

**Analytical Instruments & Systems**

# **General Specifications Catalogue 2012**





Yokogawa Electric Corporation was founded on September 1st 1915 producing electrical measuring instruments. From humble beginnings the company has over the ensuing years become a world leader in the fields of process automation, factory automation, test and measurement, medical research and aerospace. In Japan there are 3 factories and 21 offices including Corporate headquarters, whilst in the rest of the world there are 18 factories and 114 affiliates in 28 countries. The company has over 19000 employees, and sales exceeding US\$ 3 billion. Each year Yokogawa dedicates 6% of the annual revenue toward research and development. Yokogawa Europe B.V was established in 1982 as a 100% owned affiliate of Yokogawa Electric Corporation.

## Introduction

For 91 years Yokogawa has been providing innovative measurement and control solutions to the process industries. An important part of those solutions has been our integrated range of high-quality instruments covering all process measurement needs.

Our current range of analyzers and associated products is the culmination of many years practical application experience, combined with the very latest development in analytical measurement technologies – many of them pioneered in our own analyzer laboratories.

Whatever your own particular analytical measurement challenges, Yokogawa has products, the application expertise and, above all, the enthusiasm to help you meet it successfully.

# YOKOGAWA Products can be seen on the Internet too!

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## About this Catalog

This catalog is mainly consisted of exciting General Specifications (GS). All descriptions in this catalog are effective from December 2011 and subject to change without notice. For the latest information please ask your local Yokogawa office. You can find the nearest Yokogawa office on <http://www.yokogawa.com> and select World Wide locations





## What is new in the 2012 edition of this catalog?

### **FLXA21**

#### **Modular 2-wire liquid analyser which supports dual sensors**

Since the release of the 2008 catalog several new products have been released.

One of our biggest milestones is the release of the FLXA21. The FLXA21 replaces our EXA202 two-wire series, which has been a success for over a decade. The new Yokogawa FLXA21 is the latest generation of the company's range of liquid analysers designed for continuous on-line measurements in industrial installations.

The new instrument is a modular 2-wire liquid analyser that supports the use of up to two sensors and can be flexibly configured to measure several different liquid properties including pH/ORP, contacting conductivity, inductive conductivity and dissolved oxygen. The FLXA21 also incorporates a number of advanced features including a touch screen for ease of operation, sensor self-diagnostics,

maintenance time estimation, 12 language display options, and a range of digital communications interfaces. The ability of the FLXA21 to support up to two sensors of the same type helps to reduce installation and maintenance costs and save space, in addition to enabling the configuration of a highly reliable backup system with interruption-free measurement assured even during maintenance

### **SC25V**

#### **pH sensors with built-in temperature sensor and external liquid earth for general and harsh applications**

The new Yokogawa SC25V is a reliable, very stable and high-accuracy 12 mm pH sensor which uses a VP type connector to integrate multiple measuring elements in a single package, including a built-in temperature sensor and an external liquid earth. Two versions of the sensor are available.

The general-purpose version is suitable for moderate applications while the high-temperature/alkaline version is designed for harsher applications.

### **FU24**

#### **Maintenance-free pH sensor for harsh environments.**

The new sensor incorporates a patented Yokogawa-designed bellows system which automatically compensates for the effect of pressure fluctuations. Such pressure variations can be highly detrimental to sensor operation. In the FU24 sensor, pressure fluctuations are automatically compensated by the built-in bellows up to 10 bar, making the sensor virtually insensitive to pressure variations. A positive overpressure maintained by the tension in the bellows generates a steady flow out of the sensor. The positive flow out of the sensor makes it also possible to use in PW.

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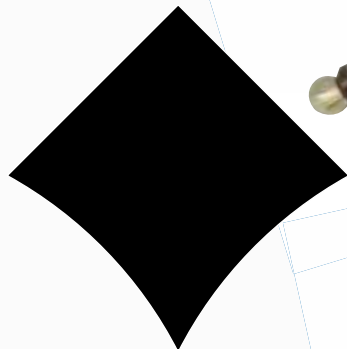
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# NEW products



**YOKOGAWA**



**SC25V**  
**Industrial Electrodes**  
**for pH/Redox**  
**SC24**



**FU24**  
**4 in 1 pH sensor**



**FLXA21**  
**2-wire analyzer**



**GC8000**  
**Gas Chromatograph**



## Gas Analyzers

# Gas Analyzers

# General Specifications

Model TDLS200  
Tunable Diode Laser  
Spectroscopy (TDLS) Analyzer

TDLS200  
**TruePeak**

The TruePeak Tunable Diode Laser Spectroscopy (TDLS) Analyzer is capable of measuring a number of near-infrared absorbing gases in difficult process applications. With the capability of measuring at very high temperature, high pressures and under difficult conditions (corrosive, aggressive, high particulate service), the TruePeak analyzer is one of the most robust process analyzers available. Most applications are measured in-situ, reducing installation and maintenance costs. In addition, most measurements are rapid (5 seconds) and interference free, offering improved accuracy when compared to other process analyzers.

## Typical gases measured include:

- Oxygen in process applications and combustion applications. Process temperatures can be as high as 1500°C, pressures can be as high as 10 bar. Measurement span is typically between 1% and 100% oxygen.
- Carbon Monoxide in process and combustion applications. Process temperatures can be as high as 1500°C. Two versions are available, high sensitivity with ppm detection limits possible and standard sensitivity for high ppm and percent level CO measurements
- Part per million Moisture in aggressive process streams. Sub-ppm detection limits are possible with measurement in corrosive and aggressive process streams

Other applications and gases are possible with the TruePeak TDLS. Please fill out the Application Data Sheet at the end of this document and send to Yokogawa.

## Features

- In Situ Analysis
- Fast Response (5-20 seconds)
- Interference Free for most applications
- TruePeak Measurement Capable of measuring under changing pressure, temperature and background
- Process Pressures up to 20 Bar
- Process Temperature up to 1500°C
- Optical Measurement, no sensor contact with process
- Low LTCO<sup>1</sup> (no moving parts, high MTTF<sup>2</sup> for components)
- Flexible Installation Options
- On Board Diagnostics
- ATEX Group II for zone 1 (Cat 2G) or 2 (Cat 3G) with purge systems

<sup>1</sup> Long term cost of ownership

<sup>2</sup> Mean time to failure

## TruePeak TDLS



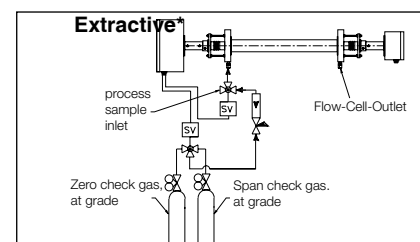
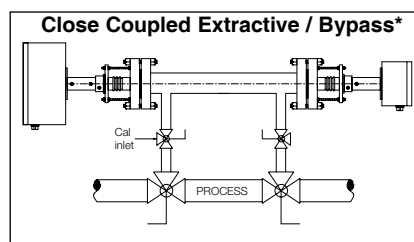
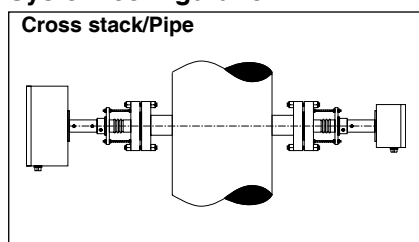
## Optional Remote Interface Unit



## Process Interface & Alignment



## System configuration



\* Contact Yokogawa for further information

## Operational Principle

Tunable Diode Laser Spectroscopy (or TDLS) measurements are based on absorption spectroscopy. The TruePeak Analyzer is a TDLS system and operates by measuring the amount of laser light that is absorbed (lost) as it travels through the gas being measured. In the simplest form a TDLS analyzer consists of a laser that produces infrared light, optical lenses to focus the laser light through the gas to be measured and then on to a detector, the detector, and electronics that control the laser and translate the detector signal into a signal representing the gas concentration.

Gas molecules absorb light at specific wavelengths, called absorption lines. This absorption follows Beers law.

TDL Analyzers are effectively infra red analyzers which obey the Beer-Lambert Law.

$$I = I_0 \cdot e^{-E \cdot G \cdot L}$$

where I is the radiation intensity after absorption

$I_0$  is the initial radiation intensity

E is the extinction coefficient

G is the gas concentration

and L is the path length of the measurement area

Using a Tunable Diode Laser as a light source for spectroscopy has the following benefits:

- **Sensitivity.** Application Dependant. Sub-PPM in some applications.
- **Selectivity.** The narrow line width of the laser is able to resolve single absorption lines. This provides more choices of a particular peak to use for measurement, usually allowing one isolated peak to be used.
- **Power.** Diode lasers have power ranging from 0.5mW to 35mW. Also, being highly coherent this allows measurement in optically thick environments (high particulate loading).
- **Monochromatic.** No dispersive element (filter, etc.) required. Light source itself is selective.
- **Tunable.** Wavelength can be swept across the entire absorption feature, this allows resonant (peak) and non resonant (baseline) measurement during every scan. By measuring the baseline and peak, power at the detector can fluctuate rapidly by large amounts without affecting the measurement. This is useful for high particulate applications.

## Measurement

- During measurement the laser is held at a fixed temperature. This is the coarse wavelength adjustment.
- A current ramp is fed to the laser. This is the fine wavelength adjustment (figure 1).
- The current is ramped to scan across the wavelength region desired.
- The collimated light passes through the gas to be measured. The amount of light absorbed by the peak is proportional to the analyte concentration.
- The light is then focused on a detector (figure 2).
- This signal is used to quantify the light absorbed by the analyte (figure 3).

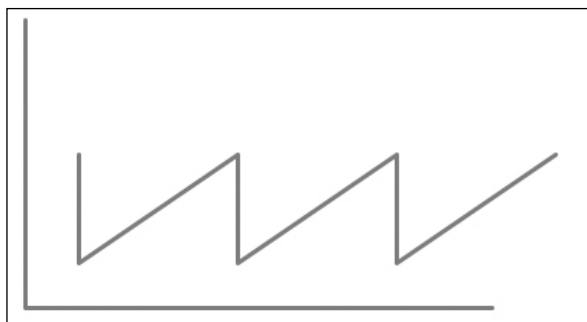


Figure 1. Current ramp to laser

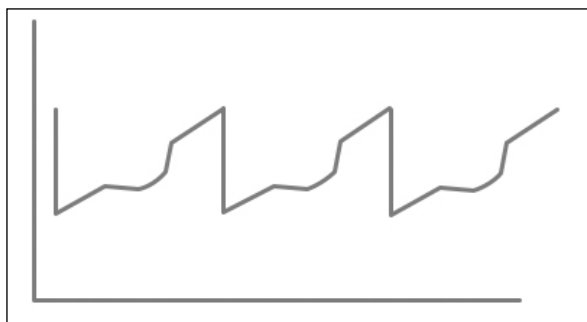


Figure 2. Signal at Detector

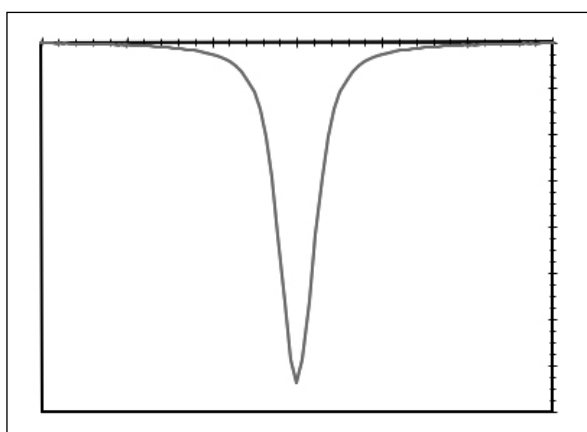


Figure 3. Processed Detector Signal



## General Specifications

- A. Measurement range:** Dependent on application, optical path length, process pressure and temperature.  
Oxygen application typically 0-1% up to 0-100%. All other measured gases range from low ppm to high % levels.
- B. Output signal:** (3x) 4- 20 mA DC with maximum load of 900 Ohm  
Three isolated outputs may be used for gas concentration, transmission, re-transmission of data inputs, dual range, or second gas measurement where applicable.  
3.3 mA user configurable on warnings and faults, according to NAMUR NE43.
- C. Output Span:** Freely programmable within measuring range
- D. Contact outputs:** (3x) configurable relays for Status (Fault, Warning, In Validation, concentration level, etc.) Form C Single Pole Double Throw (SPDT) contact outputs with maximum 1A@24VDC.
- E. Valve control:** (3x) Form C SPDT contact outputs with C connected to 24VDC power supply to activate calibration solenoid valves for zero, span and dynamic spiking (validation) gas. Maximum load 1A (max 10W/ valve for zero and span gas and dynamic spiking).
- F. Current Input** (2x) 4-20 mA inputs for Temperature and Pressure Compensation for loop powered or mains powered (115/220 VAC) mA transmitters for pressure and temperature.
- G. Digital Communication:** Ethernet IEEE 802.3 10/100 mbps, RJ45
- H. Data storage:** USB1 and USB2 connection for data transfer using memory stick, data storage in CF card (result files, spectra capture, configuration data, etc.) Capture rate is configurable.
- I. Warm-up time:** 5 min for functioning, 60 min for full operation within specifications.
- J. Power Consumption:** 24 VDC, 4A
- K. Accessories:** 100-240 VAC, 50/60 Hz can be supplied to:  
- Universal Remote Display (URD)  
- Utility Panel(s)  
- Optional Power Supply Unit  
(These devices all supply 24 VDC to power the TDLs Analyzer)
- L. Optical Path Length:** Insitu standard, up to 30 meters allowed  
Minimum, OPL 0.5 meter  
Flow Cells, bypass installation, 0.5 meter recommended

**Note:** End User may supply 23.5 to 24.5 VDC direct to analyzer (typ.4A). Optional heat trace system may require additional and/or alternate power supplies.

## Environmental Specifications

- A. Ambient Temperature:** Continuous operation - 10°C to 50°C, start up temperature 0°C to 50°C.  
Extended temperature installation options are available please contact Yokogawa.
- B. Humidity:** 0- 90 % RH non-condensing or 0- 100% with correct purge gas specifications.
- C. Area Classification:** CE Marked for zone 2 ATEX group II Cat. 3G with purge system EEx pz II T5 Class 1 Div. 2 Group BCD with integral purge kit
- D. Weather resistance:** IP65
- E. Cable entries:** ¾" FNPT threads (unused holes are plugged)
- F. Gas Connections:** Analyzer - ¼" welded Swagelok connection  
Flow Cells - ⅜" and ¼" FNPT (other connections upon request)
- G. Enclosures:** Die Cast copper free Aluminum grade AL SI 12 with a powder coat exterior finish. The alloy is particularly resistant to salt atmosphere, Sulfur gases and galvanic corrosion.  
Stainless Steel captive screws and optional keypad.  
Laminated Safety Glass for optional display(s).
- H. Sample Gas Temperature:** Maximum 1500°C, Application Dependant
- I. Sample Gas Pressure:** Maximum 20 bar, Application Dependant
- J. Mounting Flanges:** 2" 150# ANSI RF or 3" 150# ANSI RF or adaptors for 4" 150# ANSI RF, DN50 PN16, 4" 150# ANSI RF, and DN80 PN16
- K. Mounting Angle:** Flange alignment tolerance within ±2 degrees
- L. Weights, approx:** Launch Unit 16kg x (35lbs), Detect Unit 5.5kg (12lbs)  
2" 150# Alignment flange 4.5kg (10lbs),  
3" 150# Alignment flange 9.5kg (15lbs)
- M. Particulate loading:** Maximum 95% transmission loss
- Note:** Each application may differ in maximum limitations depending upon the combination of gas temperature, gas pressure, optical path length and concentration of gas being measured.

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## Performance Specification

<b>Precision:</b>	Application Dependent
<b>Linearity:</b>	Typically $R^2 > 0.999$
<b>Response time:</b>	5 seconds, plus transport time for extractive systems when applicable
<b>Drift:</b>	Application Dependent

## Installation Specifications

<b>Hazardous Area:</b>	Zone 1: Contact Yokogawa Zone 2: ATEX group II Cat. 3G with purge system EEx pz II T5 (-20 °C < Ta < 50 °C)
<b>By Design:</b>	Class 1, Grp. B,C & D, Division 2 or Division 1 - (Purged)
<b>Maximum Distance between Launch and Detect:</b>	30 m (±90ft) Maximum interconnecting cable 50m
<b>Wetted Parts:</b>	Analyzer & standard Alignment Flange - 316 SS, BK-7 Glass, Teflon encapsulated Viton and Silicone RTV sealant.
<b>Optional:</b>	Isolation Flanges and Flow Cells - 316 SS, Sapphire, Kalrez - Also available in Monel A400, Hastelloy C-276, Carpenter 20, Titanium Grade 2 and others on request.
<b>Utilities:</b>	Instrument Air may be used as a purge gas in principle for all of the below applications, but this will depend on the application type and the required precision of the measurement.
Oxygen Analyzer	N <sub>2</sub>
CO Analyzer	N <sub>2</sub> or Instrument Air
CO <sub>2</sub> Analyzer	N <sub>2</sub> or other non-CO <sub>2</sub> containing inert gas
H <sub>2</sub> O ppm Analyzer	N <sub>2</sub> with <20ppm levels H <sub>2</sub> O for feed to optional Dryer Package
H <sub>2</sub> O % Analyzer	N <sub>2</sub>
<b>Flow Rate:</b>	<ul style="list-style-type: none"> <li>• 5-30 L/min for window purge</li> <li>• 2 L/min for validation, calibration and optical purge</li> </ul>

### SIL Assessment:

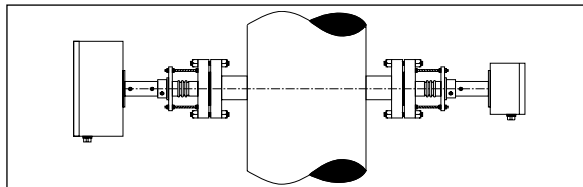
The TDLS200 has a FMEDA assessment by *exida* and is classified as a Type B1 device in compliance with the following standards; IEC 61508 or EN 954-1. Functional Safety of Electrical/electronic/programmable electronic related systems; SIL 1 capability for single device.

\* The TDLS200 is not SIL certified as standard; to be certified the unit must be specified and designed from the beginning to meet all SIL specifications.

GS 11Y01B01-01E-E

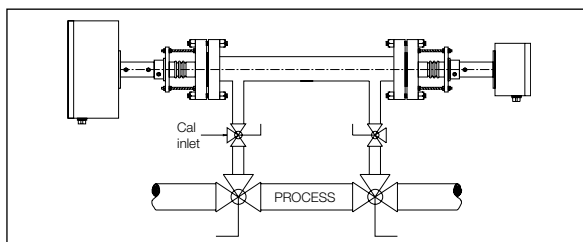
## Basic System Configuration

The TruePeak can be installed in a number of ways depending on process requirements. The most typical installation types are shown below, however other installation methods are possible, please contact Yokogawa with your application details.



### Cross Stack/Pipe Configuration

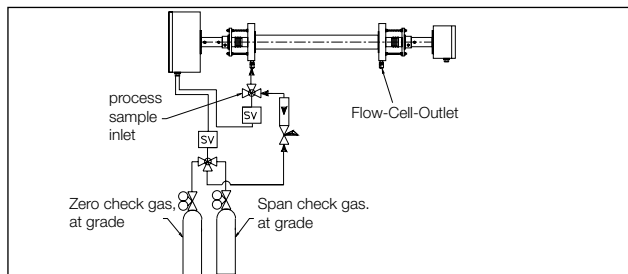
- Measures directly across process pipe or vessel
- Typically has nitrogen or other purge gas protecting process windows
- Span Validation via serial flow cell (see Operation Specifications).
- Full calibration requires removal from process
- May require pressure and temperature inputs (Application Dependant)
- Multiple methods to increase Optical Path Length (OPL) if needed
- 5 meter interconnection cable standard



### Close Coupled Extractive / Bypass Configuration\*

- Measures across a section of pipe where process flow is directed
- The measurement section can be isolated from process flow for full calibration/validation, zero and span
- Process pressure and temperature can be controlled or the analyzer may require pressure and temperature inputs (Application Dependant)
- Length of measurement section dependant on accuracy requirements and process conditions

### Extractive Configuration\*



- Sample is fully extracted from process (and may be conditioned before measurement).
- Flow cells are available with ability to purge in front of windows (balanced flow cell) if required.
- Process pressure and temperature can be controlled or the analyzer may require pressure and temperature inputs (Application Dependant)
- Length of flow cell dependant on accuracy requirements and process conditions

\* Contact Yokogawa for further details

## Standard Accessories

- Calibration Cell:**
- Used for off-line calibrations and validations
  - Stainless steel 316 with free standing frame
  - Connects Launch and Detect with 72.6cm (28.6") OPL
- Flow Cells:**
- Used for extracted sample streams at any location
  - 316SS low volume fixed alignment; 50°C, 5.5 bar (80psig) max
  - Enhanced for 200°C, 20 Bar (290psig), Sapphire window, Kalrez o-rings and can be constructed from 316SS, Monel A400, Hastelloy C-276, Carpenter 20 and other materials on request to suit the process
- Isolation Flanges:**
- Used for additional protection for in-situ or by-pass installations
  - 2" or 3" 150# or 300# ANSI RF, 4"150#, DN80 PN16 welded 5/8" or M16" bolt studs included sapphire 20 Bar (290 psig) or BK-7 5.5bar (80 psig) isolation window
  - Kalrez window seal o-ring rated max 200°C
  - 316SS, Monel A400, Hastelloy C-276, Carpenter 20, other on request

**Note:** Must use in conjunction with alignment flanges

- Utility Panel:**
- Used for convenient field installation of utilities, configurations for
  - Single, dual or four analyzers
  - Manual or automatic on-line validation (controlled by analyzer)
  - Safe area (GP), Div 2 purged or non-purged, ATEX CAT 2G components
  - Purge flowmeters with integral needle valve, glass tube variable area
  - Swagelok double ferrule stainless steel tube fittings and tubing standard
  - Panel mounted or fiberglass (NEMA 4X/ IP65), with viewing window
  - 5A 24VDC power supply, output to analyzer – requires VAC input power

**Note:** Custom configuration available to suit customer requirements

- Integration:**
- Used for convenient analyzer & extractive system/flow cell integration
  - Free standing frame, galvanized steel with 304SS roof
  - Fiberglass enclosure with powder coated steel frame
  - Heat tracing and insulation for flow cells and sample handling
  - 316SS and/or Monel A400 wetted parts – other on request
  - Sample handling and conditioning systems to suit applications
  - Stream switching manual or automatic (controlled by analyzer)

**Note:** Custom configuration available to suit customer requirements

## Display and Software Functions

TruePeak Software has multiple levels, the default (or start page) is the Main Menu:

- Main Menu Displays:**
- Concentration & Units (% or ppm)
  - Transmission %
  - Status (warm-up, OK, Warning, Fault, etc.)
  - Temperature (Fixed, Active Ambient or Active)
  - Pressure (Fixed or Active)

### Main Menu:

- Basic Menu**
- Configure, 3 functions
  - View Spectra, 2 functions
  - Data, 3 sub-menus
  - Trends

- Advanced Menu**  
(User Password)
- Configure, 9 sub-menus
  - Calibrate & Validate, 3 sub-menus
  - Data, 4 sub-menus
  - Trends,

- Active Alarms**
- List of active alarms

### Shut Down

- Analyzer**
- Instructions to close TruePeak local or VAC

### Calibration Functions:

- Off-line Calibrations:
- Zero calibration
  - Zero off-set
  - Span calibration
  - Transmission
  - Dark current
  - Peak search

- Off-line Validations:
- Check gas #1
  - Check gas #2
  - Check gas #3

- On-Line Validations:
- Manual
  - Automatic

- Setup Functions: Configuration:
- Process Path Length
  - Pressure
  - Temperature
  - Units
  - System I/O
  - System
  - Valve Control
  - Laser Spectra & Control

### Diagnostics:

- Warnings include:
- Detector signal low
  - Transmission low
  - Spectrum noise high
  - Process pressure out of range
  - Process temperature out of range
  - Concentration out of range
  - Board temperature out of range
  - Validation failure
- Faults include:
- Laser temperature out of range
  - Detector signal high
  - Detector signal lost
  - Peak center out of range

### Output Settings:

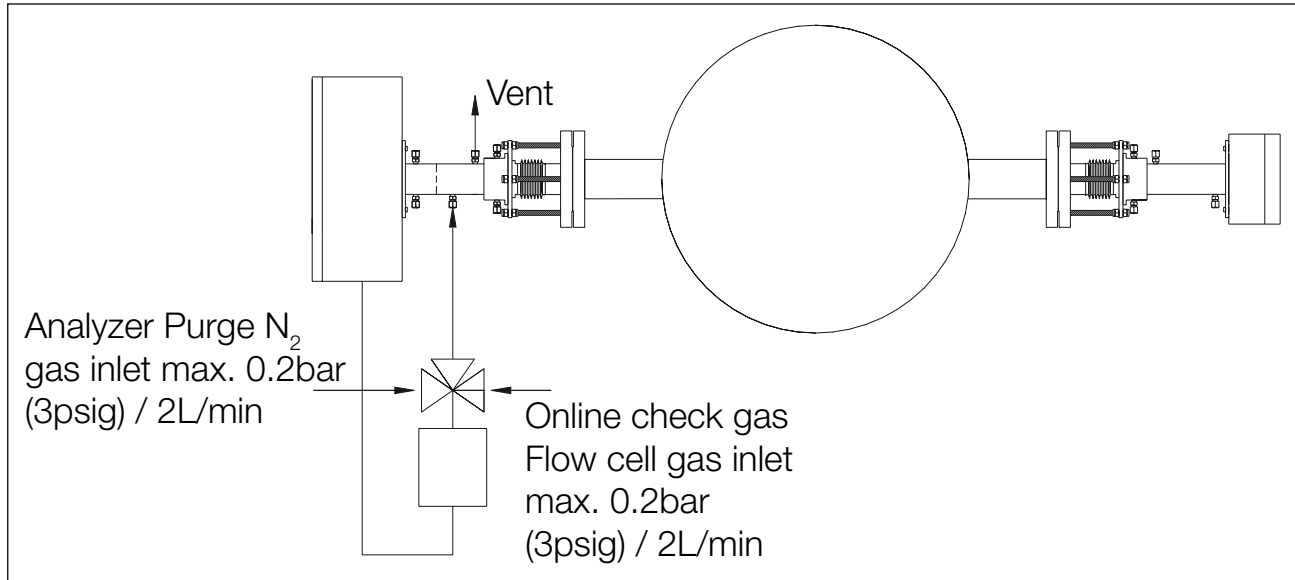
- Analog Output:
- Channel 1
  - Channel 2
  - Channel 3
  - Warning Mode
  - Fault Mode
  - Field Loop Check
  - AO CH calibration 11Y01B01-01E-E

## In-Situ Calibration / Validation

Validation (shown below) can be performed on-line. A serial validation flow cell is fitted in the analyzer between the laser source and the process window. During normal operation the validation cell is filled with nitrogen (analyzer measuring process gas only). After initiating a validation, this cell is filled with a known standard of the gas being measured, the analyzer will then measure the process gas + the validation gas (dynamic spike). The validation cell flow is then returned to nitrogen (analyzer measuring process gas only).

The analyzer will calculate the validation response by averaging the process readings before and after the dynamic spike and subtracting that value from the reading during the dynamic spike. This provides a relative proof of span and a positive indication of operation.

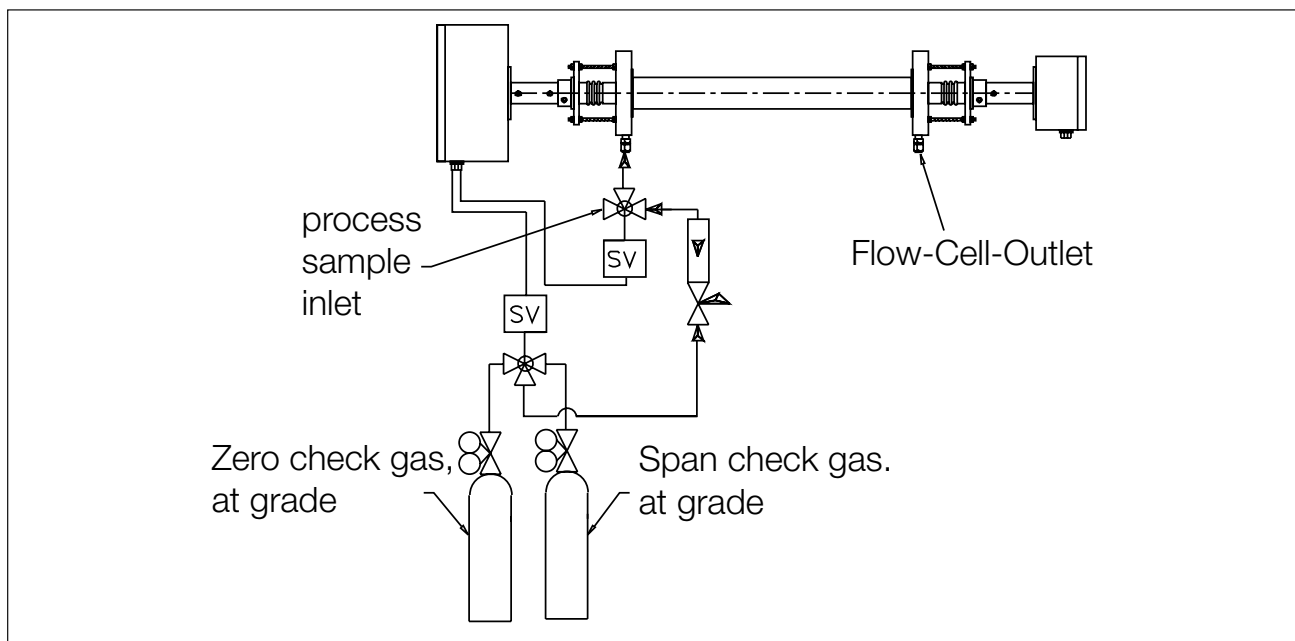
Calibration must be performed manually. The analyzer is removed from the process connections and installed on a calibration cell. Zero and span gas can then be applied to the analyzer with calibration performed through the user menu.



## Extractive or Close Coupled Calibration / Validation:

Validation can be performed manually or automatically with the serial validation cell (span check only described above), or by isolating the analyzer from the process and flowing zero and span gas through the optical path (flow cell or bypass piping).

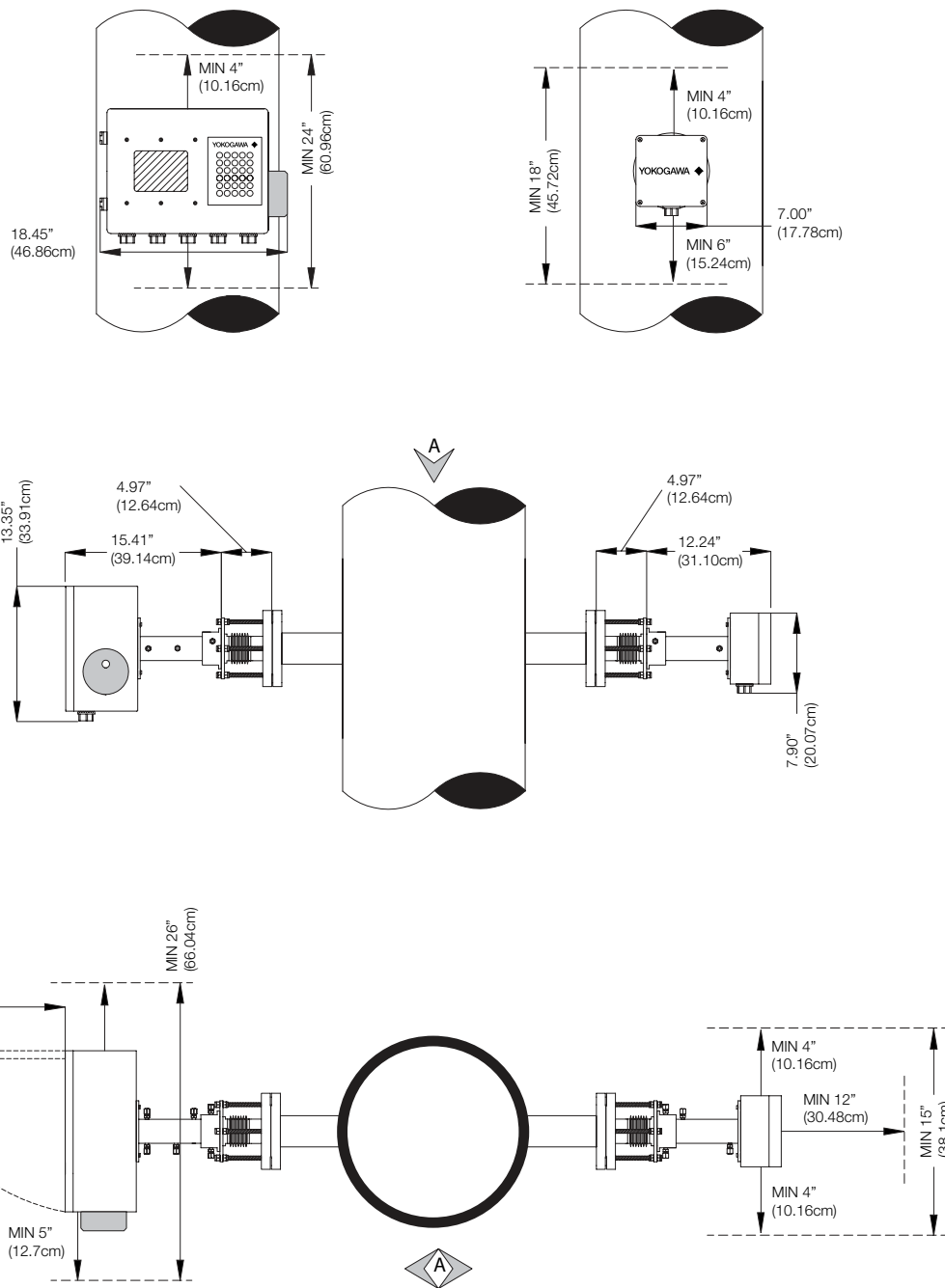
Calibration must be performed manually. The analyzer is isolated from the process gas, zero and span gas can then be applied to the analyzer with calibration performed through the user menu. For applications where the measured gas is typically not present (0 level concentration), Yokogawa recommends an auto-validation sequence once per month.



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## Dimensions

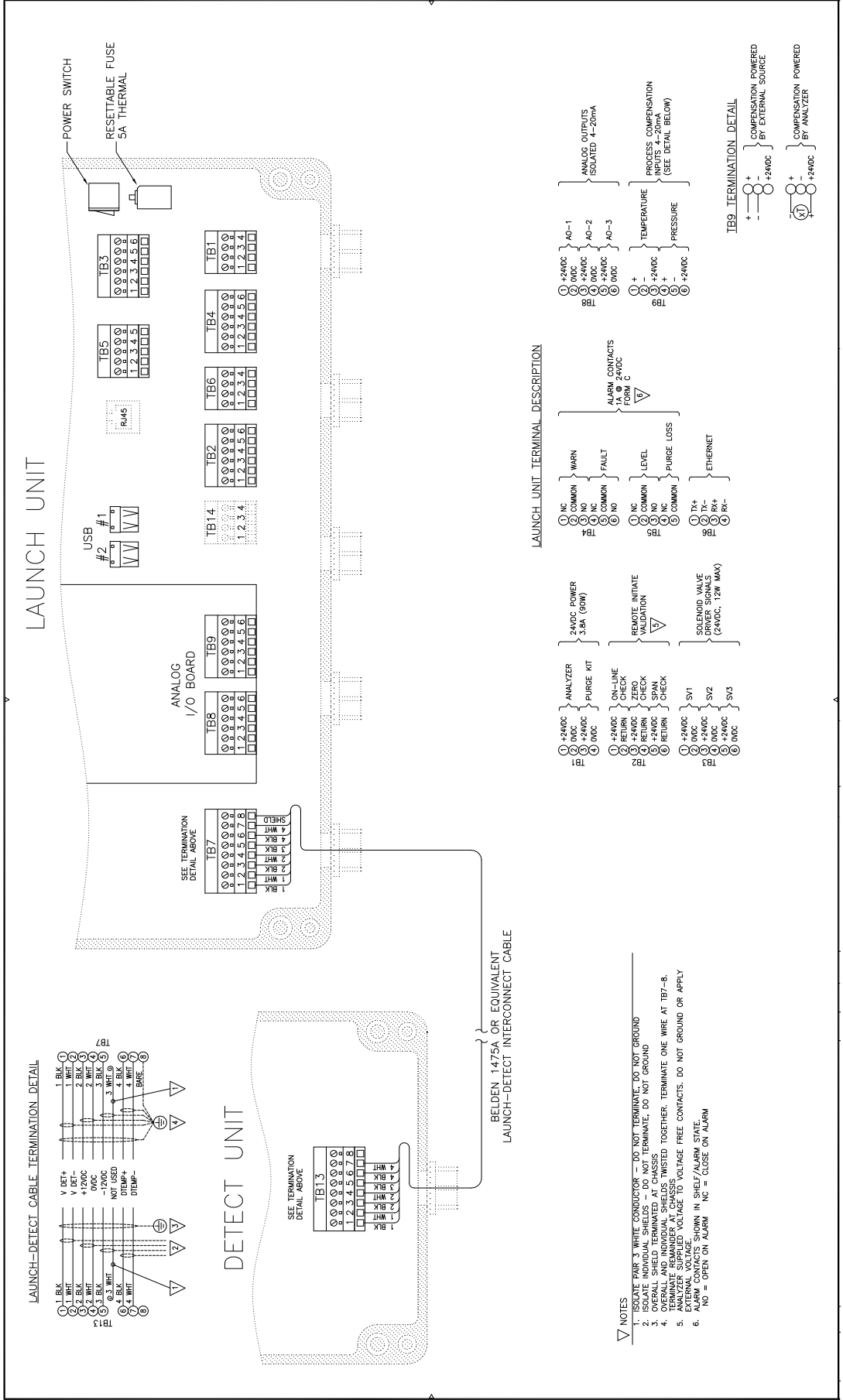


The analyzer requires purge gas  $N_2$  /air/other the flow of which needs to be controlled. Utility panels may be provided in various forms for one or two units to control purge gas and validation gases as standard and additional purge gas for hazardous area application when required. The Utility panel can automatically control via the analyzer validation gases which will indicate whether the analyzer is within calibration.

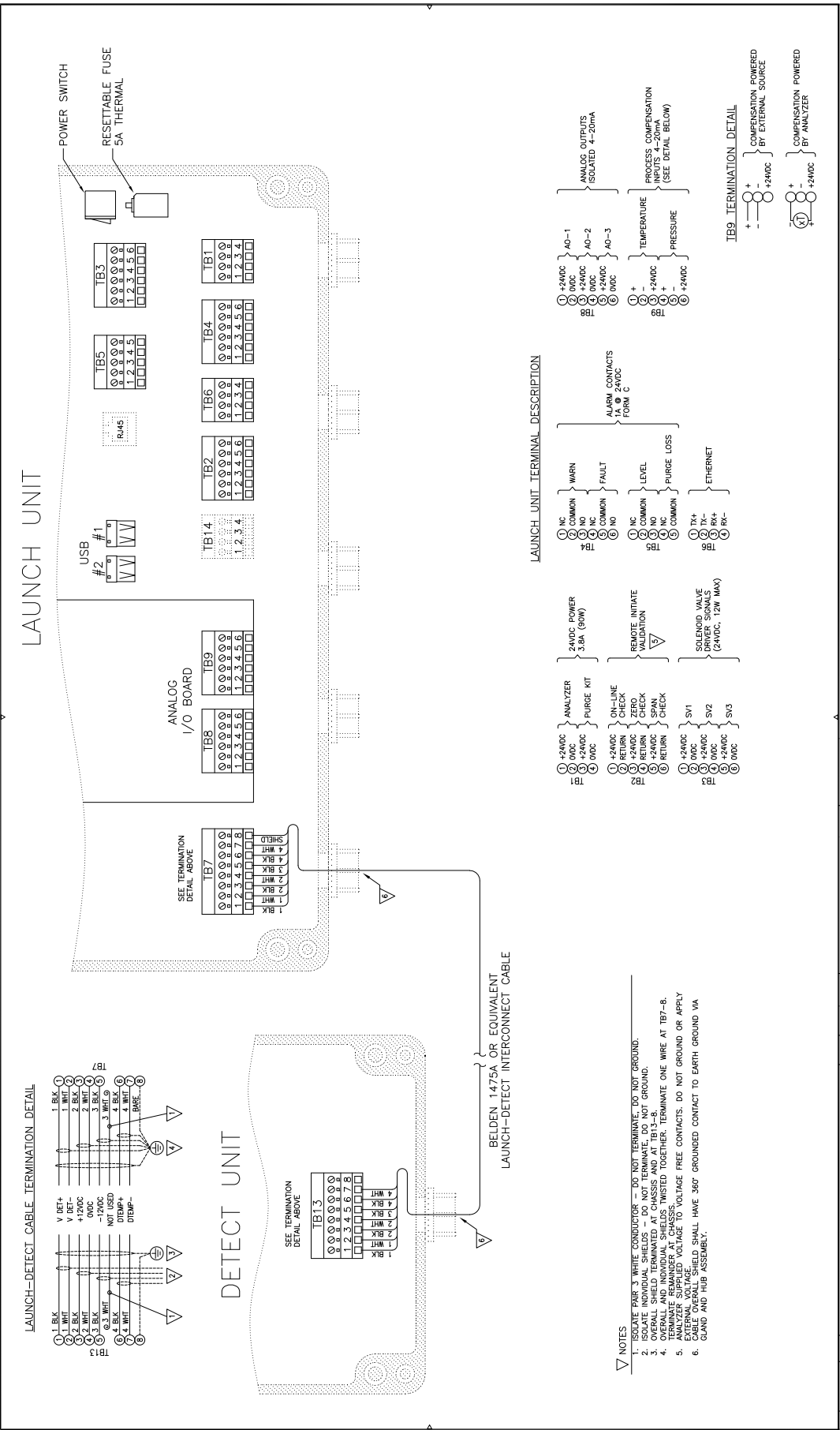
The Analyzer in normal usage is a non contact device. Purge gases are used to ensure sample does not contact the analyzer, and these gases are often a gas which does not contain the gas to be measured. Nitrogen, for example, is often used as a purge gas in Oxygen measurement. However, depending on the application, it may be possible to use air as a purge gas (even for oxygen measurements) and purge gases are not invariably required.

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Wiring of Launch for the US version



00000-6000-1-1-A-DWG



00000-6001-1-1-A (2) (DWG)

## Model and Suffix Codes

Model	Suffix Code	Option Code	Description
TDLS200	-----	-----	Tunable Diode Laser
Type	-N -G -D -S -J	----- ----- ----- ----- -----	General Purpose (None CE) General Purpose (CE) Class I Div 2 BCD Purged ATEX CAT 3/ zone 2 Purged TIIS Hazardous Area
Gas Parameter	-X1 -X2 -X3 -C1 -C2 -C3 -C4 -A1 -A2 -S1 -D1 -D5 -H1 -H2 -H3 -H4 -K1	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----	Oxygen (O <sub>2</sub> ) < 600°C, 0-25% Oxygen (O <sub>2</sub> ) < 1500°C, 0-25% Oxygen (O <sub>2</sub> ) <1500°C, 0-25%/ Temp Carbon Monoxide (CO) % <500°C Carbon Monoxide ppm (CO) <500°C Carbon Monoxide ppm (CO) <1500°C Carbon Monoxide (CO) ppm <1500°C + CH <sub>4</sub> 0-5% Ammonia (NH <sub>3</sub> ) up to 0-5,000ppm Ammonia (NH <sub>3</sub> ) 0-5,000ppm & 0-50% H <sub>2</sub> O Hydrogen Sulfide (H <sub>2</sub> S) up to 0-50% Carbon dioxide (CO <sub>2</sub> ) High Range 0-1; 0-5% Carbon dioxide (CO <sub>2</sub> ) Extend. Range 0=5; 0-50% Water moisture (H <sub>2</sub> O) min 0-30ppm Cl <sub>2</sub> background Water moisture (H <sub>2</sub> O) ppm non-hydrocarbon background Water moisture (H <sub>2</sub> O) ppm Hydrocarbon background High moisture (H <sub>2</sub> O) level min 0-5% Special Applications
User Interface	-N -1 -2	----- ----- -----	None- Blind Controller Integral Mini Display Integral Color LCD Backlit
Interface	-N -A -B -2 -3 -4 -5 -8	----- ----- ----- ----- ----- ----- ----- -----	No Process Interface Included Large Aperture Optics with 3" 150# alignment bellows Large Aperture Optics, with 4" 150# alignment bellows 2" 150# Alignment Bellows 3" 150# Alignment Bellows 4" 150# Alignment Bellows DN50 Alignment Bellows DN80 Alignment Bellows
Options		/U ----- /P ----- /D -----	Ext.USB Port IP66 (NOT ATEX) Pressure Comp Curve Diverging Beam No Large Aperture Optics

### Notes:

- When powering a process compensation transmitter (pressure or temperature), connect the + MA terminal from the loop powered device to the +24 VDC and the – terminal to the + input terminal.
- Alarm relay contacts are form C, SPDT rated max 1A@24VDC.
- The analyzer sends a voltage out to the customer voltage free contacts (or switch) and the analyzer monitors for a return voltage. Do not ground or apply any external voltage.
- When an optional DIV2/Zone 2 purge kit is installed, terminals 3 & 4 are used to power the purge kit.
- Pair 3 white conductor is not terminated. Ensure it is insulated and do not ground.
- Recommended cable for connecting launch unit to detect unit is belden 1475A. 4 shielded pairs, 18 AWG with overall shield and PVC jacket. Power limited tray rated for outdoor use.
- Cable overall shield to be wound with individual pair shields. Overall shield to be connected to terminal #8 on TB7.
- Wound individual pair shields to be landed on earth/chassis ground.



## User Interface

### 1. Local Analyzer Interface

#### Basic Unit (Blind)



No local interface built-in. USB port is provided for data transfer. To configure, start-up and service the analyzer, User must use: a PC/Laptop with Ethernet (VNC) connection and (VAC) Virtual Analyzer Controller Software Package (included), or a (RIU) Remote Interface Unit.

#### Mini-Display



A 4 line 20 character (4x20) vacuum florescent display (VFD) built in to the door of the launch unit. It will display measurement concentration, Transmission, scrolling Status (including alarm types) and scrolling system information (including process parameters). User must use: a PC/Laptop with Ethernet (VNC) connection and (VAC) Virtual Analyzer Controller Software Package (included), or a (RIU) Remote Interface Unit. A USB port is provided for data transfer.

#### Screen & Keypad



A 30 key stainless steel keypad and 6.5" graphical LCD panel built in to the door of the launch unit. This provides full local interface. It eliminates the need for a PC/laptop or (RIU) Remote Interface Units. USB port is provided for data transfer.

### 2. Remote Interface Unit (RIU)



Use with any type of analyzer, a separate wall mount enclosure with screen and keypad. Connects via Ethernet (VNC), up to 3 (standard) 8 (on request) analyzers. Requires 24 VDC input power

- Wall mount enclosure, IP65 (NEMA 4) powder coated aluminum
- Approx 460x330x180mm (18"w x 13"h x 7"d) weight 11.5kg (25lbs)
- Purged for ATEX CAT 2G or CAT 3G, CE, NEC Cl.1, BCD, Division 1 or 2
- Requires 23.5 - 24.5VDC Input power
- Integral keypad and 6.5" display
- Accepts 8 analyzer Ethernet connections – Standard
- Accepts more analyzer Ethernet connections – On request
- Connection to Analyzer Unit via 8 pair shielded twisted pair cable.

TruePeak Virtual Analyzer Controller (VAC) software included, running Window XP embedded OS.

#### Model And Suffix Code YR200 Remote Interface Unit for TDLS

Model	Suffix	Description
YR200	-----	Remote Interface Unit
Type	-G1 ----- -D2 ----- -A1 -----	General Purpose Hazardous Area Div 2 Hazardous Area ATEX
-----	-N ---	Always N

## Utility Panel

A Utility Panel provides a central location for:

- Inst Air / N<sub>2</sub> supply for purges
- Validation control
- Purge control
- 110 VAC line power in and 24VDC out to each analyzer
- Analog signals
- Digital signals
- Analyzer interface

Yokogawa supplies a single interconnect cable that connects the Utility Panel to the Launch unit for power and signal requirements. Utility Panels for 1 to 4 analyzers are available.



1 Channel Utility panel



2 Channel Utility panel



2 Channel Utility panel  
with RIU



4 Channel Utility panel  
with RIU

## Model and Suffix Codes

TDLS200 Utility Panel (YP200)

Model	Suffix Code		Description
YP200	-----		Utility Panel for TDLS
Number of Channels	-1	-----	Single Utility Panel
	-2	-----	Dual Utility Panel
	-3	-----	Triple Utility Panel
	-4	-----	Quad Utility Panel
Materials of Construction	-E1	-----	Fiberglass
	-E2	-----	Stainless Steel 316
	-E3	-----	Stainless Steel 304
Materials of Back Plate Style	-A	-----	Painted Steel
	-B	-----	Stainless Steel 316
Type	-GP	-----	General Purpose
	-H2	-----	Hazardous Area (Div 2)
	-AH	-----	ATEX Hazardous Area
Interface	-N	-----	Without Remote Interface Unit
	-R	-----	With Remote Interface Unit
Validation Type	-MA	-----	Manual Validation
	-AU	-----	Automatic Validation
-----	-N	-----	Always N

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## Cables

The WT200 cables supplied by Yokogawa Corporation of America are compatible with all Yokogawa TDLS analyzers. The purpose of these cables is to transmit the signal from the sensor/detector to the analyzer.

The cable is either a 4 pair or 8 pair bare copper stranded conductor material covered with thermoplastic PVC. The wires are also covered with thermoplastic PVC individually and colored.

### Technical Specifications

<b>Conductor</b>	: WT200-LD: 4 Pair Shielded 18 AWG bare copper material WT200-UT: 8 Pair Shielded 18 AWG bare copper material WT200-EN: 4 Pair Shielded 24 AWG bare copper material	<b>Shield</b>	: WT200-LD: Both individual wires and overall WT200-UT: Both individual wires and overall WT200-EN: No outer shield
<b>Conductor Type</b>	: Stranded Conductor	<b>Jacket</b>	: PVC- Polyvinyl Chloride
<b>Insulation Material</b>	: WT200-LD: PVC- Polyvinyl Chloride WT200-UT: PVC- Polyvinyl Chloride WT200-EN: PO- Polyolefin	<b>Voltage</b>	: 300 VAC Power Limited
		<b>Temperature Rating</b>	: WT200-LD: Up to 105°C WT200-UT: Up to 105°C WT200-EN: -20 to 75°C (installation range) -20 to 75°C (operating range)

### Model and Suffix Codes

WT200 Cables for the TDLS

Model	Suffix Code	Description
WT200	-----	TDLS Cables
Type	-LD ----- -UT ----- -EN -----	4-Pair Tray Rated 8-Pair Tray Rated Ethernet Cable
Length	-005 ----- -010 ----- -015 ----- -020 ----- -025 ----- -030 ----- -035 ----- -040 ----- -045 ----- -050 ----- -055 ----- -060 ----- -065 ----- -070 ----- -075 ----- -080 ----- -085 ----- -090 ----- -095 ----- -100 -----	5 Meters 10 Meters 15 Meters 20 Meters 25 Meters 30 Meters 35 Meters 40 Meters 45 Meters 50 Meters 55 Meters 60 Meters 65 Meters 70 Meters 75 Meters 80 Meters 85 Meters 90 Meters 95 Meters 100 Meters
Ends	-CE ----- -US ----- -NA -----	CE End Preparations US End Preparations No End Preparations
-----	-N --	Always -N

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## Application Inquiry Form

## 1. General Information

Company:	Requested Delivery Date:
Address:	Contact Person:
Email:	
Telephone:	Fax:
Plant Location	Brief Description of application:

## 2. Installation Details (check one - see drawings):

☐ Cross Stack/Pipe. For measurement across the process.  
 Path length \_\_\_\_\_ Process Connection \_\_\_\_\_

☐ Bypass Leg. Measurement across bypass leg located at process measurement point.  
 Path length \_\_\_\_\_ Process Connection \_\_\_\_\_

☐ \_\_\_ x \_\_\_ Extractive. Sample is extracted and transported (by others) to analyzer.

## 3. Analyzer Options:

User Interface: ☐ Blind analyzer ☐ With mini display ☐ With color LCD & Keypad ☐ RIU for Multiple Analyzers  
 M1276TP M1276XA M1276XB varies depending on area classification

Cable length from Analyzer Unit to User Interface (specify units): \_\_\_\_\_

Area Classification: \_\_\_\_\_

Ambient Temperature (Min-Max.) Specify units \_\_\_\_\_

## 4. Validation

Validation Method ☐ Not supplied ☐ Dynamic spiking (incl. valves and controls) ☐ Auto-calibration check (extractive system)

## 5. Process Wetted Materials

Must Use \_\_\_\_\_ Must Not Use \_\_\_\_\_

## 6. Electrical Power Supply:

☐ Optional: Universal AC Power Supply Unit, Accepts 100-240 VAC 50/60Hz input and outputs 24VDC, one per analyzer or RIU

## 7. Stream Composition (1 sheet per stream analyzed)

Component	Concentrations			Units	Measured	Range If Measured	Precision If Measured			Alarm Level
Name	Min.	Typ.	Max.	ppm(v) vol%	Yes/No			Rel	Abs	
							+/-			
							+/-			
							+/-			
							+/-			
							+/-			
							+/-			
							+/-			
							+/-			
							+/-			
							+/-			

## 8. Physical Properties

	Units	Min.	Typ.	Max
Temperature				
Pressure				
Dew Point				
Water Vapor				
Flow				
Velocity				
Particulate Concentration				

## 9. General Application &amp; Installation Notes/Comments:



<p><b>YOKOGAWA HEADQUARTERS</b> 9-32, Nakacho 2-chome, Musashinoshi Tokyo 180 Japan Tel. (81)-422-52-5535 Fax (81)-422-55-1202 E-mail: <a href="mailto:webinfo@mls.yokogawa.co.jp">webinfo@mls.yokogawa.co.jp</a> <a href="http://www.yokogawa.com.jp">www.yokogawa.com.jp</a></p> <p><b>YOKOGAWA EUROPE B.V.</b> Euroweg 2 3825 HD Amersfoort The Netherlands Tel. +31 (0)88-4641000 Fax +31 (0)88-4641111 E-mail: <a href="mailto:info@nl.yokogawa.com">info@nl.yokogawa.com</a> <a href="http://www.yokogawa.com/eu">www.yokogawa.com/eu</a></p>	<p><b>YOKOGAWA CORPORATION OF AMERICA</b> 2 Dart Road Newnan GA 30265 United States Tel. (1)-770-253-7000 Fax (1)-770-251-2088 E-mail: <a href="mailto:info@yca.com">info@yca.com</a> <a href="http://www.yokogawa.com/us">www.yokogawa.com/us</a></p> <p><b>YOKOGAWA ELECTRIC ASIA Pte. Ltd.</b> 5 Bedok South Road Singapore 469270 Singapore Tel. (65)-241-9933 Fax (65)-241-2606 E-mail: <a href="mailto:webinfo@yas.com.sg">webinfo@yas.com.sg</a> <a href="http://www.yokogawa.com.sg">www.yokogawa.com.sg</a></p>	<p>Yokogawa has an extensive sales and distribution network. Please refer to the website (<a href="http://www.yokogawa.com/an/index.htm">www.yokogawa.com/an/index.htm</a>) to contact your nearest representative.</p> <div><b>YOKOGAWA</b> ◆</div>
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# General Specifications

Model ZR22G, ZR402G, and ZR202G  
Direct In Situ Zirconia Oxygen Analyzers  
and High Temperature Humidity Analyzers

EX4ti

CE

The basic analyzer consists of a direct insertion type probe and a converter that provides an analog output for control or monitoring purposes. In addition a digital signal is superimposed on the current output (HART®) for optimization of maintenance. The converter controls also the (semi) automatic calibration when used with the calibration units.

The detector and the converter are combined in one unit (ZR202) for simplified piping and wiring or the converter is mounted separately (ZR402)

Various accessories are available for optimal installation in difficult applications (dust filter, flame arrester, probe protector, high temperature probe adapter, probe supporter) and for ease of maintenance and calibration.

The analyzer is most commonly used to monitor the Oxygen level in combustion air to allow optimal burner control to avoid air pollution and save energy. The direct insertion installation is especially attractive from a maintenance point of view: sampling systems are not required.

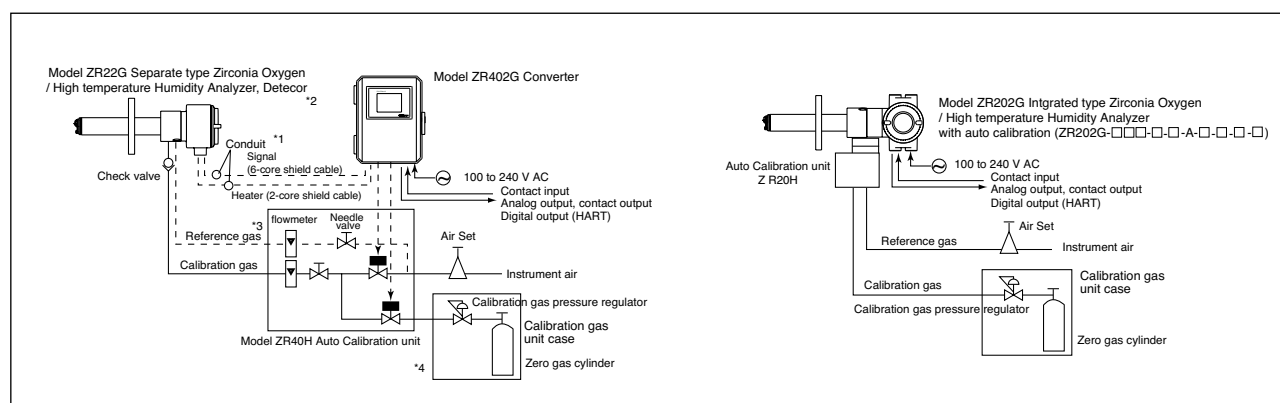
The analyzer can also be used to monitor the Humidity concentration at high temperatures in air with water as found in humidifying processes like bakeries or in indirectly heated dryers as found in paper machines.



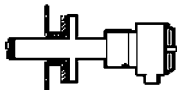
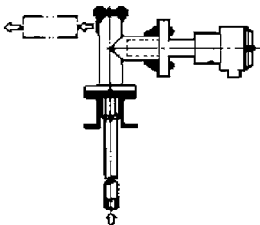
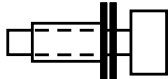
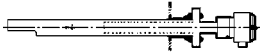
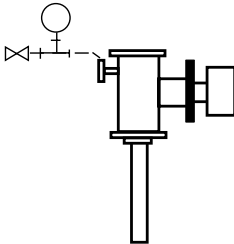
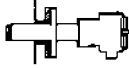
## Features

- Direct measurement: no sampling required
- Field replaceable unique Zirconia cell, made to last.
- Heavy duty sensor heater
- Rebuildable probe construction
- Various methods for reference air to optimize accuracy versus ease of installation
- Automatic compensation of duct pressure possible.
- Remote maintenance and set-up by digital communication (HART®)

## System configuration



## Examples of system component selection based on sample gas condition

Process gas temperature 0 to 600 °C ( 700 °C with inconel bolts)				Process gas temperature 0 to 1400 °C	
Mounting	Insertion length	General-use Probe	Application/dust	High temperature detector	Application
Horizontal to vertical	0.4 to 2m	 General-purpose detector ZR22G-	<ul style="list-style-type: none"> <li>• Boiler</li> <li>• Heating furnace</li> <li>• Low dust level</li> </ul>	 ZR22G-015 ZO21P-H Needle valve not supplied	<ul style="list-style-type: none"> <li>• Heating furnace</li> <li>• 0 to 5.0kPa</li> </ul>
Vertical	3m				
Horizontal	3m	 General-purpose detector with probe supporter ZO21R	<ul style="list-style-type: none"> <li>• Boiler</li> <li>• Heating furnace</li> <li>• Low dust level</li> </ul>		
Horizontal to vertical	0.4 to 2m	 General-purpose detector with protector and filter with: ZO21R K9471 UA *	<ul style="list-style-type: none"> <li>• For pulverized coil boiler with gas flow velocity 10 m/s or more</li> <li>• Cement kiln</li> <li>• High dust level</li> </ul>	 ZR22G-015 ZO21P-H E7046EC	- 0.5 to 0kPa
Horizontal to vertical	1.0 to 2m				
Vertical	3m	 General-purpose detector with filter K9471 UA	<ul style="list-style-type: none"> <li>• Black liquid recovery boiler</li> <li>• Cement kiln</li> <li>• High dust level</li> </ul>		

\* Note: Downward oriented mounting preferred

## Standard specifications (Oxygen analyzer)

### General specifications

Measurement range	: 0.01 to 100 vol% O <sub>2</sub>
Output signal	: 4- 20 mA DC, maximum load 550 Ohm
Output span	: 0-5 vol% and for zero suppression any span with minimum of 0.3 x concentration at 4 mA
Digital communication	: Frequency Shift Key following HART® protocol; 250- 550 Ohm, depending on number of field devices (multi drop mode)
Warm-up time	: approx 20 minutes

### Performance specifications

Repeatability	: ± 0.5% FS for set range <25 vol% ± 1% FS for set range >25 vol%
Linearity	: ± 1% FS for set range <25 vol% ± 3% FS for set range <50 vol% ± 5% FS for set range <100 vol%
Long term stability	: ± 2% FS per month for zero and span
Response time	: 90% within 5 seconds measured from calibration gas inlet
Conditions	: Dry instrument air used as reference air Pressure fluctuations < 0 ± 0.49 kPa Measurements > 2 weeks after first installation

### 1. ZR402 Remote Converter of Zirconia Analyzer

Display	: Graphical display 1/4 VGA (320 x 240 dots) with touch screen
Current output	: (2) current outputs 4- 20 mA DC with HART® on mA1: max. load 550Ω
Contact output	: (4) contacts max. load 3A @ 30 VDC and 3A @ 250VAC resistive load with leakage current <3 mA with adjustable hysteresis (0- 9.9vol%) and delay function (0- 250s) One contact output is fail safe, 3 contacts selectable NO or NC
Additional contacts	: (2) for live output to calibrating unit (zero gas and span gas)
Contact functions	: HIGH, LOW, FAIL, HOLD, CAL, range switch answer back), Warm-up, Start blow-back, Flame out signal (answer back), Cal gas pressure (answer back), High Temp.
Contact inputs	: (2) programmable for Cal gas pressure, Range switching, Cal start, Blow back start, system failure.
Analog input	: 4- 20 mA @24 VDC for Temperature input
Ambient temperature	: -20 to + 55°C
Storage temperature	: -30 to + 70°C
Humidity	: 0 to 95% (non condensing)
Enclosure	: IP65, NEMA 4X
Altitude	: Below 2000 m
Power supply	: 100- 240 VAC, -15% + 10%, 50/60 Hz ±10%
Power consumption	: Maximum 300 W, normal operation 100W
CE conformance	: Conforms to EN61010-1: 1993; EN61326: 1998
Cable entry	: (8) inlets M20x 1.5 other connections on request
Installation	: Pipe mounting DN50/ 2" stand pipe or wall mount
Material	: Cast Aluminum, Polyurethane coating, case and cover: silvergrey
Weight	: 6 kg
Distance from detector	: maximum resistance 10 Ohm 2-way. (300m for one mm² wire)

### 2. ZR202 Integral Zirconia Analyzer

Display	: 6-digit LCD
Operation	: 3 optical switches that can be operated without opening the cover
Analog output	: 4- 20 mA, maximum load 550 Ohm.
Digital communication	: HART® on mA: 250- 550 Ohm
Contact output	: (2) contacts: one is fail safe, Normally Open (NO)
Contact input	: (2) contacts
Weight	: 3 kg + 3 kg (flange PN10DN50) + 4 kg/m insertion
Insertion length	: 0.4, 1.0, 1.5 and 2.0 m
Material	: Cast Aluminum, Polyurethane coating, case and cover: mint green

*All other specifications of ZR22 and ZR402 are applicable for ZR202 as well.*

### 3. ZR22G Detector of Zirconia Analyzer

Sample gas temperature	: 0- 600°C for standard version 600- 700°C for version with Inconel bolts 700- 1400°C for high temperature version (0.15 m) with high temperature probe adapter.
Ambient temperature	: -20 to +150°C
Sample gas pressure	: 0 ± 5 kPa for standard models with reference air by natural convection or instrument air, -5 to 250 kPa for version with pressure compensation construction. Pressure fluctuations influence the accuracy unless pressure compensation is applied
Insertion length	: 0.15, 0.4, 1.0, 1.5, 2.0 m other insertion lengths on request
Material of probe	: Stainless Steel 316 for standard detector Stainless Steel 310S for high temperature probe (<1000°C) Silicon Carbide for high temperature probe (< 1400°C)
Exposed materials	: SUS 316 (detector), SUS 304 (flange), Hastelloy B (sensor flange), Zirconium Oxide, Platinum, (Inconel)
Reference air system	: Natural convection; instrument air or pressure compensation
Instrument air	: Dry and clean, recommended pressure 200 kPa, flow rate 1 NL/min.
Construction	: Heater and thermocouple unit replaceable (specify insertion length) General purpose, IP66/NEMA4X only with pressure compensation version
Terminal box	: Cast Aluminum, Polyurethane coating, case and cover: mint green
Connection gas lines	: R1/4 or 1/4" FNPT
Wiring connection	: M20 x 1.5. Other connections on request
Mounting	: Horizontal to vertical downward. Horizontal mounting of long detectors (>2.0 m) is only possible using probe supporter or probe protector. (<3m)
Material	: Cast Aluminum, Polyurethane coating, case and cover: mint green
Weight	: 1 +3 kg (flange DIN PN10DN50) + 4 kg/m insertion.

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#### 4. ZO21P-H High Temperature Probe Adapter for ZR22G detector

Description	: The ZO21P-H high temperature probe adapter consists of a Stainless Steel TEE piece with JIS5k32AFF flange for connection to the ZR22G-015 detector. The process side of the TEE is blinded off with a flange DIN PN10DN50 with an R <sub>1/2</sub> thread for mounting of the sampling probe. The other side of the TEE is blinded off with a flange and supplies a R1/4 or 1/4" FNPT connection for ejector or valve.
Sample temperature:	0-1400°C for SiC sampling probe 0- 800°C for SUS 310S sampling probe
Sample pressure	: -0.5 to + 5.0 kPa. For negative sample pressure an auxiliary ejector assembly is necessary.
Insertion length	: 1.0, 1.5 m
Process connection	: DIN PN10 DN50 flanged connection
Material	: SUS 316 (adapter), SUS 304 (flange), SiC or SUS310S (sampling probe)
Mounting	: Vertically downward sampling probe with zero ± 5 degree from vertical (SiC sampling probe). Horizontal mounting with SUS310S sampling probe is possible.
Weight	: 7 kg for 1m version; 8 kg for 1.5m version

#### 5. E7046EC/E7046EN Auxiliary Ejector for ZO21P-H Probe Adapter

Ejector assembly	: Inlet air pressure 29 to 68 kPa, air consumption 30- 40 NI/min, sample flow rate 3- 7 NI/min, material SUS304, connection Rc 1/4 or 1/4" NPT, tube connection compression fitting for 6 mm OD copper or SS tubing.
Pressure gauge	: 0- 100 kPa G, materials in contact with gas SUS316, case material coated aluminum.
Needle valve	: Material SUS316, connection R 1/4 or 1/4" NPT

#### 6. ZO21R Probe Protector for Zirconia Oxygen Analyzer

Used when sample gas flow velocity is approx. 10m/sec or more and dust particles wears the detector in cases such as pulverized coal boiler of fluidized bed furnace (or burner) to protect the detector from wearing by dust particles. When probe insertion length is 2.5m or more and horizontal installation, specify the ZO21R-L-uuu-u\*B to reinforce the probe.

Insertion length	: 1.05m, 1.55m, 2.05m.
Flange	: JIS 5K 65A FF equivalent. ANSI CLASS 150-4-FF (without serration) equivalent or DIN PN10-DN50-A equivalent. However, flange thickness is different.
Material	: SUS316, SUS304 (Flange)
Weight	: 1.05m; Approx. 6/10/8.5kg (JIS/ANSI/DIN), 1.55m; Approx. 9/13/11.5kg (JIS/ANSI/DIN), 2.05m; Approx. 12/16/14.5kg (JIS/ANSI/DIN)
Installation	: Bolts, nuts, and washers are provided for detector, probe adapter and process-side flange.

#### 7. Filter for Oxygen Analyzer K9471UA

This filter is used to protect the cell from corrosive dust components or high velocity dust in recovery boilers and cement kiln. Measured gas flow rate is needed to be 1m/sec or more to replace gas inside zirconia sensor.

Mesh	: 30 microns
Material	: Carborundum (Filter), SUS316
Weight	: Approx. 0.2 kg

#### 8. L9852CB/G7016XH Stop Valve

The stop valve is mounted on the calibration gas line. It is attached when the suffix code (/SV) is selected for the Zirconia oxygenAnalyzer/High-temperature Humidity Analyzer prove ZR22G or the Zirconia oxygenAnalyzer/High-temperature Humidity Analyzer ZR202G.

Connection	: Rc 1/4 or 1/4 FNPT
Material	: SUS316
Weight	: Approx. 80 g

#### 9. K9292DN/K9292DS Check Valve

This is used to prevent entry of process gas into calibration gas line. Purpose is the same as stop valve, but is convenient, as it does not need to be opened or closed for calibration. Mount directly on calibration gas inlet of detector in place of stop valve. However as source pressure of 50 kPa G or more is needed. When option code "/CV" of the ZR22G or the ZR202G is specified, check valve is provided.

Connection	: Rc1/4 or 1/4FNPT
Material	: SUS304
Pressure	: Between 70 kPa G or more 350 kPa G or less
Weight	: Approx. 40g

#### \*10. ZA8F Flow Setting Unit

Used when instrument air is provided. This unit controls flow rates of calibration gas and reference gas and consists of flowmeter and flow rate control valve.

Flowmeter	: Calibration gas; 0.1 to 1.0 l/min. Reference air; 0.1 to 1.0 l/min.
Construction	: Dust-proof and rainproof construction
Case material	: SPCC, dark-green (Munsell 2.0 GY 3.1/0.5 or equivalent)
Painting	: Baked epoxy resin, darkgreen
Tube connections	: Rc 1/4 or 1/4 FNPT
Reference air pressure	: Clean air supply of measured gas pressure+approx. 50 kPa G (pressure at inlet of the auto-calibration unit)
Air consumption	: Approx. 1.5 l/min
Weight	: Approx. 2kg
Note	: Used instrument air for span calibration gas, if without instrument air is used, contact YOKOGAWA.

\* Recommended calibration gas = 1% Oxygen in Nitrogen  
Flow Rate 0.6 ±0.1 NI/min

### \*11. ZR40H Auto-calibration Unit (for separate type)

This unit is used when the instrument air is provided and the auto-calibration unit is attached. Solenoid valves are provided as standard equipment.

Reference air pressure

: Clean air supply of measured gas  
pressure+approx. 150 kPa G (pressure  
at inlet of the auto-calibration unit)

Air consumption : Approx. 1.5 l/min

Weight : Approx. 3.5 kg

### \*12. ZR20H Auto-calibration Unit (for Integrated type)

Used when automatic calibration is specified for the integrated type and instrument air is provided. Equipped with the analyzer when automatic calibration is specified in the suffix code of the ZR202G integrated type by selecting either "-A (horizontal mounting)" or "-B (vertical mounting)". The ZR20H should be arranged when auto-calibration is to be required after the ZR202H has been installed. Ask Yokogawa service station for its mounting.

Construction : Dust-proof and rainproof construction:  
NEMA4X/IP67 (excluding flowmeter)

Mounting : Mounted on ZR202G, no vibration

Materials : Body: Aluminum alloy, Piping: SUS316,  
SUS304, Flowmeter: MA (Methacrylate  
resin)

Finish : Polyurethane corrosion-resistance coating,  
Case: frosty white CC21, Cover: deep-sea  
moss green CC32

Piping connection : Refer to Model and Suffix Codes

Power supply : 24V DC (from ZR202G),  
Power consumption: 1.3 W

Reference air pressure

: Sample gas pressure + Approx. 150 kPa  
(690 kPa max.), (Pressure at inlet of auto-  
calibration unit)

Air consumption : Approx. 1.5 l/min

Weight : Approx. 2 kg

Ambient temperature

: -20 to +55°C, no condensing and freezing

Ambient humidity : 0 to 95%RH

Storage temperature : -30 to +65°C

### 13. Dust Protector ZH21B

This protector is designed to protect the detector tip from ingress of dust (to prevent combustible materials from entering the detector cell) where humidity measurements are made under dusty environments.

Insertion length : 0.428 m

Flange : JIS 5 K 80 A FF equivalent or ANSI 4 B  
150 LB FF equivalent  
(however, thickness is different)

Materials of flange : SUS 316, SUS 304, Stainless Steel

Weight : approximately 6/8.5 kg (JIS/ANSI)

Mounting : mounted on the detector, and process  
flange with bolts and associated nuts and  
washers

\* Recommended calibration gas = 1% Oxygen in Nitrogen  
Flow Rate 0.6 ±0.1 Nl/min

### 14. ZR20-CAL – Calibration unit

Easy to use and lightweight portable unit for calibration gas supply consisting of span gas (air) and zero gas.

Included in this set:

- 2 span gas alucan light weight bottles (one as a spare)
- 2 zero gas alucan light weight bottles (one as a spare)
- 2 constant flow regulators with quick connectors, set to 0.5 L/min
- 1 m tubing with quick connectors and nipple for direct connection to the sensor
- Holder for gas bottles
- Carrying case

Capacity : 0.5 Nl

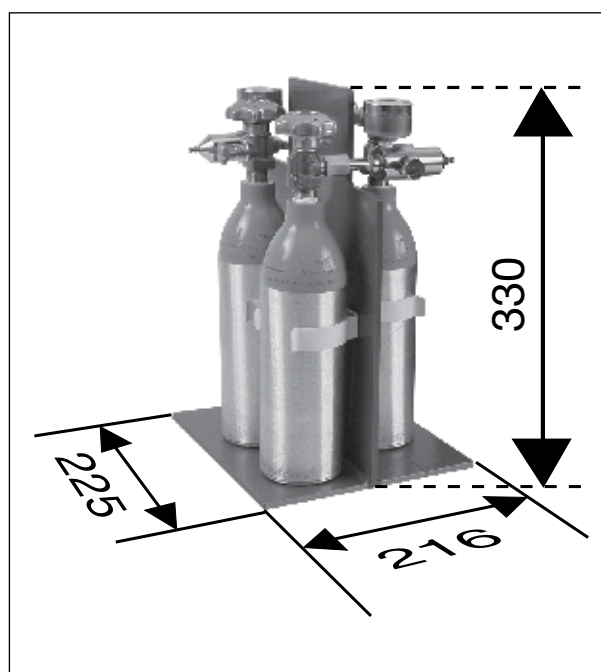
Filled pressure : 120 bar (60 liter gas)

Composition : Span gas: 21% O<sub>2</sub> (air),  
zero gas: 1% Oxygen in Nitrogen

Weight approx. : 8 kg

Material holder : PVC

Material bottles : Aluminium



Dimensions of the gas bottle holder in mm

## Standard specifications for use as Humidity Analyzer

**Description** : The Zirconia Oxygen analyzer can also be used to monitor the absolute humidity in an environment where standard air is mixed with water vapor. Standard air consists of 79% nitrogen and 21% oxygen. If the air is mixed with water vapor, the vol% of oxygen decreases as the vol% of water increases. The Zirconia based Oxygen analyzer is therefore very useful as an analyzer for moisture content of the sample gas. Both the ZR402 and the ZR202 can be software switched from Oxygen analysis to Humidity analysis.

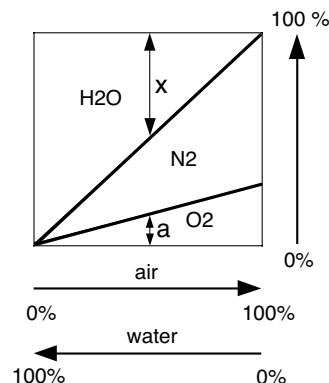
**Sample composition**: The sample gas may only contain a mixture of Oxygen, Nitrogen and Water.

**Performance** : The performance specifications are determined by the primary measurement: the measurement of Oxygen. The possible errors in humidity units can be calculated from the possible errors in the Oxygen analysis.

**Range** :

1. Percent by volume: range 0- 100%, minimum span 0- 25 vol%
2. Weight ratio: kg H<sub>2</sub>O/ kg dry air: range 1- 1.00, min span 0- 0.200 kg/kg dry air
3. Dew point: range 0- 100°C
4. Relative humidity: range 0- 100%

## Calculation

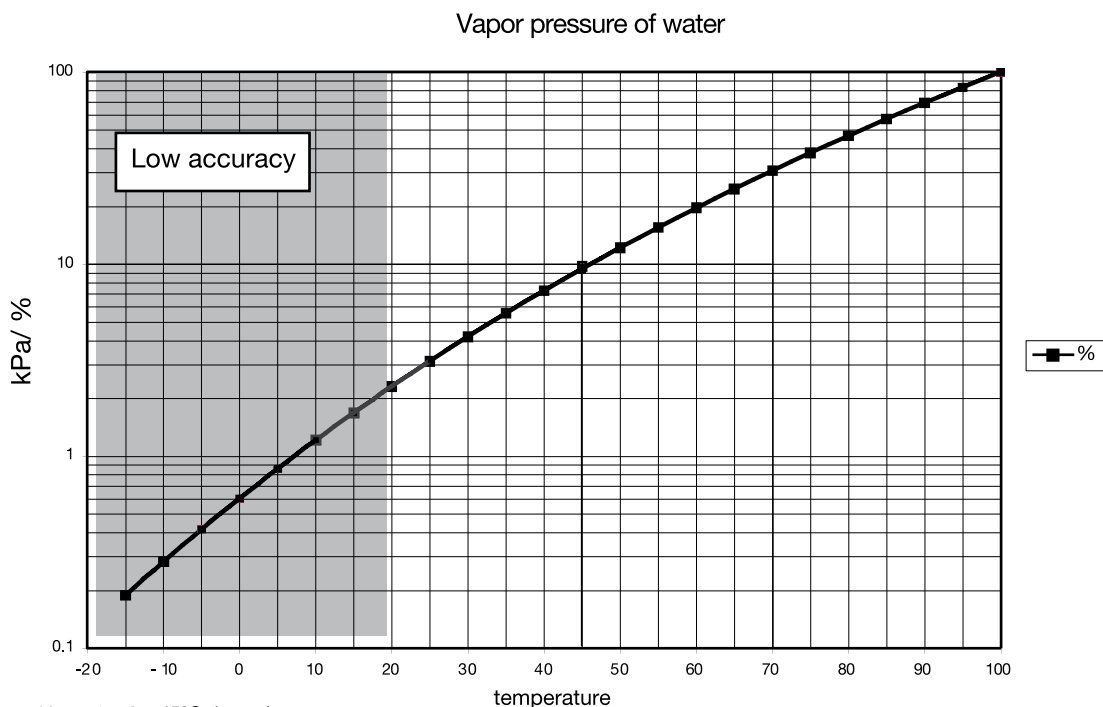


$$x = 100 - \left( \frac{100}{21} \right) \cdot a$$

$$\text{Vol\%: Vol\%H}_2\text{O} = 100 - \left( \text{Vol\%O}_2 \left( \frac{100}{21} \right) \right)$$

$$\text{kg/kg: } r = 0.622 \cdot \frac{\text{Vol\%H}_2\text{O}}{100 - \text{Vol\%H}_2\text{O}} = 0.622 \cdot \frac{21 - \text{Vol\%O}_2}{\text{Vol\%O}_2}$$

## Calculation Dew Point, calculation rH



example: 10 Vol% H<sub>2</sub>O = 45°C dewpoint

$$10 \text{ Vol\% at } 70^\circ\text{C} = \frac{10}{30} = 33\% \text{ rH}$$

**Configurations** : All configurations are possible, but insertion length of 0.4m is most common

**Options** : ZH21B Dust protector for high dust environment. Insertion length 0.416 m flange JIS 5k-80 or ANSI 150# 4", material SUS 316, Carborundum (SiC), SUS 304 (flange), weight 6 kg



## Model and Suffix codes

### 1. Separate type Zirconia Oxygen / High temperature Humidity Analyzer, Converter

Model	Suffix code	Option code	Description
ZR402G			Separate type Zirconia Oxygen/ High Temperature Humidity Analyzer, Converter
Converter thread	-M		M20x1.5 mm
Display	-E -G -F		English German French
Instruction manual	-E		English
-	-A		Always -A
Options		/HS	Instruction manual for Humidity Analyzer
		/H	Hood
		/SCT	Stainless steel tag plate
		/PT	Printed tag plate

### 2. Integrated type Zirconia Oxygen / High temperature Humidity Analyzer, Converter

Model	Suffix code	Option code	Description
ZR202G			Integrated type Zirconia Oxygen/ High Temperature Humidity Analyzer
Length	-040 -070 -100 -150 -200		0.4 m 0.7 m 1.0 m 1.5 m 2.0 m (2.5 m or > *1)
Wetted material	-S -C		SUS316 Stainless steel with Inconel calibration gas tube (*6)
Flange (*2)	-C -E		ANSI Class 150-4-RF (equivalent) DIN PN10-DN50-A (equivalent)
Auto calibration	-N -A -B		No auto calibration until mounted Horizontal mounting Vertical mounting
Reference air	-C -P		Natural convection Pressure compensation
Gas thread	-R		Rc 1/4
Connection box thread	-M		M20 x 1.5mm
Instruction manual	-E		English
-	-A		Always -A
Options		/D	Durethane coating
		/C	Inconel bolt (*3)
		/HS	Instruction manual for Humidity Analyzer
		/CV	Check valve (*4)
		/SV	Stop valve (*4)
		/H	Hood (*7)
		/F1	Dust filter (*5)
		/SCT	Stainless steel tag plate
		/PT	Printed tag plate

\*1 For the horizontal installed probe whose insertion length is 2.5 meters or more, use the Probe Protector.

Be sure to specify ZO21R-L-qqq-q. Specify the flange suffix code either -C or -K.

\*2 The thickness of the flange depends on its dimensions.

\*3 Inconel probe bolts are used. Use this option for high temperature use (ranging from 600 to 700°C).

\*4 Specify either /CV or /SV option code.

\*5 Not used with the High-Temperature Humidity Analyzer.

\*6 Recommended if measured gas contains corrosive gas like chlorine.

\*7 Sun shield hood is still effective even if scratched. Hood is necessary for outdoor installation out of sun shield roof.

### 3. Separate type Zirconia Oxygen / High Temperature Humidity Analyzer, Detectors

Model	Suffix code	Option code	Description
ZR22G			Separate type Zirconia Oxygen/ High Temperature Humidity Analyzer, Detector
Length	-015 -040 -070 -100 -150 -200		0.15 m (for high temperature use) (*1) 0.4 m 0.7 m 1.0 m 1.5 m 2.0 m (*2)
Wetted material	-S -C		SUS316 Stainless steel with Inconel calibration gas tube (*9)
Flange (*3)	-C -E -Q		ANSI Class 150 4 RF Equivalent DIN PN10 DN50 A equivalent JIS 5K 32 FF equivalent (for high temperature use) (*4)
Reference air	-C -P		Natural convection Pressure compensation
Gas thread	-R		Rc 1/4
Connection box thread	-M		M20 x 1.5mm
Instruction manual	-E		English
-	-A		Always -A
Options		/D	Durethane coating
		/C	Inconel bolt (*5)
Valves		/CV	Check valve (*6)
		/SV	Stop valve (*6)
Filter		/F1	Dust filter (*7)
Tag plates		/SCT	Stainless steel tag plate (*8)
		/PT	Printed tag plate (*8)

\*1 Used with the ZO21P High Temperature Probe Adapter. Select flange (-Q).

