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Instruction  
Manual

Model FF20  
Flow fittings

Model FS20  
Subassembly flow fittings

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## 1. Introduction

### 1.1. General

The flow fittings (Model FF20) and their subassemblies (Model FS20) are used to mount sensor tips in a piping system so that the pH and/or the ORP (Redox) potential of the liquid flowing through it can be measured.

The flow fittings are for connection between two pipes of the piping system providing a “flow through” path. From a practical plant aspect (for easy maintenance and calibration) the mounting place is in a by-pass behind a sample valve. They are supplied with a ring to hold calibration dish for this cleaning and/or calibration.

The subassemblies should be cemented or welded direct in the piping system or in a T-piece of it. The subassemblies of stainless steel meet the requirements of DIN 11850 for mounting in sanitary constructions.

### 1.2. Features

- Wide choice of construction materials.
- High degree of standardisation reduces spare holding requirements.
- Direct mounting of sensors with DIN dimensions.
- Liquid earth sensor for stable measurements.
- High pressure and temperature specifications.
- Chemical or brush cleaning (optional in 4-hole fittings).

## 2. Unpacking and checking

### 2.1. Unpacking and inspection

When you receive the flow fitting (Model FF20) or the subassembly flow fitting (Model FS20) it is packed in a cardboard box. Open the box and check that the model code is the same as on the packing list (see §2.5 for the model code). Also check that it is supplied with the options you ordered. These options are delivered in separate bags.

If you have any problems or questions, please contact the nearest Yokogawa service center or sales organization for assistance.

### 2.2 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 sensor(options) have been exposed.

### 2.3 Serial Number definition

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

X<sub>1</sub>X<sub>2</sub>                    Production Location  
 X<sub>3</sub>X<sub>4</sub>                    Year/Month code  
 X<sub>5</sub>X<sub>6</sub>X<sub>7</sub>X<sub>8</sub>X<sub>9</sub>        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

## 2.4. Specificaitons

### 2.4.1. General specifications

#### Materials

- Wetted parts
  - a. body : refer to model code
  - b. O-rings : silicon rubber, FKM (Viton)
  - c. liquid earth sensor  
(not in 1-hole subassembly) : titanium (plastic designs) SS AISI 316 (SS designs)
- Non-wetted parts
  - a. mounting bracket : SS AISI 316 (SS designs) PVC  
(plastic designs)
  - b. electrode mounting sets : Ryton R4
  - c. holder for calibration dish : SS AISI 316
  - d. calibration dish : PP
  - e. retaining nut for electrode holder : SS AISI 304

#### Volume measuring vessel

- 3-hole design : 130 ml
- 4-hole design : 250 ml

**Process connections**  
(fittings only)

: 1/2" NPT or flange LAP-joint (DIN or ANSI).  
See model code.

**Nominal pipe size for mounting subassemblies**

- 1-hole : DN20
- 3-hole : DN50
- 4-hole : DN80

WEIGHT\* : see table:

**Tabel 2.1**

Material	PP	SS	PVC	PVDF
Fitting				
1-hole subassembly		0,2 kg	0,1 kg	
3-hole subassembly		1,2 kg	0,5 kg	
4-hole subassembly		3 kg	1,4 kg	
3-hole fitting	1,1 kg	2,2 kg		1,5 kg
4-hole fitting	1,4 kg	6,5 kg		1,8 kg

\* The accessories are not included.

**2.4.2. Functional specifications**

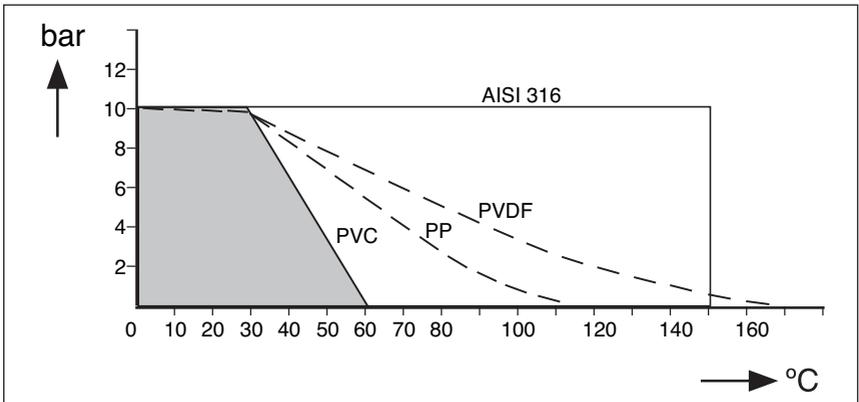
**Temperature**

- min -10 °C
- max depending on material and application (see fig. 2.2)

**Flow rate (fittings only)**

: 0,1 to 10 l/min (depending on applicaiton)

