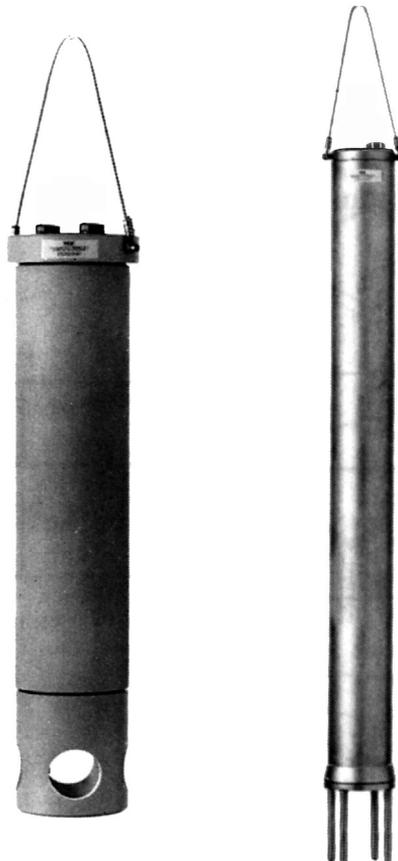




Instruction Manual

Model FD20
Immersion Fittings

pH/ORP



YOKOGAWA ◆

IM 12B06K02-01E-E
9th edition







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1. Introduction

The model FD20 immersion fittings are used to submerge sensor tips so that the pH and/or ORP (redox) potential of liquids in open vessels, tanks, drains etc. can be measured.

The fittings are available for mounting of either:

- one electrode
- three electrodes
- four electrodes or alternatively three electrodes and a cleaning system.

1.1 Features

- Designed for either pH or ORP measurements in tanks, open vessels and drains.
- “Hoisting cable” for easy maintenance.
- Pre-selected immersion length.
- Wide choice of construction materials.
- Flange mounting.
- High degree of standardisation reduces spare holding requirements.
- Liquid earth pin for stable measurements.
- Chemical or brush cleaning systems as an option.

1.2 Unpacking and Checking

Upon delivery, unpack the fitting carefully and inspect it to ensure that it is not damaged during shipment. If damage is found, retain the original packing material and immediately notify the carrier and the relevant local Yokogawa Sales Office. Make sure the Model Code and Serial Number on the sensor are the same as on the packing list. Also check if option(s) that were ordered, are included and correct.

1.3 Warranty and Service

Yokogawa products are guaranteed free from defects in workmanship and materials under normal use and service for a period of (typically) 12 months from the date of shipment from the manufacturer. Individual Sales organizations can deviate from the typical warranty period, and the conditions of sale relating to the original purchase order should be consulted. Damage caused by wear and tear, inadequate maintenance, corrosion, or by the effects of chemical

processes is excluded from this warranty coverage. In the event of a warranty claim, the defective goods should be sent (freight paid) to the Service Department of the relevant Yokogawa Sales office for repair or replacement (at Yokogawa’s discretion).

The following information must be included in the letter accompanying the returned goods:

- Model Code and Serial Number.
- Original Purchase Order and Date.
- Length of time in service and description of the process.
- Description of the fault and circumstances of the failure.
- Process/environmental conditions that may be related to the failure of the sensor.
- Statement as to whether warranty or non-warranty service is requested.
- Complete shipping and billing instructions for return of material, plus the name and phone number of a contact person that can be reached for further information.
- Clean Statement

Returned goods that have been in contact with process fluids must be decontaminated and disinfected prior to shipment. Goods should carry a certificate to this effect, for the health and safety of our employees. Material Safety Data sheets must be included for all components of the process to which the fitting(options) have been exposed.

1.4 Serial Number definition

The Serial Number is defined by nine (9) alphanumeric characters:

X₁X₂ Production Location
 X₃X₄ Year/Month code
 X₅X₆X₇X₈X₉ Tracking number

Example: N3P600028

Method used for year/month numbering

Table 1: Production Year code

Year	Year code	Year	Year code
2014	P	2026	3
2015	R	2027	4
2016	S	2028	5
2017	T	2029	6
2018	U	2030	7
2019	V	2031	8
2020	W	2032	9
2021	X	2033	A
2022	Y	2034	B
2023	Z	2035	C
2024	1	2036	D
2025	2	2037	E

Table 2: Production Month code

Month	Month code
January	1
February	2
March	3
April	4
May	5
June	6
July	7
August	8
September	9
October	A
November	B
December	C



2. Specifications

2.1 General specifications

Materials

- wetted parts
 - A. body (refer to model code) : polypropylene (PP)
stainless steel AISI 316 (SS)
polyvinylchloride (PVC)
polyvinylidene fluoride (PVDF)
 - B. O-rings : silicone rubber
 - C. liquid earth sensor : titanium (PP and PVDF design)
stainless steel AISI 316 (SS design)
- electrode mounting sets : PPS (Ryton™)
- "hoisting eye" : stainless steel cable (twisted)

Weight* : see tabel 1

Table 1

Material	PVC	PP	SS	PVDF
Fitting				
1-hole fitting	0,4 kg			
3-hole fitting		2 kg	5,3 kg	2,5 kg
4-hole fitting		4,5 kg	6,4 kg	5,5 kg

* The accessories are not included. The noted weights are at an immersion length of 1 m.

Mounting : by means of the "hoisting eye" or flange mounting

2.2 Functional specifications

Temperature

- min. : -10°C
- max. : depending on material and application (see figure 2.1)