\*2 For the horizontal installed probe whose insertion length is 2.5 meters or more, use the Probe Protector.  
Be sure to specify ZO21R-L-qqq-q. Specify the flange suffix code either -C or -K.

\*3 The thickness of the flange depends on its dimensions.

\*4 Not used in conjunction with -P (pressure compensation) for reference air. The flange thickness does not conform to JIS specification.

\*5 Inconel probe bolts and U shape pipe are used. Use this option for high temperature use (ranging from 600 to 700°C).

\*6 Specify either /CV or /SV option code.

\*7 Not used with the high temperature humidity analyzer.

\*8 Specify either /SCT or /PT option code.

\*9 Recommended if measured gas contains corrosive gas like chlorine.

**Note:** ZR22G can not be connected to Model ZA8C, AV8C, HA400 converter

**Note:** When the ZR22G is used with existing converters, ZA8C, AV8C and HA400, ROM replacement and addition of a cold junction temperature compensator.

The part numbers of each language version of ROM refer to table below.

Model \ Language	English	German	French
ZA8C	K9290KF	K9290MF	K9290MG
HA400 (kg)	K9293HU	K9293HW	K9293HV
HA400 (%)	K9293HQ	K9293HS	K9293HR
AV8C	K9296CN	K9296CN	K9296CN

**Note:** Part number for ROM K9290KF and 2021D style Cold Junction compensator is M1234FH-A

#### 4. Adapter for High temperature Probe of separate type Oxygen Analyzer

Model	Suffix code	Description
ZO21P	-H	High Temperature Probe Adapter
Material	-A -B	SiC SUS 310S
Insertion length	-100 -150	1.0 m 1.5 m
Flange	-E -A	DIN PN10-DN50-A equivalent ANSI Class 150-RF
Style code	*A	Style A

**Note:** For this high-temperature use probe adapter, be sure to specify the ZR22G probe of it's insertion length 0.15 meters.

High Temperature Probes (Spare Parts)

Part No.	Description
E7046AL	SiC, insertion length 1.0 m
E7046BB	SiC, insertion length 1.5 m
E7046AP	SUS310S, insertion length 1.0 m
E7046AL	SUS310S, insertion length 1.5 m

#### 5. Auxiliary Ejector for High Temperature Use of separate type Oxygen Analyzer

Part No.	Description
E7046EC	Rc 1/4 ø6 / ø4 TUBE joint: SUS304

#### 6. Probe Protector for Zirconia Oxygen Analyzer

Model	Suffix code	Description
ZO21R	-L	Probe protector (0 to 700°C)
Insertion length	-100 -150 -200	1.05 m (3.5ft) 1.55 m (5.1ft) 2.05 m (6.8ft)
Flange (*1)	-E -A	DIN PN10-DN50-A equivalent ANSI Class 150-4-RF equivalent
Style code	*B	Style B

\*1 Thickness of flange depends on dimensions of flange

#### 7. Filter for Zirconia Oxygen Analyzers

Part No.	Description
K9471UA	Filter

#### 8. Stop Valve for Calibration-gas line

Part No.	Description
L9852CB	Joint: Rc 1/4, material: SUS316
G7016XH	Joint: 1/4 NPT, material: SUS316

#### 9. Check Valve for Calibration-gas line

Part No.	Description
K9292DN	Joint: Rc 1/4, material: SUS304
K9292DS	Joint: 1/4 NPT, material: SUS304

#### 10. Flow setting unit for manual calibration (Needs instrument air.)

Model	Suffix code	Description
ZA8F		Flow setting unit
Joint	-J -A	Rc 1.4 With 1/4" NPT adapter
Style code	*B	Style B

#### 11. Automatic Calibration Unit for Separate type Analyzer (Needs instrument air.)

Model	Suffix code	Description
ZR40H		Automatic calibration unit for ZR402G
Gas piping connection	-R	Rc 1/4
Wiring connection	-M	20 mm (M20 x 1.5)
Style code	-A	Always A

#### 12. Automatic Calibration Unit for Integrated type Analyzer (Needs instrument air.)

Model	Suffix code	Description
ZR20H		Automatic calibration unit for ZR202G*1
Gas piping connection	-R	Rc 1/4
Reference air *2	-E -P	Instrument air Pressure compensated
Mounting	-A -B	Horizontal mounting Vertical mounting
Style code	-A	Always A

\*1 Ask Yokogawa service station for additional mounting of ZR20H to the preinstalled ZR202G.

\*2 Select the appropriate reference air of ZR20H according to the one of ZR202G.

#### 13. Dust Protector for High Temperature Humidity Analyzers

Model	Suffix code	Description
ZR21B		Dust protector (0 to 600°C)
Insertion length	-040	0.409 m
Flange	-A	ANSI Class 150-4B FF equivalent*
Style code	*B	Style B

\* The Flange thickness varies. Specify the probe ZR22G-040.

#### 14. ZR20-CAL – Standard Local Calibration unit

Model	Description
ZR20-cal	Standard Calibration Unit
Spare parts	Description
ZR20-zero	Spare Zero Gas bottle
ZR20-span	Spare Span Gas bottle

#### 15. Heater Assembly

Model	Suffix code	Description
ZR22A		Heater Assembly for ZR22G
Length (*1)	-015 -040 -070 -100 -150 -200 -250 -300	0.15 m 0.4 m 0.7 m 1 m 1.5 m 2 m 2.5 m 3 m
Jig for change	-A -N	with Jig (*2) None
Reference air (*3)	-A -B -C	Reference air natural convention External connection (instrument air) Pressure compensated (for ZE22G S2) Pressure compensated (for ZR22G S1)

\*1 Suffix code of length should be selected as same as ZR22G installed.

\*2 Jig part no. is K9470BX to order as a parts after purchase.

\*3 Select appropriately among "-A", "-B", "-C" according to the reference air supply method and style.

**Note:** The heater is made of ceramic, do not drop or subject it to pressure stress.

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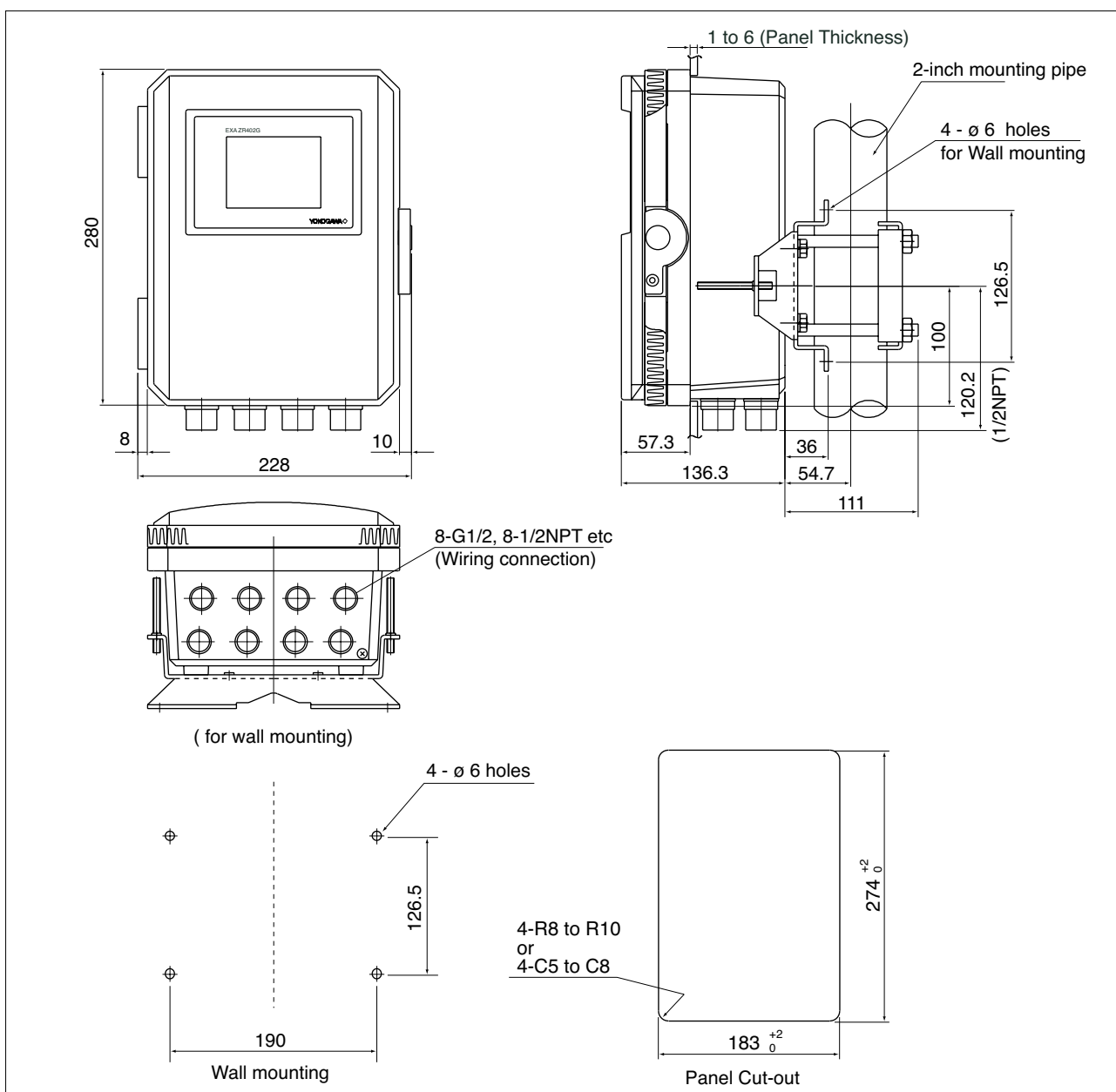
Model	Suffix code	Description
ZR202A		Heater Assembly for ZR202G
Length (*1)	-040	0.4m
	-070	0.7 m
	-100	1 m
	-150	1.5 m
	-200	2 m
	-250	2.5 m
	-300	3 m
Jig for change	-A	with Jig (*2)
	-N	None
	-A	Always A

\*1 Suffix code of length should be selected as same as ZR202G installed.

\*2 Jig part no. is K9470BX to order as a parts after purchase.

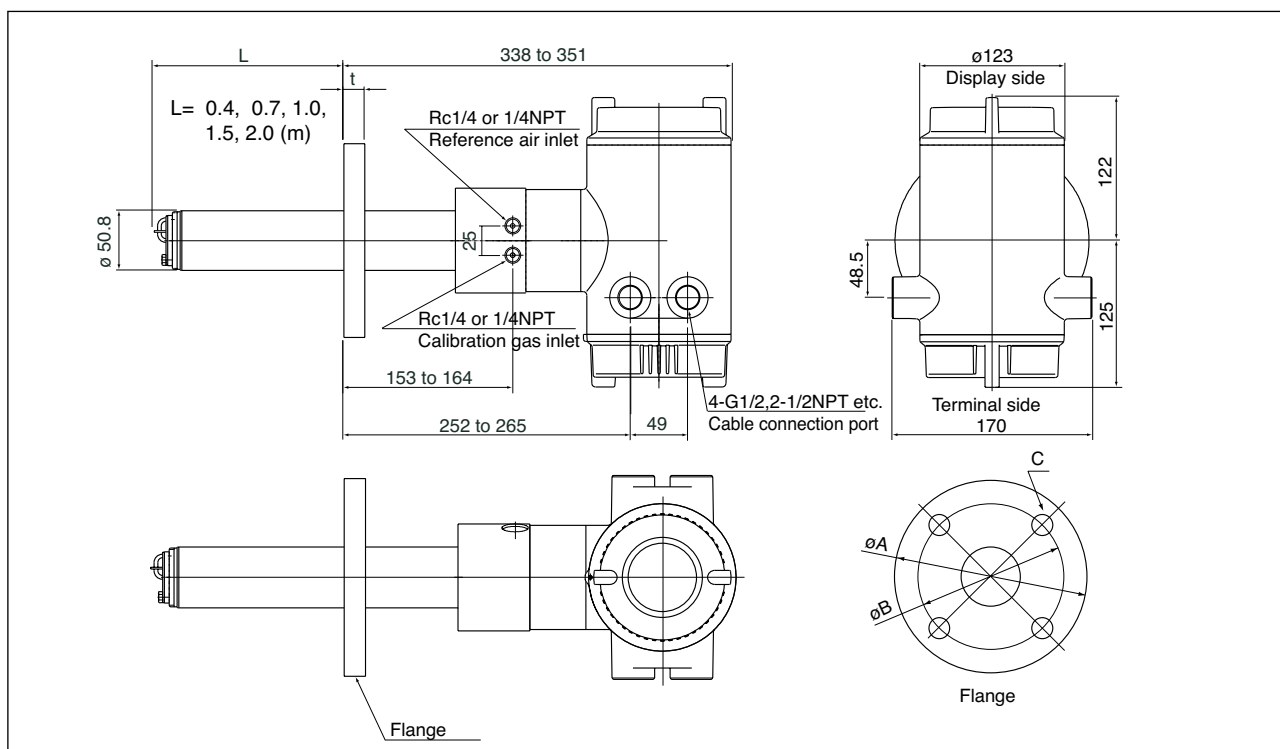
**Note:** The heater is made of ceramic, do not drop or subject it to pressure stress.

### 1. Model ZR402G Separate type Zirconia Oxygen/ High Temperature Humidity Analyzer, Converter

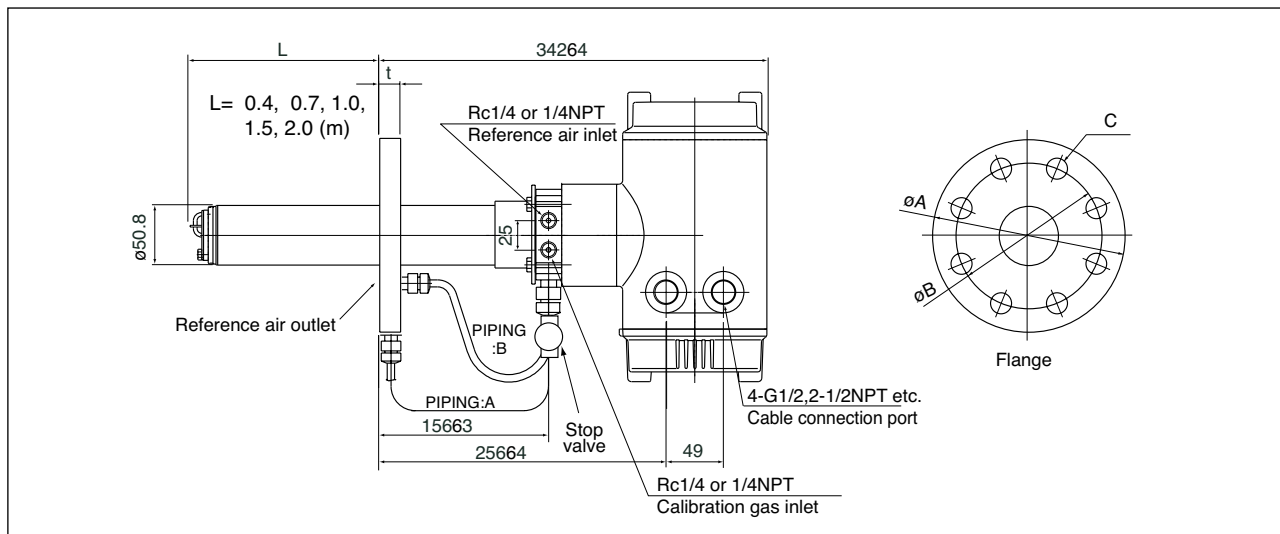


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## 2. Model ZR202G Integrated type Zirconia Oxygen/ High Temperature Humidity Analyzers



### Model ZR202G...-P (with pressure compensation) Integrated type Zirconia Oxygen / High Temperature Humidity Analyzers

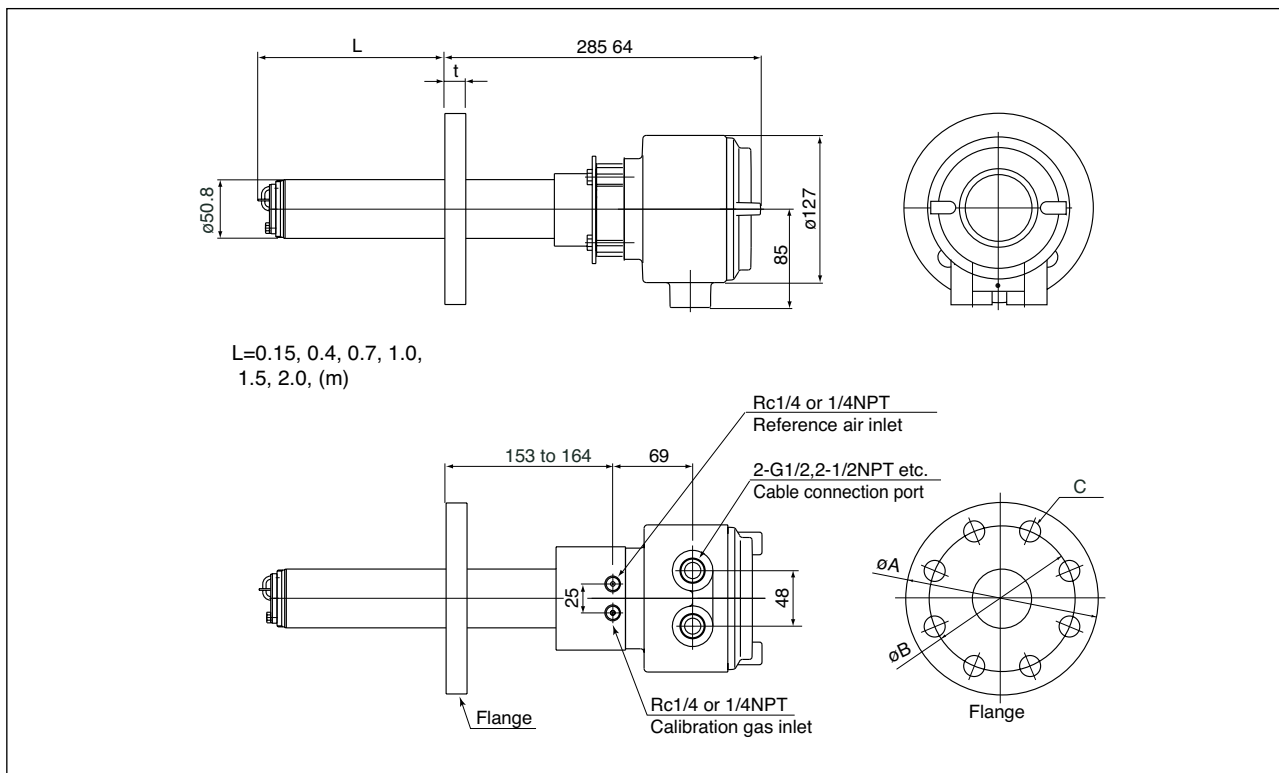


Flange	A	B	C	t	PIPING
ANSI Class 150-2-RF equivalent	152.4	120.6	4 - Ø19	19	A
ANSI Class 150-3-RF equivalent	190.5	152.4	4 - Ø19	24	B
ANSI Class 150-4-RF equivalent	228.6	190.5	8 - Ø19	24	B
DIN PN10-DN50-A equivalent	165	125	4 - Ø18	18	A
DIN PN10-DN80-A equivalent	200	160	8 - Ø18	20	B
DIN PN10-DN100-A equivalent	220	180	8 - Ø18	20	B
JIS 5K-65-FF	155	130	4 - Ø15	14	A
JIS 10K-65-FF	175	140	4 - Ø19	18	A
JIS 10K-80-FF	185	150	8 - Ø19	18	B
JIS 10K-100-FF	210	175	8 - Ø19	18	B
JPI Class 150-4-RF equivalent	229	190.5	8 - Ø19	24	B
JPI Class 150-3-RF equivalent	190	152.4	4 - Ø19	24	B
Westinghouse	155	127	4 - Ø11.5	14	A

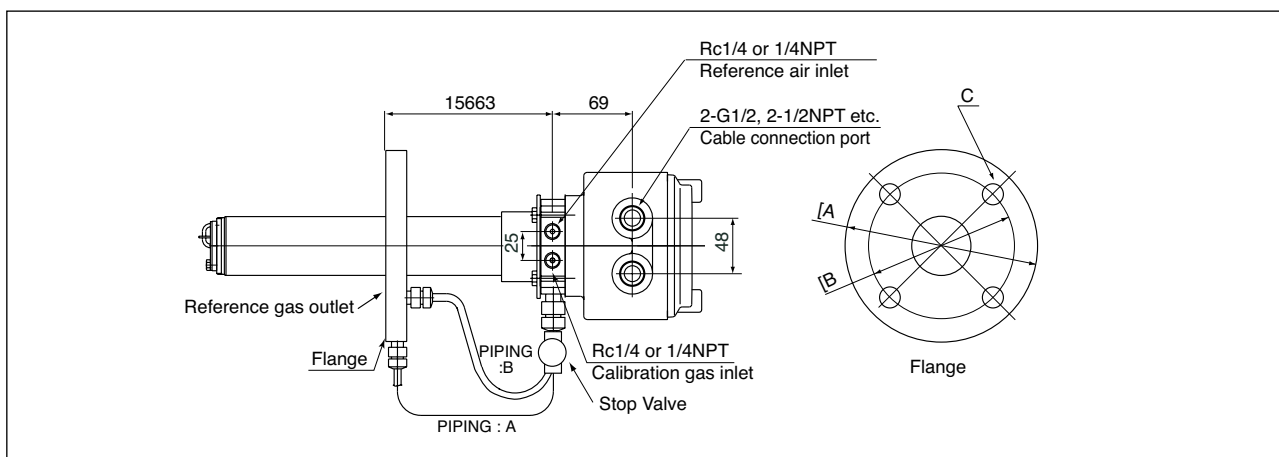
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## External Dimensions

### 3. Model ZR22G Separate type Zirconia Oxygen / High Temperature Humidity Analyzer, Detectors



### Model ZR22G...-P (with pressure compensation) Separate type Zirconia Oxygen / High Temperature Humidity Analyzer, Detectors

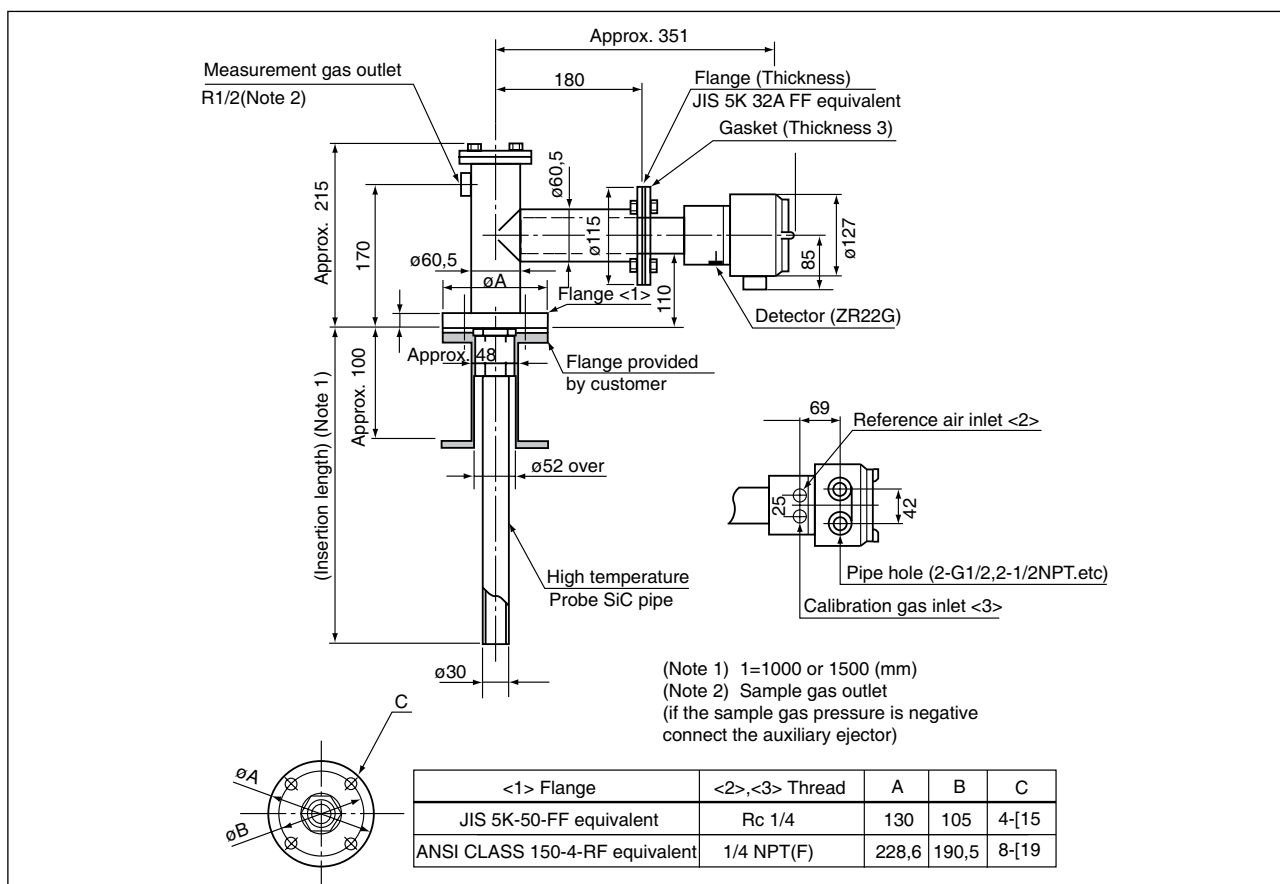


Flange	A	B	C	t	PIPING
ANSI Class 150-2-RF equivalent	152.4	120.6	4 - Ø19	19	A
ANSI Class 150-3-RF equivalent	190.5	152.4	4 - Ø19	24	B
ANSI v 150-4-RF equivalent	228.6	190.5	8 - Ø19	24	B
DIN PN10-DN50-A equivalent	165	125	4 - Ø18	18	A
DIN PN10-DN80-A equivalent	200	160	8 - Ø18	20	B
DIN PN10-DN100-A equivalent	220	180	8 - Ø18	20	B
JIS 5K-65-FF	155	130	4 - Ø15	14	A
JIS 10K-65-FF	175	140	4 - Ø19	18	A
JIS 10K-80-FF	185	150	8 - Ø19	18	B
JIS 10K-100-FF	210	175	8 - Ø19	18	B
JPI Class 150-4-RF equivalent	229	190.5	8 - Ø19	24	B
JPI Class 150-3-RF equivalent	190	152.4	4 - Ø19	24	B
Westinghouse	155	127	4 - Ø11.5	14	A

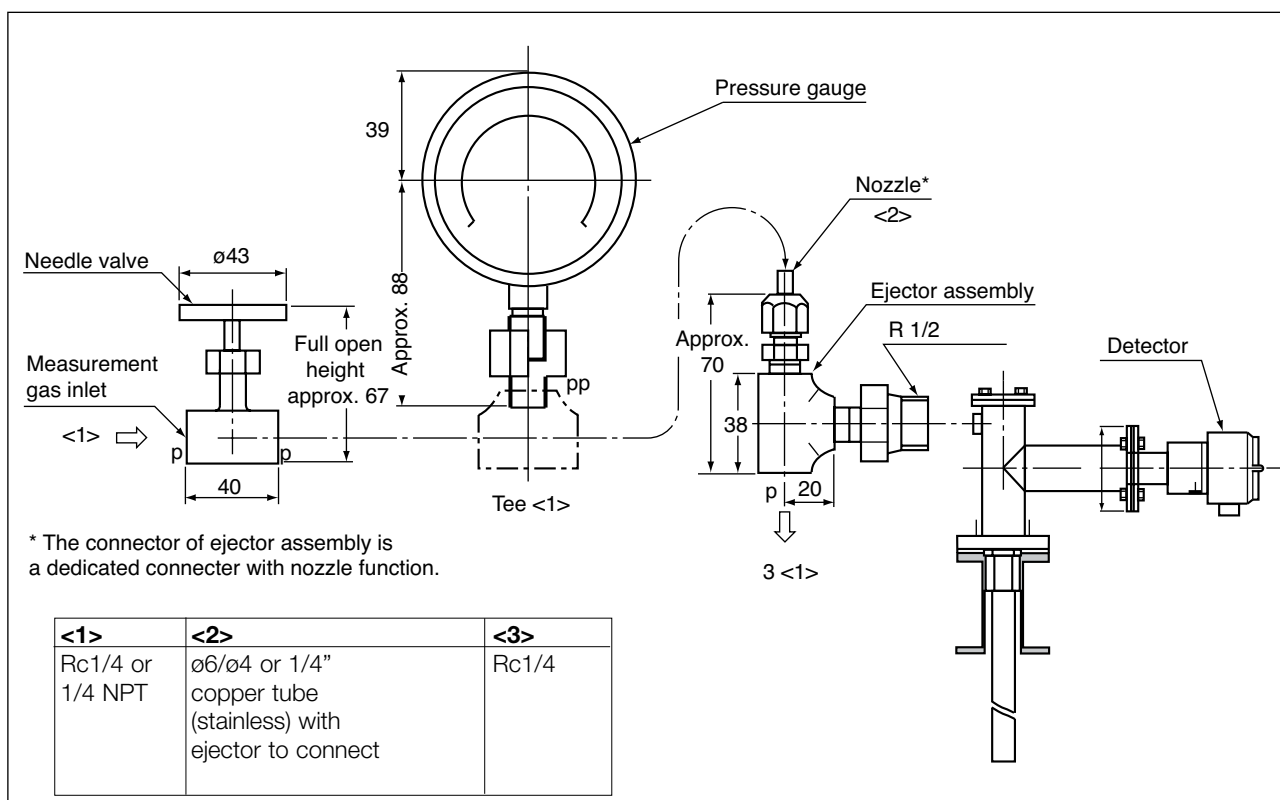
GS 11M12A01-E-E



#### 4. Model ZO21P Adapter for High Temperature Probe of separate type Oxygen Analyzer

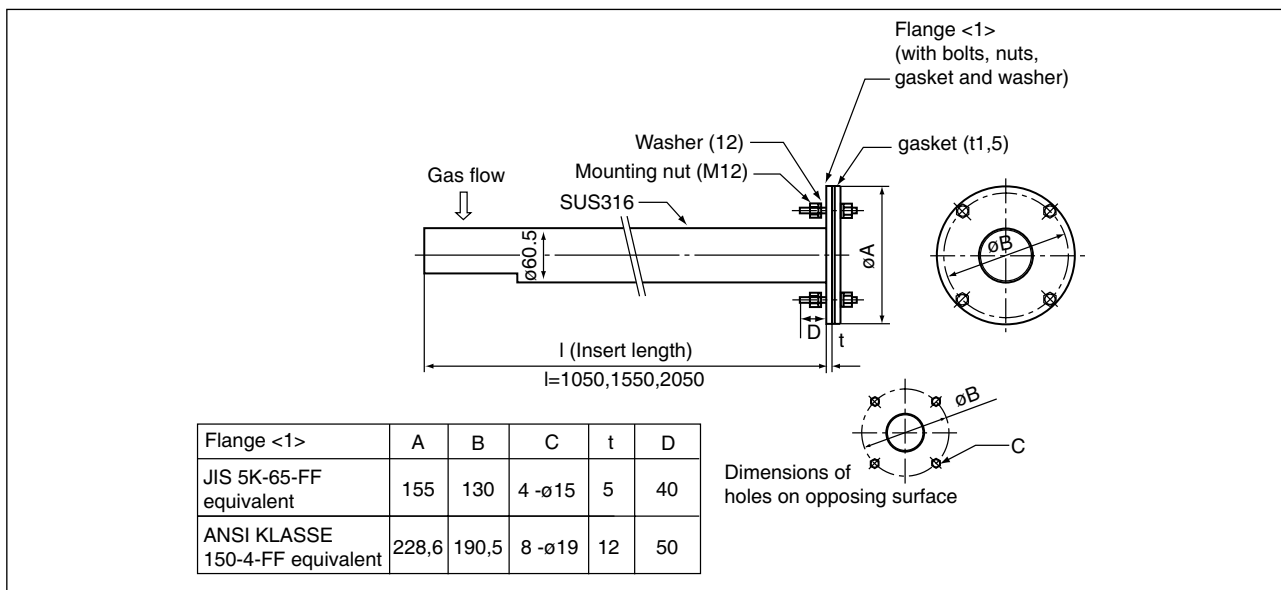


#### 5. Model E7046EC, E7046EN Auxiliary Ejector for High Temperature Use of separate type Oxygen Analyzer

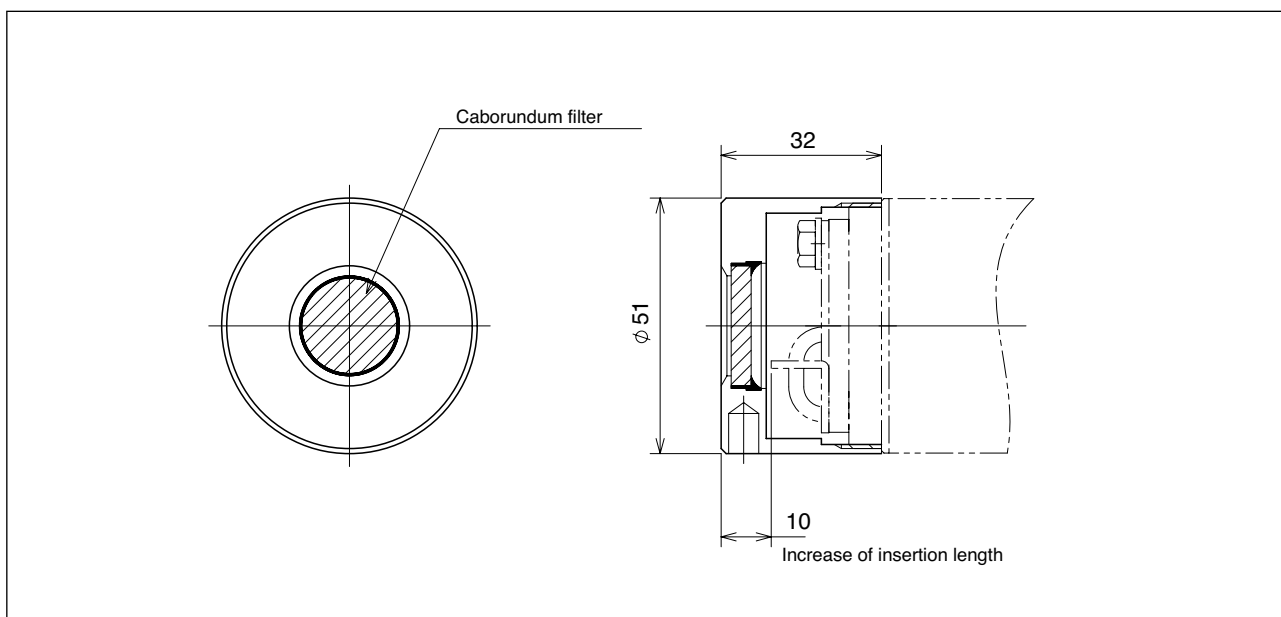


GS 11M12A01-E-E

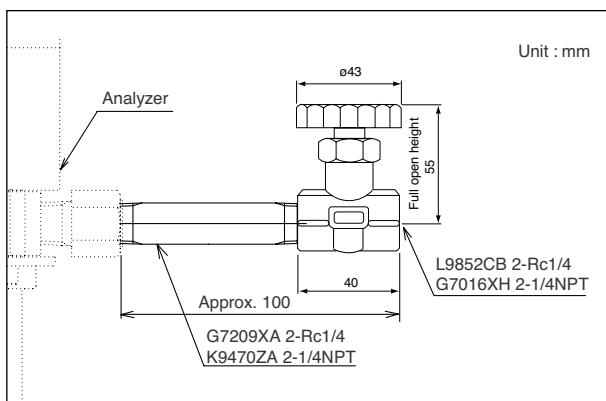
## 6. Model ZO21R Probe Protector for Zirconia Oxygen Analyzers



## 7. Model K9471UA Filter for Oxygen Analyzer

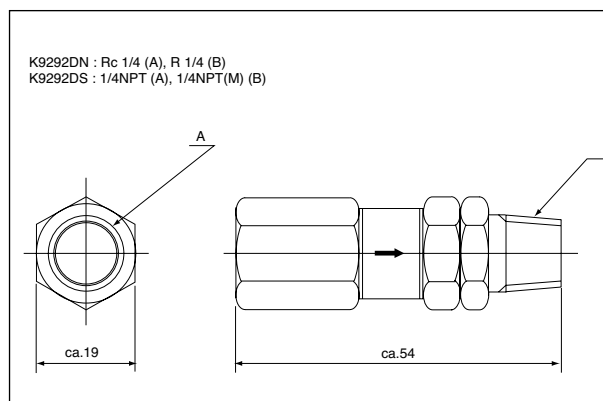


## 8. L9852CB/ G7016XH Stop Valve for Calibration-gas line + G7209XA / K9470ZA

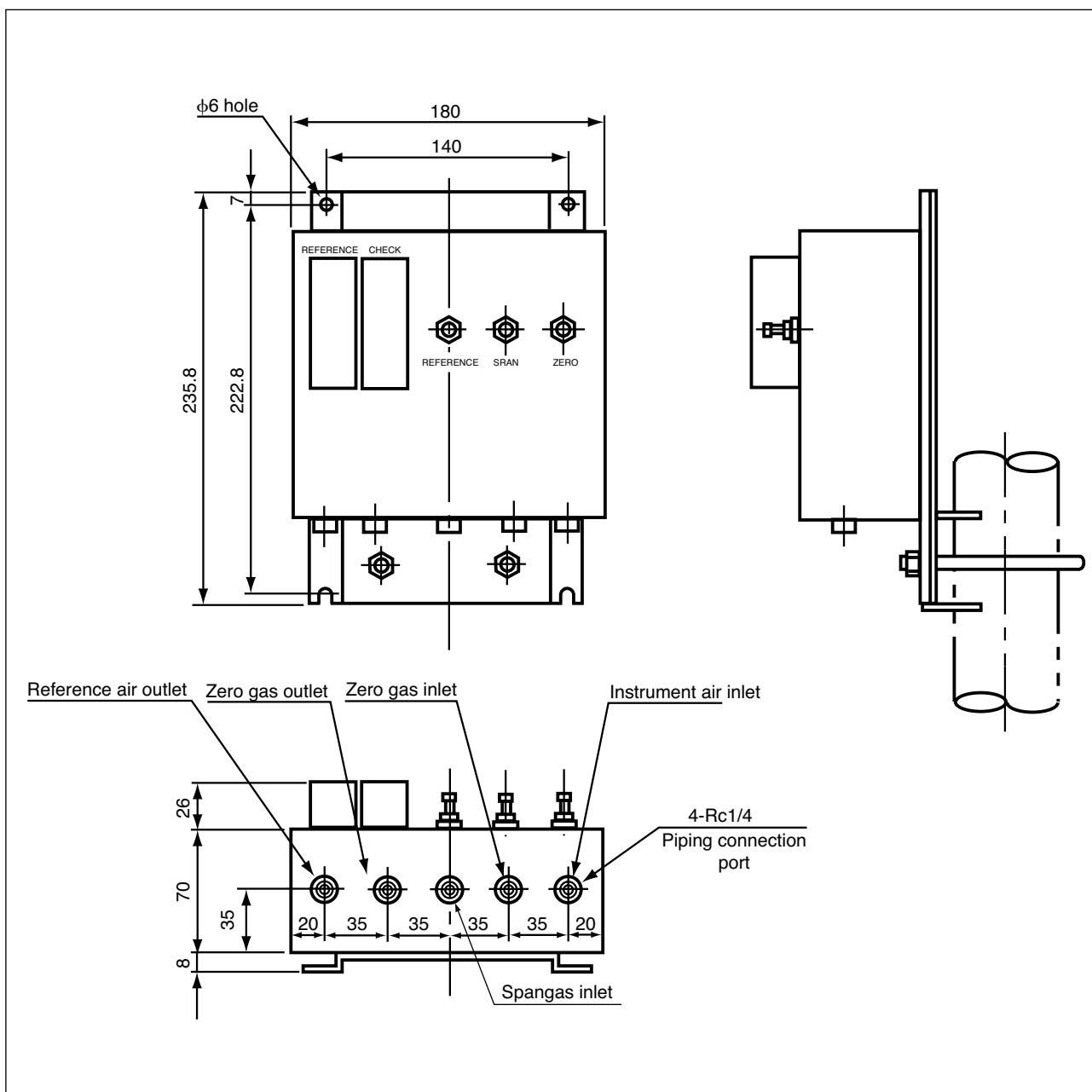


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## 9. K9292DN/ K9292DS Check Valve for Calibration-gas line



## 10. Model ZA8F Flow Setting Unit for Manual Calibration



### Fly Ash Filters

M1234SE-A self cleaning - fly ash filter

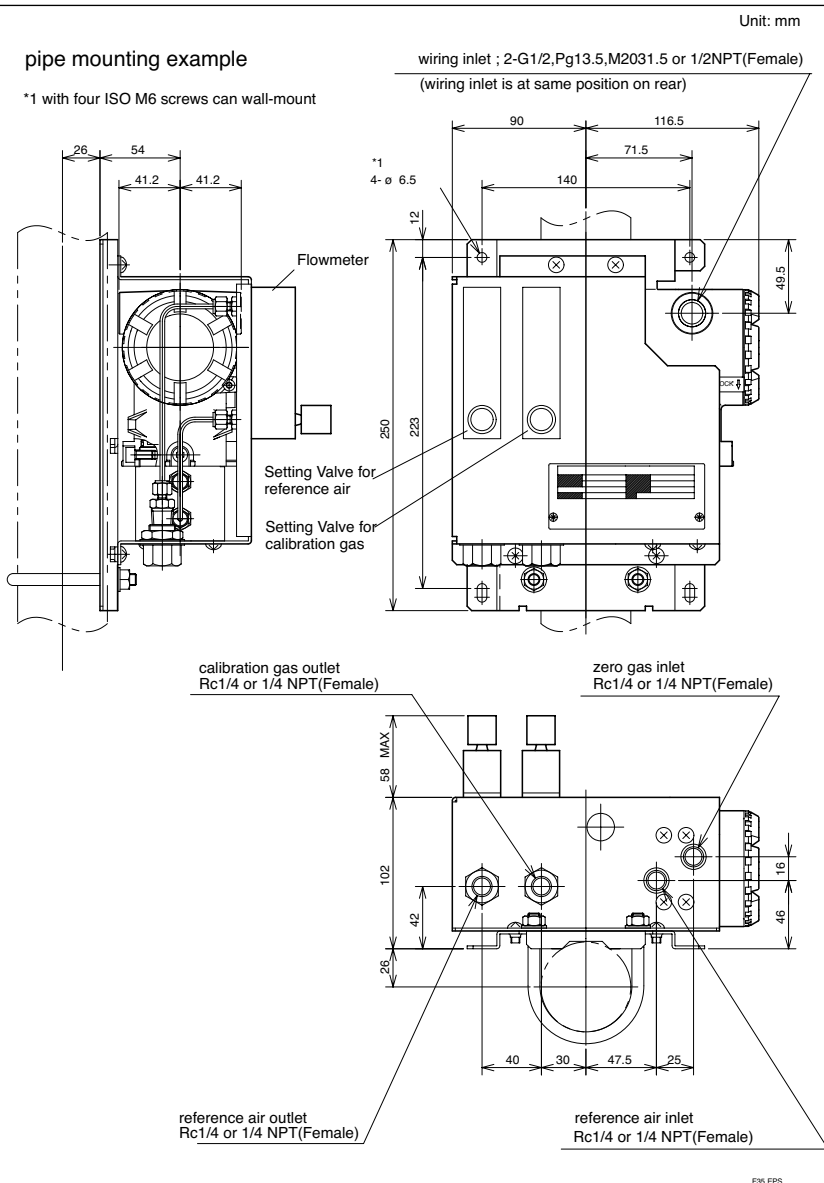
#### General Specifications:

Filter Material	: Hastelloy X
Base material	: SSTL 316
Max OD	: 6.35cm (2.5 in)
Filter surface Area	: 296 sq-cm (46 sq-in)
Max opera. Temp	: 700°C (1292 °F)
Pore size	: 10 micron



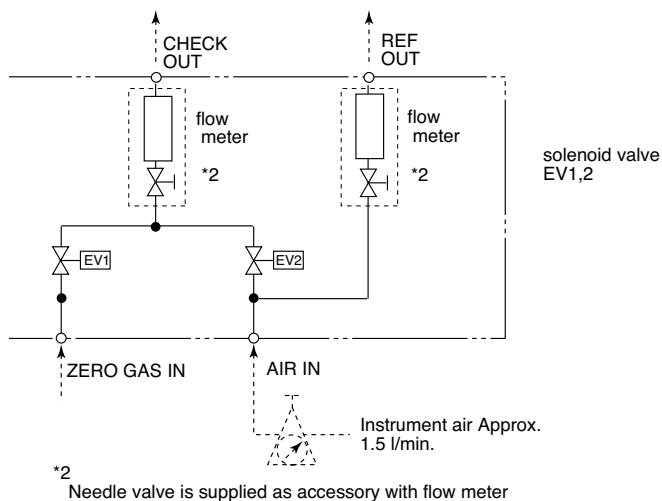
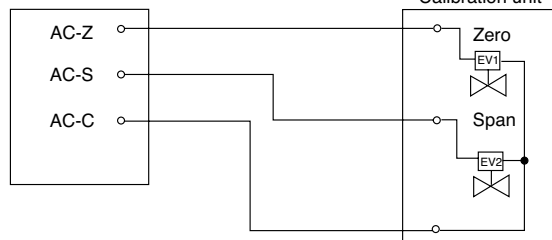
GS 11M12A01-E-E

## 11. Model ZR40H Automatic Calibration Unit for Separate type Analyzer



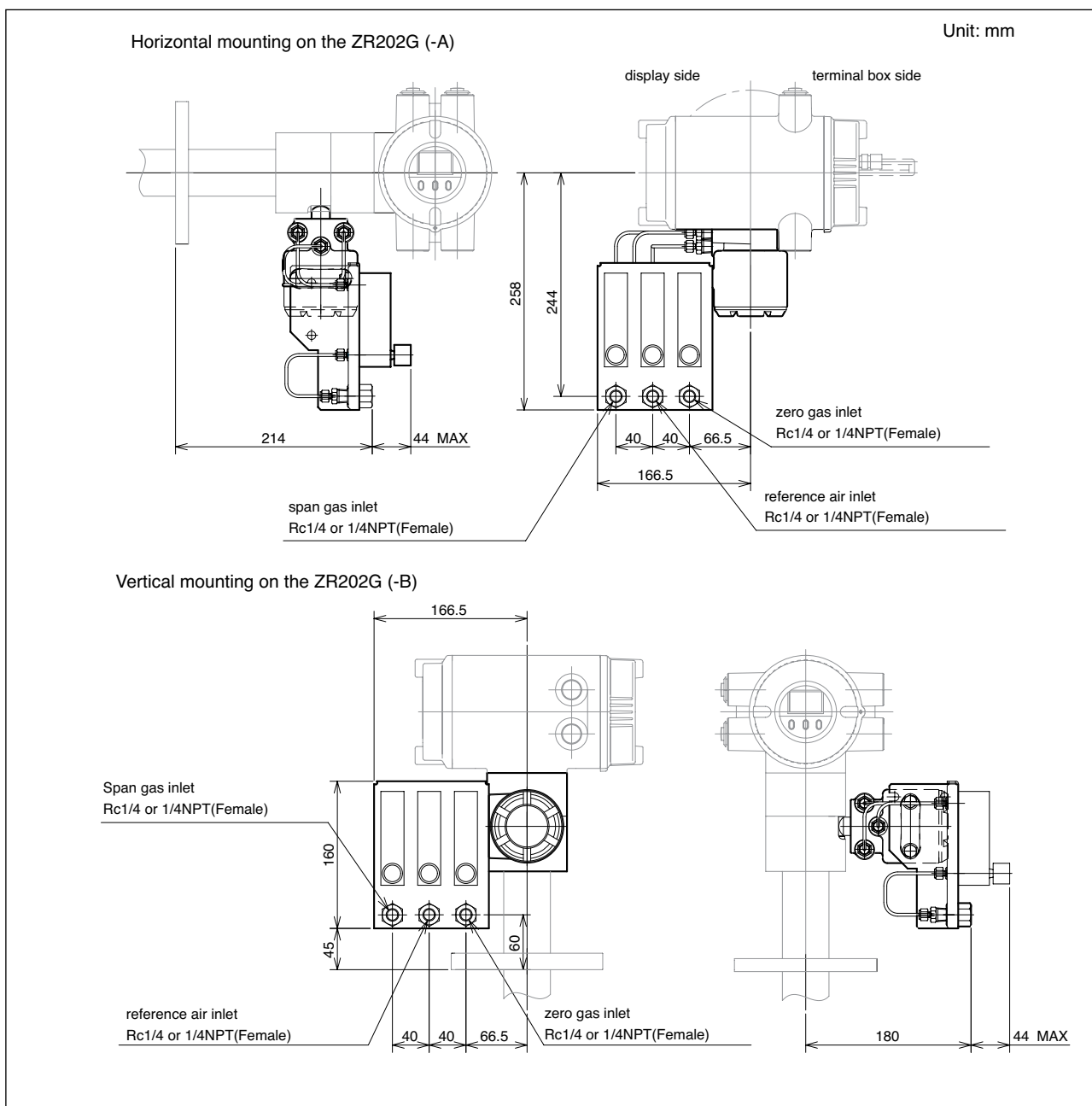
ZR402G Converter

ZR40H Automatic Calibration unit

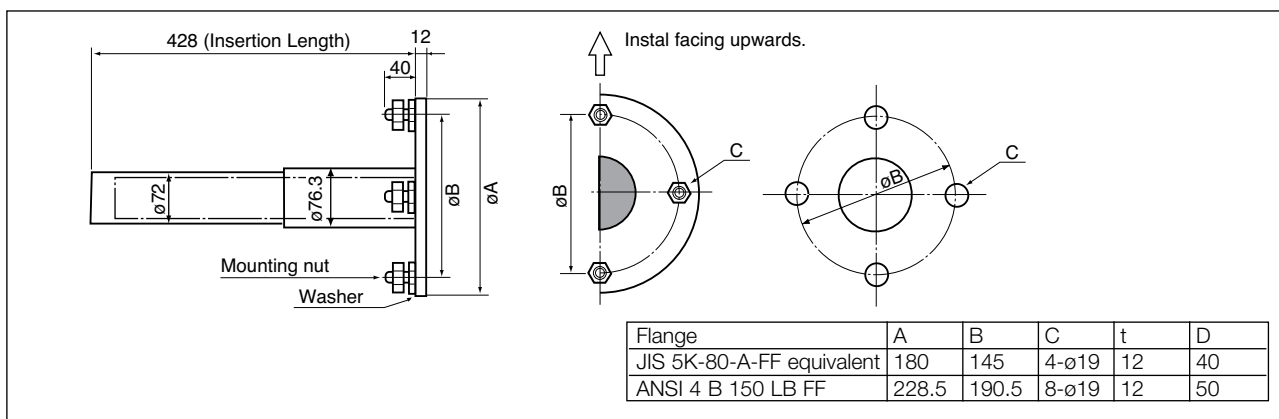


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## 12. Model ZR20H Automatic Calibration Unit for Integrated type Analyzer

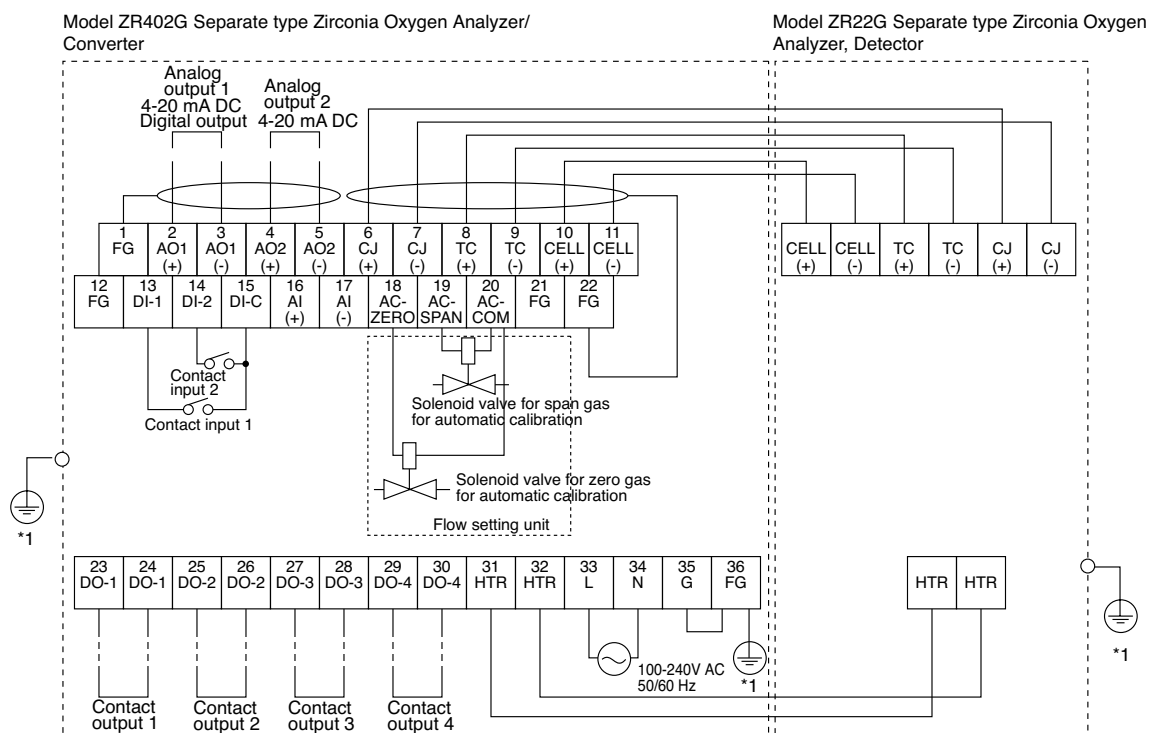


## 13. Model ZH21B Dust Protector for High Temperature Humidity Analyzers

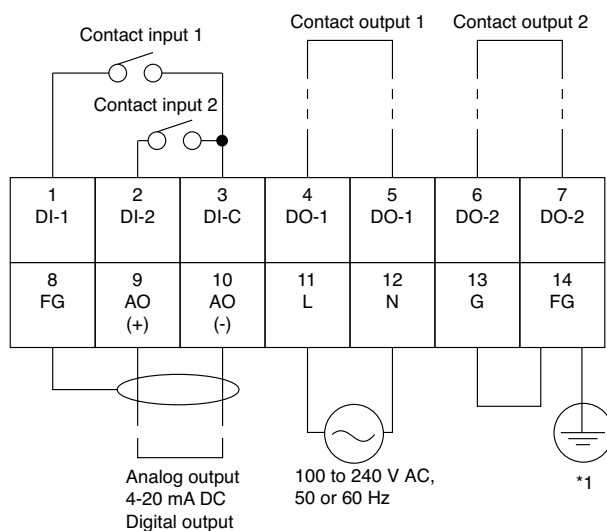


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## Wiring Connections



Model ZR202G Integrated type Zirconia Oxygen / High temperature Humidity Analyzer



\*1 Ground resistance is 100 ohm or less.



**Inquiry Sheet for Models ZR22G, ZR402G, and ZR202G****Direct In Situ Zirconia Oxygen Analyzers and High temperature Humidity Analyzers.****Please place checkmarks in the appropriate boxes and fill in the necessary information in the blanks.****1. General information**

Customer	Type of analyzer: <input type="checkbox"/> Oxygen Analyzer	<input type="checkbox"/> High temp. Humidity Analyzer
Destination of delivery	<input type="checkbox"/> Seperate type	<input type="checkbox"/> Intergrated type
Plant name	Object: <input type="checkbox"/> indication <input type="checkbox"/> record	<input type="checkbox"/> control <input type="checkbox"/> alarm
Measurement points	Fuel: <input type="checkbox"/> gas <input type="checkbox"/> oil	<input type="checkbox"/> coal <input type="checkbox"/> _____
	Power requierements	V AC Hz

**2. Process conditions**

2.1 Measurement gas components

2.2 Oxygen concentration

Moisture contents

2.3 Temperature

2.4 Pressure

2.5 Gas flow

2.6 Dust type, Size

2.7 Corrosive gas

2.8 Combustible gas

2.9 Others

**3. Installation site conditions**

3.1 Ambient temperature

3.2 Vibration

3.3 1. Probe installation location

2. Probe position

3. Probe insertion length (m)

4. Flange

3.4 Instrument air supply

3.5 Converter location

3.6 Cable length between probe and converter

3.7 Calibration method

**4. Quotation data**

Quotation		Quantity	Description
Probe	ZR22S Explosionproof Probe		Refer to the Probe Configuration for probe selection.
	ZO21P-H High Temperature Use Probe Adapter		
	E7046EC/E7046EN Auxiliary Ejector for high temperature use		
Options (for general use)	ZO21R Probe Protector for Oxygen Analyzer		
ZR402G Separate type Analyzer, Converter			
ZR202S Integrated type Explosionproof Zirconia Oxygen Analyzer			
ZO21S Standard Gas Unit			Select any one of Model ZO21S, ZA8F, ZR40H.
ZA8F Flow Setting Unit			
ZR40H Automatic Calibration Unit			Not required if probe options are specified.
L9852CB /G7016XH Stop Valve			
K9292DN /K9292DS Check Valve			
K9473XH /K9473XJ, G7004XF/K9473XG Air Set			
G7013XF /G7014XF Pressure Regulator			
ZR22A, ZR202A Heater Assembly (Spare Parts)			

GS 11M12A01-E-E

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**YOKOGAWA** ◆

# General Specifications

Model AV550G  
Zirconia Oxygen Analyzer  
Averaging Converter

EXAxt

CE

Zirconia oxygen analyzers are used in combustion facilities to measure the flue gas oxygen concentration. Boiler operators use the oxygen measurement to optimum fuel usage, minimize atmospheric emissions and reduce energy consumption.

A multiple point oxygen measurement system may be required for situations when gas stratification in the flue duct affects combustion control. The AV550G Averaging Converter can accept inputs from up to eight zirconia oxygen detectors. It sends output signals for the individual as well as averages of multiple oxygen concentrations. A robust multipoint converter reduces installation and maintenance costs.

A large 5.7-inch color LCD display shows various measurement, setup, calibration, and trend screens. Its intuitive touch screen, is easy to read and makes set up and maintenance simple. Other standard features include new self-diagnostics and a hot swap function that allows a desired probe to be disconnected/reconnected for inspection or maintenance just by turning off the power of the relevant channel.

The AV550G Averaging Converter is ideal for combustion control in large utility boilers or various industrial furnaces.



## Features

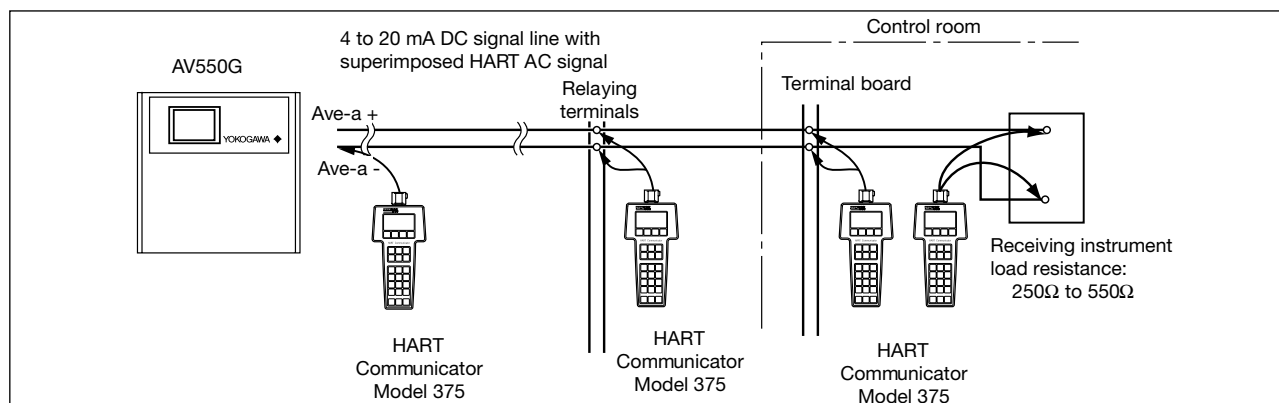
- Full color touch screen.
- Special trend graph functions with customer graph configuration.
- Multiple display modes shows average data, single detector or all detector gas concentrations.
- Handles input of up to 8 oxygen detectors.
- "Hot swap" of channel cards so the analyzer remains on line while maintenance is performed.
- Eight 4-20mA outputs for individual detectors.
- Three 4-20mA outputs for average oxygen concentration outputs.
- Failed, in calibration, or alarming, detectors are automatically excluded from average calculations.
- Allows contact input, calibration activation, range change and detector performance validation.
- Remote maintenance using digital communications (HART®) reduces maintenance costs. \*1

## Applications

**Utility Boiler** – With large boilers used in the utility industry, the oxygen concentration varies in different zones across the flue. In order to obtain the most reliable oxygen data, the most common method used is the arithmetical averaging of several measuring points using an external averaging unit. The model AV550G Averaging Converter not only averages the signals but fully controls all of the individual detectors thereby eliminating the need for costly, redundant hardware or DCS programming.

**Process Heater** – Process industries, such as refining, use large numbers of individual oxygen analyzers to maximize the combustion efficiency of process heaters. The model AV550G Averaging Converter receives and controls inputs from oxygen detectors mounted on the same or multiple flues and transmits either individual or averaged output signals.

\*1: HART is a registered trademark of HART® Communication Foundation.



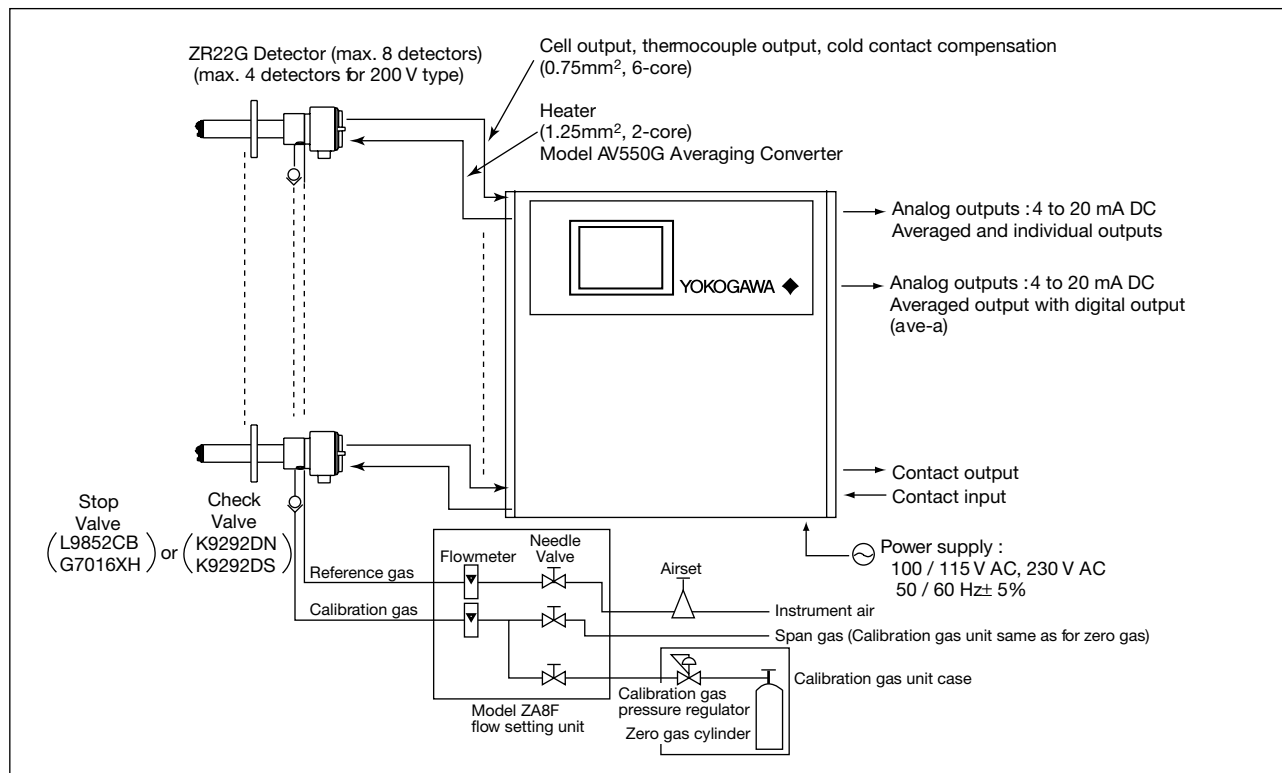
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GS 11M12D01-01E-E  
4th Edition

## Basic System Configuration

Instrument air is used as the reference gas. (max. 8 detectors)

A standard gas cylinder can be used for the calibration gas for more accurate calibration.



## General Specifications

### Compatibility of Detectors

: ZR22G, ZO21D, ZO21DW

### Number of Detectors

: 1 to 8 (100 V type)  
Expandable up to 8  
Detectors : 1 to 4 (200 V type)  
Expandable up to 4

**Note:** Specify 4 Channel Base when 200 V type is selected.

### Averaging interval

: 0.2 seconds

### Display

: 5.7 inches color LCD display of size  
320 by 240 dot with touch screen

### Output Signal

: 4 to 20 mA DC (maximum  
loadresistance 550Ω)

Average-value Output : 3 points

Independent Output : Output to each channel Common  
isolation / Individual isolation  
selectable

### Digital Communication (HART®)

: 250 to 550Ω, depending on number  
of field devices connected to the loop  
(multi-drop mode).

**Note:** HART is a registered trademark of the HART®  
Communication Foundation.

### Contact Output

: Contact capacity 30V DC 3A, 250V  
AC 3A (resistive load)  
Normally open / normally close  
selectable

### Common Contact Output

: 5 points, Four of the output points  
can be selected to either normally  
energized or normally deenergized  
status. Contact output 5 is normally  
energized.

### Contact Output for Individual Channel Fail

: Output to each channel  
Normally energized.

### Solenoid Valve Contact Output

: Contact capacity 30V  
DC 1A, 250V AC 1A, voltage free  
contacts / 24 voltage (option)  
selectable

### Contact Input

: 2 points, voltage free contacts

### Ambient Temperature

: -5 to +50°C

### Storage Temperature

: -20 to +70°C

### Humidity Range

: 10 to 90%RH (non-condensing)

### Installation Altitude

: 2000 m or less

### Category based on IEC 1010

: II (See Note)

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**Pollution degree based on IEC 1010:2 (See Note)**

**Note:** Installation category, called over-voltage category, specifies impulse withstand voltage. Category II is for electrical equipment. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength. Degree 2 is the normal indoor environment.

**Power Supply Voltage** : Ratings; 100 / 115 V AC, 230 V AC  
Acceptable range; 86 to 126.5 V AC,  
199.5 to 253 V AC

**Power Supply Frequency**  
: Rating; 50/60 Hz  
Acceptable range; 50 Hz  $\pm 5\%$ ,  
60 Hz  $\pm 5\%$

**Power Consumption:**

- : Max. 40 W + (120 W) 3 (Number of detectors) for steady operation (100 V type)
- Max. 40 W + (220 W) 3 (Number of detectors) for warm-up (100 V type)
- : Max. 40 W + (140 W) 3 (Number of detectors) for steady operation (200 V type)
- : Max. 40 W + (220 W) 3 (Number of detectors) for warm-up (200 V type)

**Safety and EMC conforming standards**

- Safety : EN61010-1  
CSA C22.2 No.61010-1  
UL61010-1
- EMC : EN 61326 Class A  
EN 55011 Class A Group 1  
EN 61000-3-2  
EN 61000-3-3  
AS/NZS CISPR 11

**Maximum Distance between Probe and Converter**

: Conductor two-way resistance must be  $10\Omega$  or less (when a 1.25mm<sup>2</sup> cable or equivalent is used, 300 m or less)

**Construction** : Indoor installation

**Wiring Connection** : Number of wire holes 30 pieces  
Wire hole size:  $\phi 17$  mm for grommet  
 $\phi 6$  to  $\phi 12$  mm for cable gland (option).

**Installation** : Wall mounting

**Case** : Aluminum alloy (100 V type), Steel plate and Aluminum alloy (200 V type)

**Paint Color** : Silver Gray (Munsell 3.2PB7.4/1.2)

**Finish** : Polyurethane corrosion-resistance coating

**Weight** : Approx. 13 kg (100 V type), Approx. 25 kg (200 V type)

**Functions****Display functions:**

- Value Display : Displays values of the measured oxygen concentration, etc
- Graph Display : Displays trends of measured oxygen concentration
- Data Display : Displays various useful data for maintenance, such as cell temperature, reference junction temperature, maximum/ minimum oxygen concentration, or the like.
- Status Message : Indicates an alarm or error occurrence with flashing of the corresponding icon. Indicates status such as warmingup, calibrating, or the like by icon.
- Alarm, Error Display : Displays alarms such as "Abnormal cell e.m.f." when any such status occurs.

**Calibration functions:**

- Auto-Calibration : It calibrates automatically at specified intervals.
- Semi-auto Calibration : Input calibration direction on the touch screen or contact, then it calibrates automatically afterwards.
- Manual Calibration : Calibration with opening/ closing the valve of calibration gas in operation interactively with an LCD touch screen.
- Validation Function : Permits control room activation of zero, span or midpoint gas concentrations without running an actual calibration.
- Blowback Function : Output through the contact in the set period and time. Auto/semi-auto selectable.
- Maintenance Functions: Can operate updated data settings in daily operation and checking. Display data settings, calibration data settings, blowback data settings, current output loop check, input/ output contact check.
- Setup Functions : Initial settings suit for the plant conditions when installing the converter. Equipment settings, current output data settings, alarm data settings, contact data settings, other settings.

**Self-diagnosis** : This function diagnoses conditions of the converter or the probe and indicates when any abnormal condition occurs.

**Password Functions** : Enter your password to operate the analyzer excepting data display. Individual passwords can be set for maintenance and setup

## Display and Setting Content

### Measuring Related Items

: Oxygen concentration (vol% O<sub>2</sub>)

### Display Items

Cell e.m.f (mV), thermocouple e.m.f (mV), cold junction resistance (V), cell temperature (°C), cold junction temperature (°C), span correction factor (%), zero correction factor (%), cell response time(second), cell condition(in four grades), cell internal resistance (V), next calibration estimate (year/ month/ day), heater on-time rate (%), time (year/ month/ day, hour/ minute), software revision, maximum/minimum/ average oxygen concentration (vol%O<sub>2</sub>), calibration record (ten times), internal temperature rise alarm record.

### Calibration Setting Items:

Span gas concentration (vol%O<sub>2</sub>), zero-gas concentration (vol%O<sub>2</sub>), calibration mode (auto, semi-auto, manual), calibration type and method (zero-span calibration, zero calibration only, span calibration only), stabilization time (minute/second), calibration time (minute/second), calibration period (day/hour), starting time (year/month/day, hour/minute)

### Equipment Related Items:

Measuring gas selection: wet/dry  
Detector selection : ZR22/ZO21

### Output Related Items:

Analog output/output mode selection, output conditions when warming- up / maintenance/ calibrating (during blowback) / abnormal, 4 mA / 20 mA point oxygen concentration (vol%O<sub>2</sub>), time constant, preset values when warming-up / maintenance / calibrating during blowback abnormal, output preset values on abnormal.

### Alarm Related Items:

Oxygen concentration high-alarm/high-high alarm limit values (vol% O<sub>2</sub>), oxygen concentration low-alarm/low-low alarm limit values (vol% O<sub>2</sub>), oxygen concentration alarm hysteresis (vol% O<sub>2</sub>), oxygen concentration alarm detection, alarm delay (seconds)

<b>Converter Output</b>	: mA analog output (4 to 20mA DC (maximum load of 550Ω).
Average-value output	: 3 points (average value a, average value b, average c = $\frac{a+b}{2}$ )
Independent Output	: Output to each channel
Range	: Any setting between 0 to 5 through 0 to 100 vol% O <sub>2</sub> in 1 vol% O <sub>2</sub> , or partial range is available (Maximum range value/minimum range value 1.3 or more). For the log output, the minimum range value is fixed at 0.1 vol% O <sub>2</sub> . 4 to 20 mA DC linear or log can be selected. Input/output isolation.
Output damping	: 0 to 255 seconds. Hold/non-hold selection, preset value setting possible with hold
<b>Contact Output</b>	: Five points, contact capacity 30 V DC 3 A, 250 V AC 3 A (resistive load) Four of the output points can be selected to either normally energized or normally deenergized status.

: Delayed functions (0 to 255 seconds) and hysteresis function (0 to 9.9 vol%O<sub>2</sub> can be added to high/low alarms.  
: The following functions are programmable for contact outputs.  
(1) Abnormal,  
(2) High-high alarm,  
(3) High alarm,  
(4) Low-low alarm,  
(5) Low-alarm,  
(6) Maintenance,  
(7) Calibration,  
(8) Range switching answer-back,  
(9) Warm-up,  
(10) Calibration-gas pressure decrease (answerback of contact input),  
(11) Blowback start,  
(12) Process alarm (answerback of contact input),  
(13) Calibration coefficient alarm,  
(14) Internal temperature rise alarm.  
: Contact output 5 is set to normally operated, fixed error status.

### Contact Output for Individual Channel Fail

: Output to each channel  
: Normally energized.  
: Each channel cards provides a failure contact output.  
(1) Abnormal cell,  
(2) abnormal cell temp. (high/low),  
(3) abnormal channel card,  
(4) abnormal control card,  
(5) abnormal card communication

### Contact Input

: Two points, contact input  
The following functions are programmable for contact inputs:  
(1) Calibration-gas pressure decrease alarm, (2) Range switching, (3) External calibration start, (4) Process alarm (if this signal is received, the heater power turns off),  
(5) Validation start, (6) Blow-back start

### Self-diagnosis

: Abnormal cell, abnormal cell temperature (high/low), abnormal channel card, abnormal control card, abnormal card communication

### Calibration

Calibration mode : Method; zero/span calibration  
: Automatic, semi-automatic and manual (All are operated interactively with an LCD touchscreen). Either zero or span can be skipped.  
Zero calibration-gas concentration setting range : 0.3 to 100 vol% O<sub>2</sub> (0.01 vol%O<sub>2</sub> in smallest units). Span calibration-gas concentration setting range: 4.5 to 100 vol% O<sub>2</sub> (0.01 vol% O<sub>2</sub> in smallest units). Use nitrogen-balanced mixed gas containing 0 to 10 % scale of oxygen, and 80 to 100 % scale of oxygen for standard zero gas and standard span-gas respectively.  
Calibration period : Date/time setting; maximum 255 days/23hours.

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## Standard Accesories (Averaging Converter)

Name	Part No	Quantity	Remarks
Fuse	A1112EF	2	2.5A
Hexagonal Allen Wrench	L9827AS	1	For lock screw.

## Model and Suffix Codes

### 1. Detector

Refer to GS 11M12A01-01E for a detailed explanation of the detector specifications and available accessories.

### 2. Averaging Converter

Model	Suffix Code	Option Code	Specification
AV550G			Averaging Converter
Base (*1)	-A -B		4 Channel Base 8 Channel Base
Number of Channels (*2)	-A1 -A2 -A3 -A4 -A5 -A6 -A7 -A8 -B1 -B2 -B3 -B4 -B5 -B6 -B7 -B8		1 Oxygen Channel Card, Common Isolation 2 Oxygen Channel Cards, Common Isolation 3 Oxygen Channel Cards, Common Isolation 4 Oxygen Channel Cards, Common Isolation 5 Oxygen Channel Cards, Common Isolation 6 Oxygen Channel Cards, Common Isolation 7 Oxygen Channel Cards, Common Isolation 8 Oxygen Channel Cards, Common Isolation 1 Oxygen Channel Card, Individual Isolation 2 Oxygen Channel Cards, Individual Isolation 3 Oxygen Channel Cards, Individual Isolation 4 Oxygen Channel Cards, Individual Isolation 5 Oxygen Channel Cards, Individual Isolation 6 Oxygen Channel Cards, Individual Isolation 7 Oxygen Channel Cards, Individual Isolation 8 Oxygen Channel Cards, Individual Isolation
Display	-J -E -F -G		Japanese English French German
Power supply	-1 -2		100 / 115 V AC 230 V AC (*5)
Communication	-A -E		4-20 mA DC analog output 4-20 mA DC with digital communication (HART protocol)
Options		/SCT /24 /G □□	Stainless steel tag palate 24 Voltage output for Solenoid valve Cable gland (Numbers in □□) (*3)

(\*1) Select code "B" when future expansion exceeding 4 channels is expected. By so doing, the expansion can be made economically.

(\*2) Common isolation is recommended, when the same instrument receives the analog outputs from each channel card. Individual isolation is recommended to prevent the trouble by mutual interference, when different instrument receives the analog outputs from each channel card.

(\*3) Inputs 01 to 30 in .

(\*5) When selecting code '2' (230 V AC) , select code '-A' (4 Channel Base).

### 3. Channel Card

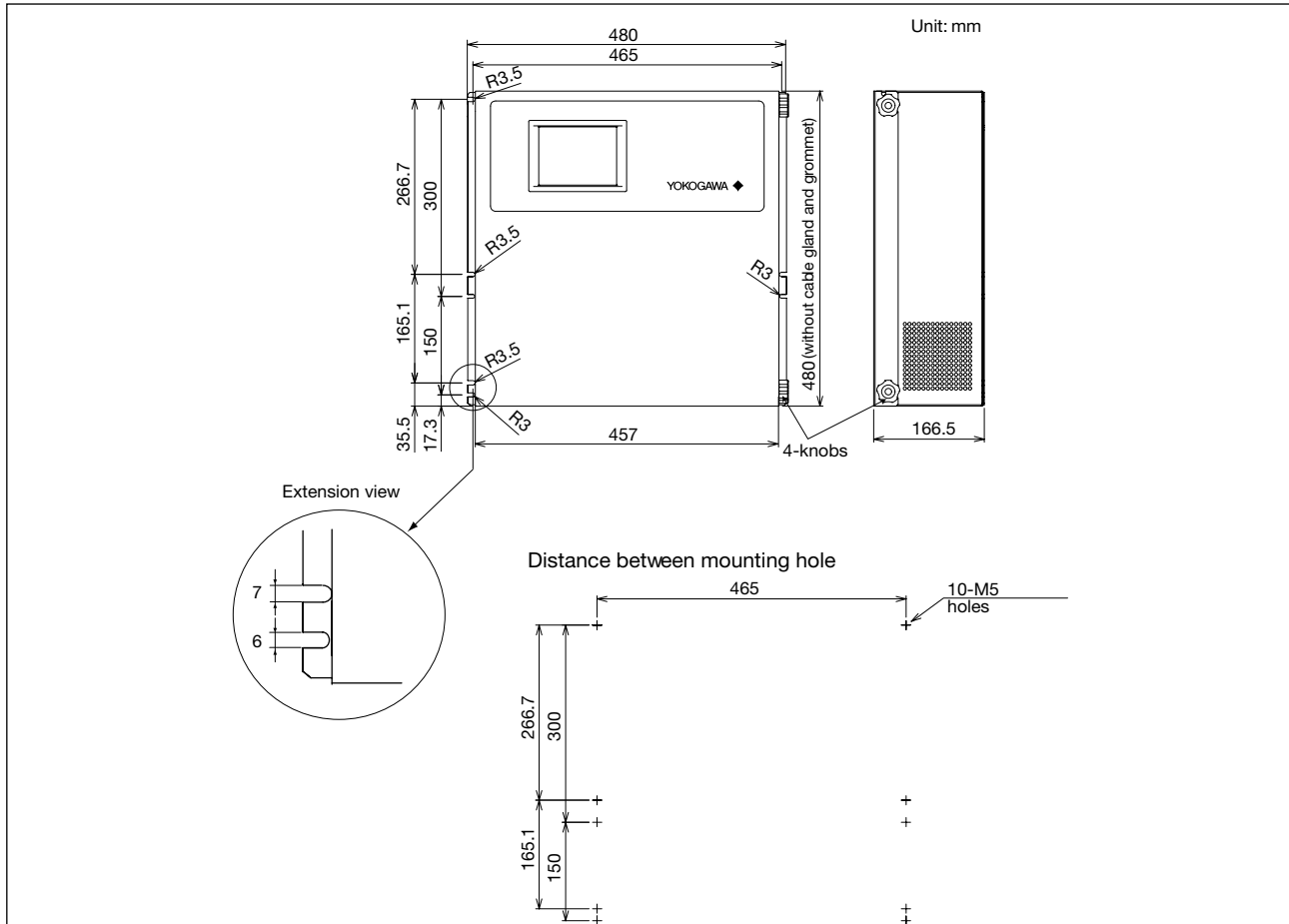
Model	Suffix Code	Option Code	Specification
AV55CM			Channel Card
Number of Channels (*1)	-A1		1 Oxygen Channel Card, Common Isolation
	-A2		2 Oxygen Channel Cards, Common Isolation
	-A3		3 Oxygen Channel Cards, Common Isolation
	-A4		4 Oxygen Channel Cards, Common Isolation
	-A5		5 Oxygen Channel Cards, Common Isolation
	-A6		6 Oxygen Channel Cards, Common Isolation
	-A7		7 Oxygen Channel Cards, Common Isolation
	-A8		8 Oxygen Channel Cards, Common Isolation
	-B1		1 Oxygen Channel Card, Individual Isolation
	-B2		2 Oxygen Channel Cards, Individual Isolation
	-B3		3 Oxygen Channel Cards, Individual Isolation
	-B4		4 Oxygen Channel Cards, Individual Isolation
	-B5		5 Oxygen Channel Cards, Individual Isolation
	-B6		6 Oxygen Channel Cards, Individual Isolation
	-B7		7 Oxygen Channel Cards, Individual Isolation
	-B8		8 Oxygen Channel Cards, Individual Isolation
—	-A		Always -A
Option		/K1	Expansion power supply unit for dry contact output of solenoid valve output. (*2)
		/K2	Expansion power supply unit for 24 voltage output of solenoid valve output. (*3)

(\*1) -A ☐ are common Isolation types  
 -B ☐ are Individual Isolation types

(\*2) Expansion power supply unit is required, when using the 4 channel base and extending the channel cards of five or more.

(\*3) Expansion power supply unit is required, when using the 4 channel base and extending the channel cards of five more.  
 Available only in U.S.