**Pressure**



**Figure 2.2. Pressure/temperature class**

## 2.5. Model and codes

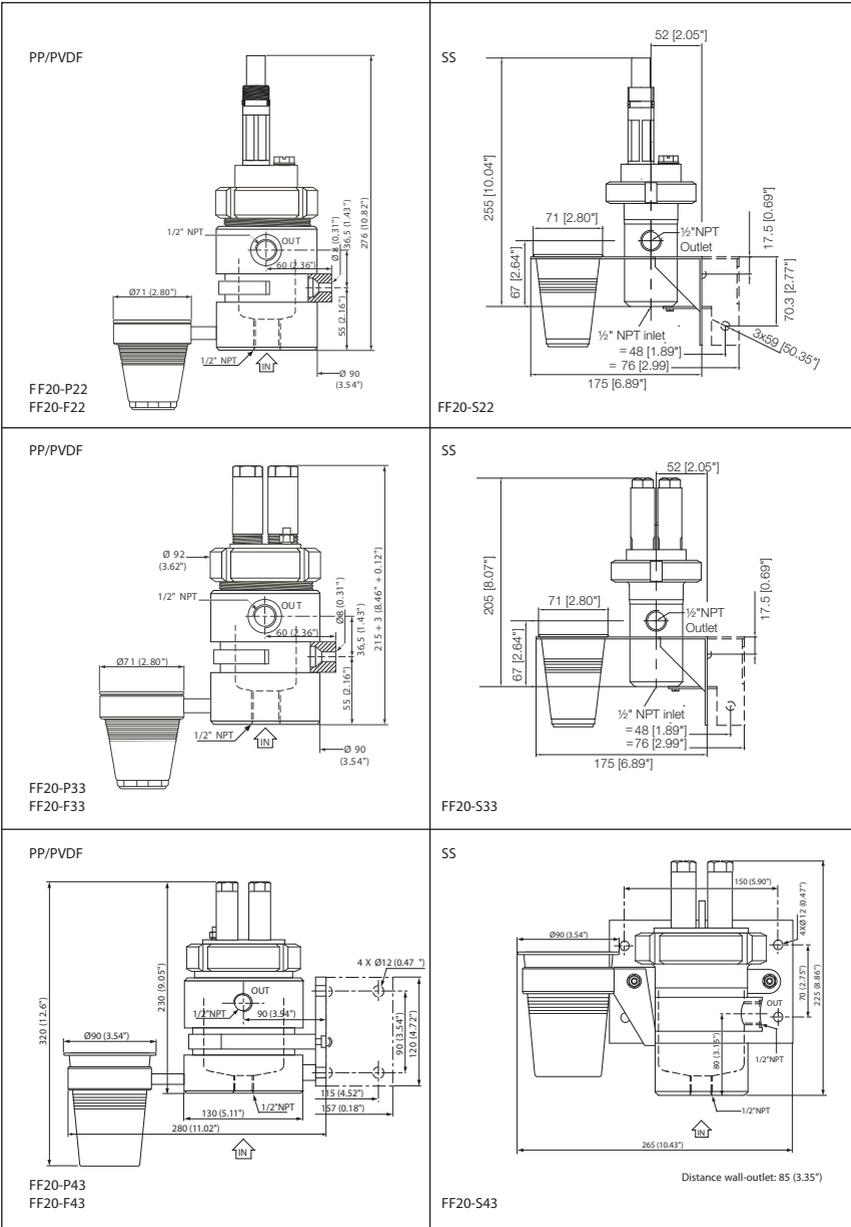
### 2.5.1. Fittings

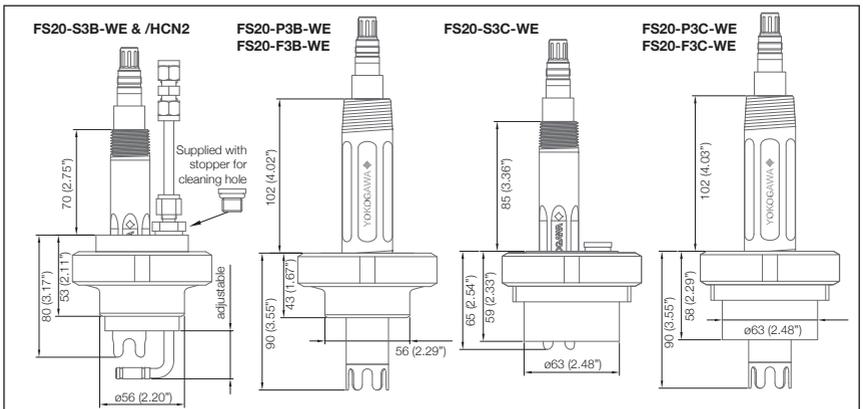
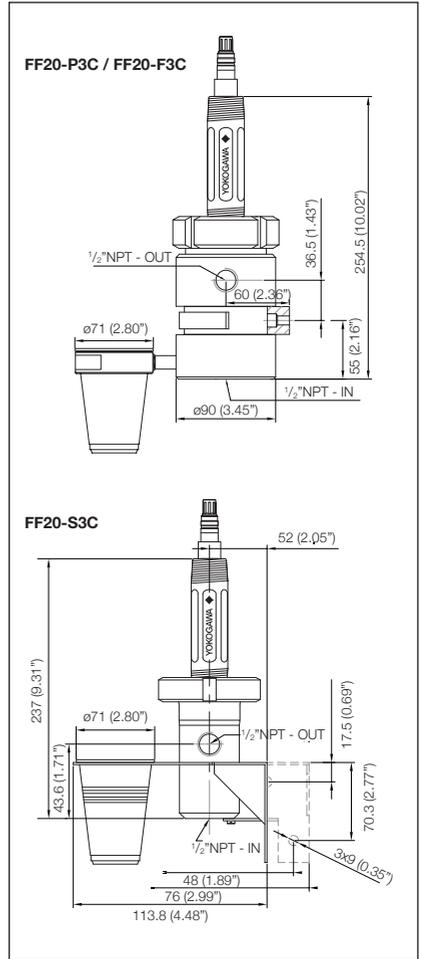
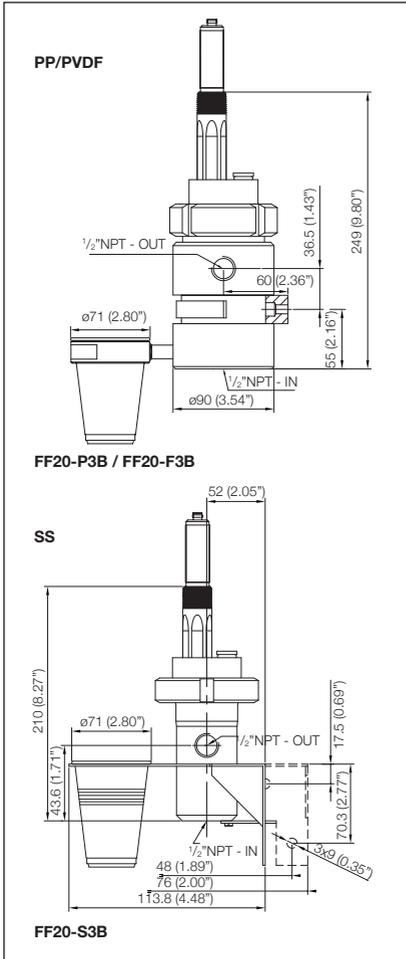
Model	Suffix Code	Option code	Description
FS20			Subassembly (Flow fitting)
Material	-V -P -S -F		Polyvinylchloride (PVC) Polypropylene (PP) Stainless steel AISI 316 (SS) Polyvinylidene fluoride (PVDF)
Number of holes	12 22 32 3B 3C 43		1 electrode mounting holes (only V, S) For PH20, 2 mounting holes 3 electrode mounting holes For FU20, 2 mounting holes (only P, S, F) For FU24, 1 mounting hole (only P, S, F) 4 electrode mounting holes (only V, S)
Mounting	-WE  -TP		Welding end: type, S12, S22,S32, S3B, S3C, S43 Glue for PVC: type V12, V22, V32, V43 Heat welding: type F22, F32, F3B, F3C, P22, P32, P3B, P3C Tapered pipe thread (2"NPT acc. ANSI B.20.1). (for 2 and 3 holes version, and not in case of type V22 and V32)
Options -Cleaning system		/HCN2 /HCN3 /HCN4	FS20- .22 / FS20- .3B FS20- .32 FS20- .43
Options -Mounting kit		/B  /R	For mounting Bellomatic reference electrodes and combined electrodes. For mounting (top) refillable electrodes with long glass shaft.
-KCl-reservoir		/K	Electrolyte tubing (2.5 m) is included.
-Salt bridge		/S	For liquid which cannot stand contamination with KCl.
-Certificate		/M	Material certificate 3.1 according to EN-10-204 (DIN 50-049) (on wetted parts).