Immersion length (in dm) : between 0,5 and 2,0 m

Pressure : see figure 2.1

: 3 bar for PP, PVDF and PVC Flange

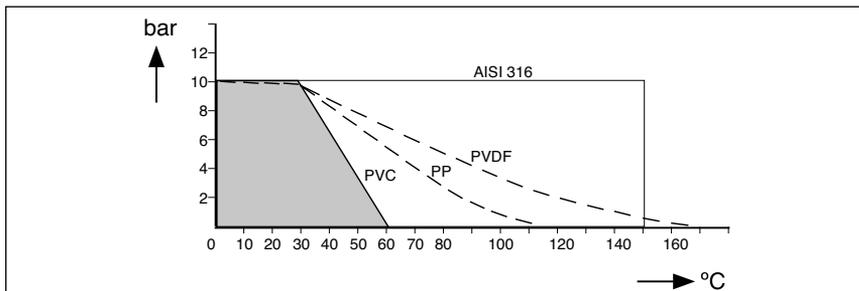


Fig. 2.1 Pressure/temperature class

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2.3 Model and codes

Model Code	Suffix Code	Option Code	Description
FD20F37 FD20F47 FD20P37 FD20P47 FD20S37 FD20S47 FD20V18 ⁽¹⁾			Immersion fitting, PVDF, 3 electrode mounting holes Immersion fitting, PVDF, 4 electrode mounting holes Immersion fitting, PP, 3 electrode mounting holes Immersion fitting, PP, 4 electrode mounting holes Immersion fitting, SS, 3 electrode mounting holes Immersion fitting, SS, 4 electrode mounting holes Immersion fitting, PVC, 1 electrode mounting holes
Immersion length ²	- □ □		Between 5 and 20 (in dm) example 06=0.6 m.
Flange ³ (Working pressure not more than 3 bar)	-NF -F1 -F2 -F3 -F4 -F5 -F6 -F7 -S1 -S2 -S3 -S4 -S7		No flange Flange DN32 for 1 hole fitting Flange DN80 for 3 hole fitting PP Flange DN80 for 3 hole fitting PVDF Flange DN80 for 3 hole fitting SS Flange DN125 for 4 hole fitting PP Flange DN125 for 4 hole fitting PVDF Flange DN100 for 4 hole fitting SS Flange ANSI 1 1/4" 150Lbs for 1 hole fitting PVC Flange ANSI 3" 150Lbs for 3 hole fitting PP Flange ANSI 3" 150Lbs for 3 hole fitting PVDF Flange ANSI 4" 150Lbs for 3 hole fitting SS Flange ANSI 4" 150Lbs for 4 hole fitting SS
		*A	Style A
Options			
Cleaning system		/HCN3 /HCN4	Chemical cleaning for FD20- .37 Chemical cleaning for FD20- .47
Protection hose installation kit		/PH5 /PH10	For 5,5 m cable For 10 m cable
Mounting kit		/R /B	For mounting (top) refillable electrodes with al long glass shaft For mounting Bellomatic reference (SR20-AC32) and combined electrodes
KCL reservoir ⁴		/K	Electrode tubing is included (2,5 m) (only in combination with /R)
Salt bridge		/S	For liquid which cannot stand contamination with KCL
Certificate		/M	3.1 according EN-10-024 (DIN 50049 3.1) for wetted metal parts

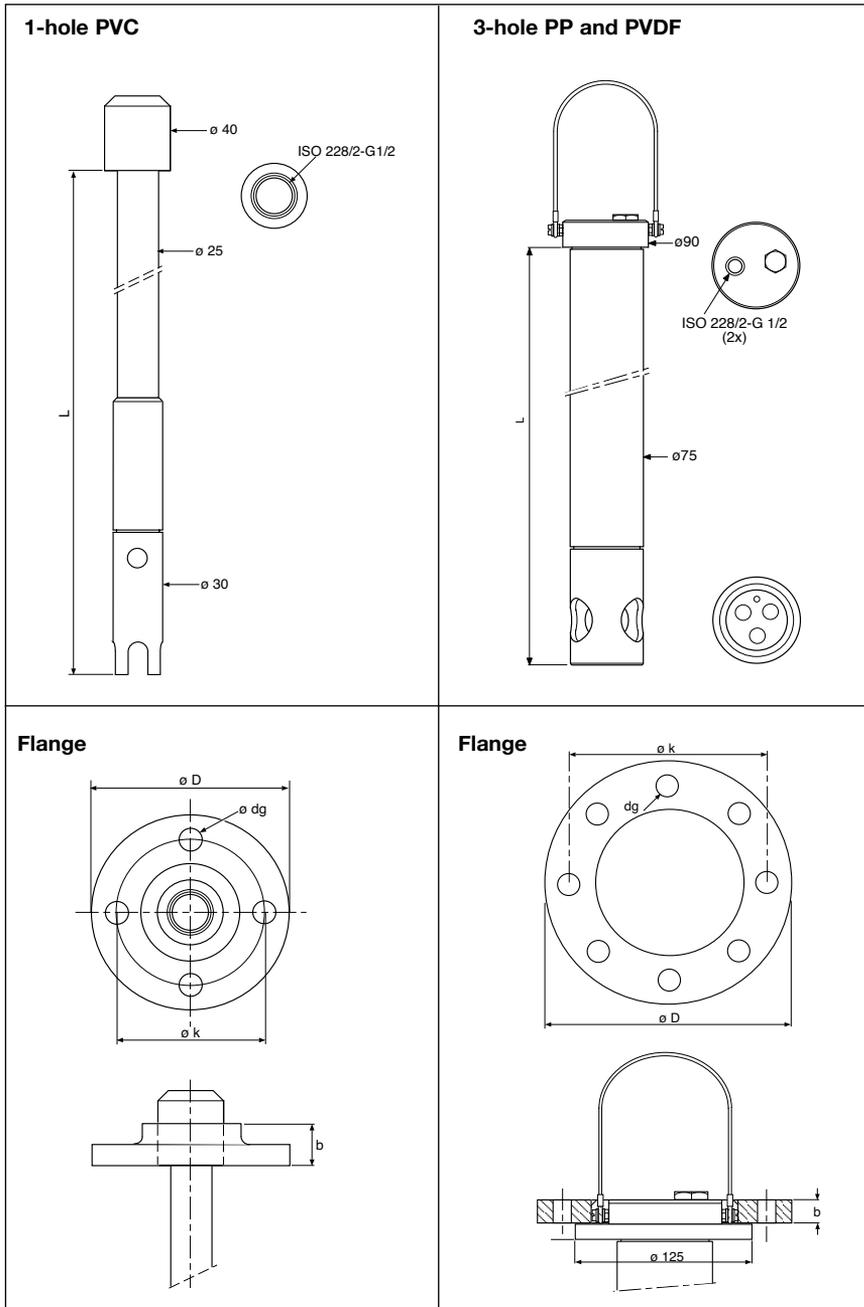
- PVC is available in a 1-hole design only.
- The immersion length of stainless steel fittings with a flange will be shortened by 35 mm (refer to dimensional drawings).
- Configuration of hole (see dimensional drawings 2.4). Working pressure not more than 3 bar for plastic flanges. For higher pressure ratings please contact your local Sales Department of Yokogawa.
- In combination with /R option only.

Notes: a. Options are supplied with the fitting.

- The available length of the electrode cables between fitting and converter or connection box is cable length minus immersion length (L).