### External Dimensions



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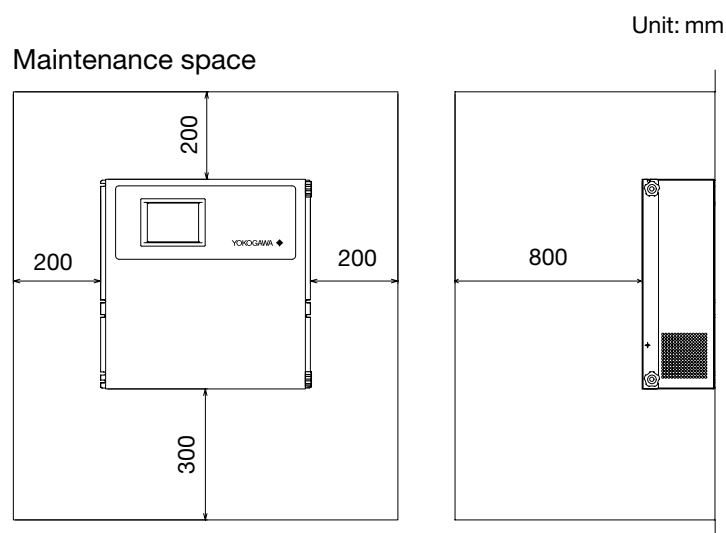
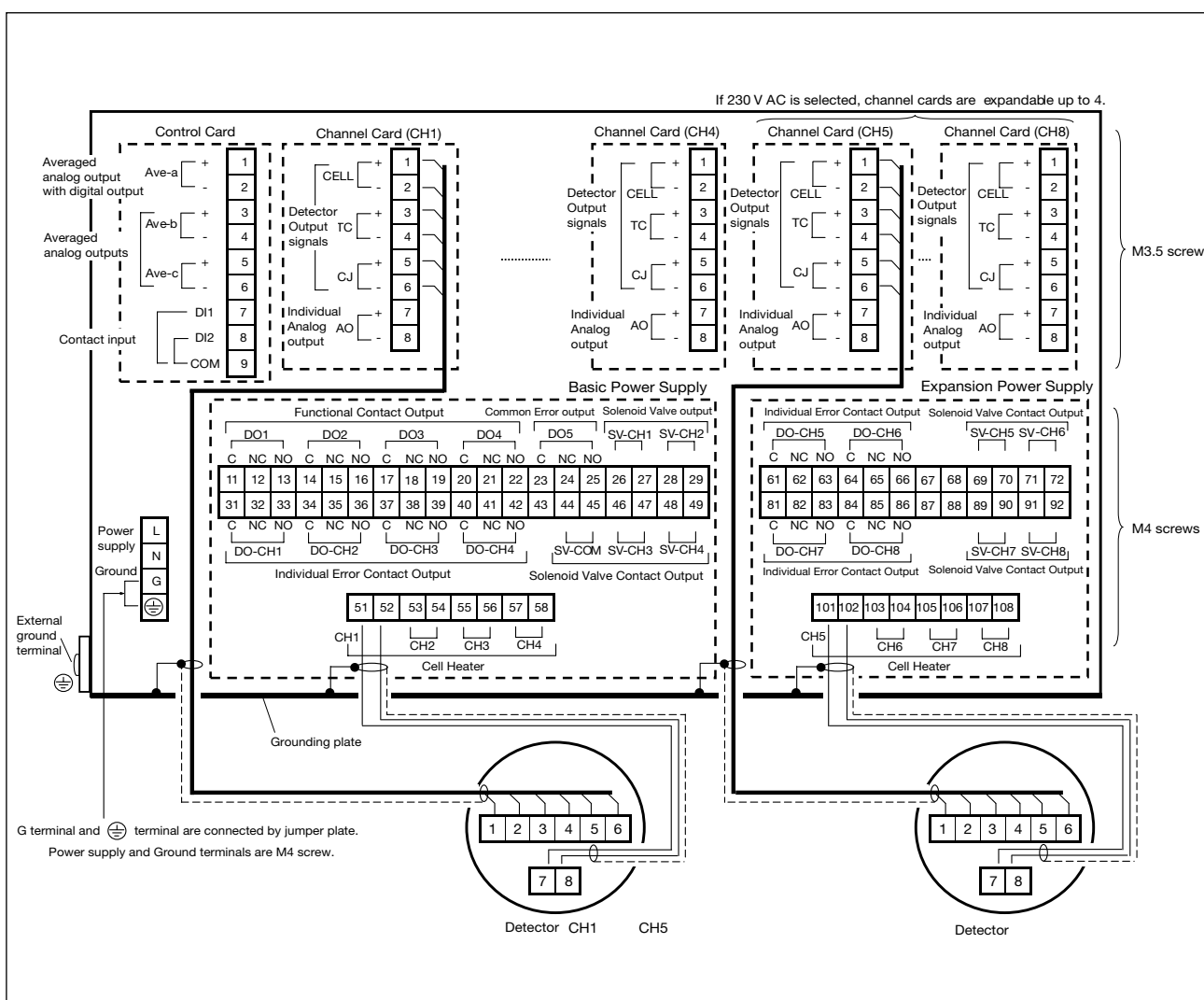


Fig.1 AV550G Averaging Converter

## Wiring



GS 11M12D01-01E-E

## IAC-24 auto-calibration unit

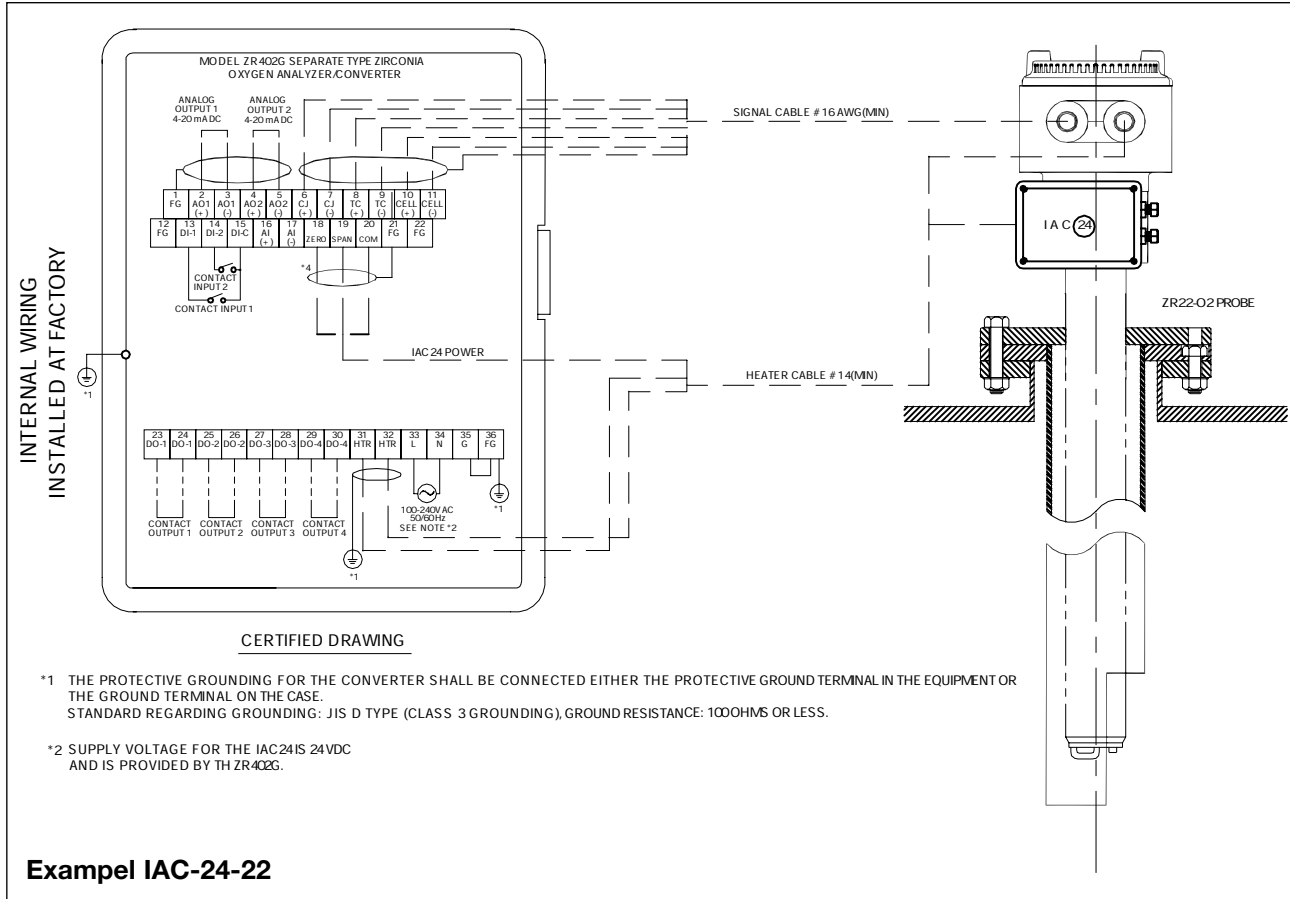
### General Specifications:

Input pressure: 0.5bar±0.1 (7 psig +/- 2 psig)  
 Output Flow: Ref: 0.8 SLPM  
 Cal: 0.6 SLPM  
 Input Flow: Min: 3.5 SLPM  
 Dimensions: 4.5" x 3.5" x 1.9"  
 (w 115mm x h 89mm x t 49mm)  
 Electrical requirements: 24 V DC  
 Connections: 2 x 1/4" swagelock type pneumatics  
 fitting 3 pin quick connect fitting  
 Ambient Temperature: 90°C (194°F)

### Model and Suffix codes

Model	Suffix	Description
IAC-24		Auto-calibration unit
	-22	Autocal for ZR22G*1*2*3
	-202	Autocal for ZR202G*1*3
	-E-A	Always -E -A

**Notes:** \*1 IAC-24-[ ] ambient temperature cannot exceed 70°C.  
 \*2 Use cable WZ-L-6H-[ ] with ZR22G  
 \*3 All connections are swagelock 1/4"  
 \*4 Preset to 6psig

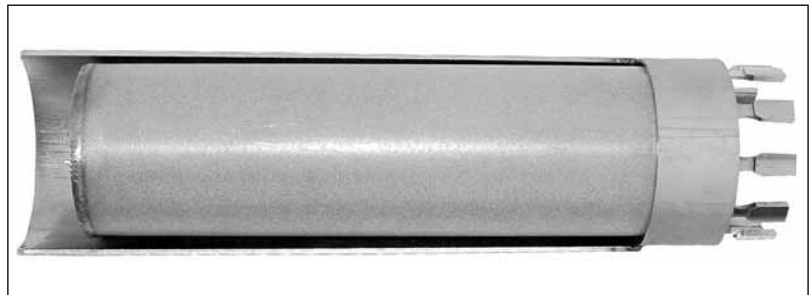


### Fly Ash Filters

M1234SE-A self cleaning - fly ash filter

### General Specifications:

Filter Material : Hastelloy X  
 Base material : SSTL 316  
 Max OD : 6.35cm (2.5 in)  
 Filter surface Area : 296 sq-cm (46 sq-in)  
 Max opera. Temp : 700°C (1292 °F)  
 Pore size : 10 micron



GS 11M12D01-01E-E

## Inquiry Sheet for Model AV550G Averaging Converter

Please place checkmarks in the appropriate boxes and fill in the necessary information in the blanks.

## 1. General information

Customer \_\_\_\_\_  
 Destination of delivery \_\_\_\_\_  
 Plant name \_\_\_\_\_  
 Measurement points \_\_\_\_\_

Object : ☐ indication ☐ record ☐ control ☐ alarm

Fuel : ☐ gas ☐ oil ☐ coal ☐ \_\_\_\_\_

Power requirements \_\_\_\_\_ V AC \_\_\_\_\_ Hz

## 2. Process conditions

## 2.1 Measurement gas components

2.2 Oxygen concentration	Nor.	Min.	Max.	<input type="checkbox"/> vol% O <sub>2</sub> ,	<input type="checkbox"/>
2.3 Temperature	Nor.	Min.	Max.	<input type="checkbox"/> °C,	<input type="checkbox"/>
2.4 Pressure	Nor.	Min.	Max.	<input type="checkbox"/> kPa,	<input type="checkbox"/>
2.5 Gas flow	Nor.	Min.	Max.	<input type="checkbox"/> m/sec,	<input type="checkbox"/>
2.6 Dust type, Size	Nor.	Min.	mm	quantity	<input type="checkbox"/> g/Nm <sup>3</sup> , <input type="checkbox"/>
2.7 Corrosive gas	<input type="checkbox"/> No gas	<input type="checkbox"/> Gas	_____	, quantity	<input type="checkbox"/> ppm, <input type="checkbox"/>
			_____	, quantity	<input type="checkbox"/> ppm, <input type="checkbox"/>
2.8 Combustible gas	<input type="checkbox"/> No gas	<input type="checkbox"/> Gas	_____	, quantity	<input type="checkbox"/> ppm, <input type="checkbox"/>
			_____	, quantity	<input type="checkbox"/> ppm, <input type="checkbox"/>

## 2.9 Others

## 3. Installation site conditions

3.1 Ambient temperature      1. Around Probe temp. from \_\_\_\_\_ to \_\_\_\_\_ °C,      2. Around Converter temp. from \_\_\_\_\_ to \_\_\_\_\_ °C

3.2 Vibration      ☐ No vibration ☐ Vibration \_\_\_\_\_

3.3 1 Probe installation location      ☐ Furnace    ☐ Stack    ☐ Others \_\_\_\_\_

2 Probe position      ☐ Horizontal    ☐ Vertical    ☐ Others \_\_\_\_\_

☐ Indoor    ☐ Outdoor ☐ Covered

3 Probe insertion length (m) (Note)      ☐ 0.4, ☐ 0.7,    ☐ 1.0,    ☐ 1.5,    ☐ 2.0,    ☐ 2.5,    ☐ 3.0,    ☐ 3.6,    ☐ 4.2,    ☐ 4.8,    ☐ 5.4

4 Flange      ☐ DIN \_\_\_\_\_    ☐ ANSI \_\_\_\_\_    ☐ Others \_\_\_\_\_

3.4 Instrument air supply      ☐ Cannot be used.    ☐ Can be used. \_\_\_\_\_ kPa

3.5 Averaging converter location      ☐ Indoor    ☐ Outdoor    ☐ Covered (under roof)

3.6 Cable length between probe and converter \_\_\_\_\_ meters

3.7 Calibration method      ☐ Manual    ☐ Automatic

(Note) 3.6 m or more is available in the U.S.

## 4. Quotation data

<input type="checkbox"/> Averaging Converter	<input type="checkbox"/> Probe protector
<input type="checkbox"/> Detector	<input type="checkbox"/> Air set
<input type="checkbox"/> Check valve	<input type="checkbox"/> Flow setting unit
<input type="checkbox"/> Rc 1/4 connection	<input type="checkbox"/> ZA8F
<input type="checkbox"/> 1/4 NPT connection	
<input type="checkbox"/> Stop valve	<input type="checkbox"/> Others
<input type="checkbox"/> Rc 1/4 connection	
<input type="checkbox"/> 1/4 NPT connection	

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# General Specifications

## Model ZR22S and ZR202S Explosionproof Direct In Situ Zirconia Oxygen Analyzers

EX4ti

CE

An explosionproof direct in situ zirconia oxygen analyzer and two types are available. Model ZR22S/ZR402G is a separate type which consists of a ZR22S explosionproof probe and a ZR402G non-explosionproof converter. Model ZR202S is an integrated type which combines a probe and a converter.

Separate and integrated type Zirconia oxygen analyzers do not need a sampling device, and allow direct installation of the probe in the wall of a flue or furnace to measure the concentration of oxygen in the stack gas. The converter displays the cell temperature and cell emf in addition to the oxygen concentration.

This analyzer is most suitable for monitoring combustion and controlling the low-oxygen combustion of various industrial furnaces in such explosive atmospheres as at petroleum refineries, petrochemical plants, and natural gas plants.

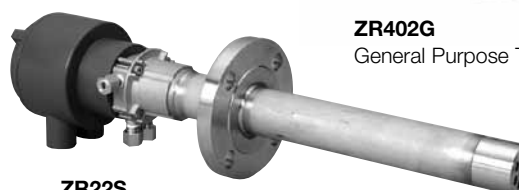
### Features

- The built-in heater assembly of the probe can be replaced on site, reducing maintenance costs.
- The probe uses a long-life, high-reliability Zirconia sensor.
- The separate type converter ZR402G incorporates a LCD touch-screen for ease of operation.
- The integrated type ZR202S integrates both probe and converter, to reduce wiring, piping, and installation costs. ZR202S of unit uses an optical switch for ease of operation at the site.
- Remote maintenance using digital communications (HART®) reduces maintenance costs. \*1

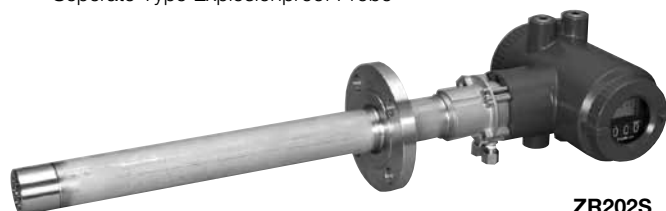
\*1: HART is a registered trademark of HART® Communication Foundation.



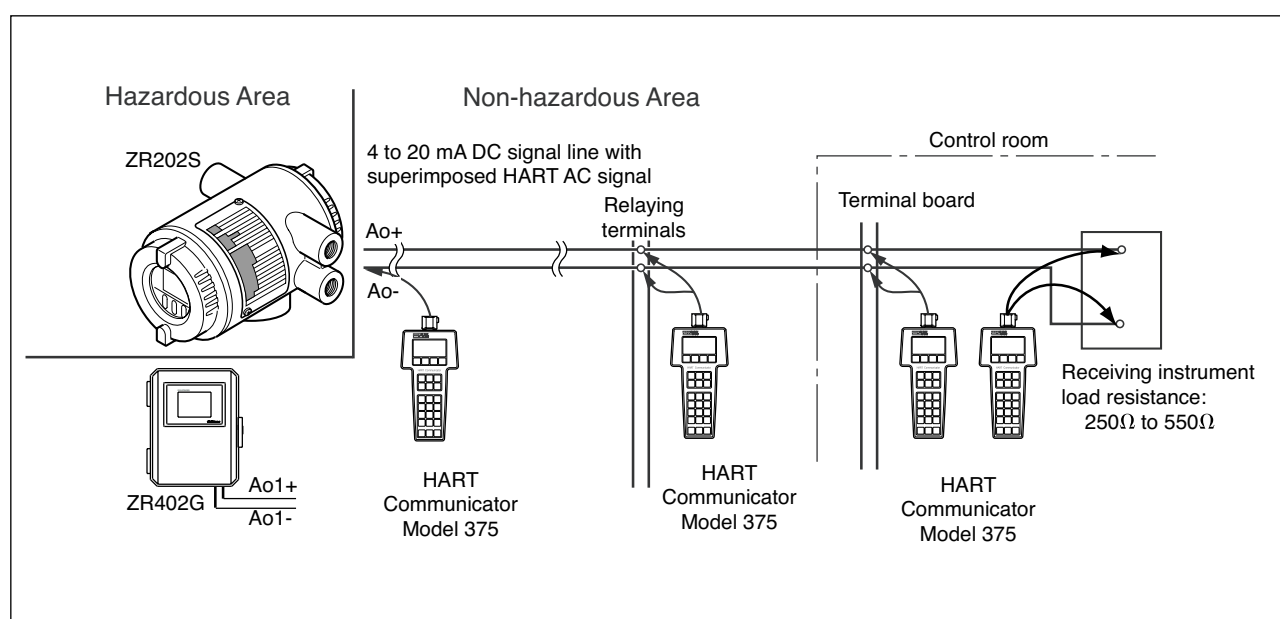
**ZR402G**  
General Purpose Type Converter



**ZR22S**  
Separate Type Explosionproof Probe



**ZR202S**  
Integrated Type Explosionproof Zirconia Oxygen Analyzer

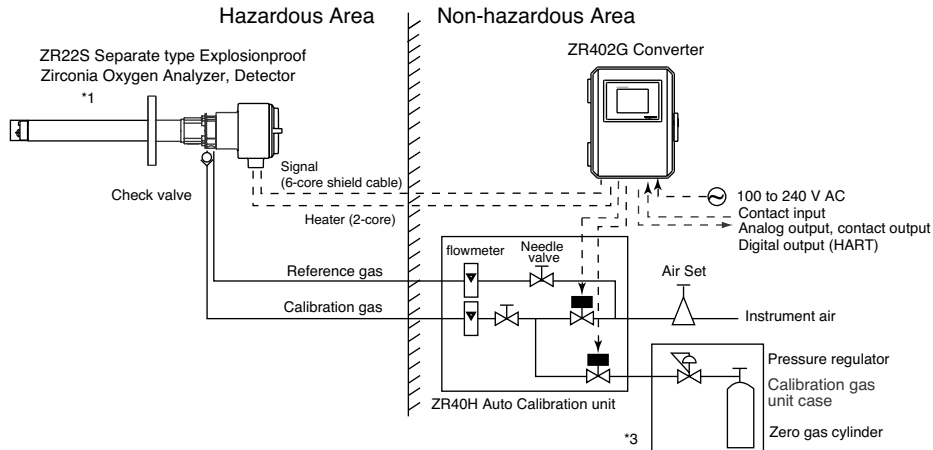


## Basic System Configuration

### System configuration - Separate type Explosionproof

#### Example 1

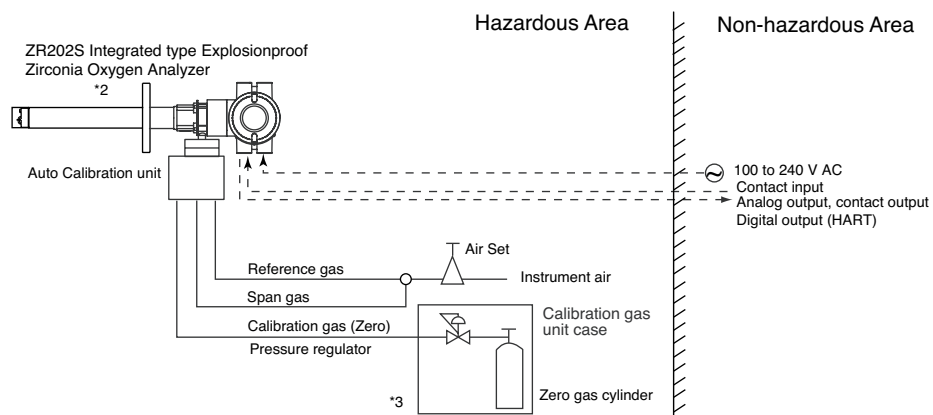
- Automatic calibration system uses instrument air for reference gas. For the calibration gas, a standard gas cylinder may be used for more accurate calibration.
- Applications: Oxygen concentration monitoring and control in boilers (for private and public power generation) and in heating furnaces.



### System configuration - Integrated type Explosionproof

#### Example 2

- For an integrated type as shown in the figure above.
- Applications: Oxygen concentration monitoring and control in boilers (for private and public power generation)



**Note:** The installation temperature limits range for integrated type analyzer is -20 to 55°C.

\*1 Shield cable: Use shielded signal cables, and connect the shields to the FG terminal of the converter.

\*2 Select the desired probe from the Probe Configuration table on page 4.

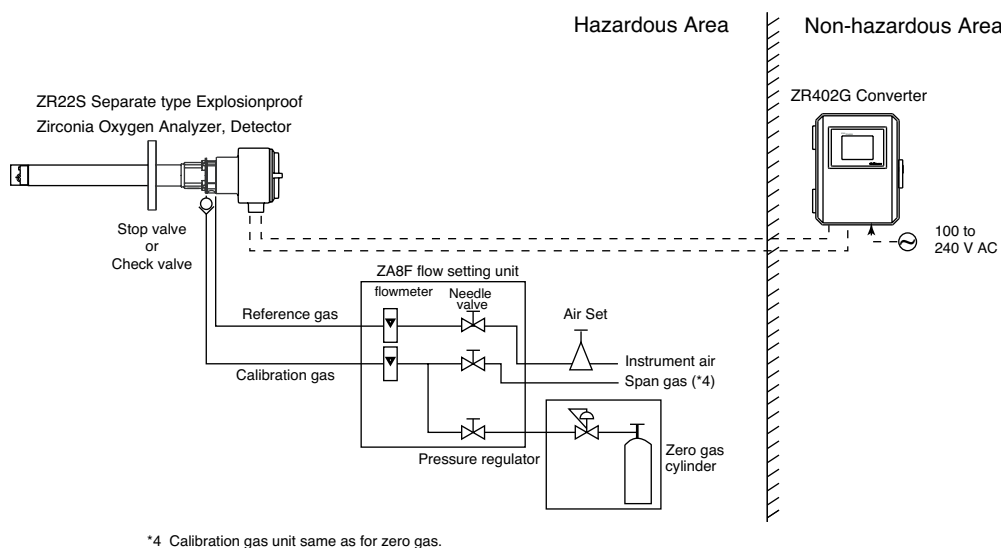
\*3 When a zirconia oxygen analyzer is used, 100% N<sub>2</sub> gas cannot be used as the zero gas. Use approx. 1 vol% O<sub>2</sub> gas (N<sub>2</sub>-balanced).

## Basic System Configuration

### System configuration — Separate type Explosionproof

#### Example 1

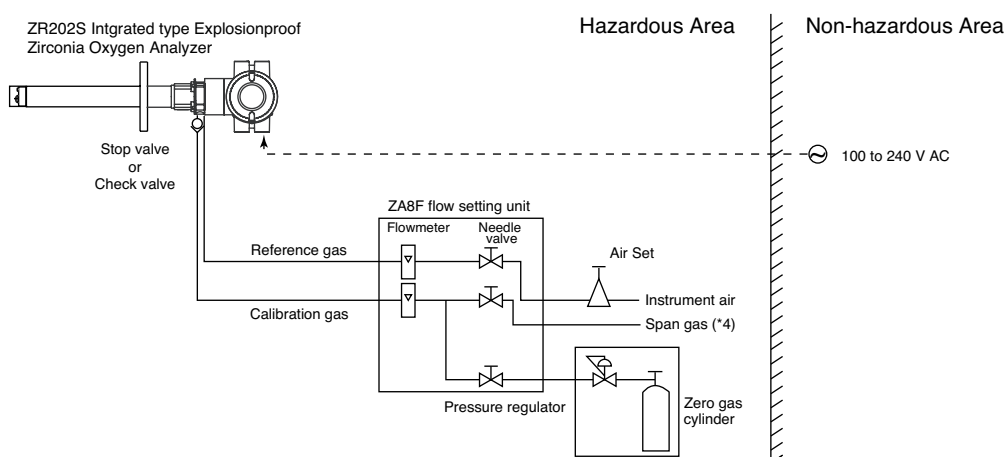
- Instrument air is used as the reference gas. A standard gas cylinder can be used for the calibration gas for more accurate calibration.
- Application example: Oxygen concentration monitoring and control in boilers (for private and public power generation) and in heating furnaces.



### System configuration — Integrated type Explosionproof

#### Example 2

- Instrument air is used as the reference gas. A standard gas cylinder can be used for the calibration gas for more accurate calibration.
- Application example: Oxygen concentration monitoring and control in boilers (for private and public power generation)



## System Components

System Components	Separate type		Integrated type	
	System Ex.1	config. Ex.2	System Ex.1	config. Ex.2
ZR22S Separate type Explosionproof Zirconia Oxygen Analyzers Detector	●	●		
ZR402G Separate type Zirconia Oxygen Analyzer, Converter(*1)	●	●		
ZR202S Integrated type Explosionproof Zirconia Oxygen Analyzers				●
ZO21P Adapter for High Temperature Probe of separate type Zirconia Oxygen Analyzer	○	○		
E7046EC, E7046EN Auxiliary Ejector for High Temperature Probe of separate type Oxygen Analyzer	○	○		
ZO21R Probe Protector for Zirconia Oxygen Analyzers	○	○	○	○
ZA8F Flow setting unit for manual calibration		●		●
ZR40H Automatic Calibration Unit for Separate type Analyzer	●			
Automatic Calibration Unit for Integrated type Analyzer (*2)			●	
L9852CB, G7016XH Stop Valve for Calibration-gas line		(●)		(●)
K9292DN, K9292DS Check Valve for Calibration-gas line	●	(●)		(●)
K9473XH/K9473XJ, G7004XF/K9473XG Air Set	●	●	●	●
G7013XF, G7014XF Pressure Regulator for Gas Cylinder	●	●	●	●
ZR22A, ZR202A Heater Assembly for Spare Parts	○	○	○	○

- : Items required for the above system example  
 ○ : To be selected depending on each application. For details, refer to Chapter of Options.  
 (●) : Select either

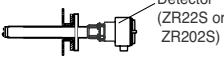
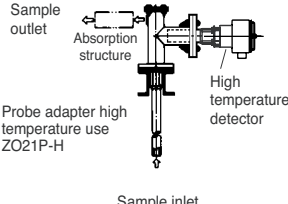
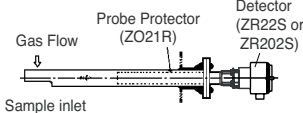
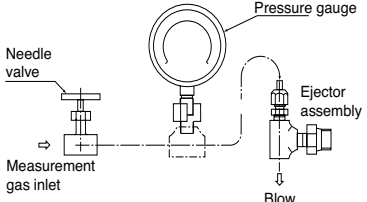
(\*1) : When used as a high temperature humidity analyzer, specify /HS options.

(\*2) : When Auto Calibration of (-A) or (-B) code is specified, Auto Calibration Unit is installed in ZR202S.

(\*3) : Non CE mark

## Detector Components

### Application Example:

Process gas temperature 0 to 700°C				Process gas temperature 0 to 1400°C	
Mounting	Insertion length	General-use Probe	Application	High temperature detector	Application
Horizontal to vertical	2 m or less		Boiler Heating furnace		Heating furnace
			For pulverized coal boiler with gas flow velocity 10 m/s or more	<p>Temperature:            Probe material SUS310S 800°C            Probe material SiC 1400°C            Mounting: Vertical downwards            Insertion length: 1.0m, 1.5m            When duct pressure is atmospheric or negative, attach air ejector.            High temperature auxiliary ejector (E7046EC, E7046EN)</p> 	

Separate and integrated type Zirconia Oxygen Analyzers

- Large, medium and small boilers (boilers for power generation: heavy oil, gas or coal)
- Various industrial furnaces (refinery process/iron manufacture heating furnace, coal kiln, and black liquid recovery boilers)  
For other applications, refer to TI 11M12A01-01E.
- May not be applicable corrosive gas such as ammonia and chlorine.

GS 11M13A01-01E-E



## STANDARD SPECIFICATIONS

### General Specifications

**Measurement Object** : Oxygen concentration in combustion exhaust gas and mixed gas (excluding inflammable gases). May not be applicable corrosive gas such as ammonia and chlorine.

**Measurement System** : Zirconia system

### Explosionproof Approval:

ZR22S-A (ATEX)	: EExd II B + H <sub>2</sub> , Group II, Category 2GD, T2, T300°C
ZR22S-B (FM)	: Class I, Division1, Groups B, C and D, Class II/III, Division1, Groups E, F and G, T2
ZR22S-C (CSA)	: Class I, Division1, Groups B, C and D, Class II/III, Division1, Groups E, F and G, T2
ZR202S-A (ATEX)	: EExd II B + H <sub>2</sub> , Group II, Category 2GD, T2, T300°C
ZR202S-B (FM)	: Class I, Division1, Groups B, C and D, Class II/III, Division1, Groups E, F and G, T2
ZR202S-C (CSA)	: Class I, Division1, Groups B, C and D, Class II/III, Division1, Groups E, F and G, T2

**Oxygen Concentration**: 0.01 to 100 vol% O<sub>2</sub>

**Output Signal** : 4 to 20 mA DC  
(maximum load resistance 550Ω)

**Measurement Range** : Any setting in the range of 0 to 5 through 0 to 100 vol% O<sub>2</sub> (in 1 vol% O<sub>2</sub>), or partial range

### Digital Communication (HART®)

: 250 to 550Ω, depending on number of field devices connected to the loop (multi-drop mode).

**Note:** HART is a registered trademark of the HART® Communication Foundation.

**Display Range** : 0 to 100 vol% O<sub>2</sub>

**Warm-up Time** : Approx. 20 min.

**Repeatability** : 0.5% Maximum value of set range. (less than 0 to 25 vol% O<sub>2</sub> range) 1 % Maximum value of set range. (0 to 25 vol% O<sub>2</sub> or more and up to 0 to 100 vol% O<sub>2</sub> range)

**Linearity** : (Excluding standard gas tolerance)  
-Use oxygen of known concentration (within the measuring range) as the zero and span calibration gases.  
1% Maximum value of set range.; less than 0 to 25 vol% O<sub>2</sub> range (Sample gas pressure: within 4.9 kPa) 3% Maximum value of set range.; 0 to 25 vol% O<sub>2</sub> or more and less than 0 to 50 vol% O<sub>2</sub> range (Sample gas pressure: within 0.49 kPa) 5% Maximum value of set range.; 0 to 50 vol% O<sub>2</sub> or more and up to 0 to 100 vol% O<sub>2</sub> range (Sample gas pressure: within 0.49 kPa)

**Drift** : Both zero and span 2% maximum value of set range/month  
(Excluding the first two weeks in use)

**Response Time** : Response of 90% within 5 seconds.  
(Measured after gas is introduced from calibration gas inlet and analog output starts changing.)

## 1. ZR22S Separate type Explosionproof

### Zirconia Oxygen Analyzer, Detector

#### Sample Gas Temperature

: 0 to 700°C (Probe only) It is necessary to mount the cell using Inconel cell-bolts when the temperature is greater than 600°C. 700 to 1400°C (with High Temperature Probe Adapter) For high-temperature sample gas, apply 0.15m length probe and High Temperature Probe Adapter ZO21P-H.

#### Sample Gas Pressure

: -5 to +5 kPa  
For 0.15m probe, -0.5 to +5 kPa.  
No pressure fluctuation in the furnace should be allowed.

**Probe Length** : 0.15, 0.4, 0.7, 1.0, 1.5, 2.0 m

**Probe Material** : SUS 316 (JIS)

**Ambient Temperature** : -20 to +60°C (-20 to +150°C on the terminal box surface)

**Reference Air System** : Instrument Air

**Instrument Air System** : Pressure; 50 kPa + the pressure inside the furnace (It is recommended to use air which has been dehumidified by cooling to dew point -20°C or less, and dust or oil mist removed.)  
Consumption; Approx. 1NI/min

#### Material in Contact with Gas

: SUS 316 (JIS), Zirconia, SUS 304 (JIS) (flange), Hastelloy B, (Inconel 600, 601)

#### Construction

: Heater and thermocouple replaceable construction.  
Equivalent to NEMA 4X/IP66. (Achieved when pipes are installed at calibration gas and reference air inlets and pipe is installed so that reference air can be exhausted to clean atmosphere. Excluding probe top. And achieved when the cable entry is completely sealed with a cable gland.)

#### Terminal Box Case: Material

: Aluminium alloy

#### Terminal Box Paint Color

Case : Mint green (Munsell 5.6BG3.3/2.9)

Cover : Mint green (Munsell 5.6BG3.3/2.9)

#### Finish

: Polyurethane corrosion-resistance coating

#### Gas Connection

: Rc 1/4 or 1/4 NPT

#### Wiring Connection

: ATEX; M20 by 1.5 mm or 1/2 NPT select one type (2 pieces)  
FM; 1/2 NPT (2 pieces)  
CSA; 1/2 NPT (2 pieces)

#### Installation

: Flange mounting

**Probe Mounting Angle**: Installing at angles from horizontal to vertical downward is possible.

#### Weight

:

Insertion length of 0.4 m: approx. 13 kg (ANSI 150 4)

Insertion length of 0.7 m: approx. 14 kg (ANSI 150 4)

Insertion length of 1.0 m: approx. 15 kg (ANSI 150 4)

Insertion length of 1.5 m: approx. 17 kg (ANSI 150 4)

Insertion length of 2.0 m: approx. 19 kg (ANSI 150 4)

**Available Converter** : ZR402G, AV550G

GS 11M13A01-01E-E

## 2. ZR402G Separate type General purpose

### Zirconia Oxygen Analyzer, Converter

Converter must not be located in hazardous area.

Operated using an LCD touchscreen on the converter.

<b>Display</b>	: LCD display of size 320 by 240 dot with touchscreen.
<b>Output Signal</b>	: 4 to 20 mA DC, two points (max load 550Ω)
<b>Contact Output Signal</b>	: Four points (one is fail-safe, normally open)
<b>Contact Input</b>	: Two points
<b>Auto-calibration Output</b>	: Two points (for dedicated autocalibration unit)
<b>Ambient Temperature</b>	: -20 to +55°C
<b>Storage Temperature</b>	: -30 to +70°C
<b>Humidity Range</b>	: 0 to 95% RH (non-condensing)
<b>Installation Altitude</b>	: 2000 m or less Category based on IEC 1010: II* Pollution degree based on IEC 1010: 2*
<p><b>* Note:</b> Installation category, called over-voltage category, specifies impulse withstand voltage. Category II is for electrical equipment. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength. Degree 2 is the normal indoor environment.</p>	
<b>Power Supply Voltage</b>	: Ratings; 100 to 240 V AC
<b>Acceptable range</b>	: 85 to 264 V AC
<b>Power Supply Frequency</b>	: Ratings; 50/60 Hz
<b>Acceptable range</b>	: 45 to 66 Hz
<b>Power Consumption</b>	: Max. 300 W, approx. 100 W for ordinary use.
<b>Safety and EMC conforming standards</b>	
Safety	: Conforms to EN 61010-1 CSA C22.2 No.61010-1 certified UL 61010-1 certified
EMC	: Conforms to EN 61326 Class A EN55011 Class A, Group 1 EN61000-3-2
<b>Maximum Distance between Probe and Converter</b>	: Conductor two-way resistance must be 10Ω or less (when a 1.25 mm <sup>2</sup> cable or equivalent is used, 300 m or less).
<b>Construction</b>	: Outdoor installation, equivalent to NEMA 4 (with conduit holes completely sealed with a cable gland)
<b>Wiring Connection</b>	: G1/2, Pg13.5, M20 by 1.5 mm, 1/2 NPT, eight holes
<b>Installation Case</b>	: Panel, wall or 2-inch pipe mounting
<b>Case</b>	: Aluminum alloy
<b>Paint Color</b>	: Door: Silver gray (Munsell 3.2PB7.4/1.2) : Case: Silver gray (Munsell 3.2PB7.4/1.2)
<b>Finish</b>	: Polyurethane corrosion-resistance coating
<b>Weight</b>	: Approx. 6 kg

## Functions

### Display Functions:

Value Display	: Displays values of the measured oxygen concentration, etc
Graph Display	: Displays trends of measured oxygen concentration
Data Display	: Displays various useful data for maintenance, such as cell temperature, reference junction temperature, maximum/minimum oxygen concentration, or the like
Status Message	: Indicates an alarm or error occurrence with flashing of the corresponding icon. Indicates status such as warming-up, calibrating, or the like by icons.
Alarm, Error Display	: Displays alarms such as "Abnormal oxygen concentration" or errors such as "Abnormal cell e.m.f." when any such status occurs.

### Calibration Functions :

Auto-Calibration	: Requires the Auto-calibration Unit. It calibrates automatically at specified intervals.
Semi-auto Calibration	: Requires the Auto-calibration Unit. Input calibration direction on the touchscreen or contact, then it calibrates automatically afterwards.
Manual Calibration	: Calibration with opening/closing the valve of calibration gas in operation interactively with an LCD touchscreen.

**Blowback Function** : Output through the contact in the set period and time. Auto/semi-auto selectable.

**Maintenance Functions:** Can operate updated data settings in daily operation and checking. Display data settings, calibration data settings, blowback data settings, current output loop check, input/output contact check.

**Setup Functions** : Initial settings suit for the plant conditions when installing the converter. Equipment settings, current output data settings, alarm data settings, contact data settings, other settings.

**Self-diagnosis** : This function diagnoses conditions of the converter or the probe and indicates when any abnormal condition occurs.

**Password Functions** : Enter your password to operate the analyzer excepting data display. Individual passwords can be set for maintenance and setup.

### Display and setting content:

Measuring related items	: Oxygen concentration (vol% O <sub>2</sub> ), Output current value (mA), air ratio, moisture quantity (in hot gases) (vol% H <sub>2</sub> O)
Display Items	: Cell temperature (C), thermocouple reference junction temperature (C), maximum/minimum/average oxygen concentration (vol% O <sub>2</sub> ), cell e.m.f. (mV), cell internal resistance (Ω), cell condition (in four grades), heater on-time rate (%), calibration record (ten times), time (year/month/day, hour/minute)

**Calibration Setting Items**

: Span gas concentration (vol% O<sub>2</sub>), zero-gas concentration (vol% O<sub>2</sub>), calibration mode (auto, semi-auto, manual), calibration type and method (zero-span calibration, zero calibration only, span calibration only), stabilization time (min.sec), calibration time (min.sec), calibration period (day/hour), starting time (year/month/day, hour/minute)

**Equipment Related Items**

: Measuring gas selection

**Output Related Items** : Analog output/output mode selection, output conditions when warmingup/ maintenance/calibrating (during blowback)/abnormal, 4 mA/20 mA point oxygen concentration (vol% O<sub>2</sub>), time constant, preset values when warming-up/ maintenance/calibrating during blowback abnormal, output preset values on abnormal

**Alarm Related Items** : Oxygen concentration high-alarm/ high-high alarm limit values (vol% O<sub>2</sub>), Oxygen concentration low-alarm/ low-low alarm limit values (vol% O<sub>2</sub>), Oxygen concentration alarm hysteresis (vol% O<sub>2</sub>), Oxygen concentration alarm detection, alarm delay (seconds)

**Contact Related Items** : Selection of contact input 1 and 2, selection of contact output 1 to 4 (abnormal, high-high alarm, high-alarm, low-alarm, low-low alarm, maintenance, calibrating, range switching, warming-up, calibration-gas pressure decrease, temperature high-alarm, blowback, flameout gas detection)

**Converter Output** : Two points mA analog output (4 to 20 mA DC (maximum load resistance of 550Ω) and one mA digital output point (HART®) (minimum load resistance of 250Ω).

: Range: any setting between 0 to 5 through 0 to 100 vol% O<sub>2</sub> in 1 vol% O<sub>2</sub>, or partial range is available (Maximum range value/minimum range value 1.3 or more)

: For the log output, the minimum range value is fixed at 0.1 vol% O<sub>2</sub>.

: 4 to 20 mA DC linear or log can be selected.

: Input/output isolation

: Output damping: 0 to 255 seconds.

: Hold/non-hold selection, preset value setting possible with hold

**Contact Output**

: Four points, contact capacity 30 V  
: DC 3 A, 250 V AC 3 A (resistive load)  
: Three of the output points can be selected to either normally energized or normally deenergized status.  
: Delayed functions (0 to 255 seconds) and hysteresis function (0 to 9.9 vol% O<sub>2</sub> can be added to high/low alarms.  
: The following functions are programmable for contact outputs.  
(1) Abnormal,  
(2) High-high alarm,  
(3) Highalarm,  
(4) Low-low alarm,  
(5) Low-alarm,  
(6) Maintenance,  
(7) Calibration,  
(8) Range switching answer-back,  
(9) Warm-up,  
(10) Calibration-gas pressure decrease (answerback of contact input),  
(11) Temperature high-alarm,  
(12) Blowback start,  
(13) Flameout gas detection (answerback of contact input),  
(14) Calibration coefficient alarm,  
(15) Startup power stabilization timeout alarm  
: contact output 4 is set to normally operated, fixed error status.

**Contact Input**

: Two points, contact input The following functions are programmable for contact inputs:  
(1) Calibration-gas pressure decrease alarm,  
(2) Range switching,  
(3) External calibration start,  
(4) Process alarm  
(if this signal is received, the heater power turns off),  
(5) Blow-back start

**Contact capacity  
Self-diagnosis**

: Off-state leakage current: 3 mA or less  
: Abnormal cell, abnormal cell temperature (low/high), abnormal calibration, defective A/ D converter, defective digital circuit

**Calibration**

: Method; zero/span calibration  
: Calibration mode; automatic, semi-automatic and manual (All are operated interactively with an LCD touchscreen). Either zero or span can be skipped.  
: Zero calibration-gas concentration setting range: 0.3 to 100 vol% O<sub>2</sub> (0.01 vol% O<sub>2</sub> in smallest units).  
: Span calibration-gas concentration setting range: 4.5 to 100 vol% O<sub>2</sub> (0.01 vol% O<sub>2</sub> in smallest units).  
: Use nitrogen-balanced mixed gas containing 10 vol% O<sub>2</sub> scale of oxygen, and 80 to 100 vol% O<sub>2</sub> scale of oxygen for standard zerogas and standard span-gas respectively.  
: Calibration period; date/time setting: maximum 255 days

### 3. ZR202S Integrated type Explosionproof

#### Zirconia Oxygen Analyzer

<b>Display</b>	: 6-digit LCD
<b>Switch</b>	: Three optical switches
<b>Output Signal</b>	: 4 to 20 mA DC, one point (maximum load resistance 550)
<b>Digital Communication (HART®)</b>	: 250 to 550Ω, depending on quantity of field devices connected to the loop (multi-drop mode).
<b>Note:</b> HART is a registered trademark of the HART® Communication Foundation.	
<b>Contact Output Signal</b>	: Two points (one is fail-safe, normally open)
<b>Contact Input Signal</b>	: Two points
<b>Sample Gas Temperature</b>	: 0 to 700°C It is necessary to mount the cell using Inconel cell-bolts when the temperature measures more than 600°C. High-temperature service greater than 700°C is not available.
<b>Sample Gas Pressure</b>	: - 5 to + 5 kPa No pressure fluctuation in the furnace should be allowed.
<b>Probe Length</b>	: 0.4, 0.7, 1.0, 1.5, 2.0
<b>Probe Material</b>	: SUS 316 (JIS)
<b>Ambient Temperature</b>	: -20 to +55°C (- 5 to +70°C on the case surface)
<b>Storage Temperature</b>	: -30 to +70°C
<b>Humidity Range</b>	: 0 to 95 %RH (non-condensing)
<b>Installation Altitude</b>	: 2000 m or less Category based on IEC 1010: II (Note) Pollution degree based on IEC 1010: 2 (Note)
<b>Note:</b> Installation category, called over-voltage category, specifies impulse withstand voltage. Category II is for electrical equipment. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength. Degree 2 is the normal indoor environment.	
<b>Power Supply Voltage</b>	: Ratings; 100 to 240 V AC Acceptable range : 85 to 264 V AC
<b>Power Supply Frequency</b>	: Ratings; 50/60 Hz Acceptable range : 45 to 66 Hz
<b>Power Consumption</b>	: Max. 300 W, approx. 100 W for ordinary use.
<b>Safety and EMC conforming standards</b>	
Safety	: EN61010-1 CSA C22.2 No.61010-1 UL61010-1
EMC	: EN 61326 Class A EN 55011 Class A Group 1 EN 61000-3-2 AS/NZS CISPR 11
<b>Reference Air System</b>	: Instrument Air
<b>Instrument Air System:</b>	
Pressure	: 50 kPa + the pressure inside the furnace 150 kPa + the pressure inside the furnace with auto calibration unit. (It is recommended to use air which is dehumidified by cooling to dew point -20°C or less, and filtering to remove dust or oil mist.)
Consumption	: Approx. 1.5Nl/min

#### Material in Contact with Gas

: SUS 316 (JIS), Zirconia, SUS 304 (JIS) (flange), Hastelloy B, (Inconel 600, 601)

#### Construction

: Heater and thermocouple replaceable construction.  
: NEMA 4X/IP66  
(Achieved when pipes are installed at calibration gas and reference air inlet and exhaust pipe is installed so that reference air can be exhausted to clean atmosphere. Excluding probe top.) (Achieved when the cable entry is completely sealed with a cable gland.)

#### Gas Connection

: Rc 1/4 or 1/4 NPT

#### Wiring Connection

:  
ATEX : M20 by 1.5mm, 1/2 NPT select one type (4 pieces)  
FM : 1/2 NPT (4 pieces),  
CSA : 1/2 NPT (4 pieces),

#### Installation

: Flange mounting

#### Probe Mounting Angle:

: Horizontal to vertically downward.  
Installing at angles from horizontal to vertical downward is available.

#### Case

: Aluminum alloy

#### Paint Color:

Cover : Mint green (Munsell 5.6BG3.3/2.9)  
Case : Mint green (Munsell 5.6BG3.3/2.9)

#### Finish

: Polyurethane corrosion-resistance coating

#### Weight:

Insertion length of 0.4 m: approx. 15 kg (ANSI 150 4)  
Insertion length of 0.7 m: approx. 16 kg (ANSI 150 4)  
Insertion length of 1.0 m: approx. 17 kg (ANSI 150 4)  
Insertion length of 1.5 m: approx. 19 kg (ANSI 150 4)  
Insertion length of 2.0 m: approx. 21 kg (ANSI 150 4)

### Functions

#### Display Function

: Displays values of the measured oxygen concentration, etc.

#### Alarm, Error Display

: Displays alarms such as "AL-06" or errors such as "Err -01" when any such status occurs.

#### Calibration Functions:

Auto-calibration : Requires the Auto-calibration Unit. It calibrates automatically at specified intervals.  
Semi-auto Calibration: Requires the Auto-calibration Unit. Input calibration start signal by optical switch or contact, then it calibrates automatically afterwards.  
Manual Calibration : Calibration with opening/closing the valve of calibration gas in operation interactively with the optical switch.

#### Maintenance Functions

: Can operate updated data settings in daily operation and checking. Display data settings, calibration data settings, test settings (current output loop check, input/ output contact check).  
**Setup Functions** : Initial settings suit for the plant conditions when installing the converter. Current output data settings, alarm data settings, contact data settings, other settings.

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**Display and setting content:**

Display Related Items: Oxygen concentration (vol% O<sub>2</sub>), Output current value (mA), air ratio, moisture quantity (in hot gases) (vol% H<sub>2</sub>O), Cell temperature (°C), thermocouple reference junction temperature (°C), maximum/minimum/average oxygen concentration (vol% O<sub>2</sub>), cell e.m.f. (mV), cell internal resistance (Ω), cell condition (in four grades), heater on-time rate (%), calibration record (ten times), time (year/month/day/hour/minute)

Calibration Setting Items

: Span gas concentration (vol% O<sub>2</sub>), zero-gas concentration (vol% O<sub>2</sub>), calibration mode (auto, semiauto, manual), calibration type and method (zero-span calibration, zero calibration only, span calibration only), stabilization time (min.sec), calibration time (min. sec), calibration period (day/hour), starting time (year/month/day/hour/minute)

Output Related Items: Analog output/output mode selection, output conditions when warming-up/maintenance/calibrating/abnormal, 4 mA/20 mA point oxygen concentration (vol% O<sub>2</sub>), time constant, preset values when warming-up/maintenance/calibrating/ abnormal, output preset values on abnormal

**Alarm Related Items** : Oxygen concentration highalarm/ high-high alarm limit values (vol% O<sub>2</sub>), Oxygen concentration lowalarm/ low-low alarm limit values (vol% O<sub>2</sub>), Oxygen concentration alarm hysteresis (vol% O<sub>2</sub>), Oxygen concentration alarm detection, alarm delay (seconds)

**Contact Related Items**: Selection of contact input 1 and 2, selection of contact output 1 and 2 (abnormal, high-high alarm, high-alarm, low-alarm, low-low alarm, maintenance, calibrating, range switching, warming-up, calibration-gas pressure decrease, flameout gas detection (answerback of contact input))

**Converter Output** : One mA analog output point (4 to 20 mA DC (maximum load resistance of 550Ω)) with mA digital output point (HART®) (minimum load resistance of 250Ω).  
: Range: any setting between 0 to 5 through 0 to 100 vol% O<sub>2</sub> in 1 vol% O<sub>2</sub>, and partial range is available (Maximum range value/ minimum range value 1.3 or more)  
: For the log output, the minimum range value is fixed at 0.1 vol% O<sub>2</sub>.  
: 4 to 20 mA DC linear or log can be selected. Input/output isolation  
: Output damping: 0 to 255 seconds. Hold/non-hold selection, preset value setting possible with hold.

**Contact Output**

: Two points, contact capacity 30 V DC 3 A, 250 V AC 3 A (resistive load)  
: One of the output points can be selected to either normally energized or normally deenergized status.  
: Delayed functions (0 to 255 seconds) and hysteresis function (0 to 9.9 vol% O<sub>2</sub>) can be added to high/low-alarms.

: The following functions are programmable for contact outputs.  
(1) Abnormal,  
(2) High-high alarm,  
(3) High-alarm,  
(4) Low-low alarm,  
(5) Lowalarm,  
(6) Maintenance,  
(7) Calibration,  
(8) Range switching answer-back,  
(9) Warmup,  
(10) Calibration-gas pressure decrease (answerback of contact input),  
(11) Flameout gas detection (answerback of contact input).  
: Contact output 2 is set to normally operated, fixed error status.

**Contact Input**

: Two points, voltage-free contacts  
The following functions are programmable for contact inputs:  
(1) Calibration-gas pressure decrease alarm,  
(2) Range switching (switched range is fixed),  
(3) External calibration start,  
(4) Process alarm (if this signal is received, the heater power turns off)

**Self-diagnosis**

: Abnormal cell, abnormal cell temperature (low/high), abnormal calibration, A/D converter abnormal, digital circuit abnormal

**Calibration**

: Method; zero/span calibration  
: Calibration mode; automatic, semiautomatic and manual (All are operated using optical switches). Either zero or span can be skipped.  
: Zero-calibration gas concentration setting range: 0.3 to 100 vol% O<sub>2</sub> (in 0.01 vol% O<sub>2</sub>).  
: Span-calibration gas concentration setting range: 4.5 to 100 vol% O<sub>2</sub> (in 0.01 vol% O<sub>2</sub>).  
: Use nitrogen-balanced mixed gas containing 10 vol% O<sub>2</sub> scale of oxygen for standard zero-gas, and 80 to 100 vol% O<sub>2</sub> scale of oxygen for standard span-gas.  
: Calibration period; date/time setting: maximum 255 days

#### 4. ZO21P-H High Temperature Probe Adapter

Measuring O<sub>2</sub> in the high temperature gases (exceeds 700°C) requires the ZR22S of 0.15m length and a hightemperature prove adapter.

##### Sample gas temperature

: 0 to 1400°C (when using SiC probe)  
0 to 800°C (when using SUS 310S probe adapter)

**Sample gas pressure** : -0.5 to + 5 kPa. When using in the range of 0 to 25 vol% O<sub>2</sub> or more, the sample gas pressure should be in the range of -0.5 to +0.5 kPa. (Where the sample gas pressure for the high-temperature probe is negative, an auxiliary ejector is necessary.)

**Insertion length** : 1 m, 1.5 m

##### Material in Contact with Gas

: SUS 316 (JIS), Zirconia, SiC or SUS 310S, SUS 304 (JIS) (flange)

**Probe Material** : SiC, SUS 310S (JIS)

**Installation** : Flange mounting (FF type or RF type)

**Probe Mounting Angle**: Vertically downward within 5°  
Where the probe material is SUS 310S, horizontal mounting is available.

**Construction** : Non explosion-proof. Rainproof construction

**Weight** : Insertion length of 1.0 m: approx. 6.5 kg (JIS) / approx. 8.5 kg (ANSI)

**Insertion length of 1.5m**: approx. 7.5 kg (JIS) / approx. 9.5 kg (ANSI)

#### 5. E7046EC/E7046EN Auxiliary ejector

For use in cases where pressure of sample gas for high temperature detector is negative.

##### 5.1 Ejector Assembly

###### Ejector Inlet Air Pressure

: 29 to 68 kPa G  
Air Consumption: Approx. 30 to 40 l/min

**Suction gas flow rate**: 3 to 7 l/min

**Connection** : E7046EC Rc1/4 or E7046EN 1/4 NPT, SUS304 (JIS)

**Tube Connection** : (ø6/ø4 or 1/4 inch copper tube or stainless tube)

##### 5.2 Pressure Gauge Assembly

###### Pressure Gauge

**Type** : JIS B7505, A1.5U3/8 x75

###### Material in Contact with Gas

: SUS316 (JIS)

**Case Material** : Aluminum alloy (Paint color; black)

**Scale** : 0 to 100 kPa G Bushing (G3/8 x Rc1/4 or 1/4NPT, SUS304 (JIS))

##### 5.3 Needle Valve

**Connection** : Rc1/4 or 1/4NPT

**Material** : SUS316 (JIS)

**Note**: Pipes and connectors are not provided.

#### 6. ZO21R Probe Protector

Used when sample gas flow velocity is approx. 10m/sec or more and dust particles wears the detector in cases such as pulverized coal boiler of fluidized bed furnace (or burner) to protect the detector from wearing by dust particles.

**Insertion Length** : 1.05 m

**Flange** : JIS 5K 65A FF equivalent. ANSI CLASS 150-4-FF (without serration) equivalent or DIN PN10-DN50-A equivalent. However, flange thickness is different.

**Material** : SUS316 (JIS), SUS304 (JIS) (Flange)

**Weight** : 1.05 m; Approx. 6/10/8.5 kg (JIS/ANSI/DIN),

**Installation** : Bolts, nuts, and washers are provided for detector, probe adapter and process-side flange.

#### 7. ZA8F Flow Setting Unit

Used when instrument air is provided.

This unit controls flow rates of calibration gas and reference gas and consists of flowmeter and flow rate control valve.

**Flowmeter** : Calibration gas; 0.1 to 1.0 l/min.  
Reference air; 0.1 to 1.0 l/min.

**Construction** : Dust-proof and rainproof construction

**Case Material** : SPCC (Cold rolled steel sheet)

**Painting** : Baked epoxy resin, Dark-green (Munsell 2.0 GY 3.1/0.5 or equivalent)

**Tube Connections** : Rc1/4 or 1/4 NPT

**Reference Air pressure**: Clean air supply of measured gas pressure plus approx. 50 kPa G measured gas pressure plus approx. 150kPa (pressure rating is 70 to 100 kPa) when a check valve is used (pressure at inlet of the auto-calibration unit)

**Air Consumption** : Approx. 1.5 l/min

**Weight** : Approx. 2.3 kg



## 8. ZR40H Auto-calibration Unit for Separate type Analyzer

Auto-calibration Unit must be located in hazardous area. Used when auto calibration is required for the separate type and instrument air is provided. The solenoid valves are provided as standard.

<b>Construction</b>	: Dust-proof and rainproof construction: NEMA 4X / IP67 - only for case coating solenoid valve, not flowmeter (excluding flowmeter)
<b>Mounting</b>	: 2-inch pipe or wall mounting, no vibration
<b>Materials</b>	: Body: Aluminum alloy, : Piping: SUS316 (JIS), SUS304 (JIS), : Flowmeter: MA (Methacrylate resin) : Bracket: SUS304 (JIS)
<b>Finish</b>	: Polyurethane corrosion-resistance coating, Mint green (Munsell 5.6BG3.3/2.9)
<b>Piping Connection</b>	: Refer to Model and Suffix Codes
<b>Power Supply</b>	: 24V DC (from ZR402G), Power consumption: Approx. 1.3 W
<b>Reference Air Pressure</b>	: Sample gas pressure + Approx. 150 kPa (Pressure at inlet of auto-calibration unit)
<b>Air Consumption</b>	: Approx. 1.5 l/min
<b>Weight</b>	: Approx. 3.5 kg
<b>Ambient Temperature</b>	: -20 to +55°C, no condensing and freezing
<b>Ambient Humidity</b>	: 0 to 95%RH
<b>Storage Temperature</b>	: -30 to +65°C

## 9. Automatic Calibration Unit for Integrated type Analyzer

When Auto Calibration of (-A) or (-B) code is specified, Auto Calibration Unit is installed in ZR202S. Only Auto Calibration Unit is not available.

## 10. L9852CB/G7016XH Stop Valve

The stop valve and the nipple are mounted on the calibration gas line. The nipple is used to connect the stop valve. They are attached when the suffix code (/SV) is selected for the ZR22S or the ZR202S.

<b>Connection</b>	: L9852CB Rc 1/4 or G7016XH 1/4 NPT
<b>Material</b>	: SUS316 (JIS)
<b>Weight</b>	: Approx. 80 g

## 11. K9292DN/K9292DS Check Valve

This is used to prevent entry of process gas into calibration gas line. Purpose is the same as stop valve, but is convenient, as it does not need to be opened or closed for calibration. Mount directly on calibration gas inlet of detector in place of stop valve. However as source pressure of 150 kPa G or more is needed, standard gas unit cannot be used. When option code "/CV" of the ZR22S or the ZR202S is specified, check valve is provided.

<b>Connection</b>	: K9292DN Rc1/4 or K9292DS 1/4 NPT
<b>Material</b>	: SUS304 (JIS)
<b>Pressure</b>	: Between 70 kPa G or more 350 kPa G or less
<b>Weight</b>	: Approx. 40g

## 12. ZR20-CAL Calibration unit

Easy to use and lightweight portable unit for calibration gas supply consisting of span gas (air) and zero gas.

Included in this set:

- 2 span gas alucan light weight bottles (one as a spare)
- 2 zero gas alucan light weight bottles (one as a spare)
- 2 constant flow regulators with quick connectors, set to 0.5 L/min
- 1 m tubing with quick connectors and nipple for direct connection to the sensor
- Holder for gas bottles
- Carrying case

Capacity	0.5 liter
Filled pressure	120 bar (60 liter gas)
Composition	Span gas: 21% O <sub>2</sub> (air), zero gas: 1% Oxygen in Nitrogen
Weight approx.	8 kg
Material holder	PVC
Material bottles	Aluminium

## 13. ZR22A, ZR202A Heater assembly

ZR22A	: Spare Parts for ZR22s
ZR202A	: Spare Parts for ZR202s

**Note:** Yokogawa shall not guarantee the heater assembly after its replacement.

## STANDARD ACCESSORIES

### ZR402G

Item	Parts. No.	Q'ty	Description
Fuse	A1113EF	1	3.15A
Bracket	F9554AL	1	For pipe, panel, or wall mounting
Screws for Bracket	F9123GF	1	

### ZR22S

Item	Parts. No.	Q'ty	Description
Allen wrench	L9827AB	1	For lock screw

### ZR202S

Item	Parts. No.	Q'ty	Description
Fuse	A1113EF	1	3.15A
Allen wrench	L9827AB	1	For lock screw

## Model and Suffix Codes

### 1. Separate type Explosionproof Zirconia Oxygen Analyzer, Detectors

Model	Suffix code	Option code	Description
ZR22S			Separate type Explosionproof Zirconia Oxygen Analyzer, Detector
Explosion proof Approval	-A -B -C		ATEX certified flameproof (*11) FM certified explosionproof CSA certified explosionproof
Length	-015 -040 -070 -100 -150 -200		0.15 m (for high temperature use) (*1) 0.4 m 0.7 m 1.0 m 1.5 m 2.0 m
Wetted material	-S -C		SUS316 Stainless steel with Inconel calibration gas tube (*7)
Flange (*2)	-A -B -C -E -F -G -K -L -M -P -Q -R -S -W		ANSI Class 150 2 RF SUS304 (*10) ANSI Class 150 3 RF SUS304 ANSI Class 150 4 RF SUS304 DIN PN10 DN50 A SUS304 (*10) DIN PN10 DN80 A SUS304 DIN PN10 DN100 A SUS304 JIS 5K 65 FF SUS304 JIS 10K 65 FF SUS304 JIS 10K 80 FF SUS304 JIS 10K 100 FF SUS304 JIS 5K 32 FF SUS304 (for high temperature use) (*3) JPI Class 150 4 RF SUS304 JPI Class 150 3 RF SUS304 Westinghouse
Reference air	-E		External connection (Instrument air) (*8)
Gas Thread	-R -T		Rc 1/4 1/4 NPT
Connection box thread	-M -T		M20 x1.5 mm 1/2 NPT (*9)
Instruction manual	-E		English
—	-A		Always -A
Options	Valves Tag plates	/C /CV /SV /SCT /PT	Inconel bolt (*4) Check valve (*5) Stop valve (*5) Stainless steel tag plate (*6) Printed tag plate (*6)

\*1 Used with the ZO21P High Temperature Probe Adapter. Select flange (-Q).

\*2 The thickness of the flange depends on its dimensions.

\*3 The flange thickness does not conform to JIS specification.

\*4 Inconel probe bolts and U shape pipe are used. Use this option for high temperature use (ranging from 600 to 700°C).

\*5 Specify either /CV or /SV option code. Please select /CV or /SV.

\*6 Specify either /SCT or /PT option code.

\*7 Recommended if measured gas contains corrosive gas like chlorine.

\*8 Piping for reference air must be installed to supply reference air constantly at a specified flow rate.

\*9 When selecting code -B (FM certified explosionproof) or -C (CSA certified explosionproof), select code -T (1/2 NPT).

\*10 Confirm inside diameter of pipe attached to customer's flange in case that -A or -E is selected.

\*11 Certified cable glands that meet or exceed the requirements for EEx dII B+H2 IP66, provide at least 6 threads engaged when installed, and resist heat so that they can be used in the operating environment, should be used.



## 2. Separate type General Purpose Zirconia Oxygen Analyzer, Converter

Model	Suffix code	Option code	Description
ZR402G	-----	-----	Separate type Zirconia Oxygen Analyzer, Converter
Converter thread	-P -G -M -T	----- ----- ----- -----	G1/2 Pg13.5 M20x1.5 mm 1/2NPT
Display	-J -E -G -F	----- ----- ----- -----	Japanese English German French
Instruction manual	-J -E	----- -----	Japanese English
—	-A	-----	Always -A
Options		/H /SCT /PT	Hood (*2) Stainless steel tag plate (*1) Printed tag plate (*1)
Tag plates			

\*1 Specify either /SCT or /PT option code.

\*2 Sun shield hood is still effective even if scratched.

## 3. Integrated type Explosionproof Zirconia Oxygen Analyzer

Model	Suffix code	Option code	Description
ZR202S			Integrated type Explosionproof Zirconia Oxygen Analyzer
Explosion proof Approval	-A -B -C		ATEX certified flameproof (*11) FM certified explosionproof CSA certified explosionproof
Length	-040 -070 -100 -150 -200		0.4 m 0.7 m 1.0 m 1.5 m 2.0 m
Wetted material	-S -C		SUS316 Stainless steel with Inconel calibration gas tube (*7)
Flange (*1)	-A -B -C -E -F -G -K -L -M -P -R -S -W		ANSI Class 150 2 RF SUS304 (*10) ANSI Class 150 3 RF SUS304 ANSI Class 150 4 RF SUS304 DIN PN10 DN50 A SUS304 (*10) DIN PN10 DN80 A SUS304 DIN PN10 DN100 A SUS304 JIS 5K 65 FF SUS304 JIS 10K 65 FF SUS304 JIS 10K 80 FF SUS304 JIS 10K 100 FF SUS304 JPI Class 150 4 RF SUS304 JPI Class 150 3 RF SUS304 Westinghouse
Auto Calibration	-N -A -B		Not required Horizontal mounting (*5) Vertical mounting (*5)
Reference air	-E		External connection (Instrument air) (*8)
Gas Thread	-R -T		Rc 1/4 1/4 NPT(F)
Connection box thread	-M -T		M20x1.5 mm 1/2 NPT (*9)
Instruction manual	-E		English
—	-A		Always -A
Options		/C /CV /SV /H /SCT /PT	Inconel bolt (*2) Check valve (*3) Stop valve (*3) Hood (*6) Stainless steel tag plate (*4) Printed tag plate (*4)

\*1 The thickness of the flange depends on its dimensions.

\*2 Inconel probe bolts and U shape pipe are used. Use this option for high temperature use (ranging from 600 to 700°C).

\*3 Specify either /CV or /SV option code. Please select /CV or /SV.

\*4 Specify either /SCT or /PT option code.

\*5 No need to specify the option codes, /CV and /SV, since the check valves are provided with the autocalibration unit.

\*6 Sun shield hood is still effective even if scratched. Hood is necessary for outdoor installation out of sun shield roof.

\*7 Recommended if measured gas contains corrosive gas like chlorine.

\*8 Piping for reference air must be installed to supply reference air constantly at a specified flow rate.

\*9 When selecting code “-B”(FM certified explosionproof) or “-C”(CSA certified explosionproof), select code “-T”(1/2 NPT).

\*10 Confirm inside diameter of pipe attached to customer's flange in case that “-A” or “-E” is selected.

\*11 Certified cable glands that meet or exceed the requirements for EEx dII B+H2 IP66, provide at least 6 threads engaged when installed, and resist heat so that they can be used in the operating environment, should be used.

#### 4. Adapter for High Temperature Probe of separate type Oxygen Analyzer

Model	Suffix code	Option code	Description
ZO21P	-H -----		High Temperature Probe Adapter
Material	-A ----- -B -----		SiC SUS 310S
Insertion length	-100 ----- -150 -----		1.0 m 1.5 m
Flange	-J ----- -N ----- -M ----- -L ----- -A ----- -R ----- -Q ----- -T ----- -S ----- -E -----		JIS 5K 50 FF SUS304 JIS 10K 65 FF SUS304t JIS 10K 80 FF SUS304 JIS 10K 100 FF SUS304 ANSI Class 150 4 RF SUS304 ANSI Class 150-2 1/2 RF SUS304 ANSI Class 150 3 RF SUS304 JPI Class 150 3 RF SUS304 JPI Class 150 4 RF SUS304 DIN PN10 DN50 A SUS304
Style code	*A -----		Style A

**Note:** For this high-temperature use probe adapter, be sure to specify the ZR22S probe of its insertion length 0.15 meters.

#### High temperature Probes (Spare Parts)

Part No.	Description
E7046AL	SiC, insertion length 1.0 m
E7046BB	SiC, insertion length 1.5 m
E7046AP	SUS310S, insertion length 1.0 m
E7046AQ	SUS310S, insertion length 1.5 m

#### 5. Auxiliary Ejector for High Temperature Use of separate type Oxygen Analyzer

Part No.	Description
E7046EC	Rc 1/4 $\phi$ 6 / $\phi$ 4 TUBE joint: SUS304 (JIS)
E7046EN	1/4 NPT, 1/4 TUBE joint: SUS304 (JIS)

#### 6. Probe Protector for Zirconia Oxygen Analyzers

Model	Suffix code	Option code	Description
ZO21R	-L -----		Probe Protector(0 to 700°C)
Insertion length	-100 -----		1.05 m (3.5 ft)
Flange (*1)	-J ----- -A -----		JIS 5K 65 FF SUS304 ANSI Class 150 4 FF SUS304
Style code	*B -----		Style B

#### 7. Flow setting unit for manual calibration (Needs instrument air.)

Model	Suffix code	Option code	Description
ZA8F			Flow setting unit
Joint	-J ----- -A -----		Rc 1/4 With 1/4" NPT adapter
Style code	*B -----		Style B

## 8. Automatic Calibration Unit for Separate type Analyzer (Needs instrument air.)

Model	Suffix code	Option code	Description
ZR40H	.....	.....	Automatic calibration unit for ZR402G
Gas piping connection	-R .....	.....	Rc 1/4
	-T .....	.....	1/4" NPT
Wiring connection	-P .....	.....	Pipe connection (G1/2)
	-G .....	.....	Pg 13.5
	-M .....	.....	20 mm (M20 x 1.5)
	-T .....	.....	1/2 NPT
—	-A	.....	Always -A

## 9. Automatic Calibration Unit for Integrated type Analyzer ZR202S

When Auto Calibration of (-A) or (-B) code is specified, Auto Calibration Unit is installed in ZR202S.

When (-N) is selected, Auto Calibration Unit is not available.

## 10. Stop Valve for Calibration-gas line

Stop valve

Part No.	Description
L9852CB	Joint: Rc 1/4, Material: SUS316 (JIS)
G7016XH	Joint: 1/4 NPT, Material: SUS316 (JIS)

Nipple

Part No.	Description
G7209XA	R 1/4, Material: SUS316 (JIS)
K9470ZN	1/4 NPT, Material: SUS316 (JIS)

## 11. Check Valve for Calibration-gas line

Part No.	Description
K9292DN	Joint: Rc 1/4, Material: SUS304 (JIS)
K9292DS	Joint: 1/4 NPT, Material: SUS304 (JIS)

## 12. Air Set

Part No.	Description
K9473XH	Joint: Rc 1/4, Material: Aluminum
K9473XJ	Joint: 1/4 NPT(F), Material: Body; Aluminum Adapter; SUS316
G7004XF	Joint: Rc 1/4, Material: Zinc alloy
K9473XG	Joint: 1/4 NPT(F), Material: Body; Zinc alloy Adapter; SUS316

## 13. Pressure Regulator for Gas Cylinder

Part No.	Description
G7013XF	Inlet: W22 14 threads Outlet: Rc 1/4
G7014XF	Inlet: W22 14 threads Outlet: 1/4 NPT(F)

## 14. Heater Assembly ZR22A

Model	Suffix code	Description
ZR22A	.....	Heater Assembly for ZR22G
Length (*1)	-015	0.15 m
	-040	0.4 m
	-070	0.7 m
	-100	1 m
	-150	1.5 m
	-200	2 m
	-250	2.5 m
	-300	3 m
Jig for change	-A	with Jig (*2)
	-N	None
Reference air (*3)	-A	Reference air natural convection External connection (instrument air)
	-B	Pressure compensated (for ZE22G S2)
	-C	Pressure compensated (for ZR22G S1)

\*1 Suffix code of length should be selected as same as ZR22G installed.

\*2 Jig part no. is K9470BX to order as a parts after purchase.

\*3 Select appropriately among "-A", "-B", "-C" according to the reference air supply method and style.

**Note:** The heater is made of ceramic, do not drop or subject it to pressure stress.

## 15 Heater Assembly ZR202A

Model	Suffix code	Option code	Description
ZR202A	.....	.....	Heater Assembly for ZR202
Length (*1)	-040 .....	.....	0.4 m
	-070 .....	.....	0.7 m
	-100 .....	.....	1 m
	-150 .....	.....	1.5 m
	-200 .....	.....	2 m
Jig for change	-A .....	.....	with Jig (*2)
	-N .....	.....	None
—	-A	.....	Always -A

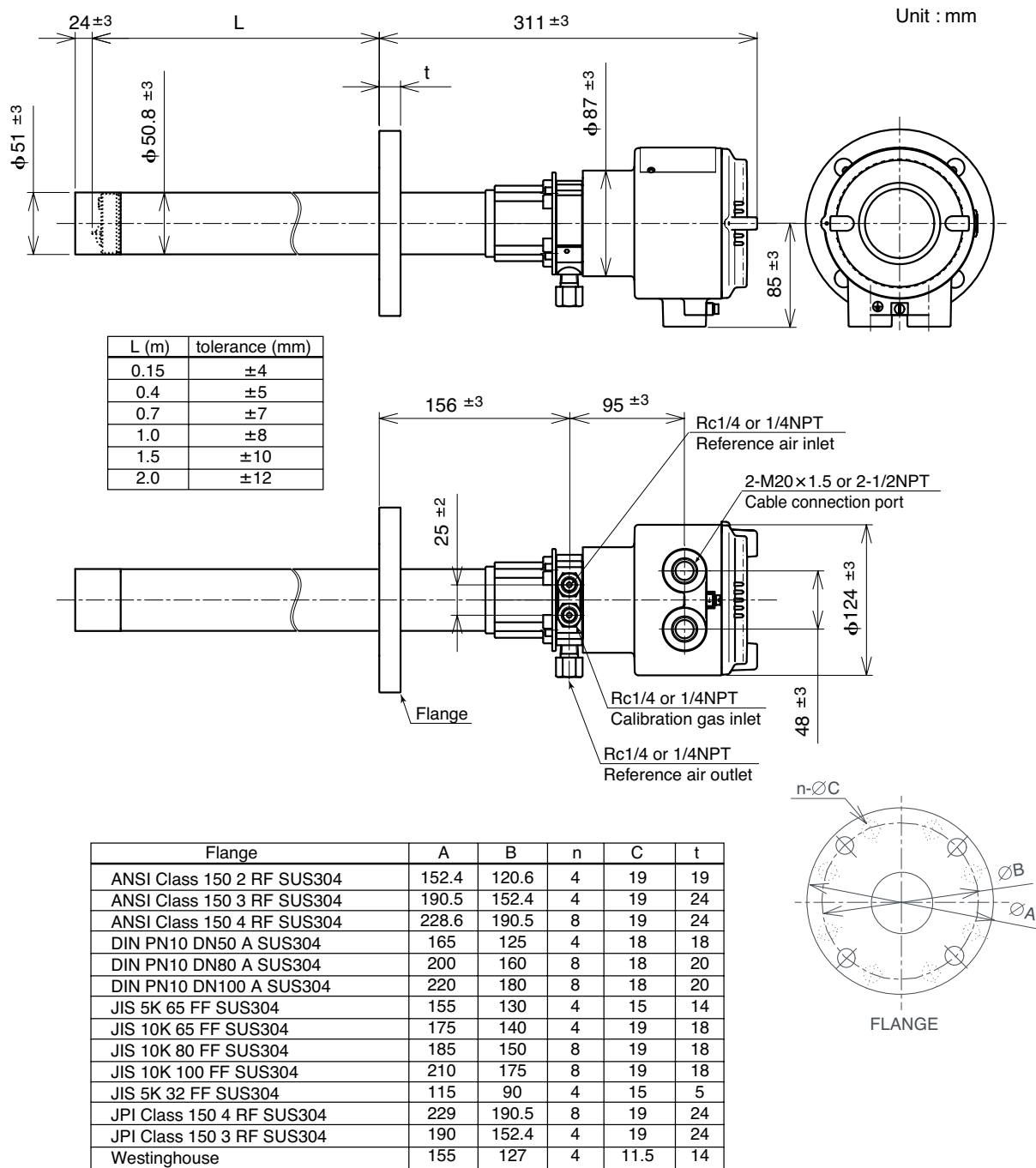
\*1 Suffix code of length should be selected as same as ZR202S installed.

\*2 Jig part no. is K9470BX to order as a parts after purchase.

**Note:** The heater is made of ceramic, do not drop or subject it to pressure stress. Yokogawa shall not guarantee the heater assembly after its replacement.

