

# General Specifications

## Model FU20 Widebody type pH/ORP sensor

### GS 12B06J03-00EN-P

A family of the wide body sensor is available for application in a wide variety of processes. The sensors share the same valuable features:

- Long life saturated Ag/AgCl reference system.
- PTFE reference diaphragm to prevent fouling and reduced measurement error.
- Double junction combined with ion-trap to prolong the life of the reference probe, even in chemically unfavorable environments.
- Integral Pt1000 element for accurate temperature measurements.
- Platinum ORP/LE electrode for accurate simultaneous pH and ORP measurements.
- Polymerized electrolyte to extend the sensors life time.
- Versatile in-line, immersion or off-line installation.
- Any angle of installation including upside down mounting for all VP/VS models

The FU20 combination sensor shows how Yokogawa applies the motto "Simply the Best" to sensor technology. The wide body sensors (26 mm diameter) hold four separate measuring elements in one unbreakable and chemical resistant PPS 40GF body. Installation is simple with the integrated industrial 3/4" tapered thread. Temperature fluctuations are compensated to extend the sensor life. The FU20 is targeted at those applications where simplicity will result in accurate and reliable pH- or redox measurements. This means that in 90% of the known applications, this sensor will be an excellent choice. In general purpose applications running at constant pressure and temperature the FU20 sensor has proven its use for years. In the standard configuration the wide body sensors hold four separate measuring elements in one unbreakable body made of PPS 40GF. This sensor offers a cost effective and rigid solution to the users. In strong acidic applications and in cases where the chemical compatibility of PPS does not address the process needs, the FTD version made in a PVDF body offers the required solution. The additional chemical compatibility offered by the PVDF version addresses the needs in several applications.

The FU20 widebody type pH/ORP sensors are available with VP connector. This makes installation a lot easier. All sensors are delivered with a Quality Certificate.

In addition to our analogue sensors Yokogawa delivers a platform consisting of so called SMART sensors in combination with the SENCOM SMART adapter SA11. In the SENCOM platform digital functionality allows:

- Perform off-line calibration reducing process impact.
- Enable easier asset management
- Enable easier statistical process control
- Easier monitoring of extreme conditions during use.

For additional information about SENCOM and its benefits request you to check the applicable GS-document number GS 12A06S01-01Z1. This document is available from our website and through our regional offices.



## ■ 1. General Specification FU20

### 1.1 Measuring elements

Sensor type	: pH glass electrode
Reference system	: Silver Chloride reference
Electrode type	: Solid Platinum electrode
Temperature sensor	: Pt1000 temperature sensor

### 1.2 Construction materials

#### Wetted parts

Sensor body	: NPT, FSM, PPS GF40: FTD, PVDF- (GF25+TZ24)
Earthing pin	: Solid Platinum
Measuring sensor	: G-glass
LE glass tube	: AR-glass
O-ring	: Viton-FTS and FSM,FTD and NPT
Reference junction	: Porous PTFE

### 1.3 Functional specifications (at 25°C)

Isothermal point	: pH 7
Reference system	: Ag/AgCl with saturated KCl
Glass impedance	
- Dome shape	: nominal 200MΩ
- Flat Surface	: nominal 700MΩ
Junction resistance	: < 10 kΩ
Temperature element	: Pt1000 to IEC 751
Asymmetry potential	: 8 ± 15 mV
Linearity PH (Slope)	: > 96 % (of theoretical value)

### 1.4 Dynamic specifications (at 25°C)

Response time pH step (7 to 4)	: < 15 sec for 90%
Response time temp step (10°C)	: < 1 min for 90%
- Dome shape	: < 4 min for 90%
- Flat Surface Stabilization time (0.02 pH unit/10 s)	: < 2 minutes

### 1.5 Operating range

pH	: 0 to 14
ORP	: -1500 to 1500 mV
rH	: 0 to 100
Temperature	
- Dome shape	: -10°C to 105°C (14°F to 221°F)
- Flat surface	: 15°C to 105°C (59°F to 221°F)
Pressure	: (See Figure 1)
Conductivity	: > 50 μS/cm

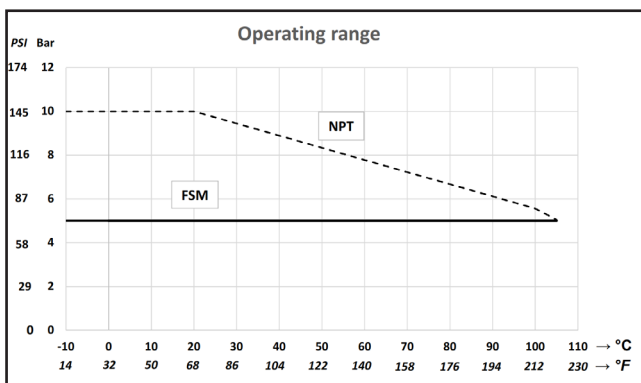


Figure 1: Pressure and temperature range for FU20

### 1.5 Environmental conditions

Storage temp.	: -15 to 50 °C (5 to 122 °F)
Ingress Protection	: IP67

Note: The pH operating range at room temperature is 0-14pH, but at high temperatures the lifetime will be seriously shortened outside 2-12 pH range.

Note: For detailed information about SENCOM sensors refer to current edition of GS12B03J04.

Note: The upper process temperature for the intrinsically safe version is limited by the ambient temperature (Tamb.) defined for each temperature class (T3, T4, T5 and T6)

Table 1: Regulatory compliance

Item	Description, Approval, Certification
LVD <sup>1</sup>	<ul style="list-style-type: none"> <li>ANSI/ISA 61010-1</li> <li>CAN/CSA C22.2 No. 61010-1</li> </ul>
RoHS	<p>EU Directive 2011/65/EU and Commission Delegated Directive (EU) 2015/863 amending Annex II, applying Annex IV as regards the application of the sensors, detectors and electrodes per</p> <ul style="list-style-type: none"> <li>EN-IEC 63000</li> </ul>
PED	EU Directive 2011/68/EU applying Article 4.3: Sound Engineering Practice.
WEEE	<p>EU directive 2012/19/EU</p> <p>This sensor is intended to be sold and used only as a part of equipment which is excluded from the WEEE directive, such as large-scale stationary industrial tools, a large-scale fixed installation etc., and therefore it is in principle fully compliant with WEEE directive.</p> <p>The sensor should be disposed in accordance with applicable national legislations/regulations respectively.</p>
ATEX (EU)	<p>EU Directive 2014/34/EU</p> <p>ATEX approval: DEKRA 11ATEX0014 X ~<sub>0344</sub> 0 II 1 G Ex ia IIC T3...T6 Ga</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>EN IEC 60079-0</li> <li>EN 60079-11</li> </ul>
IECEX	<p>IECEX approval: IECEX DEK 11.0064X</p> <p>Ex ia IIC T3...T6 Ga</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>IEC 60079-0</li> <li>IEC 60079-11</li> </ul>
FM (Canada)	<p>FM approval Canada: FM20CA0062X</p> <p>IS SI CL I, DIV 1, GP ABCD, T3...T6 CL I, ZN 0, Ex ia IIC, T3...T6 Ga</p> <p>Control Drawing: D&amp;E 2020-023-A51</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>CAN/CSA-C22.2 No. 60079-0</li> <li>CAN/CSA-C22.2 No. 60079-11</li> <li>CAN/CSA-C22.2 No. 61010-1</li> </ul>