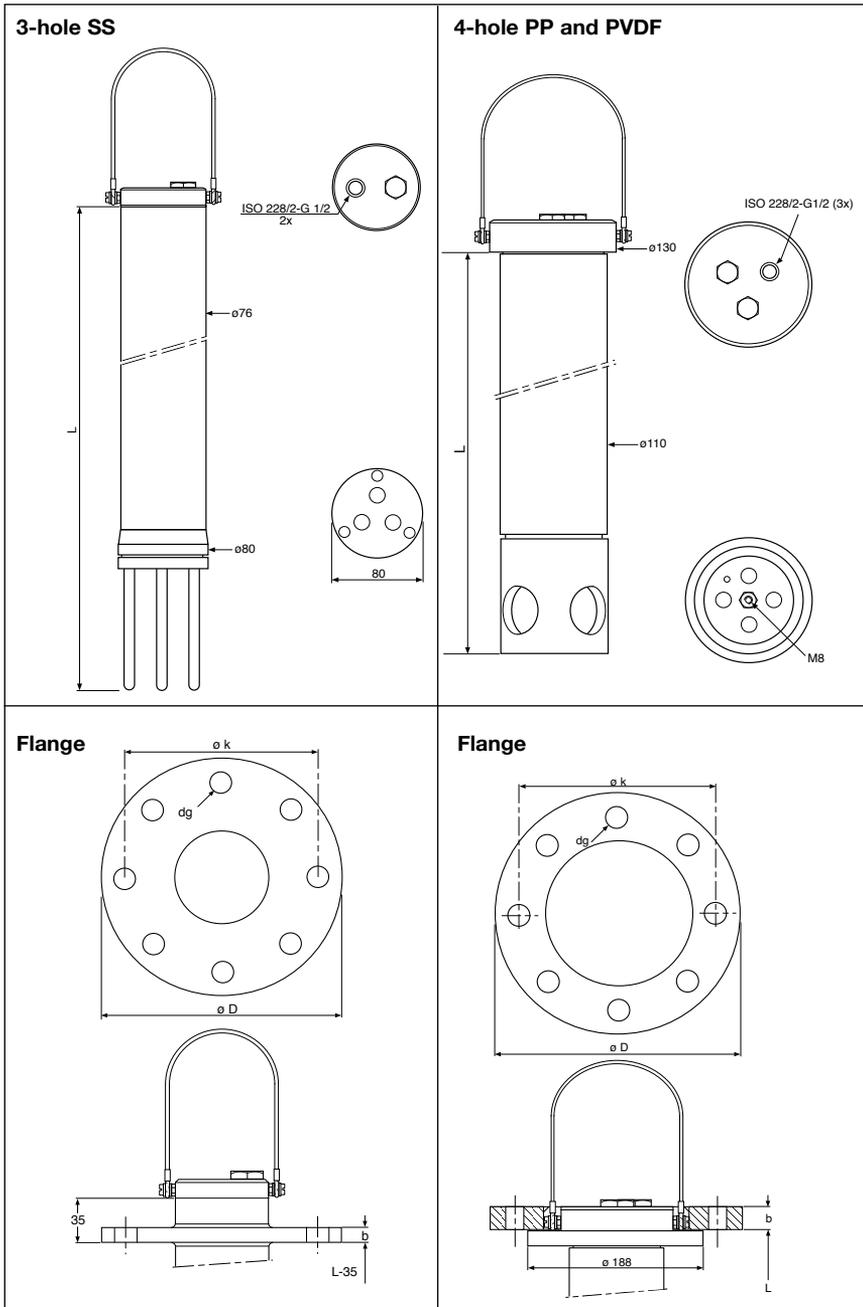


2.4 External dimensions



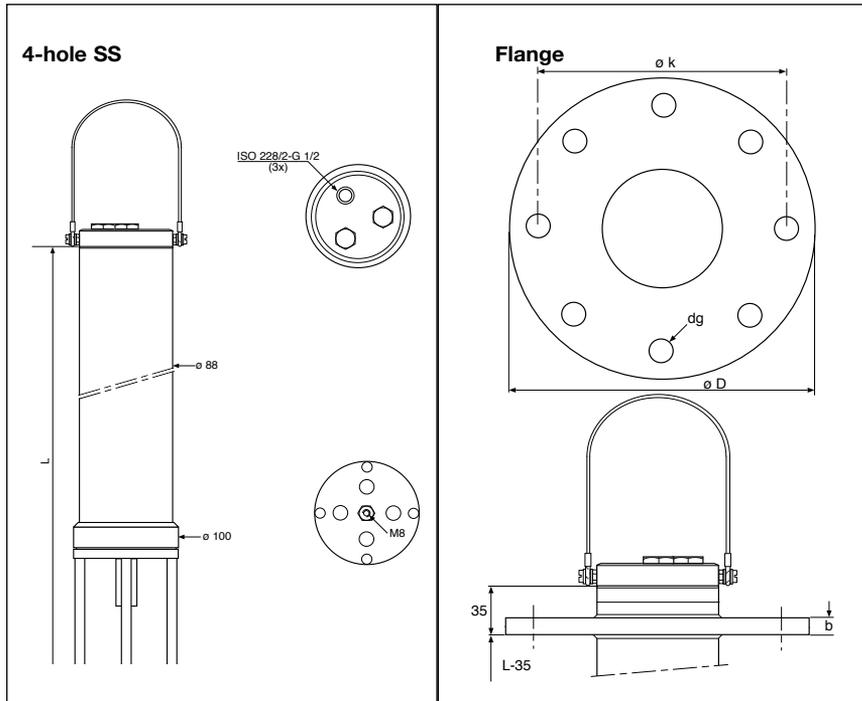
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	L	D	k	dg	b
FD20-V18-.-NF	5-20dm				
FD20-V18-.-F1	5-20dm	120	90	14	26
FD20-V18-.-S1	5-20dm	120	90	16	26
FD20-P37-.-NF	5-20dm				
FD20-F37-.-NF	5-20dm				
FD20-P37-.-F2	5-20dm	200	160	18	20
FD20-F37-.-F3	5-20dm	200	160	18	20
FD20-P37-.-S2	5-20dm	190	152.4	20	18
FD20-F37-.-S3	5-20dm	190	152,4	20	18
FD20-S37-.-NF	5-20dm				
FD20-S37-.-F4	5-20dm	200	160	18	20
FD20-S37-.-S4	5-20dm	228,6	190,5	19	23,8
FD20-P47-.-NF	5-20dm				
FD20-F47-.-NF	5-20dm				
FD20-P47-.-F5	5-20dm	250	210	18	24
FD20-F47-.-F6	5-20dm	250	210	18	24
FD20-S47-.-NF	5-20dm				
FD20-S47-.-F7	5-20dm	220	180	18	20
FD20-S47-.-S7	5-20dm	228,6	190,5	19	23,8

unit in mm

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3. Installation

3.1 Selecting the installation site

It is important that, whatever method of mounting is used, the point of measurement is truly representative for the entire solution.

- Avoid an area where the measurement value varies significantly.
 - Ensure that the sensors are always immersed in the process liquid (not dry).
 - When selecting the installation site, first check that the liquid temperature and pressure meets the sensors and fittings requirements.
 - If the fitting is used in a tank with stirrer or agitator, or if it is placed in a fast flowing process, care must be taken that it is adequately supported to prevent any movement.
 - Install the fitting in a site where it can be easily maintained.
- The mounting position of the sensors must be within the area as shown in figure 3.1.