## EXTERNAL DIMENSIONS

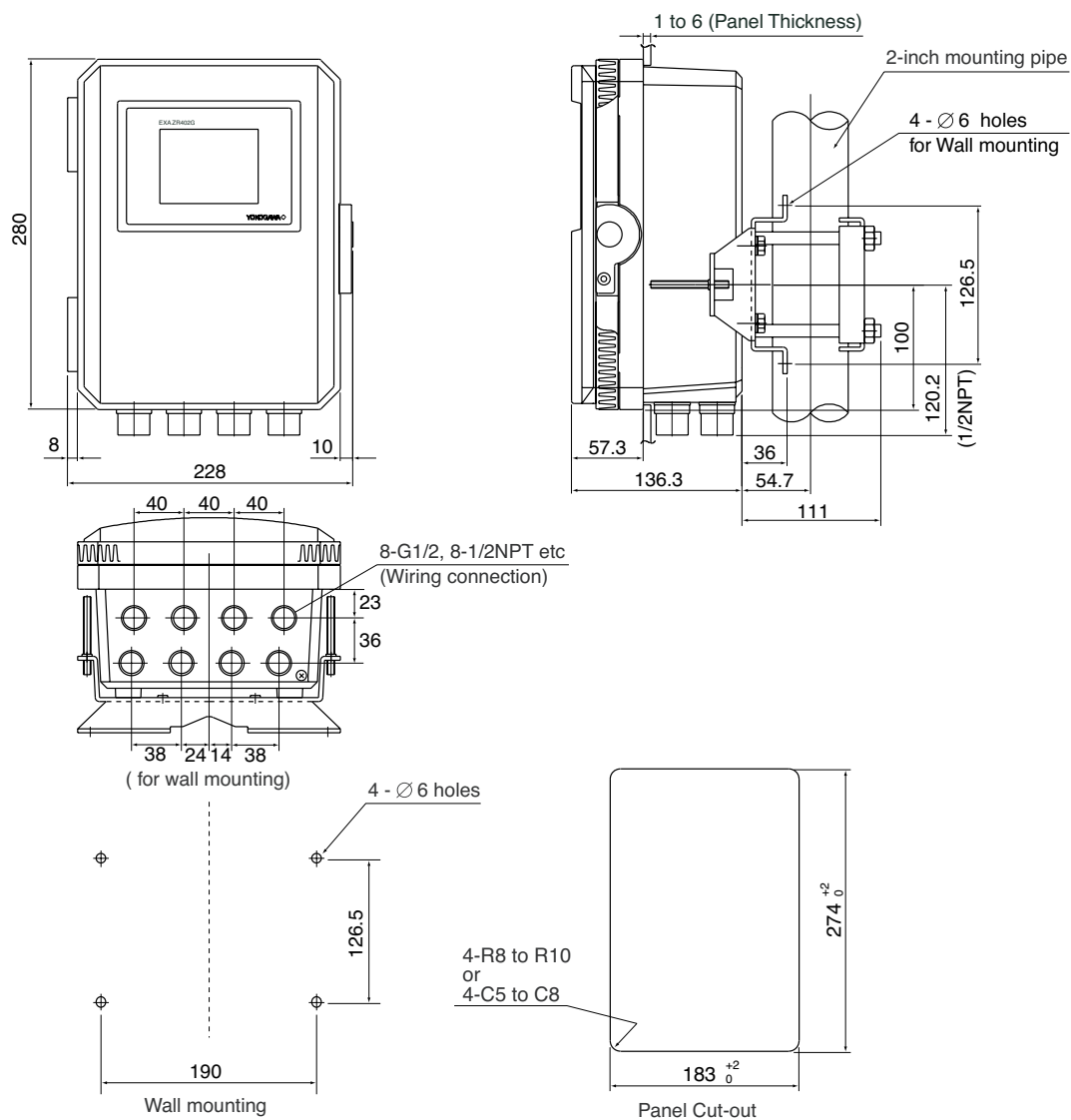
## 1. ZR22S Separate type Explosionproof Zirconia Oxygen Analyzer, Detectors



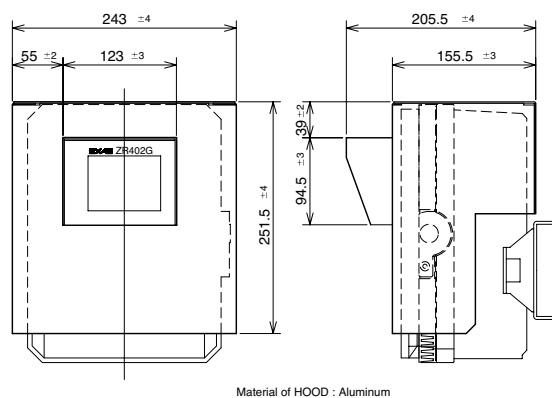
GS 11M13A01-01E-E

## 2. ZR402G Separate type Zirconia Oxygen Analyzers, Converter

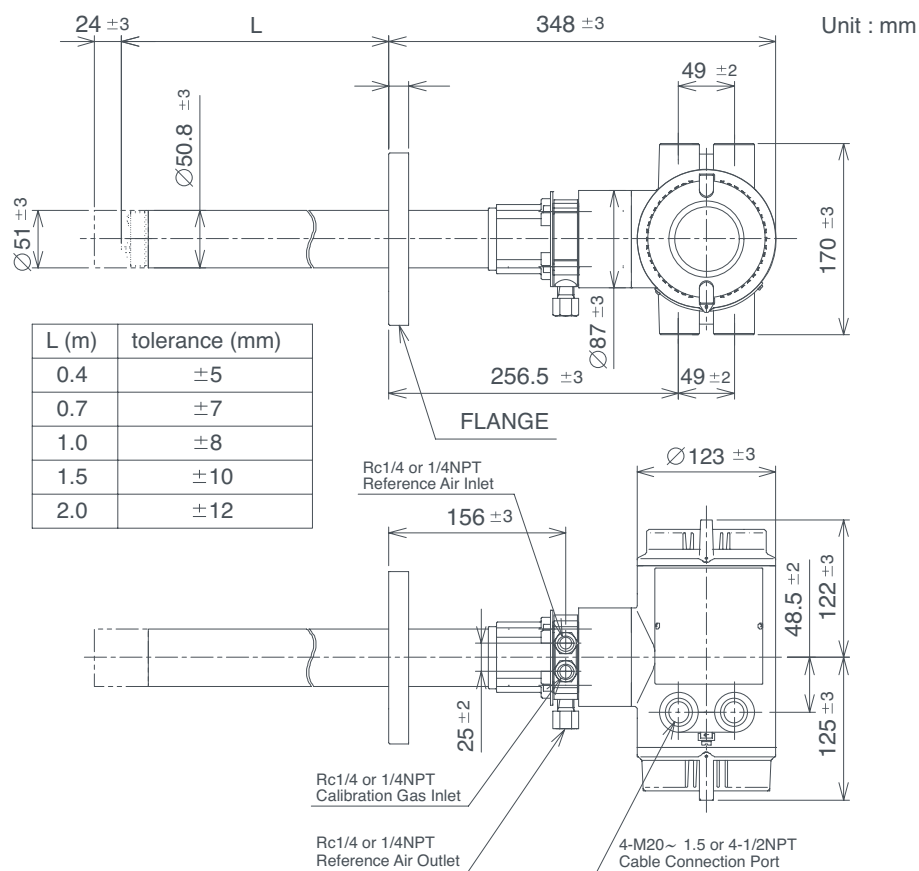
Unit : mm



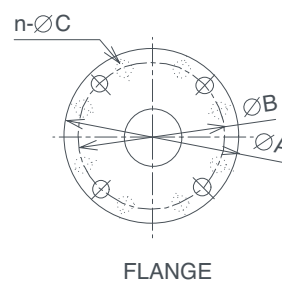
● With sun shield hood (option code /H)



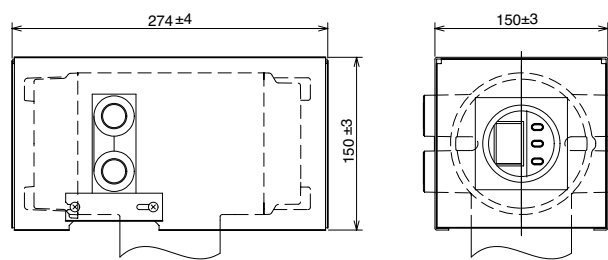
### 3. ZR202G Intergrated type Explosionproof Zirconia Oxygen Analyzers



Flange	A	B	C	t
ANSI Class 150 2 RF SUS304	152.4	120.6	4 - $\phi 19$	19
ANSI Class 150 3 RF SUS304	190.5	152.4	4 - $\phi 19$	24
ANSI Class 150 4 RF SUS304	228.6	190.5	8 - $\phi 19$	24
DIN PN10 DN50 SUS304	165	125	4 - $\phi 18$	18
DIN PN10 DN80 SUS304	200	160	8 - $\phi 18$	20
DIN PN10 DN100 SUS304	220	180	8 - $\phi 18$	20
JIS 5K 65 FF SUS304	155	130	4 - $\phi 15$	14
JIS 10K 65 FF SUS304	175	140	4 - $\phi 19$	18
JIS 10K 80 FF SUS304	185	150	8 - $\phi 19$	18
JIS 10K 100 FF SUS304	210	175	8 - $\phi 19$	18
JPI Class 150 4 RF SUS304	229	190.5	8 - $\phi 19$	24
JPI Class 150 3 RF SUS304	190	152.4	4 - $\phi 19$	24
Westinghouse	155	127	4 - $\phi 11.5$	14

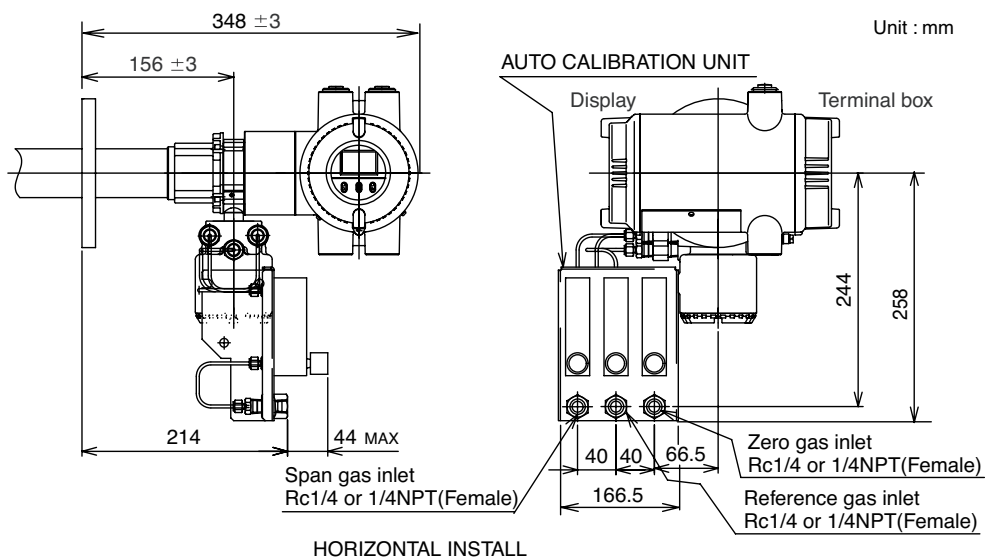
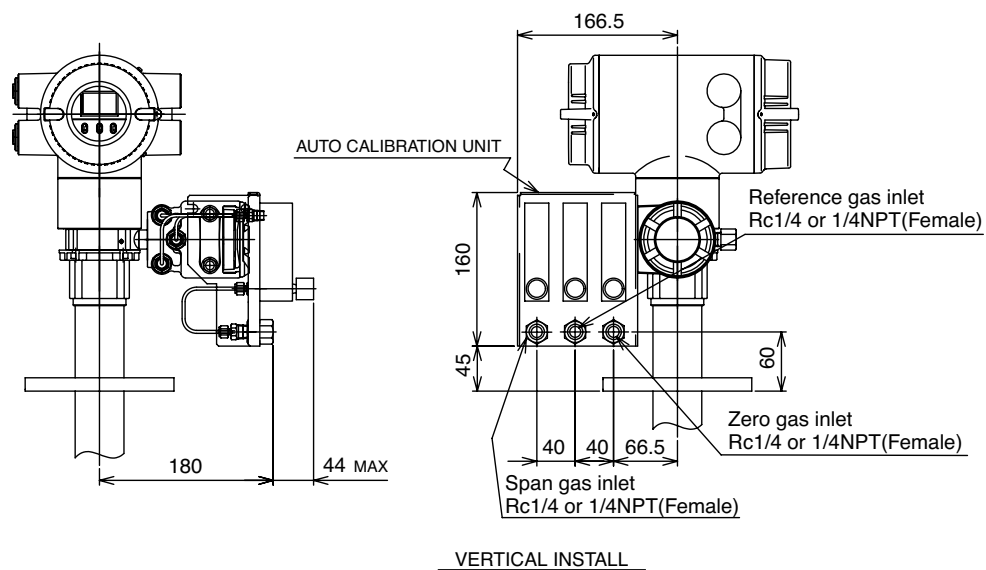


- With sun shield hood (option code /H)



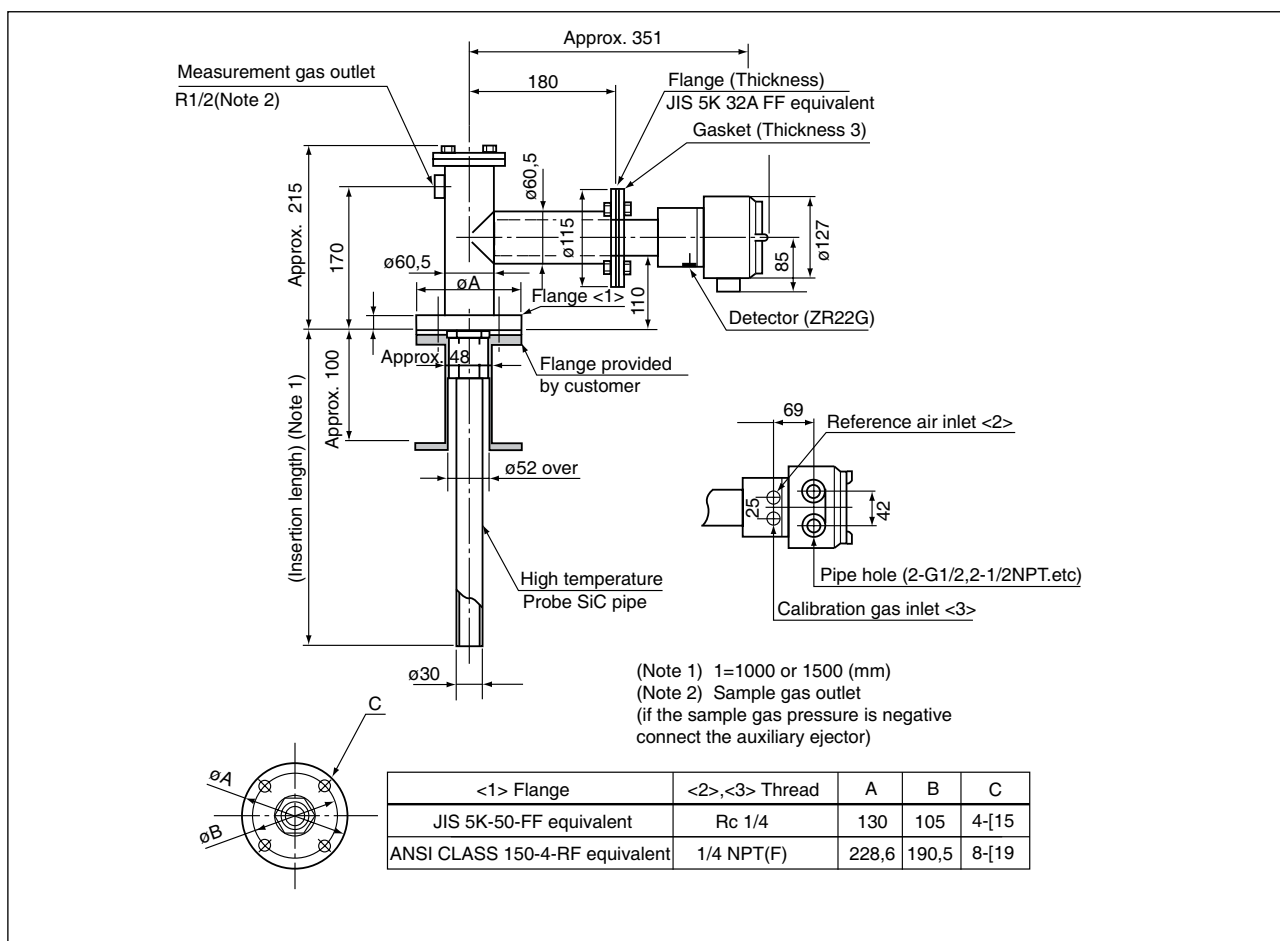
Material of HOOD : Aluminum

GS 11M13A01-01E-E

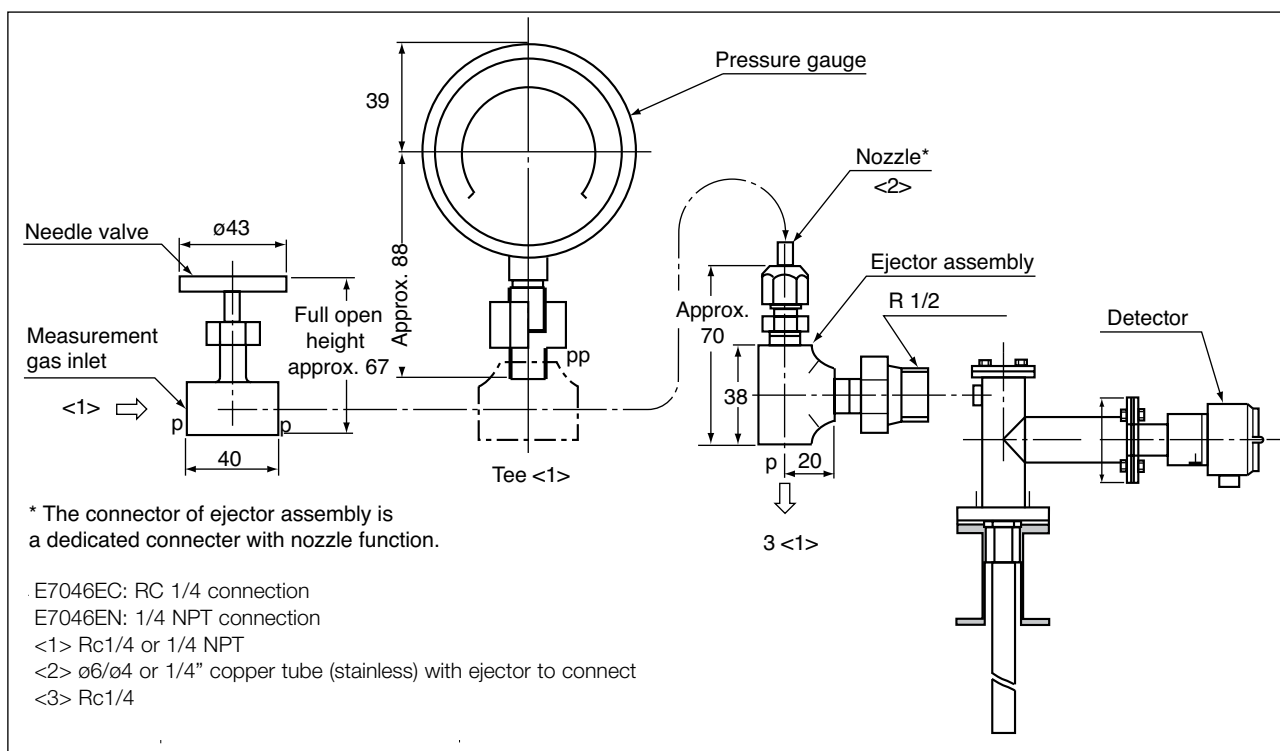
**ZR202G Intergrated type Explosionproof Zirconia Oxygen Analyzers**
**With Auto Calibration Unit (Horizontal Mount)**

**With Auto Calibration Unit (Vertical Mount)**




#### 4. Z021P Adapter for High Temperature Probe of separate type Oxygen Analyzer

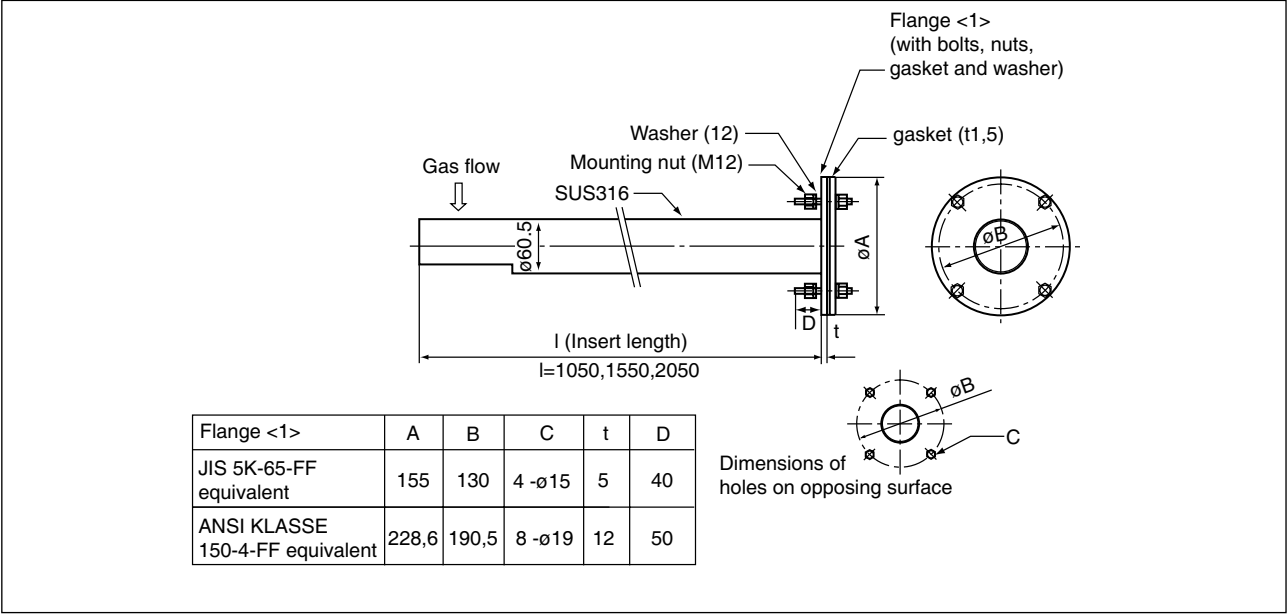


#### 5. E7046EC, E7046EN Auxiliary Ejector for High Temperature Use of separate type Oxygen Analyzer

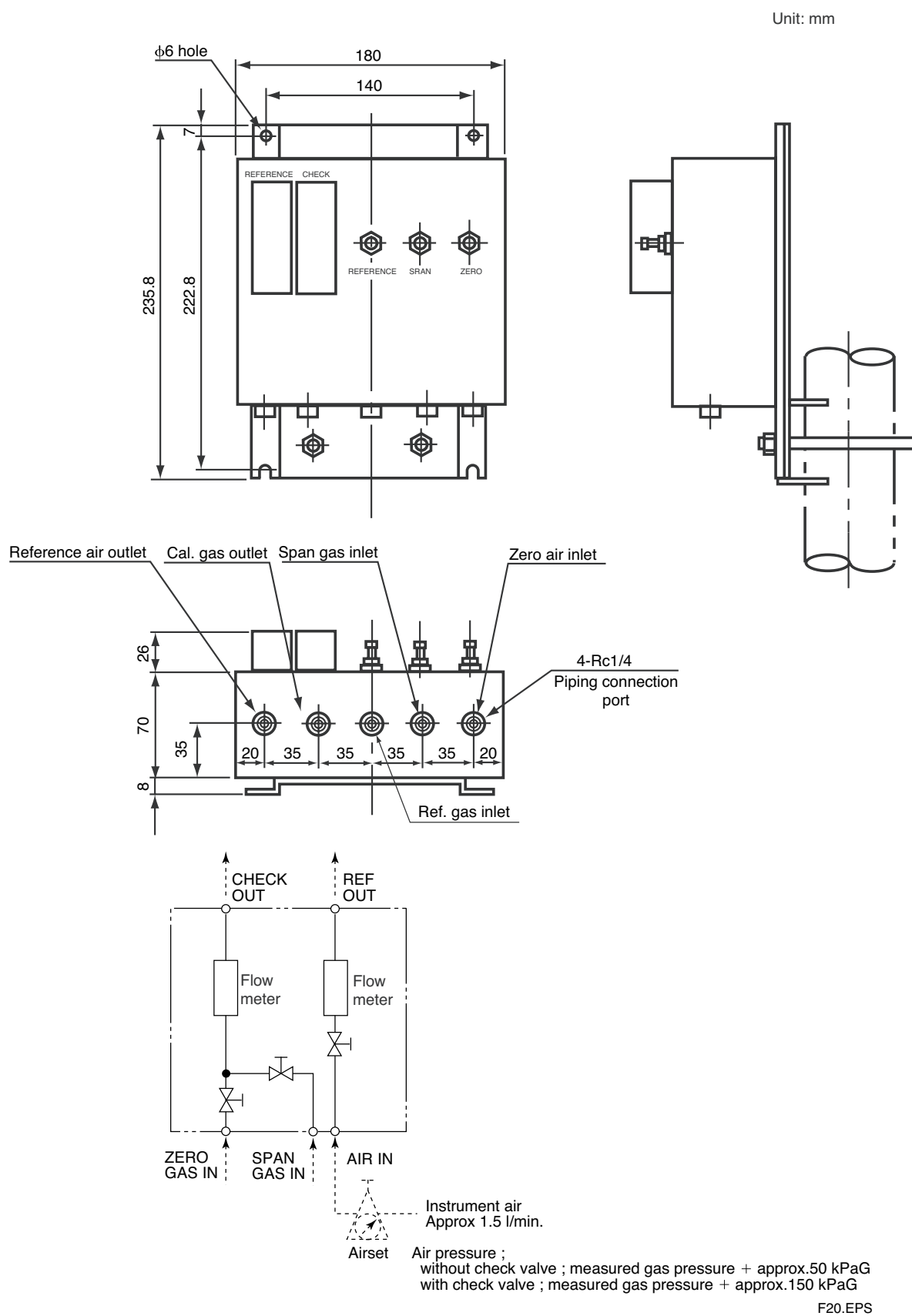


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6. Z021R Probe Protector for Zirconia Oxygen Analyzers

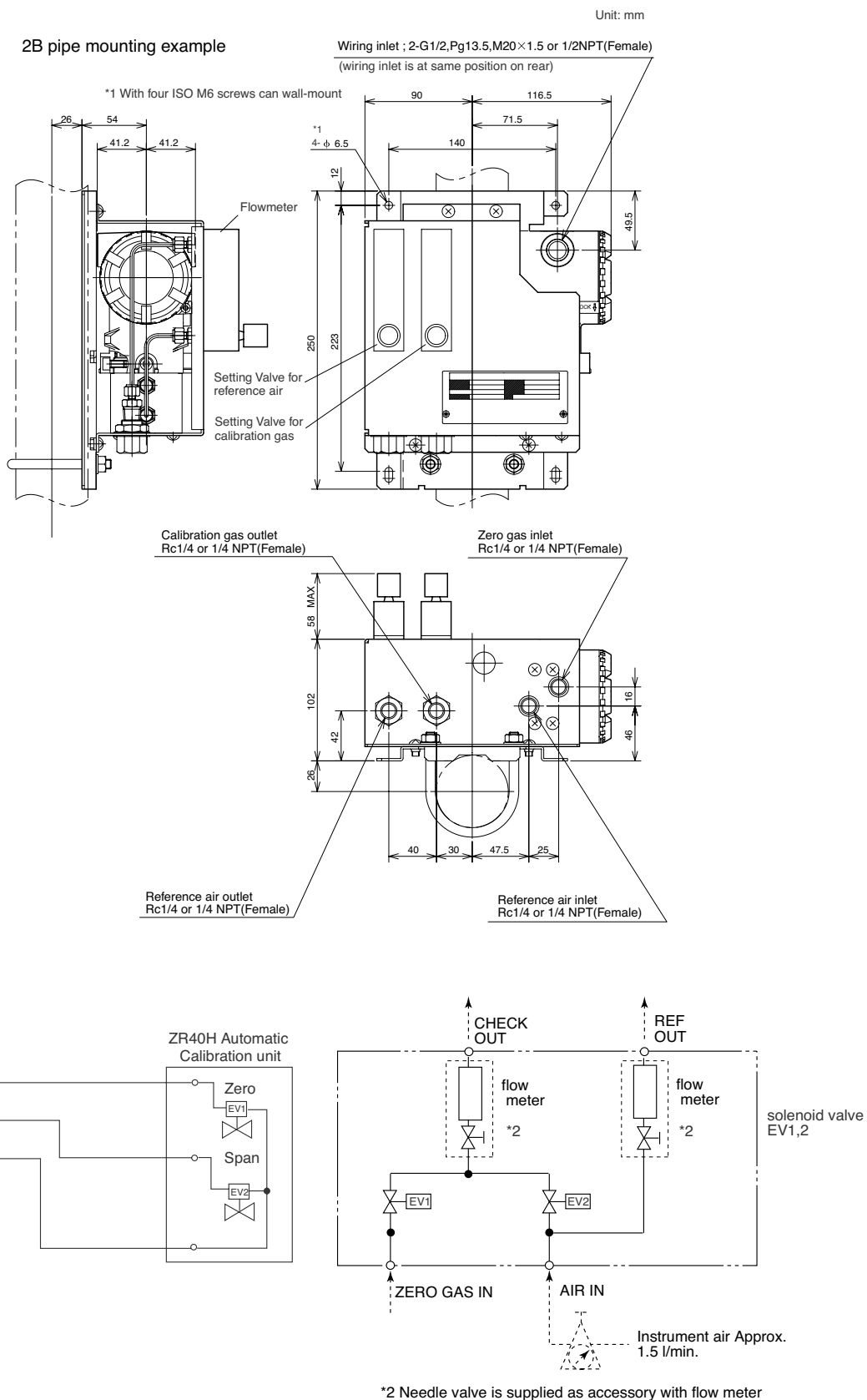


## 7. ZA8F setting unit for manual calibration



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## 8. ZR40H Automatic Calibration Unit for Seperate type Analyzer



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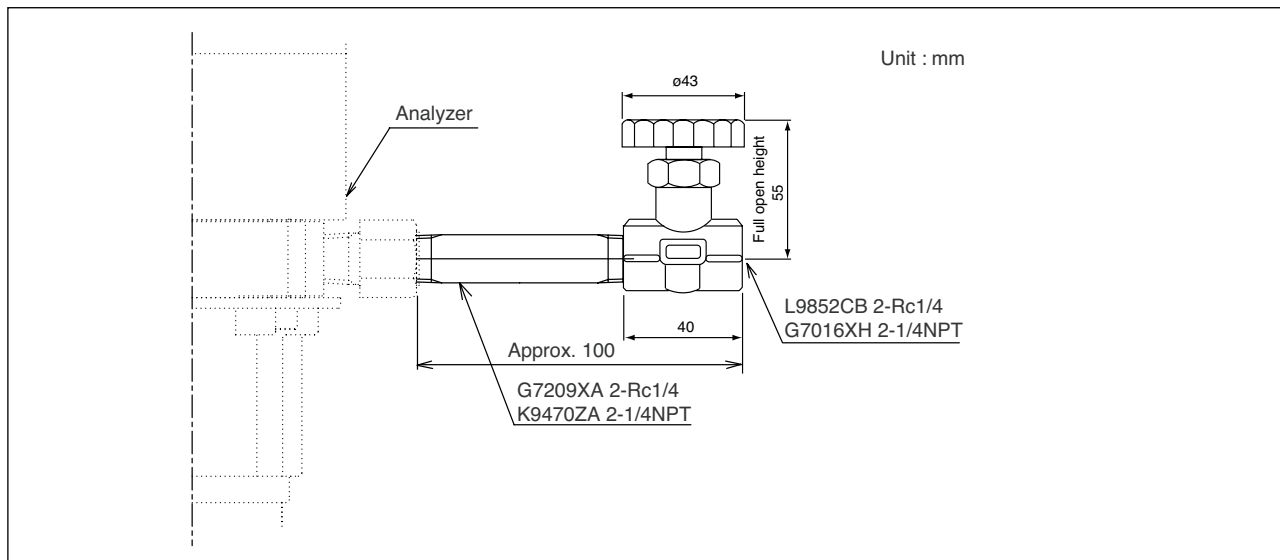
### 9. Automatic Calibration Unit for Integrated type Analyzer

When Auto Calibration of (-A) or (-B) code is specified, Auto Calibration Unit is installed in ZR202S.

Refer to the 20 Pages for the figure.

When (-N) is selected, Auto Calibration Unit is not available.

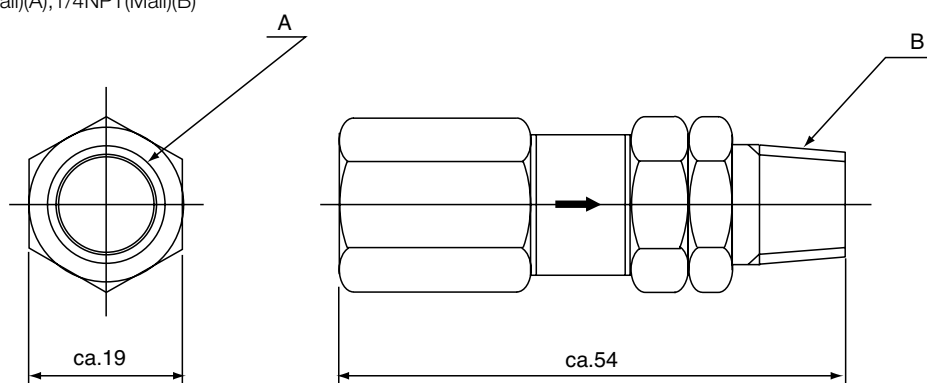
### 10. L9852CB /G7016XH Stop Valve for Calibration-gas line



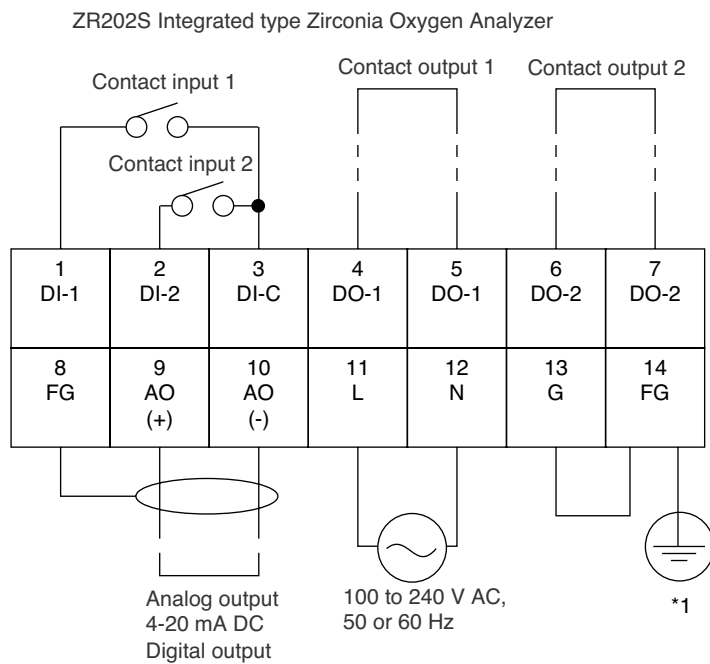
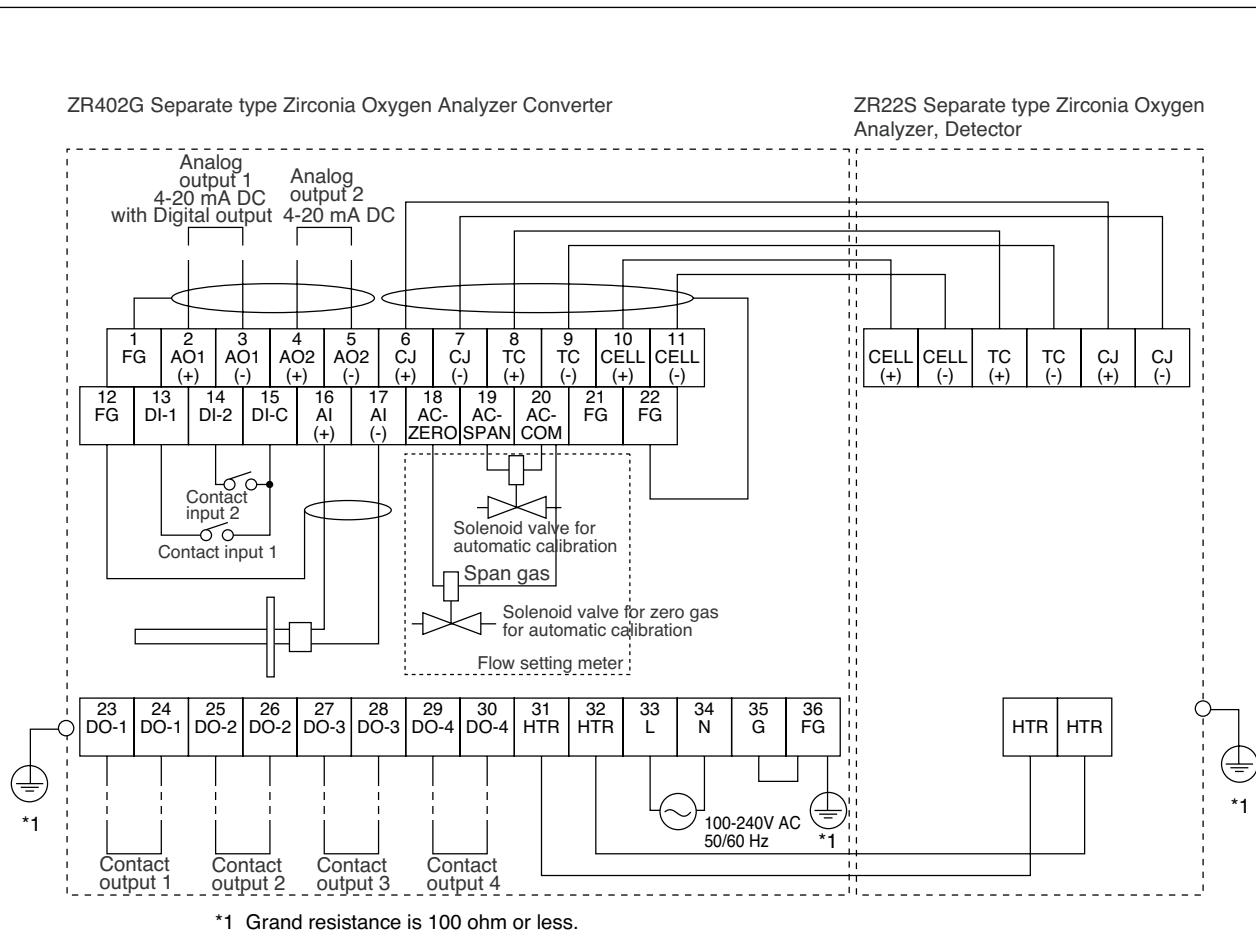
### 11. K9292DN /K9292DS Check Valve for Calibration-gas line

K9292DN : Rc 1/4(A), R 1/4(B)

K9292DS : 1/4NPT(Female)(A), 1/4NPT(Male)(B)



## Wiring Connections



**Inquiry Sheet for Models ZR22S, ZR402G, and ZR202S Direct In Situ Zirconia Oxygen Analyzers**  
**Please place checkmarks in the appropriate boxes and fill in the necessary information in the blanks.**

**1. General information**

Customer				
Destination of delivery				
Plant name	Object:	<input type="checkbox"/> Seperate type	<input type="checkbox"/> Intergrated type	
Measurement points	Fuel:	<input type="checkbox"/> indication <input type="checkbox"/> record	<input type="checkbox"/> control	<input type="checkbox"/> alarm
		<input type="checkbox"/> gas <input type="checkbox"/> oil	<input type="checkbox"/> coal	<input type="checkbox"/> _____
Power requierements		V AC	Hz	

**2. Process conditions**

2.1 Measurement gas components

2.2 Oxygen concentration	Nor.	Min.	Max.	<input type="checkbox"/> vol%O <sub>2</sub>	<input type="checkbox"/>
2.3 Temperature	Nor.	Min.	Max.	<input type="checkbox"/> °C,	<input type="checkbox"/>
2.4 Pressure	Nor.	Min.	Max.	<input type="checkbox"/> kPa,	<input type="checkbox"/>
2.5 Gas flow	Nor.	Min.	Max.	<input type="checkbox"/> m/sec,	<input type="checkbox"/>
2.6 Dust type, Size	Nor.	Min.	μm	quantity	<input type="checkbox"/> g/Nm <sup>3</sup> , <input type="checkbox"/>
2.7 Corrosive gas	<input type="checkbox"/> No gas	<input type="checkbox"/> Gas	, quantity		<input type="checkbox"/> ppm <input type="checkbox"/>
			, quantity		<input type="checkbox"/> ppm <input type="checkbox"/>
2.8 Combustible gas	<input type="checkbox"/> No gas	<input type="checkbox"/> Gas	, quantity		<input type="checkbox"/> ppm <input type="checkbox"/>
			, quantity		<input type="checkbox"/> ppm <input type="checkbox"/>
2.9 Others					

**3. Installation site conditions**

3.1 Ambient temperature	<input type="checkbox"/> 1. Around Probe temp. from    to    °C,		<input type="checkbox"/> 2. Around Converter temp. from    to    °C	
3.2 Vibration	<input type="checkbox"/> No vibration <input type="checkbox"/> Vibration			
3.3 1. Probe installation location	<input type="checkbox"/> Furnace <input type="checkbox"/> Stack <input type="checkbox"/> Others			
2. Probe position	<input type="checkbox"/> Horizontal <input type="checkbox"/> Vertical <input type="checkbox"/> Others			
<input type="checkbox"/> Indoor	<input type="checkbox"/> Outdoor <input type="checkbox"/> Covered (under roof)			
3. Probe insertion length (m)	<input type="checkbox"/> 0.15,	<input type="checkbox"/> 0.4,	<input type="checkbox"/> 0.7,	<input type="checkbox"/> 1.0, <input type="checkbox"/> 1.5, <input type="checkbox"/> 2.0
4. Flange	<input type="checkbox"/> DIN <input type="checkbox"/> ANSI <input type="checkbox"/> Others			
3.4 Converter location	<input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor <input type="checkbox"/> Covered (under roof)			
3.5 Cable length between probe and converter	meters			
3.6 Calibration method	<input type="checkbox"/> Manual <input type="checkbox"/> Automatic			

**4. Quotation data**

Quotation	Quantity	Description
Probe		Refer to the Probe Configuration for probe selection.
ZR22S Explosionproof Probe		
ZO21P-H High Temperature Use Probe Adapter		
E7046EC/E7046EN Auxiliary Ejector for high temperature use		
Options (for general use)		
ZO21R Probe Protector for Oxygen Analyzer		
ZR402G Separate type Analyzer, Converter		
ZR202S Integrated type Explosionproof Zirconia Oxygen Analyzer		
ZO21S Standard Gas Unit		Select any one of Model ZO21S, ZA8F, ZR40H.
ZA8F Flow Setting Unit		
ZR40H Automatic Calibration Unit		
L9852CB /G7016XH Stop Valve		Not required if probe options are specified.
K9292DN /K9292DS Check Valve		
K9473XH /K9473XJ, G7004XF/K9473XG Air Set		
G7013XF /G7014XF Pressure Regulator		
ZR22A, ZR202A Heater Assembly (Spare Parts)		

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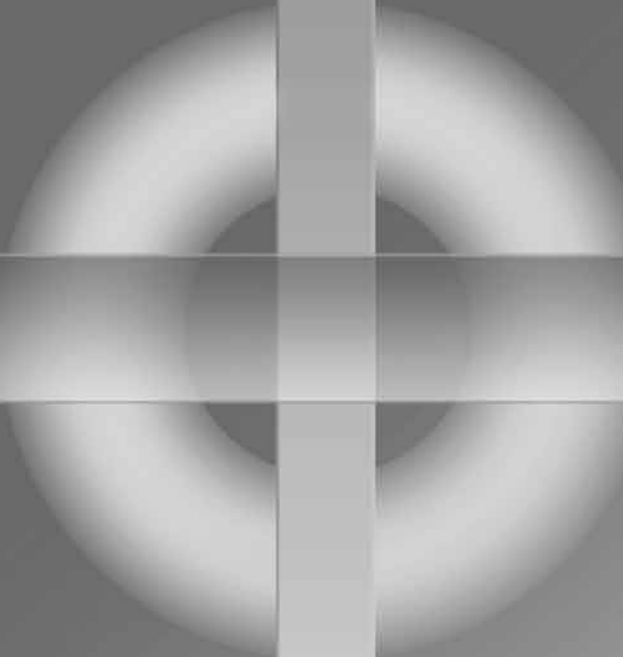
YOKOGAWA ◆





Flexa

Flexa



# General Specifications

Model FLXA21  
2-Wire Analyzer

**FLEXA**  
CE

The model FLXA21® two-wire analyzer is used for continuous on-line measurements in industrial installations. It offers an option for single or dual sensor measurement, making it the most flexible 2-wire analyzer available. The model FLEXA21® modular-designed series analyzer offers 4 parameter choices – pH/ORP (oxidation-reduction potential), contacting conductivity (SC), inductive conductivity (ISC) or dissolved oxygen (DO) – with the respective sensor module.

For dual sensor measurement, the sensor modules must be the same parameter – pH/ORP and pH/ORP, SC and SC, and DO and DO. Dual sensor measurement offers additional functionalities including a variety of calculated data from the two measuring parameters, as well as, the option to program the analyzer as a redundant system. In the redundant system the main output parameter is automatically switched over to the second sensor output in case of the main sensor's failure. ISC is only available as a single measurement.

When the analyzer is initially powered on the FLXA21® automatically recognizes the installed sensor module and initiates Quick Start menus for fast easy start up. Only a few setups; date/time, language, basic sensor configurations and output, are needed to start the measurement.

The FLXA21® incorporates the same unique Human Machine Interface (HMI) as seen in the EXA450 series; offering easy touch screen operation and a simple intuitive menu structure available in 12 different selectable languages.

The FLXA21® provides industry proven measurement accuracy incorporating essential temperature compensation and calibration functionalities, with advanced self-diagnostics and sensor wellness indication to provide a highly reliable measurement. The logbook of events and diagnostic data provided are useful information sources for preventive maintenance.

Yokogawa designed the FLXA21® to withstand a wide range of industrial environments. The FLXA21® is housed in a robust NEMA 4X, IP66 mountable enclosure, and meets all the CE regulatory standards. It is designed to have the option for enclosure housing selection to meet specific industry needs: poly carbonate, stainless steel or stainless steel with corrosion resistant coating.



## Features

- One analyzer can accept any of 4 types of measurements; pH/ORP, Contacting Conductivity (SC), Inductive Conductivity (ISC) and Dissolved Oxygen (DO)
- Dual sensor measurement on a 2-wire type analyzer pH/ORP and pH/ORP, SC and SC, and DO and DO
- Modular design: replaceable sensor modules
- Redundant system on dual sensor measurement
- Intuitive easy touch screen operation on 2-wire type analyzer
- Unique HMI menu structure in 12 languages
- Quick setup menu for fast and easy measurement operation
- Online Sensor Wellness checking for predictive maintenance
- NEMA 4X / IP66 Enclosure
- Hazardous location approvals - ATEX and IECEx

**FLEXA**

## General Specifications

### Basic

#### Measurement Parameter

The FLXA21® can be configured to measure:

- pH/Oxidation-reduction Potential (pH/ORP)
- Contacting Conductivity (SC)
- Inductive Conductivity (ISC)
- Dissolved Oxygen (DO)

**Note:** The available measurement parameter depends on a sensor module installed in the analyzer.

#### Analyzer Structure

Module structure

#### Composition of Analyzer

One (1) Base Module

- General Purpose
- ATEX and IECEx
- CSA and FM (pending)
- FOUNDATION Fieldbus, (pending)
- PROFIBUS (pending)

One (1) or two (2) Sensor modules inputs

The FLXA21® supports up to two sensors of the same type, thereby reducing installation costs.

Allowable combinations when two modules are installed are:

- pH/ORP and pH/ORP
- SC and SC
- DO and DO

## Measurement

### pH/Redox Potential (pH/ORP)

#### Input Specification

Dual high impedance input ( $\geq 10^{12} \Omega$ ), compatible with all Yokogawa pH/ORP sensors and most competitor electrodes.

#### Input Range

pH	: -2 to 16 pH
ORP	: -1500 to 1500 mV
rH	: 0 to 100 rH

Temperature:

Pt1000	: -30 to 140 °C (-22 to 284°F)
Pt100	: -30 to 140 °C (-22 to 284°F)
6k8	: -30 to 140 °C (-22 to 284°F)
PTC10k	: -30 to 140 °C (-22 to 284°F)
NTC 8k55	: -10 to 120 °C (-22 to 284°F)
3k Balco	: -30 to 140 °C (-22 to 284°F)
PTC500	: -30 to 140 °C (-22 to 284°F)

Cable length : 60 meters (196 feet) from the sensor to the analyzer

#### Output Range

pH	: min. Span 1 pH : max. Span 20 pH
ORP	: min. Span 100 mV : max. Span 3000 mV
rH	: min. Span 2 rH : max. Span 100 rH
Temperature	: min. Span 25 °C : max. Span 170 °C (338°F)

### Performance (Accuracy)

(The specifications are expressed with simulated inputs.)

pH

Linearity	: $\pm 0.01$ pH
Repeatability	: $\pm 0.01$ pH
Accuracy	: $\pm 0.01$ pH

ORP

Linearity	: $\pm 1$ mV
Repeatability	: $\pm 1$ mV
Accuracy	: $\pm 1$ mV

Temperature

(with Pt1000, 6k8, PTC10k, NTC 8k55, 3k Balco, PTC500)

Repeatability	: $\pm 0.1$ °C
Accuracy	: $\pm 0.3$ °C

with Pt100

Linearity	: $\pm 0.4$ °C
Repeatability	: $\pm 0.1$ °C
Accuracy	: $\pm 0.4$ °C

### Calibration

Semi-automatic 1 or 2 point calibration using pre configured NIST, US, DIN buffer tables 4, 7 & 9, or with user defined buffer tables, with automatic stability check; or Manual adjustment to grab sample.

## Conductivity (SC)

### Input Specification

Two or four electrode measurement with square wave excitation. Any cell constant from 0.005 to 50.0 cm<sup>-1</sup> can be used.

Influence of cable can be adjusted by doing an AIR CAL with the cable connected to a dry cell.

#### Input Range

Conductivity	: min. 0 $\mu$ S/cm : max. 200 mS x Cell constant (over range 2000 mS/cm)
--------------	---

Resistivity	: min. 0.005 k $\Omega$ / Cell constant : max. 1000 M $\Omega$ x cm
-------------	--

Temperature:

Pt1000	: -20 to 250 °C (-4 to 482°F)
Pt100	: -20 to 200 °C (-4 to 392°F)
Ni100	: -20 to 200 °C (-4 to 392°F)
NTC 8k55	: -10 to 120 °C (14 to 248°F)
Pb36(JIS NTC 6k)	: -20 to 120 °C (-4 to 248°F)

Cable length : 60 meters (196 feet) from the sensor to the analyzer. Influence of cable can be adjusted by doing an AIR CAL with the cable connected to a dry cell.

#### Output Range

Conductivity	: min. 0.01 $\mu$ S/cm : max. 2000 mS/cm (max 90% zero suppression)
Resistivity	: min. 0.001 k $\Omega$ x cm : max. 1000 M $\Omega$ x cm (max 90% zero suppression)
Temperature	: min. 25 °C (77°F) : max. 270 °C (518°F)

GS 12A01A02-01E-E

**Performance (Accuracy)**

(The specifications are expressed with simulated inputs.)

**Conductivity**2  $\mu$ S x CC to 200 mS x CCAccuracy :  $\pm 0.5\%$ F.S.1  $\mu$ S x CC to 2  $\mu$ S x CCAccuracy :  $\pm 1\%$ F.S.**Resistivity**0.005k $\Omega$  / CC to 0.5M $\Omega$  /CCAccuracy :  $\pm 0.5\%$ F.S.0.5M $\Omega$  / CC to 1M $\Omega$  /CCAccuracy :  $\pm 1\%$ F.S.**Temperature**

with Pt1000, Pb36, Ni100

Accuracy :  $\pm 0.3$  °C

with Pt100, NTC 8k55

Accuracy :  $\pm 0.4$  °C**Temperature compensation**NaCl table :  $\pm 1$  %Matrix :  $\pm 3$  %

Stop response 90% (&lt;2decades) in 7 secs.

**Note:** "F.S." means maximum setting value of analyzer output.

"CC" means Cell Constant. YOKOGAWA provides conductivity sensors of which cell constants are 0.01 to 10 cm<sup>-1</sup>.

Calibration Semi-automatic calibration using pre-configured OIML (KCl) buffer tables with automatic stability check, or Manual adjustment to grab sample

**Inductive Conductivity (ISC)****Input Specification**

Compatible with the Yokogawa inductive conductivity ISC40 series with integrated temperature sensor: NTC30k or Pt1000.

**Input Range**

Conductivity : 0 to 2000 mS/cm at 25 °C (77°F)  
 min. : 0  $\mu$ S/cm (at process temperature)  
 max. : 2 S/cm (at process temperature)

Temperature : -20 to 140 °C (-4 to 284°F)

Cable length : max. 60 meters (196 feet) total length of the fixed sensor cable + WF10 extension cable. Influence of cable can be adjusted by doing an AIR CAL with the cable connected to a dry cell.

**Output Range**

Conductivity : min. span 100  $\mu$ S/cm  
 : max. span 2000 mS/cm  
 (max 90% zero suppression)

Temperature : min. 25 °C (77°F)  
 : max. 200 °C (320°F)

**Performance (Accuracy)**

(The specifications are expressed with simulated inputs.)

(Output span is 0-100  $\mu$ S/cm or more)**Conductivity:**Linearity :  $\pm(0.4\% \text{ F.S.} + 0.3 \mu\text{S/cm})$ Repeatability :  $\pm(0.4\% \text{ F.S.} + 0.3 \mu\text{S/cm})$ Temperature : Accuracy:  $\pm 0.3$  °C**Note:** "F.S." means maximum setting value of analyzer output.**Calibration**

Semi-automatic calibration using pre-configured OIML (KCl) standard tables conductivity

Stop response 90% (&lt;2decades) in 7 secs.

**Dissolved Oxygen (DO)****Input Specification**

The FLXA21 accepts output from membrane covered Dissolved Oxygen sensors. These sensors can be Galvanic type, where the sensor generates its own driving voltage, Polarographic type, where the sensor uses external driving voltage from the transmitter, or Optical sensor where luminiscent technology is utilized.

The input range is 0 to 50  $\mu$ A for Galvanic sensors, 0 to 1 micro A for Polarographic sensors and Optical sensors.

For temperature compensation, the FLXA21 accepts Pt1000 (DO30G and Visiferm sensor) and NTC22k elements (OXYFERM, OXYSENS and OXYGOLD sensors).

**Input Range Output Range**

DO30G sensor Input:

Dissolved Oxygen : 0 to 50 mg/l (ppm)

DO30G Sensor Output:

DO concentration : min.: 1 mg/l (ppm)  
 : max.: 50 mg/l (ppm)

% saturation : min.: 10%  
 max -600%

Cable length : max. 60 meters (196 feet) total length of the fixed sensor cable + WF10 extension cable.

**Hamilton™ Sensors Input and Output:**

OXYFERM:

Measurement range : 10 ppb to saturation or  
 0.1 % - 200% of air oxygen

Temperature range : 0 to 130 °C (32 to 266°F)

OXYSENS:

Measurement range : 40 ppb to saturation

Temperature range : 0 to 60°C (32 to 140°F)

OXYGOLD G:

Measurement range : 1 ppb to saturation or  
 0.012 % - 200% of air oxygen

Temperature range : 0 to 130 °C (32 to 266°F)

OXYGOLD B:

Measurement range : 8 ppb to saturation or  
 0.1 % - 200% of air oxygen

Temperature range : 0 to 100 °C (32 to 212°F)

VISIFERM:

Measurement range : 4 ppb to 40 ppm

Temperature range : 0 to 130°C (32 to 266°F)

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### Performance (Accuracy)

(The specifications are expressed with simulated inputs.)

Performance in ppm mode:

Linearity	: ±0.05 ppm or ±0.8% F.S., whichever is greater
Repeatability	: ±0.05 ppm or ±0.8% F.S., whichever is greater
Accuracy	: ±0.05 ppm or ±0.8% F.S., whichever is greater

Performance in ppb mode:

Linearity	: ±1 ppb or ±0.8% F.S., whichever is greater
Repeatability	: ±1 ppb or ±0.8% F.S., whichever is greater
Accuracy	: ±1 ppb or ±0.8% F.S., whichever is greater

Temperature

Linearity	: ±0.3 °C
Repeatability	: ±0.1 °C
Accuracy	: ±0.3 °C

**Note:** "F.S." means maximum setting value of analyzer output.

### Electrical

#### Output Signal

FOUNDATION Fieldbus and PROFIBUS-PA (Pending)

General	: One 4-20 mA DC loop powered output Note: Tolerance ±0.02 mA : Bi-directional HART digital communication, superimposed on mA (4-20mA) signal
Output function	: Linear or Non-linear (21-step table)
Burn out function	: (NAMUR 43)
Without HART/PH201G:	
Down	: 3.6 mA (signal: 3.8 to 20.5 mA for pH/ORP, SC and DO) (signal: 3.9 to 20.5 mA for ISC)
Up	: 22mA
With HART:	
Down	: 3.6 mA for pH/ORP, SC and DO
Down	: 3.9 mA for ISC (signal: 3.8 to 20.5 mA for pH/ORP, SC and DO) (signal: 3.9 to 20.5 mA for ISC)
Up	: 22mA

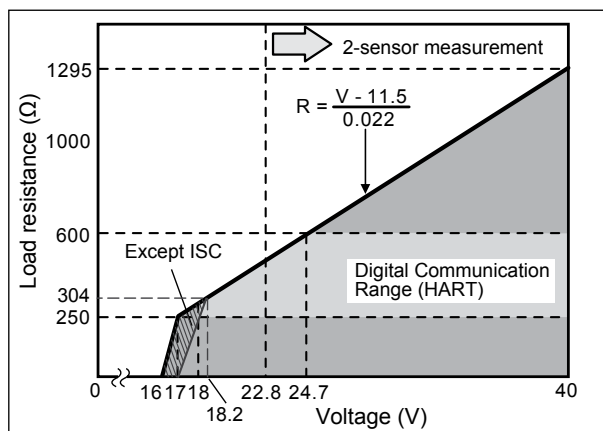
#### Power Supply

Nominal 24 V DC loop powered system

One (1) Sensor module (1 input)	: 16 to 40V DC (for pH/ORP, SC & DO) : 17 to 40V DC (for ISC)
Two (2) Sensor modules (2 inputs)	: 22.8 to 40V DC (for pH/ORP, SC & DO)

### Maximum Load Resistance (Figure 1)

The FLEXA21® will not start-up below 16V and the load resistance has to be above 250 ohm, the HART communication will only work above 18.2VDC and 304 ohm load (max 600 ohm).



### Supply Supply Voltage and Load Resistance

#### Display

LCD with a touch screen	: Black/White: 213 x 160 pixels Contrast adjustment available on the touch screen
Message language	: 12 (English, Japanese, Chinese, Korean, German, Portuguese, Russian, Spanish, French, Italian, Czech and Polish) : One analyzer has 12 languages.

**Note:** On a language selection screen, its title and description and its menu of languages are described in English.

**Note:** Only English alphabet and numeric are available for a tag number and an additional description for each value on the display screen and passwords.

**Note:** Only for message language on the screen, 12 languages are provided.

### Mechanical and others

#### Housing Options Available

Case	: Polycarbonate : Stainless steel without painting : Stainless steel with epoxy coating : Stainless steel with urethane coating
Case color and finish:	
Color	: Silver gray (equivalent to Munsell 3.2PB7.4/1.2) (for poly carbonate case, stainless steel cases with coating)
Finish	: Electropolishing (for stainless steel case without painting)
Window	: Polycarbonate (flexible)
Protection	: NEMA4X, IP66, Type 3S/4X (Canada)

#### Plate

Main name plate	: inside case cover
Regulation plate	: on the case outside

#### Cable and Terminal

Cable Size Requirements (Not Provided)

Outer diameter	: 6 to 12 mm (suitable for M20 cable gland) : 3.4 to 7 mm (grounding cable for poly carbonate case)
Terminal screw size	: M4

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## Cable Entry

Polycarbonate case:

- 1-Sensor measurement: 3 holes,
  - : M20 cable gland x 3 pcs,
  - : Sleeve x 1 pc (for grounding cable line)

- 2-Sensor measurement: 4 holes,
  - : M20 cable gland x 4 pcs,
  - : Sleeve x 1 pc (for grounding cable line)

- Stainless steel case
  - : 7 holes,
  - : M20 cable gland x 7 pcs
  - : Close up plug x 5 pcs

**Note:** Cable gland and plug are delivered with an analyzer, but not assembled into the analyzer.

## Mounting

Mounting hardware (option):

- : Universal mounting kit (Note)
- : Pipe and wall mounting hardware
- : Panel mounting hardware

**Note:** This kit contains the pipe and wall mounting hardware and the panel mounting hardware.

- Hood (option)
  - : Stainless steel
  - : Stainless steel with urethane coating
  - : Stainless steel with epoxy coating

## Stainless Steel Tag Plate

Blank tag plate is hanging type (delivered with an analyzer).

When the additional code "/SCT" and a tag number is specified, the specified tag number is inscribed. (Inscription is optional.)

## Conduit Adapter

- Using optional adapter
  - : G1/2 (quantity: 4)
  - : 1/2NPT (quantity: 4)
  - : M20 x 1.5(quantity: 4)

These conduit adapters are delivered with an analyzer, but not assembled into the analyzer.

## Size of Housing Case

- Poly carbonate
  - : 144 x 144 x 151 mm (L x W x D)
  - (without cable gland)
- Stainless steel case
  - : 165 x 165 x 160.1 mm (L x W x D)
  - (without cable gland)

## Shipping Details

- Package size
  - : App. 340 x 340 x 370 mm (L x W x H)
- Weight
  - : approx. 1 kg (polycarbonate housing)
- Weight
  - : approx. 2 kg (stainless steel housing)

## Ambient Operating Temperature

- : -20 to +55 °C (-4 to 131°F)

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

**Humidity** : 10 to 95% RH (Non-condensing)

## Document

Following documents are delivered with an analyzer;

- Paper copy
  - : Start-up Manual written in English
- CD-ROM
  - : Start-up Manual (pdf) written in 12 languages
  - : User's Manual (pdf) written in English
  - : Safety Regulation Manual (pdf) for European region written in 25 languages

## Regulatory Compliance

ATEX (CSA/FM pending)

## Explosion-proof (Intrinsically safe type)

: (for suffix code: -EA)

- ATEX Intrinsically safe approval
- Applicable standard
- Electrical Apparatus for Potentially Explosive Atmospheres
- EN 60079-0:2009 General requirements
- EN 60079-11:2007 Intrinsic safety "i"
- EN 60079-26:2007 Equipment with equipment protection level (EPL) Ga
- EN 60529:1992 Degrees of protection provided by enclosures (IP Code)

## Type of protection

- II 1G Ex ia IIC Ga
- Group: II
- Category: 1G
- T4: for ambient temperature:-20 to 55°C
- T6: for ambient temperature:-20 to 40°C
- Atmosphere pressure: 80kPa (0.8bar) to 110kPa (1.1bar)
- Degree of Protection of the Enclosure: IP66

## IECEx Intrinsically safe

- Applicable standard
- IEC 60079-0: 2007 Part 0: General requirements
- IEC 60079-11: 2006 Part 11: Intrinsic safety "i"
- IEC 60079-26: 2006 Part 26: Construction, test and marking of
- Group II Zone 0 electrical apparatus
- IEC 60529: 2001 Degrees of protection provided by enclosures (IP Code)

## Type of protection

- Ex ia IIC Ga
- T4: for ambient temperature:-20 to 55°C
- T6: for ambient temperature:-20 to 40°C
- Atmosphere pressure: 80kPa (0.8bar) to 110kPa (1.1bar)
- Degree of Protection of the Enclosure: IP66

## Electrical Parameters (Ex ia)

- Each housing assembly (base module) and each sensor module are respectively certified.
- Input parameters of sensor module meet output parameters of housing assembly.

## Digital Communication

### Type of Digital Communication

- HART
- FOUNDATION Fieldbus (Pending)
- PROFIBUS (Pending)

**Note:** Only one kind of digital communication is available for one analyzer.

### Output Value Parameter (HART)

- Four value parameters are available for one digital communication.
- For 1-sensor measurement, these parameters are measured values.
- For 2-sensor measurement, refer to the next item.

### Digital Communication of 2-Sensor Measurement (HART)

- Even when two sensor modules are installed, only one digital communication is available for 2-sensor measurement.
- Four value parameters can be selected from the followings;
  - Measured values of two sensors
  - Calculated data of 2-sensor measurement
  - Redundant system output

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## Features of FLEXA

### Sensor Calculation

For pH + pH  
For DO + DO

Differential  $(input1) - (input2)$   
Average  $(input1 + input2) / 2$

### Sensor Calculation

For SC + SC\*

Ratio  $(input1) / (input2)$   
Average  $(input1 + input2) / 2$   
Differential  $(input1) - (input2)$   
Passage[%]  $(input2) / (input1) \times 100$   
Rejection[%]  $(input1 - input2) / (input1) \times 100$   
Deviation[%]  $(input2 - input1) / (input1) \times 100$   
pH calc.  $(VGB) pH = 8.6 + \log\{(input1) - (input2)/3\}$

**Note:** for resistivity, only differential and average can be selected.

### PROFIBUS-PA Communications (Pending)

Input signal : Digital  
Supply voltage : 9 to 32 V DC  
Operating current : 26.0 mA (pH) and 24.5 mA SC, ISC, and DO  
Operating values : According to IEC 1158-2  
Bus connection : Fieldbus interface based on IEC 1158-2 according to FISCO-Model  
Power supply : Power supply is achieved dependant on the application by means of segment coupler  
Data transfer : According to PROFIBUS- PA profile class B based on EN 50170 and DIN 19245 part 4  
GSD file : The actual file can be downloaded from [www.profibus.com](http://www.profibus.com)  
Configuration : Local with 6 keys  
Software : Firmware based on Siemens DPC31 stack.  
Hardware : PC- or PCMCIA-interfaces from Siemens  
Other control : Siemens PDM systems  
Electrical connection : Terminals acc. to IEC 1158-2  
Fieldbus-cable-types : Twisted and shielded two wire cable according to recommendation based on IEC 1158-2  
Cable diameter : 6 to 12 mm (0.24 to 0.47 inch)

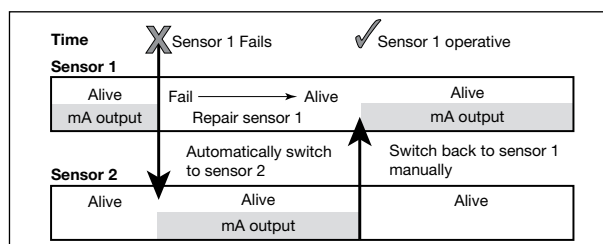
### FOUNDATION Fieldbus H1 Communications (Pending)

Input signal : Digital  
Supply voltage : 9 to 32 V DC  
Operating current : 26.0 mA (pH) and 24.5 mA SC, ISC, and DO  
Operating values : According to IEC 1158-2  
Bus connection : Fieldbus interface based on IEC 1158-2 according to FISCO-Model  
Power supply : Power supply is achieved dependant on the application by means of segment coupler  
Data transfer : FF Specification Rev. 1.4, Basic device  
Function blocks : 3xAl, Transducer, Resource  
Files : Actual file can be downloaded from our homepage  
Configuration : Local with 6 keys,

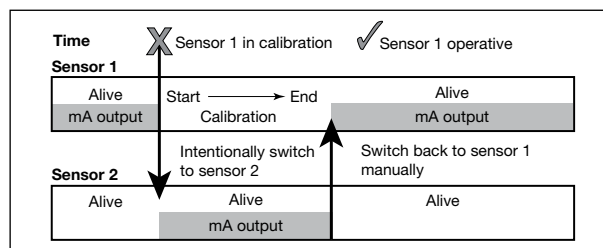
Software : National Instruments, NI-FBUS configurator  
Hardware : FBUS-interfaces from National Instruments (AT-FBUS and PCMCIA FBUS)  
Other control systems : Yokogawa PRM, DMT

## Redundancy

A Variety of calculated data from two measuring parameters is selectable for each measurement. The redundant system is a function of backing up the 1st module with the 2nd module. This function is designed such that under normal conditions, the sensor-1 pH value is the current output and if the sensor 1 fails, the sensor-2 pH value is the current output.



### Example 1: sensor failure



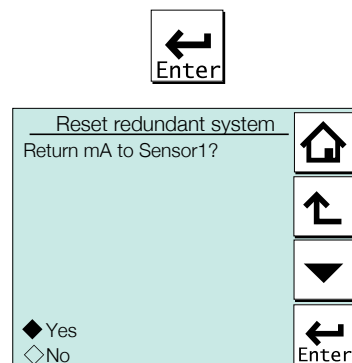
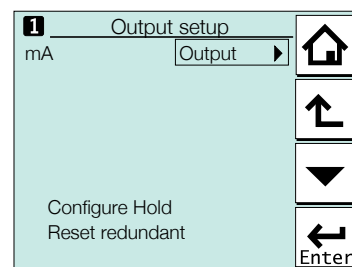
### Example 2: sensor calibration

If sensor 1 fails, the output is automatically switched to the sensor-2 value.

Even if a failure on the sensor 1 is recovered automatically after failure detection, the output will not be switched back automatically and the sensor 2 value will continue to be output.

After repairing sensor 1, reset the backup made by the redundant system. This enables the sensor 1 value to be incorporated in the output. On the Reset redundant system, selection of "Yes" makes the output return to the output of the 1st module.

This display is the example when "Redundant" is selected as a process parameter.

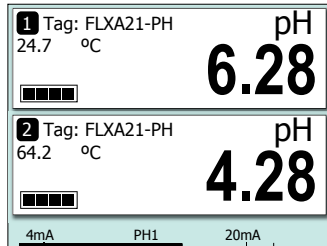


### Example 2: Calibration



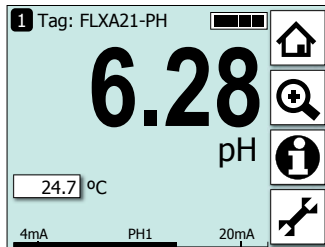
## Display and Operating Interface

The Display is a Black/White LCD touch screen. FLXA21® uses the same unique Human Machine Interface (HMI) as seen in the EXA450 series, offering easy touch screen operation and simple menu structure. Graphical keys on the right and other areas of the touch screen respond to contact as virtual push buttons. (Figures below show a conductivity and pH measurement, and the value will reflect the sensor modules installed in the FLXA21®)



### Home Display

Home Display appears upon startup when two sensor modules are connected. (Home display is not available when only one sensor is connected)



### Main Display

Main Display appears upon startup when one sensor module is connected. When a FLEXA21® has two sensor modules in the unit, selecting Sensor 1 or Sensor 2 on the home display brings up the main display of the selected sensor.



#### Status screen

Status screen or Information button (i), gives access to diagnostic information with regard to the analyzer or sensors.



No malfunction detected



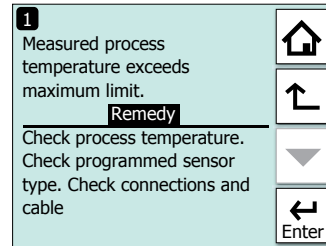
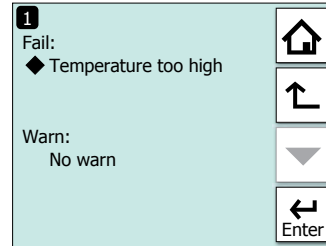
#### Warning

When a warning indicator appears, maintenance is required. Pressing this key displays the detected malfunction code, and pressing the malfunction codes displays troubleshooting guide lines for resolving the malfunction.



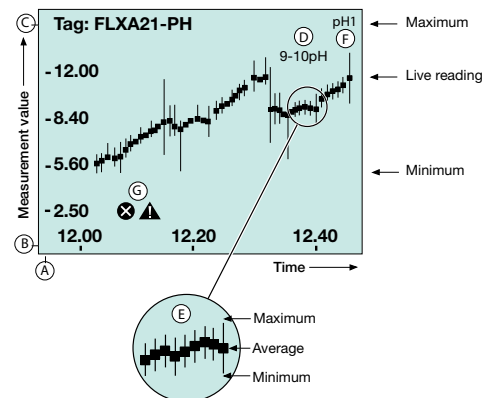
#### Fail

Indicates malfunction. Pressing this key displays the detected malfunction code, and pressing the malfunction codes displays troubleshooting guidelines for resolving the malfunction.



### Trend Screen

Trend Screen appears when the primary value on the main display is pressed, or when the Trend button (T), on the Zoom display is pressed.



A: X axis Show the Time scale

(user programmable from 15 minutes to 14 days)

B: Y axis Measurement value axis user (programmable)

C: Tag No.

D: Current measurement value with unit

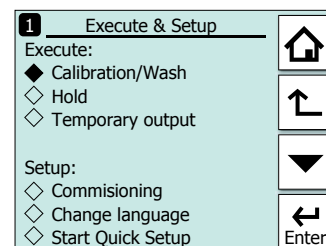
E: Trend (maximum, minimum and average values during the display update time)

F: Icon (current measurement value, and maximum and minimum values until the display update)

G: Warn/Fail indicators (indicated only during Warn/Fail status)



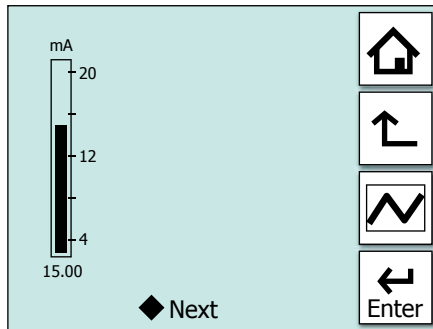
**Maintenance screen** (Execute & Setup) appears when the commissioning button is pressed. The maintenance screen gives access to calibration, commissioning and configuration of the instrument. These operations can be protected by passwords.





### Zoom Display

Zoom Display appears when the Zoom button on the main display is pressed. The Zoom display shows an easy-to-read graphical display of the output status. When "Next" is pressed it will give access to current sensor settings, sensor wellness, last known calibration data, and log book data.



1

pH:	Zero	0.000 mV	
	Slope	0.000 %	
	Sensor	50.00 mV	
ORP:	Zero	0.000 mV	
	Slope	0.000 %	
	Sensor	0.000 mV	
Impedance1	----		
Impedance2	----		

◆ Next

1 2010/10/15 17:04:07

Last calibrated at  
2020/09/08 08:00:00

Calibration due at  
2020/10/08 08:00:00

Projected maintenance  
6-12 months (no meaning)

Projected replacement  
3-6 months (good pred.)

◆ Next

1 Read Logbook:

Logbook 1-1

Logbook 1-2

◆ Next

### Sensor Wellness

It is important that the system be well maintained to make a precise measurement. The electrodes must be properly cleaned and regularly calibrated. At the Sensor wellness window, the healthiness of a sensor is displayed. A larger number of in each gauge indicates that the particular parameter is sound. A gauge is indicated for only those parameters whose sensor wellness setting is "enabled," while a bar (—) is displayed if the sensor wellness setting is "disabled."

Sensor wellness setup can be made in

Commissioning — Measurement setup — Sensor diag. settings.

The Reset wellness data button allows you to reset data except temperature calibration. This is done when a new sensor is installed.

1

Sensor wellness:

Zero		
Slope		
Input 1 imp.		
Input 2 imp.		
Heat cycle		
Progress Time		
◆ Reset wellness data		

◆ Next

### For pH

1

Sensor wellness:

Polarization		
Cellconstant		
Heat cycle	----	
Progress Time	----	
◆ Reset wellness data		

◆ Next

### For SC

The FLXA21® still utilizes the same self diagnostics as seen in the EXA series.

On-line checks : Impedence of glass (pH)

Faults

Off-line checks : Zero

: Slope

Calibration Due

Projected replacement

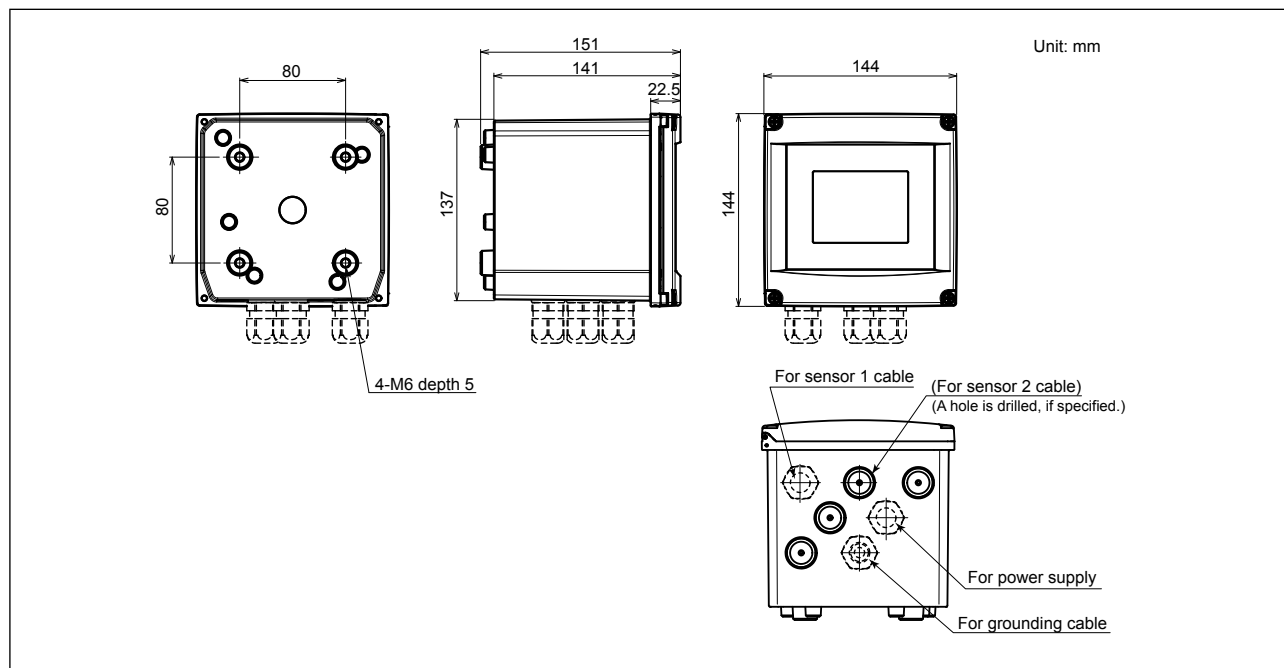
## Model & Suffix Code

Model	Suffix code	Option code	Description
FLXA21			2-Wire Analyzer
Power supply	-D		Always -D
Housing	-P -S -U -E		Poly carbonate Stainless steel Stainless steel + urethane coating Stainless steel + epoxy coating
Display	-D -N		Standard LCD Without display (Note 1)
Type	-AA -EA		General purpose ATEX, IECEx, FM, CSA (Note 6)
1st input	-P1 -C1 -C5 -D1		pH/ORP Conductivity (SC) Inductive conductivity (ISC) Dissolved oxygen (DO)
2nd input (Note 2)	-NN -P1 -C1 -D1		Without input pH/ORP Conductivity (SC) Dissolved oxygen (DO)
Output	-A		4-20 mA + HART
—	-N		Always -N
Language set (Note 3)	-LA		English and 12 languages
Country (Note 4)	-N -J		Global except Japan Japan
—	-NN		Always -NN
Option	Mounting hardware Hood Tag plate Conduit adapter	/UM /U /PM /H6 /H7 /H8 /SCT /CB4 /CD4 /CF4	Universal mounting kit (Note 5) Pipe and wall mounting hardware Panel mounting hardware Hood, stainless steel Hood, stainless steel + urethane coating Hood, stainless steel + epoxy coating Stainless steel tag plate Conduit adapter (G1/2 x 4 pcs) Conduit adapter (1/2NPT x 4 pcs) Conduit adapter (M20 x 1.5 x 4 pcs)

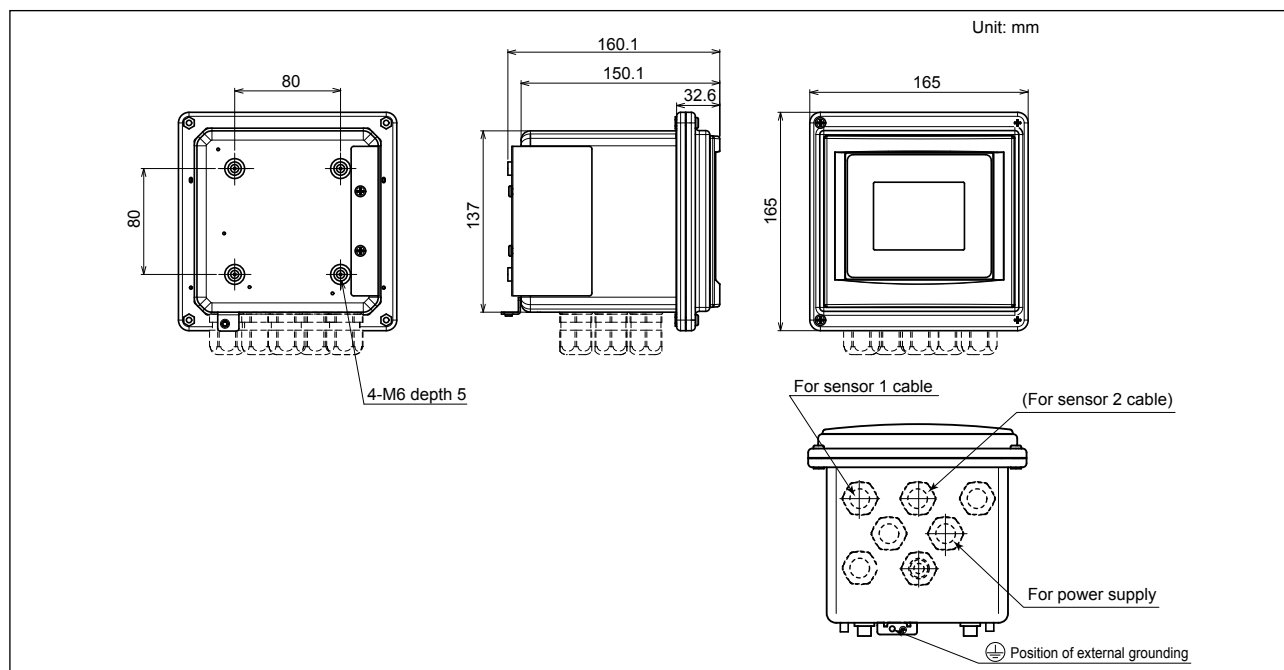
### Notes:

- 1 : HMI (Human Machine Interface) is not available on the analyzer. HART communication is to be used.
- 2 : When a 2<sup>nd</sup> input is selected, only the same kind of the 1<sup>st</sup> input is available.  
For example, when a 1<sup>st</sup> input is “-P1”, the 2<sup>nd</sup> input must be the same “-P1”.  
The combination of ISC and ISC is not available.
- 3 : These languages are message languages on the analyzer's display.  
One analyzer has English and 11 languages. All languages are as follows;  
English, German, Portuguese, Russian, Japanese, Korean, Chinese, Spanish, Czech, Italian, French and Polish.
- 4 : When an analyzer is used in Japan, it must meet the Japanese Measurement Law.  
Only SI units must be used on the analyzer and its documents in Japan.
- 5 : The universal mounting kit contains the pipe and wall mounting hardware (/U) and the panel mounting hardware (/PM).
- 6 : The type “-EA” is intrinsically safe type of ATEX, IECEx, FM and CSA. and non-incendive of FM and CSA. (pending).

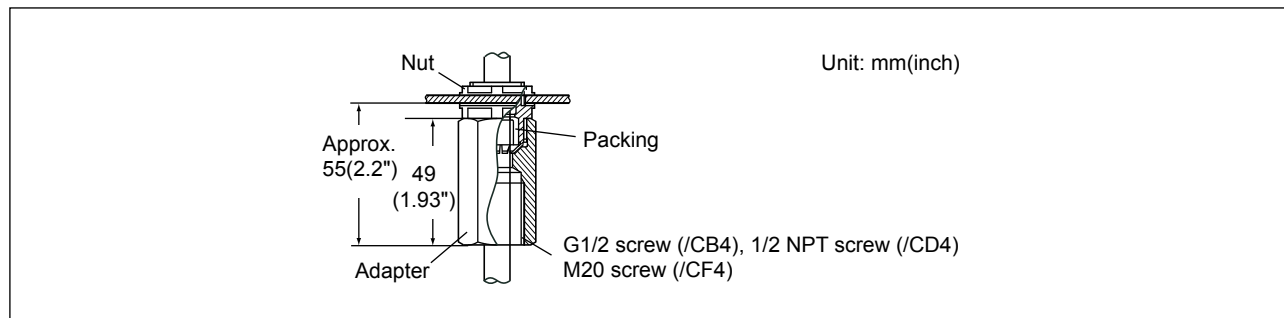
## Dimensions and Mounting



### Poly carbonate Housing

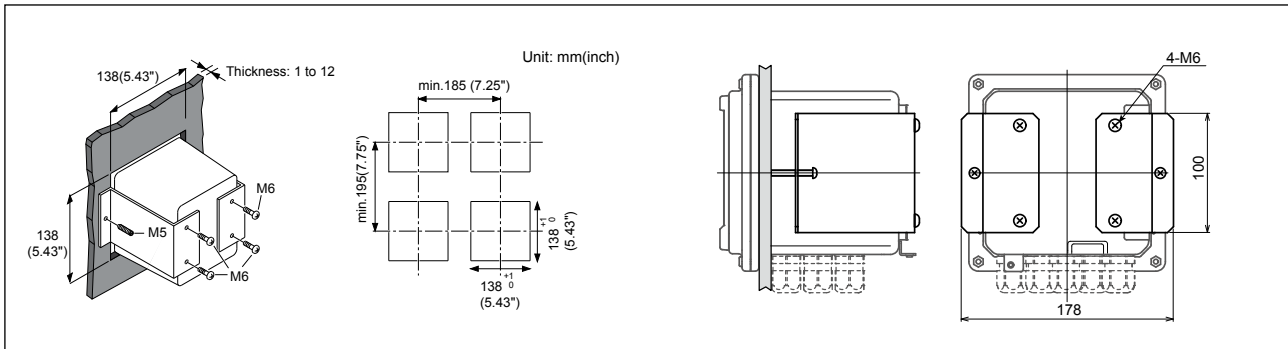


### Stainless Steel Housing

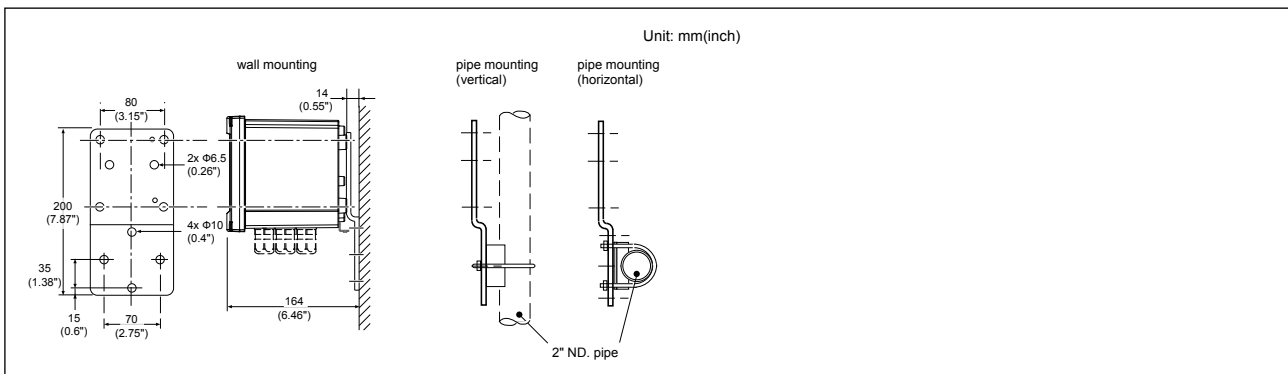


### Conduit adapter

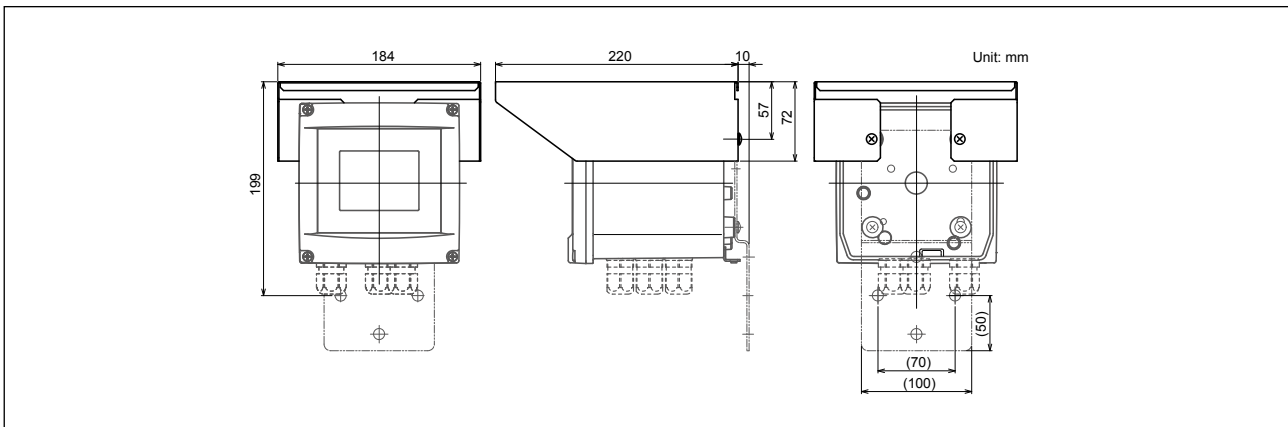
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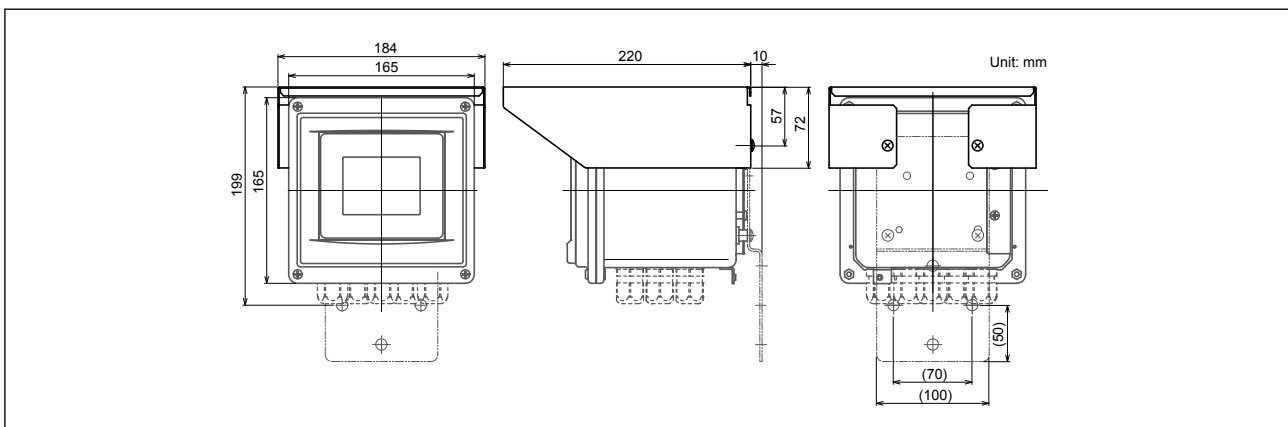
Option /PM: panel mounting diagram



Option /U: wall and pipe mounting diagram



Housing with stainless steel hood (Option /H6 /H7 /H8) (Poly carbonate housing)

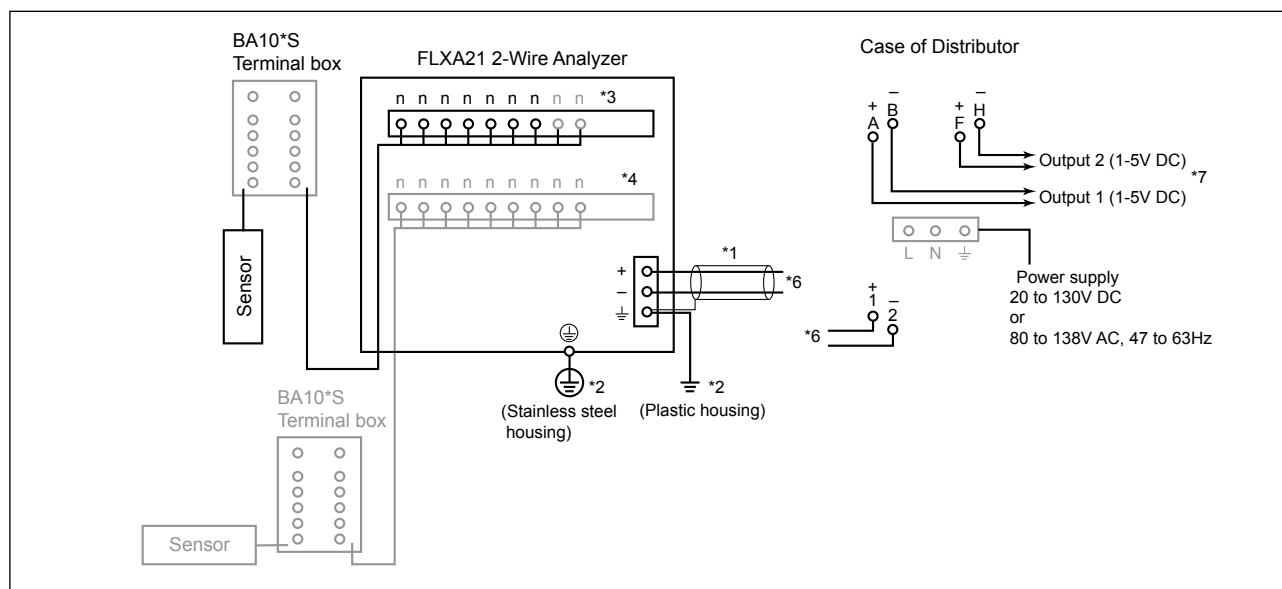


Housing with stainless steel hood (Option /H6 /H7 /H8) (Stainless steel housing)

**Note:** When option code "/UM" is specified, universal pipe/wall/panel mounting kit are supplied  
 ---same as option code "/U" and "/PM" both specified.