Item	Description, Approval, Certification
FM (United States)	<p>FM approval United States: FM20US0123X</p> <p>IS CL I, DIV 1, GP ABCD, T3...T6 CL I, ZN 0, AEx ia IIC, T3...T6 Ga</p> <p>Control Drawing: D&amp;E 2020-023-A50</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>FM Class 3600</li> <li>FM Class 3610</li> <li>ANSI/ISA 60079-0</li> <li>ANSI/ISA 60079-11</li> <li>ANSI/ISA 61010-1</li> </ul>
NEPSI (China)	<p>NEPSI approval: GYJ21.2891X</p> <p>Ex ia IIC T3...T6 Ga</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>GB 3836.1</li> <li>GB 3836.4</li> <li>GB 3836.20</li> </ul>
PESO (India)	<p>PESO approval: PESO approval is based on ATEX approval DEKRA 11ATEX0014 X, iss. 2 – 29.11.2019</p> <p>Equipment reference numbers: P512760/1</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>EN IEC 60079-0</li> <li>EN 60079-11</li> </ul>
TS (Taiwan)	<p>TS approval: TS Safety Label is based on IECEX approval IECEX DEK 11.0064X</p> <p>Identification Number: TD04000C</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>IEC 60079-0</li> <li>IEC 60079-11</li> </ul>
KCs (Korea)	<p>Korea Ex certificates: Korea Ex certificate is based on IECEX approval</p> <p>IECEX DEK 11.0064X, iss. 1 and applicable for the following models:</p> <p>FU20-VP-CG: 21-KA4BO-0416X</p> <p>FU20-VS-CG: 21-KA4BO-0417X</p> <p>FU20-**-CG: 21-KA4BO-0418X</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>IEC 60079-0</li> <li>IEC 60079-11</li> <li>KS C IEC 60079-14</li> </ul>
EAC Ex (Russia)	<p>EAC Ex certificate: RU C-NL.AA87.B.00754</p> <p>0Ex ia IIC T6...T3 Ga X</p> <p>Applied standards:</p> <ul style="list-style-type: none"> <li>GOST 31610.0 (IEC 60079-0)</li> <li>GOST 31610.11 (IEC 60079-11)</li> <li>GOST IEC 60079-14</li> </ul>

## 2. Dimensions

Units in mm [inch]

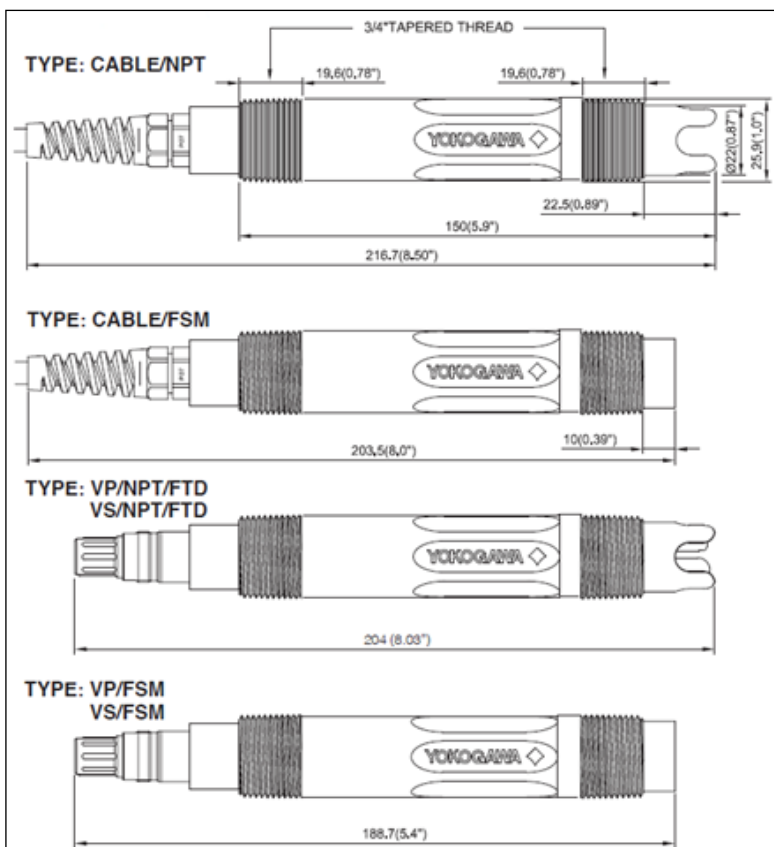


Figure 2: Dimensions FU20

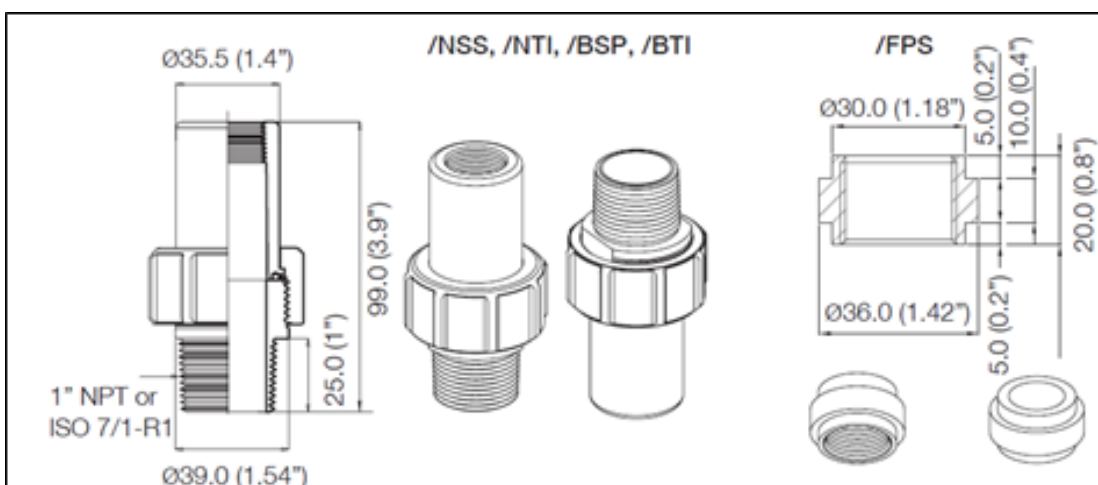


Figure 3: Dimensions 1" FU20 adapter Stainless Steel & Titanium and FU20 adapter for FF40, FS40 and FD40 fittings

### ■ 3. Model Codes & Parts

Table 2: Model & Suffix codes FU20

Model	Suffix Code	Option code	Description
FU20			Wide Body sensor
Cable length	-3		3 m cable
	-5		5 m cable
	-10		10 m cable
	-20		20 m cable
	-VP		No Cable; VarioPin connector ® not available for MTS
	-VS		No Cable; VarioPin connector with ID-chip
Temperature Sensor	-CG		Pt1000, IS for KCs
	-T1		Pt1000, IS for ATEX/IECEX/FM-US/FM-CAN/NEPSI/PESO/TS/EACEX
	-T2*		Pt100 ® not available for -FTD, -FTS, -MTS and -VS
Model	-NPT		PPS body / Tapered Thread / Dome shaped
	-FSM		PPS body / Tapered Thread / Flat Surface
	-FTD		PVDF body / Tapered Thread / Dome shaped
	-FTS		PVDF body / Tapered Thread / Salt Sensitive membrane / Silicone and FKM (Viton) sealing
	-MTS		PVDF body / Tapered Thread / Salt Sensitive membrane / FFKM and EPDM sealing
Options		/HCNF	Complete Hastelloy cleaning system
		/FPS	Adapter F*40 from PPO
		/NSS	1" NPT, SS316
		/NTI	1" NPT, Titanium
		/BSS	1" BSP, SS316
		/BTI	1" BSP, Titanium