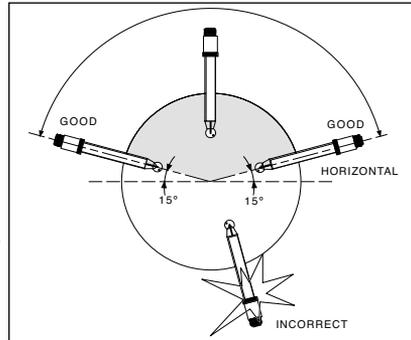


Fig. 3.1 Mounting position of sensors

3.2 Installation

Before installing the immersion fitting, check that all parts and accessories were supplied by Yokogawa.

Ensure that there is enough spare around to withdraw the fitting for calibration and maintenance.

3.2.1 “Hoisting eye” type mounting

On top of each fitting is a “hoisting eye” to withdraw from the process.

3.2.2 Flange mounting fitting

If ordered, the immersion fittings are supplied with a flange for fixing in a tank. The flange is connected to the fitting as shown in the dimensional drawings. These drawings also show the configuration of holes.

Table 2. Flanges being used as a standard

Type fitting	Material fitting	TypePP flange	Material flange	DN	Thickness flange
1-hole	PVC	glue-flange	PVC	32	
3-hole	SS	weld-flange	SS	80	20 mm
4-hole	SS	weld-flange	SS	100	20 mm
3-hole	PP	collar-bush + lap-joint flange	PP + PP (steal inlay)	80	
4-hole	PP	collar-bush + lap-joint flange	PP + PP (steal inlay)	125	
3-hole	PVDF	collar-bush + lap-joint flange	PVDF + PP (steal inlay)	80	
4-hole	PVDF	collar-bush + lap-joint flange	PVDF + PP (steal inlay)	125	



3.3 Cables and sensor mounting

Before mounting a sensor and/or accessory the cables must be passed through the fitting. When mounting Yokogawa sensors the electrode cables, model WU20(D), should be used (see figure 3.2). Length 1, 2, 5¹/₂, 10, 15, 20 or 25 m.

3.3.1 1-Hole fitting

Unscrew the protector from the lower end and the nut with glands from the top end of the fitting. Mount the cable and sensor as shown in figure 3.3.

Model code	Suffix code	Description
WU20(D)		Electrode cable
Type	-PC -LT	COAX TRIAx
Length in mm	01 02 05 10 15 20 25	1 mtr 2 mtr 5 ¹ / ₂ mtr 10 mtr 15 mtr 20 mtr 25 mtr

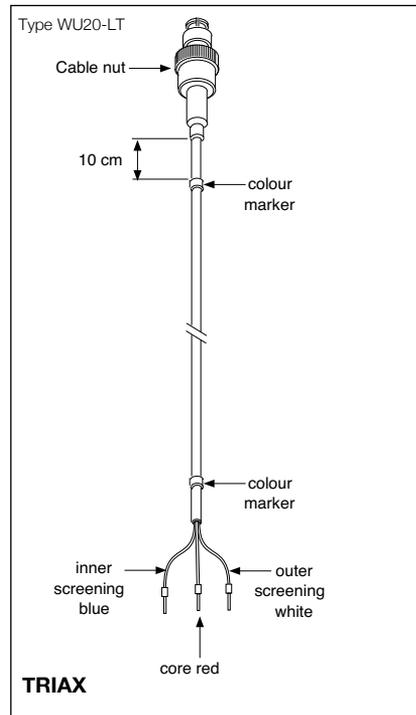
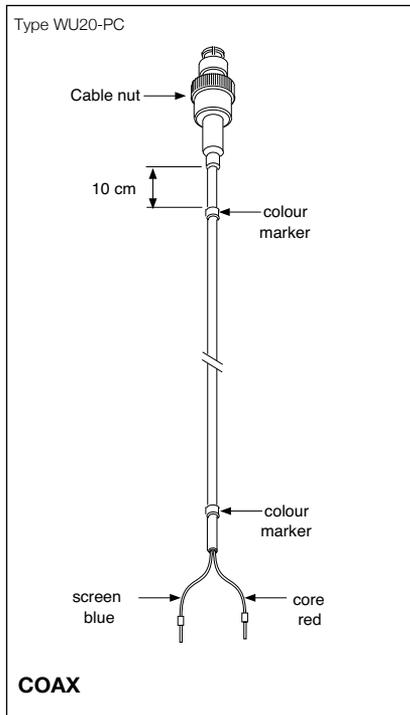
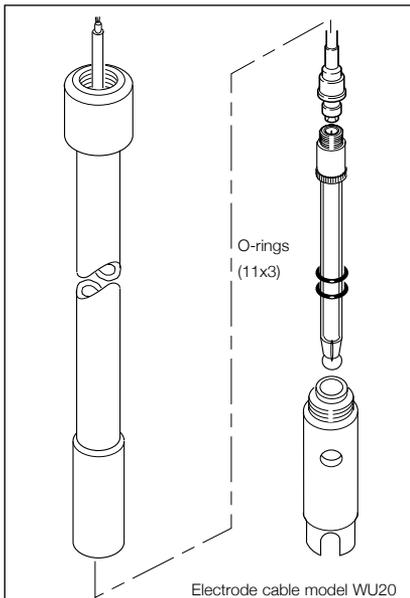
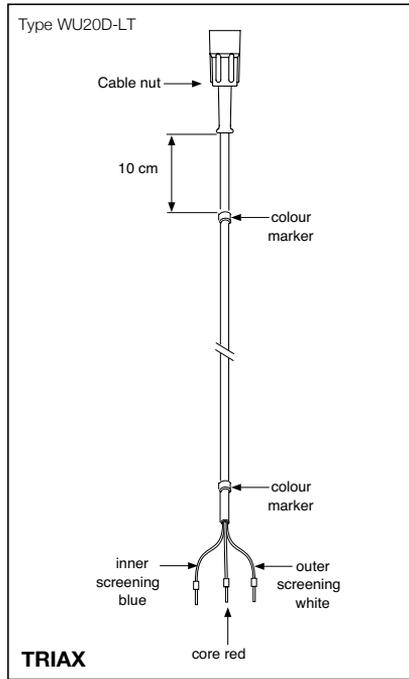
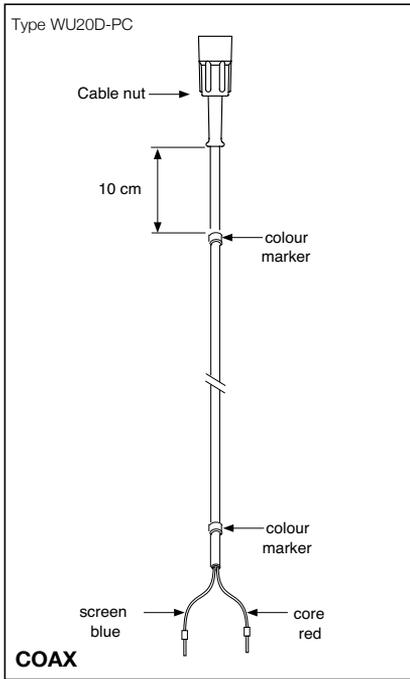


Fig. 3.2 Electrode cables





Attention:

Ensure that the cable has slack remaining in the fitting so that sensor replacement is simplified. To prevent damage of the O-rings the nut and glands must be screwed **HAND-TIGHT** to the fitting. Prepare the sensor to be used in accordance with the directions for use. After that mounting can be made as shown in fig. 3.3.