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## Wiring Diagrams



\*1: Use a 2-conductor shielded cable with an outside diameter of 6 to 12 mm.

\*2: Ground FLXA21 ( Class D ground: 100 ohm or less)

The way of connecting the grounding cable varies depending on the poly carbonate housing and stainless steel housing.

In the case of the poly carbonate housing, connect the grounding cable to the terminal of the power module inside, and in the case of the stainless steel housing, connect the grounding cable to the terminal of the housing.

Use a cable with an outside diameter of 3.4 to 7 mm for the grounding line of the poly carbonate housing.

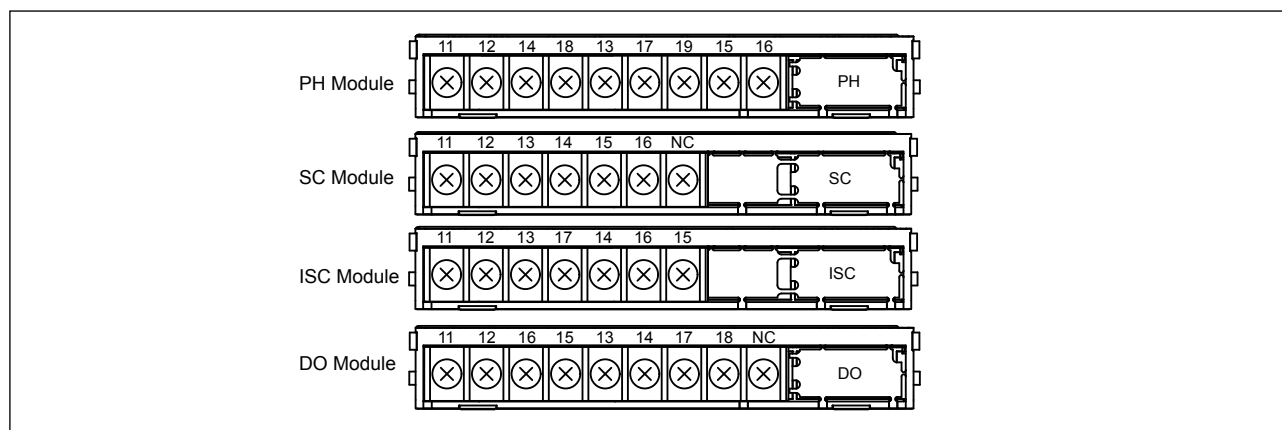
\*3: Refer to module

\*4: Two modules can be connected to the same object. When measuring inductive conductivity, only one module can be connected.

\*5: The terminal box may need to be connected depending on the object under test or the sensor selected.

\*6: This line is connected to a distributor.

\*7: Two outputs of SDBT are same.



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## pH/Redox Analyzers

## pH/Redox Analyzers



# General Specifications

Model PH450G  
pH and Redox (ORP) analyzer

**EXAxt**

The EXAxt 450 series is designed to combine the superior functionality of the Yokogawa EXA series with the ease of use offered in pocket computers (PDA).

The PH450 offers the best accuracy in the industry by combining the pH measurement with advanced temperature compensation functionality, preloaded calibration standards and stability checks.

The PH450 is a true multivariable analyzer that combines pH with Temperature and ORP (Redox) measurement and all these measurements can be utilised through the different output functions: two mA current outputs, four independent SPDT contact outputs and HART®. Both DD and DTM files are available for direct connection to HART® Handheld terminal, HIM monitor and Pactware PC configurator.

The PH450 offers full functionality with PID control on either mA output(s) or on contact output(s) and with integral wash function.

Most important requirements for Electrochemical Analyzers are reliability and repeatability. This is guaranteed in PH450 sensor diagnostics impedance monitoring of both pH and reference cell. In addition to this a dynamic sensor checking coupled with the wash cycle function assure troublefree and accurate analysis with a minimum of maintenance.

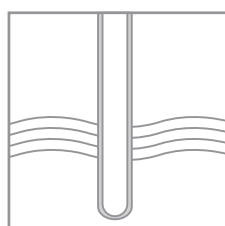
Truly unique is the EXAxt450 series in the Human Machine Interface. The high resolution graphical display and the touchscreen operation make all information visible to the operator. Configuration with the touchscreen is as easy as operating a PDA. Simply choose the language of choice and on screen instructions assure that the best configuration for the application is obtained.



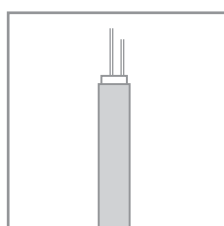
## Features

- Easy touchscreen operation
- IP66/NEMA4X 1/2 DIN enclosure for field mounting and panel mounting
- Unique HMI menu structure in 6 languages
- Predefined buffer solutions
- Trending display up to 2 weeks
- On-screen logbooks store calibration data, configuration changes and events
- Advanced Process Temperature Compensation
- Three sets of preloaded pH buffer standards

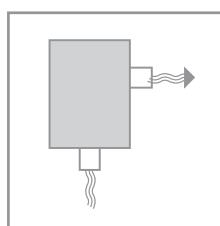
## System Configuration



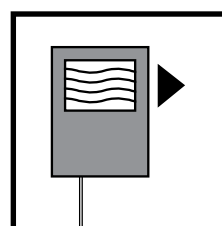
Sensors



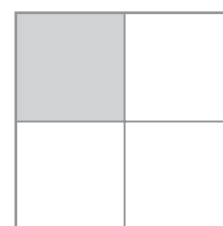
Cables



Fittings



Transmitters



Accessories

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GS 12B6B5-E-E  
4th Edition

## General Specifications of EXAxt PH450

**A) Input specifications** : Dual high impedance input ( $\geq 10^{13}\Omega$ ).

### B) Input ranges

pH	: -2 to 16 pH.
ORP	: -1500 to 1500 mV.
rH	: 0 to 100 rH.
Temperature	
- Pt1000	: -30 to 140°C.
- Pt100	: -30 to 140°C.
- 350 $\Omega$ (DKK)	: -30 to 140°C.
- 5k1	: -30 to 140°C.
- 6k8	: -30 to 140°C.
- PTC10k	: -30 to 140°C.
- NTC 8k55	: -10 to 120°C.
- 3kBalco	: -30 to 140°C.

### C) Accuracy

pH input	: $\leq 0.01$ pH.
ORP input	: $\leq 1$ mV.
Temperature	: $\leq 0.3^\circ\text{C}$ ( $\leq 0.4^\circ\text{C}$ for Pt100) .
mA output circuits	: $\leq 0.02$ mA.
Ambient temperature influence	: 100 ppm /°C.
Step response	: < 4 sec for 90% (pH 7 - pH 4).

### D) Transmission signals

General	: Two isolated outputs of 4-20 mA. DC with common negative. Maximum load 600 $\Omega$ . Bi-directional HART® digital communication, superimposed on mA1 (4-20mA) signal.
Output function	: Linear or Non-linear (21-step table) output for pH, temperature, ORP or rH.
Control function	: PID control.
Burn out function	: Burn up (21.0 mA) or burn down (3.6 mA) to signal failure acc. NAMUR NE43.
	: Adjustable damping. Expire time.
Hold	: The mA-outputs are frozen to the last/ fixed value during calibration/ commissioning.

### E) Contact outputs

General	: Four SPDT relay contacts with display indicators.
Switch capacity	: Maximum values 100 VA, 250 VAC, 5 Amps. Maximum values 50 Watts, 250 VDC, 5 Amps.
Status	: High/Low process alarms, selected from pH, ORP, rH and temperature. Configurable delay time and hysteresis. Failure annunciation.
Control function	: On/Off, PID duty cycle or pulsed frequency control.
Wash	: Contact can be used to start manual- or interval time wash cycles.
Hold	: Contact can be used to signal the Hold situation.
Fail	: Contact S4 is programmed as fail-safe contact.

**F) Contact input** : Remote wash cycle start.

### G) Temperature compensation

Function : Automatic or manual. Compensation to Nernst equation. Process compensation by configurable temperature coefficient, NEN6411 for water or strong acids/bases or programmable matrix.

**H) Calibration** : Semi-automatic 1 or 2 point calibration using pre-configured NIST, US, DIN buffer tables 4, 7 & 9, or with user defined buffer tables, with automatic stability check. Manual adjustment to grab sample.

**I) Logbook** : Software record of important events and diagnostic data readily available in the display.

**J) Display** : Graphical Quarter VGA (320 x 240 pixels) LCD with LED backlight and touchscreen. Plain language messages in English, German, French, Spanish, Italian and Swedish.

### K) Shipping details

Package size : 290 x 300 x 290 mm (L x W x D)  
(11.5 x 11.8 x 11.5 inch).  
Package weight : app. 2.5 kg (5.5lbs).

**L) Housing** : Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window. The colour of the case and cover is silvergrey. Cable entry via six M20 polyamide glands. Cable terminals are provided for up to 2.5 mm<sup>2</sup> finished wires. Weather resistant to IP66 and NEMA4X standards. Pipe, wall or panel mounting, using optional hardware.

**M) Power supply**: 85-265 VAC ( $\pm 10\%$ ). Max 15VA, 47-63Hz.  
9.6-30 VDC ( $\pm 10\%$ ), max 10W.

### N) Regulatory compliance

EMC : conforms to EN61326 Class A, AS/NZS CIPR 11  
Installation altitude : 2000 m or less Category based on IEC 61010:  
II (Note) Pollution degree based on IEC 61010: 2 (Note)

**Note**: Installation category, called over-voltage category, specifies impulse withstand voltage. Category II is for electrical equipment. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength. Degree 2 is the normal indoor environment.

Low Voltage : Meets directive 73/23/EEC Conform IEC 61010-1, UL61010C-1 and CSA 22.2 No. 1010.1, Installation category II, Pollution degree 2 Certification for cCSAus, Kema Keur T<sub>6</sub> for T<sub>a</sub> -20 to 55°C.

### O) Environment and operational conditions

Ambient temp.: -20 to +55°C (-5 - 130 °F).  
Storage temp.: -30 to +70°C (-20 - 160 °F).  
Humidity : Up to 90% RH at 40°C (100 °F) (non-condensing).

Data protection : EEPROM for configuration data and logbook.  
Lithium cell for clock.

Watchdog timer : Checks microprocessor.

Power down : Reset to measurement.

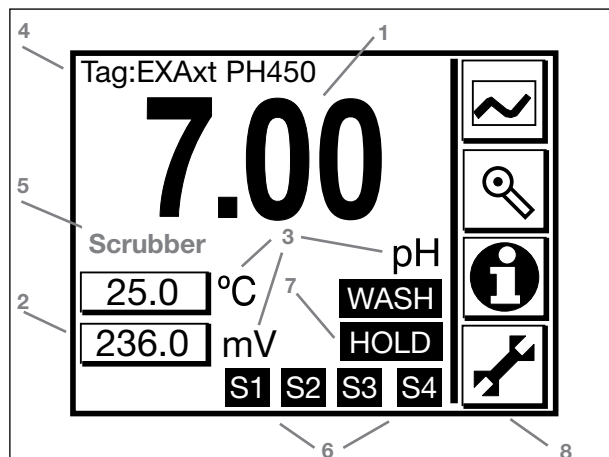
Automatic safeguard : Auto return to measuring mode when touchscreen is untouched for 10 min.

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## Display and Operating Interface

The Display is a backlight graphical display with QVGA resolution. Operation is done by a touchscreen. Graphical keys on the right and other area's of the touchscreen respond to contact as virtual push buttons.

### Main screen

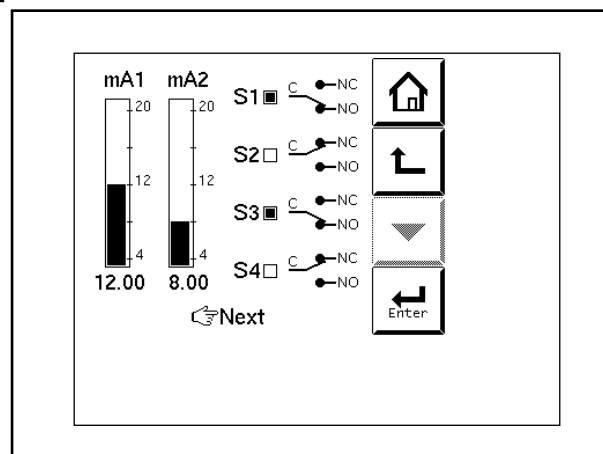


#### The main screen displays:

- 1 The primary variable in large font (user selectable)
- 2 Other process variable(s) in small font
- 3 Unit symbols
- 4 Tagnumber (user programmable)
- 5 Process description (user programmable)
- 6 Status of alarm output(s)
- 7 Status indicator during HOLD and WASH situation
- 8 Main function keys



### Zoom screen



The zoom screen displays an easy graphic representation of the output functions. When "next" is pressed it will give access to the logbook data.



### Status screen

The Status screen gives access to diagnostic information with regards to analyzer or sensors.



No malfunction detected.



Soft alarm detected. Maintenance is recommended for best accuracy.

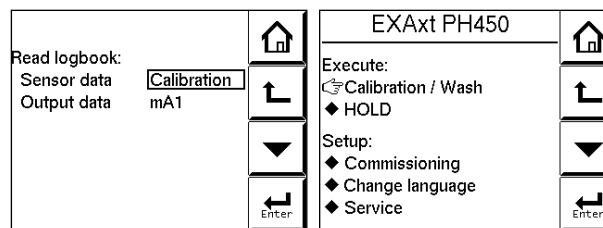


Hard alarm is detected indicating malfunction that is critical for good analysis. When this key is pressed details are displayed with regards to detected malfunction and troubleshooting guidelines are displayed to resolve the malfunction.

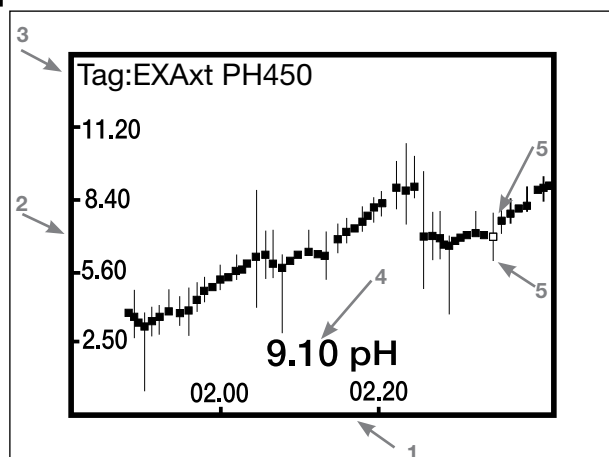


### Maintenance screen

The maintenance screen gives access to calibration, commissioning and setup of the instrument. These levels can be protected by passwords.



### Trend screen



#### The trendscreen displays:

- 1 Time scale.
- 2 PV scale. User selectable
- 3 TAG number
- 4 Actual Primary Value
- 5 Average, maximum and minimum Primary Value in this interval (time scale / 51)

## Functionality Characteristics

### Safe operation

EXAxt450 features BURN-OUT functionality according to NAMUR Recommendation 43. This document recommends to use the mA Output for fault detection by controlling the mA output in the following way:

4-20 mA: scaled to measuring range

3,8-4 mA for underflow detection

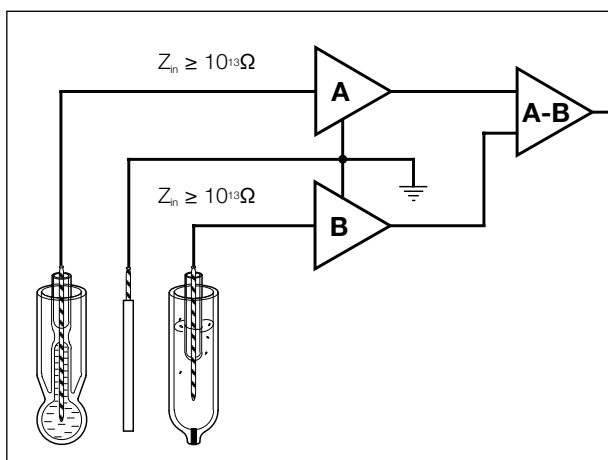
20- 20,5 mA for overflow detection

=<3,6 mA for fault detection

=>21 mA for fault detection

### Input circuitry

The input circuitry of the PH450 is a dual-amplifier system with liquid earth. Measuring electrode and reference electrode inputs are amplified separately against the liquid earth contact. Following a differential amplifier, normal signal processing takes place. This configuration provides the best immunity to noise, stray solution potentials and earth loops.

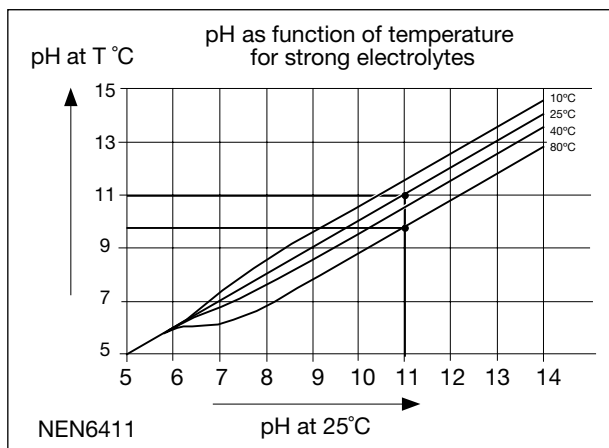


### Dual amplifier system

The input amplifiers both have a very high input impedance ( $\geq 10^{13}$  ohms). This means the PH450 is capable of accepting glass, enamel and metal measuring and reference sensors. Together with the ability to configure the ITP (isothermal point), the system can be adapted to accept almost all sensor types.

### Temperature compensation

EXAxt 450 offers automatic temperature compensation. To ensure full compatibility with most commercially available pH sensors it is possible to choose out of eight different temperature sensing elements. All elements have been calibrated during



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initialisation of the analyzer. The default configuration of the PH450 uses Pt1000 RTD for temperature compensation. The temperature compensator is used to correct for the slope (sensitivity) of the pH sensor dependence on temperature. In addition to this NERNST compensation function the PH450 also offers advanced temperature compensation for the process pH dependance on temperature.

Water, weak acids, weak alkali's make the pH change as function of temperature without changing the chemistry of the sample. This temperature function is often undetected and uncompensated and results in substantial process control and analyzer validation problems.

### PH450 offers three additional modes for advanced temperature compensation:

- 1) Full compensation for strong acids and alkali's using NEN6411 algorithm.
- 2) Linear temperature coefficient setting
- 3) Matrix temperature compensation

#### 1) NEN6411

This algorithm takes into account the dissociation of water in strong acid and alkaline solutions. This function is especially useful for pH measurement in Pure and Ultrapure water as found in Power Generation Water Chemistry.

#### 2) Linear temperature coefficient

This function is used when the water chemistry is unknown. Therefore the temperature coefficient is determined empirically by taking a sample, reading pH and temperature at two different temperatures. The TC to be programmed is defined as  $\Delta\text{pH}/\Delta T$ . In words: the PH drift over a temperature span of one degree Celcius.

#### 3) Matrix temperature compensation

This function is used when the empirical method has shown that the temperature coefficient varies within the measuring range of the analyzer. Then a Matrix is built of 25 points, where the pH of 5 different samples is recorded for 5 different temperatures.

### WASH

The wash function is used primarily to activate a pump or solenoid that brings cleaning fluid in contact with the pH/ORP sensor to remove deposits from the process. Most scaling deposits can easily be removed by dipping the sensor in a acid solution. That is why the PH450 features an automatic HOLD function during wash operation. This results in constant output of the analyzer during the wash operation.

During the wash operation one of the four contact outputs can be used to activate the pump or open the solenoid.

The wash cycles can be started by using a programmed timer, by closing the input contact or manually from the keypad.

After the wash operation is ended the PH450 is able to monitor the dynamic response of the sensor as a dynamic sensor checking function. This feedback on the wash operation guarantees optimal usage of cleaning fluid while maintaining good responsive pH function.

## Control and Alarm Functions

**Both mA-outputs** have the following generic functions: Control (PID), Output (Linear or Non-linear by table), Simulate (percentage output) and Off.

### Control (PID control on both the mA outputs)

Proportional control action produces an output signal that is proportional to the difference between the Setpoint and the PV (deviation or error). Proportional control amplifies the error to lead the process value towards the desired Setpoint. Proportional control will reduce but not eliminate the error. Therefore, proportional control action includes a manual reset. The manual reset is used to eliminate the steady state error. Integral control will accumulate Setpoint and process (load) changes. The integral term is provided with an anti wind-up function. When the output of PI portion of the controller is outside the control range (less than -5% or greater than 105%), the I-part is frozen.

Derivative control acts on the slope (rate of change) of the process value, thereby minimizing overshoot. It provides "rate" feedback, resulting in more damping.

*Adjustable parameters:* Setpoint, Range, Direction, I-time, D-time (Manual reset only for P-control)

**All four SPDT Contacts** have the same generic functions: Control, Alarm, HOLD, Wash, Fail, Simulate and Off

### PID duty cycle control

The functionality is the same as the mA-output control function except for the fact that the contact is used to control the time a solenoid dosing valve is opened. The PID control is achieved by opening and closing the solenoid valve and varying the ratio of on and off time (Ton, Toff).

*Adjustable parameters:* Setpoint, Range, Direction, I-time, Dtime (Manual reset only for P-control). Total time of the pulse period (1 to 999 seconds)

### PID pulse frequency control

The functionality is the same as the mA-output control function except for the fact that the contact is used to control a pulsed driven dosing pump. The frequency of pulses regulates the pump speed.

*Adjustable parameters:* Setpoint, Range, Direction, I-time, Dtime (Manual reset only for P-control). Pulse frequency (1 to 120 pulses per minute)

### Process alarm

The contact will be switched (energized) when the process value exceeds the preset alarm limit. This can either be a high or low limit. *Adjustable parameters:* Setpoint, Direction, Hysteresis, Delay time, Expire time

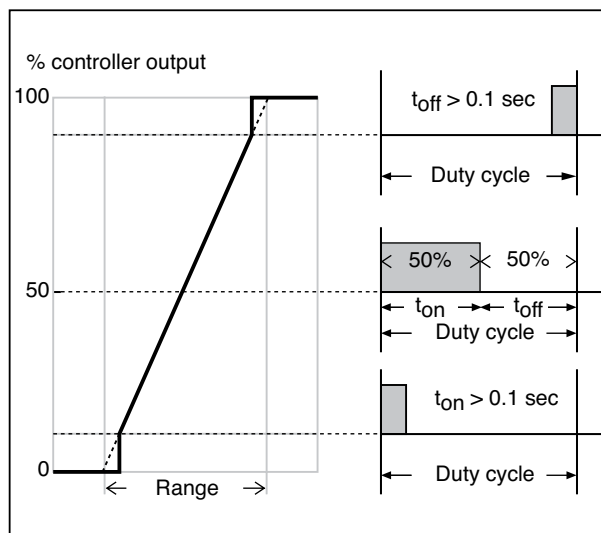
### Wash, Chemical- or mechanical cleaning of sensors:

Any contact can be used to control the wash cycle.

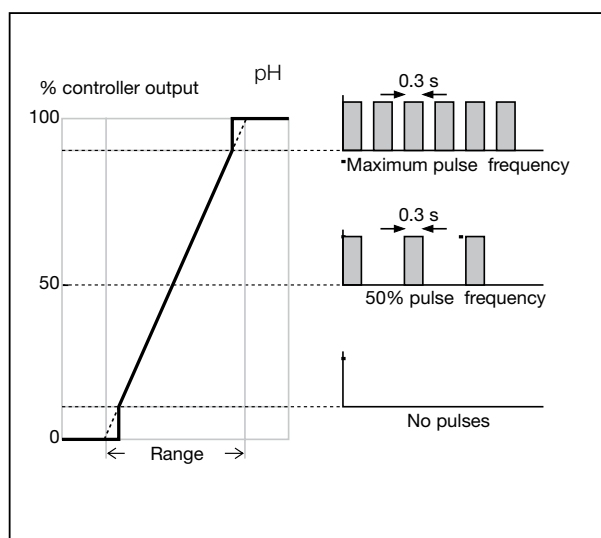
*Adjustable parameters:* Cleaning time or washing time ( $T_w$ ) Recovery time after washing ( $T_R$ ) interval time for wash cycle. An on-line dynamic response test of the electrode can be activated after cleaning. The response time is a good diagnostic tool to see the condition of the electrode system. During the recovery time the response is monitored and an error is generated when the "half time value" was not reached within  $1/3$  of the recovery time.

### Fail alarm

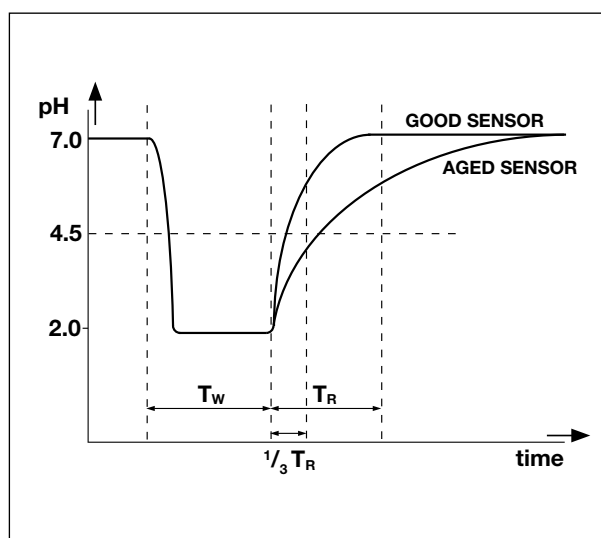
Any contact can be set to function as an alarm, indicating that the EXAxt has found a fault in the measuring loop. If the self diagnostics of the EXAxt indicates a fault or error, the FAIL contact will be switched (energized).



Duty cycle control



Pulse frequency control



Dynamic response check after wash

## System Configuration

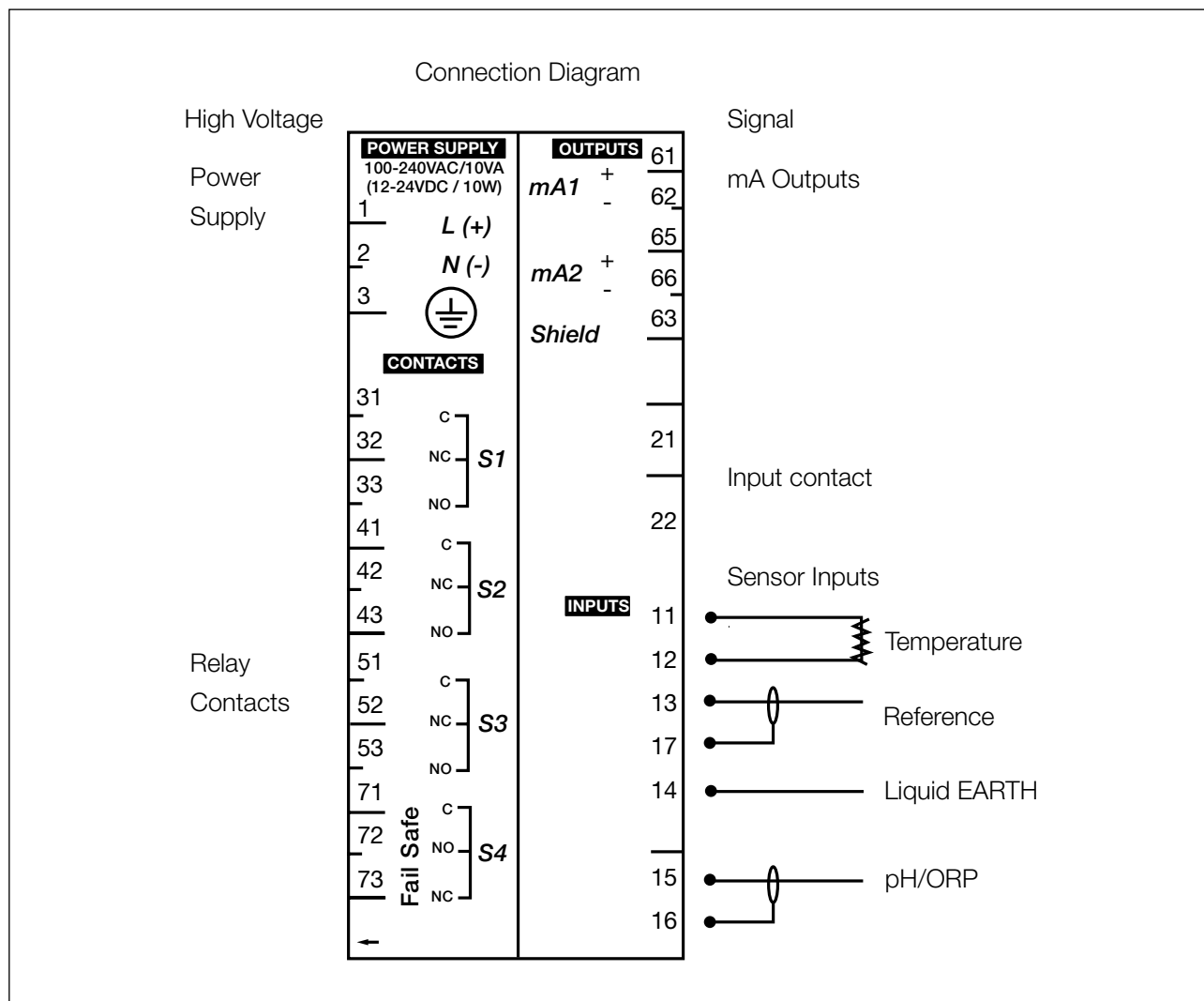
Model	Suffix Code	Option code	Description
PH450G			pH / ORP transmitter
Power	- A		AC version (85...265 VAC)
	- D		DC version (9.6...30 VDC)
	- A		General purpose version
	- U		FM version
Options		/ SCT**	Predefined tagnumber (text only)
		/ Q*	Quality and calibration certificate
		/ UM	Universal mounting kit (panel, pipe, wall)

### Notes:

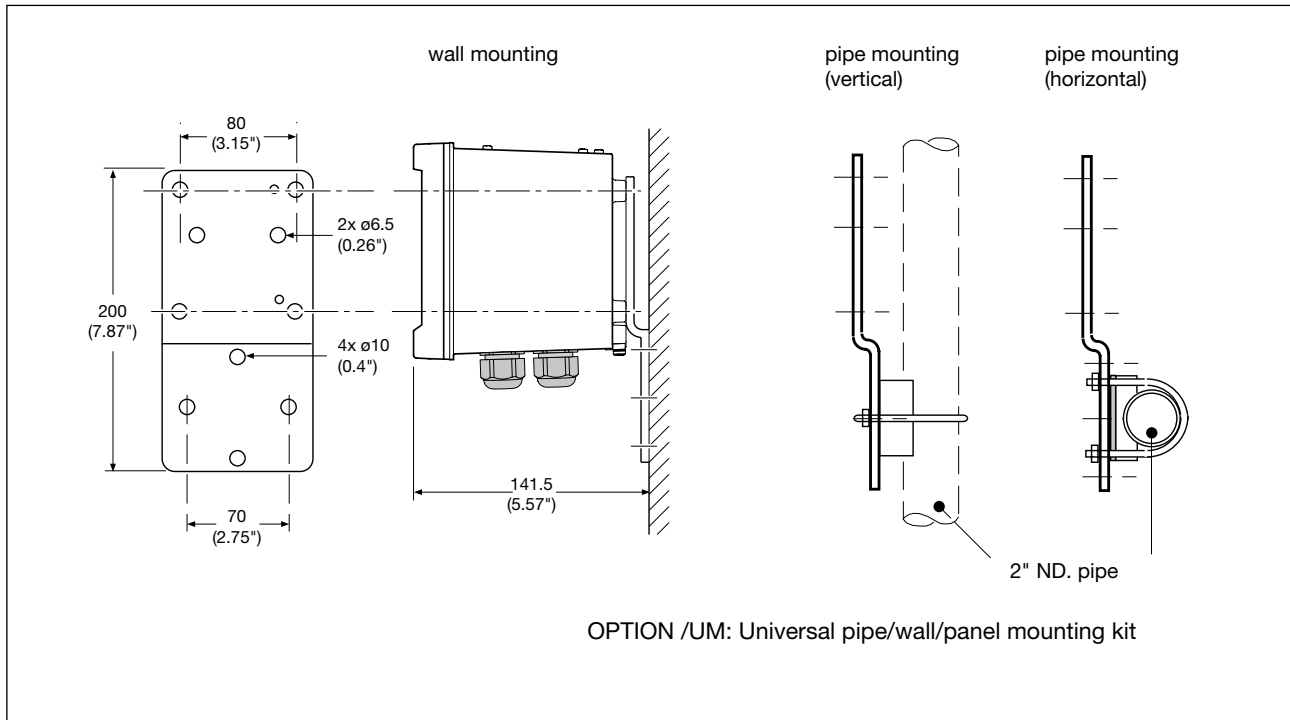
\* /Q: Quality Inspection certificate is always included with the product.

\*\* If the tagnumber is predefined with the purchase, Yokogawa will inscript the tagplate with the specified tagnumber, and program the tagnumber in the transmitter.

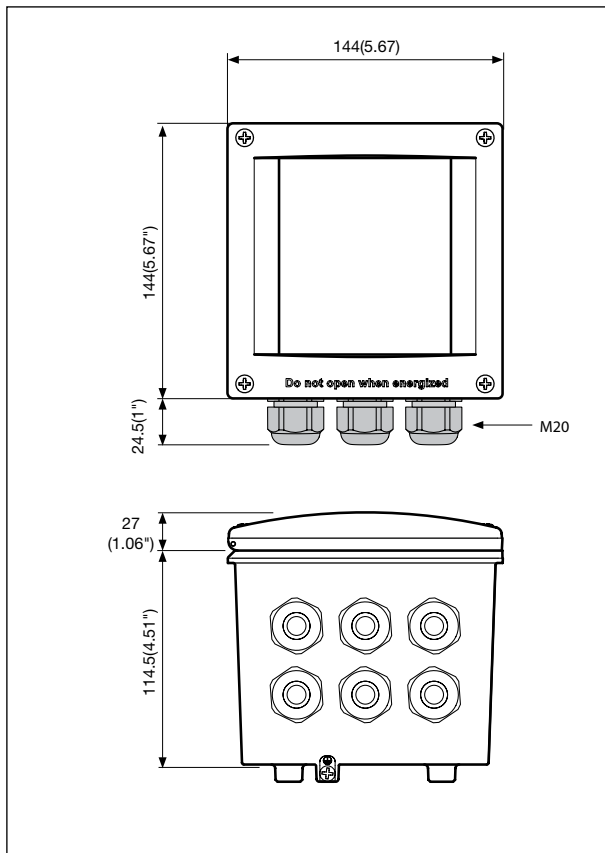
## Input and Output Connections



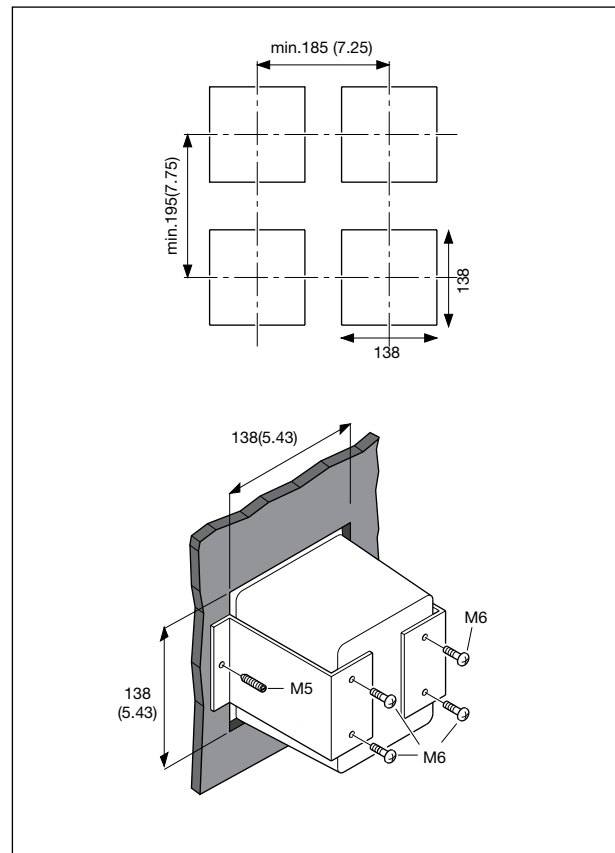
## Dimension and Mounting



## Wall and pipe mounting diagram



Housing dimensions and layout of glands



Option/UM. Universal mounting kit, panel mounting diagram

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## Spare Parts

Part no.	Description
K1541KR	/PM panelmounting for EXA400/402
K1542KW	/U pipe/wall mounting for EXA
K1548FU	Flash-loader kit
K1548MT	Tagplate blank EXAxt450
K1548MV	Glands M20 (6 pcs.)
K1548MW	Grommetset
K1548MY	Cover assembly EXAxt450

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# General Specifications

Model PH71/72  
pH71/72 pH and/or ORP pocketmeter

Compact, Easy-to-Use, and Dip-proof, the PH72 is designed specifically to meet the needs of both the field and the laboratory. This portable pH meter includes advanced features such as optional ORP measurement (with appropriate electrodes), Automatic or Manual Temperature Compensation, and several calibration options. Combined with a wide variety of pH electrodes, the PH72 offers the flexibility to meet the requirements of nearly any pH application.

## Features

- Waterproof (IP67), sealed case and connector cover to keep out moisture
- Automatic and Manual Calibration
- Large, easy-to-read LCD display
- Auto or Manual Temperature Compensation
- ORP Measurement with appropriate electrode
- Auto power off extends battery life

## Specifications

### Measuring Ranges:

pH	0 - 14 pH
ORP	-2000 to 2000 mV <sub>mV</sub>
Temperature	0 - 80°C (or 0 - 100°C <sup>1</sup> )

### Resolution:

pH	0.01 pH (± 1 digit)
ORP	1 mV (± 1 digit)
Temperature	0.1°C

### Repeatability:

pH	±0.01 pH ±1 digit
ORP	±1mV ±1 digit

**Process temperature:** 0 - 80 or 100°C<sup>1</sup>

**Ambient temperature:** 0 - 50°C

**Power Supply:** Two AA size Alkaline Batteries

<sup>1</sup> Only upto 100°C when needle type or test tube size pH sensor is used



## Model and Suffixcodes

### Personal pH Meter

Model	Suffix Code	Option Code	Description
PH71			Personal pH meter
pH sensors	-00		Without sensor
	-11		With KCl replenish-free type combination pH sensor (cable length: 0.75 m)
	-13		With KCl replenish-free type combination pH sensor (cable length: 3 m)
	-21		With KCl refillable type combination pH sensor (cable length: 0.75 m)
	-23		With KCl refillable type combination pH sensor (cable length: 3 m)
	-32		With needle type pH sensor (cable length: 0.75 m)
	-33		With test tube size pH sensor (cable length: 0.75 m)
Label language	-J		Japanese
	-E		English
	-AA		Always -AA

## Personal pH/ORP Meter

Model	Suffix Code	Option Code	Description
PH72			Personal pH/ORP meter
sensors	-00		Without sensor
	-11		With KCl replenish-free type combination pH sensor (cable length: 0.75 m)
	-13		With KCl replenish-free type combination pH sensor (cable length: 3 m)
	-21		With KCl refillable type combination pH sensor (cable length: 0.75 m)
	-23		With KCl refillable type combination pH sensor (cable length: 3 m)
	-32		With needle type pH sensor (cable length: 0.75 m)
	-33		With test tube size pH sensor (cable length: 0.75 m)
	-41		With KCl refillable type ORP sensor (cable length: 0.75 m)
	-43		With KCl refillable type ORP sensor (cable length: 3 m)
	-51		With KCl refillable type combination pH sensor (cable length: 0.75 m) + KCl refillable type ORP sensor (cable length: 0.75 m)
Label language	-J		Japanese
	-E		English
	-AA		Always -AA

## pH Sensors for Personal pH/ORP Meter

Model	Suffix Code	Option Code	Description
PH72SN			pH sensor for personal pH/ORP meter
	-11		For PH71/72: KCl replenish-free type combination pH sensor (cable length: 0.75 m)
	-13		For PH71/72: KCl replenish-free type combination pH sensor (cable length: 3 m)
	-18 <sup>*1</sup>		For PH81/82: KCl replenish-free type combination pH sensor (cable length: 0.75 m)
	-19 <sup>*1</sup>		For PH81/82: KCl replenish-free type combination pH sensor (cable length: 3 m)
	-21		For PH71/72: KCl refillable type combination pH sensor (cable length: 0.75 m)
	-23		For PH71/72: KCl refillable type combination pH sensor (cable length: 3 m)
	-28		For PH81/82: KCl refillable type combination pH sensor (cable length: 0.75 m)
	-32		For PH71/72: Needle type pH sensor (cable length: 0.75 m)
	-33		For PH71/72: Test tube size pH sensor (cable length: 0.75 m)
	-38 <sup>*1</sup>		For PH82: Needle type pH sensor (cable length: 0.75 m)
	-39 <sup>*1</sup>		For PH82: Test tube size pH sensor (cable length: 0.75 m)
	-AA		Always -AA

<sup>\*1</sup> Combination of pH sensors for PH81/82 meter with PH71/72 meter will not be IP67 waterproof.

## ORP Sensors for pH/ORP Meter

Model	Suffix Code	Option Code	Description
OR72SN <sup>*1</sup>			ORP sensor for personal pH/ORP meter
	-41		For PH72: KCl refillable ORP sensor (cable length: 0.75 m)
	-43		For PH72: KCl refillable ORP sensor (cable length: 3 m)
	-48 <sup>*2</sup>		For PH82: KCl refillable ORP sensor (cable length: 0.75 m)
	-49 <sup>*2</sup>		For PH82: KCl refillable ORP sensor (cable length: 3 m)
	-AA		Always -AA

<sup>\*1</sup> Cannot be connected to PH81 and PH71 meters

<sup>\*2</sup> Combination of ORP sensors for PH81/82 meter with PH72 meter will not be IP67 waterproof.

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# General Specifications

## Industrial Electrodes for pH/Redox

Model SC25V/ SC24V/ SM21/ SR20/ SC21/ SM29 /SC29/ SM60

Selecting the proper pH electrode for an application can be a challenging exercise.

The heart of a pH measuring loop is the electrode system. Yokogawa has designed a wide range of electrodes to ensure this heart keeps beating under the most severe conditions.

The dimensions and design meet the requirements of DIN 19263 (excluding the refillable types). A high degree of standardisation makes it possible to mount any electrode in the standard program of fittings.

The combination of electrode plug and cable socket is watertight and temperature is resistant up to 125°C. It meets the requirements of IP65.

Colour coded strips on electrode, cable and clear identification of sensor specifications makes incorrect installation virtually impossible.

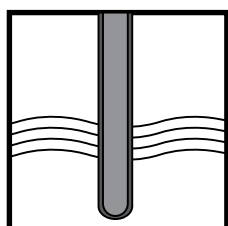
### Features

- Dome shaped membrane for "Heavy Duty" applications
- Wide range of electrodes to suit almost all process conditions
- Color codes strips for easy identification of electrodes and cables
- High degree of standardisation for mounting in various flow, insertion- and immersion fittings
- Separate electrode system for high accuracy applications
- Reference sensors with a junction made of ceramic, PTFE, pNa glass or Zirconium
- Combination electrode with external liquid earth

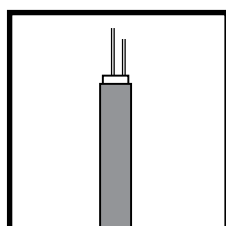
**NEW**

**pH/Redox  
Analyzers**

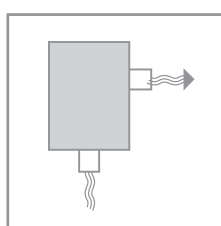
### System configuration



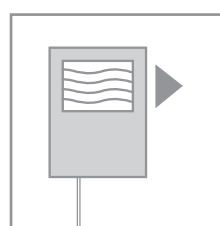
Sensors



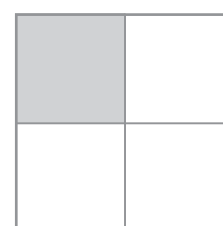
Cables



Fittings



Transmitters



Accessories










**YOKOGAWA** ◆

GS 12B6J1-E-E  
19th Edition

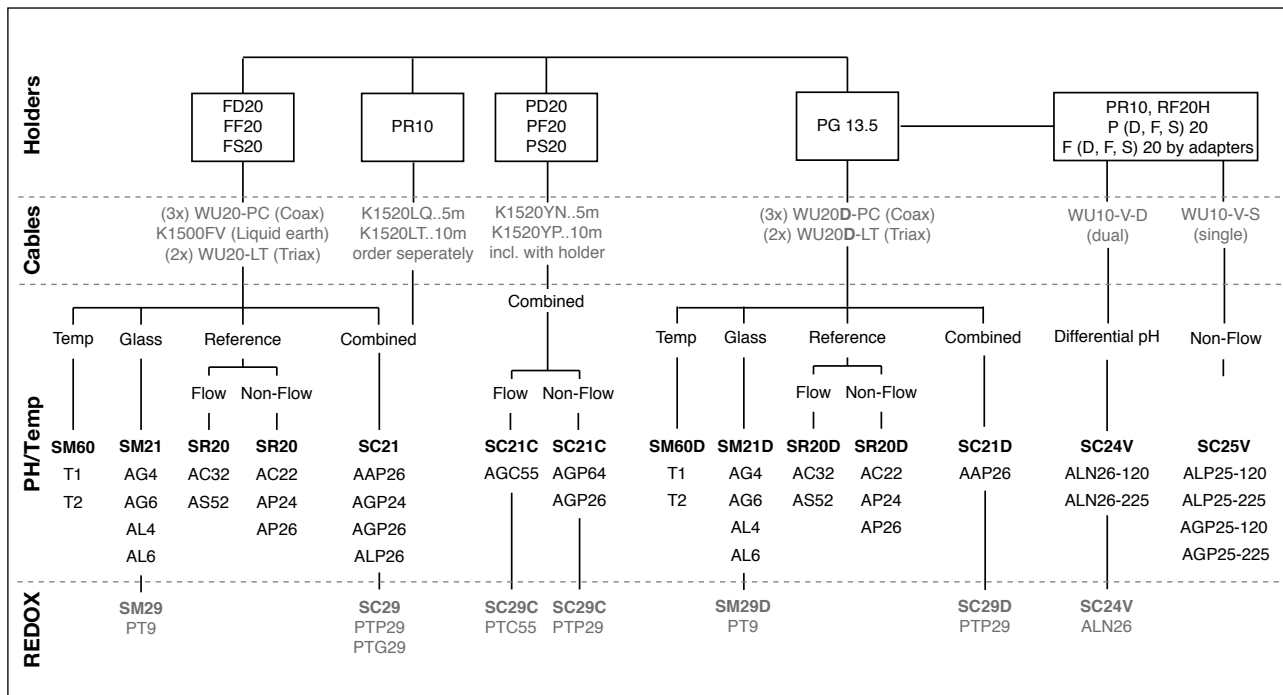
Yokogawa Europe B.V  
Amersfoort, The Netherlands.

## Properties

## Petrochemical

	pH range	ORP range (mV)	Minimum Conductivity (µS/cm)	Pressure range (bar)	Temperature (°C)	High process Temperature	High process Pressure	Sour water Stripper (also Quench [lower] wa	After sour water stripp to demin tank	Cooling tower (corrosion control)	API Separator (waste water treatmen	Mono and Tri ethyle g/yol (meg /leg)
<b>SC24V</b> 	4-14			0-10	0-120	●	●	●				
<b>SC25V</b> 	0-14		>10	0-10	0-130	●					●	●
<b>FU20</b> 	0-14	-1500/1500	>50	0-10	0-105		●				●	
<b>FU24</b> 	0-14	-1500/1500	>10	0-10	0-105		●				●	
<b>SC21-AAP26</b> 	0-14		>50	0-5	0-110						●	
<b>SC21-ALP26</b> 	0-14		>50	0-5	10-120	●					●	
<b>SC21-AGP26</b> 	0-14		>50	0-5	-10-100						●	
<b>SC21C-AGC55</b> 	0-14		>0.05	0-10	0-100		●	●	●	●	●	●
<b>SC29C-PTG29</b> 		-1500/1500	>50	0-10	0-100	●						

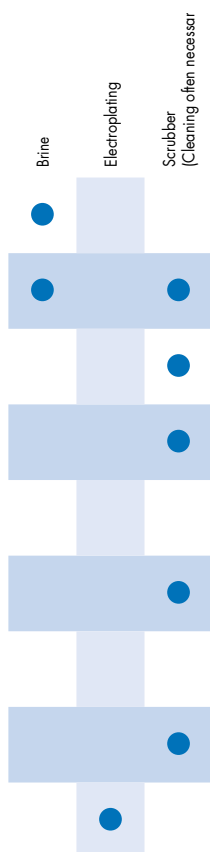
● Best choice specifications of the PH20, FU20 and FU24 are in GS 12B6J3-E-E



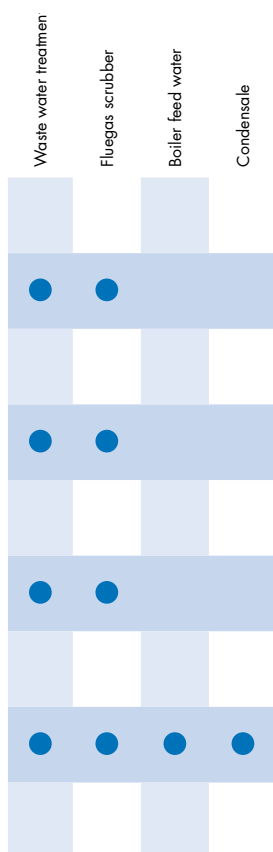
Note	Electrode	Mounting	Reservoir	Electrolyte	Thickened electrolyte
1	SR20-AC52 / SC21-AGC52	K1500BY	K1500FU	K1520VA	K1520VN
2	SR20D-AC52	included	K1500FU	K1520VA	K1520VN
3	SR20-AC32	FP20-S13	-	K1520VA	K1520VN
4	SR20D-AC32	-	-	K1520VA	K1520VN
5	SC21C-AGC55	included	K1520YA	K1520VA	K1520VN

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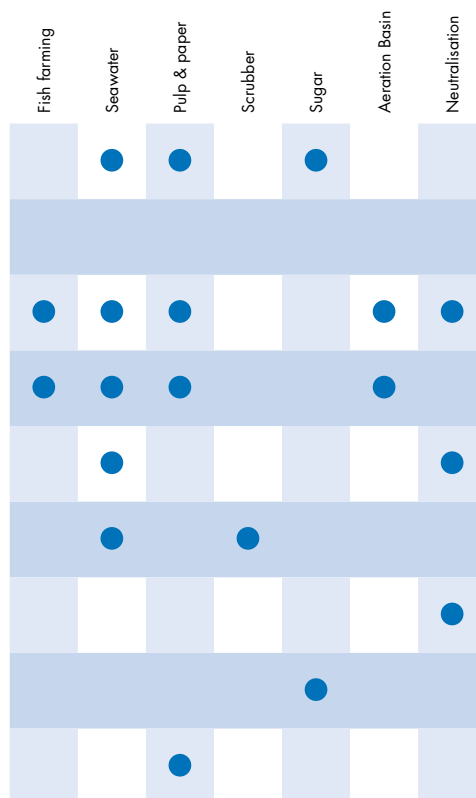
## Chemical



## Power



## Various

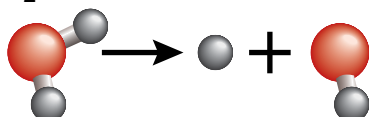


### What is a pH measurement ?

- Measure the amount of  $H_3O^+$  and  $OH^-$  ions
- $2 \cdot 10^{-7}$  mol/l of the water molecules will dissociate
- Adding  $H^+$  or  $OH^-$  will change this balance
- $pH = -\log [H_3O^+] = -\log [1 \cdot 10^{-7}] = 7$

Acids and bases when dissolved in water simply alter the relative amount of  $H_3O^+$  and  $OH^-$  ions in solution.

### $H_2O \rightleftharpoons H^+ + OH^-$ Water dissociation



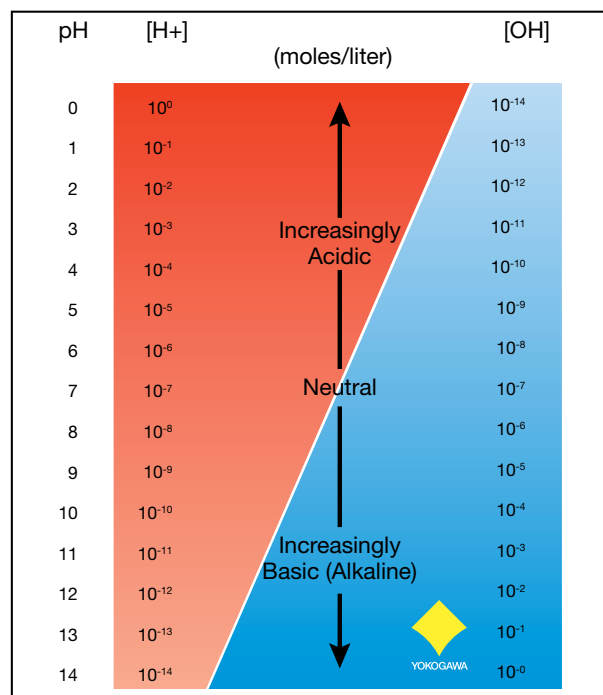
### How to measure pH ?

- pH sensitive glass
- Reference (potential) that is stable under all conditions
- Weak point: reference with open contact to the process
- Solution: select the proper electrodes for the application

### Maintenance and calibration

- For accurate measurement frequent maintenance is required
- Cleaning of the electrodes prior to calibration is important

pH can be measured in several ways, but it always consists of an element that is sensitive to the  $H^+$  concentration (usually glass), a reference electrode that, as the name suggests, produces a stable reference value (potential) at any given temperature. One can see that even the measurement itself is reliant on temperature. Therefore a pH electrode needs temperature input. As reference electrodes have an open connection to the process therefore subject to fouling, electrolyte depletion, etc., the system must be calibrated periodically to ensure accurate, repeatable measurements. Although calibration against one buffer typically ensures accurate pH readings, frequent two-buffer calibrations ensure the most reliable results. When selecting buffers, use buffers on either side of your pH value you will be measuring.



Buffer solutions are readily available. Realize that these should be traceable to national or international standards (IEC, NIST). As any solution, the pH value of buffers is dependant on temperature. For proper calibration each buffer should come with a temperature table. Yokogawa uses traceable buffers to NIST.

### Why use a temperature compensation ?

- pH changes with temperature
- Introduces error in the measurement
- Necessary for reliable control

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### SC21 & SC25V Combined pH Electrodes (non-flow)

Yokogawa is continuously improving the present pH sensing portfolio and designing new pH sensors integrating the latest improvements into the new design and upgrading our present.

The SC25V is the latest addition to the family. Yokogawa's first combination pH sensor in a 12 mm design with an external Liquid earth. A new design made it possible to create a large electrolyte volume making this sensor last longer than most other comparable pH electrodes.

The SC21 series, already for many years Yokogawa's trusted range of combination pH electrodes, still has the same variety of choices making it easy to find the best electrode for each application.

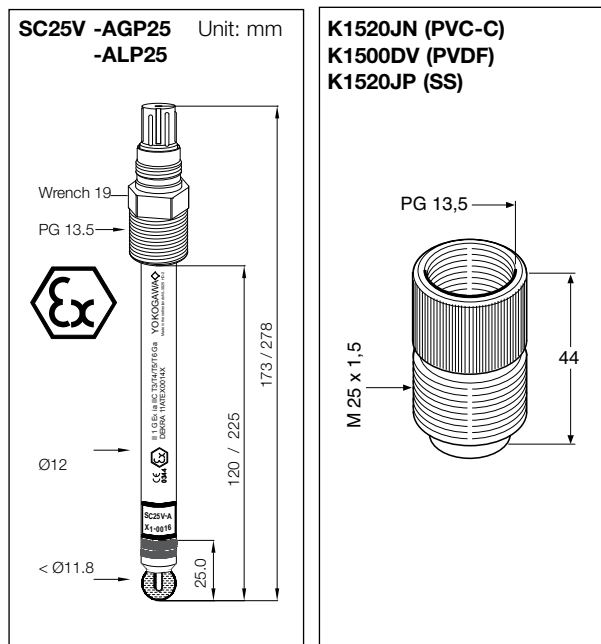
#### Features SC25V

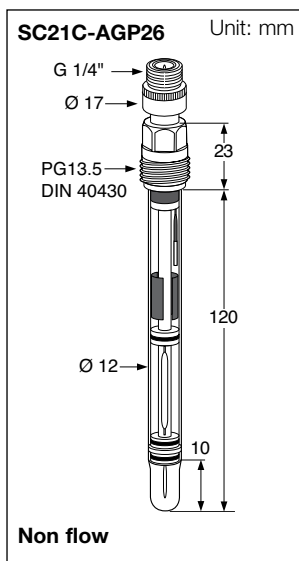
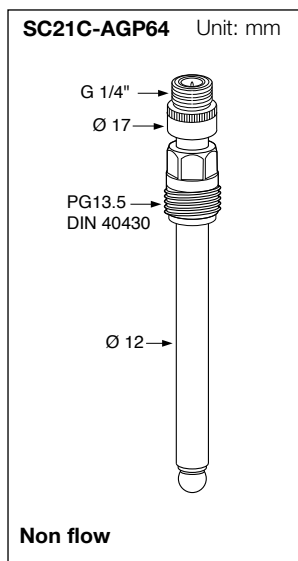
- External titanium Liquid Earth
- Pt1000 integration in pH compartment giving highly accurate temperature compensation
- ATEX certified : ATEX II1G Ex ia IIC T3...T6 Ga
- CIP and Steam cleaning possible
- Large internal KCl volume giving the sensor a longer life time
- Measuring in Pure Water applications from 10  $\mu$ S/cm
- Variopin connector
- SC25V-ALP25 for chemically harsh applications and high temperatures
- SC25V-AGP25 for all General Purpose applications

Model	Suffix Code	Option Code	Description
SC25V			Combined 12mm sensor: pH, Ref, LE, Temperature Equipped with Variopin connector
Sensor type	-AGP25 -ALP25		General purpose High temp: Chemical resistant
Sensor length		-120 -225	120mm 225mm

### Specifications Combined pH electrodes with Temperature + Liquid earth

Type	Membrane	Resistance in $M\Omega/25^{\circ}C$	pH-range	Temp. range ( $^{\circ}C$ )	Pressure range kPa	Reference liquid	Diaphragm system	Ref.	Atex
SC25V-AGP25	Universal pH-glass bulb	175-275	0-14	-10 - 80	0-1000	Oversaturated KCl	Ag/AgCl (wire)	PTFE	Yes
SC25V-ALP25	Chem. Res. pH-glass dome	500-700	0-14	+15 - 130	0-1000	Oversaturated KCl	Ag/AgCl (wire)	PTFE	Yes





#### Characteristics of type SC21-AGP24

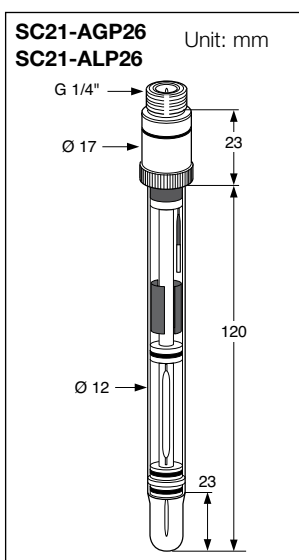
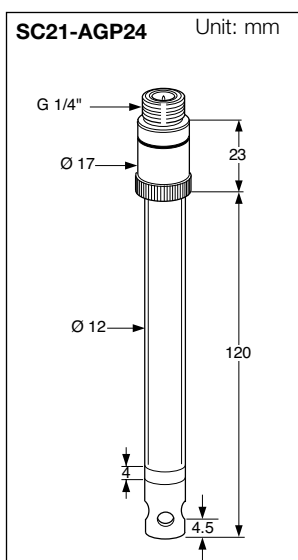
- Ag/AgCl wire reference system.
- pH bulb with cage protection
- Less maintenance due to the gelled electrolyte and porous PTFE.
- Thickened electrolyte (3.3 m.).

#### Characteristics of type SC21-AAP26

- High quality Ag/AgCl reference system (pin) which can stand high temperatures and temperature fluctuations.
- Built-in salt bridge to prevent poisoning of the reference system.
- A large area PTFE junction to resist fouling to a high degree.

#### Characteristics of type SC21(C)-AGP26

- High quality Ag/AgCl reference system (pin) which can stand high temperatures and temperature fluctuations.
- Double junction (thickened saturated KCl-solution). The built-in salt bridge prevents poisoning of the reference system.
- Heavy duty glass membrane for prolonged operation in corrosive, abrasive and fouling environments (withstanding traces of HF).
- A large area PTFE junction to resist fouling.

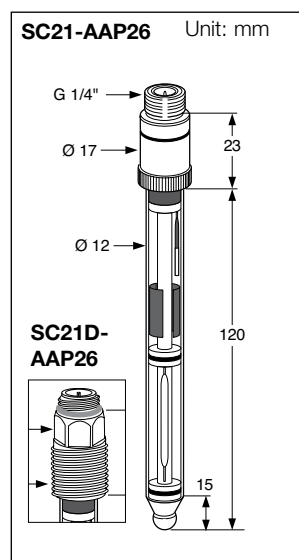


#### Characteristics of type SC21(C)-ALP26

- Chemical resistant, steam-sterilisable pH-glass.

#### Characteristics of type SC21C-AGP64

- Ag/AgCl wire reference system
- Less maintenance by the combination of gelled electrolyte and porous PTFE.
- 3.3 m KCl electrolyte



### Specifications Combined pH Electrodes (non-flow)

Type	Membrane	Resistance in MΩ/25°C	pH-range	Temp. range (°C)	Pressure range kPa	Reference liquid	Reference system	Diaphragm	Flow
SC21-AGP24	Universal pH-glass bulb	50 - 100	0 - 14	0 - 80	1-500	3.3 m. KCl Thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21(D)-AAP26	Chem. res. pH-glass bulb steam-sterilisable ¾ bulb	250 - 400	0 - 14	0 - 110	1-500	Oversaturated KCl thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21-ALP26	Chem. res. pH-glass dome	500 - 900	0 - 14	10 - 120	1-500	Oversaturated KCl thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21-AGP26	Universal pH-glass bulb	120 - 200	0 - 14	-10 - 100	1-500	Oversaturated KCl thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21-AGP64	Universal pH-glass bulb	50 - 100	0 - 14	0 - 80	1-500	3.3 m. KCl Thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0

Model	Suffix code	Description 1	Description 2	Description 3
SC21(C/D)		pH/ref combination electrode		
Sensor type	-AGP24	General purpose	with protection cage	
Non-flow	-AGP64	General purpose	PG13.5 process connection	
	-AAP26	General purpose	Double junction	High temperature electrode
	-AGP26	Heavy duty	Double junction	Moderate temperature
	-ALP26	Heavy duty	Double junction	High temperature electrode

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### SC24V Differential pH sensor

The SC24V is a differential pH sensor. This means that the reference is not a (liquid) junction but a glass sensor which does not respond to pH changes (within the applicable range of the sensor). Therefore the sensor is truly maintenance free and the output voltage of the sensor depends only on the salt concentration of the process.

The sensor responds to pH changes rather than analyzes the accurate pH value. In that sense it is best to describe the sensor as pH control sensor rather than pH measuring sensor.

A pH sensor measures the voltage that the pH membrane measures as function of the pH value of the process sample. This voltage is then compared with the mV output of a reference cell that is independent on the pH value of the sensor

In most pH control applications the salt concentration is rather constant, so the output of the SC24V differential sensor is only dependent on the pH of the process.

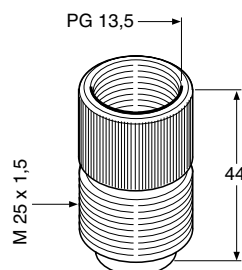
A rule of thumb is that a change in salt concentration of +/- 25% has an effect of less than 0.1pH on the pH reading.

Model	Suffix Code	Option Code	Description
SC24V Sensor	-ALN26		Combined 12mm 4 in 1 differential pHsensor with Variopin connector Ag/AgCl reference system, pH half cell L-glass, reference cell salt sensitive glass, non-flow, heavy duty
Sensor length		-120 -225	120mm 225mm

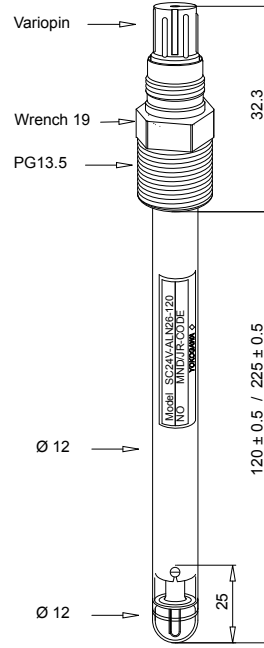
#### Features

- VP connector
- Sterilisable pH sensor
- No reference electrode or junction
- Maintenance free pH sensor
- No diffusion = high stability

K1520JN (PVC-C)  
K1500DV (PVDF)  
K1520JP (SS)



### SC24V





### SC21C Combined pH Electrodes (Flow)

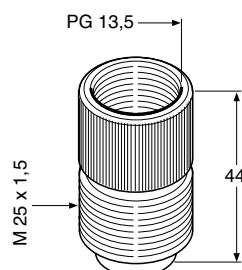
This flowing electrolyte sensors uses a ceramic reference junction, with the electrolyte (3.3 molal KCl). The flow of electrolyte through the junction, while small, remains the safest way to prevent clogging and to protect the internal reference against poisoning and diffusion.

#### Features for type SC21C-AGC55

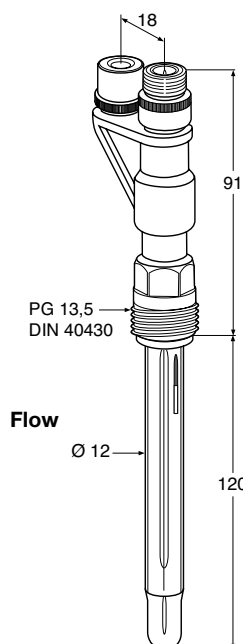
- For tough application where pollution of the reference system is to be expected
- Low ionic application where the positive flow of electrolyte provides the conductivity needed to measure pH (< 50  $\mu\text{S}/\text{cm}$ )
- Heavy duty pH sensitive glass.
- Flowing reference system for pollution resistance, and highly stable reference potential.
- PG13.5 standard DIN electrode connection.
- Adapter to ensure compatibility with full fitting program.
- Use in combination with the pressurisable electrolyte reservoir to obtain a positive flow towards the process (K1500YA)

For compatibility with the Yokogawa "Compact" range of electrode holders, the SC21C-AGC55 combined sensor, has a PG13.5 DIN connector. This also makes the sensor suitable for mounting in a wide range of industry standard equipment. The SC21C-AGC55 is supplied with a PG13.5 to M25 adapter (K1520JN) that makes the sensor compatible with the full Yokogawa fitting program. For temperatures higher than 85°C we recommend to use the PVDF version.

K1520JN (PVC-C)  
K1500DV (PVDF)  
K1520JP (SS)



SC21C-AGC55 Unit: mm



### Specifications Combined pH Electrodes (Flow)

Type	Membrane	Resistance in MOhm/25°C	pH-range	Temperature range (°C)	Pressure liquid	Reference system	Reference	Diaphragm	Flow
SC21-AGC55	Universal pH-glass dome (heavy duty)	120 - 200	0 - 14	0 - 100	1-500kPa (only with pressure reservoir)	3.3 m.. KCl	Ag/AgCl pin	Ceramic	max.0.5 ml per day at 10kPa overpressure

### SM29 Redox Electrodes

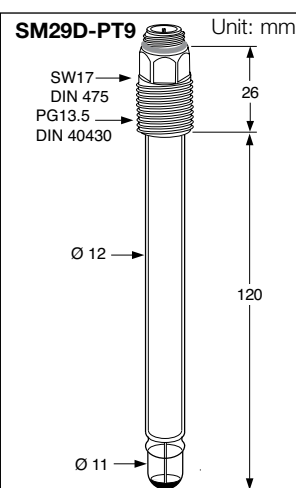
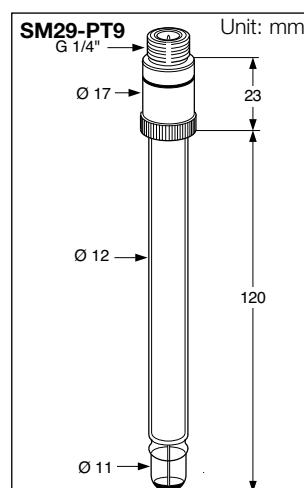
Redox measurements are a potentiometrical measurement of the oxidizing/reducing power of a liquid. To be able to measure this equilibrium of reversible redox reactions the electrodes used should be inert. Noble electrodes such as Platinum (Pt) and Gold (Au) are widely used for this purpose and seem to approximate the behaviour of an ideal inert electrode. Platinum is used most widely, has excellent chemical resistance but suffers slightly from chemisorption of Oxygen, which slows down its response.

The potential of reference electrodes is depending on their composition. A table with the actual values for each system is given next. All values refer to 25°C. The reference system is also indicated on the textplate of the electrode.

System	Fill solution	Value against Standard Hydrogen Electrode
Ag/AgCl	3.3 m. KCl	203 mV
Ag/AgCl	sat. KCl	196 mV

#### Combined Redox Electrodes

For redox measurement Yokogawa offers non-flow general purpose electrodes and a heavy duty flow electrode. All electrodes are equipped with a solid platinum pin to provide long lifetime, even in processes that harm the platinum electrodes such as hypochloride.



## SC29 Redox/pH

This combined electrode can be used in processes with a constant pH value or for processes where the Redox potential is dependent on the pH in order to achieve a pH compensated Redox potential. In such a case a pH/Redox converter with a high input is required. All pH/Redox converters of Yokogawa have such an input.

## SC29(C) Redox/Reference

### Additional features for type SC29C-PTP29

- General purpose redox measurements
- Diaphragm resistance (25°C) < 5 kΩ
- High quality Ag/AgCl reference system (pin) which can stand high temperatures and temperature fluctuations
- Double junction, thickened saturated KCl-solution
- Built-in salt bridge prevents poisoning of the reference.
- Large area PTFE junction to resist fouling.

### Additional features of type SC29-PTG29

- Bulb shaped glass membrane.
- Ag/AgCl wire reference system
- Glass Resistance (25°C): 50 to 100 MΩ

### Additional features for types SC29C-PTC55

- Heavy duty pH sensitive glass.
- Flowing reference system for pollution resistance, and highly stable reference potential.
- PG13.5 standard DIN electrode connection.
- Adapter to ensure compatibility with full fitting program.

## Specifications Redox Electrodes

Type	Temperature range	Process pressure	Metal surface
SM29-PT9	0 - 130°C	max. 1000 kPa	Platinum
SC29C(D)-PTP29	-10 - 100°C	max. 500 kPa	Platinum
SC29-PTG29	0 - 100°C	max. 1000 kPa	Platinum
SC29C-PTC55	-10 - 100°C	max. 500 kPa	Platinum

### Type coding

SC29 ☐ - ☐ ☐

#### Construction, Liquid outlet

- 2. = Non-flow
- .9 = Solid metal cup
- 55 = Heavy duty flow type

#### Diaphragm, Membrane

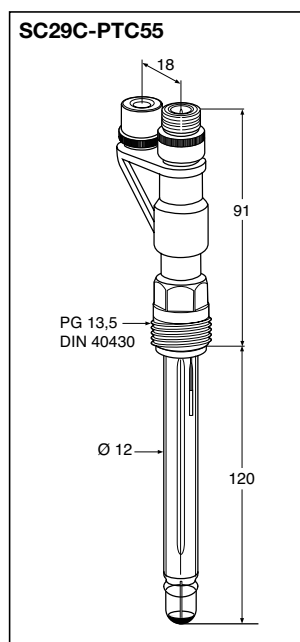
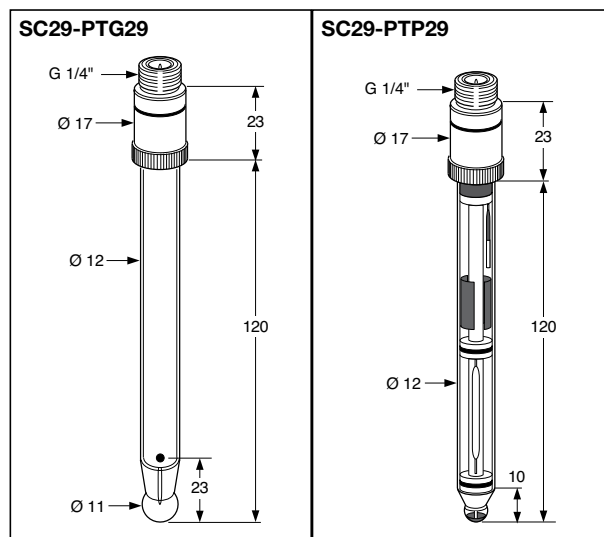
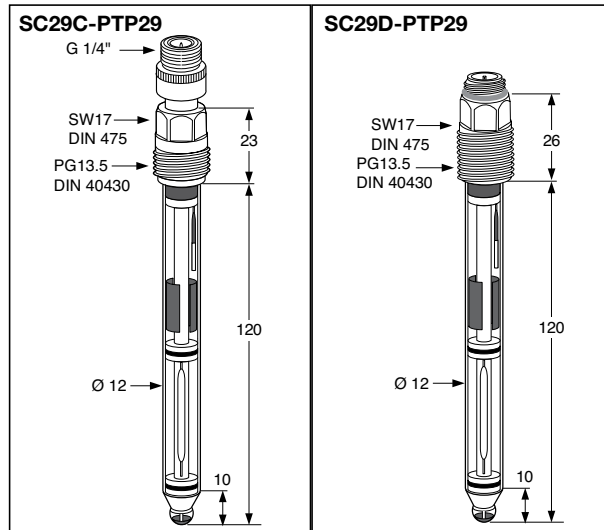
- P = PTFE (teflon) membrane
- G = Universal glass
- C = Ceramic

#### Metal

- PT = Platinum

#### Connector type

- ☐ = Yokogawa connector
- D = Din connector
- C = Compact connector



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## SM21 Single Glass Electrodes

The glass membrane is the most important part of the complete pH measuring loop. pH sensitive glass has the particular property that alkali metal ions present in the texture of the glass are exchanged with  $H^+$  ions of the liquid. The selection of the correct type of glass electrode depends on both the type of glass membrane thickness of the glass membrane.

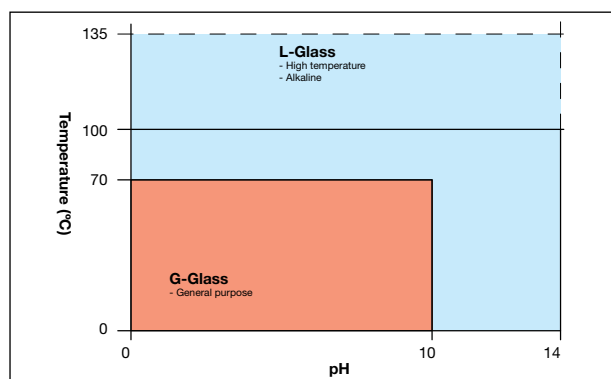
Two types of glass are available, as described here:

### "G" glass

This is used for the membranes of electrodes in processes where the nominal pH value varies between pH0 and pH10. Since this type of glass has a wide application range it is also termed "general purpose" glass.

### "L" glass

The application of "L" glass is for measurements in alkaline media with high process temperatures.



## Features

- Low resistance glass for fast response and sensitivity
- High resistance glass for chemical resistance
- L-glass sensors for high temperature chemically harsh applications
- G-glass sensors for all general applications
- "All glass" construction.
- Dimensions and design meet the requirements of DIN 19263.
- Isothermal point of intersection: pH 7 (nominal value at 0 mV).
- Maximum pressure: 1000 kPa (10 bar).
- Metal foil screening.
- Bulb membrane for general purpose.
- Dome shaped membrane for "Heavy Duty" applications.

## Thickness of the glass membrane

### Shockproof

A bulb shaped glass membrane suitable for general purpose

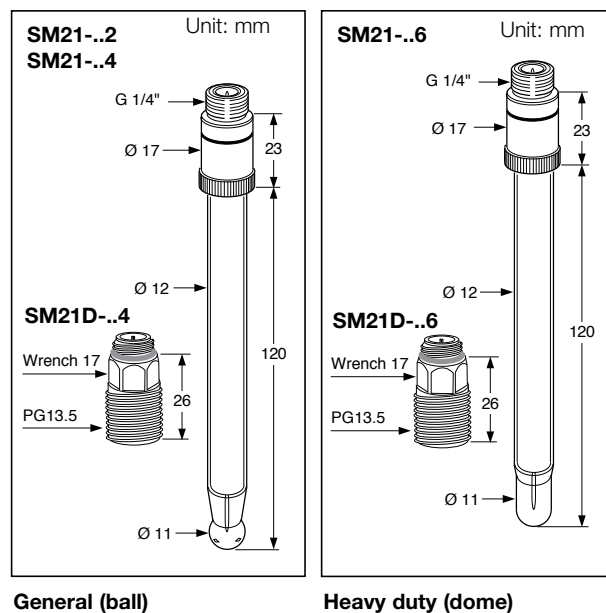
### Heavy duty

This dome shaped glass membrane is suitable for harsh and abrasive applications.

## Selection guide separate electrodes : Glass sensors

modelcode	Bulb type	Glass resistance (Mohm)	T range (°C)	Pressure (bar)	Applications	remark
SM21(D)-AG2	Universal	25-50	0-80	10	light, laboratory	fast response, high sensitivity
SM21(D)-AG4	shockproof	50-100	0-100	10	general	Universal
SM21(D)-AG6	heavy duty	120-200	0-100	10	Harsh	mechanically strong
SM21(D)-AL4	shockproof	300-450	15-130	10	High Temperature	T cont. $\geq 70^{\circ}C$ , high chem. Resistance
SM21(D)-AL6	heavy duty	600-900	25-130	10	High T + abrasive	T cont. $\geq 70^{\circ}C$ , high chem. Resistance

\* all pH glass sensors have a sodium error of 0.17 pH above pH=13 this because the glass then will see the  $Na^+$  ion as  $H^+$  ion.  
The pH reading is lower than it is in reality.



General (ball)

Heavy duty (dome)

### Type coding

SM21 ☐ - ☐ ☐

#### Membrane shape

- 2 = Ball (light application)
- 4 = Ball (shockproof)
- 6 = Dome (heavy duty)

#### Kind of membrane

- G = Universal
- L = High temperature, chemical resistant

#### Reference system

A = Ag/AgCl (silver-silverchloride)

#### Connector typ

- ☐ = Yokogawa connector
- D = Din connector
- C = Compact connector

### SR20 Single Reference Electrodes (non-flow)

The selection of the correct type of junction of a reference electrode depends on the process conditions under which this electrode has to function. The following junction types are available:

1. Ceramic junction.
2. Glass sleeve capillary element.
3. PTFE junction.

The purpose of the junction is to maintain contact between the reference system in the electrode and the process liquid. When selecting the correct junction, consideration has to be given to ensure that the process liquid does not penetrate into the electrode causing poisoning and a consequential unstable liquid junction potential.

With the first two types of junction, listed above, the KCl solution flows slowly into the process. The flow rate is dependent on the over-pressure in the electrode and on the process temperature. The electrolyte flow rate increases with increasing temperature. For use in very dirty liquids a glass sleeve capillary element is preferred because of its larger flow surface. The sleeve can be easily cleaned by first moving the ground ring upwards and then wiping the ground faces. Non-flowing reference electrodes with a porous PTFE junction can also be used in many dirty liquid applications. The dirt resistant properties of PTFE will prevent complete fouling of the diaphragm.

A non-flow type reference electrode can be used for processes that don't contain components that poison the reference system. The gel-type electrodes have a large area of porous PTFE junction for optimal resistance against electrode pollution. The SR20-AP26 electrode is the optimal choice for processes that cannot stand contamination with KCl. The SR20-AC22 electrode has a flexible PTFE tube. Therefore this electrode can be applied in processes with frequent temperature- and pressure fluctuations.

#### Features

- Easy maintenance.
- No reference liquid wastage.
- Maximum process pressure: 1000 kPa (10 bar).
- High quality Ag/AgCl reference system (pin) which can stand high temperatures

#### Additional features of types SR20(D)-AC22

- Temperature / pressure variation compensation.
- To be used in non-polluting fluids.
- Saturated KCl-solution (pellets).
- For low ionic applications and high temperatures.
- Temperature range: 0 to 120°C.
- Diaphragm resistance (25°C) <5kΩ.