For suffix –FTS -MTS : further specifications can be found in GS12B06J03- 05...-

Note: T2 is not intrinsically safe certified

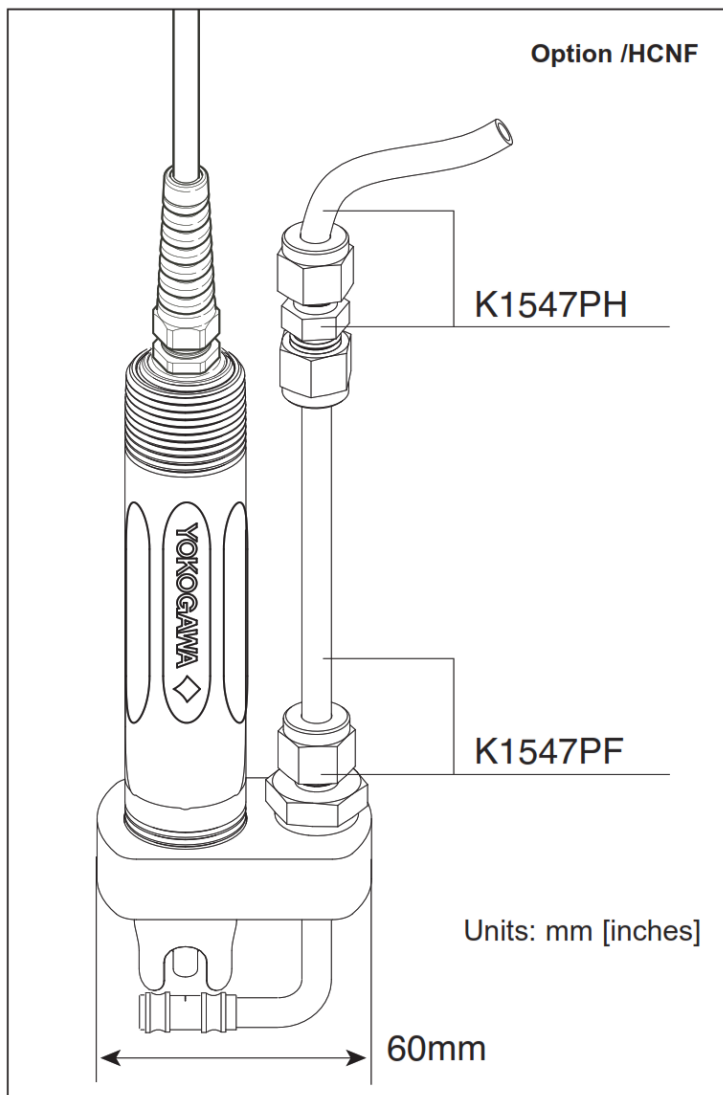
**Table 3: Spare parts PH20, FU20, FU24 & cleaning system**

Spare part		Description
K1523DD	FU20	/FPS Adapter for FF40, FS40 and FD40 fittings (PPO)
K1547PK		/NSS 1" NPT, Stainless Steel adapter (Viton O-ring)
K1547PL		/BSS ISO 7/1-R1, Stainless Steel adapter (Viton O-ring)
K1547PM		/NTI 1" NPT, Titanium adapter (Viton O-ring)
K1547PN		/BTI ISO 7/1-R1, Titanium adapter (Viton O-ring)
K1500FR		Viton O-rings 29.82*2.62 (5 pcs) for 1" adapter
K1500FS		EPDM O-rings 29.82*2.62 (5 pcs) for 1" adapter
K1500FT		Silicone O-rings 29.82*2.62 (5 pcs) for 1" adapter
K1547PJ	Cleaning system for FU20	Hastelloy cleaning system (HCNF)
K1547PG		Hastelloy nozzle and mounting set (HCNF)
K1547PH		Nylon tube (10 metre) and tube mounting set for chemical cleaning system
K1520BA	Buffer solutions	Buffer Solution pH4.01+6.87+9.18(3x0.5L)
K1520BB		Buffer Solution pH 1.68 (3x 0.5L)
K1520BC		Buffer Solution pH 4.01 (3x 0.5L)
K1520BD		Buffer Solution pH 6.87 (3x 0.5L)
K1520BE		Buffer Solution pH 9.18 (3x 0.5L)
WU10-V-D-XX	Connection cables for Suffix -03, -05,-10, -20, -VP	Variopin cable (XX = 02, 05, 10, 15 and 20m)
WU10-V-S-XX		Variopin cable (XX = 02, 05, 10, 15 and 20m)
WE10-H-D-XX		Extension cable for SENCOM SMART ADAPTER SA11
BA11	Connection equipment for Suffix -VS	Active Junction box
SA11-P1		SENCOM SMART adapter
WU11		Interconnection cable
IB100		Interface box
K1522PS	Part K1522PS Protection sleeve	Protection sleeve for 3/4" NPT sensor

#### ■ 4. Cleaning system for FU20

Some applications require frequent cleaning of the electrode.