Attention:

To prevent fouling of the contacts, it is recommended to screw the electrode cable on the electrode as soon as possible. Ensure that there is no moisture or dust in the connection sensor-cable.

Fig. 3.3 Mounting a cable and sensor in a 1-hole fitting

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3.3.2 3-Hole and 4-hole fitting

Unscrew the protector complete with electrode holder from the lower end of the fitting (see figure 3.3).

Unscrew the cap of an electrode mounting set. Pass the electrode cable through this cap and after that through the fitting. Mount the other electrode cables in a similar manner. Pass the electrode cables and the liquid earth cable through a hose connection, which is delivered with the fitting in a plastic pocket.

Attention:

Ensure that the cables have slack remaining in the fitting. The plug of the electrode cable must be ± 15 cm out of the lower end so that torsion will be avoided and sensor mounting is simplified.

Before screwing the hose connection into place **HAND-TIGHT**, some glue must be put to the screw end (see figure 3.4).

Prepare the sensors to be used in accordance with the directions for use and mount them in the fitting as shown in fig. 3.4. For stable measurements the glass and reference electrode should be mounted in the holes nearest to the earth connection.

As delivered the O-rings (2x) for water-tight sealing in the mounting holes are on the blanking plugs. These plugs are for unused holes.

To prevent fouling of the contacts, it is recommended to screw the electrode cable on the electrode as soon as possible. **ENSURE THAT THERE IS NO MOISTURE OR DUST IN THE CONNECTION CABLE-ELECTRODE.**

Attention:

To have slack remaining in the fitting the protector complete with electrode holder should be turned to the left before fixing **HAND-TIGHT** to the fitting.

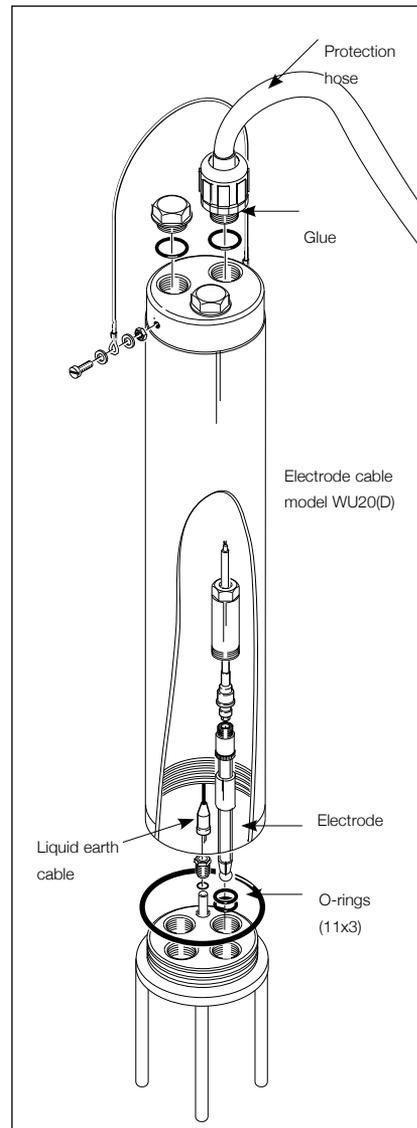


Fig. 3.4 Mounting cables and sensors in 3-hole and 4-hole fittings



4. Mounting of Accessoires

4.1 Mounting kit option /B (FP20-S13)

Using this mounting kit a SR20-AC32 reference electrode of Yokogawa can be mounted in a fitting (see figure 4.1).

Electrodes to be used*

Order nr.	Description
SR20-AC32	Reference electrode

* For specifications of the electrodes see separate sheets.

Parts and accessories

Order nr.	Description
FP20-S13	Mounting kit for SR20-AC32 (10x)
K1500HC	Rubber rings for FP20-S13 (10x)
K1500GE	O-rings for SR20(D)-AC32 electrode (5x)
K1500GF	250 ml, KCl-solution (1 m)
K1520VA	250 ml, KCl-solution (3,3 m)
K1500GG	250 ml, KCl-solution (1 m) thickened
K1520VN	250 ml, KCl-solution (3,3 m) thickened

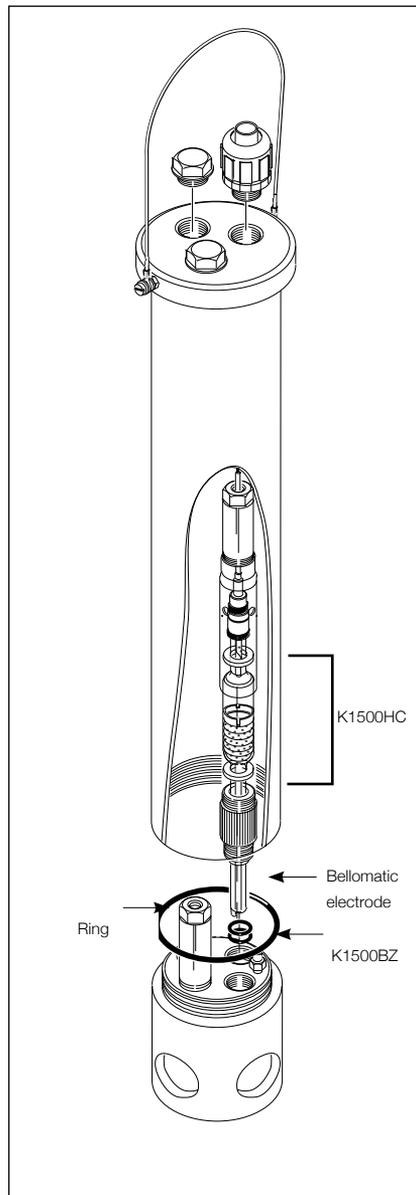


Fig. 4.1 Mounting of a BELLOMATIC electrode



4.2 Mounting kit option /R, (order nr. K1500BY)

This mounting kit replaces the standard electrode mounting set so that Yokogawa refillable electrodes with a long glass shaft can be mounted in a fitting. The mounting set may be used at process pressures up to 3 bar. Higher pressure ratings require the standard mounting set and consequently, electrodes with DIN-dimensions. Figure 4.2 shows the mounting.