#### Additional characteristics of type SR20(D)-AP24

- General purpose PTFE diaphragm electrode.
- Large PTFE diaphragm.

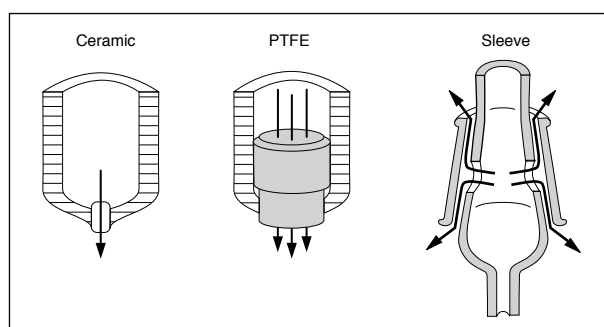
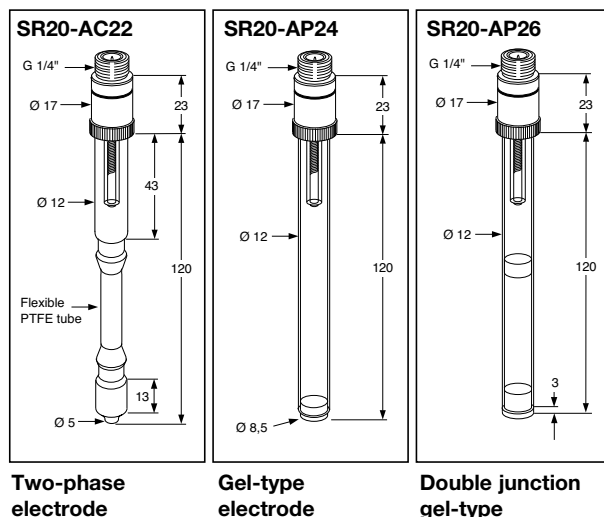
#### Additional characteristics of type SR20(D)-AP26

- When KCl is prohibited in the application.
- Double junction, thickened KNO<sub>3</sub> in buffer compartment.
- Large PTFE diaphragm against pollution.

### Specifications Single Reference Electrodes (non-flow)

Type	Temperature range (°C)	Pressure (bar)	Reference liquid	Reference system	Diaphragm	Diaphragm resistance/25°C
SR20(D)-AC22	0 - 120	10	Saturated KCl-solution (pellets)	Ag/AgCl (pin)	Ceramic	< 5 kOhm
SR20(D)-AP24*	0 - 80	10	Thickened KCl (3.3 m.)	Ag/AgCl (pin)	PTFE	< 5 kOhm
SR20(D)-AP26*	0 - 80	10	Thickened KCl (3.3 m.) Thickened KNO <sub>3</sub> (3.3 m.)	Ag/AgCl (pin)	PTFE	< 5 kOhm

\* In application where high process temperature occur together with very low (<2) or very high (>12) pH levels the lifetime is shortened.  
GS 12B6J1-E-E



#### Type coding

SR20 ☐ ☐ ☐ ☐

#### Liquid outlet

##### Non-flow

- 22 = PTFE hose filled with KCl pellets
- 24 = Filled with thickened electrolyte
- 26 = Double junction filled with gelled Gel-type electrodeelectrolyte

##### Flow

- 11 = Refillable laboratory reference electrode
- 32 = Process pressure compensated
- 52 = Refillable at the top

#### Diaphragm

- C = Ceramic
- P = PTFE (porous)
- S = Sleeve

#### Reference system

- A = Ag/AgCl (silver-silverchloride)

#### Connector type

- ☐ = Yokogawa connector
- D = Din connector
- C = Compact connector

### SR20 Single Reference Electrodes (flow)

#### Pressure compensated Reference Electrode

In processes with pressure variations, the composition of the electrolyte may change as a result of process liquid penetration into the electrode. Any change in composition of the electrolyte may cause a measuring error or even poisoning of the reference system of the electrode. To alleviate this problem, the electrode with an integral pressure compensation system ("Bellomatic"-type electrode") may be the solution.

#### Reference electrode

- Flowing type sensors for dirty applications or (Ultra) pure water applications (often needs a electrolyte reservoir)
- Non-flow type sensors for all general applications
- Ceramic and PTFE junction : electrolyte flows slowly into the process. PTFE resists dirt
- Glass sleeve : very dirty applications or for (Ultra) pure water applications because of the larger flow-rate

#### Features

- Liquid flow output preventing diaphragm fouling and poisoning the reference system.
- High quality Ag/AgCl reference system (pin) which can stand high temperatures and temperature fluctuations.
- Standard 3.3 m. KCl electrolyte, at temp. above 70°C thickened electrolyte is advised.
- Automatic compensation for process pressure variations.
- Chemical resistant Viton Bellow material.
- Constant flow of reference liquid, independent of the process pressure variations for minimal diffusion potential.
- Suitable for pure water applications and for polluting fluids.
- Refillable, large KCl reservoir.

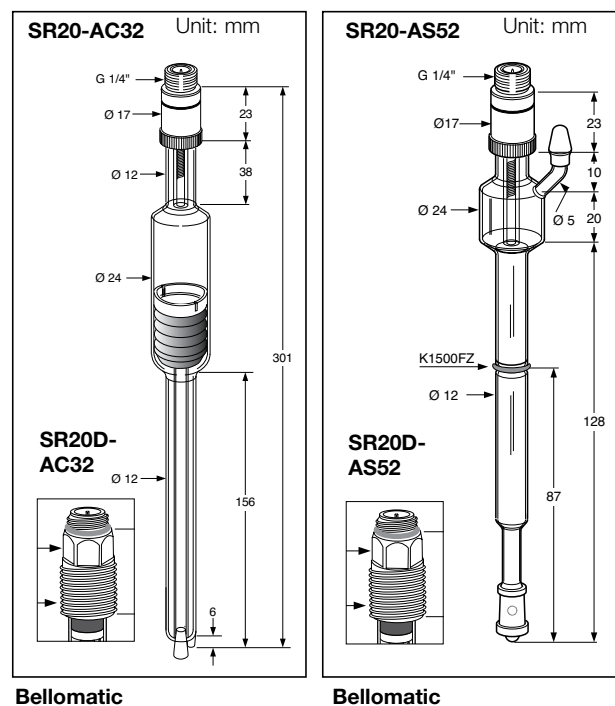
#### Note:

The flow is highly dependent on temperature. When using the electrode continuously at temperature over 70°C it is recommended to fill the electrode with a reference liquid having a higher viscosity, order nr. K1520VN (3.3 m. KCl).

#### The electrode function is as follows:

The electrolyte vessel of the electrode contains a bellow which is compressed in the working position. One side of the bellow is connected to the pressure via the ceramic junction and at the other side via the inner tube. The pressure inside the bellow equals the pressure outside and only the elasticity of the bellow itself causes the over-pressure which results in a flow of electrolyte. When the bellow is fully "expanded" the electrolyte is exhausted and refilling is required. The bellow must be compressed before refilling.

The refillable reference electrodes have a positive flow of electrolyte to prevent junction fouling or poisoning of the reference system. To prevent penetration of the process liquid into the electrode the pressure in the electrode must be higher than the process pressure. The ceramic junction is suitable for most applications. In strong polluting processes a sleeve junction is preferable.



#### Specifications Single Reference Electrodes (flow)

Type	Temp. range (°C)	Pressure range	Reference liquid	Reference system	Diaphragm	Diaphragm resistance/25°C	Flow at 25°C
SR20(D)-AS52	0 - 100	Atmospheric	KCl-solution (3.3 m.)	Ag/AgCl (pin) Silver-silverchloride	Sleeve	< 10 kOhm	Max. 0.2 ml/day at 10 kPa overpressure
SR20(D)-AC32	0 - 120	0 - 1 MPa	KCl-solution (3.3 m.)*	Ag/AgCl (pin) Silver-silverchloride	Ceramic	< 10 kOhm	Max. 0.5 ml/day*

## Mounting Kit for SR20-AC32

### type FP20-S13

This mounting kit is used whenever a refillable electrode with a large KCl reservoir is to be fitted in a flow or immersion fitting.

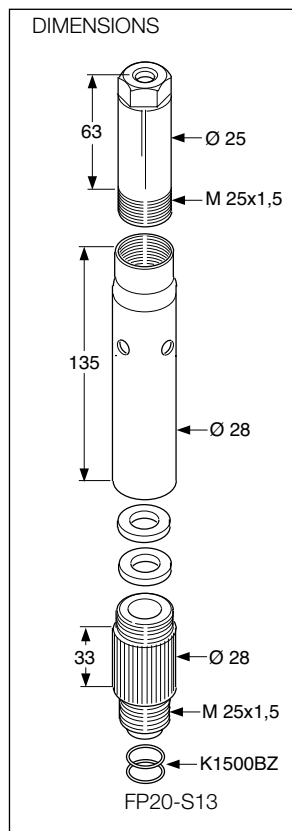
### Specifications

#### Materials

Electrode mounting set	: Ryton R4
Body	: stainless steel (AISI 316)
Screw piece	: stainless steel (AISI 316)
O-rings	: silicone
Rings	: silicone
Weight	: approx. 120 g

### Ordering Instructions

Type nr.	Description
FP20-S13	Mounting kit for SR20-AC32
K1500HC	Rubber ring (10x)
K1500GE	O-rings (5x) for "BELLOMATIC" electrode

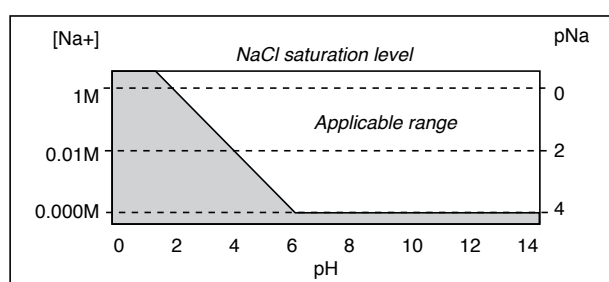


### SM23 single pNa electrode

The SM23 is suitable for long term, reliable Sodium ion monitoring. Another application is to use the pNa sensor as reference electrode for pH measurement in combination with and analyzer with dual high input impedance specification. This may considerably save maintenance costs in application where the salt content is constant and  $\text{pH} > \text{pNa} + 2$ .

pNa measurement is used in many applications, but the most frequent applications are found in pure water applications, where Sodium is measured to detect carry-over of salts in steam, leakage of salt through cation filters, Leakage of salt from leaking condensers.

Other applications where the pNa electrode is used for measurement is in brine solutions. Please note that accurate measurement requires that the pH is 2-3 units higher than the pNa value.



#### Features

- Dimensions and design meet the requirements of DIN 19263
- Temperature range 0 – 100°C
- Shockproof and heavy-duty (dome shaped) membranes
- pNa range < 0 to 4
- pH 2 units higher than the pNa ( $\text{pH} - \text{pNa} > 2$ )
- $\text{Na}^+$  range is 0.0001M up to saturation

#### Additional characteristics for type SM23-AN4

- Glass resistance @ 25°C 100-300M $\Omega$
- Suitable (Ultra-, pure-) water application
- Shock-proof glass membrane with fast response

#### Additional characteristics for type SM23-AN6

- Glass resistance @ 25°C 450 - 700M $\Omega$
- heavy-duty membrane guarantees great strength retaining the necessary sensitivity
- Especially suitable for the more harsh processes. For example brine applications

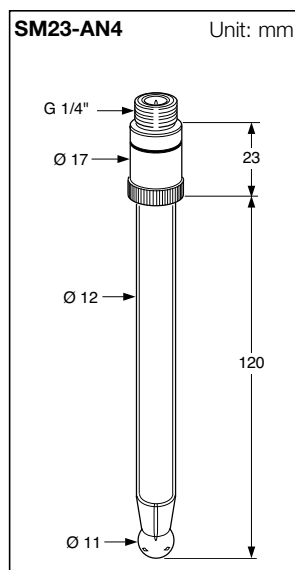
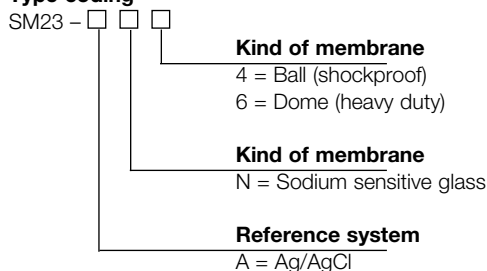
### Specifications Single pH Glass Electrodes

Type	Membrane in MOhm/25°C	Resistance* range	pH range	Temperature (°C)	Reference system	Sodium error 0,1 N[Na-]/25°C
SM23-AN4	Universal pNa-glass bulb (shockproof)	100-300	*	0 - 100	Ag/AgCl (pin)	n.a.
SM23-AN6	Universal pNa-glass bulb (heavy duty)	450-700	*	0 - 100	Ag/AgCl (pin)	n.a.

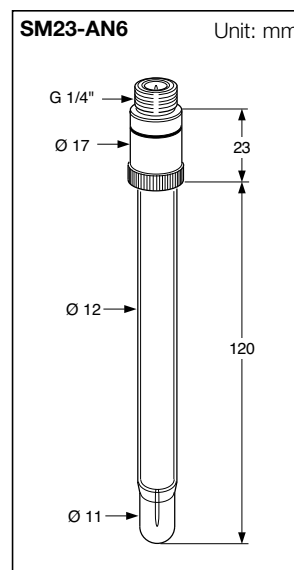
\* pNa range < 0 to 4 (0.0001M up to saturation) and pH 2 units higher than the pNa ( $\text{pH} - \text{pNa} > 2$ )

**Note:** The resistance may not exceed 1000 M $\Omega$  under measuring and calibrating conditions (according DIN the resistance of the glass may not exceed 1G $\Omega$ ). As a general rule, the glass-resistance will increase by 100% with every temperature decrease of 10°C (likewise, the glass impedance will decrease by 50% with every temperature increase of 10°C).

#### Type coding



Shock proof AN4



Heavy duty AN6



## Electrolyte Reservoirs for F..20 fittings

The purpose of the electrolyte reservoir is dual. By mounting the electrolyte reservoir at a certain distance above the electrode, the pressure on, the reference liquid in an electrode and hence, the liquid outlet of the electrode, can be increased. The amount of electrolyte is increased, so less refilling is required. The reservoir can be connected to the electrode by a silicone tube. For fixing on top of an immersion fitting a screw thread  $\frac{1}{2}$ " BSPP at the lower end of the reservoir is available.

### Specifications

Material	: PVC, PVC (transparent)
Temperature	: max. 70°C
Tube connection	: Ø 10
Screw thread	: 1/2" BSPP

### Ordering Instruction

Model	Description
SB20-VC	Ceramic Junction
SB20-VP	Porous PTFE Junction
SB20-VS	Glass Sleeve Junction

## SB20 Salt Bridge

*This reference electrode/salt bridge combination allows the measurement of pH or redox in those cases when:*

- Excessive contamination of the reference diaphragm or poisoning of the reference system is expected. The flow of the reference liquid through the diaphragm is increased by pressuring the container. The distance to the reference system is increased. Consequently, the contamination rate will decrease.
- The process can not be contaminated with KCl. The salt bridge can be filled with several types of electrolytes.
- Measurement has to be performed at processes up to 1000 kPa (10 bar) and temperatures up to 100°C. As the reference electrode is mounted in the container and therefore in more favourable conditions, the lifetime will be extended reasonably. The container with reference liquid can be pressurised.

### FLOW TUBE (A)

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

### TUBING (B)

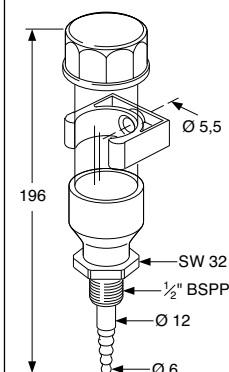
Material	: nylon
Diameter	: 1/4" o.d.
Length	: 5 or 10 mtr.

### CONTAINER (C)

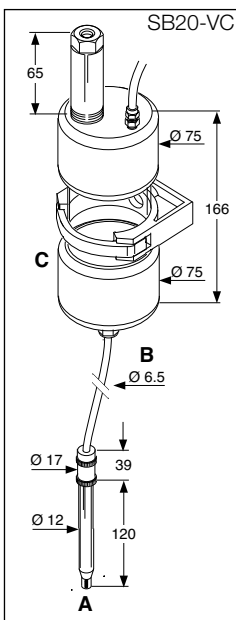
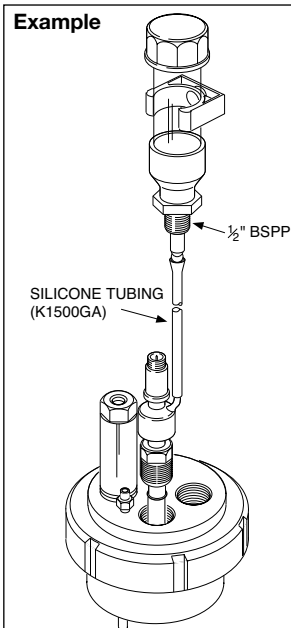
Container	: PVC, PVC (transparent)
Electrode mounting set	: Ryton R4
"O" ring	: silicone
Connection	: nylon
Weight	: approx. 300 g.
Mounting	: wall mounting (screw M5)
Temperature/pressure ratio	: max. 200 kPa (2 bar) at 100°C

The normal standard reference electrodes can be mounted in the container. This reference electrodes can be ordered separately. For standard applications the SR20-AP24 is most suitable.

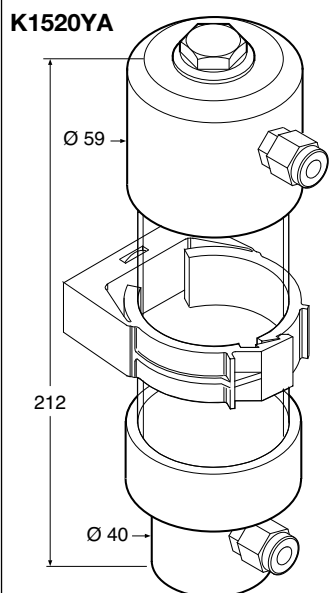
## K1500FU



## Example



## K1520YA

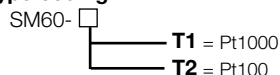




## SM60 Temperature Sensor

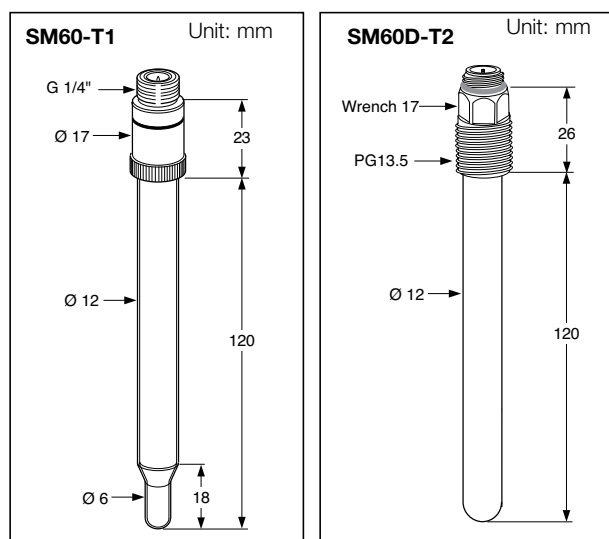
For accurate pH measurement temperature compensation is required. Either a Pt100 or a Pt 1000 temperature electrode can be selected.

### Type coding



### Specifications Temperature Sensor

Type sensor	Temperature range	Pressure range	Temperature
SM60-T2	Pt100	0 - 1 MPa	-20 - 150°C
SM60-T1	Pt1000	0 - 1 MPa	-20 - 150°C



### SM60 Temperature Sensor label

Pt100		Pt1000	
°C	Ohm	°C	Ohm
-25	90,15	-25	901,5
-20	92,13	-20	921,3
-15	94,10	-15	941,0
-10	96,07	-10	960,7
-5	98,04	-5	980,4
0	100,00	0	1000,0
5	101,95	5	1019,5
10	103,90	10	1039,0
15	105,85	15	1058,5
20	107,80	20	1078,0
25	109,74	25	1097,4
30	111,68	30	1116,8
35	113,61	35	1136,1
40	115,54	40	1155,4
45	117,47	45	1174,7
50	119,40	50	1194,0
55	121,32	55	1213,2
60	123,24	60	1232,4
65	125,26	65	1252,6
70	127,08	70	1270,8
75	129,00	75	1290,0
80	130,91	80	1309,1
85	132,81	85	1328,1
90	134,70	90	1347,0
95	136,60	95	1366,0
100	138,50	100	1385,0
105	140,40	105	1404,0
110	142,29	110	1422,9
115	144,18	115	1441,8
120	146,07	120	1460,7

### Spare Parts SC21

Part no.	Description
K1500BZ	O-rings Viton 11x3 (6Pcs)
K1500GF	1 Molal KCl solution (250 ml)
K1500GG	1 Molal KCl solution (250 ml), thickened
K1520BB	Three bottles with NIST buffer 2.68 pH (replacing 6C231)
K1520BC	Three bottles with NIST buffer 4.01 pH (replacing 6C232 and K94...)
K1520BD	Three bottles with NIST buffer 6.86 pH (replacing 6C237 and K94...)
K1520BE	Three bottles with NIST buffer 9.18 pH (replacing 6C234 and K94...)
K1520JN	Adapter M25x1.5 - PG13.5
K1520VA	3.3 molal KCl solution (250 ml.)
K1520VN	3.3 molal KCl solution (250 ml.), thickened

### Spare Parts SR20(D)

Part no.	Description
K1500BZ	O-rings Viton 11x3 (6Pcs)
K1500FZ	O-rings 10x4 5pcs SR20-AC52
K1500GE	O-ring sets (5x). SR20(D)-C32/52
K1500GF	1 Molal KCl solution (250 ml)
K1500GG	1 Molal KCl solution (250 ml), thickened
K1520VA	3.3 molal KCl solution (250 ml.)
K1520VN	3.3 molal KCl solution (250 ml.), thickened

### Spare Parts SB20

Part no.	Description
K1500BW	Flow tube for SB20-VC
K1500DW	Set of 12 cable nuts for WU20
K1500DV	Mounting adapter PG13.5 - M25 (PVDF)
K1500DX	5 m tubing for SB20
K1500EE	Flow tube for SB20-VP
K1500EF	Flow tube for SB20-VS
K1500FU	Electrolyte reservoir (SR20-A.52 / SC21-A.C52) (includes 2.5 mtr. silicon tubing)
K1500GA	5 mtr silicon tubing (7x4mm od,id)
K1500GF	1 Molal KCl solution (250 ml)
K1500GG	1 Molal KCl solution (250 ml), thickened
K1500GR	O-rings silicon 11x3 8pcs
K1500HD	O-rings silicon 11x3 50pcs
K1520JN	Mounting adapter PG13.5 - M25 (PVC-C)
K1520VA	3.3 molal KCl solution (250 ml.)
K1520VN	3.3 molal KCl solution (250 ml.), thickened

## WU20(D) Cables for Industrial Applications

When you need optimal pH or Redox measuring results, the complete measuring loop not only requires highly qualified sensors and transmitters but also the special purpose sensor cables.

The program of Yokogawa includes a range of high quality, low-noise cables for accurate transmission of low voltage signals even in areas where interference is present. They have a shield with an internal anti-noise sheath and can be connected to all pH and ORP (Redox) electrodes fitted with an O-connector.

At the electrode end the cables are provided with a socket having spring gilded contacts for secure connection to the sensor.

The combination electrode plug and cable socket is watertight and temperature resistant up to 125°C. It meets the requirements of IP 65.

### Features

- Internal anti-noise sheath for accurate measurement.
- Gold plated spring O-connectors parts, for good electrical contact under the most severe conditions.
- Coaxial plug and socket with watertight sealing that meets the requirements of IP 65.
- Cables for industrial applications and for laboratory use are available.

### Coax Cables

These cables are for connecting to **single or combined** sensors fitted with an O-plug. For use at higher temperature specifications (up to 110°C continuously or 125°C for short times) and the most severe conditions.

### Triax Cables

These cables are for connecting to **combined** sensors fitted with an O-plug or to **single** sensors with an O-plug for use in areas where electrical interference is present. They have both inner, and outer shielding. In areas where electrical interference is likely we recommend to use the Triax electrode cable type WU20(D)-LT. marked with a blue strip.

### Notes:

- For industrial applications the cables can be colour coded with the following marks:
  - Measuring electrode : red
  - Reference electrode : yellow
  - Temperature electrode: green
  - Combined electrode : blue
 Adhesive markers are provided for this purpose and should be fitted to both ends of the cables.
- To secure optimal conditions, the cables may not be damaged or shortened. For protection of the cables there are special hoses available of 5 or 10 mtr. (K1500CJ, K1500CK respectively)
- Suitable for use in intrinsically safe areas.

### Specifications

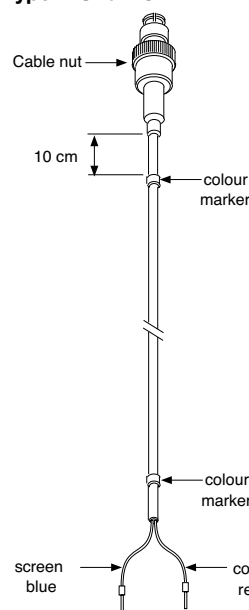
**Bending radius** : min. 50 mm

#### Max. temperature

- type WU20(D)-PC : 110°C (continuously)  
125°C (for short times)
- type WU20(D)-LT : 70°C (continuously)

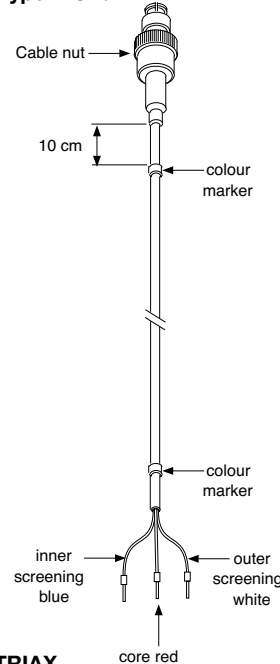
**Wire connections** : 2 mm contact pins

Type WU20-PC



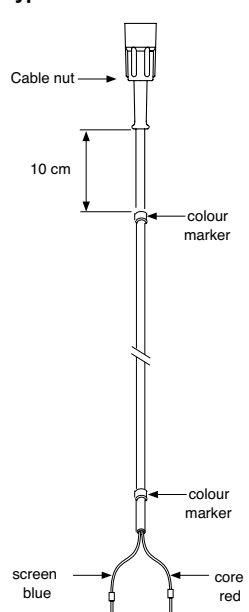
COAX

Type WU20-LT



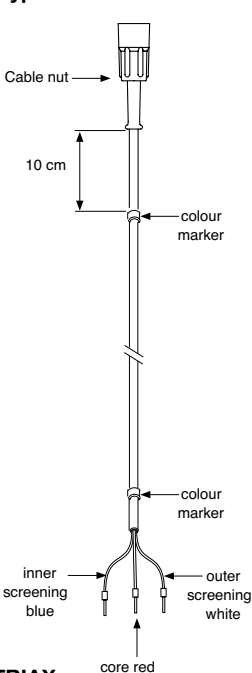
TRIAX

Type WU20D-PC



COAX

Type WU20D-LT

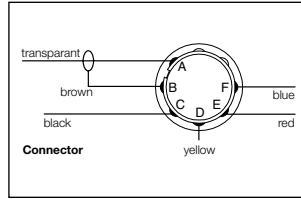
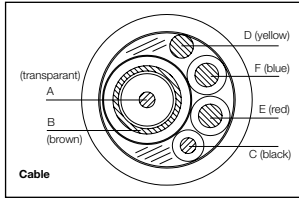


TRIAX

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

## Specifications WU10-V-S-□-□

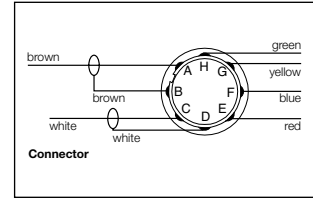
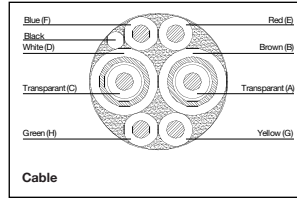
### Single Coax



Description	: Multi core shielded cable with one low-noise coax and three insulated wires
Max. temperature	: 90 °C continuously and 105 °C for max. 1000 hr.
Sheath	: PVC
Colour	: Black
Diameter	: 6.5 mm
Internal insulation	: HDPE (Polyethylene)
Isolation resistance	: > $1.5 \times 10^{13}$ Ohm between E, F and overall shield > $0.5 \times 10^{13}$ Ohm between D and overall shield > $1.5 \times 10^{14}$ Ohm between A and overall shield
Capacity	: <100 pF/m between A and overall shield <120 pF/m between A and B <350 pF/m between B and overall shield
Resistance	: <100 Ohm/km for A <45 Ohm/km for wire C, E and F <100 Ohm/km for wire D
Coaxial cable	: Brown Thermoplastic Rubber sheath. : After termination core lead insulation transparent and shield insulated with brown cover : Diameter 3.3 mm
Wire D	: Bare drain wire covered with Yellow insulation after termination (overall shield)
Wire C	: Black cover diameter 1.2 mm
Wire E	: Red cover diameter 1.5 mm
Wire F	: Blue cover diameter 1.5 mm

## Specifications WU10-V-D-□-□

### Dual Coax



Description	: Multi core shielded cable with two low-noise coaxes and four insulated wires
Max. temperature	: 105 °C continuously and 125 °C for max. 3000 hr.
Sheath	: Thermoplastic Rubber sheath copper stabilized
Colour	: Black
Diameter	: 7 mm
Internal insulation	: Thermoplastic Rubber sheath copper stabilized
Isolation resistance	: > $1.5 \times 10^{13}$ Ohm between E, F, G, H and overall shield > $0.5 \times 10^{13}$ Ohm between black wire and overall shield > $1.5 \times 10^{14}$ Ohm between A and overall shield
Capacity	: <90 pF/m between A, C and overall shield <120 pF/m between A and B and between C and D <350 pF/m between B, D and overall shield
Resistance	: <100 Ohm/km for A and C <45 Ohm/km for wire C, E and F <100 Ohm/km for wire D
Coaxial cables	: Brown or white Thermoplastic Rubber sheath copper stabilized. : After termination core lead insulation transparent and shield insulated with brown or white cover : Diameter 2.7 mm
Black wire (drain)	: Bare drain wire covered with Black insulation after termination (overall shield)
Wire E	: Red cover diameter 1.4 mm
Wire F	: Blue cover diameter 1.4 mm
Wire G	: Yellow cover diameter 1.4 mm
Wire H	: Green cover diameter 1.4 mm

Flame retardant in accordance to IEC 60332-1

### Model and Suffix codes

Model	Suffix Code	Description
WU10		Sensor cable
Connector type	-V	Variopin
Cable type	-S	Single Coax
	-D	Dual Coax
Cable length	-02	2 meters
	-05	5 meters
	-10	10 meters
	-15	15 meters
	-20	20 meters



# General Specifications

Model PH20, FU20 and FU24  
4 in 1 pH sensor

A family of 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 reduce 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.

## For general purpose applications the FU20 is the sensor of choice:

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 (Ryton™) 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.

## For more difficult applications the FU24 sensor will be the better choice:

The FU24 is also made with a chemical resistant PPS 40GF body. It is particularly useful in harsh applications with fluctuating pressure and/or temperature. These processes can be "killing" for a sensor. Process fluid may be moving in and out of the sensor under influence of frequent pressure and/or temperature fluctuations. This results in fast desalting and dilution of the reference electrolyte. This on its turn will change the reference voltage and cause a drifting pH measurement.

By using the successful Yokogawa patented Bellow system integrated in the FU24 electrode, a strong pressure compensation mechanism is created. The build-in bellow ensures immediate interior pressure equalization to the outside pressure, making the sensor virtually insensitive to external pressure variations.



A slight overpressure caused by the bellow tension, prevents fluid ingress and maintains a positive ion flow out of the sensor. This feature is of particular interest in pure water applications.

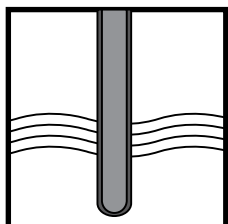
## In applications where chemical resistance is a vital issue the PH20 will be a good choice:

The PH20 body is made of chemically resistant PVDF. The sensor is nicknamed "Tempress" because of the patented compensation for changes in the process temperature and pressure. A simple mechanical feature makes the sensor more accurate, and gives it a longer lifetime. The compensation panels flex to accommodate changes in the avoiding large differential pressures across the diaphragm. This prevents most problems associated with the reference junction.

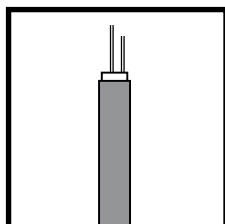
Both FU20 and FU24 are also available with VP connector. This makes installation a lot easier. All sensors are delivered with a Quality Certificate.

pH/Redox  
Analyzers

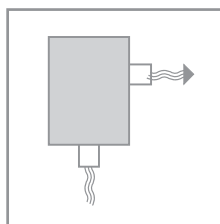
## System Configuration



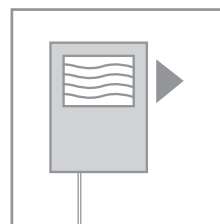
Sensors



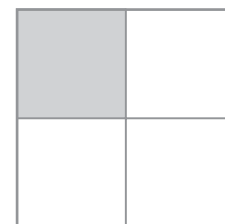
Cables



Fittings



Transmitters



Accessories

## General Specifications FU20

<b>Measuring elements</b>	: pH glass electrode
	: Silver Chloride reference
	: Solid Platinum electrode
	: Pt1000 temperature sensor

### Construction materials

Body	: PPS 40GF (glass filled Ryton)
Earthing pin	: Solid platinum
O-ring	: None
Reference Junction	: Porous PTFE
Cable	: Coaxial with 4 extra leads
Sheet material	: Thermoplastic rubber
Measuring Sensor	: G-Glass

### Functional specifications (at 25°C)

Isothermal point	: pH 7
Reference system	: Ag/AgCl with saturated KCl
Glass impedance	
- Dome shape	: nominal 200MΩ, G-glass
- Flat Surface	: nominal 700MΩ, G-glass
Junction resistance	: 1 to 10 kΩ
Temperature element	: Pt1000 to IEC 751
Asymmetry potential	: 8 ± 15 mV
Slope	: > 96 % (of theoretical value)

### Dynamic specifications (at 25°C)

Response time pH step (7 to 4)	: < 15 sec for 90%
Response time temp step (10°C)	
- Dome shape	: < 1 min for 90%
- Flat Surface	: < 1.5 min for 90%
Stabilization time (0.02 pH unit/10 s)	: < 2 minutes

### Operating range

pH	: 0 - 14*
Temperature	: -10 to 105°C (14 to 212 °F)
Pressure	: 0 to 10 bar (0 to 142 PSIG)
Conductivity	: > 50 µS/cm
Storage temperature	: -10 to 50°C (-22 to 122 °F)

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

## General specifications FU24

<b>Measuring elements</b>	: pH glass electrode
	: Silver/Silver Chloride reference
	: Solid Platinum electrode
	: Pt1000 temperature sensor

### Construction materials

#### Wetted materials:

Body	: PPS 40GF (glass filled Ryton)
Earth Pin	: Solid platinum
O-ring	: Viton
Reference Junction	: Porous PTFE
Measuring Sensor	: G-Glass

### Functional specifications

Isothermal point	: pH 7
Glass impedance	
- Dome shape	: nominal 200 MΩ
- Flat Surface	: nominal 700 MΩ
Reference system	: Double junction, Ag/AgCl with saturated KCl, including Ag <sup>+</sup> ion trap
Junction resistance	: 1 to 15 kΩ
Temperature element	: Pt1000 to IEC 751
Asymmetry potential	: 8 ±15 mV
Slope	: > 96 % (of theoretical value)

**Note:** The temperature sensor included in the FU24 is intended to provide indication and cell compensation. The construction has not been tested to the pressure vessel standards required for plant temperature control.

### Dynamic specifications

Response time pH step (7 to 4)	: < 15 sec for 90%
Response time temp step (10°C)	
- Dome shape	: < 1 min for 90%
- Flat Surface	: < 1.5 min for 90%
Stabilization time (0.02 pH unit/10 s)	: < 1 minutes

### Operating range

pH	: 0 to 14
Temperature	: -10 to 105 °C (14 to 221 °F)
Pressure	: 0 to 10 bar (0 to 145 PSIG)
Storage temp.	: -15 to 50 °C (5 to 122 °F)

**Note:** The FU24 is suitable for pure water applications.

**Note:** Specifications should not be considered in isolation.

For example the pH range can be 2-12pH, where the measurement is at elevated temperatures. For advice about specific applications please contact your local sales office.

## General Specifications PH20

**Measuring elements** : pH glass electrode and Silver /Silver chloride reference system.  
: Platinum electrode and Pt1000 temperature sensor.

### Construction materials

Body : PVDF  
Earthing pin : Solid platinum/glass  
O-ring : Viton  
Reference junction : Porous PTFE  
Cable : Coaxial with 4 extra leads  
Sheet material : Thermoplastic rubber  
Measuring Sensor : G-Glass

### Functional specifications (at 25°C)

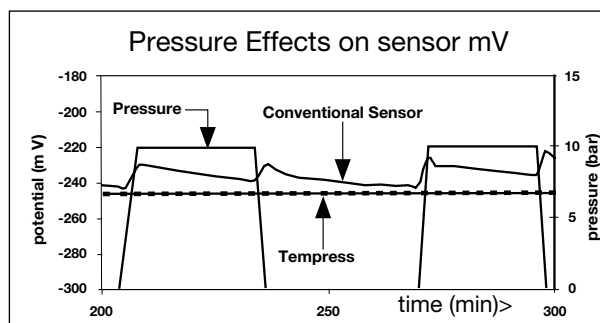
Isothermal point : pH 7  
Reference system : Ag/AgCl with saturated KCl  
Glass impedance : 200 M $\Omega$  (nominal), G-glass  
Junction resistance : 1 to 10 k $\Omega$   
Temperature element : Pt1000 to IEC 751  
Asymmetry potential :  $8 \pm 15$  mV  
Slope :  $> 96$  % (of theoretical value)

### 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 %  
Stabilisation time (0.02 pH/10 s)  
:  $< 1$  minute

### Operating range

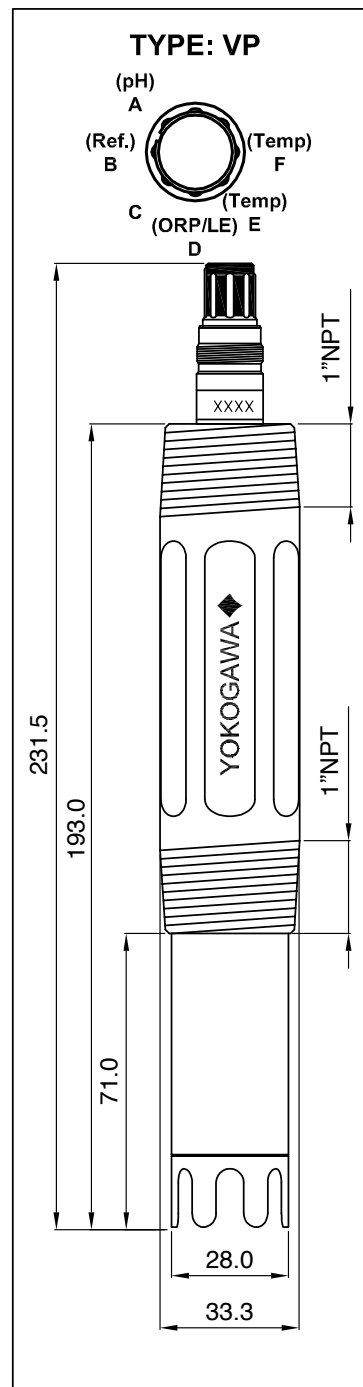
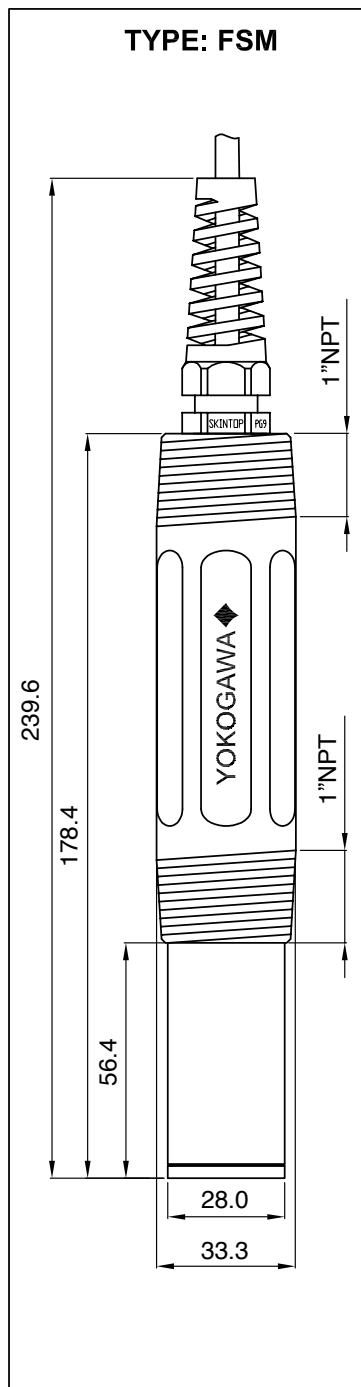
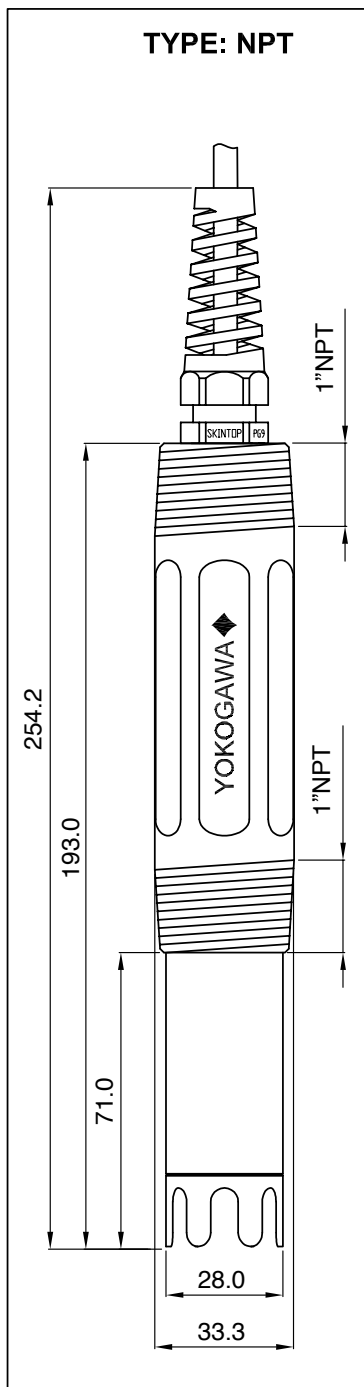
pH : 0 - 14\*  
Temperature : -10 to 105°C (14 to 212 °F)  
Pressure : 0 to 10 bar ( 0 to 142 PSIG)  
Conductivity :  $> 50$   $\mu$ S/cm  
Storage temperature : -10 to 50°C (-22 to 122 °F)



The erratic trend of the standard sensor shows the progressive contamination of its reference junction. The graph indicates between 0.1 to 0.4 pH error with the conventional sensor while the readings from the PH20 are extremely stable.

Sensor	FU20-03 FU20-05 FU20-10 FU20-20	FU20-VP	FU24-05 FU24-10	FU24-VP	PH20	
Cable	Integrated	WU10-V-S-02 WU10-V-S-05 WU10-V-S-10 WU10-V-S-15 WU10-V-S-20	Integrated	WU10-V-S-02 WU10-V-S-05 WU10-V-S-10 WU10-V-S-15 WU10-V-S-20	Integrated	
Fitting	Flow Immersion Sub assembly	FF40 + option /FPS or K1523DD FD40 + option /FPS or K1523DD FS40 + option /FPS or K1523DD	Flow Sub assembly	FF20 + K1521JA FS20 + K1521JA	Flow Immersion Subassembly	FF20-*22 FD40 + option /SF4 or K1547QF FS20-*22
Cleaning	Option HCNF or K1547PJ				Option /HCN2 or K1547PA when using FF20 or FS20 Option /HCNF or K1547PJ when no fitting is used	
Adapters	1"NPT SS 1"NPT T1 1"BSP SS 1"BSP Ti	/NSS or K1547PK /NTI or K1547PM /BSS or K1547PL /Bti or K1547PN			3/4"NPT SS /SN3 or K1547QA 3/4"R SS /SR3 or K1547QB 1"NPT PVDF /FN4 or K1547PC 1"R PVDF /FR4 or K1547PD For PH8 combi fittings /PH8 or K1547PE	

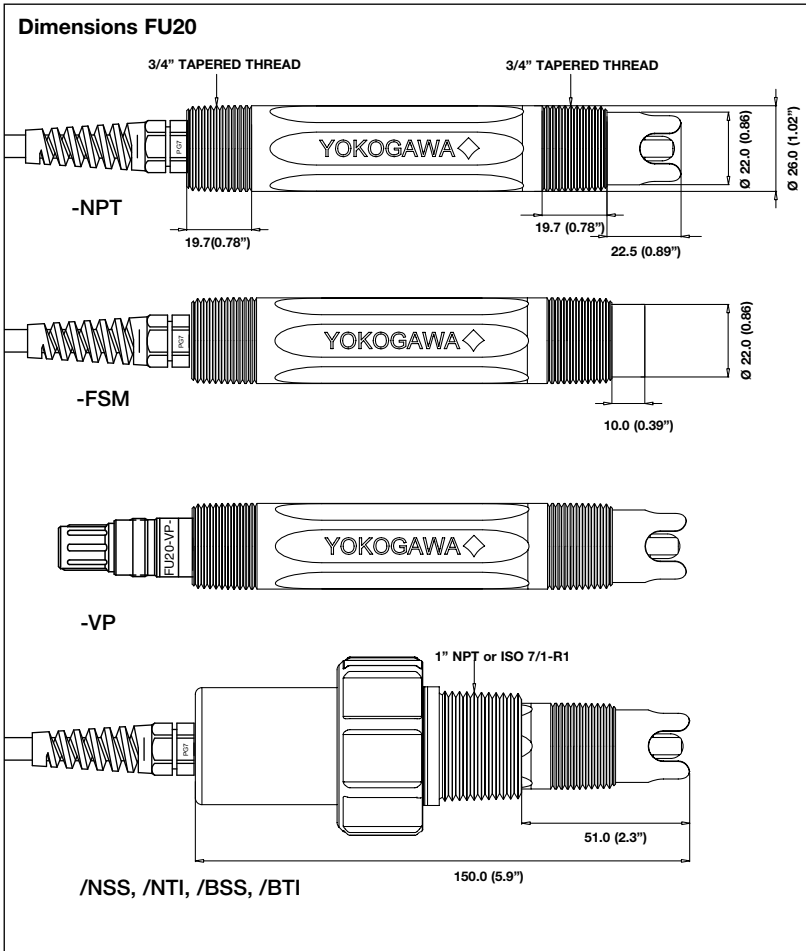
# Dimensions FU24



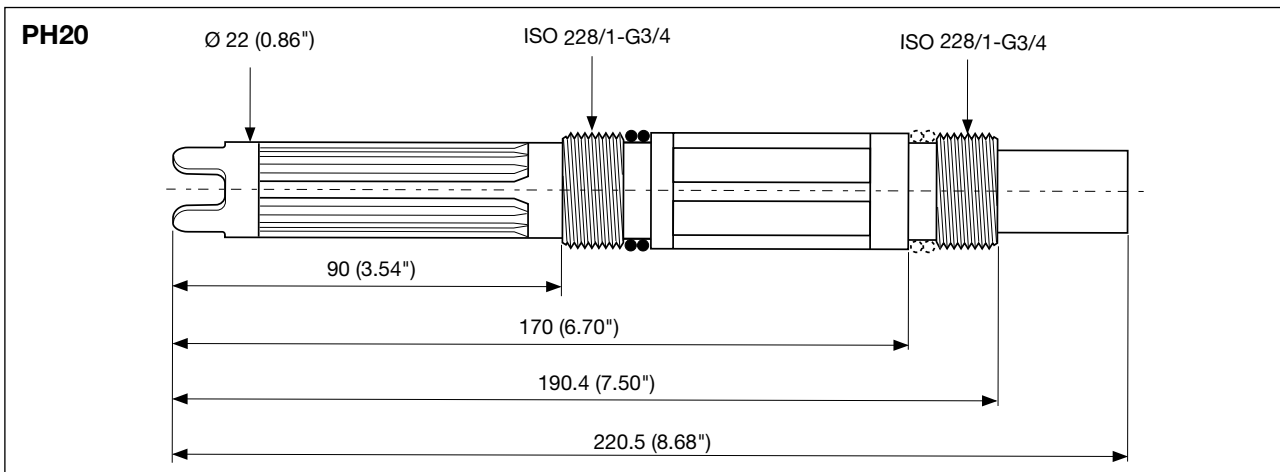
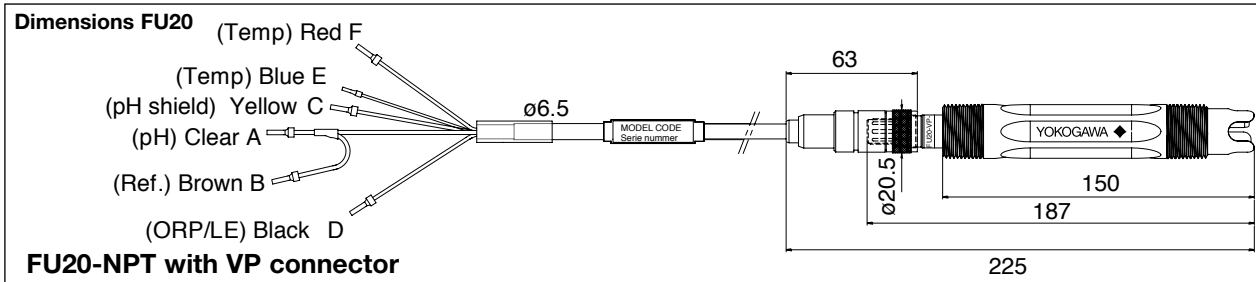
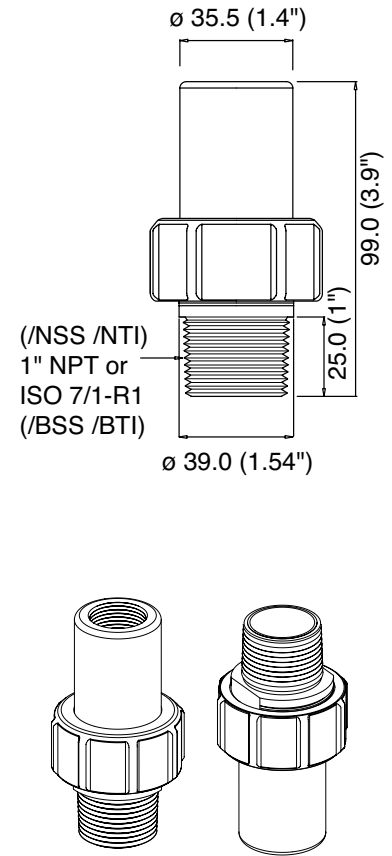
Unit: mm



## Dimensions



## FU20 Adapter

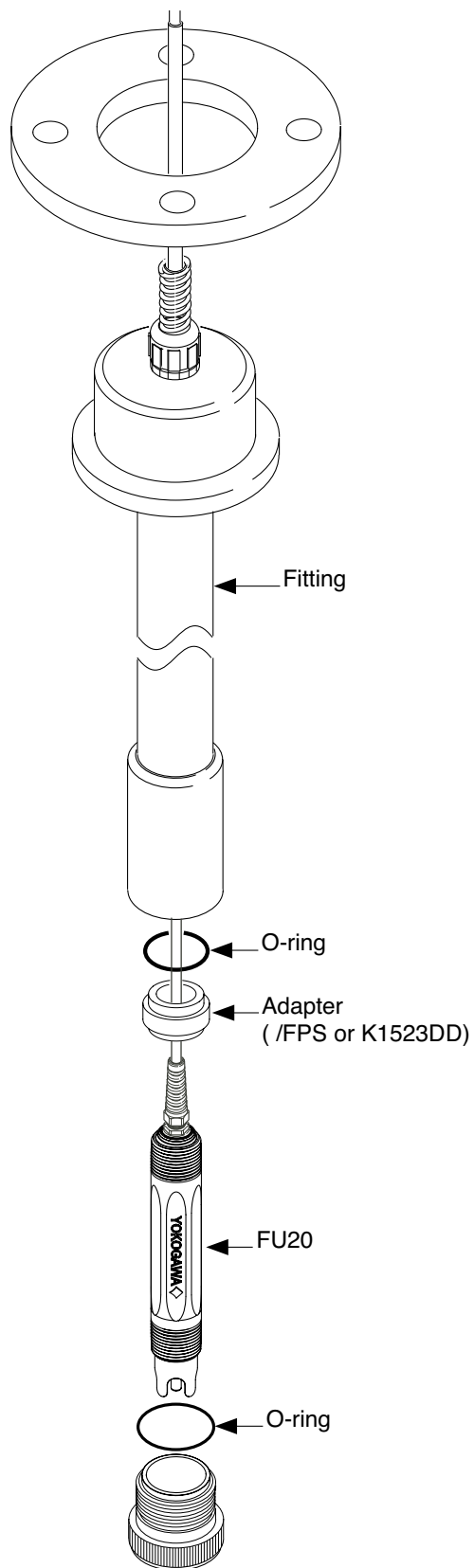


Unit: mm (inches)

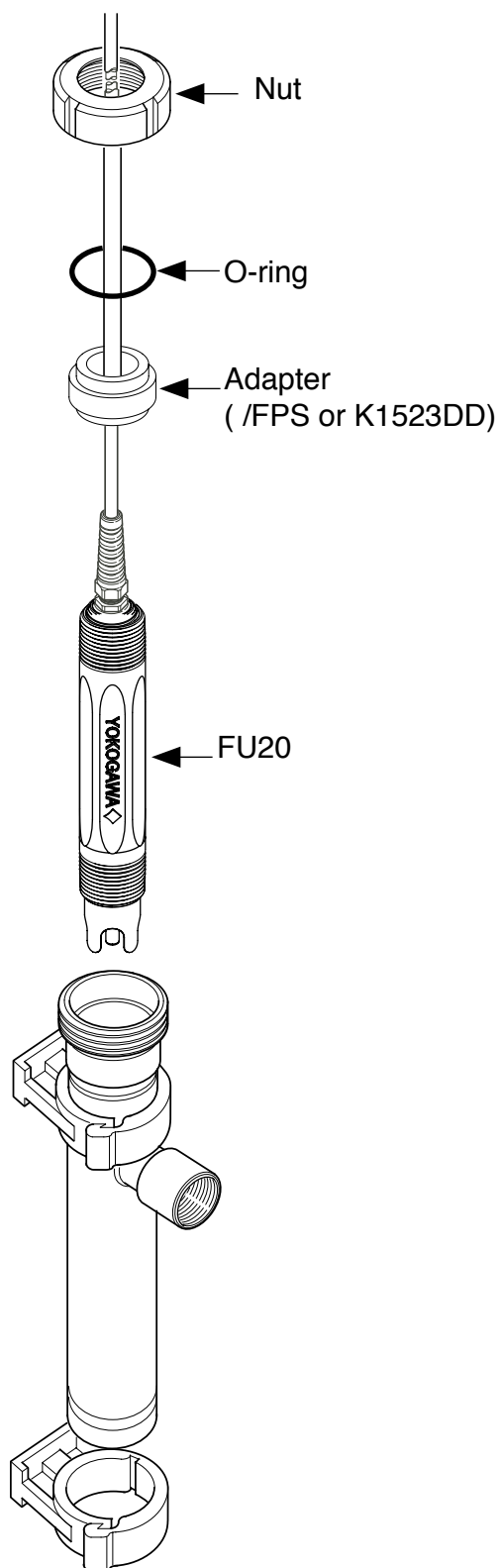
GS 12B6J3-E-E

# Installation examples using the FU20 adapter range

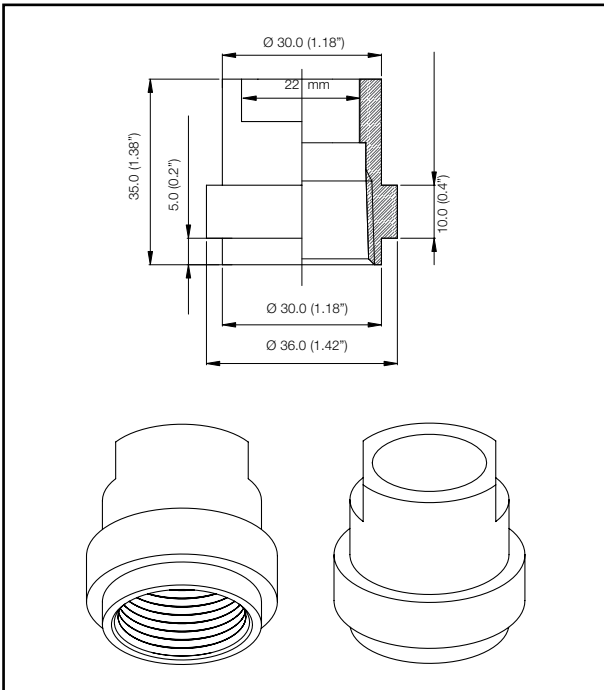
## FD40 also for FF40 and FS40



## FF40 example



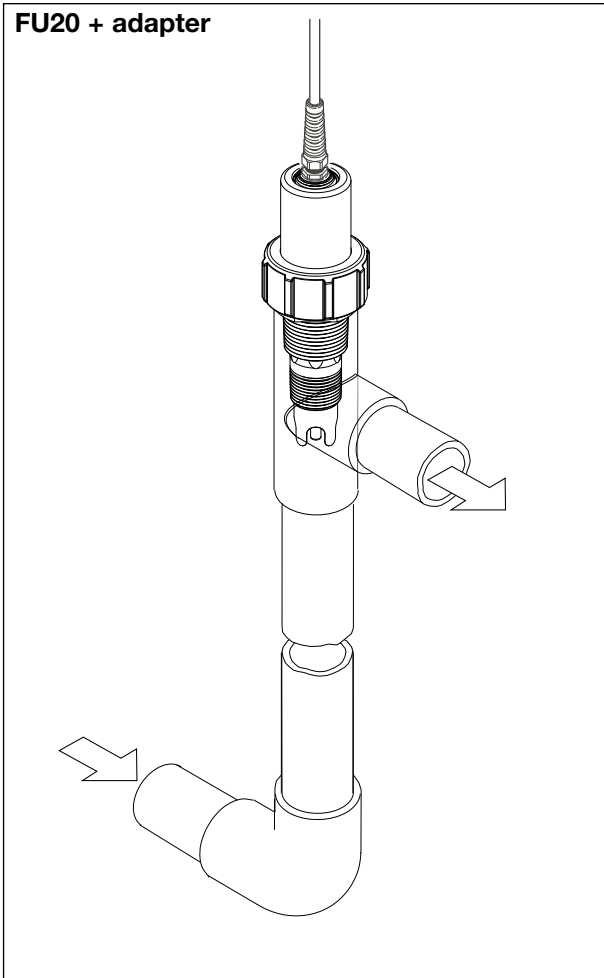
GS 12B6J3-E-E



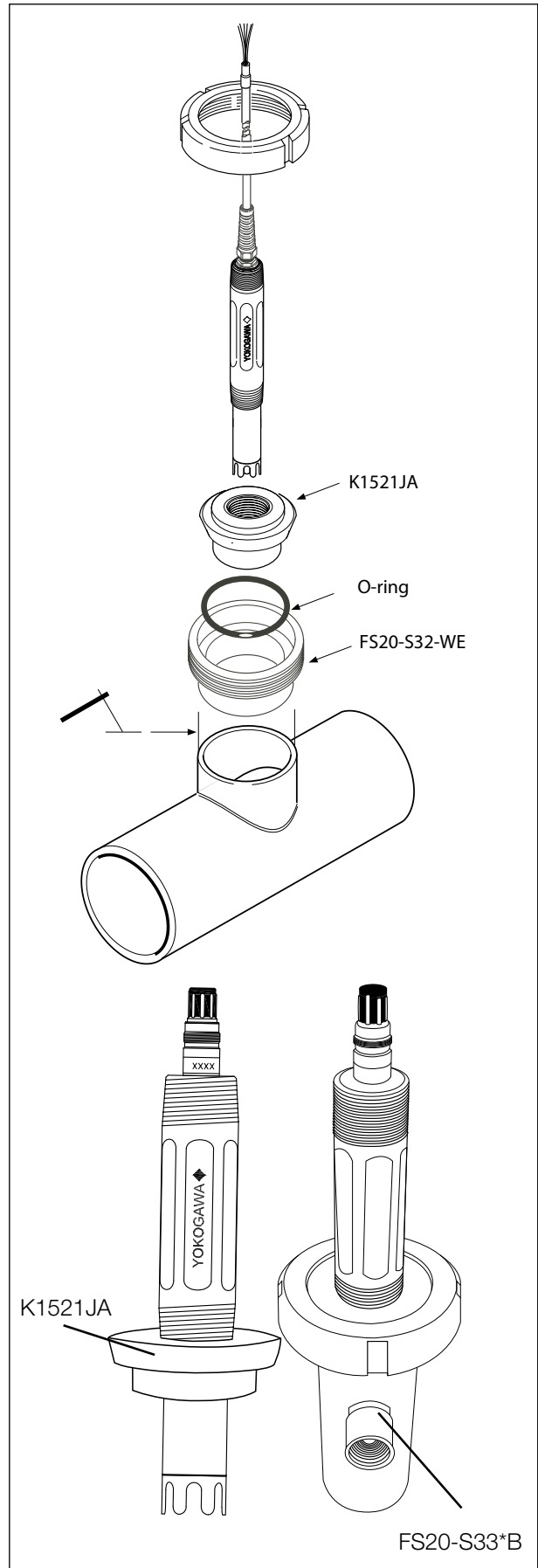
Dimensions Ryton adapter for FF40, FS40 and FD40 fittings (/FPS or K1523DD)

**Note:** old part K1523DC is not compatible with VP connector and sensors manufactured after December 2009.

#### FU20 + adapter

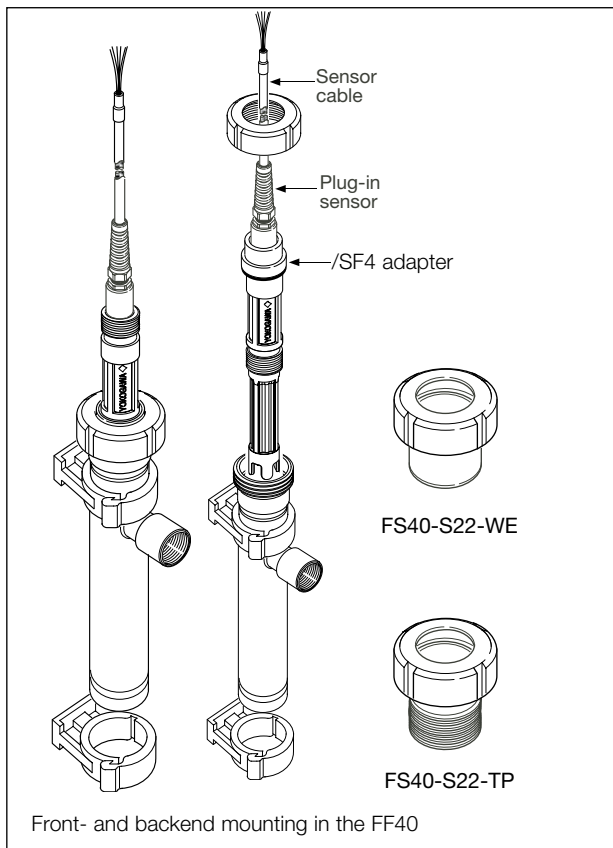


#### FS20 installation example for FU24

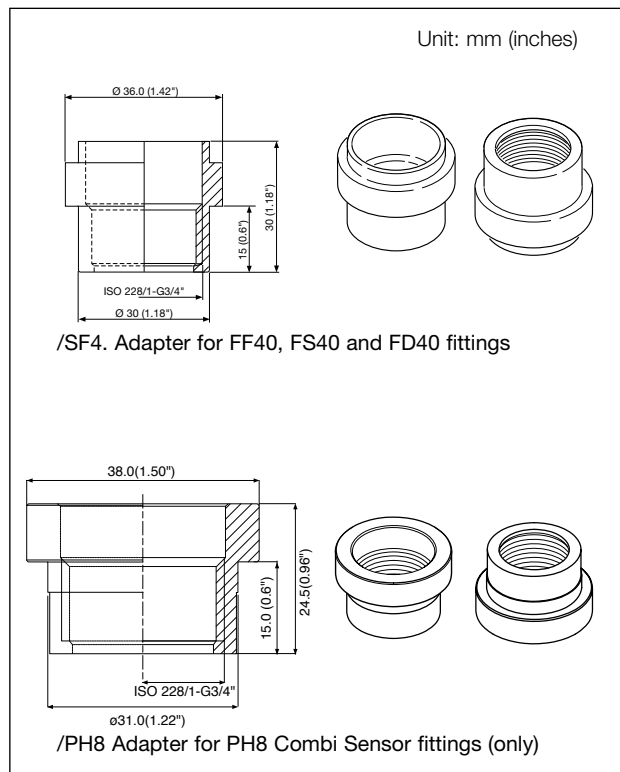
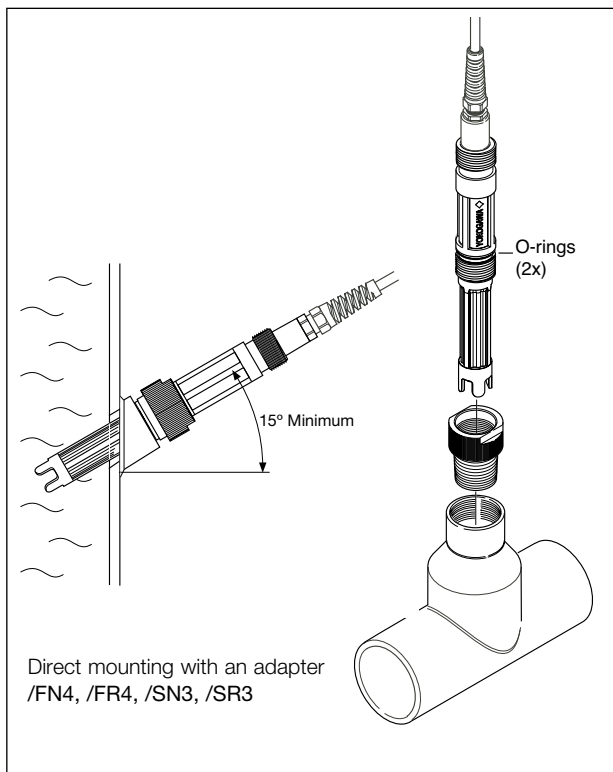
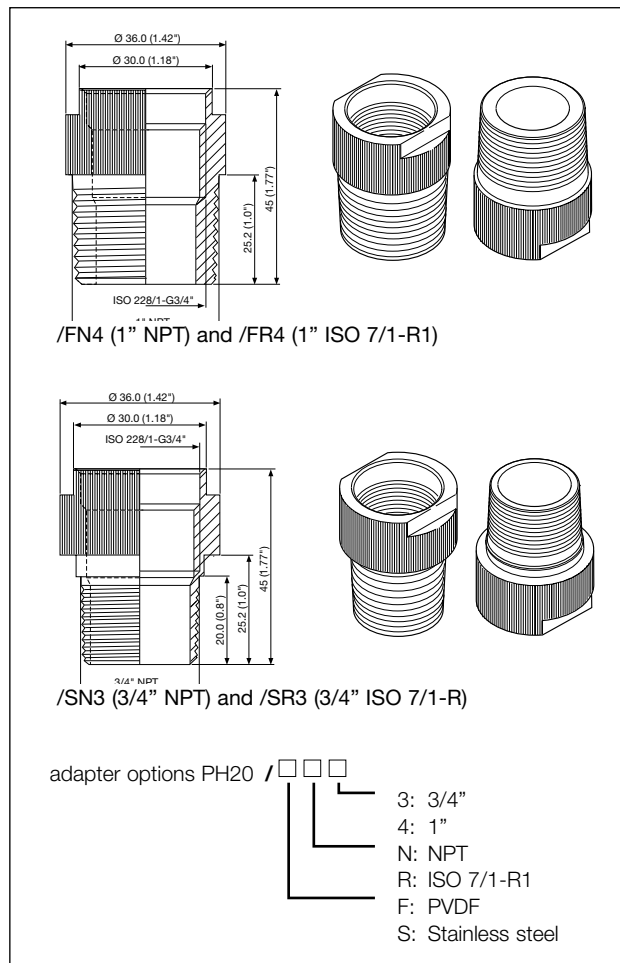


GS 12B6J3-E-E

## Installation examples using the PH20 adapter range



Using the /SF4 adapter, the PH20 can be mounted in the standard range of conductivity flow fitting (FF40...), the immersion fittings (FD40...) and sub-assemblies (FS40...). The adapter can be mounted on the front thread, or the back thread dependent on the required insertion depth.



## Model and Suffix codes

Model code	Suffix code	Option code	Description
<b>FU20</b>			Wide body sensor
	-VP		Variopin connector
Cable length	-03 -05 -10 -20		3 meter 5 meter 10 meter 20 meter
Temp. element	-T1		Pt1000
Model	-NPT -FSM		Dome shape model Flat surface model
Options		/HCNF /FPS /NSS /NTI /BSS /BTI	Hastelloy cleaning system Adapter F*40 from noryl 1" NPT adapter, SS (316L) 1" NPT adapter, Titanium 1" BSP adapter, SS (316L) 1" BSP adapter, Titanium

Model code	Suffix code	Option code	Description
<b>FU24</b>			Combined pH sensor
Sensor connection	-05 -10 -VP		5m fixed cable 10m fixed cable Variopin connector
Temperature sensor	-T1		Pt1000
Sensor tip	-FSM -NPT		Self cleaning, flat surface Heavy duty, dome shaped
Reference system	- N		Non-flowing
Options			

Model code	Suffix code	Option code	Description
<b>PH20</b>			4-in-1 pH sensor
Material	-F		PVDF
Membrane	-G		Dome shaped
Cable length	-02 -05 -10 -20 -30		2 meter 5 meter 10 meter 20 meter 30 meter
Temp. element	-T1		Pt1000
	-N -A		Always -N -A
Options		/SN3 /SR3 /FN4 /FR4 /PH8 /SF4 /HCNF	Stainless steel 3/4" NPT adapter (316L) Stainless steel 3/4" R adapter (316L) PVDF 1" NPT adapter PVDF 1" R adapter Adapter for PH8 combi sensor fittings (only) Stainless steel adapter for FF40, FS40 and FD40 fittings Hastelloy cleaning system

Model code	Suffix Code	Option code	Description
<b>WU10</b>			Sensor cable
Connector type	-V		Variopin
Cable type	-S		Single Coax
Cable length	-02 -05 -10 -15 -20		2 meters 5 meters 10 meters 15 meters 20 meters

## Spare parts PH20, FU20, FU24 & cleaning system

Part no.	Description
K1500EK	O-rings Viton 6.07x1.78 (5x2)
K1500ER	O-ring set Viton FF20-S22
K1511DP	O-rings Viton 21.9x2.62 (5x2)
K1511DQ	O-rings EPDM 21.9x2.62 (5x2)
K1521JA	SS holder FU24 1"NPT FF20 + FS20
K1547PC	/FN4 for PH20
K1547PD	/FR4 for PH20
K1547PE	/PH8 for PH20
K1547PG	Nozzle and mounting HCN4
K1547PP	Spare Part EPDM spraying valves
K1547QA	/SN3 for PH20
K1547QB	/SR3 for PH20
K1547QF	/SF4 for PH20
K1500FR	O-rings Viton 29.82x2.62 (5)
K1500FS	O-rings EPDM 29.82x2.62 (5)
K1500FT	O-rings Silicone, 29.82x2.62 (5)
K1520ZD	Mounting nut for PH20
K1523DD	/FPS, FU20-mounting in F*40
K1547PK	Adapter 1" NPT, SS 316 for FU20
K1547PL	Adapter 1" BSP, SS 316 for FU20
K1547PM	Adapter 1" NPT, Ti for FU20
K1547PN	Adapter 1" BSP, Ti for FU20
K1547PJ	Hastelloy cleaning unit HCNF
K1547PF	Nozzle and mounting HCN2/3/F

## Spare Parts

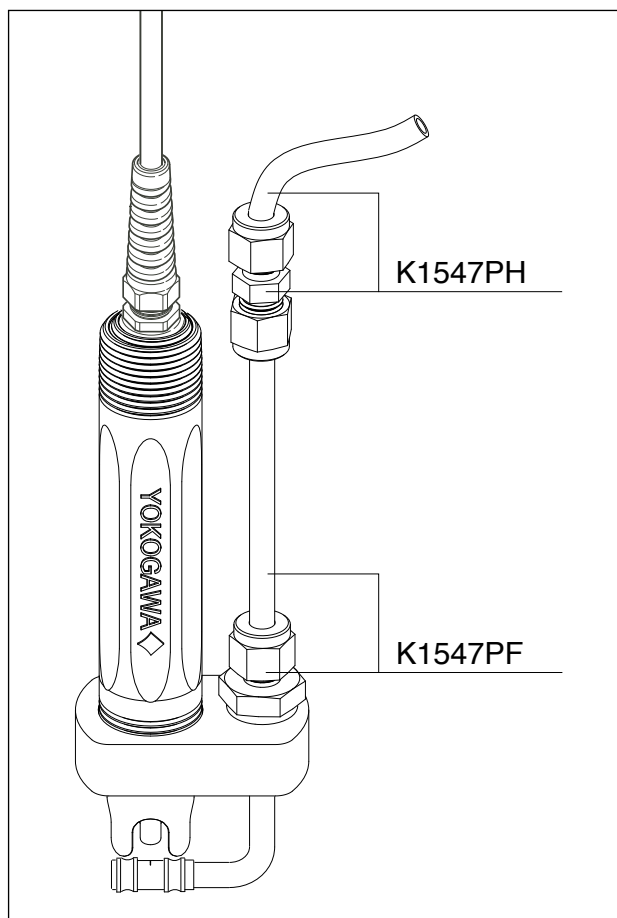
Prod. No.	Description
K1520BA	Starters Kit: (3x 500 ml)
	Buffer Solutions pH 4.01 / 6.87 / 9.18
K1520BB	Buffer Solution (500 ml) pH 1.68
K1520BC	Buffer Solution (500 ml) pH 4.01
K1520BD	Buffer Solution (500 ml) pH 6.87
K1520BE	Buffer Solution (500 ml) pH 9.18
K1521JA	SS holder FU24 1"NPT FF20 + FS20

## Connection equipment

BA10	Junction box for pH extension cables
WF10-xxx-F	pH signal cable with terminated ends. Specify length in whole meters
WU10-V-S-XX	Variopin cable

## Cleaning system for FU20 & PH20

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.



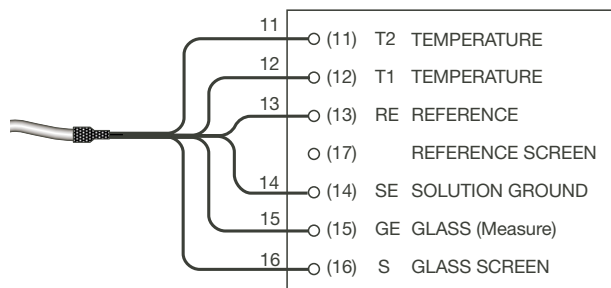
Option /HCNF

## Wiring of the PH20 / FU20 / FU24

### Conventional pH (& ORP) wiring

Connect the cable versions PH20, FU20 or FU24 to the EXA or EXAxt PH analyzer as shown. With this configuration, it is possible to measure ORP (or rH) at the same time (Refer to the EXA or EXAxt manual for appropriate impedance jumper and Service Code settings).

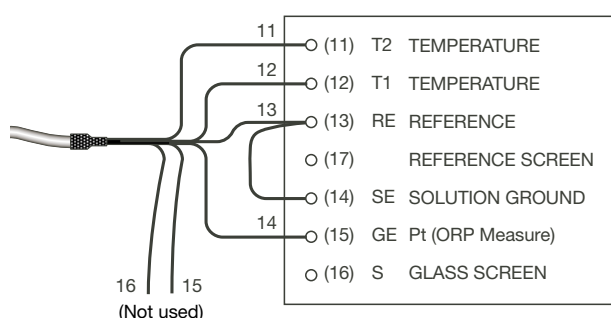
pH (& ORP) WIRING DIAGRAM



### Wiring for ORP measurement with normal reference

Connect the PH20, FU20 or FU24 to the EXA PH analyzer as shown. Refer to the EXA manual for appropriate impedance jumper and Service Code settings.

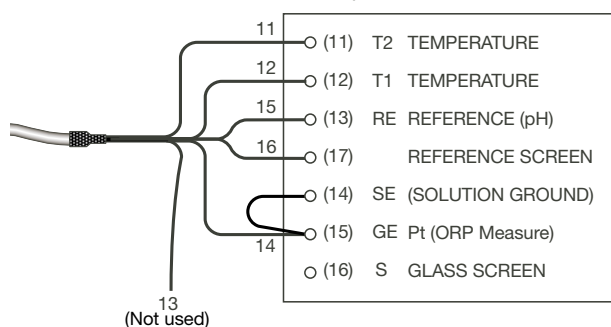
ORP WIRING DIAGRAM with normal reference



### Wiring for ORP measurement with pH reference

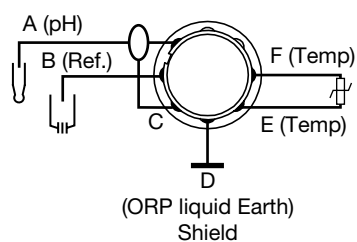
Connect the PH20, FU20 or FU24 to the EXA Glass PH analyzer as shown. Refer to the EXA manual for appropriate impedance jumper and Service Code settings.

ORP WIRING DIAGRAM with pH sensor as reference

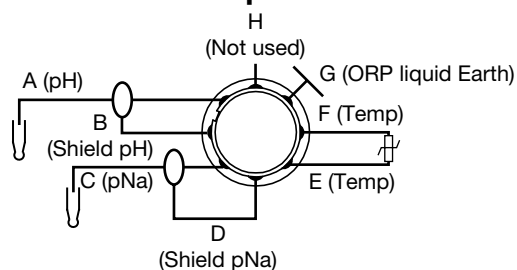


## Pin lay-out for Variopin sensors

### pH sensor



### Differential pH sensor



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Please refer to the European website ([www.yokogawa.com/eu](http://www.yokogawa.com/eu)) to contact your nearest representative.



**YOKOGAWA** ◆



# General Specifications

## Hamilton Industrial Electrodes for pH/Redox

*When you purchase an analyzer system from Yokogawa, you know you are getting the ultimate technology fit for your purpose. Because Yokogawa is a global leader in analyzer technology based on an outstanding track record of continuous innovation. And now Yokogawa has signed a Global Preferred Vendor Agreement with the Hamilton Company a world leader in sensor technology.*

*This agreement is to supply sensors to meet the stringent requirements of the pharmaceutical and biotechnology industries and in food production processes such as fermentation.*

### Hamilton Company

The Hamilton Company is a global enterprise with a long track record in fluid measurement. For over 50 years, Hamilton has been using quality materials and skilled workmanship and has a life-long commitment to precision, accuracy and quality. The Sensor Technology Group designs and manufactures sensors for the measurement of pH, temperature, conductivity, and dissolved oxygen. These sensors have a well-established reputation for long-life and fast stable readings in both laboratory and in-line process applications.

### Vigilance

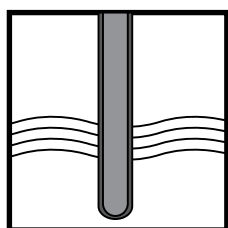
Our agreement with Hamilton as Global Preferred Vendor for state-of-the-art sensors is in line with Yokogawa's strategy as a vigilant supplier and our commitment to leading edge technology. The combined expertise of Yokogawa and Hamilton ensures that your total analyzer systems give accurate, reliable performance. Because we have subjected the Hamilton sensors in combination with our analyzers to rigorous testing under different operating conditions. By joining forces, we offer you world-class technologies in the one system, giving top class performance.



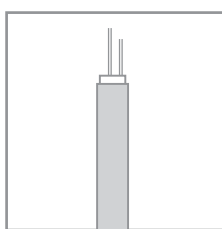
### Features

- Includes the new analytical Instrumentation standard: Variopin connector
- Autoclavable and Sterilisable pH sensors
- Build-in temperature sensor when Variopin type connector is selected
- Sensors and fittings complement Yokogawa products
- Sensors qualify fully for Biotechnology, Pharmaceutical and food production applications
- Sanitary fittings
- Autoclavable electrode for biotechnology, pharmaceutical and chemical applications
- ATEX certified sensors and fittings
- Certificate downloadable from [www.Hamiltoncompany.com](http://www.Hamiltoncompany.com)

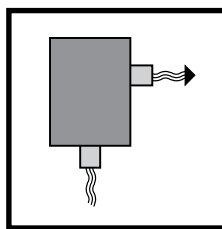
### System configuration



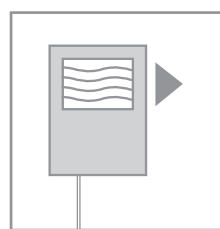
Sensors



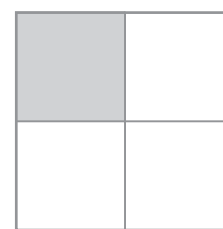
Cables



Fittings



Transmitters



Accessories

## Combined pH electrodes (Flow)

Both sensors have a special reference system called the EVER-F. The AgCl reservoir is separated from the reference electrolyte by a diffusion distance preventing poisoning of the reference system and keeping the Ag in the reference system, avoiding black ceramics. These sensors fit into most common pressurizable armatures for electrodes with a reservoir diameter of about 30 mm.

### Features Chemotrode

- Temperature range 0-130°C
- Steam sterilizable
- High Quality Ag/AgCl reference system
- Maximum pressure : 6 bar
- pH range 0-14

Part No.	Description
10/238760	Chemotrode 120
10/238762	Chemotrode 150
10/238766	Chemotrode 250

### Additional characteristics of Chemotrode Bridge

- Build in Pt100 in VP Version
- One platinum single pore diaphragm for clog-free operation
- Refillable with Skylyte electrolyte
- Suitable for harsh applications where there is a possible of poisoning

Part No.	Description
10/238753	Chemotrode Bridge VP 120
10/238754	Chemotrode Bridge VP 150
10/238770	Chemotrode Bridge 120
10/238772	Chemotrode Bridge 150

**Note:** The ATEX certificate is downloadable from the Hamilton website: [www.Hamiltoncompany.com](http://www.Hamiltoncompany.com)



Chemotrode Bridge VP



Chemotrode



Chemotrode P

### Combined pH electrodes (Non-flow)

The non-flow type sensors are filled with a polymer electrolyte which can be used from pH 0-14 and can withstand temperatures from -10° to 130°C. This high temperature rating also means that these sensors are also steam sterilizable.