### 2.5.2. Subassemblies (flow fittings)

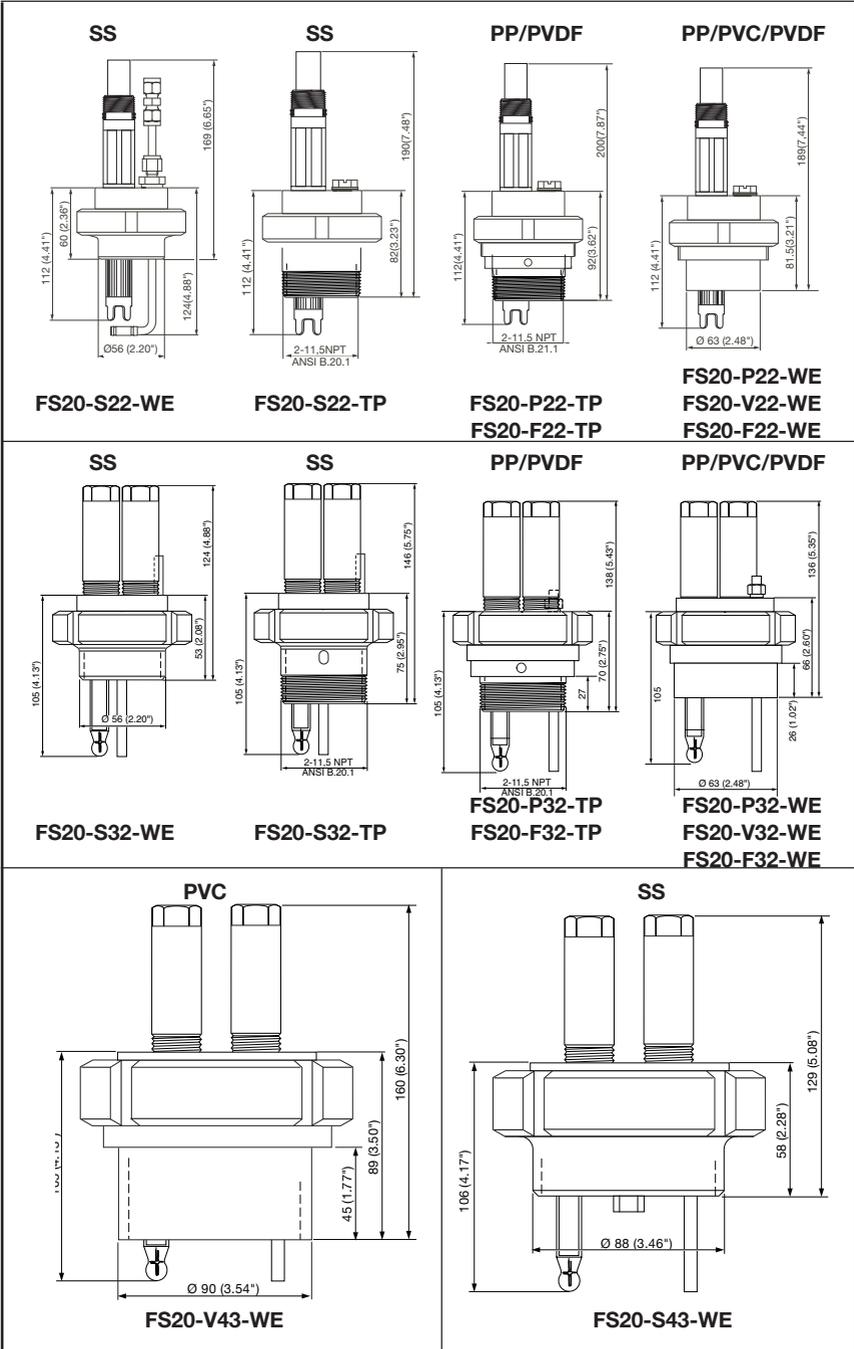
Model	Suffix Code	Option code	Description
FF20			Flow fitting
Material	-P -S -F		Polypropylene (PP) Stainless steel AISI 316 (SS) Polyvinylidene fluoride (PVDF)
Number of holes	22 33 3B 3C 43		For PH20, 2 mounting holes 3 electrode mounting holes For FU20, 2 mounting holes For FU24, 1 mounting hole 4 electrode mounting holes
	*B		Style code B
Options		/HCN2	Cleaning only for FF20-.22 / FF20-.3B / FF20-.4B
-Cleaning system		/HCN3 /HCN4	Cleaning only for FF20-.33 Cleaning only for FF20-.43
Options		/B	For mounting Bellomatic reference electrodes and combined electrodes
-Mounting kit		/R	For mounting (top) refillable electrodes with long glass shaft.
-Flange adapters (NPT ½" male lap joint).		/FP1 /FP2 /FP3 /FP4 /FF1 /FF2 /FF3 /FF4 /FS1 /FS2 /FS3 /FS4	DN15-PN10 PP DN25-PN10 PP ½" 150 lbs PP 1" 150 lbs PP DN15-PN10 PVDF DN25-PN10 PVDF ½" 150 lbs PVDF 1" 150 lbs PVDF DN15-PN10 SS 316 DN25-PN10 SS 316 ½" 150 lbs SS 316 1" 150 lbs SS 316
-KCl-reservoir		/K	Electrolyte tubing (2.5 m) is included.
-Salt bridge		/S	For liquid which cannot stand contamination with KCl.
-Certificate		/M	Mat. certificate 3.1 according to EN-10-024 (DIN 50-049), on SS wetted parts. Not for P3B, P4B, F3B and F4B without /HCN*.

2.6. Dimensions  
2.6.1. Flow Fittings





2.6.2. Subassemblies



## 3. Piping and installation

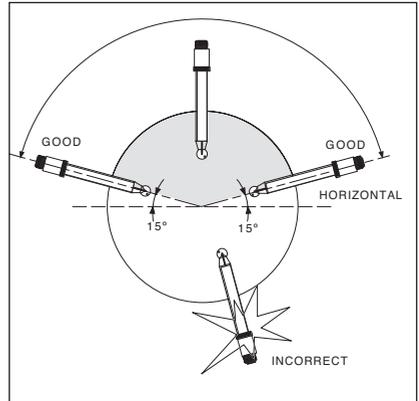
### 3.1. General

It is important that, whatever method of mounting is used, the point of measurement is truly representative of the entire solution. Avoid an area where the measurement varies significantly or the flow can be interrupted (the sensors must always be immersed in the process liquid). The recommended type of fitting or subassembly will depend on pressure, temperature, kind of liquid, pollution, etc. Check whether the specifications of the fitting/subassembly and electrodes fulfil the maximum occurring process conditions. The fitting/subassembly has several options and optional connection possibilities. Check that you received the correct size and type.

#### 3.1.1. Mounting location

The flow fitting or subassembly flow fitting is intended to be used for pH and/or ORP (Redox) measurement. The location should be in a bypass of a piping system behind a sample valve. The angle of the fitting with the horizontal should be less than  $15^\circ$  (see fig. 3.0).

The pressure and temperature ratings of the electrode inside the fitting should be noticed to determine the maximum rating of the measurement point.