Note:

The pressure on the KCl-solution must always exceed the liquid pressure.

The refillable electrodes can be connected to a KCl-reservoir via a silicone tubing (see figure 4.2). The pressure on the KCl-solution and consequently, the liquid outlet of the electrode can be increased by mounting the reservoir on top of the fitting. This prevents penetration of the process liquid into the electrode.

Electrode to be used*

Order nr.	Description
SR20-AC52	Reference electrode
SR20-AS52	Reference electrode

* For specifications see separate sheets.

Parts and accessories

Order nr.	Description
K1500BY	Mounting kit
K1500FZ	O-ring for mounting kit
K1500GF	250 ml, KCl-solution (1 m.)
K1500GG	250 ml, KCl-solution (1m.), thickend

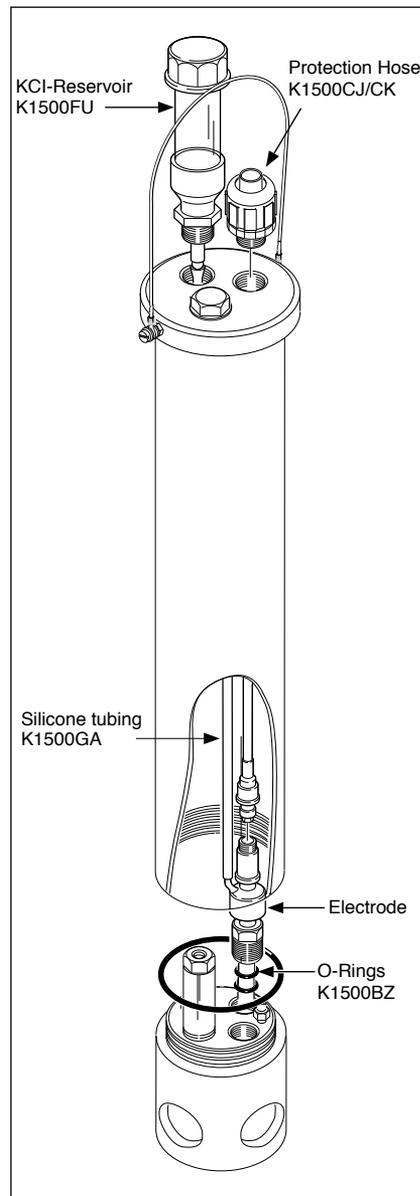


Fig. 4.2 Mounting of refillable electrodes with a long glass shaft





4.3 Cleaning systems

The standardised design of fittings makes it possible to mount FC20 cleaning systems directly. The 4-hole types are especially designed for these applications.

The Yokogawa program includes two different types of cleaning systems (see figure 4.3):

- brush cleaning (electrically or pneumatically driven)
- chemical cleaning



Fig. 4.3a Brush Cleaning

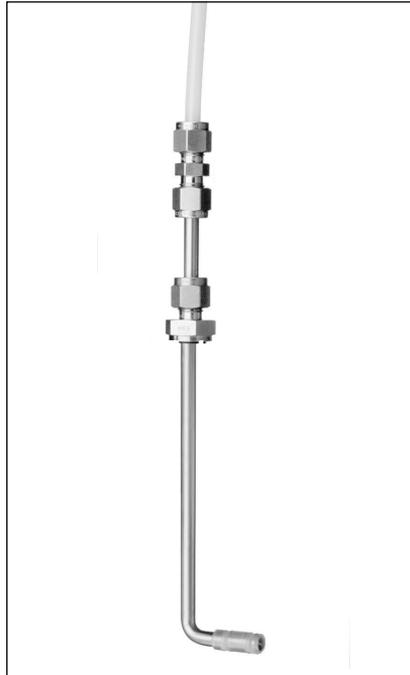


Fig. 4.3b Chemical Cleaning

4.3.1 Selection criteria

Cleaning system	Mechanical	Chemical	
	Brush	Acid	Base
Oils, fats			
Resins (wood, pulp)			X
Emulsions of latex	X		
Fibers (paper, textile)	X		
Crystalline precipitations (carbonates)	X	XX	
Amorphous precipitations (hydroxides)	X	XX	





4.3.2 Brush cleaning

The brush of this cleaning system wipes across the glass membrane of the

electrode every 30 seconds. Electrically or pneumatically driven versions are available. Figures 4.4a and 4.4b show the mounting.

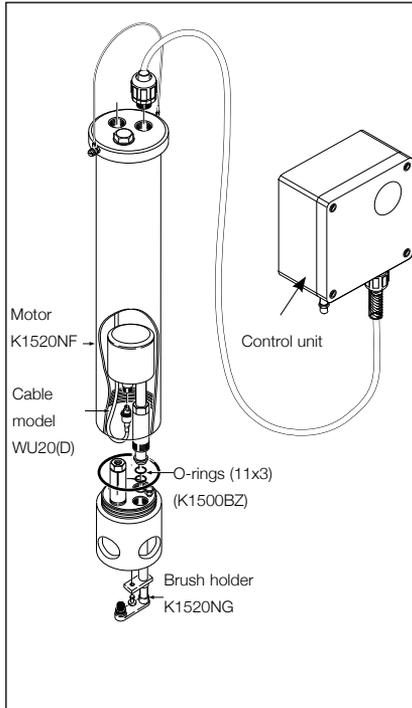


Fig. 4.4a Mounting a brush cleaning (electrically driven) FC20-VE

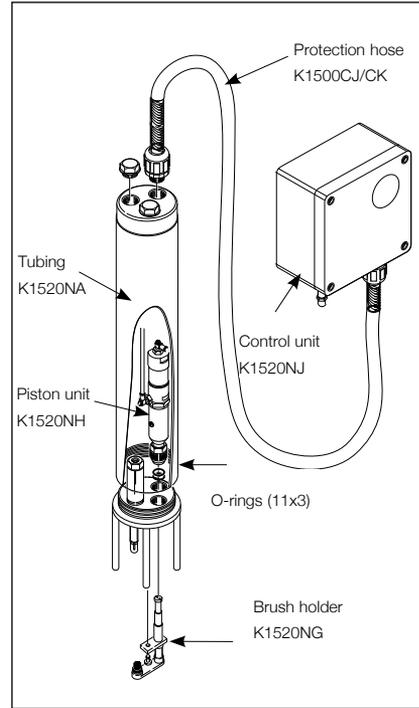


Fig. 4.4b Mounting a brush cleaning (pneumatically driven) FC20-VP

Parts and accessories

Order nr.	Description
FC20-VE	Brush cleaning (electrically driven)
WU20-PC	Electrode cable (to be used as a supply cable for the motor)* Length: 1, 3, 5, 10, 15, 20 or 25 m.
FC20-VP	Brush cleaning (pneumatic driven)*
K1520NB	Brush
K1520NA	Tubing (ø 4 mm) for FC20-VP for connection between piston and supply unit

* Detailed specifications are on separate sheets.