#### Features

- Very stable readings in most ion weak solutions
- range 0 to 14 pH
- All sensors available with DIN and VP connector
- Built-in temperature sensor (VP version)

#### Additional characteristics of Polilyte Pro (VP)

- Suitable for samples containing solids, bacteria or sludge as well as normal drinking water
- Maximum pressure: 6 bar
- Suitable for process temperatures from -10°C up to 60°C
- Pt1000 in VP-version
- Stable measurement in low-conductive solutions

Part no.	Description
10/238411	Polilyte PRO 120
10/238417	Polilyte PRO VP 120

#### Additional characteristics of Polilyte HT(VP)

- Up-side down mounting with VP-type possible
- Steam sterilizable and autoclavable
- Withstands continuous high process temperatures
- Maximum pressure: 6 bar at 130°C
- Suitable for high alkali processes

Part no.	Description
10/238431	Polilyte HT 120
10/238432	Polilyte HT 225
10/238428	Polilyte HTVP 120
10/238429	Polilyte HTVP 225

#### Additional characteristics of Polyclave (VP)

- Maximum pressure: 6 bar
- Maximum temperature 130°C
- Withstands CIP, steam sterilizable and autoclavable
- Up-side down mounting with VP-type possible

Part no.	Description
10/238450	Polyclave 120
10/238452	Polyclave 170
10/238455	Polyclave VP 120
10/238456	Polyclave VP 225

#### Additional characteristics of Easyferm

- Maximum pressure: 4 bar
- Not suitable for use in media with citric acid or in the case of frequent CIP

Part no.	Description
10/238490	Easyferm 120
10/238492	Easyferm 225
10/238494	Easyferm 325

#### Additional characteristics of Easyferm plus (VP)

- Withstands CIP, steam sterilizable and autoclavable
- Pt100 in VP-versions
- High performance coartramic diaphragms prevent clogging due to proteins
- Maximum: 6 bar at 135°C

Part no.	Description
10/238633	Easyferm Plus VP 120
10/238634	Easyferm Plus VP 225
10/238635	Easyferm Plus VP 325
10/238645	Easyferm Plus 325



Polilyte Pro



Polilyte HTVP



Polyclave



Easyferm plus VP

GS 12B6J5-E-E

**Additional characteristics of Mecotrode (VP)**

- 3 High performance ceramic diaphragms
- Specially suitable for applications with a higher pH or higher temperatures
- Maximum: 6 bar at 130°C
- Maximum: 16 bar at 25°C

Part no.	Description
10/238801	Mecotrode 120
10/238437	Mecotrode 120 Pt100 VP

**Additional characteristics of Features Fermotrode**

- Maximum pressure: 400 kPa (4 bar at 130°C)
- pH range 0 - 14
- 3 high performance ceramic junctions for lower risk of blocking
- Not suitable for use in processes with citric acid or in case of frequent CIP

Part no.	Description
10/238480	Fermotrode 120
10/238482	Fermotrode 150
10/238484	Fermotrode 200
10/238486	Fermotrode 250

**Additional characteristics of Clarytrode**

- Specially suited for HF applications
- Pt100 in VP type
- Maximum 6bar at 100°C
- C 0.01M / 200mg / L HF at 20°C
- or 0.05M / 1000mg / HF at 50°C

Part no.	Description
10/238821	Clarytrode 120
10/238831	Clarytrode VP 120

**Consumables**

Part no.	Description	
10/238079	Hamilton Electrolyte 0,1M KCl,	100 ml
10/238939	Hamilton Electrolyte 3M KCl viscous,	500 ml
10/238036	Hamilton Electrolyte 3M KCl,	100 ml
10/238936	Hamilton Electrolyte 3M KCl,	500 ml
10/238931	Hamilton Storage Solution,	500 ml
10/238038	Protelyte, 100 ml (Fermotrode)	
10/238037	Skylite, 100 ml (Chemotrode)	
10/238937	Skylite, 500 ml (Chemotrode)	
10/238290	Cleaning Solution Set (2x500mL A+B + 1x500mL Storage Solution)	
10/238317	Duracal Buffer pH 4.01	250 ml
10/238217	Duracal Buffer pH 4.01	500 ml
10/238917	Duracal Buffer pH 4,01	3 x 500 ml
10/238318	Duracal Buffer pH 7.00	250 ml
10/238218	Duracal Buffer pH 7.00	500 ml
10/238918	Duracal Buffer pH 7,00	3 x 500 ml
10/238319	Duracal Buffer pH 9.21	250 ml
10/238219	Duracal Buffer pH 9.21	500 ml
10/238919	Duracal Buffer pH 9.21	3 x 500 ml
10/238321	Duracal Buffer pH 10.01	250 ml
10/238223	Duracal Buffer pH 10.01	500 ml
10/238923	Duracal Buffer pH 10,01	3 x 500 ml
10/238228	Hamilton Redox-Buffer 271 mV	500 ml
10/238227	Hamilton Redox-Buffer 475 mV	500 ml
10/238322	Hamilton Redox-Buffer 475 mV	250 ml

**Mecotrode VP****Fermotrode****Clarytrode****Clarytrode VP**

## Armatures for Industrial Applications

### Retractofit and retractomatic

This armature allows the user to install maintenance-free electrodes in critical processes. The main advantage of this design is that the sensor can be withdrawn while the process is running (i.e. for cleaning, calibration or even to replace the electrode), without interrupting the process. The armature is very easy to use and maintain. Two tube connectors allow access to the rinsing chamber. A closed insertion tube converts these armatures a sampling system for diverse applications. Both accessories can easily be exchanged for the standard insertion tube using only gentle hand pressure.

### Additional features Retractofit

- The design allows the use of sensors with 210 to 225 mm shaft length
- An integral safety mechanism prevents the armature from being inserted into the sample without an electrode installed.
- Only one press of the red button is needed to move the electrode into or out of the process. All o-rings are easily replaced without special tools.
- A shortened insertion tube that allows use of the armature in narrow bore pipes for which the standard insertion tube is too long.
- Designed for applications in the chemical and waste water industry.
- All wetted steel parts are replaced by PEEK with the Retractofit PEEK

### Additional features Retractofit Bio

- This armature is designed for applications where sanitary concerns are critical.
- The armature is steam sterilizable and autoclavable.
- The SS DIN 1.4435 (SS 316) and the FDA approved EPDM O-rings withstand typical CIP cleanings.
- Check with your dealer for the right O-ring position or weld-in socket!

### Additional features Retractable

- Powerful 24 VDC drive
- Controlled from a simple time switch to a computerized process control system such as PLC's
- In the retracted position, the electrode is retained in a chamber where it can be kept moist, cleaned and even calibrated.
- Two switches for reporting electrode position or for control of external instruments (pumps, magnetic valves)
- Fixed cable length 5 m.

Part no.	Description
10/237202	Weld-In Socket 15°, for armatures with o-ring at 25 mm
10/237290	Service Kit for Retractable
10/237230	Blind Plug for Weld-In socket
10/237239	Service Kit for Retractofit & Retractable
10/237240	Retractofit
10/237252	Pressure Adapter
10/237255	Insertion tube short for Retractofit/-matic
10/237260	Retractable
10/237278	Insertion tube closed for Retractofit/-matic
10/237338	Service Kit for Flexifit Bio & Retractofit Bio (FDA)
10/237339	Kalrez Kit for Retractofit, Retractable & Retractable
10/237440	Retractofit BIO OP = 25mm
10/237480	Retractofit BIO PEEK OP = 25mm
10/237490	Retractofit PEEK 25



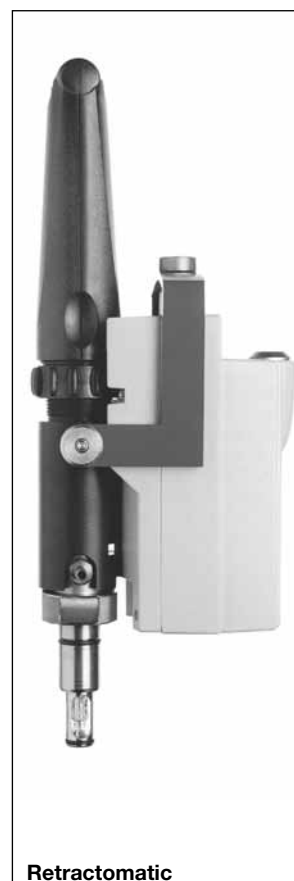
Retractofit



Retractofit PEEK



Retractofit Bio



Retractable

GS 12B6J5-E-E

## Masterfit and retractomaster

Suitable for applications where high accuracy or long-term stability is required in conjunction with liquid electrolyte electrodes. Such electrodes must be pressurized to ensure flow of the electrolyte solution. The retractable version can be used when cleaning or recalibration during the process is desirable.

The armatures allow electrodes to be mounted on pipe work or tanks with a weld-in socket. There are no awkward flat seals for sealing the armature. Large windows allow visual inspection of the electrolyte level in the installed electrode. Both armatures have an integrated manometer into the housing to easily check for the pressure. All O-rings are easily replaced without special tools.

### Additional feature Masterfit

- Temperature range: -10°C to 130°C
- Maximum pressure: 6 bar
- Suitable for all electrodes with electrolyte reservoir with shaft length 250mm.
- Mechanical connection 1 1/4
- Fitted with a tension lever that allows a slow release of the pressure
- Three stainless steel pins protect the electrode tip from damage
- Available in three insertion depths for vessels or fermenters of different wall thicknesses.

Part no.	Description
10/237200-OP Masterfit 120	
10/237225-OP Masterfit 150	
10/237235	Masterfit 200
10/237245	Masterfit 250
10/237252	Pressure Adapter
10/237320	FlexiFlange (1-1/2" fange, wetted parts PTFE)
10/237910	Flange-Adapter for Masterfit 120 with 150'-a-length electrodes
10/237229	Service Kit for Masterfit
10/237319	Kalrez Kit for Flexifit & Masterfit

### Additional feature Retractablemaster

- Suitable for applications in which liquid electrolyte electrodes must be used and cleaning or recalibration during the process is desirable.
- The armature is very easy to use and maintain. Only one press of the red button is needed to move the electrode into or out of the process.
- In the retracted position, the electrode is retained in a chamber where it can be kept moist, cleaned and even calibrated. This can all be done without process interruption or disassembly of the armature. Two tube connectors allow access to the rinsing chamber.

Part no.	Description
10/237255	Insertion tube short for Retractablefit/-matic
10/237278	Insertion tube closed for Retractablefit/-matic
10/237930	Flange flowthrough cell PFA
10/237202	Weld-In Socket 15°, for armatures with o-ring at 25 mm
10/237230	Blind Plug for Weld-In socket
10/237213	Glass cylinder Masterfit



\*Please specify the desired O-ring position (OP) in your order.



## Sanitary Non-Retractable Armatures

Maintenance-free sensors with a standard 12 x 120 mm design and PG 13.5 thread will fit perfectly. Steam sterilizable, autoclavable and CIP compatible cleaning are possible with the sanitary design. The materials used are SS DIN 1.4435 (SS 316) and the EPDM O-rings are FDA approved.

### Additional features Flexifit VV

- Temperature range: -10°C to 130°C
- Maximum pressure: 6 bar
- Suitable for Tuchenhausen VARIVENT sanitary process connections.
- The 15° version might be used for classic sensors with the need for vertical mounting of the connector head
- The 0° version is ideal when using Hamilton electrodes for up-side-down mounting

### Additional features Flexifit TC

- Designed for mounting on TriClamp 1.5" process connections.
- The short immersion depth makes this armature perfect for small flow-through cells.
- Good sensor protection with 3 protection rods

### Additional features Flexifit Bio

- G1 1/4" process connection
- The surface quality is N5 (Ra = 0.4 µm) electropolished.
- The armature comes with a material certificate.
- Good sensor protection with 3 protection rods
- Good sanitary design (easy cleaning and no sensor clogging).

### Additional features Flexi Flow SL 10

- Flowthrough armature
- Swagelok process connectors
- Materials: D1.4435 and O-rings of FDA-EPDM

Part No.	Description
10/237202	Weld-In Socket 15°, for armatures with o-ring at 25 mm
10/237219	Service Kit for Flexifit
10/237230	Blind Plug for Weld-In socket
10/237331-OP	Flexifit BIO
10/237338	Service Kit for Flexifit Bio & Retractable Bio
10/237340	FlexiFlow SL 10 (flow cell for 120 mm sensors with 10mm Swagelok connectors)
10/237344	Flexifit VV-0
10/237345	Flexifit VV-15
on request	Flexifit BIO 225
on request	Flexifit BIO 325

\* Please specify the desired O-ring position (OP) in your order.



Flexi Fit VV-0



Flexi Fit VV-15



Flexi Flow SL10



Flexi Fit Bio



Flexi Flow SL 10

GS 12B6J5-E-E

## Cables for Industrial Applications, type WU20D

When you need optimal pH or Redox measuring results, the complete measuring loop not only requires highly qualified sensors and transmitters but also the special purpose sensor cables.

The program of Yokogawa includes a range of high quality, low-noise cables for accurate transmission of low voltage signals even in areas where interference is present. They have a shield with an internal anti-noise sheath and can be connected to all pH and ORP (Redox) electrodes fitted with an O-connector. At the electrode end the cables are provided with a socket having spring gilded contacts for secure connection to the sensor. The combination electrode plug and cable socket is watertight and temperature resistant up to 125°C. It meets the requirements of IP 65.

### Features

- Internal anti-noise sheath for accurate measurement.
- Gold plated spring O-connectors parts, for good electrical contact under the most severe conditions.
- Coaxial plug and socket with watertight sealing that meets the requirements of IP 65.
- Cables for industrial appl. and for laboratory use are available.

### Coax Cables

These cables are for connecting to **single or combined** sensors fitted with an O-plug. For use at higher temperature specifications (up to 110°C continuously or 125°C for short times) and the most severe conditions.

### Triax Cables

These cables are for connecting to **combined** sensors fitted with an O-plug or to **single** sensors with an O-plug for use in areas where electrical interference is present. They have both inner, and outer shielding. In areas where electrical interference is likely we recommend to use the Triax electrode cable type WU20D-LT, marked with a blue strip.

### Notes:

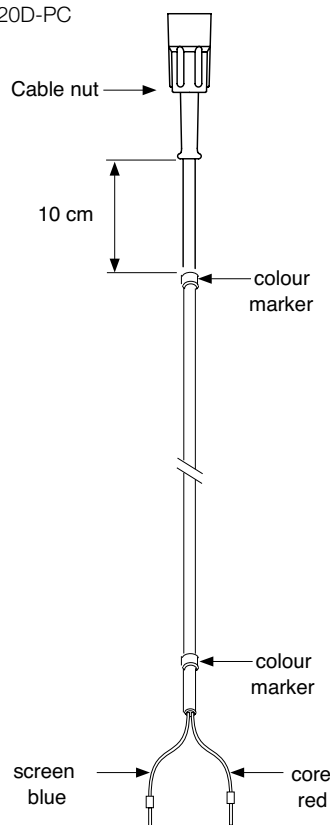
- For industrial applications the cables can be colour coded with the following marks:
  - Measuring electrode: red
  - Reference electrode: yellow
  - Temperature electrode: green
  - Combined electrode: blue

Adhesive markers are provided for this purpose and should be fitted to both ends of the cables.
- To secure optimal conditions, the cables may not be damaged or shortened. For protection of the cables there are special hoses available of 5 or 10 mtr. (K1500CJ, K1500CK respectively)
- Suitable for use in intrinsically safe areas.

### Specifications

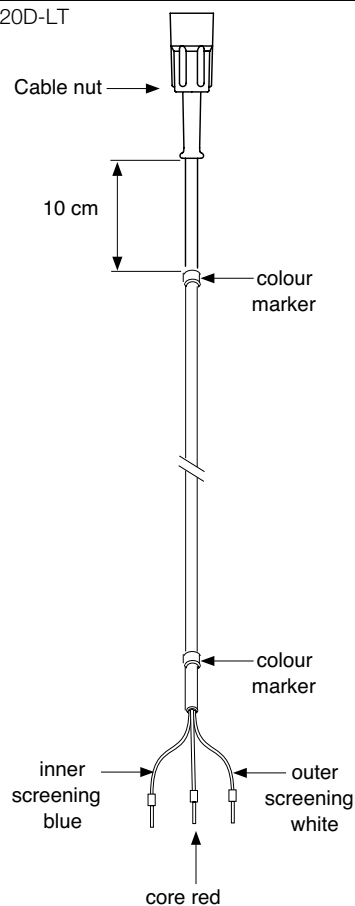
<b>Bending radius</b>	: min. 50 mm
<b>Max. temperature</b>	:
- type WU20D-PC	: 110°C (continuously) 125°C (for short times)
- type WU20D-LT	: 70°C (continuously)
<b>Wire connections</b>	: 2 mm contact pins

Type WU20D-PC



COAX

Type WU20D-LT



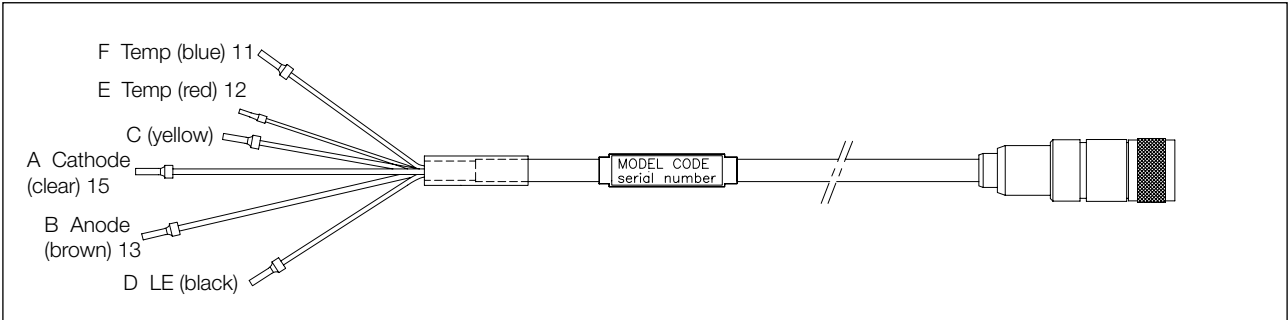
TRIAx



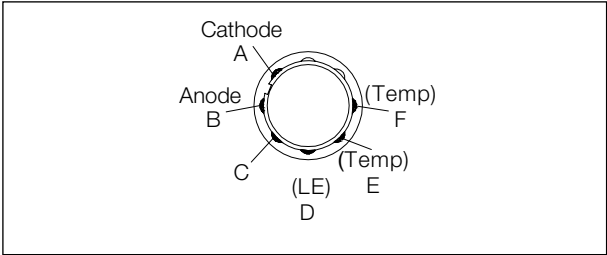
Cables for Industrial Applications

- Internal anti-noise sheath for accurate measurement.
- Gold plated spring O-connectors parts, for good electrical contact under the most severe conditions.
- Coaxial plug and socket with watertight sealing that meets the requirements of IP 65.
- Cables for industrial appl. and for laboratory use are available.

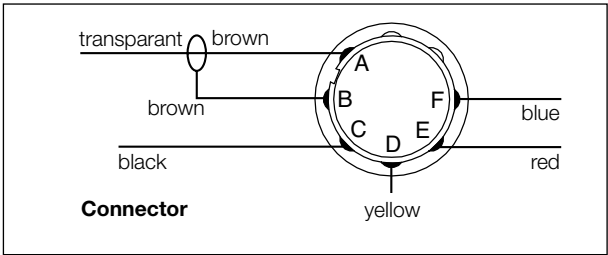
Dimensions



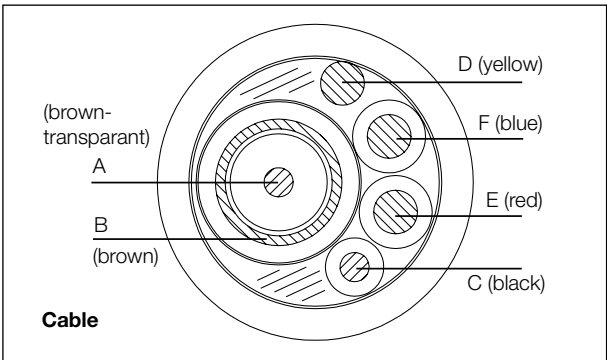
Connector lay out



Connector wiring



Cable lay out



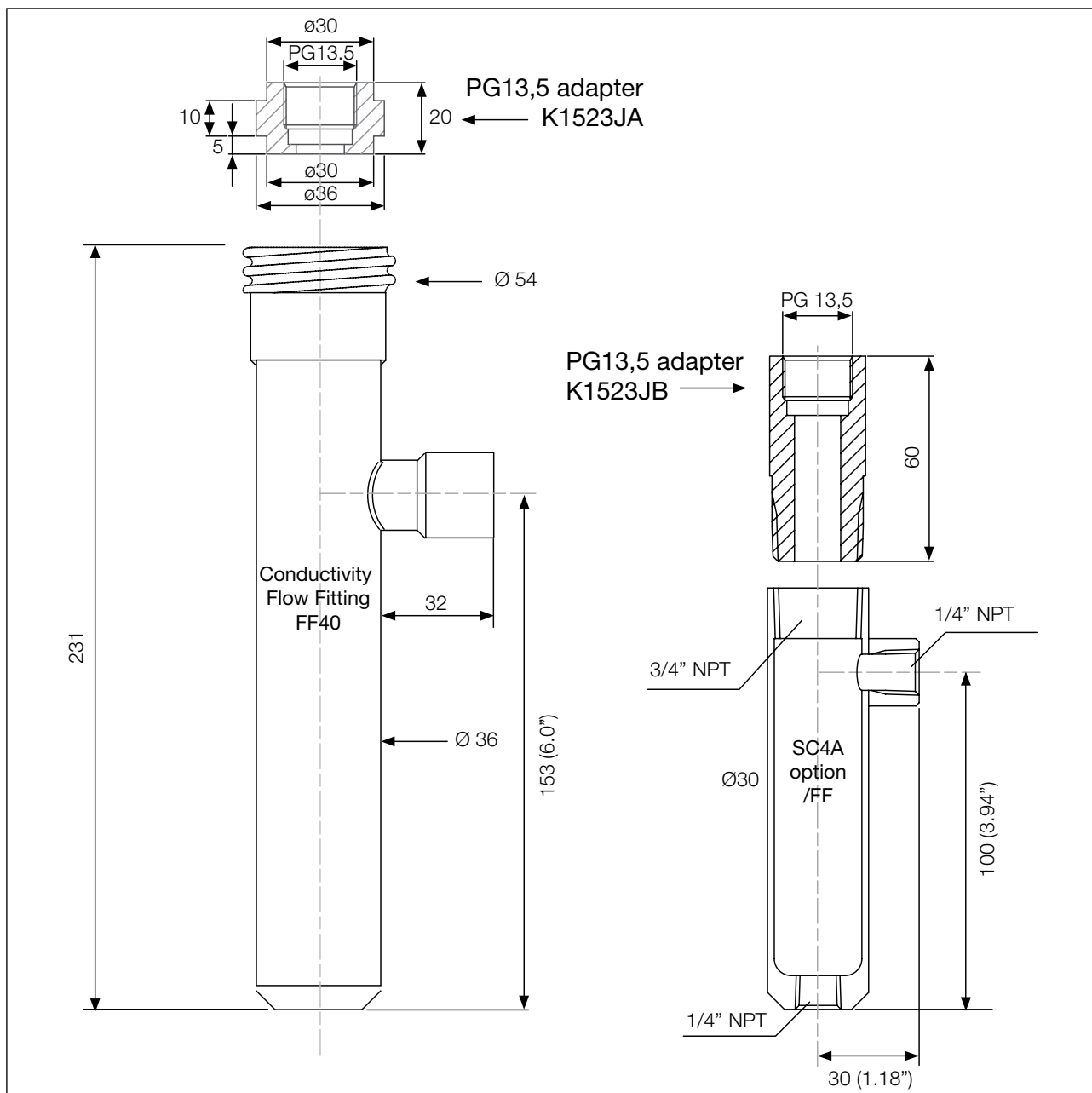
**Plugs for weld-in sockets**  
Enables weld-in sockets to to be capped when the armature is removed. Seals at 25 mm. Other dimensions on request!



Model and Suffix codes

Model	Suffix Code	Description
WU10		Universal sensor cable
Connector type	-V	Variopin
Cable type	-S	Single Coax
Cable length	-03	3 meters
-05	5 meters	
-10	10 meters	
-15	15 meters	
-20	20 meters	

Model	Suffix code	Description
WU20D		Electrode cable
Type	-PC	COAX
-LT	TRIAx	
Length in m	01	1 mtr
02	2 mtr	
05	5 1/2 mtr	
10	10 mtr	
15	15 mtr	
20	20 mtr	
25	25 mtr	



**Flow fitting FF40**  
with K1523JA: Adapter to fit sensors with a PG13,5  
process connection in FF40/FS40 and FD40 fittings.  
Material: Polypropylene

**Flow fitting option /FF K1598AC (incl. 3.1 B certificate)**  
with Adapter K1523JB to fit sensors with PG13,5 process  
connection

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nearest representative.



**YOKOGAWA** ◆

# General Specifications

Model FF20/FS20  
Flow Fittings for pH/ORP  
(Redox) measuring loops

pH/ORP

*For liquid analysis, the sensors are usually mounted in either a flow or an immersion fitting. Therefore Yokogawa has invested considerable design and development time in producing a full range of fittings with particular emphasis on designs that reduce installation and maintenance time and consequently save operation costs.*

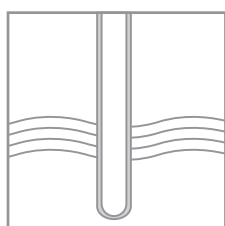
*A high degree of standardisation makes it possible to mount electrodes with DIN dimensions directly into a fitting. For most other types a mounting kit (accessory) is available. A wide choice of construction materials gives the user the optimal solution for any process considering chemical resistance, pressure and temperature specifications. The program includes fittings and subassemblies for mounting of a variety of electrodes and/or a cleaning system.*

## Features

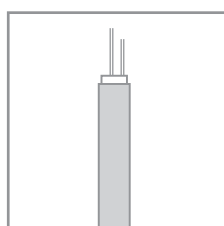
- Wide choice of construction materials.
- High degree of standardisation reduces spare holding requirements.
- Direct mounting of sensors with DIN dimensions.
- Liquid earth pin for stable measurements.
- High pressure and temperature specifications.
- Chemical cleaning system as an option for 2-, 3- and 4-hole fitting.
- Brush cleaning system as an option for 4-hole fitting only.
- Electrolytically polished stainless steel fittings for optimal corrosion resistance.



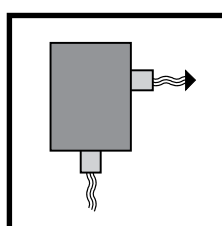
## System Configuration



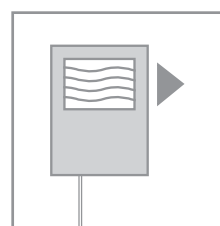
Sensors



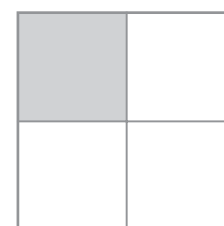
Cables



Fittings



Transmitters



Accessories

## Flow Fittings

From a practical plant aspect, the optimal mounting place of a sensor is in a by-pass behind a sample valve. For these applications the complete flow fittings are the optimal solution. They are provided with a ring to hold a calibration dish for easy cleaning and maintenance.

### Features

- Easy calibration and maintenance using the calibration dish.
- Changeable liquid outlet position (right or left).
- Wall mounting bracket.
- Possible to decrease temperature and/or pressure.



FF20-F43

### In-line measurement

- Real-time measurement gives better process control
- Low stability and short life by exposure to process P/T
- Limited access for maintenance
- High operating costs under severe process conditions

### In-Line is direct

## Subassemblies

The subassemblies are the optimal solution for mounting sensors directly in a piping system. They can be easily adapted to the process piping by welding or cementing. The subassemblies of stainless steel meet the requirements of DIN 11850 and DIN 11851 for mounting in sanitary constructions.

### Features

- Suitable for mounting in a T-piece or directly in the piping system by cementing or welding.
- Online installation generating a fast response to process changes.



FS20-V12



FS20-S32



FS20-P22

### On-line measurement

- Control errors possible by time delay, Pressure / Temperature drop
- High stability by sample conditioning
- Easy maintenance and repair
- Sampling pitfalls under mild process conditions

### On-line is easy to maintain

## 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/Viton
  - C. Liquid earth sensor : Titanium (in plastic design)
  - (not in 1-hole subassy) : Stainless steel AISI 316 (in SS design)
- Mounting brackets : Stainless steel AISI 316 (for SS design)
- Polyvinylchloride (for plastic design)
- Electrode mounting sets : Rytan R 4
- Holder for calibration dish : Stainless steel AISI 316
- Calibration dish : polyethylene
- Retaining nut for electrode holder : Stainless steel AISI 304

### Volume measuring vessel

- 2-hole fitting : 130 ml
- 3-hole fitting : 130 ml
- 4-hole fitting : 250 ml

### Process connections for fittings

- 2-, 3- and 4-hole fitting : 1/2" NPT or flange LAP-joint (DIN or ANSI) see model code

### Nominal pipe size for mounting subassemblies

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

**Weight\*** : See tabel 1

**Table 1**

Fitting \ Material	PP	SS	PVC	PVDF
1-hole subassembly		0.2 kg	0.1 kg	
2-hole subassembly	0.5 kg	1.2 kg	0.5 kg	0.7 kg
3-hole subassembly	0.5 kg	1.2 kg	0.5 kg	0.7 kg
4-hole subassembly		3 kg	1.4 kg	
2-hole flowfitting	1.1 kg	2.2 kg		1.5 kg
3-hole flowfitting	1.1 kg	2.2 kg		1.5 kg
4-hole flowfitting	1.4 kg	6.5 kg		1.8 kg

\* The accessories are not included

## Functional Specifications

### Temperature

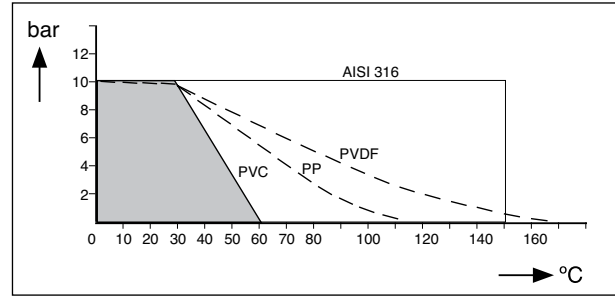
- min. : -10°C
- max. : depending on material and application (see figure 1)

### Flow rate (fittings)

: 0.1 to 10 l/min (depending on application)

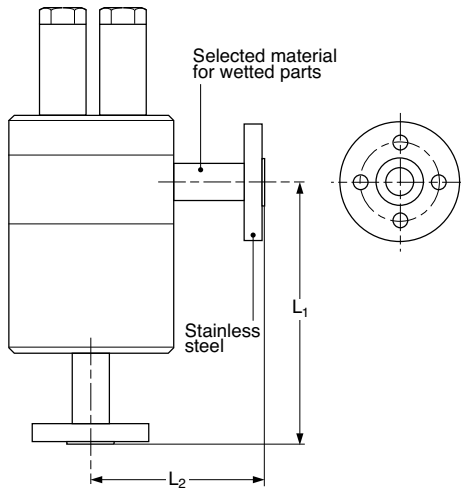
### Pressure

: see figure >>>



Pressure/temperature class

## Flange adapters (NPT<sup>1</sup>/<sub>2</sub>" male lap joint)

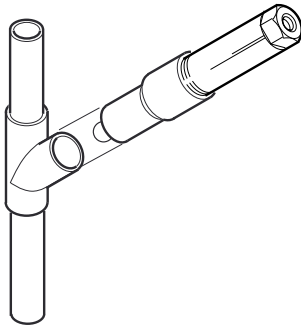


### Dimensions

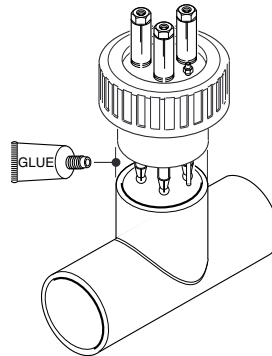
TYPE	FP1-FF1-FS1		FP2-FF2-FS2		FP3-FF3-FS3		FP4-FF4-FS4	
	L1	L2	L1	L2	L1	L2	L1	L2
FF20-S22	143	137	153	147	5.6	5.4	6.0	5.8
FF20-P22	180	133	169	122	7.1	5.2	6.6	4.8
FF20-F22								
FF20-S33	143	137	153	147	5.6	5.4	6.0	5.8
FF20-P33	180	133	169	122	7.1	5.2	6.6	4.8
FF20-F33								
FF20-S43	156	133	166	143	6.1	5.2	6.5	5.6
FF20-P43	183	153	172	142	7.2	6.0	6.8	5.6
FF20-F43								
Flange adapter	DN15	PN10	DN25-PN10		1/2"150lbs		1"150lbs	
Material	PVDF		PVDF		SS316		SS316	

## Application examples subassemblies

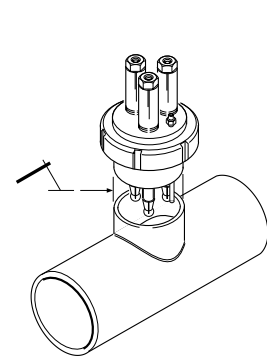
### SS/PVC



### PVC



### SS

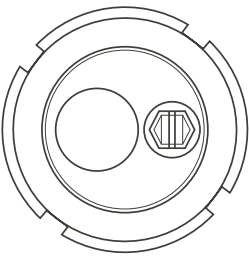
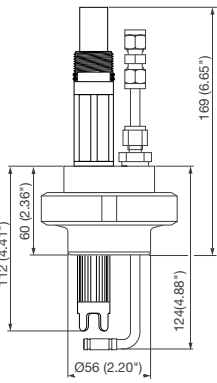
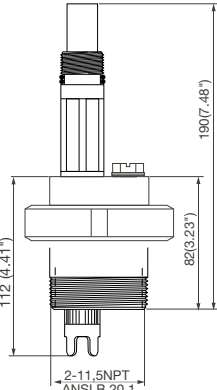
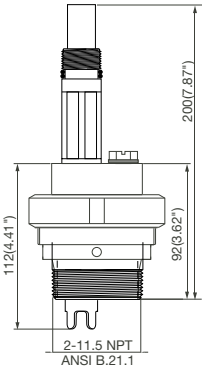
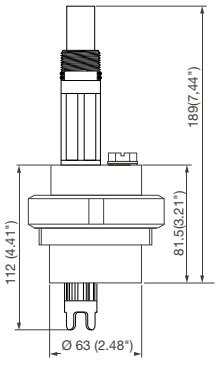
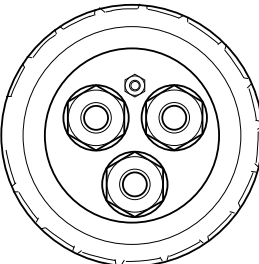
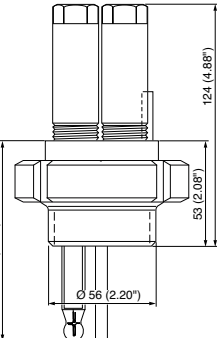
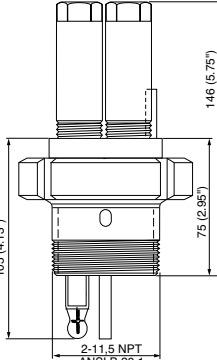
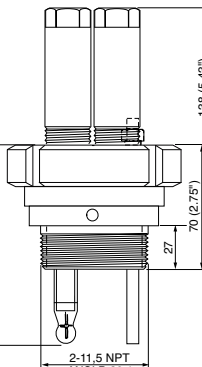
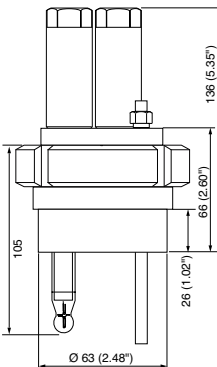
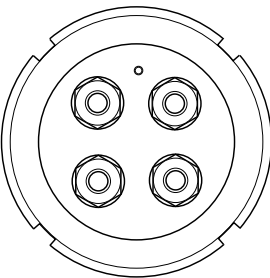
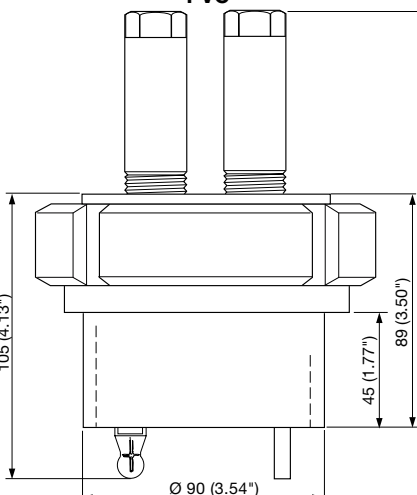
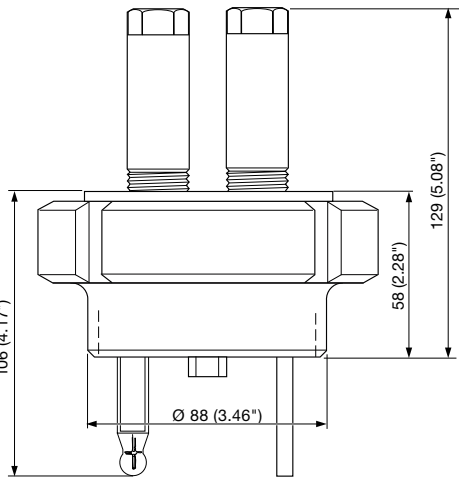


## Dimensions

Configurations	Dimensions	Subassemblies
1-Hole	SS/PVC	<p>(Unit: mm)</p> <p>Ø22 (0.87'') ss design Ø25 (0.98'') pvc design</p> <p>Ø28 (1.10'') ss design Ø30 (1.18'') pvc design</p> <p>FS20-S12-WE FS20-V12-WE</p>

GS 12B6K1-01E-E

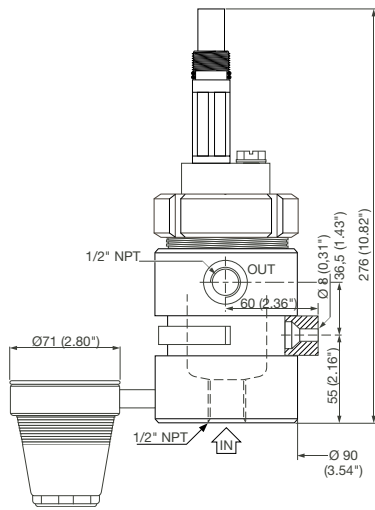
**Dimensions** (Unit: mm)

Configurations	Subassemblies			
<b>2-Hole</b>  	<b>SS</b>    <b>FS20-S22-WE</b>	<b>SS</b>    <b>FS20-S22-TP</b>	<b>PP/PVDF</b>    <b>FS20-P22-TP</b> <b>FS20-F22-TP</b>	<b>PP/PVC/PVDF</b>    <b>FS20-P22-WE</b> <b>FS20-V22-WE</b> <b>FS20-F22-WE</b>
<b>3-Hole</b>  	<b>SS</b>    <b>FS20-S32-WE</b>	<b>SS</b>    <b>FS20-S32-TP</b>	<b>PP/PVDF</b>    <b>FS20-P32-TP</b> <b>FS20-F32-TP</b>	<b>PP/PVC/PVDF</b>    <b>FS20-P32-WE</b> <b>FS20-V32-WE</b> <b>FS20-F32-WE</b>
<b>4-Hole</b>  	<b>PVC</b>    <b>FS20-V43-WE</b>	<b>SS</b>    <b>FS20-S43-WE</b>		

GS 12B6K1-01E-E

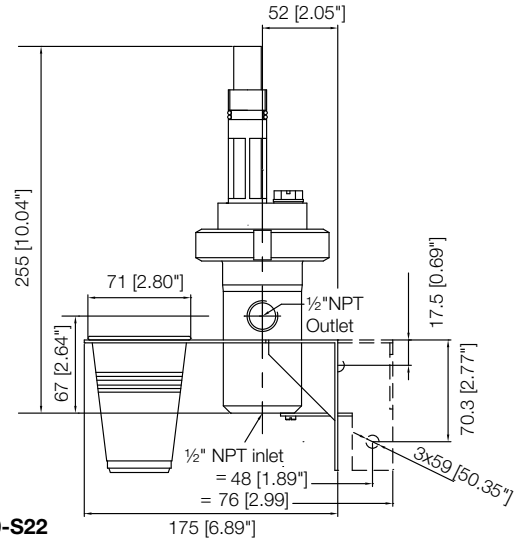
## Flow Fittings

PP/PVDF



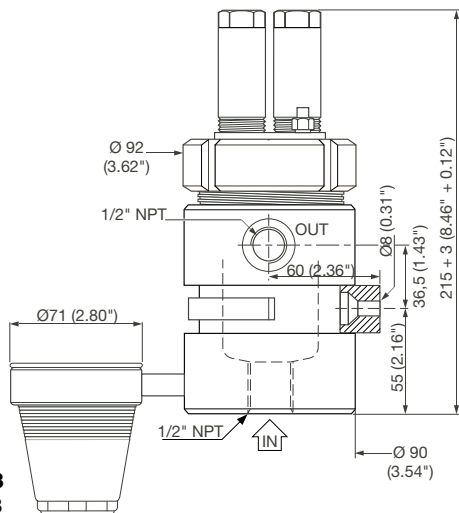
FF20-P22  
FF20-F22

SS



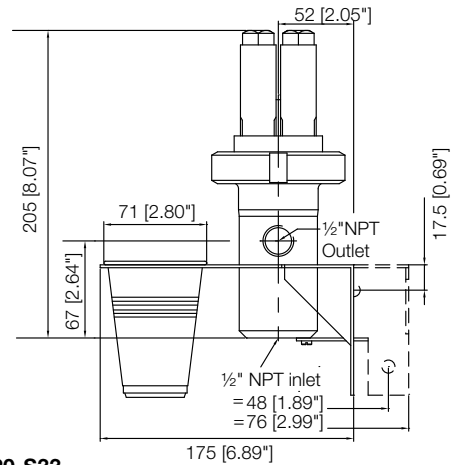
FF20-S22

PP/PVDF



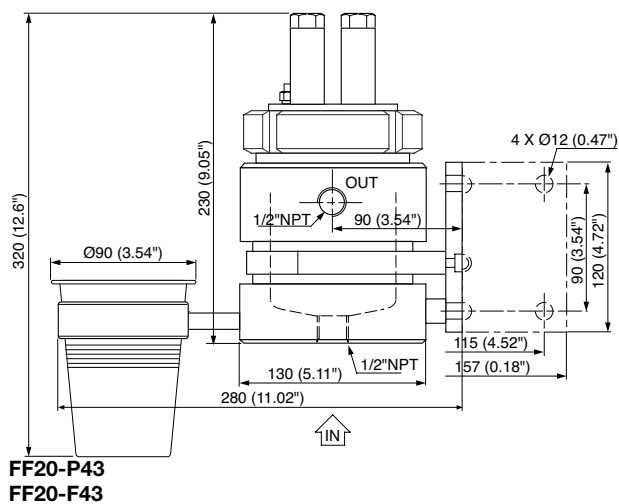
FF20-P33  
FF20-F33

SS



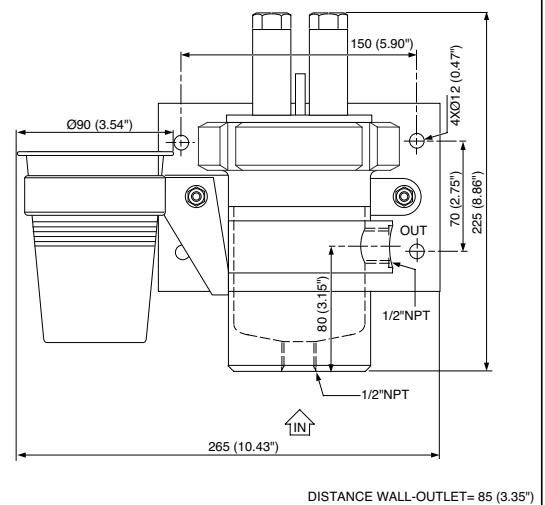
FF20-S33

PP/PVDF



FF20-P43  
FF20-F43

SS



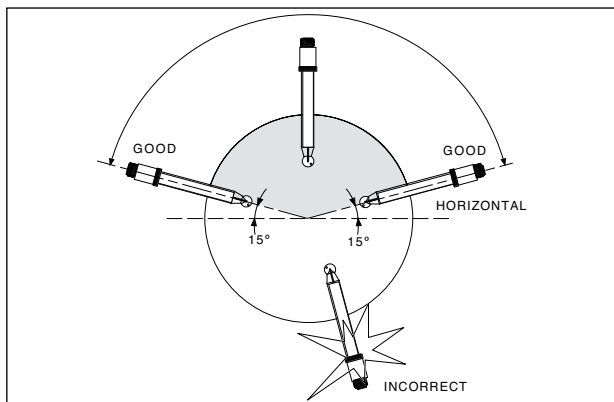
FF20-S43

DISTANCE WALL-OUTLET= 85 (3.35")

## Model and Suffix Codes

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 43		For PH20 3 electrode mounting holes 4 electrode mounting holes
	*B		Style code B
Options -Cleaning system	/HCN2 /HCN3 /HCN4		FF20- .22 FF20- .33 FF20- .43
Options -Mounting kit	/B /R		For mounting SR20-AC32 reference electrodes For mounting (top) refillable electrodes with long glass shaft.
-Flange adapters (NPT 1/2" male lap joint)	/FP1 /FP2 /FP3 /FP4 /FF1 /FF2 /FF3 /FF4 /FS1 /FS2 /FS3 /FS4		DN15-PN10 PP DN25-PN10 PP 1/2" 150 lbs PP 1" 150 lbs PP DN15-PN10 PVDF DN25-PN10 PVDF 1/2" 150 lbs PVDF 1" 150 lbs PVDF DN15-PN10 SS 316 DN25-PN10 SS 316 1/2" 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		Material certificate 3.1 according to EN 10204 for wetted metal parts only

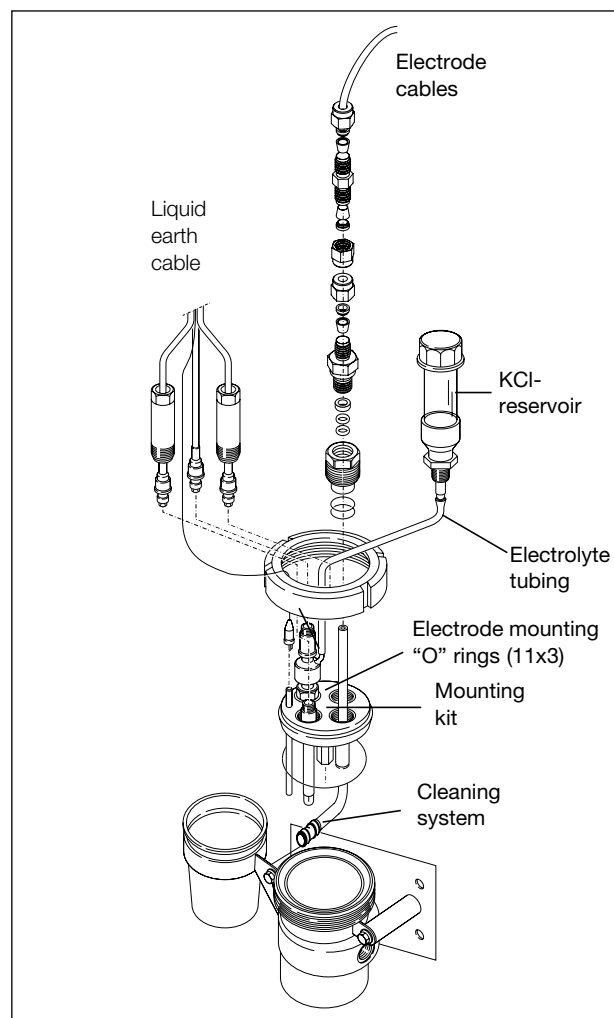
Model	Suffix Code	Option Code	Description
FS20			Subassembly (Flow fitting)
Material	-V -P -S -F		Polyvinylchloride (PVC) Polypropylene (PP) Stainless steel AISI 316 (SS) Polyvinylidene fluoride (PVDF)
Number of holes	12 22 32 43		1 electrode mounting holes (only V,S) For PH20 3 electrode mounting holes 4 electrode mounting holes (only V,S)
Mounting	-WE  -TP		Welding end: Type, S12, S22, S32, S43 Glue for PVC: Type V12, V22, V32, V43 Heat welding: Type F22, F32, P22, P32 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 -Cleaningsystem	/HCN2 /HCN3 /HCN4		FS20- .22 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 10204 for wetted metal parts only



**Fig. 2. Mounting positions of electrodes**

### Notes:

1. Mounting position of electrodes
2. For mounting or replacing the electrodes some space (ca. 20 cm) must be available at the top of the fitting.



**Fig. 3. Assembled flow fitting (example)**



## Selection Criteria

Chemical		Concentration and pH		Material			
		W/V (%)	pH (25°C)	PVC	PVDF	PP	SS 316
Inorganic acid	Sulfuric acid 0.05	0.5	1.0	O	O	O	X
		2.0	O	O	O	X	
	Hydrochloric acid 0.04	0.4	1.0	O	O	O	X
		2.0	O	O	O	X	
	Nutric acid 0.06	0.6	1.0	O	O	O	O
		2.0	O	O	O	O	
	Phosphoric acid	1.0	1.5	O	O	O	O
	Boric acid	0.6	5.0	*	O	O	*
	Carbonic acid	0.6	3.6	O	O	O	*
Organic acid	Chromic acid	1.2	0.8	O	O	O	O
	Sulfurous acid	0.8	1.4	O	O	O	*
	Acetic acid	0.6	2.8	*	O	O	*
	Formic acid	0.5	2.3	*	O	O	O
	Oxalic acid	0.9	1.0	*	O	*	*
	Lactic acid	0.9	2.4	*	X	O	O
	Phenol acid	0.9	5.4	*	O	*	O
Alkali	Monochloroacetic acid	0.9	1.8	X	O	O	O
	Calcium hydroxide	0.2	12.4	O	O	O	O
	Potassium hydroxide	0.5	12.7	O	O	O	*
	Sodium hydroxide	0.4	12.9	O	O	O	O
Acid salt	Ammonium hydroxide	0.5	10.4	O	O	O	O
	Ammonium chloride	5		O	O	O	X
	Aluminous water	5		O	O	O	*
	Zinc chloride	5		O	O	O	X
	Iron (III) chloride	5		O	O	O	X
Basic salt	Iron (III) nitrate	5	1.3	O	O	O	O
	Sodium sulfite	5		O	O	O	*
	Sodium carbonate	5	11.8	O	O	O	O
Neutral salt	Sodium phosphate	5		O	O	O	*
	Potassium chloride	5		O	O	O	X
	Sodium sulfate	5		O	O	O	*
	Calcium chloride	5		O	O	O	X
	Sodium nitrate	5	8.2	O	O	O	*
Oxidizing agent	Aluminium chloride	5		O	O	O	X
	Hydrogen peroxide	1		O	O	O	*
	Sodium hypochlorite solution	1	12.5	O	O	*	X
	Chlorinated lime	1		*	O	O	*
Organic solvent	Potassium dichromate	5	4.5	O	O	O	*
	Alcohol	10		O	O	O	O
	Organic solvent or oil (excluding alcohol)			*	O	*	O
	Chlorinated solvent			X	O	X	*

O = can be used

\* = shortens useful life

X = cannot be used

**Note:**

- pH in table was calculated with dissociated constant (related to measurement)
- When any of the two conditions listed below are applicable, please consult our sales department.
  - Strong, oxidizing solutions such as aqua regia, chromic acid, hypochloric acid, perchloric acid, etc.
  - The organic solvent is contained in the order of a few percent.

## Accessories

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 /FP2
K1521AQ	Flange adapter /FP2

## 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 FS20

Part no.	Description
K1500BW	Flow tube for SB20-VC
K1500BY	Option /R for F*20.. (82850747)
K1500DW	Set of 12 cable nuts for WU20
K1500DX	5 m tubing for SB20
K1500DZ	Nut SS, FF/S20-3* + ISC40FF/S
K1500FU	KCl reservoir PVC for F*20
K1500GA	5 m tube for KCl reservoir
K1500GZ	Earthpin assy for F*20 non-S
K1520CD	Spare 3-hole holder PVC
K1520CE	Spare 3-hole holder PP
K1520CF	Spare 3-hole holder PVDF
K1547PF	Nozzle and mounting HCN2/3/F
K1547PG	Nozzle and mounting HCN4
K1547PH	10 m PVDF Tube and mounting
K1547PP	Spare Part EPDM spraying valves

## Consumable Parts

Part no.	Description
K1500GF	250 ml. KCl-solution (1 M)
K1500GG	250 ml. KCl-solution (1 M), thickened
K1520BA	Starters kit containing the NIST buffers with pH of 4.01; 6.86 and 9.18 pH: The default buffers in all our pH analyzers (PH71, PH72, PH402, PH202, PH450, etc): so Plug and play
K1520BB	Three bottles with NIST buffer 2.68 pH (replacing 6C231)
K1520BC	Three bottles with NIST buffer 4.01 pH (replacing 6C232 and K94...)
K1520BD	Three bottles with NIST buffer 6.86 pH (replacing 6C237 and K94...)
K1520BE	Three bottles with NIST buffer 9.18 pH (replacing 6C234 and K94...)
K1520VA	250 ml. KCl-solution (3.3 M)
K1520VN	250 ml. KCl-solution (3.3 M), thickened

## Spare parts FF20

Part no.	Description
K1500BW	Flow tube for SB20-VC
K1500BY	Option /R for F*20.. (82850747)
K1500DW	Set of 12 cable nuts for WU20
K1500DX	5 m tubing for SB20
K1500DZ	Nut SS, FF/S20-3* + ISC40FF/S
K1500EL	Mounting set for FF20-S22/33
K1500GA	5 m tube for KCl reservoir
K1500GN	O-ring set FF/FS20 3-hole SS
K1500GP	O-ring set FF/FS20 3-hole P/F
K1500GR	O-rings silicon 11x3 8pcs
K1500GT	O-ring set silicon. FF20-.4.
K1500GZ	Earthpin assy for F*20 non-S
K1500ZA	Nut PVDF for old FF20-F33
K1500ZB	Nut PP for old FF20-P33
K1520CE	Spare 3-hole holder PP
K1520CF	Spare 3-hole holder PVDF
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

## Spare parts FP20

Part no.	Description
K1500GR	O-rings silicon 11x3 8pcs
K1500GS	O-rings set for FP20-S14
K1500HC	Rings set, rubber for FP20-S13(D)
K1500HD	O-rings silicon 11x3 50pcs

## Model and Suffix codes

Model code	Suffix Code	Option code	Description
WU10			Sensor cable
Connector type	-V		Variopin
Cable type	-S		Single Coax
Cable length		-02	2 meters
		-05	5 meters
		-10	10 meters
		-15	15 meters
		-20	20 meters

**O-ring selection FS20**

Spare part	Size	Quantity	Material	Description GS
K1500GR	11X3	8	silicone	O-rings silicon for electrode mounting
K1500HD	11X3	50	silicone	O-rings silicon for electrode mounting
K1500GT	4.5X1.8	1	Viton	O-ring set silicon FF20-.4
	85X5	1	silicone	O-ring set silicon FF20-.4
	11X3	8	silicone	O-ring set silicon FF20-.4
K1500BV	11X3	6	EPDM	O-rings EPDM
K1500EK	6.1X1.8	5X2	Viton	O-rings viton
K1500BZ	11X3	6	Viton	O-ring Viton
K1500ER	21.9X2.6	2	Viton	O-ring set Viton FF20-S22
	54X5	1	Viton	O-ring set Viton FF20-S22
K1511DP	21.9X2.6	5X2	Viton	O-rings Viton
K1500GN	53X5	1	silicone	O-ring set FF/FS20 3-hole SS
	11X3	6	silicone	O-ring set FF/FS20 3-hole SS
K1500GP	4.5X1.8	1	Viton	O-ring set FF/FS20 3-hole P/F
	56.5X5.3	1	silicone	O-ring set FF/FS20 3-hole P/F
	11X3	6	silicone	O-ring set FF/FS20 3-hole P/F

**O-ring selection FF20**

Spare part	Size	Quantity	Material	Description GS
K1500GR	11X3	8	silicone	O-rings silicon for electrode mounting
K1500HD	11X3	50	silicone	O-rings silicon for electrode mounting
K1500FX	29.7X3.5	5	silicone	silicone O-rings for mounting sensor in fitting and subassembly
K1500FY	37.8X2.6	5	silicone	O-rings for mounting the sensor in the fitting
K1500GT	4.5X1.8	1	Viton	O-ring set silicon FF20-.4
	85X5	1	silicone	O-ring set silicon FF20-.4
	11X3	8	silicone	O-ring set silicon FF20-.4
K1500BV	11X3	6	EPDM	O-rings EPDM
K1500EQ	21.9X2.6	2	EPDM	O-ring set EPDM FF20-S22
	53X5	1	EPDM	O-ring set EPDM FF20-S22
K1500EU	53X5	1	EPDM	O-ring set EPDM FF20-S33
	11X3	6	EPDM	O-ring set EPDM FF20-S33
K1500EY	85X5	1	EPDM	O-ring set EPDM FF20-S43
	11X3	8	EPDM	O-ring set EPDM FF20-S43
K1500ES	4.5X1.8	1	EPDM	O-ring set EPDM FF20P&F33
	56.5X5.3	1	EPDM	O-ring set EPDM FF20P&F33
	11X3	6	EPDM	O-ring set EPDM FF20P&F33
K1500EW	4.5X1.8	1	EPDM	O-ring set EPDM FF20P&F43
	85X5	1	EPDM	O-ring set EPDM FF20P&F43
	11X3	8	EPDM	O-ring set EPDM FF20P&F43
K1500FJ	21.9X2.6	2	EPDM	O-ring set EPDM FF20P&F22
	56.5X5.3	1	EPDM	O-ring set EPDM FF20P&F22
K1500BZ	11X3	6	Viton	O-rings Viton
K1500EK	6.1X1.8	5X2	Viton	O-rings viton
K1500ER	21.9X2.62	2	Viton	O-ring set Viton FF20-S22
	54X5	1	Viton	O-ring set Viton FF20-S22
K1500ET	4.5X1.8	1	Viton	O-ring set Viton FF20P & F33
	56.5X5.3	1	Viton	O-ring set Viton FF20P & F33
	11X3	6	Viton	O-ring set Viton FF20P & F33
K1500EV	54X5	1	Viton	O-ring set Viton FF20-S33
	11X3	6	Viton	O-ring set Viton FF20-S33
K1500EX	4.5X1.8	1	Viton	O-ring set Viton FF20P & F43
	85X5	1	Viton	O-ring set Viton FF20P & F43
	11X3	8	Viton	O-ring set Viton FF20P & F43
K1500EZ	85X5	1	Viton	O-ring set Viton FF20-S43
	11X3	8	Viton	O-ring set Viton FF20-S43
K1500FK	21.9X2.6	2	Viton	O-ring set Viton FF20P & F22
	56.5X5.3	1	Viton	O-ring set Viton FF20P & F22
K1511DP	21.9X2.6	5X2	Viton	O-rings Viton
K1500FL	21.9X2.6	2	Viton	O-ring set standard FF20P & F22
	56.5X5.3	1	silicone	O-ring set standard FF20P & F22
K1500FM	21.9X2.6	2	Viton	O-ring set FF20-S22
	53X5	1	silicone	O-ring set FF20-S22
K1500GN	53X5	1	silicone	O-ring set FF/FS20 3-hole SS
	11X3	6	silicone	O-ring set FF/FS20 3-hole SS
K1500GP	4.5X1.8	1	Viton	O-ring set FF/FS20 3-hole P/F
	56.5X5.3	1	silicone	O-ring set FF/FS20 3-hole P/F
	11X3	6	silicone	O-ring set FF/FS20 3-hole P/F
K1500DD	53.34x5.33	1	Kalrez	O-ring Kalrez for FF20-S33

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# General Specifications

Model FD20  
Immersion Fittings for pH/ORP (Redox)  
measuring loops

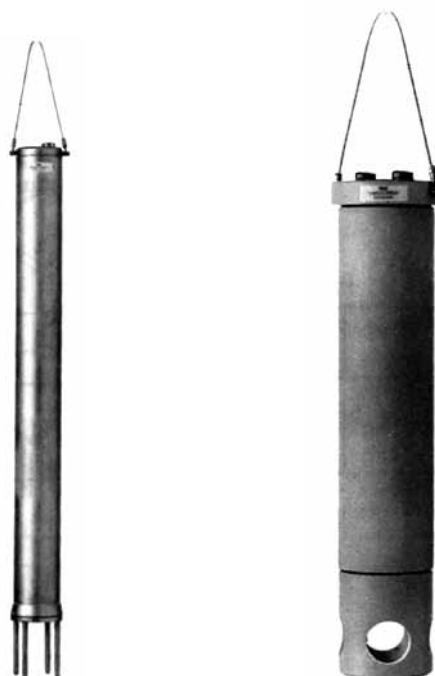
pH/ORP

For liquid analysis, the sensors are usually mounted in either a flow or an immersion fitting. Therefore Yokogawa has invested considerable design and development time in producing a full range of fittings with particular emphasis on designs that reduce installation and maintenance time and consequently save operation costs.

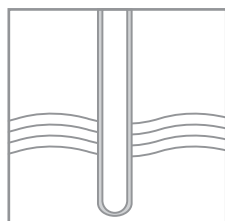
A high degree of standardisation makes it possible to mount electrodes with DIN dimensions direct in a fitting. For most other types a mounting kit (accessory) is available. A wide choice of construction materials gives the user the optimal solution for any process considering chemical resistance, pressure and temperature specifications. The immersion fittings are designed for either pH or ORP (Redox) measurements in tanks, open vessels and drains. They have a "hoisting cable" for easy maintenance. The program includes fittings for mounting of 1 electrode, 3 electrodes, 4 electrodes or alternatively 3 electrodes and a cleaning system. As standard, the immersion length can be between 0.5 and 2 m. A flange for fixing in tanks, etc. is available on request.

## Features

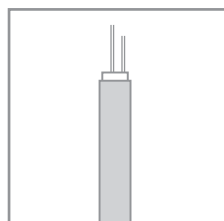
- Designed for either pH or ORP measurements in tanks open vessels and drains.
- "Hoisting cable" for easy maintenance.
- Pre-selected immersion length.
- Wide choice of construction materials.
- Flange mounting.
- High degree of standardisation reduces spare holding requirements.
- Liquid earth pin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



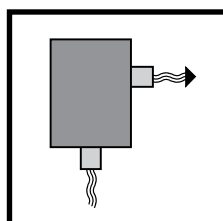
## System Configuration



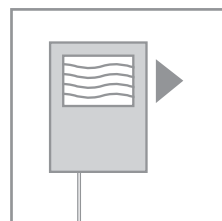
Sensors



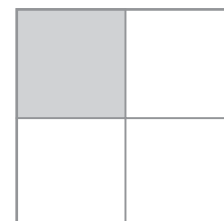
Cables



Fittings



Transmitters



Accessories

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)  
(not in 1-hole fitting) : Stainless steel AISI 316 (SS design)
- Electrode mounting sets : Ryton R 4
- "Hoisting eye" : Stainless steel cable (twisted)

Weight\* : See tabel 1

Table 1

Material Fitting	PVC	PP	SS	PVDF
1-hole fitting	0.4 kg			
3-hole fitting		2 kg	5.3 kg	2.5 kg
4-hole fitting		4.5 kg	5.4 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

Functional Specifications

Temperature

- min. : -10°C
- max. : depending on material and application (see figure 1)

Immersion length (in dm) : between 0.5 and 2.0 m

Pressure : see figure 1

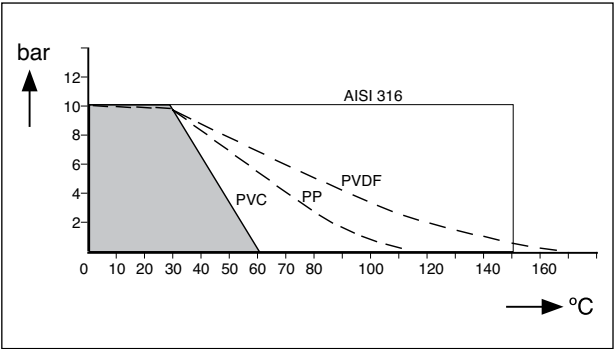
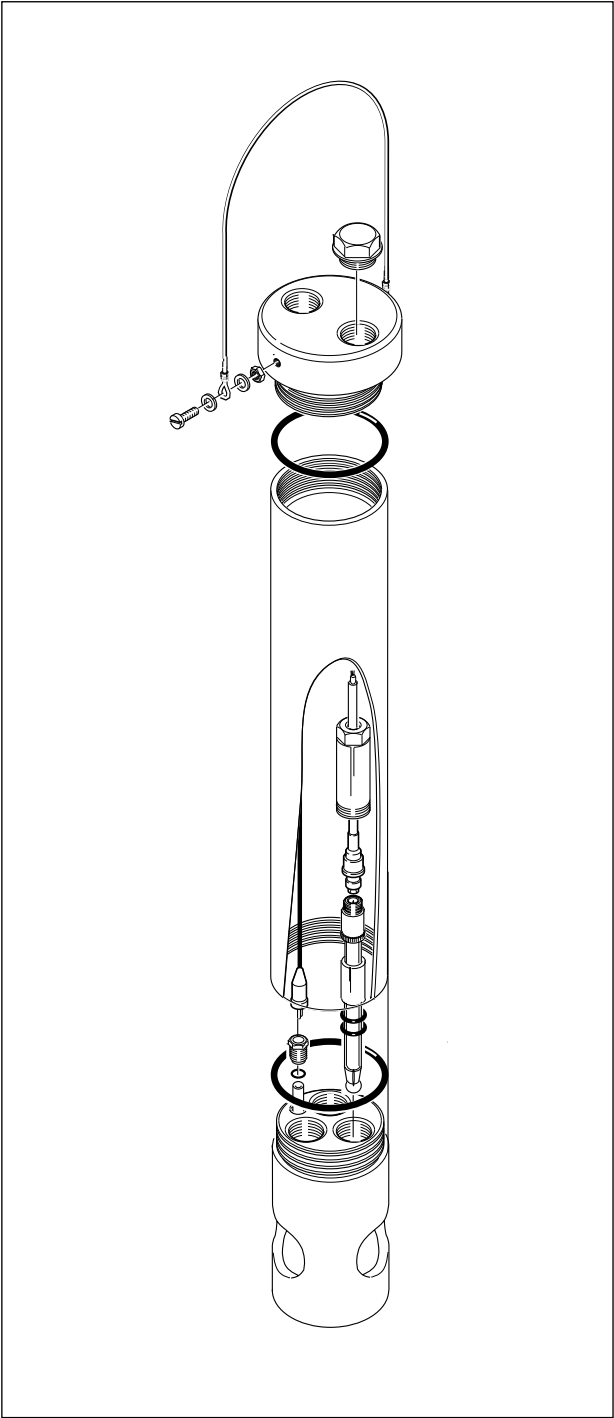


Fig. 1. Pressure/temperature class



FD20-P37-10-NF\*A

## Model and Suffix codes

Model	Suffix Code	Option Code	Description
FD20F37			Immersion fitting, PVDF, 3 electrode mounting holes
FD20F47			Immersion fitting, PVDF, 4 electrode mounting holes
FD20P37			Immersion fitting, PP, 3 electrode mounting holes
FD20P47			Immersion fitting, PP, 4 electrode mounting holes
FD20S37			Immersion fitting, SS, 3 electrode mounting holes
FD20S47			Immersion fitting, SS, 4 electrode mounting holes
FD20V18 <sup>1</sup>			Immersion fitting, PVC, 1 electrode mounting hole
Immersion length <sup>2</sup>	-NN		Between 5 and 20 (in dm) example 06=0.6 mtr.
Flange <sup>3</sup> (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
<b>Options</b>			
Cleaning system		/HCN2 /HCN3 /HCN4	FD20- .27 FD20- .37 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 along glass shaft For mounting Bellomatic reference and combined electrodes
KCL reservoir <sup>4</sup>		/K	Electrolyte 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 10024 for wetted metal parts

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

### Notes:

- a. Options are supplied with the fitting.
- b. The available length of the electrode cables between fitting and converter or connection box is cable length minus immersion length (L).
- c. It is possible to order the fittings assembled (complete with cables, cleaning system, options, etc.). Please contact your local Yokogawa sales organisation for more information.

## Dimensions

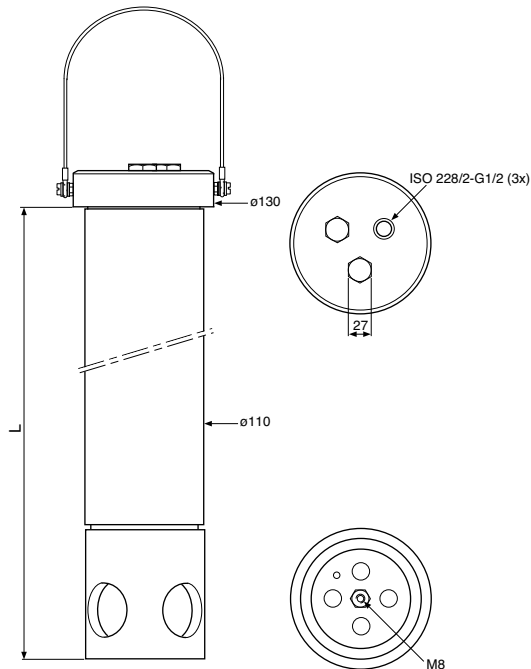
Unit: mm

<p><b>1-Hole PVC</b></p>	<p><b>3-Hole PP and PVDF</b></p>	<p><b>3-Hole SS</b></p>
<p><b>Flange</b></p>	<p><b>Flange</b></p>	<p><b>Flange</b></p>

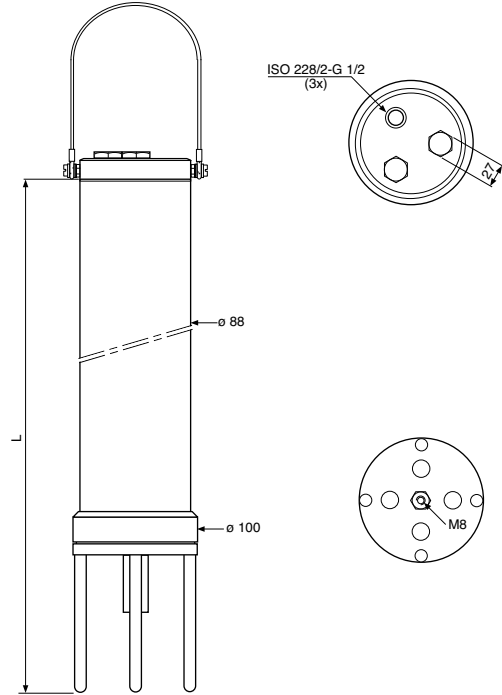
GS 12B6K2-01E-E



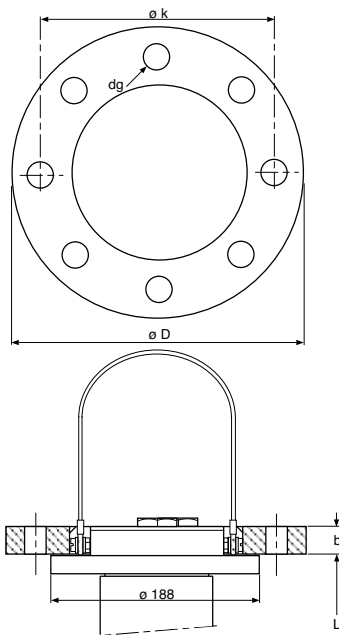
## 4-Hole PP and PVDF



## 4-Hole SS



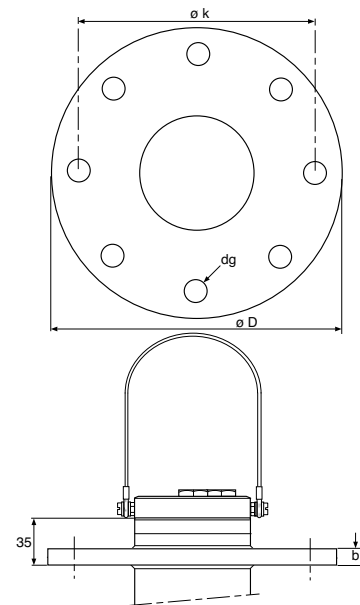
## Flange



unit in mm

	L	D	k	dg	b
FD20-V18-...-FN	5-20dm				
FD20-V18-...-F1	5-20dm	120	90	14	26
FD20-V18-...-S1	5-20dm	120	90	16	26
FD20-P37-...-FN	5-20dm				
FD20-F37-...-FN	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-...-FN	5-20dm				
FD20-S37-...-F4	5-20dm	200	160	18	10
FD20-S37-...-S4	5-20dm	228.6	190.5	19	23.8
FD20-P47-...-FN	5-20dm				
FD20-F47-...-FN	5-20dm				
FD20-P47-...-F5	5-20dm	250	210	18	25
FD20-F47-...-F6	5-20dm	250	210	18	25
FD20-P47-...-S5	5-20dm	285	241	22	30
FD20-F47-...-S6	5-20dm	285	241	22	30
FD20-S47-...-FN	5-20dm				
FD20-S47-...-F7	5-20dm	220	180	18	10
FD20-S47-...-S7	5-20dm	228.6	190.5	19	23.9

## Flange



GS 12B6K2-01E-E

## Accessories

Part no.	Description
K1500FU	KCl-reservoir + tubing (2.5 mtr) (option /K)
K1500GA	Electrolyte tubing (5 mtr) for connection between KCl-reservoir and electrode
SB20-VC	Salt bridge (option /S)
FC20-VE*	Brush cleaning system (electric driven)
BC10*	Supply unit (220 V/24 V) for motor-drive of electric driven brush cleaning
FC20-VP*	Brush cleaning system (pneumatic driven)
BA10	Connection box (between electrodes and transmitter)
WF10	Connection cable (per mtr) between connection box and transmitter input
K1500BX	Grommet for watertight cable input in PG 16 gland (3 electrodes cables and liquid earth cable)
K1500BY	Mounting kit for (top) refillable electrodes (option /R)
FP20-S13	Mounting kit for BELLOMATIC reference electrode and combined electrodes (option /B)
WU20-PC01	COAX-cable (1 mtr) for single electrode
WU20-PC02	COAX-cable (2 mtr) for single electrode
WU20-PC05	COAX-cable (5.5 mtr) for single electrode
WU20-PC10	COAX-cable (10 mtr) for single electrode
WU20-PC15	COAX-cable (15 mtr) for single electrode
WU20-PC20	COAX-cable (20 mtr) for single electrode
WU20-PC25	COAX-cable (25 mtr) for single electrode
WU20-LT01	TRIAX-cable (1 mtr) for combined electrode
WU20-LT02	TRIAX-cable (2 mtr) for combined electrode
WU20-LT05	TRIAX-cable (5.5 mtr) for combined electrode
WU20-LT10	TRIAX-cable (10 mtr) for combined electrode
WU20-LT15	TRIAX-cable (15 mtr) for combined electrode
WU20-LT20	TRIAX-cable (20 mtr) for combined electrode
WU20-LT25	TRIAX-cable (25 mtr) for combined electrode
K1500FV	Liquid earth cable (10 mtr)
K1500DU	Liquid earth cable (25 mtr)

\* For details see GS 12B6V1-E-E

## Service Parts

Part no.	Description
K1500BW	Diaphragm tube for SB20-VC
K1500EE	Diaphragm tube for SB20-VP
K1500EF	Diaphragm tube for SB20-VS
K1500DX	Nylon tubing for salt bridge
K1520NA	Tubing (ø 4x6) for brush cleaning (pneumatic driven)
K1520FJ	Tubing (ø 1/4") for chemical cleaning (5 m)
K1520FK	Tubing (ø 1/4") for chemical cleaning (10 m)
K1500GR	O-ring (11x3) for electrode mounting (8 pieces)
K1500GH	Set O-rings for 1-hole fitting (PVC)
K1500GU	Set O-rings for 3-hole fitting (PP and PVDF)
K1500GV	Set O-rings for 4-hole fitting (PP and PVDF)
K1500GW	Set O-rings for 3-hole fitting (SS)
K1500GX	Set O-rings for 4-hole fitting (SS)
FP20-R12	Electrode mounting set (Ryton R4)
FP20-S12	Electrode mounting set (SS)
K1500HC	Sealing rings for BELLOMATIC electrode holder (10 pieces)
K1500GE	5 Sets O-rings for BELLOMATIC electrode
K1500FZ	O-ring for mounting the (top) refillable electrodes with a long glass shaft
K1520NB	Brush for mechanical cleaning
K1500DQ	/PH3 protection hose (3 m)
K1500DN	/PH3 protection hose (10 m)
K1500DR	/PH15 protection hose (15 m)
K1500DS	/PH20 protection hose (20 m)
K1500DM	/PH25 protection hose (25 m)

## Consumable Parts

Part no.	Description
K1520BB	Three bottles with NIST buffer 2.68 pH (replacing 6C231)
K1520BC	Three bottles with NIST buffer 4.01 pH (replacing 6C232 and K94...)
K1520BD	Three bottles with NIST buffer 6.86 pH (replacing 6C237 and K94...)
K1520BE	Three bottles with NIST buffer 9.18 pH (replacing 6C234 and K94...)
K1500GF	250 ml. KCl-solution (1 M)
K1500GG	250 ml. KCl-solution (1 M), thickened
K1520VA	250 ml. KCl-solution (3.3 M)
K1520VN	250 ml. KCl-solution (3.3 M), thickened

## Spare Parts FD20F47

Part no.	Description
K1500FE	O-ring set EPDM FD20P&F47
K1500FF	O-ring set Viton FD20P&F47
K1500GV	O-ring set FD20P&F47

## Spare Parts FD20S37

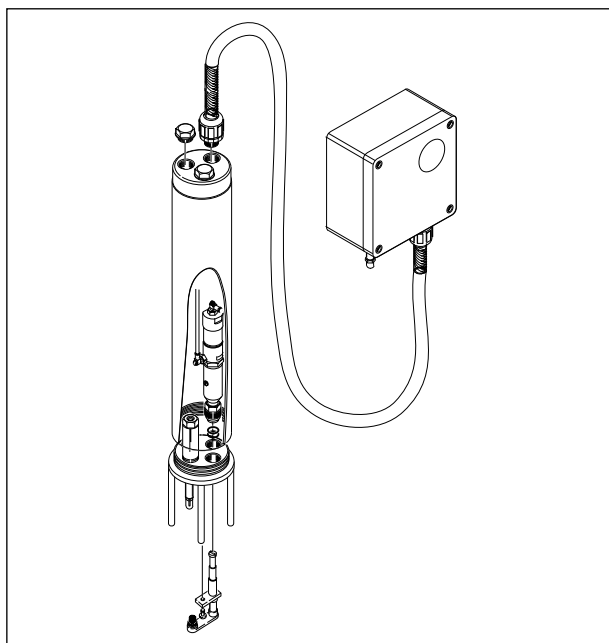
Part no.	Description
K1500AN	Hauling parts kit for FD20-SS
K1500FC	O-ring set EPDM FD20-S37
K1500FD	O-ring set Viton FD20-S37
K1500GW	O-ring set FD20S37

## Spare Parts FD20S47

Part no.	Description
K1500FG	O-ring set EPDM FD20-S47
K1500FH	O-ring set Viton FD20-S47
K1500GT	O-ring set silicon. FF20-.4.
K1500GX	O-ring set FD20S47

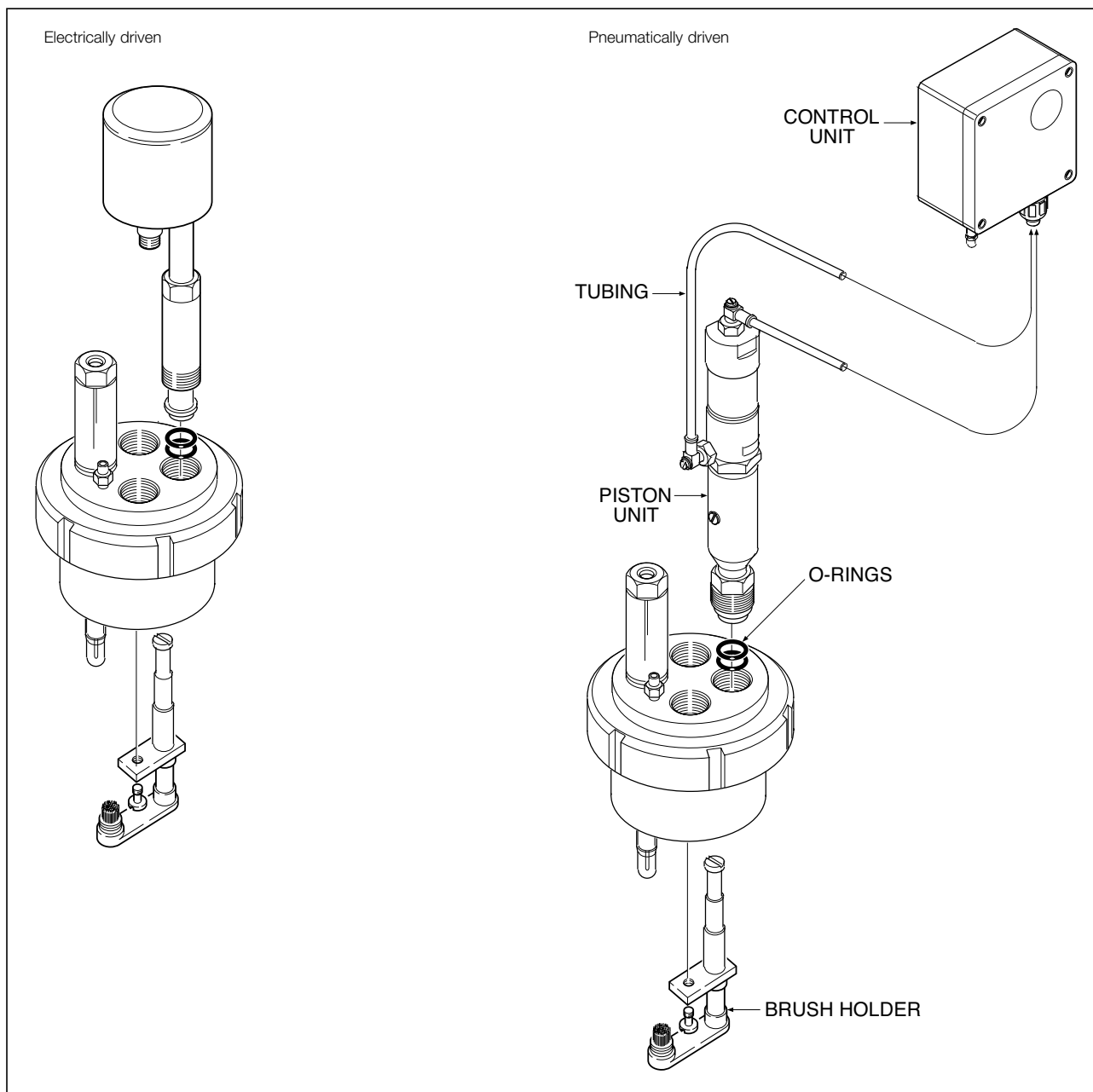
## Spare Parts FD20V18

Part no.	Description
K1500GH	O-ring set 1-hole imm. PVC



FD20-S47-10-NF\*A with FC20-VP fitted

GS 12B6K2-01E-E



## Ordering Instructions

When ordering, specify model and codes, item name and part numbers.