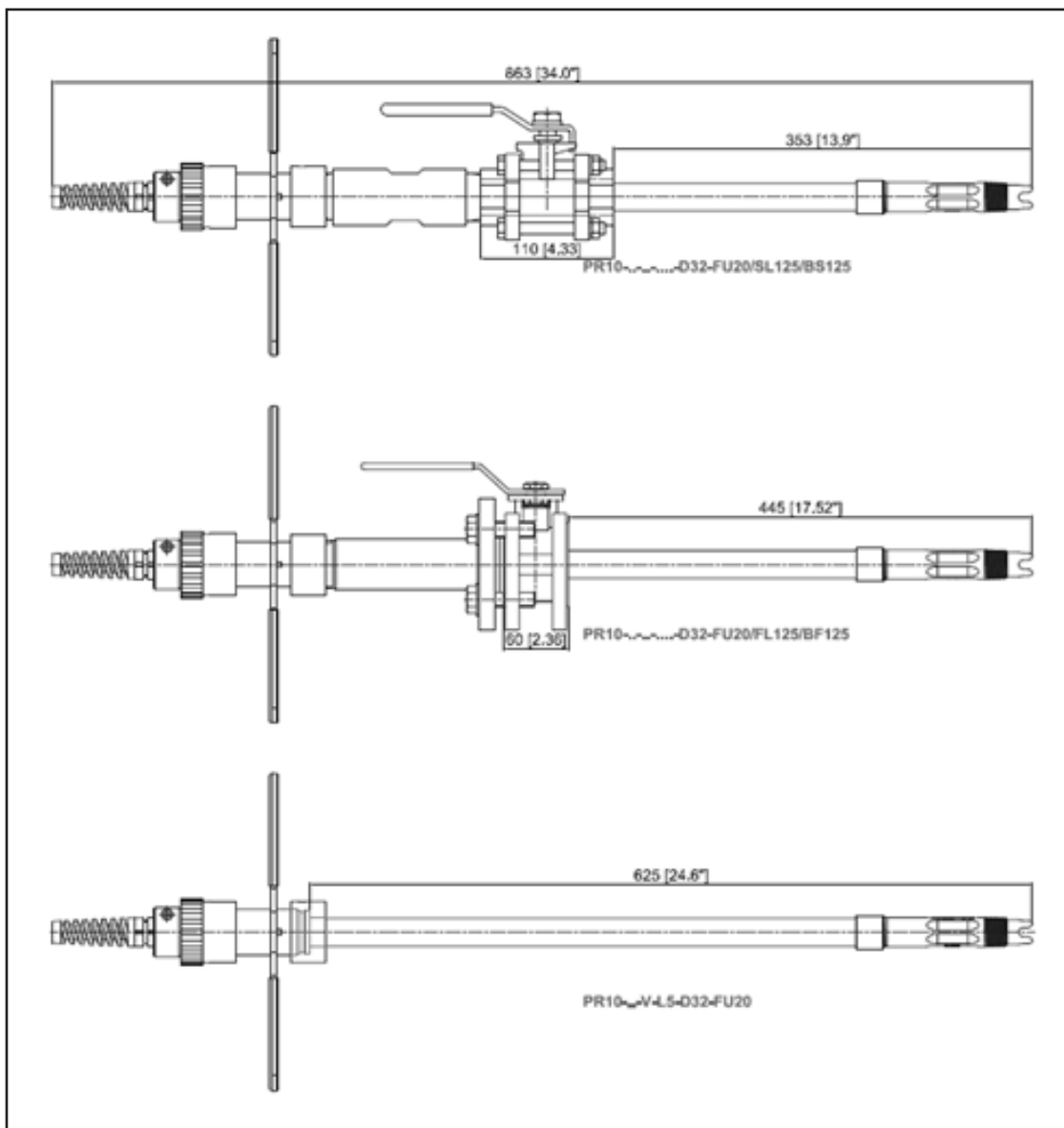
For these applications Yokogawa designed a chemical cleaning system that can either be used in the Yokogawa fitting range (HCN2, HCN3 or HCN4) or as back-end mounting option for the PH20 and FU20. The /HCNF option comes with a hastelloy cleaning nozzle, Stainless steel mounting and ferrules sets and a nylon tube of 10 meters.



**Figure 4:** FU20 + / HCNF Option (Spray Cleaner)

### Adendum 1 - Mounting the FU20 in PR10 retractable

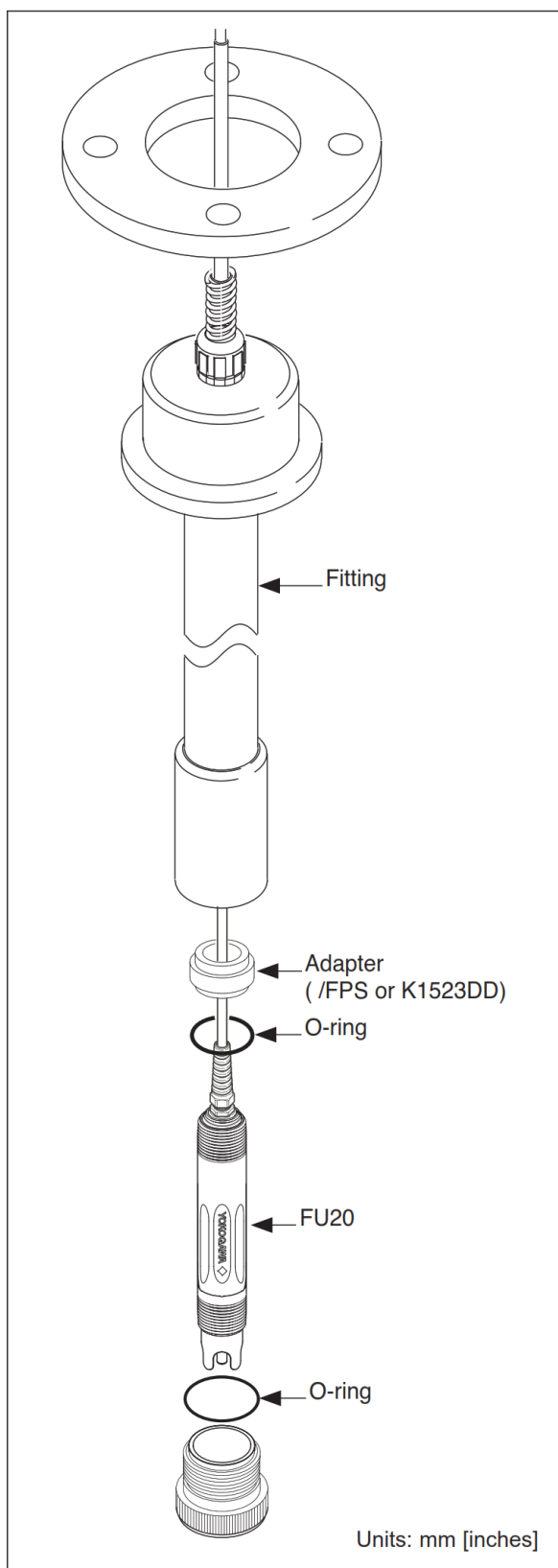
1. Take the sensor out of the box and apply Teflon tape to the appropriate threaded end.
2. Bind the separate wires of the cable together with a piece of tape.
3. Take the fitting out of the box and remove the option(s), if necessary.
4. Release the pigtail (cable gland) completely. Do not undo the part in the metal tube!
5. Lead the sensor cable through the tube of the fitting, from the side where the knurled knob has been removed. Attach the sensor and cable as usual.
6. Hold the sensor still and turn the metal tube onto the sensor. Don't rotate the cell, but rotate the tube of the fitting, because the cable can be disconnected from the cell, when rotating it.
7. Lead the loose part of the pigtail onto the cable and screw it onto the fixed part.
8. Remove the tape.