4.3.3 Chemical cleaning

The chemical cleaning system is based on periodically spraying of a cleanser on to the glass membrane of the electrode. The cleanser to be used, the cleaning frequency, etc. are highly dependent on the liquid to be measured. The cleaning period and frequency can be adjusted on a control unit. The mounting procedure is shown in figure 4.5.

Parts and accessories

Order nr.	Description
K1520FJ	Tubing $\varnothing 1/4"$ for chemical cleaning (5 m)
K1520FK	Tubing $\varnothing 1/4"$ for chemical cleaning (10 m)
K1547PA	Complete chemical cleaning system HCN2, HCN3 for 2-hole and 3-hole fittings
K1547PB	Complete chemical cleaning system HCN4, for 4-hole fittings
K1547PP	EPDM spraying valve nozzle 5 sets (for all HCN- chemical cleaning systems)

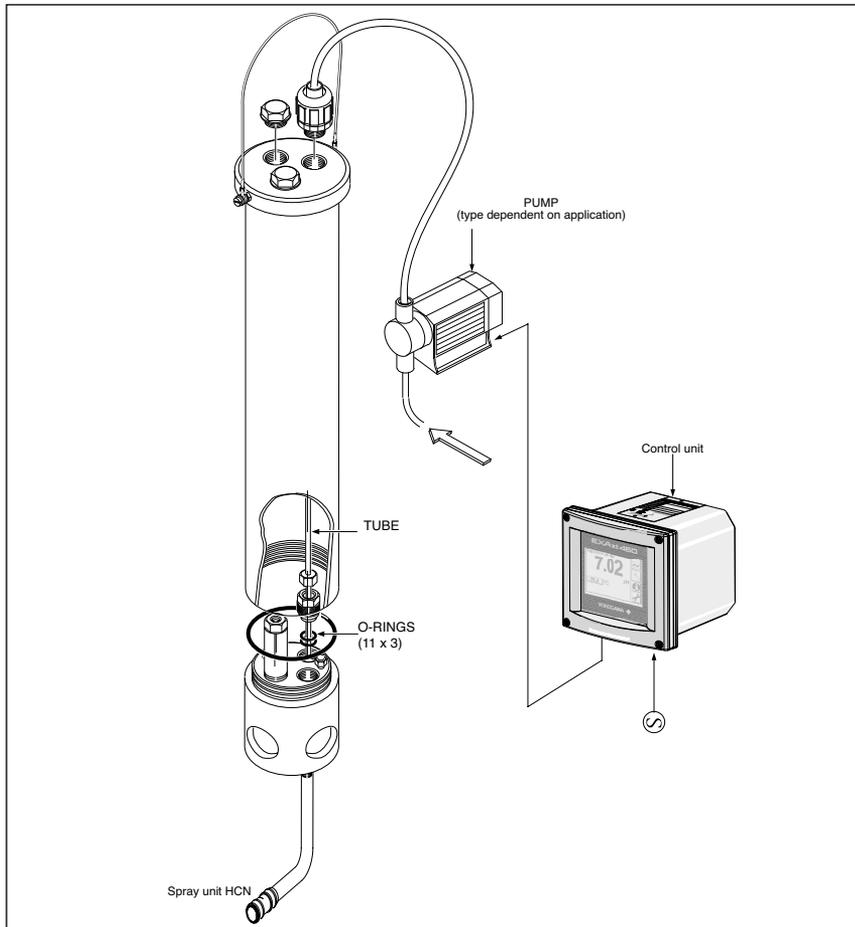


Fig. 4.5 Mounting a spray unit

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4.4 Salt bridge

This reference electrode/salt bridge combination allows the measurement of pH and ORP (Redox) potentials with normal electrodes in those cases when:

- A. excessive contamination of the flow diaphragm is expected. The flow of the reference liquid through the diaphragm is increased by pressurising the container. Consequently, the contamination rate will decrease.
- B. the process to be measured cannot stand contamination with KCl. The salt bridge can be filled with several electrolytes, e.g. KNO₃.
- C. measurement has to be performed at pressures up to 10 bar and temperatures up to 100 °C. As the container with reference liquid can be pressurised.

FLOW TUBE (A)

Material : glass
 Flow diaphragm : ceramic, PTFE or sleeve
 Connector : PPS (Ryton™)

TUBING (B)

Material : nylon
 Diameter : 1/4" o.d.
 Length : 2 mtr.

CONTAINER (C)

Container : PVC, PVC (transparent)
 Mounting set : PPS (Ryton™)
 O-ring : silicone
 Connection : nylon
 Weight : approx. 300 g.
 Mounting : wall mounting (support with hole for screw M5)

Temperature/
 pressure ratio : max. 200 kPa
 (2 bar) at 100°C

Parts and accessories

Order nr.	Description
SB20-VC	Salt bridge with ceramic junction
SB20-VP	Salt bridge with porous PTFE junction
SB20-VS	Salt bridge with glass sleeve junction
K1500DX	5m tubing for SB20
K1500BW	flow tube for SB20-VC
K1500EE	flow tube for SB20-VP
K1500EF	flow tube for SB20-VS

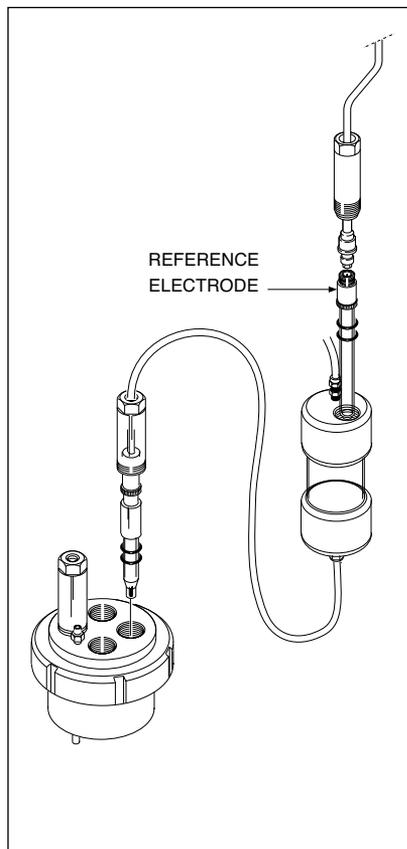


Fig. 4.6 Mounting the salt bridge

Note: The reference electrode must be ordered separately.