**Fig. 3.0**

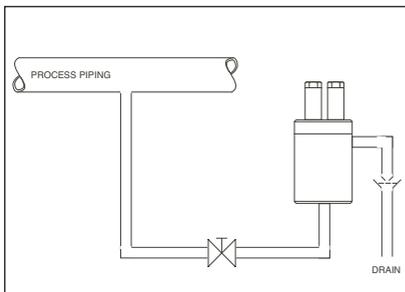
### 3.2. Piping

#### 3.2.1. Mounting in a sample line

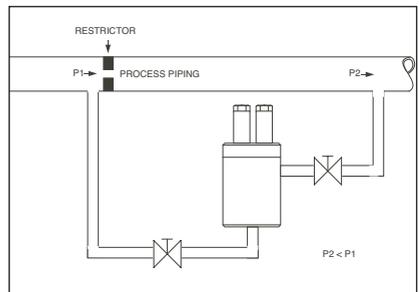
Part of the process liquid is tapped off to the flow fitting or subassembly (see fig. 3.1).

#### 3.2.2. Mounting in a shunt line

By means of restrictor in the main line a small flow of the process liquid is lead through the flow fitting or subassembly via the shunt line (see fig. 3.2). The pressure in the fitting or subassembly is controlled by means of two valves.



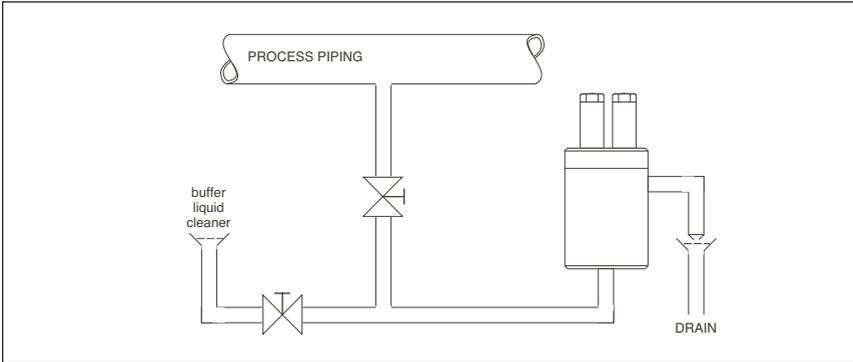
**Figure 3.1**



**Figure 3.2**

### 3.2.3. Mounting in a sample line with extra connection for buffer liquid/cleaner

The sample line has an extra input for cleaning or calibration (see fig. 3.3).



**Figure 3.3**

### 3.3. Installation

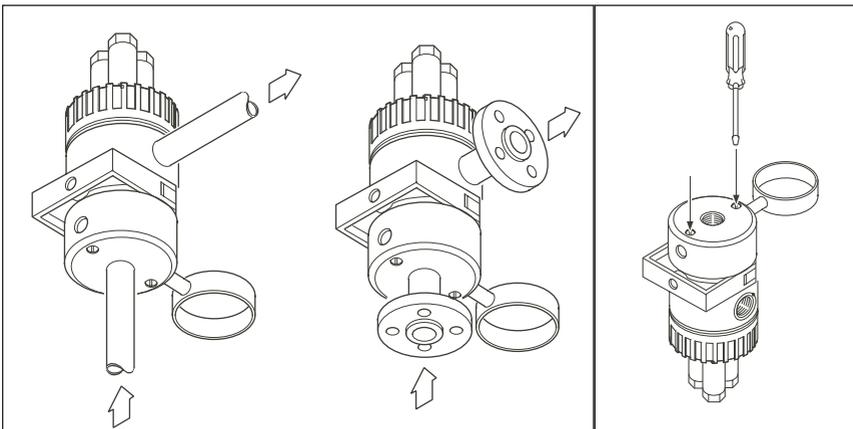
#### 3.3.1. Mounting the fitting

Install the fitting at a convenient location for maintenance and calibration.

Ensure that there is some place at the top of the fitting (approx. 20 cm) for mounting or replacing the electrodes.

Mounting the fitting in a piping system is shown in fig. 3.4.

Refer to §2.6 for dimensional drawings.



**Figure 3.4**

**Figure 3.5**

NOTE: The process connection (liquid outlet) can be turned from right to left.

1. The plastic fittings have locking screws for the holder of the calibration dish (see fig. 3.5). These screws must be loosened before turning.
2. The liquid outlet of the stainless steel fittings can be turned after loosening from the mounting bracket (see exploded view at the end of this manual).

### 3.3.2. Mounting the subassembly

The subassembly can be cemented or welded directly in a piping system or in a T-piece of it. Install the subassembly at a convenient location for maintenance and calibration. Ensure that there is some place at the top of the fitting (approx. 20 cm) for mounting or replacing electrodes.

Fig. 3.6 shows some mounting examples. Select the mounting position so that the sensors are immersed in the process liquid during measurement.

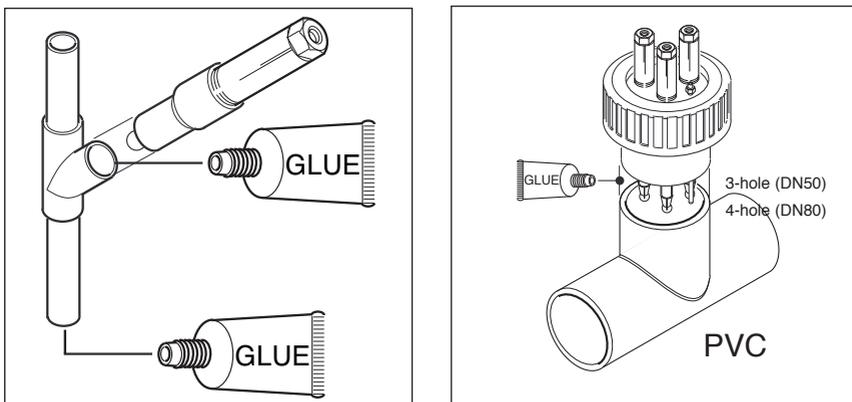


Figure 3.6

### 3.4. Sensor mounting

#### 3.4.1. General

For stable measurement the glass- and the reference electrode should be mounted in the holes nearest to the earth connection.

When mounting sensors of Yokogawa in a fitting or subassembly the electrode cables (Model WU20) should be used (see fig. 3.7).

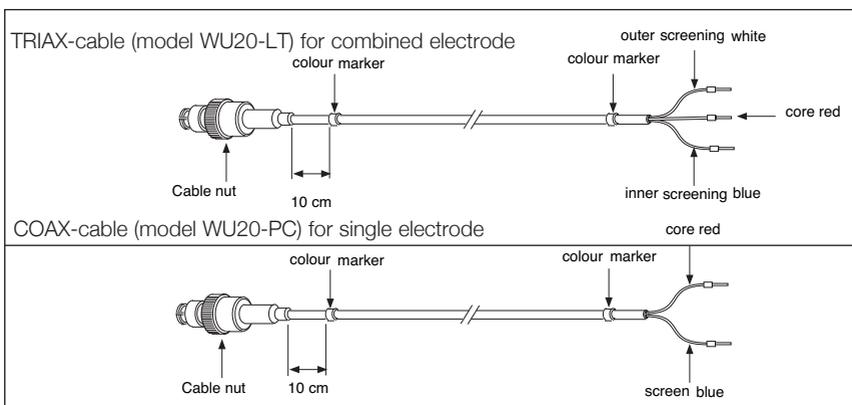


Figure 3.7

**3.4.2. Mounting in a 1-hole design**

Unscrew the electrode mounting set and fix the cable and electrode as shown in fig. 3.8.