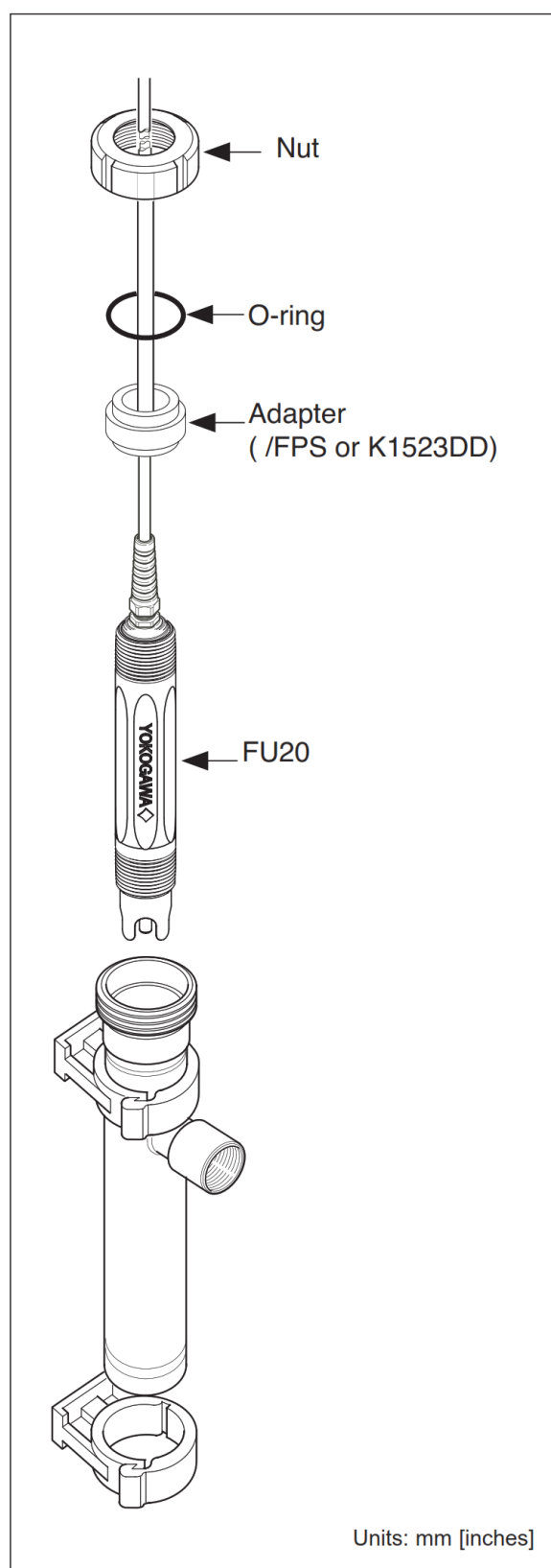
**Figure 5:** Dimensional drawing PR10...-D32 with mounted FU20 sensor units mm (inches)



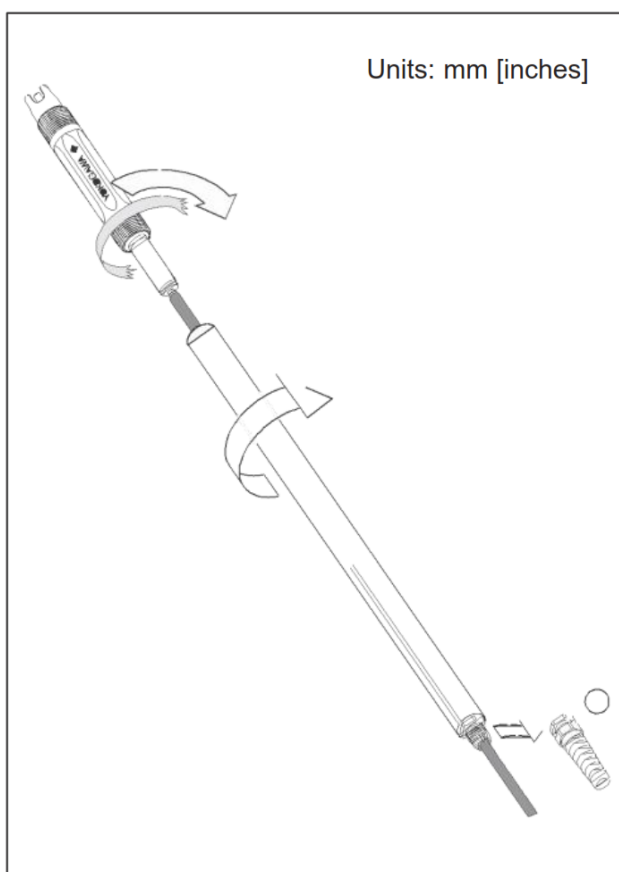
# Installation examples using the FU20 adaptor flange



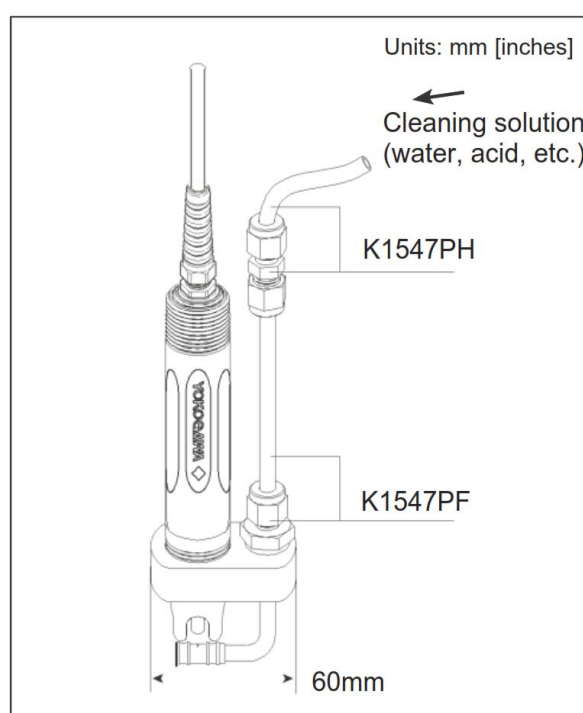
**Figure 6:** FD40 also for FF40 and FS40