4.5 Protection hose installation kit

The protection hose installation kit is for protection of electrode cable and/or tubing between fitting and converter, connecting box, supply unit, etc. The hoses can be mounted directly to the hose connection(s) on top of each fitting. Clamps for fixing are part of the installation kit.

Parts and accessories

Order nr.	Description
K1500CJ	Protection hose kit 5 m
K1500CK	Protection hose kit 10 m



5. Maintenance and Inspection

5.1 Cleaning and fitting

Usually no cleaning is necessary.

5.2 Inspection of the O-ring seal

The O-ring seal used in the wetted parts of the fitting is made of silicone rubber which has superior resistance to corrosion and is suitable for use with most process liquids.

Usually no periodically inspection is necessary. To prevent trouble, replace the O-ring seal periodically, e.g. every year.

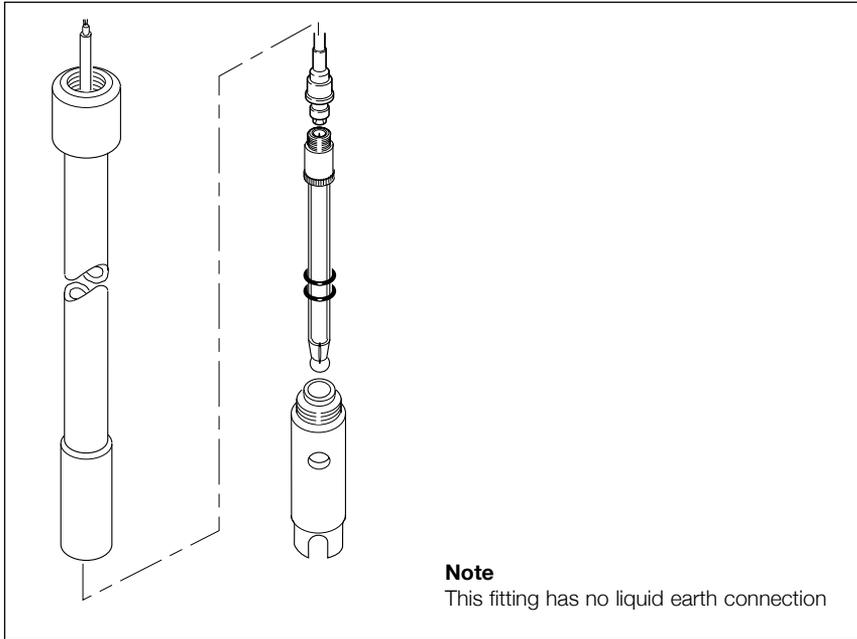
Note: For chemical resistance of the used material refer to General Specifications sheet GS 12B06K02-01E-E.

6. Spare Parts

Order nr.	Description
K1500GR	O-rings (11x3) for electrode mounting (8 pieces)
K1500GU	Set O-rings for 3-hole fitting (PP and PVDF)
K1500FB (viton)	Set O-rings for 3-hole fitting (PP and PVDF)
K1500FA (EPDM)	Set O-rings for 3-hole fitting (PP and PVDF)
K1500GV	Set O-rings for 4-hole fitting (PP and PVDF)
K1500FF (viton)	Set O-rings for 4-hole fitting (PP and PVDF)
K1500GW	Set O-rings for 3-hole fitting (SS)
K1500FD (viton)	Set O-rings for 3-hole fitting (SS)
K1500FC (EPDM)	Set O-rings for 3-hole fitting (SS)
K1500GX	Set O-rings for 4-hole fitting (SS)
K1500FH (viton)	Set O-rings for 4-hole fitting (SS)
K1500FG (EPDM)	Set O-rings for 4-hole fitting (SS)
K1500DQ	10 m protection hose and glands
K1500DP	5,5 m protection hose and glands
FP20-R12	Electrode mounting set (Ryton R4) (1x)
FP20-R12M	Mounting set (Ryton R4) (12x)
FP20-S12	Electrode mounting set (SS)
K1500FV	Liquid earth cable (10 m)
K1500DU	Liquid earth cable (25 m)
K1500FU	KCl-reservoir
WU20-PC01	COAX-cable (1 m) for single electrode
WU20-PC02	COAX-cable (2 m) for single electrode
WU20-PC05	COAX-cable (5,5 m) for single electrode
WU20-PC10	COAX-cable (10 m) for single electrode
WU20-PC15	COAX-cable (15 m) for single electrode
WU20-PC20	COAX-cable (20 m) for single electrode
WU20-PC25	COAX-cable (25 m) for single electrode
WU20-LT01	TRIAX-cable (1 m) for combined electrode
WU20-LT02	TRIAX-cable (2 m) for combined electrode
WU20-LT05	TRIAX-cable (5,5 m) for combined electrode
WU20-LT10	TRIAX-cable (10 m) for combined electrode
WU20-LT15	TRIAX-cable (15 m) for combined electrode
WU20-LT20	TRIAX-cable (20 m) for combined electrode
WU20-LT25	TRIAX-cable (25 m) for combined electrode

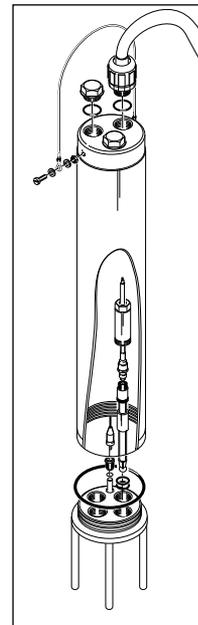
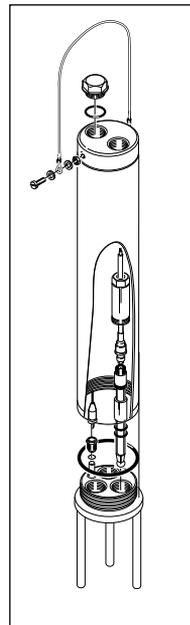
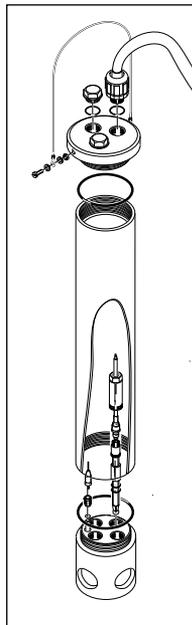
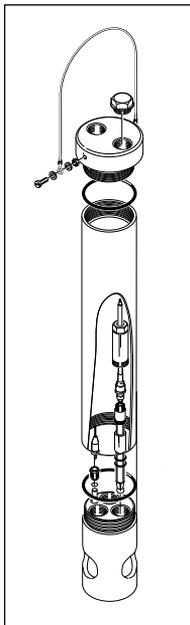


1-Hole PVC



3-Hole PP and PVDF 4-Hole PP and PVDF 3-Hole SS

4-Hole SS



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