**3.4.3. Mounting in a 3- and 4-hole design**

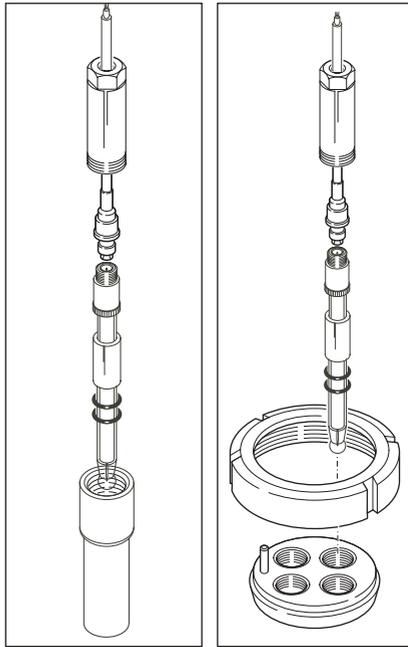
Unscrew the nut from the top end of the fitting or subassembly. Fix the electrodes and cables as shown in fig. 3.9.

Note: In the holes for placing the electrodes are blanking plugs (stoppers). These plugs can be placed in unused holes after pushing the two O-rings over the bottom end.

**Attention**

To prevent fouling of the contact new Yokogawa electrodes are delivered with a cap. It is recommended to remove the cap just before fixing the cable.

ENSURE THAT THERE IS NO MOISTURE OR DUST IN THE PLUG



**Figure 3.8**

**Figure 3.9**

**4. Accessoires**

**4.1. General**

For mounting the non-DIN sized sensors in the fittings and subassemblies Yokogawa added a range of accessories to the program of fittings which can be indispensable tools for optional measuring tools (the specifications of the accessories are on separate sheets, see GS 12B6J1-E-E).

See the chapters below for mounting the accessories.

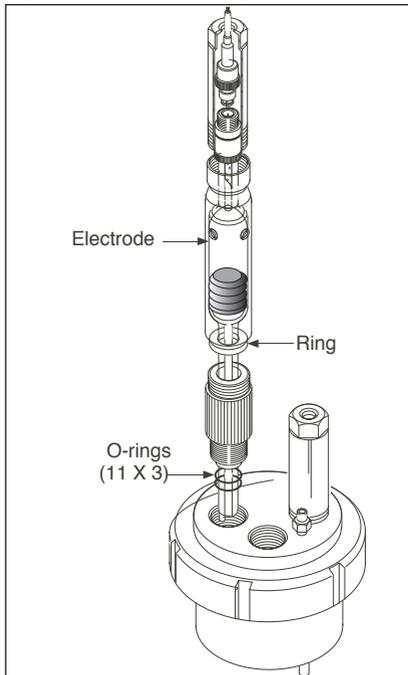
**4.2. Mounting kit for BELLOMATIC electrodes (Model FP20-S13)**

Using this mounting kit a BELLOMATIC electrode of Yokogawa can be fixed in a fitting or subassembly (see fig. 4.1).

**Recommended electrode\***

TYPE	DESCRIPTION
SR20-AC32	Reference electrode

\* For specifications of the electrodes see GS 12B6J1



**Figure 4.1**

## Parts and Accessoires

Order NR.	Description
K1500HC	Set rubber ring (10x)
K1500GE	Set O-rings (5x) for BELLOMATIC electrode
K1500GF	250 ml KCl-solution (1 m.)
K1520VA	250 ml KCl-solution (3,3 m.)
K1500GG	250 ml KCl-solution (1 m.) thickend
K1520VN	250 ml KCl-solution, (3,3 m.) thickend

### 4.3. Mounting kit for refillable ref. electrodes

This mounting kit replaces the standard electrode mounting set so that electrodes of Yokogawa with a long glass shaft can be fixed in the fitting or subassembly (see fig. 4.2). This mounting kit may be used as process pressure up to 3 bar. Higher pressure ratings require the standard mounting set for electrodes with DIN dimensions or, alternately a salt bridge (see §4.5). The refillable electrodes can be connected to a KCl-reservoir via a silicone tubing (see fig. 4.2). The pressure on the KCl-solution and consequently, the liquid outlet can be increased by mounting the reservoir above the fitting or subassembly. This prevents penetration of the process liquid into the electrode.

**Note:** The pressure on the KCl-solution must exceed the liquid pressure.

In §7 you will find the spareparts

### 4.4. Cleaning systems

#### 4.4.1. General

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

Three different types of cleaning systems are available:

- mechanical cleaning (electrically or mechanically driven) (see fig. 4.3)
- chemical cleaning

Detailed specifications of the cleaning systems are on separate sheets (see GS 12B6V1-E-E).

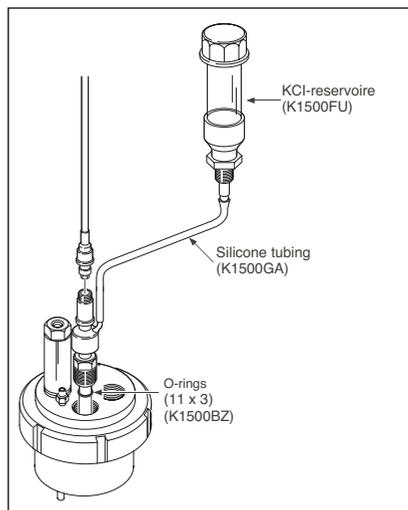


Figure 4.2

brush cleaning



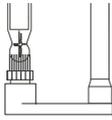
Figure 4.3

chemical cleaning



Figure 4.4

**4.4.2. Selection criteria**

Cleaning system	mechanical	chemical		
				
Applications:	brush	acid	base	emulsifier
oils fats				x
resins (wood, pulp)			x	
emulsions of latex	x			
fibers (paper, textile)	x			
crystalline precipitations (carbonates)	x	xx		
amorpheus precipitations	x	xx		

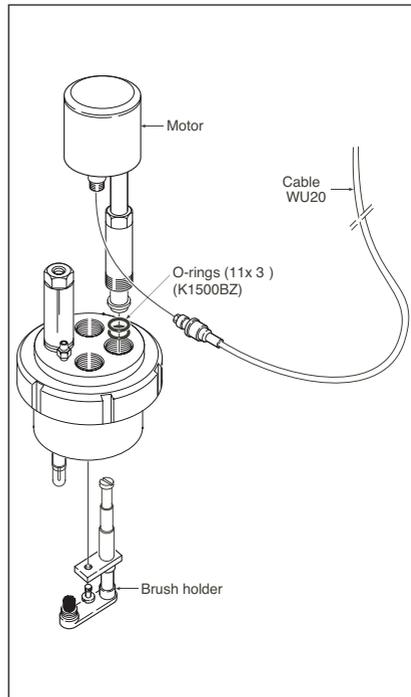
**4.4.3. Mechanical cleaning**

The brush of this cleaning system periodically strikes along the sensitive glass membrane of the electrode, so that this part is wiped frequently preventing sediment formation on it. Electrically or pneumatically versions are available.