**Figure 7:** FF40 example

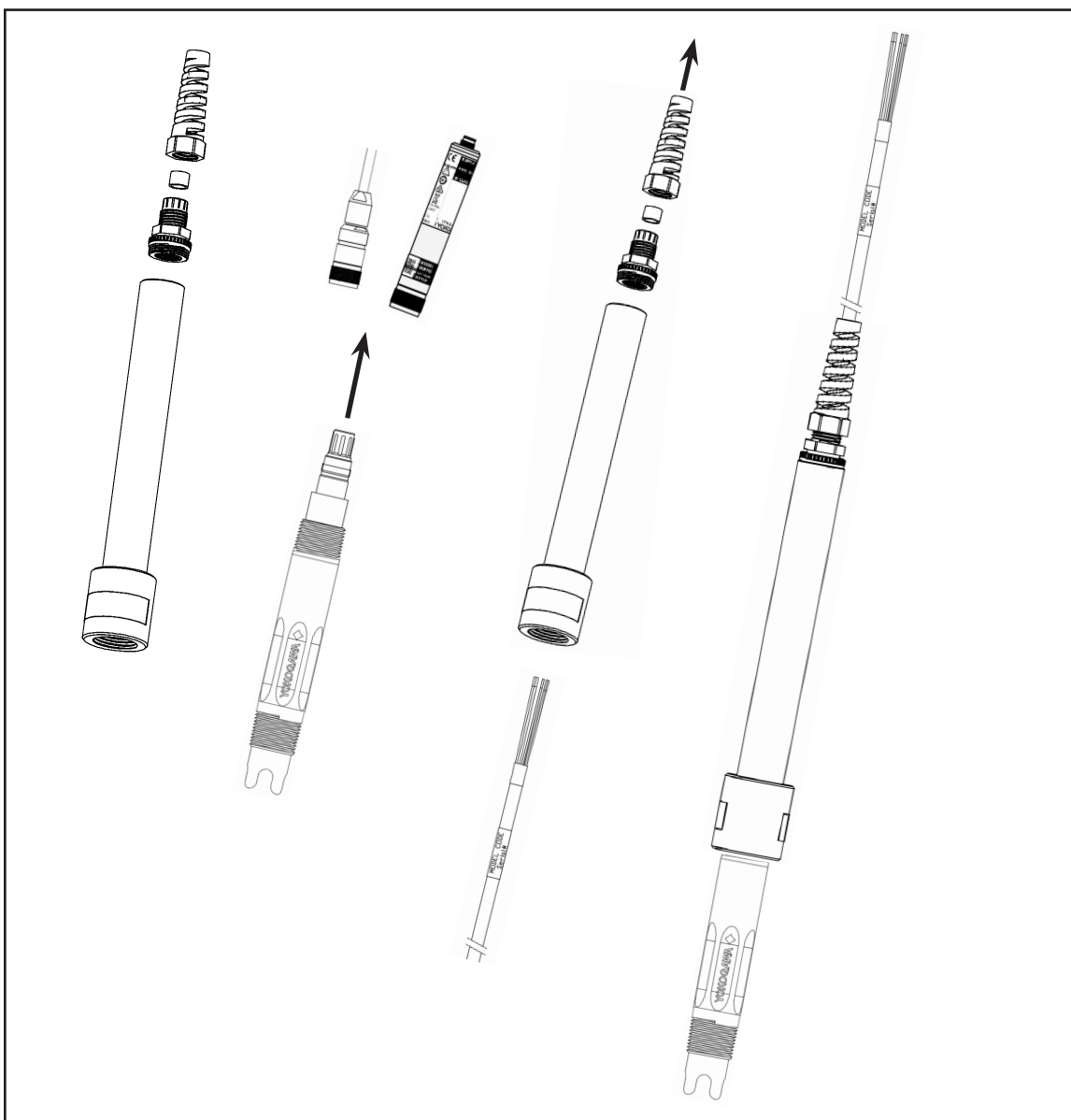


**Figure 8:** FU20 and PR10



**Figure 9:** Option / HCNE, Spray Cleaner

## Installation examples using the K1522PS protection sleeve



**Figure 10:** Installation using the protection sleeve K1522PS

Note: For details on installation FU20 sensor using protection sleeve please use instruction from SD 12A06K01-00EN-P

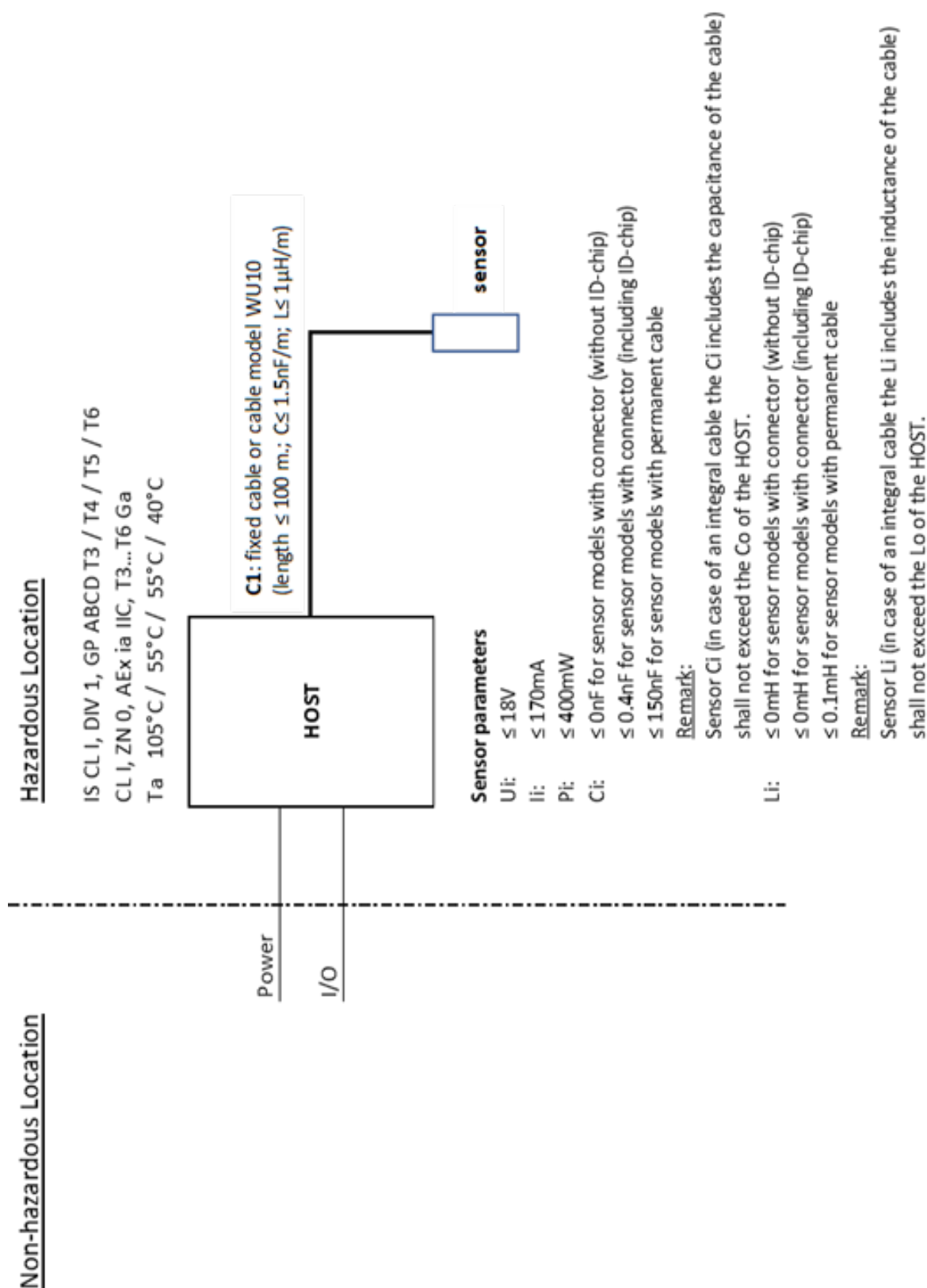
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**Adendum 2 - Available models****Table 4: FU20 Available models**

Available Models
FU20-03-T1-NPT
FU20-05-T1-NPT
FU20-10-T1-NPT
FU20-20-T1-NPT
FU20-03-T2-NPT
FU20-05-T2-NPT
FU20-10-T2-NPT
FU20-20-T2-NPT
FU20-03-T1-FSM
FU20-05-T1-FSM
FU20-10-T1-FSM
FU20-20-T1-FSM
FU20-03-T2-FSM
FU20-05-T2-FSM
FU20-10-T2-FSM
FU20-20-T2-FSM
FU20-VP-T1-NPT
FU20-VP-T2-NPT
FU20-VS-T1-NPT
FU20-VP-T1-FSM
FU20-VP-T2-FSM
FU20-VS-T1-FSM
FU20-VP-T1-FTD
FU20-VS-T1-FTD
FU20-VP-T1-FTS
FU20-VS-T1-FTS
FU20-VS-T1-MTS

## Adendum 3: Control Drawings

Control drawing: D&E 2020-023-A50 (part 1)



