maximum at 140°C (284°F). Maximum pressure for removal or insertion is 50 psig.
Temperature	140°C (284°F) at 200 psig
Process Connection	1 1/4" NPT male
Insertion Depth	Varies between 165 mm and 224 mm (6.5" and 8.8") from end of nipple, depending on cell constant; 112, 224 and 336 mm (4.4, 8.8 and 13.2") additional depths available on special order.
Overall Length	From process connection: 422 mm (16.6"); 521 mm (20.5") with junction head option
Total Length Required for Cell Removal	1130 mm (44.5"); 1238 mm (50.5") with junction head option.
Wetted Materials	316 SS ball valve, Viton & Teflon internal sealing materials, PES cell, nickel or platinum electrodes, as specified.
Weight	4.5kg (10 lbs.)
Specifications for 4909 CPVC Plastic Assembly	
Pressure and Temperature	862 kPa (125 psig) maximum @ -5°C (23°F) 621 kPa (90 psig) maximum @ 50°C (122°F) 345 kPa (50 psig) maximum @ 80°C (176°F)
Process Connection	1 1/2" NPT male
Purge Port Connection	1/4" NPT female. Purge fluid temperature and pressure not to exceed 4909 CPVC temperature and pressure specifications.
Insertion Depth	Varies between 114 mm and 173 mm (4.5" and 6.8") depending on cell constant. For 152 mm (6") additional depth, specify 074344 tube separately.
Overall Length	From process connection: 502 mm (19.7"); 564 mm (22.2") with junction head option.
Total Length Required for Cell Removal	914 mm (36"); 1067 mm (42") if 074344 tube is used.
Wetted Materials	CPVC ball valve, Viton, Teflon & EPDM internal sealing materials, PES cell, nickel or platinum electrodes, as specified.
Weight	1.6 kg (3.5 lb.)

4801 and 4802 Series Cell Overview

The 4800-Series Cells feature high corrosion resistance and a rugged configuration to provide reliable continuous measurements in industrial processes. The insertion- and immersion-types are usable in process temperatures up to 125°C.

High-constant cells (5 to 50 cm^{-1}) are constructed of glass-reinforced Teflon F.E.P. Low-constant cells (0.01, 0.1, and 1 cm^{-1}) are made of PES (polyethersulfone). Electrodes for cell constants of 5, 10, 20, 25, or 50 are platinized platinum; electrodes for cell constants of 0.01, 0.1, and 1 are platinum.

All cells are supplied with integral 7' leadwires; either a PVC-covered cable (100°C, maximum) or, where applicable, Teflon-covered individual wires (125°C, maximum).



The 4801 Insertion-type has a 1" NPT male thread to permit permanent installation in a pipe or tank and is available with an integral automatic temperature compensator.

The 4802 Immersion-type is used directly in a process tank or reservoir. A 1" NPT male thread is provided for mounting; an extension nipple, supplied by the user, determines the depth of immersion (limited by the integral 7' leadwire). An integral Automatic Temperature Compensator is available.

4800 Series		
Type	**4801 Insertion Type**	**4802 Immersion Type**
Maximum Temperature Limit*	125°C*	
Maximum Pressure Limit	1384 kPa (200 psig)	
Electrode and Cell Body Materials	For cell constants 0.01, 0.1, and 1 cm^{-1}, platinum electrode, PES (polyethersulfone) body. For cell constants 5, 10, 20, 25, or 50 cm^{-1}, platinized platinum electrode, glass-reinforced Teflon body.	
Mounting Connection	1" NPT male thread	
Insertion Depth	For cell constants 0.01 to 5: 190 mm (7 1/2"). For cell constants 10 to 50: 203 mm (8").	Cell assembly supplied in two sections; user must supply 1/2" NPT pipe nipple to length desired.
Wetted Parts**	Carpenter 20 SS	Carpenter 20 SS
Weight (Approximate)	1.3 kg (3 lb.)	
Electrical Connections	Two leads, for cell only; three leads for cell and integral ATC.	
Leadwire	Integral 18-gauge cable(s) PCV-covered (100°C max.) or Teflon-covered separate leads (125°C max.), 2.1 m (7') long. If a length greater than 7' is required, order a 31316260 Junction Box and appropriate length of 834059 cable.	

*Actual process-temperature limits are determined by Automatic Temperature Compensator selected.
**Carpenter 20 SS, for highly corrosive mineral acid solutions (except HCl); Monel, for corrosive salt solutions.

Accessory Extension Leadwire for all Cells

When Temperature Compensator suffix is 333 with *standard* range 9782 Analyzers: Up to 500 feet: 834059 3-conductor, 18-gage cable and 835024 coaxial cable (Belden 9259) Up to 1000 feet: 834055 4-conductor (3 used), 18-gage cable and 835024 coaxial cable (Belden 9259)
When Temperature Compensator suffix is 333 with wide range 9782 Analyzers only: Up to 500 feet: 31834052 4-conductor, 18-gage cable Up to 1000 feet: 834055 4-conductor, 16-gage (Leadwire resistance compensation is provided on wide range analyzers.)
When Temperature Compensator is other than 333: 834059 3-conductor, 18-gage unshielded cable If integral junction box is not specified, use with 31316260 junction box.

Distributor:

Industrial Automation and Control

Honeywell Inc.

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27

28