Electrically driven brush cleaning (Model FC20-VE). Figure 4.5 shows the mounting.

**Parts and Accessoires**

Part no.	Description
WU20-PC	Cable (to be used as a supply cable for the motor)
K1520NG	Brush holder
K1520NB	Brush
K1520NF	Motor unit



**Figure 4.5**

#### 4.4.4. Pneumatically driven brush cleaning (Model FC20-VP)

##### Parts and Accessoires

Part no.	Description
K1520NA	Tubing (ø4 mm)
K1520NG	Brush holder
K1520NB	Brush
K1520NH	Piston
K1520NJ	Control unit

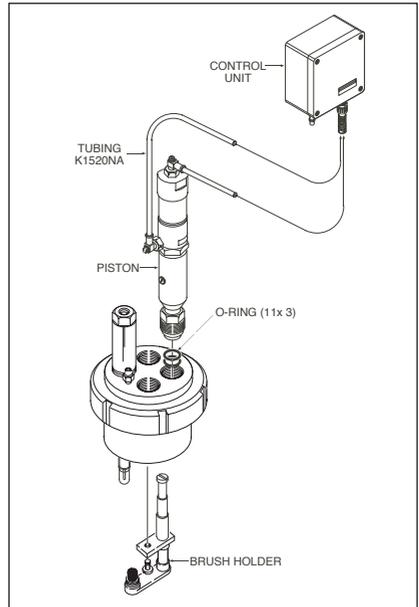


Figure 4.6 Example FC20-VP

#### 4.4.5. Chemical cleaning HCN.

The chemical cleaning system is effective in processes where deposits can be removed by a suitable solvent. Good cleaning effects can be obtained from periodically spraying of an electrode. EXA has a built-in wash timer with programmable washtime, interval time and relaxation time for automatic cleaning of the electrodes, preventing pollution of the pH sensitive parts. After washing, it is possible to check the response time of the electrodes. A built-in (no return) nozzle in the spray unit prevents penetration of the process liquid in the cleaning system. The standardised dimensions allow mounting in all flow -insertion- and immersion fittings of Yokogawa as well as back-end mounting on the 4-in-one pH/Redox electrodes, like FU20.

##### Features

- The EXA analyzer has a built-in timer and HOLD circuit.
- Built-in (no return) nozzle to prevent penetration of the process liquid into the cleaning system.

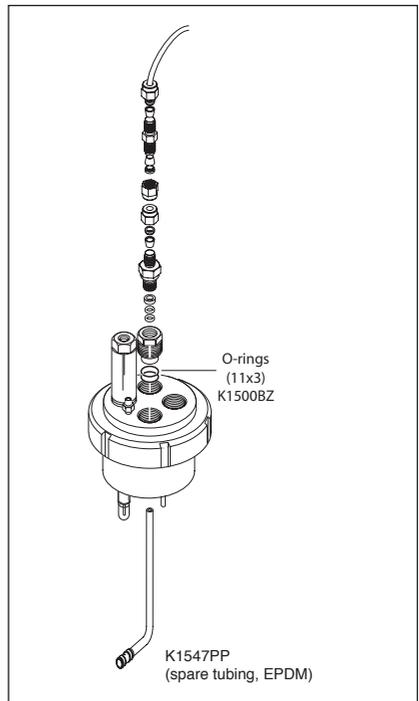


Figure 4-7 Example HCN4

## Specifications

### Materials

Nozzle	: Hastelloy
O-rings	: EPDM rubber
Mounting set	: Stainless steel
Tubing	: 1/4" (OD Ø) Nylon tubing
Process cond.	: Max. 1 MPa (10 bar) at 100 °C

### Mounting

K1547PA	: / <b>HCN2</b> , 2-hole flow-, insertion fitting (PH20)
K1547PA	: / <b>HCN3</b> , 3-hole flow-, insertion-, immersion fitting
K1547PB	: / <b>HCN4</b> , 4-hole flow-, insertion-, immersion fitting
K1547PJ	: / <b>HCNF</b> , back-end mounting on FU20/PH20

## 4.5. Salt bridge

### (Model SB20-VP, VC and VS)

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

- excessive contamination of the ceramic 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.
- the process to be measured cannot stand the contamination with KCl
  - the salt bridge can be filled with several electrolytes.
- measurements have to be performed at pressures up to 10 bar and temperatures up to 100 °C
  - the container with reference liquid can be pressurised.

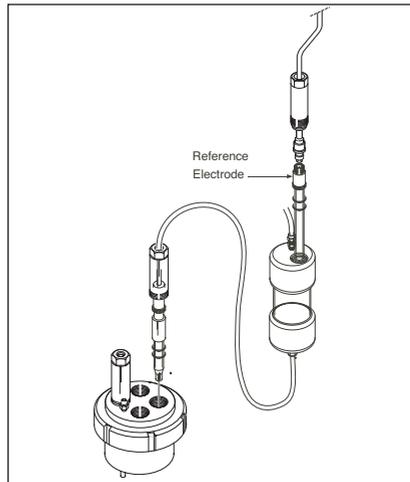


Figure 4.8

### FLOW TUBE (A)

Material	: glass
Flow diaphragm	: ceramic, PTFE or sleeve
Connector	: Ryton R4

### TUBING (B)

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

### CONTAINER (C)

Container	: PVC, PVC (transparent)
Electrode mounting set	: Ryton R4
"O" ring	: silicone

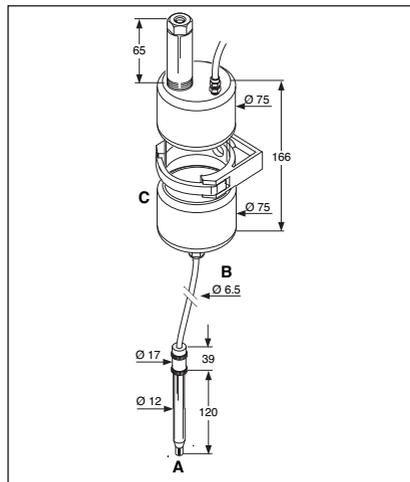


Figure 4.9

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

**Notes:**

1. The dimensions of the flow tube equal to those of standard electrodes
2. The standard reference electrodes can be mounted in the container
3. To observe the electrolyte level, the container is made of PVC.

For mounting instructions see fig. 4.9

**Parts and Accessoires**

Part no.	Description
K1500BW	Flow tube with ceramic diaphragm
K1500EE	Flow tube with PTFE diaphragm
K1500EF	Flow tube with sleeve diaphragm
K1520VA	Electrolyte 3.3M KCl (250 ml)
K1520VN	Thickened electrolyte 3.3M KCl (250 ml)
K1500GF	Electrolyte 1M KCl (250 ml)
K1500GG	Thickened electrolyte 1M KCl (250 ml)

## 5. Maintenance

### 5.1 General

Before the electrodes can be serviced, the electrode holder should be physically separated from the process. The fittings can be changed from the measuring position in the maintenance position by following the reversed procedures described in §3.