## Remarks:

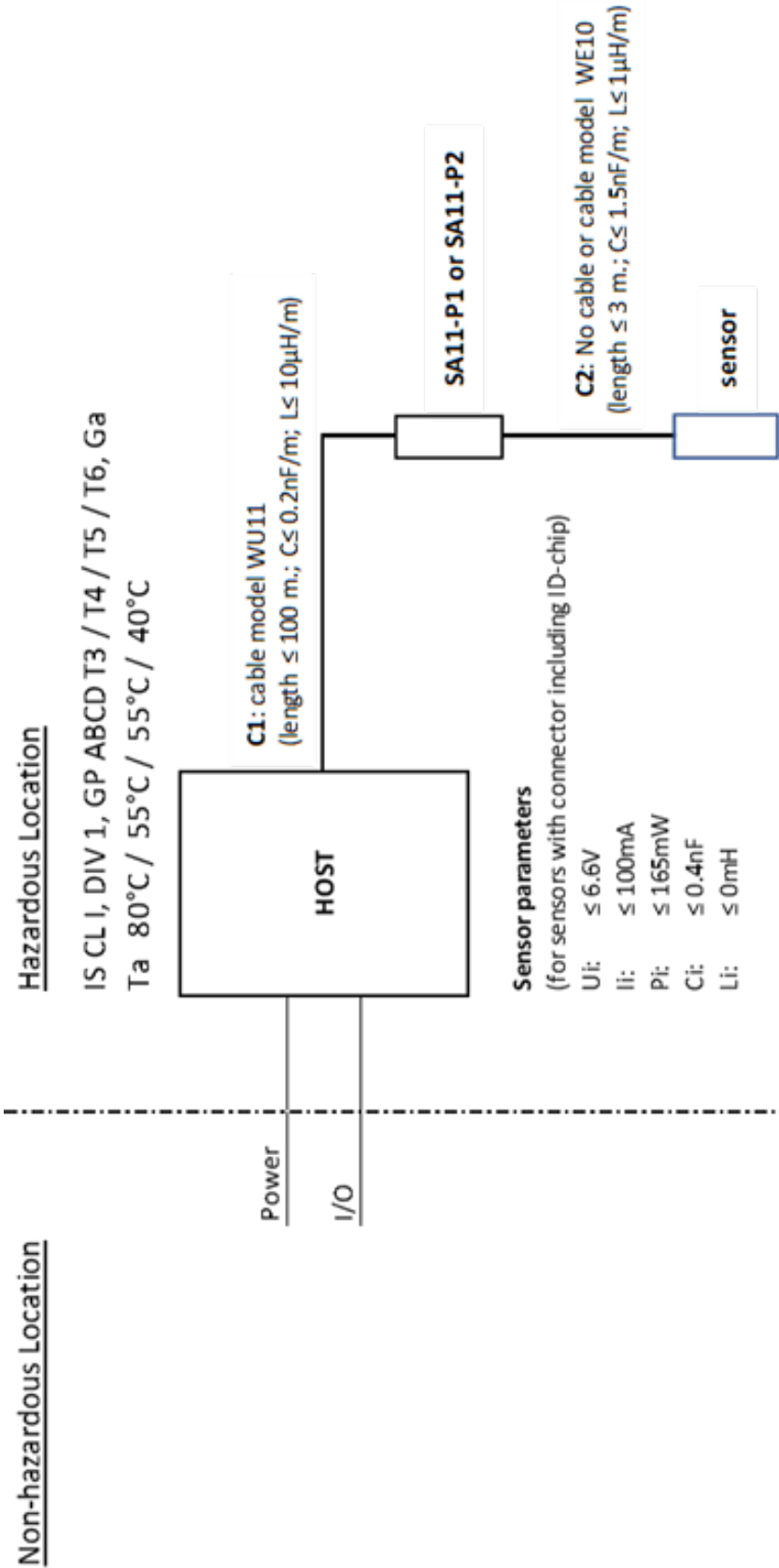
1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the National Electrical Code (ANSI/NFPA 70), ANSI/ISA-RP12.06.01, and relevant local codes.
3. The sensor shall be installed to a certified intrinsically safe HOST with the following maximum values:  $U_o = 18\text{ V}$ ,  $I_o = 170\text{ mA}$ ,  $P_o = 400\text{ mW}$ .
4. The sensor does not provide isolation from earth. Installers shall take necessary measures to prevent the possibility of sparking resulting from differing earth potentials between the sensors and interconnecting equipment. This can be realized for example by selecting interconnecting equipment which provides input-to-output and input-to-earth isolation up to 500 V rms.
5. Sensor Model code:

**Table 5: Regulatory compliance**

Model	Suffix Codes	Option Codes
FU20	-ab-cd-efg	/h
ab	Connection type:	Two alphanumeric characters identifying the length of the permanent cable, each character from 0 to 9 VP Connector without ID-chip VS Connector with ID-chip
cd	Temperature sensor + Region:	T1 Pt1000, IS for ATEX/IECEX, FM-US, FM-CAN NPT PPS body/Tapered Thread/ Dome shaped
efg	Type:	FSM PPS body/Tapered Thread/Flat Surface FTD PVDF body/Tapered Thread Dome shaped
h	Option code:	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

6. WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS
  - pH sensors containing accessible plastic parts and/or external conductive parts, must be installed and used in such a way, that dangers of ignition due to hazardous electrostatic charges cannot occur, especially in the case that the process medium is non-conductive.

Control drawings:



**Remarks:**

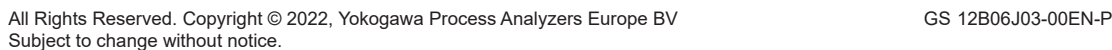
1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the National Electrical Code (ANSI/NFPA 70), ANSI/ISA-RP12.06.01, and relevant local codes.
3. The sensor shall be installed to a certified intrinsically safe Smart Adapter, model SA11-P1 with the following maximum values:  $U_o = 6.6 \text{ V}$ ,  $I_o = 100 \text{ mA}$ ,  $P_o = 165 \text{ mW}$ .
4. The installers shall take necessary measures to prevent the possibility of sparking resulting from differing earth potentials between the sensors and interconnecting equipment. The sensor itself does not provide 500 V rms isolation from earth, the interconnecting equipment Model SA11-P1 Smart Adapter however provide this required isolation.
5. Sensor Model code:

**Table 6: Regulatory compliance**

Model	Suffix Codes	Option Codes
FU20	-ab-cd-efg	/h
ab	Connection type:	VS Connector with ID-chip
cd	Temperature sensor + Region:	T1 Pt1000, IS for ATEX/IECEx, FM-US, FM-CAN NPT PPS body/Tapered Thread/ Dome shaped
efg	Type:	FSM PPS body/Tapered Thread/Flat Surface FTD PVDF body/Tapered Thread Dome shaped
h	Option code:	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

6. WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS
  - pH sensors containing accessible plastic parts and/or external conductive parts, must be installed and used in such a way, that dangers of ignition due to hazardous electrostatic charges cannot occur, especially in the case that the process medium is non-conductive.