### 5.2. Cleaning

#### Cleaning the fitting

When process liquid contains slurry which intends to settle in the fitting regularly, the electrode holder must be removed for cleaning.

#### Cleaning the electrodes

When the sensitivity of the electrode has decreased or the response has slowed down, the electrode should be cleaned. The .33 and .44 hole fittings are provided with a calibration ring with a set of beakers. The electrode holder complete with electrodes and liquid earth sensor can be placed on the ring for cleaning.

If cleaning with hot water is not sufficient, more aggressive water based agents should be used.

- Deposits of limes, hydroxides or carbonates can be removed by immersing the electrode in a solution containing diluted hydrochloric acid. Afterwards rinse the electrode with water.
- Deposits of oil and fat can be removed with hot water in conjunction with a detergent. When the results are unsatisfactory a mild (carbonate based) abrasive can be used.
- Protein (albuminous) deposits should be removed with a protein enzymatic solution. For instance a solution containing 8.5 ml concentrated hydrochloric acid and 10 gr pepsin in 1 litre water.

**Attention**

Avoid using non-polar solvents like tri-chloro ethylene, toluene or hexane. Even cleaning with ethanol or acetone is not recommended. These solvents will break up the gel-layer on the glass bulb and afterwards needs to remain soaked in water for at least 12 hours before functioning normal. The PTFE diaphragm of the combined electrode can sometimes be regenerated by putting it in hot (60 to 80 °C) 1 molar Potassium chloride (KCl) solution and letting it cool to room temperature. After cleaning the probe is re-inserted into the process by following the reverse procedure (see §3.5).

**5.3. Calibration**

It is recommended to start calibration with clean electrodes. Always calibrate new electrodes. With the electrodes connected to the transmitter a calibration can take place. Check the appropriate chapters in the instruction manual of the pH transmitter for details.

*General procedure for calibration*

To calibrate a pH transmitter two buffer solutions with known pH value are required. It is recommended that one buffer solution has a value near pH 7.

Depending on the liquid to be measured the second buffer solution should either be in the acidic or base area. Normally the buffers pH 4.01 or 9.22 are used.

*Generally the procedure for calibration is as follows:*

- Clean the electrodes
- Rinse the electrodes
- Immerse the electrodes in the first buffer solution (pH 7)
- Adjust the asymmetry setting of the transmitter for reading a known value
- Rinse the electrodes
- Immerse the electrodes in the second buffer (pH 4 or pH 9)
- Adjust the slope setting of the transmitter for reading a known value
- Rinse the electrodes.

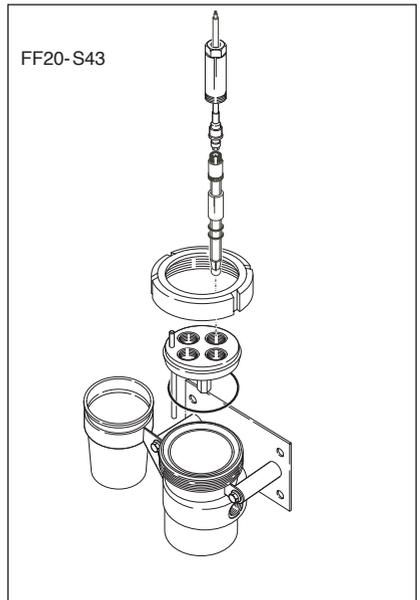
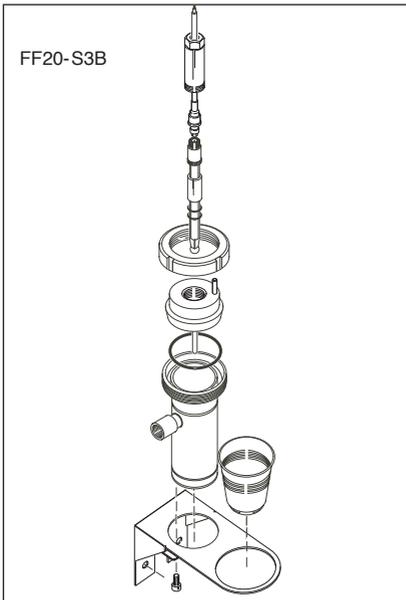
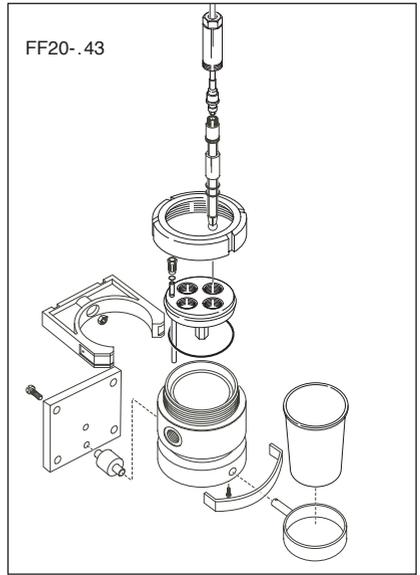
During calibration the temperature compensation should be active. It is advised to calibrate with buffer solutions at a temperature near the process temperature.

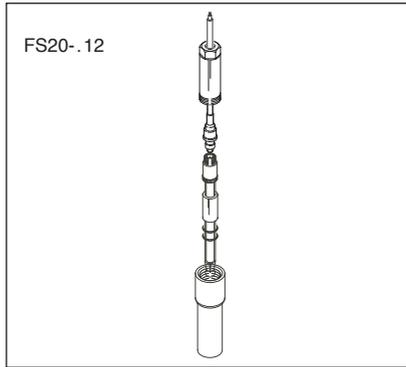
**5.4. Replacing the O-rings**

The exploded view (see §6) shows the position of the sealing O-rings. The O-rings used in the wetted part are made of silicone rubber, which has superior resistance to corrosion suitable for use with most process liquids.

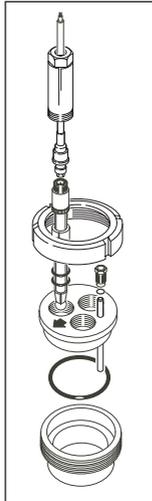
Usually no periodical inspection is necessary. To prevent trouble, replace the O-ring seal periodically, e.g. every year.

### 6. Exploded view

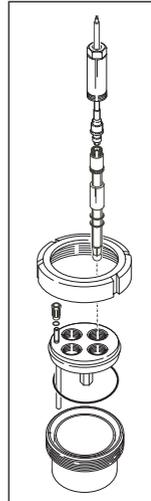




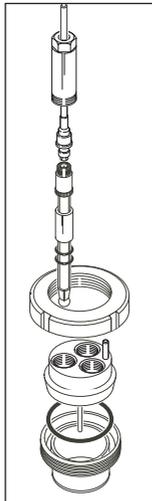
FS20-.32



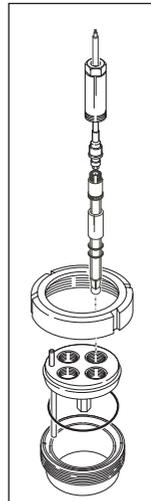
FS20-.43



FS20-S32



FS20-S43



## 7. Spare Parts

### Accessoires

Part no.	Description
K1500FU	KCl reservoir PVC for F*20
SB20	Salt bridge
K1500BX	Grommet for watertight cable input in PG 16 gland (3 electrodes cables and liquid earth cable)
K1500BY	Mounting kit for (top) refillable electrodes
K1547PA	Complete hastelloy cleaning system /HCN2 and /HCN3
K1547PB	Complete hastelloy cleaning system /HCN4
K1521AD	Flange adapter /FS3
K1521AE	Flange adapter /FF3
K1521AF	Flange adapter /FP3
K1521AG	Flange adapter /FS4
K1521AH	Flange adapter /FF4
K1521AJ	Flange adapter /FP4
K1521AK	Flange adapter /FS1
K1521AL	Flange adapter /FF1
K1521AM	Flange adapter /FP1
K1521AN	Flange adapter /FS2
K1521AP	Flange adapter /FF2
K1521AQ	Flange adapter /FP2

### Consumable Parts

Part no.	Description
K1520BA	Buffer Solution Starters Kit: (3x 500 ml) Solutions pH 4.01 / 6.87 / 9.18
K1520BB	Buffer Solution (3x 500 ml) pH 1.68
K1520BC	Buffer Solution (3x 500 ml) pH 4.01
K1520BD	Buffer Solution (3x 500 ml) pH 6.87
K1520BE	Buffer Solution (3x 500 ml) pH 9.18
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

### Cables

Part no.	Description
K1500FV	Liquid earth cable (10 m)
K1500DU	Liquid earth cable (25 m)
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-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

## Spare parts FF20 / FS20

Part no.	Description
K1500BV	O-rings EPDM 11x3 (6 Pcs.)
K1500BW	Flow tube for SB20-VC
K1500BY	Option /R for F*20.. (82850747)
K1500BZ	O-rings Viton 11x3 (6Pcs)51250
K1500DU	Liquid earth cable 25m
K1500DW	Set of 12 cable nuts for WU20
K1500DX	5 m tubing for SB20
K1500DZ	Nut SS, FF/S20-3* + ISC40FF/S
K1500EK	O-rings viton 6.07x1.78 (5x2)
K1500EQ	O-ring set EPDM FF20-S22
K1500ER	O-ring set Viton FF20-S22
K1500ES	O-ring set EPDM FF20-P&F33/3B
K1500ET	O-ring set Viton FF20-P&F33/3B
K1500EU	O-ring set EPDM FF20-S33/S3B
K1500EV	O-ring set Viton FF20-S33/S3B
K1500EW	O-ring set EPDM FF20-P&F43/4B
K1500EX	O-ring set Viton FF20-P&F43/4B
K1500EY	O-ring set EPDM FF20-S43/S4B
K1500EZ	O-ring set Viton FF20-S43/S4B
K1500FK	O-ring set Viton FF20P&F22
K1500FL	O-ring set standard FF20P&F22
K1500FM	O-ring set FF20-S22
K1500FU	KCl reservoir PVC for F*20
K1500FV	Liquid earth cable 10m
K1500GA	5 m tube for KCl reservoir
K1500GN	O-ring set silicon FF/FS20 3-hole/3B SS
K1500GP	O-ring set std FF/FS20 3-hole/3B P/F
K1500GR	O-rings silicon 11x3 8pcs
K1500GT	O-ring set silicon. FF20-.4.
K1500GZ	Earthpin assy for F*20 non-S
K1500HA	Calibr. dish for FF20-*33 (50)
K1500HB	Calibr. dish for FF20-*43 (50)
K1500HD	O-rings silicon 11x3 50pcs
K1511DP	O-rings viton 21.9x2.62 (5x2) PH20
K1520CE	Spare 3-hole holder PP
K1520CF	Spare 3-hole holder PVDF
K1521AD	Flange adapter /FS3
K1521AE	Flange adapter /FF3
K1521AF	Flange adapter /FP3
K1521AG	Flange adapter /FS4
K1521AH	Flange adapter /FF4
K1521AJ	Flange adapter /FP4
K1521AK	Flange adapter /FS1
K1521AL	Flange adapter /FF1

<b>Part no.</b>	<b>Description</b>
K1521AM	Flange adapter /FP1
K1521AN	Flange adapter /FS2
K1521AP	Flange adapter /FF2
K1521AQ	Flange adapter /FP2
K1521JA	Holder for FU24(F) in FF20-S3* (SS)
K1521JB	Holder for FU24(F) in FF20-F3* (PVDF)
K1521JD	Holder for FU20(F) in FF20-S3* (SS)
K1521JE	Holder for FU20(F) in FF20-F3* (PVDF)
K1521JF	Holder for FU20(F) in FF20-P3* (PP)
K1521JG	Holder for FU20(F) in FF20-S4* (SS)
K1521JH	Holder for FU20(F) in FF20-F4* (PVDF)
K1521JJ	Holder for FU20(F) in FF20-P4* (PP)
K1547PA	Hast. cleaning unit HCN2/3
K1547PB	Hast. cleaning unit HCN4
K1547PF	Nozzle and mounting HCN2/3/F
K1547PG	Nozzle and mounting HCN4
K1547PH	10 m Nylon Tube and mounting
K1547PP	Spare Part EPDM spraying valves

**YOKOGAWA ELECTRIC CORPORATION****World Headquarters**

9-32, Nakacho 2-chome, Musashino-shi  
Tokyo 180-8750  
Japan  
[www.yokogawa.com](http://www.yokogawa.com)

**YOKOGAWA CORPORATION OF AMERICA**

2 Dart Road  
Newman GA 30265  
USA  
[www.yokogawa.com/us](http://www.yokogawa.com/us)

**YOKOGAWA EUROPE BV**

Euroweg 2  
3825 HD AMERSFOORT  
The Netherlands  
[www.yokogawa.com/eu](http://www.yokogawa.com/eu)

**YOKOGAWA ELECTRIC ASIA Pte. LTD.**

5 Bedok South Road  
Singapore 469270  
Singapore  
[www.yokogawa.com/sg](http://www.yokogawa.com/sg)

**YOKOGAWA CHINA CO. LTD.**

3F Tower D Cartelo Crocodile Building  
No.568 West Tianshan Road Changing District  
Shanghai, China  
[www.yokogawa.com/cn](http://www.yokogawa.com/cn)

**YOKOGAWA MIDDLE EAST B.S.C.(c)**

P.O. Box 10070, Manama  
Building 577, Road 2516, Busaiten 225  
Muharraq, Bahrain  
[www.yokogawa.com/bh](http://www.yokogawa.com/bh)

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