## Remarks:

1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the Canadian Electrical Code (CEC) CSA22.1, and relevant local codes.
3. The sensor shall be installed to a certified intrinsically safe HOST with the following maximum values:  $U_o = 18\text{ V}$ ,  $I_o = 170\text{ mA}$ ,  $P_o = 400\text{ mW}$ .
4. The sensor does not provide isolation from earth. Installers shall take necessary measures to prevent the possibility of sparking resulting from differing earth potentials between the sensors and interconnecting equipment. This can be realized for example by selecting interconnecting equipment which provides input-to-output and input-to-earth isolation up to 500 V rms.
5. Sensor Model code:

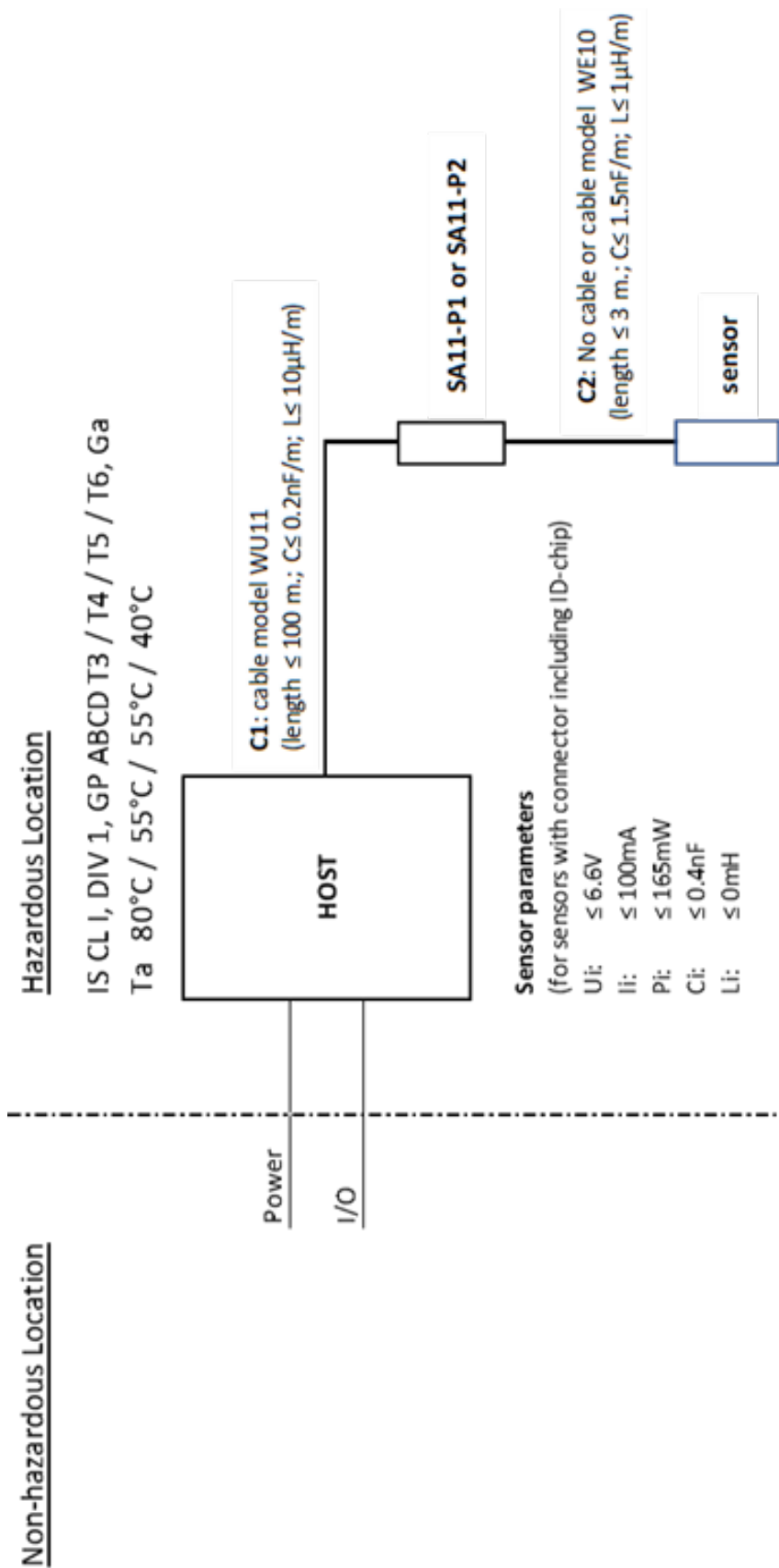
**Table 7: Regulatory compliance**

Model	Suffix Codes	Option Codes
FU20	-ab-cd-efg	/h
ab	Connection type:	Two alphanumeric characters identifying the length of the permanent cable, each character from 0 to 9 VP Connector without ID-chip VS Connector with ID-chip
cd	Temperature sensor + Region:	T1 Pt1000, IS for ATEX/IECEX, FM-US, FM-CAN NPT PPS body/Tapered Thread/ Dome shaped
efg	Type:	FSM PPS body/Tapered Thread/Flat Surface FTD PVDF body/Tapered Thread Dome shaped
h	Option code:	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

6. WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS
  - pH sensors containing accessible plastic parts and/or external conductive parts, must be installed and used in such a way, that dangers of ignition due to hazardous electrostatic charges cannot occur, especially in the case that the process medium is non-conductive.

**AVERTISSEMENT – DANGER POTENTIEL DE CHARGES ÉLECTROSTATIQUES – VOIR LES INSTRUCTIONS**

Les sondes de pH contenant des pièces en plastique accessibles et / ou des pièces conductrices externes doivent être installées et utilisées de manière à éviter tout risque d'inflammation dû à des charges électrostatiques dangereuses, en particulier dans le cas où le fluide de procédé n'est pas conducteur.



## Remarks:

1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the Canadian Electrical Code (CEC) CSA22.1, and relevant local codes.
3. The sensor shall be installed to a certified intrinsically safe Smart Adapter, model SA11-P1 with the following maximum values:  $U_o = 6.6 \text{ V}$ ,  $I_o = 100 \text{ mA}$ ,  $P_o = 165 \text{ mW}$ .
4. The installers shall take necessary measures to prevent the possibility of sparking resulting from differing earth potentials between the sensors and interconnecting equipment. The sensor itself does not provide 500 V rms isolation from earth, the interconnecting equipment Model SA11-P1 Smart Adapter however provide this required isolation.
5. Sensor Model code:

**Table 8: Regulatory compliance**

Model	Suffix Codes	Option Codes
FU20	-ab-cd-efg	/h
ab	Connection type:	Two alphanumeric characters identifying the length of the permanent cable, each character from 0 to 9 VS Connector with ID-chip
cd	Temperature sensor + Region:	T1 Pt1000, IS for ATEX/IECEX, FM-US, FM-CAN NPT PPS body/Tapered Thread/ Dome shaped
efg	Type:	FSM PPS body/Tapered Thread/Flat Surface FTD PVDF body/Tapered Thread Dome shaped
h	Option code:	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

6. WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS
  - pH sensors containing accessible plastic parts and/or external conductive parts, must be installed and used in such a way, that dangers of ignition due to hazardous electrostatic charges cannot occur, especially in the case that the process medium is non-conductive.

**AVERTISSEMENT – DANGER POTENTIEL DE CHARGES ÉLECTROSTATIQUES – VOIR LES INSTRUCTIONS**

Les sondes de pH contenant des pièces en plastique accessibles et / ou des pièces conductrices externes doivent être installées et utilisées de manière à éviter tout risque d'inflammation dû à des charges électrostatiques dangereuses, en particulier dans le cas où le fluide de procédé n'est pas conducteur.