Items to be specified:

- |   |  |
|---|--|
| 1. Immersion fitting  | : FD20-V18, FD20-P37, FD20-P47, FD20-S37, FD20-S47, FD20-F37 or FD20-F47   |
| 2. Suffix codes, if relevant                                      | :  |
| 3. Electrode cables   | : WU20-PC01, WU20-LT01<br>WU20-PC02, WU20-LT02<br>WU20-PC05, WU20-LT05<br>WU20-PC10, WU20-LT10<br>WU20-PC15, WU20-LT15<br>WU20-PC20, WU20-LT20<br>WU20-PC25, WU20-LT25 |
| 4. Liquid earth cable   | : K1500FV (10 m)   |
| 5. Connecting box/extension cable<br>(up to 30 mtr. cable length) | : BA10/WF10  |
| 6. Cleaning system  | : FC20-VP, FC20-VE, HCN2/3, HCN4 or HCNF   |
| 7. Consumable parts   | : Part name and part number (quantity)   |
| 8. Service parts  | : Part name and part number (quantity)   |

GS 12B6K2-01E-E

## Selection Criteria

Chemical		Concentration and pH		Material			
		W/V (%)	pH (25°C)	PVC	PVDF	PP	SS 316
Inorganic acid	Sulfuric acid 0.05	0.5	1.0	O	O	O	X
	Hydrochloric acid 0.04	2.0	O	O	O	X	
		0.4	1.0	O	O	O	X
		2.0	O	O	O	X	
	Nitric acid 0.06	0.6	1.0	O	O	O	O
		2.0	O	O	O	O	
	Phosphoric acid	1.0	1.5	O	O	O	O
	Boric acid	0.6	5.0	*	O	O	*
	Carbonic acid	0.6	3.6	O	O	O	*
Organic acid	Chromic acid	1.2	0.8	O	O	O	O
	Sulfurous acid	0.8	1.4	O	O	O	*
	Acetic acid	0.6	2.8	*	O	O	*
	Formic acid	0.5	2.3	*	O	O	O
	Oxalic acid	0.9	1.0	*	O	*	*
	Lactic acid	0.9	2.4	*	X	O	O
	Phenol acid	0.9	5.4	*	O	*	O
Alkali	Monochloroacetic acid	0.9	1.8	X	O	O	O
	Calcium hydroxide	0.2	12.4	O	O	O	O
	Potassium hydroxide	0.5	12.7	O	O	O	*
	Sodium hydroxide	0.4	12.9	O	O	O	O
Acid salt	Ammonium hydroxide	0.5	10.4	O	O	O	O
	Ammonium chloride	5		O	O	O	X
	Aluminous water	5		O	O	O	*
	Zinc chloride	5		O	O	O	X
	Iron (III) chloride	5		O	O	O	X
	Iron (III) nitrate	5	1.3	O	O	O	O
Basic salt	Sodium sulfite	5		O	O	O	*
	Sodium carbonate	5	11.8	O	O	O	O
	Sodium phosphate	5		O	O	O	*
Neutral salt	Potassium chloride	5		O	O	O	X
	Sodium sulfate	5		O	O	O	*
	Calcium chloride	5		O	O	O	X
	Sodium nitrate	5	8.2	O	O	O	*
	Aluminium chloride	5		O	O	O	X
Oxidizing agent	Hydrogen peroxide	1		O	O	O	*
	Sodium hypochlorite solution	1	12.5	O	O	*	X
	Chlorinated lime	1		*	O	O	*
	Potassium dichromate	5	4.5	O	O	O	*
Organic solvent	Alcohol	10		O	O	O	O
	Organic solvent or oil (excluding alcohol)			*	O	*	O
	Chlorinated solvent			X	O	X	*

O = can be used  
 \* = shortens useful life  
 X = cannot be used

### Note:

- pH in table was calculated with dissociated constant (related to measurement)
- When any of the two conditions listed below are applicable, please consult our sales department.
  - Strong, oxidizing solutions such as aqua regia, chromic acid, hypochloric acid, perchloric acid, etc.
  - The organic solvent is contained in the order of a few percent.

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YOKOGAWA ◆

GS 12B6K2-01E-E

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# General Specifications

Model PR10  
pH  
Retractable fitting

*On-line measurements always present extra challenges compared to at-line measurements. For example when maintenance needs to be done. Applications where the sensors has to be removed without interruptions or shut-downs the PR10 is especially suitable. Without any special tools the PR10 can be retracted safely from the process up to 5 bar.*

*For easy of use optional flush ports are available. In the retracted position the sensor can be kept moist, cleaned or even calibrated. This can all be done without process interruption or disassembly of the armature.*

*The model PR10 can be adapted for use with pH electrodes with pG13,5 connection by changing only one part of the retractable assembly.*

## Features

- One model for pH, conductivity and inductive conductivity sensors
- Integrated protection cage
- Build in scraper to avoid contamination of the fitting
- Usable for wide range of sensors
- A safe "through the valve" insertion and retraction design
- Simplified installation by optional ball valves with flanged or tapered connections
- Optional flush port for keeping moist, cleaning and calibration



pH/Redox  
Analyzers

## General Specifications

### A. Wetted materials

- For sensor check Instruction Manual
- Stainless steel AISI 316L
- O-ring seals: Viton 70° shore

### B. Non-wetted materials

- For sensor check Instruction Manual
- Stainless steel AISI 316, 304
- Polypropylene glass filled

### C. Insertion length

- Ref. mechanical drawing Figure 2.

### D. Pressure/temperature ratings

- Static conditions: see Figure 1.
- Operating conditions during extraction and insertion max. 500kPa, max. 100°C

### E. Flange ratings:

- DIN flange DN32 PN10
- ANSI flange 1¼" 150 lbs

### F. Specifications of the sensor used

- Please check sensor specifications

### G. Weight

- Approx 2.5 kg excl. ball valve

### H. Specifications of the sensor used

#### YPA pH sensors

- All SC21D sensors (PG13,5 connector) and can be used with the standard spare part cable (see table 1).
- All sensors (YEF connector) spare part cable is needed to fit in the PR10.
- Maximum sensor length is 120 mm

#### Competitor pH sensors

- All pH sensors with PG13,5, VP or Smart connector with a max sensor length of 120 mm can be used (see table 1 and 2 for yokogawa sensors).

**Table 1 Specifications Combined pH Electrodes (non-flow)**

Type	Membrane	Resistance in MΩ/25°C	pH-range	Temp. range (°C)	Pressure range kPa	Reference liquid	Reference system	Diaphragm	Flow
SC21(D)-AGP24	Universal pH-glass bulb	50 - 100	0 - 14	0 - 80	1-500	3.3 m. KCl Thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21(D)-ASP23	Low ohmic pH-glass bulb	40 - 100	0 - 10	0 - 80	1-500	3.3 m. KCl Thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21(D)-AAP26	Chem. res. pH-glass bulb steam-sterillisable ¾ bulb	250 - 400	0 - 14	0 - 110	1-500	Oversaturated KCl thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21(D)-ALP26	Chem. res. pH-glass dome	500 - 900	0 - 14	10 - 120	1-500	Oversaturated KCl thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21(D)-AGP26	Universal pH-glass bulb	120 - 200	0 - 14	-10 - 100	1-500	Oversaturated KCl thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0
SC21(C)-AGP64	Universal pH-glass bulb	50 - 100	0 - 14	0 - 80	1-500	3.3 m. KCl Thickened	Ag/AgCl (wire) Silver-silverchloride	Porous PTFE	0

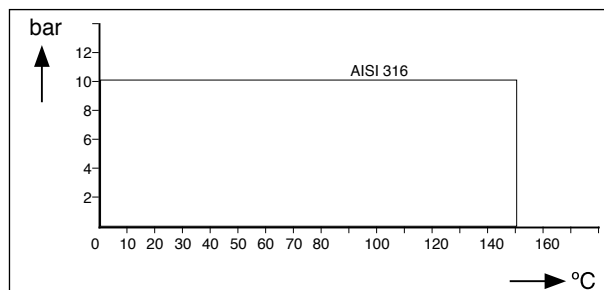
**Note 1:** with D connector No Temperature compensation is possible

**Note 2:** with YEF connector PR20 cable is needed with integral T sensor K1520LP, K1520LQ, K1520LS and K1520LT.

**Table 2 Specifications Redox Electrodes**

Type	Temperature range	Process pressure	Metal surface
SM29-PT9	0 - 130°C	max. 1000 kPa	Platinum
SC29C(D)-PTP29	-10 - 100°C	max. 500 kPa	Platinum
SC29-PTG29	0 - 100°C	max. 1000 kPa	Platinum

**Note 1:** with D connector No T comp. is possible



**FIG. 1 Pressure / Temperature graphic**

**Table 3 Model- and suffix codes**

Model	Suffix	Option	Description
<b>PR10</b>			<b>Retractable Conductivity Fitting 19 mm</b>
Fitting	-S		SS Type AISI 316
O-ring	-V		Viton O-ring sealing
Tube length	-L5		0.5 meter tube length
Connection	-D32		DN32 / 1¼" mounting
Sensor adapter for	-PH12 -PH13		12mm Y-cap 12mm (PG13.5) sensors
Screw-in adapters (SS AISI 316)		/SA125	ISO 228/1 G1¼ to 1¼" M-NPT
Flange adapters (SS AISI 316)		/FA125 /FN125 /FAD32 /FND32	Flange adapter drain 1¼" 150 lbs Flange adapter no drain 1¼" 150 lbs Flange adapter drain DN32 PN10 Flange adapter no drain DN32 PN10
Weld-in adapter (SS AISI 316)		/WA125	Straight weld-in adapter ISO 228/1 G1¼
Ball valves (SS AISI 316)		/BF125 /BFD32 /BS125	Flanged ball valve 1¼" 150 lbs Flanged ball valve DN32 PN10 Screw-in ball valve 1¼" F-NPT
Certificate		/M	3.1 according EN 10024 for wetted metal parts

**\*Note:** With a ball valve, either a screw-in or flanged adapter is required  
**Note:** Please order the K1525AF O-ring pick-up tool for maintenance purposes

## Dimensions

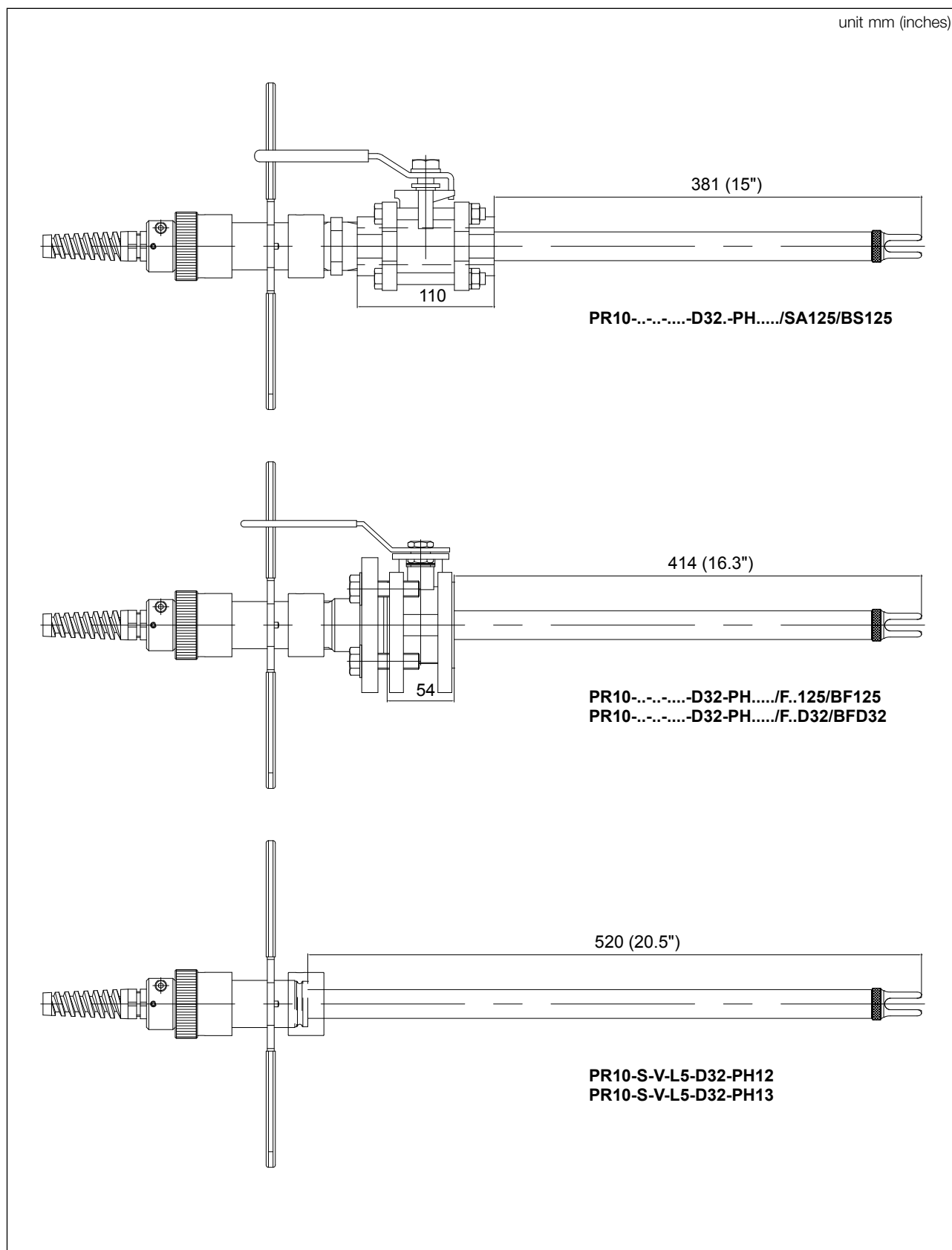
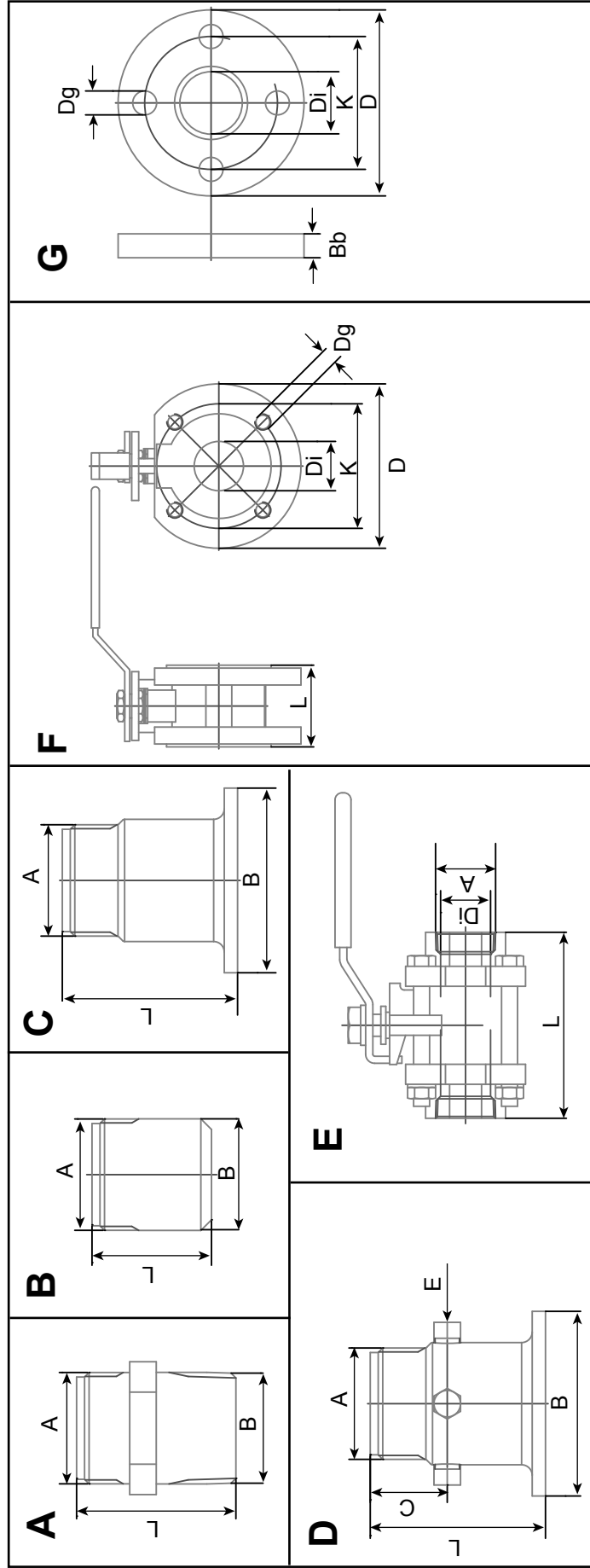


FIG. 2 Dimensional drawing PR10...-D32 with mounted pH12 + pH13 sensor



## Options PR10



**FIG. 3 Dimensions of the PR10 options**

**Table 4 Dimensions options in mm (inches)**

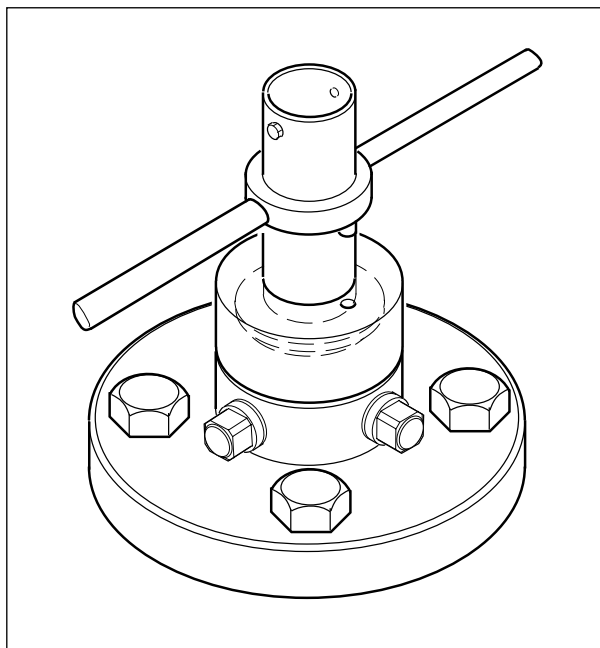
Option	Description	Fig.	A	B	L	C	Bb	D	E	Di	Dg	K
/SA125	ISO 228/1 G1¼ to 1¼" M-NPT	A	ISO 228/1 - G1¼	1¼" NPT	60 (2.4)	29 (1.1)	15.7 (0.6)	117.3 (4.6)	1/8" NPT	47 (1.9)	15.7 (0.6)	88.9 (3.5)
/FA125	Flange adapter drain 1¼" 150 Lbs	D, G	ISO 228/1 - G1¼	69.5 (2.7)	66 (2.6)	29 (1.1)	15.7 (0.6)	117.3 (4.6)	1/8" NPT	47 (1.9)	15.7 (0.6)	88.9 (3.5)
/FN125	Flange adapter no drain 1¼" 150 Lbs	C, G	ISO 228/1 - G1¼	69.5 (2.7)	66 (2.6)	29 (1.1)	16 (0.6)	140 (5.5)	1/8" NPT	47 (1.9)	18 (0.7)	100 (3.9)
/FAD32	Flange adapter drain DN32 PN10	D, G	ISO 228/1 - G1¼	69.5 (2.7)	66 (2.6)	29 (1.1)	16 (0.6)	140 (5.5)		47 (1.9)	18 (0.7)	100 (3.9)
/FND32	Flange adapter no drain DN32 PN10	C, G	ISO 228/1 - G1¼	69.5 (2.7)	66 (2.6)	29 (1.1)	16 (0.6)	140 (5.5)		47 (1.9)	18 (0.7)	100 (3.9)
/WA125	Straight weld-in adapter ISO 228/1 G1¼	B	ISO 228/1 - G1¼	42 (1.7)	45 (1.8)							
/BF125	Ball-valve flanged 1¼" 150 Lbs	F	1¼" NPT		54 (2.1)			118 (4.6)		32 (1.3)	M14	89 (3.5)
/BFD32	Ball-valve flanged DN32 PN10	F			54 (2.1)			140 (5.5)		32 (1.3)	M16	100 (3.9)
/BS125	Ball-valve screw-in 1¼" F-NPT	E			110 (4.3)					32 (1.3)		

**Table 5 Spareparts**

Part no.	Description
K1525AG	Adapter Y-cap
K1525AB	Sensor holder PG13.5
K1525AA	Outer tube
K1525AF	O-ring pick up tool
K1525BA	O-ring set PR10-S-V-L5-D32
K1525BC	Key set
K1525BD	Squeezing set
K1520LP	Cable retractable fitting 5M PT100
K1520LQ	Cable retractable fitting 5M PT1000
K1520LS	Cable retractable fitting 10M PT100
K1520LT	Cable retractable fitting 10M PT1000
K1525BE	Set M16 bolt & washer (8 pcs)
K1525BF	Set M14 bolt & washer (8 pcs)
K1525BH	Gaskets ball valves - D32 + 1¼"
K1525YA	PR10/SA125
K1525YB	PR10/FA125
K1525YC	PR10/FN125
K1525YF	PR10/FAD32
K1525YG	PR10/FND32
K1525YH	PR10/WA125
K1525YK	PR10/BF125
K1525YM	PR10/BFD32
K1525YP	PR10/BS125
K1541EM	Adapter 2" NPT-G2 SS (ISC40PR/B)

**Drain ports connection**

The PR10 retractable fitting can be equipped with optional drain (or flush) ports on the flanged adapter. The drain ports are tapered 1/8" NPT female for small diameter connectors.

**FIG. 4 Drain Port Connection**



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# General Specifications

## Model EXA Series Compact pH Probes PF20, PD20 and PS20

EXA Compact is a versatile series of probes suitable for pH measurements in all common applications in industrial processes and (waste) water treatment installations.

EXA Compact is available as a flow type, an insertion type and an immersion type of fitting. A wide choice of process connections is available to make installation in a tank, open basin or pipe/bypass very simple. The careful choice of chemically resistant materials makes it suitable for most processes.

The EXA Compact probe is flexible in use and its small size and light weight makes it easy to handle.

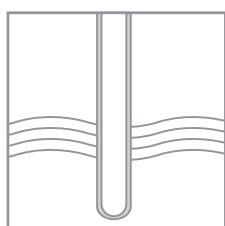
EXA Compact comes as a complete system including a basic holder with electrode, integrated liquid earth with temperature sensor, a spray unit for chemical cleaning (optional) and one combination cable.

The EXA Compact system is perfectly suited for the advanced capabilities of the EXA PH analyzers, e.g.: sensor diagnostics and automatic chemical cleaning, resulting in a reliable pH-loop with outstanding performance.

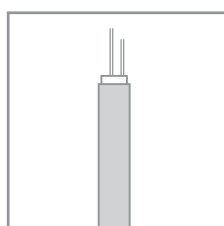
### Features

- Available for flow-, insertion- and immersion mounting.
- Integrated liquid earth for sensor diagnostics with the EXA PH-series.
- Suitable for measurement with double sided high impedance input circuits.
- Integrated spray unit for chemical cleaning available as option.
- Integrated temperature sensor (Pt100 or Pt1000) supporting automatic temperature compensation.
- Electrode removal without twisting the cable.
- One combination cable incorporating all leads and shields.
- Easy installation by modular design and various process connections.
- Easy handling by small size, light weight and fast-fit parts.
- All-in-one system eases stock and order processing.
- Non-flow combination electrode with PTFE-diaphragm.
- Wetted parts from ryton, PVC-C and stainless steel (or hastelloy) for excellent chemical resistance.
- Flow electrode suitable for severe fouling and poisoning applications.

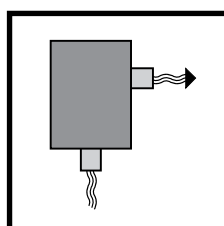
### System configuration



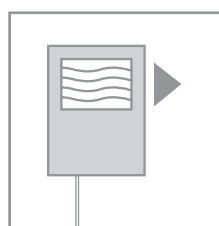
Sensors



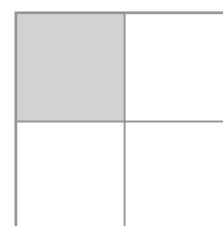
Cables



Fittings

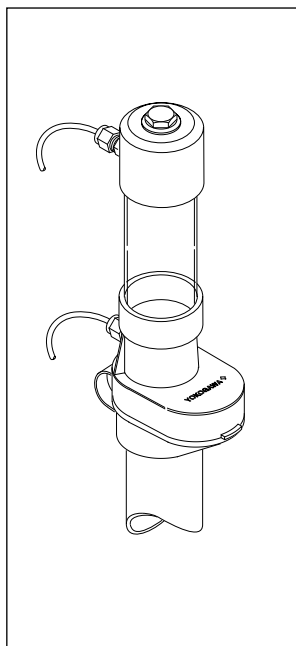


Transmitters

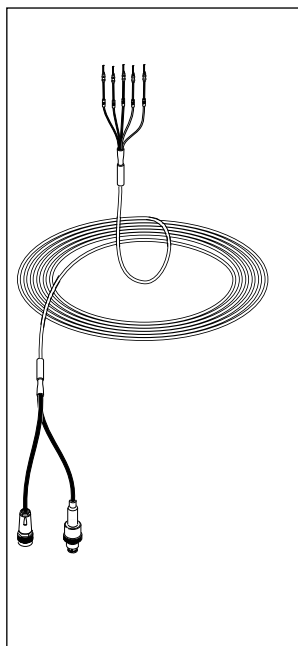


Accessories

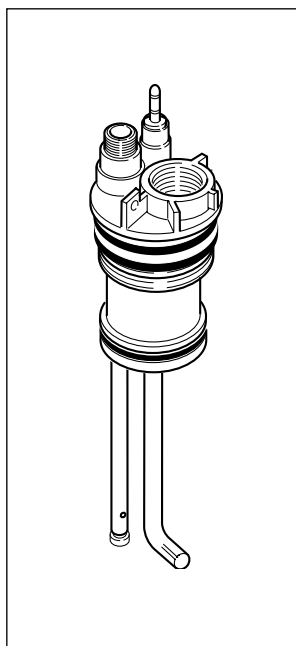




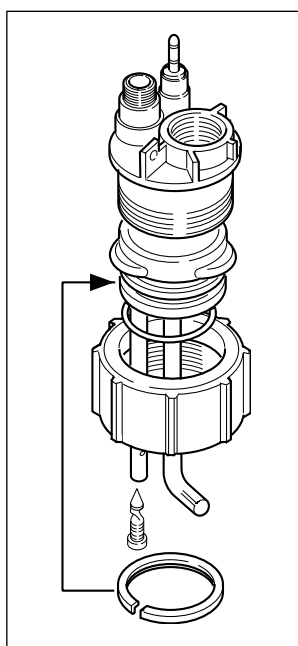
**Electrolyte reservoir with protection cap**



**Combination cable**



**Basic holder (PD20)**



**Basic holders (PF20, PS20)**

## The EXA Compact Probe System

### Reference liquid (KCl) reservoir (optional):

The reference liquid reservoir is used to supply electrolyte (KCl) to the flow electrode when used. This gives a constant out-flow of electrolyte into the process preventing penetration of process liquid into the electrode. This protects the reference electrode against risk of poisoning. For this purpose the reservoir can also be pressurized up to 5 bar.

The reservoir with electrolyte saves maintenance costs and, because of its transparency, the electrolyte level is shown all the time. Mounting and de-mounting on the protective cap is very simple so the standard system can retrospectively be upgraded to a flow version if necessary.

### Protection hood with cap:

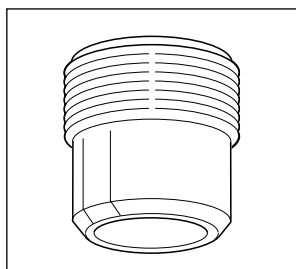
The protection hood with cap protects the electrode head and electrical connections of the basic holder against rain, dust and mechanical damage. It can be withdrawn easily from the basic holder to give fast access to the electrode and connections. The cap also retains the cable and tubes for electrolyte and chemical cleaning agent. Unlocking is easy by opening the cap.

### Combination cable:

The combination cable is a factory finished multi-core coax cable with simple connectors for the electrode and liquid earth with integrated temperature sensor and a 5-lead connection to the converter. This allows a quick and simple installation on site.

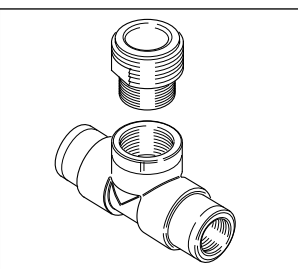
### Basic holder:

This is the central unit of the system upon which the electrode and all other parts are mounted. It includes the liquid earth pin which gives a stable measurement in combination with the high impedance input circuits of the pH converter. In the case of the EXA pH converter it also supports on line diagnostics of the sensor. The integral temperature sensor gives optimum accuracy over a wide range of process temperatures. With the optional spray unit a cleaning agent can be sprayed onto the pH electrode. In conjunction with EXA 4-wire instruments the dynamic response of the sensor is also checked. A unique twist-lock system ensures with easy handling a watertight connection.



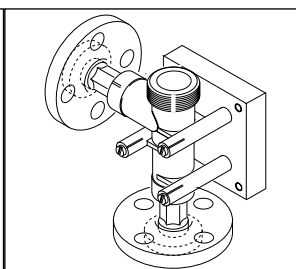
### Welding sockets

The probe can be supplied with welding sockets for direct insertion into a pipe or tank.



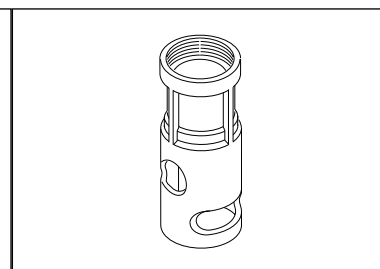
### T-pieces

T-pieces are available for installation directly in line.



### Flow vessel

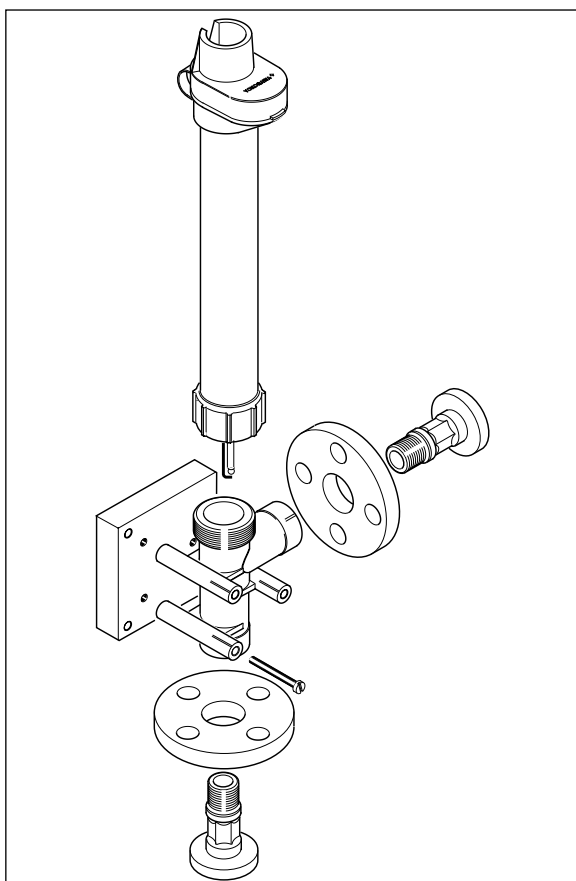
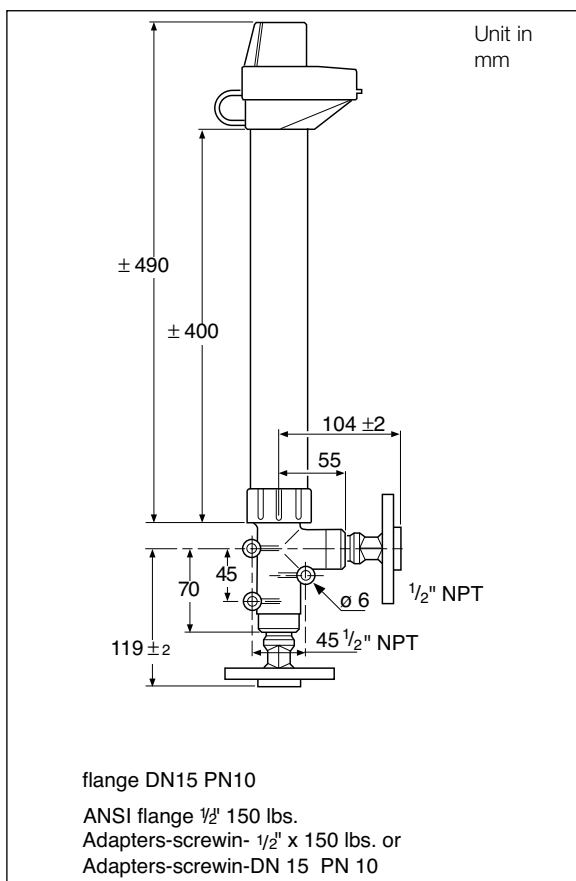
The injection-moulded flow vessel is suitable for installation in a sample line. Flange connection for DIN or ANSI are available.



### Protection cage

The immersion probe is suitable for installation in open/closed tanks using a gas-tight flange or clamps for wall mounting. The protection cage shields the electrode from mechanical damage.

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**Flow type****The EXA Compact Flow Probe Model PF20**

The EXA Compact flow system is ideal for installation in a by-pass circulation pipe line of a tank or fast sample loop from a large volume flow line. It has a very small dead volume giving immediate response to changes. A by-pass measurement has the advantage of easy isolation from the main stream for maintenance.

The flow fitting can be located at a convenient place and level with small diameter pipe-line connecting to the vessel.

The basic holder with electrode can be quickly taken off for inspection or calibration with the large fixing nut without twisting the cable.

The flow vessel has 1/2" NPT female connections. In addition to that flange adapters are available for DN 15 DIN flanges or 1/2" ANSI flanges. The inlet at the bottom gives an angled flow with the outlet on the horizontal level. When the outlet runs down the tip of the electrodes will stay wetted with the sample.

The flow vessel can be surface mounted by three long bolts (M5) or by an optional wall mounting plate.

**Specifications:****Wetted parts**

Holder	: Glas-fitted PPS (RYTON)
Earth pin	: Stainless steel 316L or Hastelloy C276
O-ring	: Viton/NBR
Spray unit (optional)	: Stainless steel 316L or Hastelloy C276

**General**

Cap	: EPDM rubber
Protection hood	: Polypropylene

**Process conditions**

Temperature limits	: 0-70°C
Pressure limits	: 0-2 bar (0-200 kPa)
Flow rate max.	: 3 l/m

**Model code**

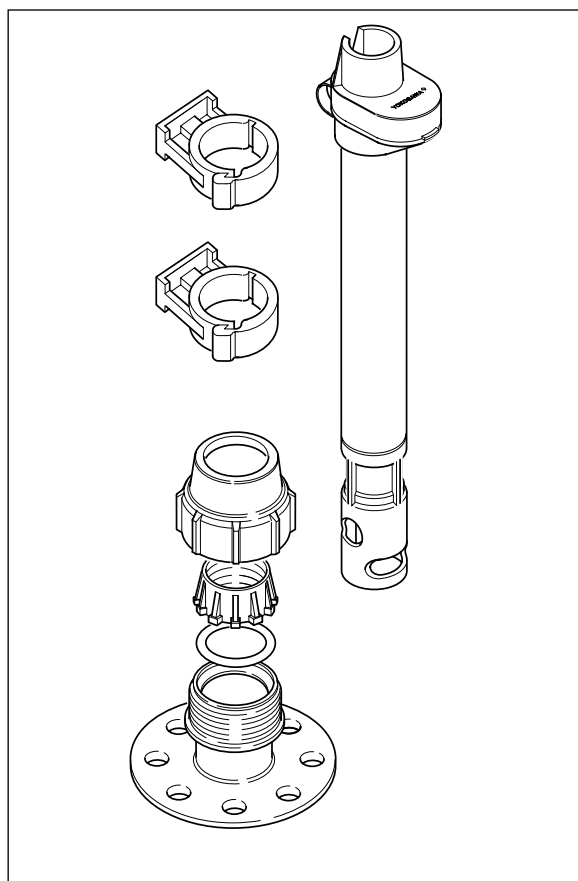
Model	Suffix	Option	Description
PF20			Flow pH probe with flow vessel and electrode holder in Rytan and 1/2" NPT process connection
Liquid	-RS		Liquid earth in stainless steel 316L (not with Hastelloy)
Earth	-RH		Liquid earth in Hastelloy C276 (not in combination with-CS)
Chemical cleaning	-CS		Chemical cleaning in stainless steel 316L
	-CH		Chemical cleaning in Hastelloy C276
Length of cable/cleaning	-05		5 mtr.
	-10		10 mtr.
Temperature compensation	-T1		Pt1000
	-T2		Pt100
Style code	*A		Style A
Options (process connections)	/WM		Wall mounting plate (use recommended with options /FC and /FD)
	/FC		2x DN15 PN10 Flanges in reinforced polyester
	/FD		2x 1/2 ANSI (Class 150) flanges in reinforced polyester
	/M		Material certificate 3.1 according to EN 10024 for wetted metal parts only
	/KR		Flow reservoir

**Note:**

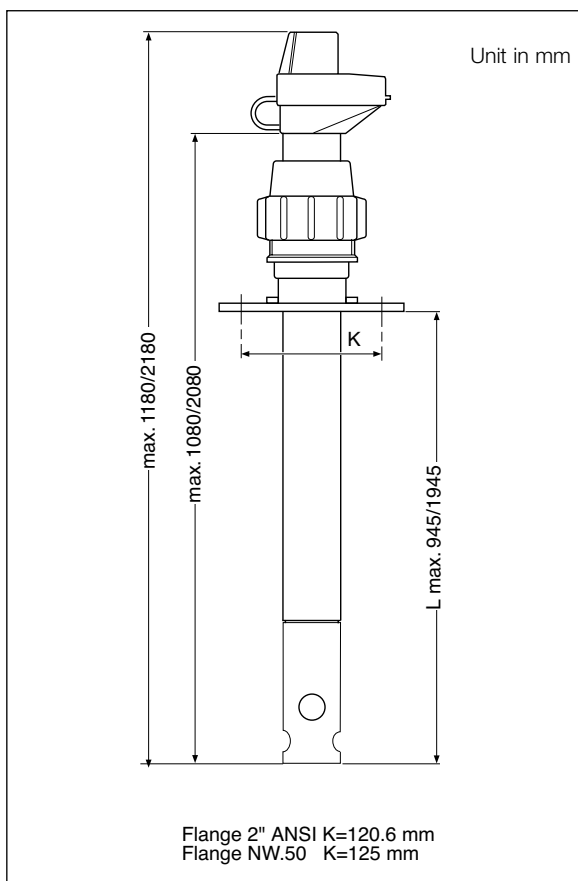
Suitable sensors: Non-flow electrode SC21C-AGP64 + SC21C-AGP26  
Flow electrode (SC21C-AGC55)+ SC21C-AGP26

The SC21C-AGP64 (non flow) and the SC21C-AGC55 (flow) can be ordered separately. The electrodes will suit the great majority of the (waste) water applications. When a non-flow, heavy duty electrode is required one should order the SC21C-AGP26 which can withstand more severe conditions. Also for redox measurements, flow- and non-flow electrodes are available.

GS 12B6K4-E-E



Immersion type



GS 12B6K4-E-E

### The EXA Compact Immersion Probe Model PD20

The EXA Compact immersion system is ideal for installation in open or closed tanks or channels. The light weight and small diameter make it easy to handle. For maintenance the basic holder with electrode comes off without tools or turning, leaving the cable untwisted. Standard lengths of 1 or 2 mtr. are available. When the rubber cap is removed from the top the pipe can be shortened if needed. Mounting with the optional gas-tight sliding flange is ideal for installation in a closed tank. The immersion depth can be varied by sliding the pipe through the flange.

The flange has both DIN DN50 and ANSI 2" fixing holes.

Mounting in open vessels or channels is easy with the optional clamps for wall mounting. The immersion depth into the process can be adjusted by sliding the tube through the clamps.

### Specifications:

#### Wetted parts

Holder	: Glas-fitted PPS (RYTON R4XT)
Earth pin	: Stainless steel 316L or Hastelloy C276
O-ring	: Viton
Immersion tube	: High temperature polyvinylchloride (PVC-C)
Protection cage	: Reinforced polypropylene
Flange	: Reinforced polypropylene

#### General

Cap	: EPDM rubber
Protection hood	: Polypropylene
Wall mounting clamps	: Polypropylene

#### Process

Temperature limits	: 0-70°C
Pressure limits	: 0-0.5 bar (50 kPa)
Flow speed limits	: 0.5 m/s

### Model Code

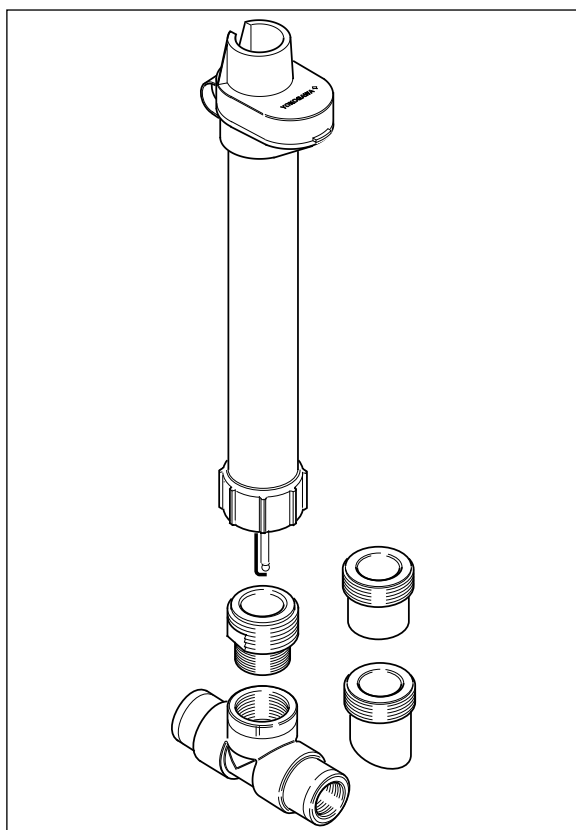
Model	Suffix	Option	Description
PD20			Immersion pH probe with immersion tube in PVC-C and electrode holder in Ryton
Liquid	-RS		Liquid earth in stainless steel 316L (not with Hastelloy)
Earth	-RH		Liquid earth in Hastelloy C276 (not in combination with-CS)
Chemical cleaning	-CS		Chemical cleaning in stainless steel 316L
	-CH		Chemical cleaning in Hastelloy C276
Length of cable/cleaning	-05		5m
	-10		10m
Length insertion tube	1		1m (adjustable on site)
	2		2m (adjustable on site)
Temperature compensation	-T1		Pt1000
	-T2		Pt100
Style code	*A		Style A
Options (process connections)	/CW		2 clamps (PP) for wall mounting
	/FA		Flange (PP), DN50 (holes acc.to PN10) or 2" holes acc. to ANSI
	/KR		Flow reservoir
	/M		Material certificate 3.1 according to EN 10024 for wetted metal parts only

#### Note:

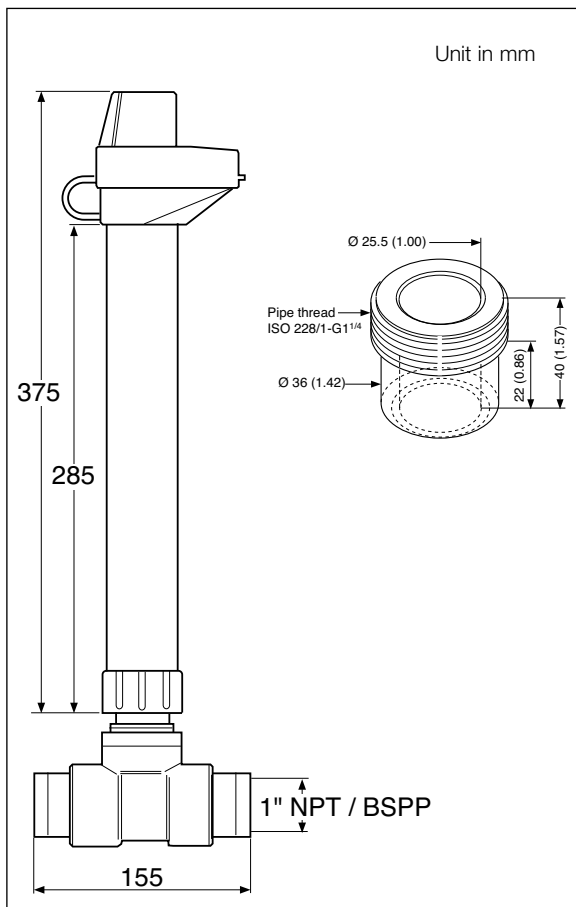
Suitable sensors: Non-flow electrode (SC21C-AGP64)  
Flow electrode (SC21C-AGC55)

The SC21C-AGP64 (non flow) and the SC21C-AGC55 (flow) can be ordered separately. The electrodes will suit the great majority of the (waste) water applications. When a non-flow, heavy duty electrode is required one should order the SC21C-AGP26 which can withstand more severe conditions. Also for redox measurements, a flow- and a non-flow electrode are available.





Insertion type



Insertion type dimensions

### The EXA Compact Direct Insertion Probe Model PS20

The EXA Compact direct insertion system is ideal for installation directly in a flow line or tank. With a choice of adapters the system can be used in a variety of applications.

The standard 1 1/4" BSP female connections can be mounted into the stainless steel weld-in sockets. These sockets are either welded from a vertical or angled position into the wall of the tank or into the pipe.

The minimal angle of mounting is 15° from the horizontal level. For mounting into a tapered stud we provide a polypropylene 1 1/4" BSPT male and stainless steel 1" NPT male adapter.

Further accessories include T-pieces in polypropylene (ISO 228/1-G1) and stainless steel (ISO 228/1-G1) for easy fitting into a piping system.

These wide bore systems have the advantage of keeping the electrode clean through the high flow velocity. The disadvantage is that for inspection or calibration the flow has to be stopped.

### Specifications:

#### Wetted parts

Holder	: Glas-fitted PPS (RYTON)
Earth pin	: Stainless steel 316L or Hastelloy C276
O-ring	: Viton
Weld-in adapters	: Stainless steel 316
T-piece with adapter	: Stainless steel 316 or Polypropylene

#### General

Cap	: EPDM rubber
Protection hood	: Polypropylene

#### Process conditions

Temperature limits	: 0-70°C
Pressure limits	: 0-2 bar (0-200 kPa)
Flow rate max	: 20 l/min

### Model Code

Model	Suffix	Option	Description
PS20			Direct insertion pH probe with electrode holder In Ryton and 1 1/4" BSPP female process connection
Liquid earth	-RS		Liquid earth in stainless steel 316L (not with Hastelloy)
	-RH		Liquid earth in Hastelloy C276 (not in combination with-CS)
Chemical cleaning	-CS		Chemical cleaning in stainless steel 316L
	-CH		Chemical cleaning in Hastelloy C276
Length of cable/cleaning	-05		5m
	-10		10m
Insertion length	0		Always 0
Temperature Compensation	-T1		Pt1000
	-T2		Pt100
Style code	*A		Style A
Options (process connections)	/NP		1 1/4" BSPT (male (PP)
	/NS		1" NPT male (SS 316)
	/WA		Angle welding (SS 316)
	/WS		Straight welding (SS 316)
	/TP		T-piece (PP); 2 x ISO 228/1-G1 female (incl. option /NP)
	/TS		T-piece (SS316); 2 x ISO 228/1-G1 female (incl. option /NS)
	/KR		Flow reservoir
	/M		Material certificate 3.1 according to EN 10024 for wetted metal parts only

**Note:** Suitable sensors: Non-flow electrode (SC21C-AGP64)  
Flow electrode (SC21C-AGC55)

The SC21C-AGP64 (non flow) and the SC21C-AGC55 (flow) can be ordered separately. The electrodes will suit the great majority of the (waste) water applications. When a non-flow, heavy duty electrode is required one should order the SC21C-AGP26 which can withstand more severe conditions. Also for redox measurements, a flow- and a non-flow electrode are available.

GS 12B6K4-E-E

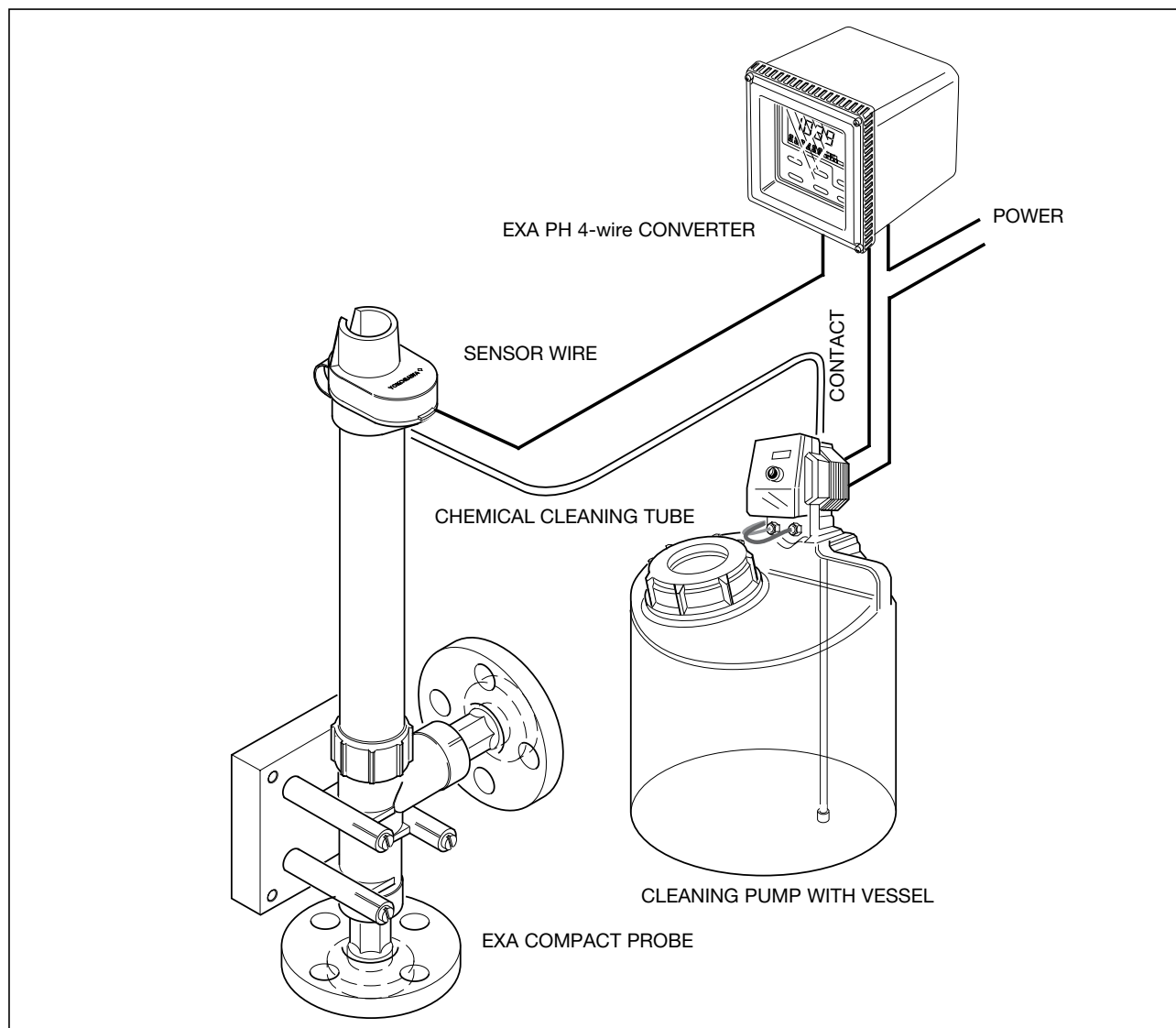
## Automatic Cleaning

The EXA Compact pH probe can be easily upgraded with an integrated spray unit for a chemical cleaning of the electrode, where there is a risk of fouling. This reduces the maintenance costs.

As can be seen from the configuration chart, the EXA Compact pH probe should be connected to a pump (or solenoid valve), spraying the cleaning agent from a reservoir onto the electrode. A pump pressure from 3 to 10 bar is needed to achieve an effective cleaning. The EXA PH402 and EXAxt PH450 converters with built-in washtimer can be used for controlling the automatic chemical cleaning cycle.

Depending of the cleaning agent used and the process conditions, the choice has to be made between a spray unit in stainless steel or Hastelloy (see model code). In a lot of processes, 3-5% HCl or hot water only is sufficient to achieve a chemical cleaning effect. By using a pump pressure of 10 bar also a chemical cleaning effect will be achieved.

Please consult Yokogawa for more detailed information about the chemical cleaning of electrodes and delivery of the complete configuration.



**Configuration with cleaning system**

GS 12B6K4-E-E

### Consumables and accessories

The SC21C-AGP64 (option /EN, non-flow) and the SC21C-AGC55 (option /EF, flow) can be ordered through the modelcode options. The electrodes will suit the great majority of the (waste) water applications. When a non-flow, heavy duty electrode is required one should order the SC21C-AGP26 which can withstand more severe conditions.

Also for redox measurements, a flow- and a non-flow electrode are available.

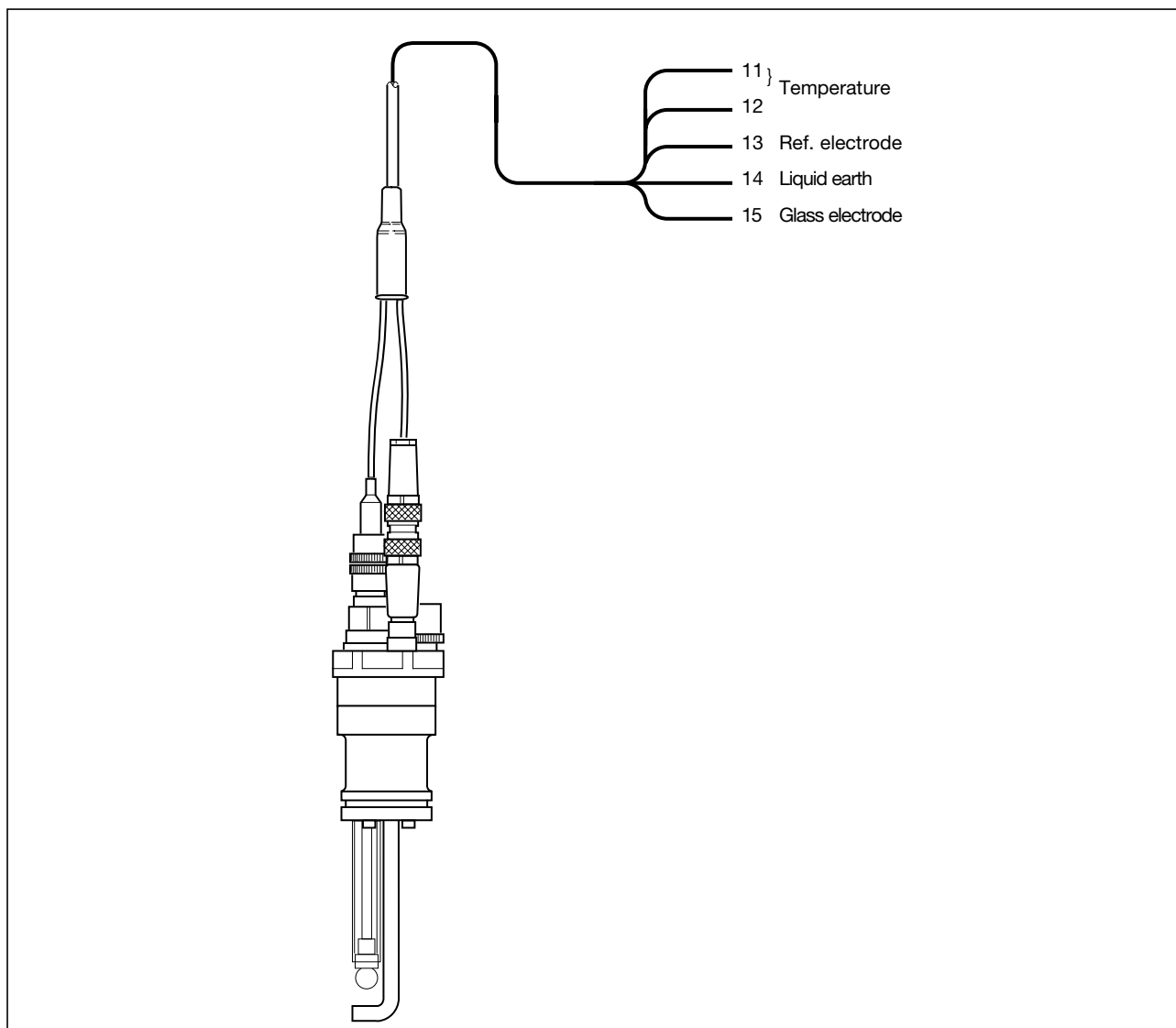
EXA Compact pH/redox electrode

Part no.	Description of electrode
SC21C-AGP64	Non-flow pH/ref electrode with PTFE diaphragm
SC21C-AGP26	Non-flow pH/ref electrode with double junction and heavy duty glass membrane
SC21C-AGC55	Flow pH/ref electrode with ceramic diaphragm
SC29C-PTP29	Non-flow platinum/ref electrode with double junction
SC29C-PTC55	Flow platinum/ref electrode

**Note:** For more information on the Compact electrode see GS 12B6J1-E-E

### Options can be ordered separately:

PF20 (flow model)		
K1520GF	/WM	Wall mounting plate (use with Part no. K1500YC or K1500YD)
K1500YC	/FC	2 x DN15 PN10 flanges in reinforced polyester
K1500YD	/FD	2 x 1/2" ANSI (class 150) flanges in reinforced polyester
K1520YN		cable, 5 mtr
K1520YP		cable, 10 mtr
PD20 (immersion model)		
K1500YA	/CW	Clamps (PP)
K1520EV	/FA	Flange (PP), DN50 (holes acc. to PN10) or 2" (holes acc. to ANSI)
PS20 (insertion model)		
K1520CZ	/NP	11/4" BSPT male (PP)
K1520DZ	/NS	1" NPT male (SS 316)
K1520EJ	/WS	Straight welding (SS 316)
K1520EK	/WA	Angle welding (SS 316)
K1520YE	/TP	T-piece (PP), 2 x ISO 228/1-G1 female (incl. K1520CZ)
K1520YF	/TS	T-piece (SS 316), 2 x ISO 228/1-G1 female (incl. K1520DZ)
K1520ZD		Ryton mounting nut for PS20



Wiring diagram

GS 12B6K4-E-E

## Spare parts PD20

Part no.	Description	Part no.	Description
K1500AJ	O-rings EPDM for /FA (2pcs)	K1520EA	Rubber cap for P*20
K1500BZ	O-rings Viton 11x3 (6Pcs)51250	K1520ET	Spraying valve for P*20
K1500DW	Set of 12 cable nuts for WU20	K1520FJ	Tubing set, chem. cleaning 5m
K1500ZF	Ferrule set, flow/cleaning tube	K1520FK	Tubing set, chem. cleaning 10m
K1520AR	Basic holder, P*20-RS-CS-T1	K1520JN	Adapter M25x1.5 - PG13.5
K1520AS	Basic holder, P*20-RS-CS-T2	K1520YA	/KR for PD/PF/PS20 holders
K1520AT	Basic holder, P*20-RH-CH-T1	K1520YN	PD/PF/PS20 cable, 5 m
K1520AU	Basic holder, P*20-RH-CH-T2	K1520YP	PD/PF/PS20 cable, 10 m
K1520DG	Protection cage for PD20	K1520ZA	O-rings viton 37.77x2.62 (2pcs)
K1520DS	Pipe, 2 m for PD20	K1520ZB	O-ring set viton, for PD20
K1520DU	Pipe, 1 m for PD20	K1547PH	10 m Nylon tube and mounting

## Spare parts PF20

Part no.	Description	Part no.	Description
K1500AD	Screw set for PF20/WM (3pcs)	K1520DC	Flow chamber for PF20
K1500AE	O-ring set viton, PF/PS20 (5)	K1520DT	Protection tube for PF/PS20
K1500BZ	O-rings Viton 11x3 (6Pcs)51250	K1520EA	Rubber cap for P*20
K1500DW	Set of 12 cable nuts for WU20	K1520ET	Spraying valve for P*20
K1500ES	O-ring set EPDM FF20P&F33	K1520FJ	Tubing set, chem. cleaning 5m
K1500FK	O-ring set Viton FF20P&F22	K1520FK	Tubing set, chem. cleaning 10m
K1500ZF	Ferrule set, flow/cleaning tube	K1520JN	Adapter M25x1.5 - PG13.5
K1520AR	Basic holder, P*20-RS-CS-T1	K1520YA	/KR for PD/PF/PS20 holders
K1520AS	Basic holder, P*20-RS-CS-T2	K1520YN	PD/PF/PS20 cable, 5 m
K1520AT	Basic holder, P*20-RH-CH-T1	K1520YP	PD/PF/PS20 cable, 10 m
K1520AU	Basic holder, P*20-RH-CH-T2	K1520ZD	Mounting nut for PS20
		K1547PH	10 m Nylon tube and mounting

## Spare parts PS20

Part no.	Description	Part no.	Description
K1500AE	O-ring set viton, PF/PS20 (5)	K1520EA	Rubber cap for P*20
K1500BZ	O-rings Viton 11x3 (6Pcs)51250	K1520ET	Spraying valve for P*20
K1500DW	Set of 12 cable nuts for WU20	K1520FJ	Tubing set, chem. cleaning 5m
K1500FK	O-ring set Viton FF20P&F22	K1520FK	Tubing set, chem. cleaning 10m
K1500ZF	Ferrule set, flow/cleaning tube	K1520JN	Adapter M25x1.5 - PG13.5
K1520AR	Basic holder, P*20-RS-CS-T1	K1520YA	/KR for PD/PF/PS20 holders
K1520AS	Basic holder, P*20-RS-CS-T2	K1520YN	PD/PF/PS20 cable, 5 m
K1520AT	Basic holder, P*20-RH-CH-T1	K1520YP	PD/PF/PS20 cable, 10 m
K1520AU	Basic holder, P*20-RH-CH-T2	K1520ZD	Mounting nut for PS20
K1520DT	Protection tube for PF/PS20	K1547PH	10 m Nylon tube and mounting

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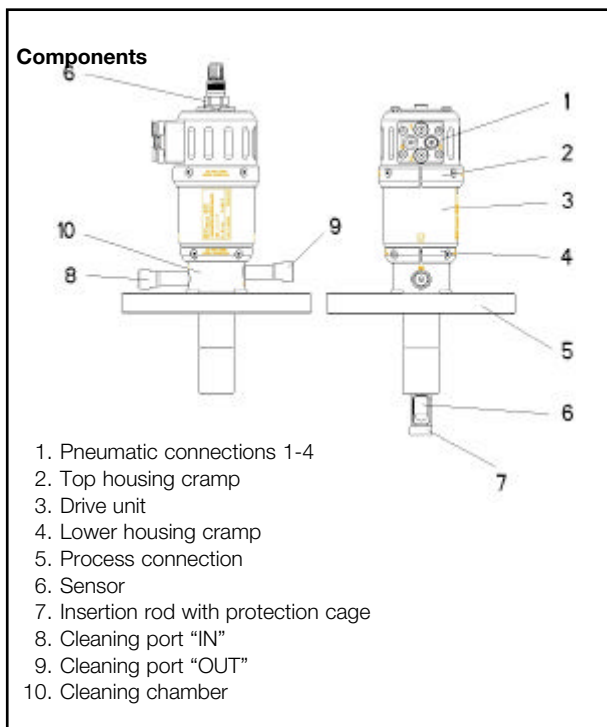
## General Specifications

EXAtrac RF20H  
Process retractable holder



## 1. Product description

### 1.1 Automatic Retractable RF20H



**Fig. 1: Retractable fitting**

#### Options

The retractable fittings are installed with a suitable process connection to a container or pipe. In order to adapt to the various process connections, the retractable fitting RF20H is made of high-grade metal or made of plastic. In addition one can choose between different process- and flushing port connectors, sealing materials and sensors.

#### Drive

Compressed air is supplied to the pneumatics connections. The pneumatic drive unit drives the immersion tube down to maximum insertion depth into the process medium. For security reasons this is only possible when a sensor is inserted.

#### Measurement

When the end point of the position "Measure" is reached, the control unit will receive a pneumatic position feedback. In this situation the sensor head is sunk in the drive unit and cannot not be RF20Hed from the process. The sensor measures the chemical and / or physical characteristics of the process liquid.

#### Service

The sensor can be cleaned, rinsed and calibrated during process runs. To do so, the armature must be locked into the "service" position. Again, a pneumatic position feedback is triggered when the end point is reached. In the "Service" position, the immersion-tube seals the rinsing chamber from the process so that no process liquid escapes. The necessary rinsing liquid can be applied to the flushing port connector "IN", into the rinsing chamber and will flow out via flushing connector "OUT".

### 1.2 Process integration

#### Control

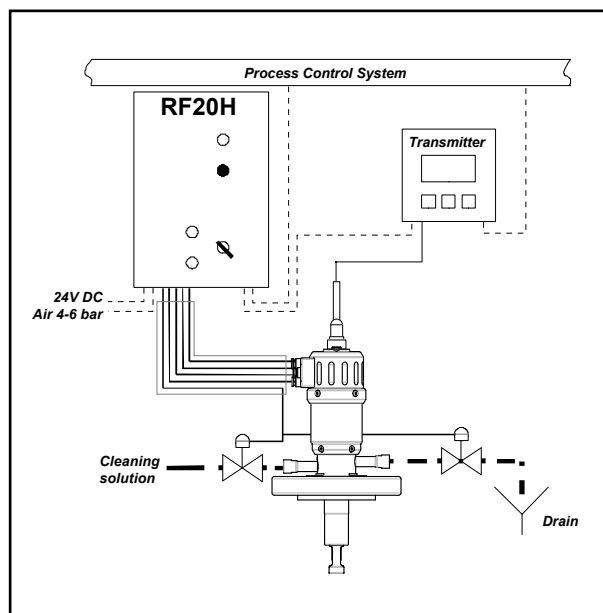
For the well functioning of the Retractable fitting RF20H the automatic control unit EXmatic can be used. It is specially designed to match the functions of the retractable armature

#### Transmitter

The retractable armature brings a sensor into the process liquid, which is then able to pass its measurement signals to the transmitter.

#### PLC

The external control unit as well as the transmitter can be connected to a process control system. Dependent on the results of measurement the measuring and rinsing intervals can then be started automatically.



**Fig. 2: Process Cycle**

#### Pressure Temperature

The selection of a suitable armature is dependant on the pressure and temperature conditions of the process. Retractable armatures made of high-grade metal can be used up to a pressure of 16 bar. The plastic armatures up to 10 bar. The process temperature must lie between -10°C and 140°C. Please check the pressure v.s. temperature diagrams.



Please check the pressure and temperature diagrams

#### Installation

The armature can be operated in any type of installation. In order to receive reliable results from the measurement the proper sensor has to be selected for that process.



## 2. Special functions

### 2.1 Safety Requirements

#### Position „Service“

The safety lock prevents that – without a sensor - the immersion tube can be inserted into the process as this could cause leakage of process liquid.

The sensor can only be removed when in the armature is in the “service” position.

#### Position „Measure“

The sensor is set into the „Measure“ position.

In this position, the sensor cannot be removed.

#### Protection cage

The protection cage - at the end of the immersion tube- can be aligned in order to protect the sensor against mechanical damage.

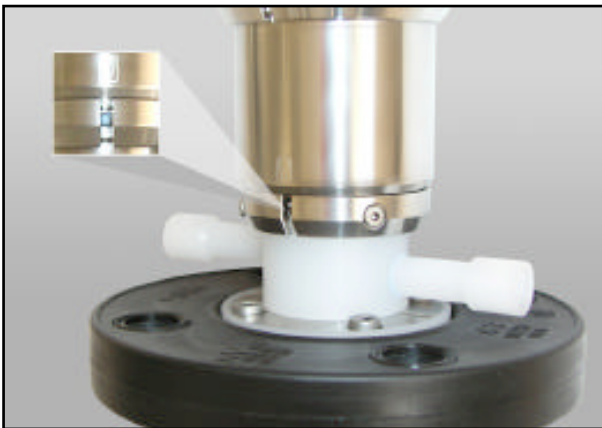
### 2.2 Protection cage

The protective cage at the lower end of the immersion tube can be aligned to the direction of flow. The symbol on the drive unit shows the position of the opening in the immersion tube. If the symbol is parallel to the direction of flow, the immersion tube's opening is in line with the process stream. If the symbol stands perpendicularly to the current, then the sensor is completely protected against direct flow. The immersion tube can be aligned in any position between the parallel and perpendicular positions.

### 2.3 Proces affected seals check

The Retractable fitting has a small check window, which lies between the lower housing clips

When process liquid is present at the check window, the process seals must be replaced.



**Fig. 3: Check window at the lower housing-clamps**

### 2.4 Pneumatic connections

The Retractable fitting RF20H is operated with compressed air. Four compressed air ports are present. Two to drive the cylinder and two for the feedback function.



**Fig. 4: Pneumatic connections 1 – 4**

#### Requirements :

- 2 Pneumatic tubing  $\varnothing = 4$  mm
- 2 Pneumatic tubing  $\varnothing = 6$  mm.

### 2.5 Automatic operation



For the automatic operation of the retractable fitting an external control unit is necessary.

#### Consider the functions of the pneumatics connections!

- 1) connection 2: Air supply position "Measure".
- 2) connection 4: Feedback position "Measure".
- 3) connection 1: Air supply position "Service".
- 4) connection 3: Feedback position "Service".

The external control unit can change the armature's position from the "Service" position into the "Measure" position.

A pneumatic signal is send when either the "Service" or "Measure" position is reached.

## Technical Data

## 2.6 Material Properties

Wetted components					
Holder					
metal	plastic		seals		
RF20H	1.4404/316L	Alloy C22, 2.4602	PVDF	PEEK	EPDM / FPM / FFKM

Drive unit			
cylinder	cylinder extension	seals	
RF20H	1.4404/316	PA66 GF30	EPDM

Drive Unit			
RF20H	Cylinder	Cylinder extension	Sealing
	1.4404/316	PA66 GF30	EPDM

## 2.7 Flush ports connections

Threads	
Without connection adapter	G 1/8" (inner)
	G 1/4" (inner)
With connection adapter	NPT 1/4" (inner)

Flush port pressure range	
	1 - 4 bar

## 2.8 Sensoren

Gel filled Sensors			
RF20H	length [mm]	diameter [mm]	Thread
	225	12	PG 13,5

Flowing Sensors			
RF20H	Length [mm]	diameter [mm]	Thread
	280	12	PG 13,5

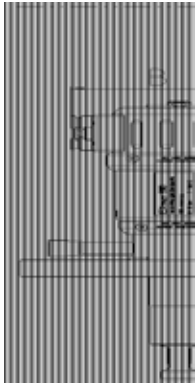
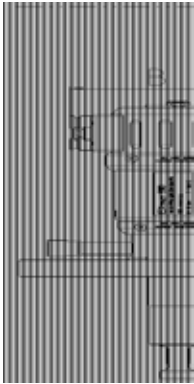
## 2.9 Pneumatics

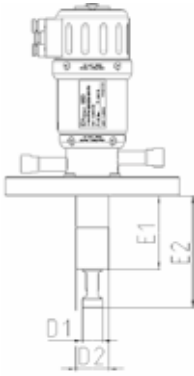

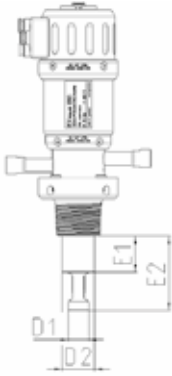
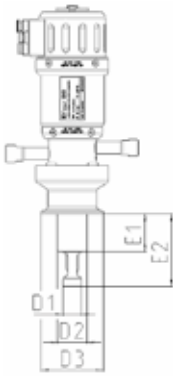
Pneumatic hose		
	ø - outer	ø - inner
Piston drive hoses	6 mm	4 mm
Position feedback	4 mm	2 mm

Compressed air	
	filtered 40µm, water- and oil free
	4 - 6 bar
	No continuous air usage!



## 2.10 Dimensions

Holder		
		
Dimensions	RF20H	RF20H
Metal	Plastic	
A1 [mm]	180	180
A2 [mm]	350	350
B [mm]	95	95

Process connections RF20H in Metal				
A	B	C	D	
Flange 4404	Flange C22	NPT	TriClamp	
				
Dimensions				
E1 [mm]	71	66	34	39
E2 [mm]	107	102	70	75
D1 [mm]	19	19	19	19
D2 [mm]	31	31	31	31
D3 [mm]	-	-	-	64

Process connections RF20H in Plastic		
A Flange	B	
	NPT	
Dimensions		
E1 [mm]	58	29
E2 [mm]	94	65
D1 [mm]	19	19
D2 [mm]	31	30.5

2.11 Ambient Conditions

Ambient temperatures - 10 - 70 °C  
Transport- and storage temperatures - 20 - 80 °C

2.12 Process Conditions RF20H

max. Allowable pressures PS: 16 bar  
max. Allowable Temperatures TS: 140 °C

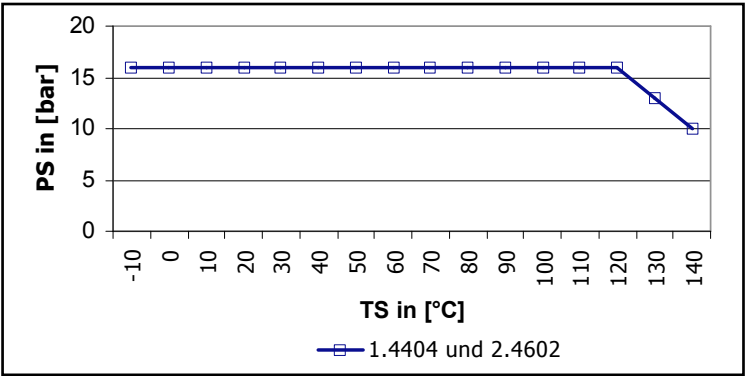


Fig. 5: Pressure-Temperature-Diagram

2.13 Process Conditions RF20H

max. Allowable pressures PS: 10 bar  
max. Allowable Temperatures TS: 140 °C

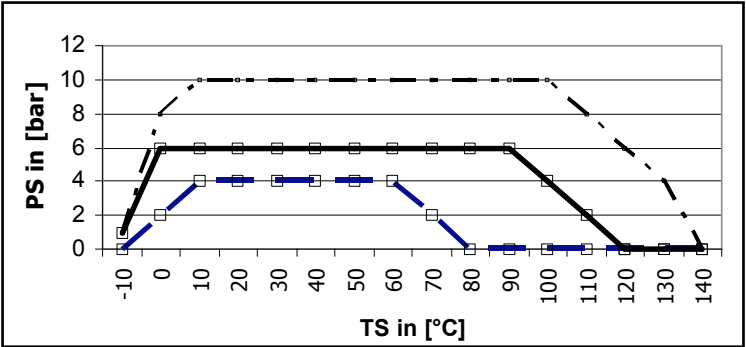


Fig 6. : Pressure-Temperature-Diagram RF20H

### 3. Ordering structure RF20H S.S./Hast.

RF20H		pH-Retractable Holder RF20H	remark
Material (wetted parts)	-PP	PP	
	-PF	PVDF	
	-PK	PEEK	
	-SS	Stainless Steel 1.4404 / 316L	
	-HC	Alloy C22 2.4602	
Sealing Material (wetted sealings)	-EPD	EPDM	
	-FPM	FPM (Viton)	
	-FKM	FFKM (Kalrez)	
Sensor	-225	Suitable for 225mm PG13.5 Gel-filled	
	-280	Suitable for 280mm PG13.5 Liquid-filled	
Process Connection	-D32	Flange DN32 PN16	SS/Hast only
	-D40	Flange DN40 PN16	SS/Hast only
	-D50	Flange DN50 PN16	
	-A14	Flange ANSI 1 1/4" 150lbs	SS/Hast only
	-A12	Flange ANSI 1 1/2" 150lbs	SS/Hast only
	-A20	Flange ANSI 2" 150lbs	
	-N14	NPT M 1 1/4"	
	-T20	Tri Clamp 2"	SS/Hast only
Cleaning Connection	-G18	G 1/8" thread female	
	-G14	G 1/4" thread female	
	-N14	1/4" NPT female	
Position switch	-PN	Pneumatic	

#### Spareparts

Part no.	Description
10/2-123-40-001	Sealing Set EPDM
10/2-123-41-001	Sealing Set FPM
10/2-123-42-001	Sealing Set FFKM (Kalrez)
10/2-075-03-001	Drive Unit - sensor 225/325 pneum. position switch
10/2-075-03-002	Drive Unit - sensor 280/380 pneum. position switch
10/2-061-33-004	Insertion rod RF20H 1.4404 / 316L
10/2-061-34-004	Insertion rod RF20H 2.4602 / Alloy C22
10/2-061-22-004	Insertion rod RF20H PP
10/2-061-23-004	Insertion rod RF20H PVDF/Alloy C22
10/2-061-29-004	Insertion rod RF20H PEEK
10/2-086-32-001	Set blind plug G 1/8" 1.4301/316 for cleaning chamber

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## General Specification

EXAtrac RF20M  
Pneumatic Control Unit

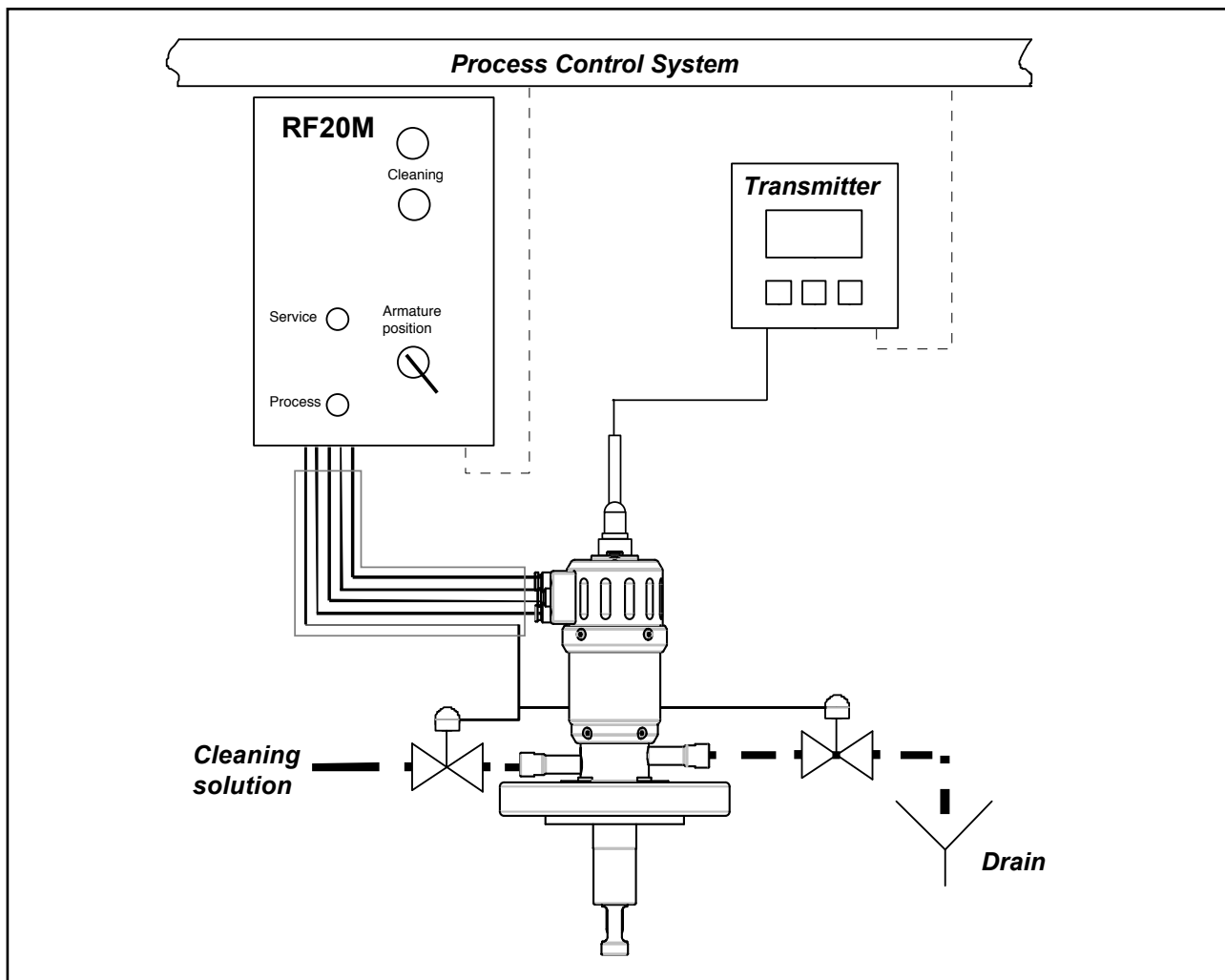


### Product description

The RF20M is a pneumatic control unit for retractable fittings such as EXtract. With this control unit it is possible to drive the retractable fitting into the positions "maintenance" and into the position "Service" and again back. The reached position is acknowledged over pneumatic

feedback and show on the cabinet by lamp indicators. With the use of pushbuttons, Pneumatic valves can be opened and close for the control of rinsing solutions and draining. When the pushbutton is activated, pneumatic signals are produced, which opens the rinsing- and drain valve.

### Process integration



The RF20M is supplied with compressed air 4-6 bar. The connection with the retractable fitting and the cleaning- / drain valves is made by pneumatic tubing, which are combined in a multi-hose.

### Installation

Attach the supply air at the bottom side of the control unit (A)

- pneumatics hose  $\varnothing = 6\text{mm}$ .
- air filtered (40  $\mu\text{m}$ ), water and oil-free only with compressed air

operate Attach the multi-hose at the top site of the control unit

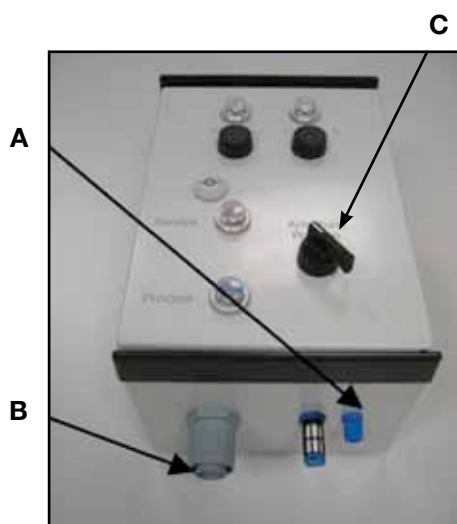
Attach the multi-hose at the top site of the control unit (B)

### Functions

The position of the retractable fitting is controlled with the black switch on the front side (C). Pneumatic end-switches of the retractable fitting are connected to the lamp indicators on the front of the control unit.

In order to start a cleaning, operate the push-button "Cleaning". When Cleaning code 2 (for two cleaning solutions) is ordered, operate the push-button "Cleaning I" and the valve to the first cleaning solution is opened. With push button "Cleaning II" the second valve is opened.

The respective cleaning runs are as long as the push buttons are pushed.



### Model and Suffix Codes

Model	Suffixcode	Description
<b>RF20M</b>		<b>Pneumatic Control Unit for Retractable</b>
Housing	-GF	Plastic Housing
	-SS	Stainless Steel Housing
Cleaning	-C1	For One Cleaning Solution valve
	-C2	For Two Cleaning Solutions valves
Drain	-ND	Without
	-N1	With Drain Valve
Connection hose	-NH	Without
	-03	3m Length
	-05	5m Length
	-10	10m Length
Fastener	-NF	Without
	-EX	Fastening Angle Exatrac
	-RE	Fastening Angle Hamilton Retractex

### Spareparts

Part no.	Description
10/2-083-70-001	Wall Mounting Set (for plastic housing)
10/2-083-70-002	Wall Mounting Set (for stainless steel housing)
10/2-083-70-003	Post Mounting Set (for plastic and stainless steel)
10/2-095-70-001	Membrane-valve PVDF/FPM (single) G3/8"; Air $\varnothing 6$ ; DN12 PN6 NC for Cleaning solution or drain
10/2-095-70-002	Cleaning valve set PVDF/FPM with 2 membrane valves for 1 cleaning solutions and one drain, connectors, PTFE-tubing and mounting brackets included
10/2-095-70-003	Cleaning valve set PVDF/FPM with 3 membrane valves for 2 cleaning solutions and one drain, connectors, PTFE-tubing and mounting brackets included

## Material

Materials switchgear	
Cabinet housing	Glass Reinforced Plastic: GRP
	Stainless steel option

## Ambient conditions

Temperature	
Ambient temperature	0... +55°C
Transport and storage temperature	10... +60°C

Environment	
Relative humidity	10... 95 % non-condensing
Enclosure	
Housing	IP 54

## Pneumatics

Pneumatics hoses	ø outside	ø inside
for control air	6 mm	4 mm
for position feedback	4 mm	2 mm

Compressed air	
	Filtered 40µm, water and oil-free 4 - 6 bar no continuous air consumption

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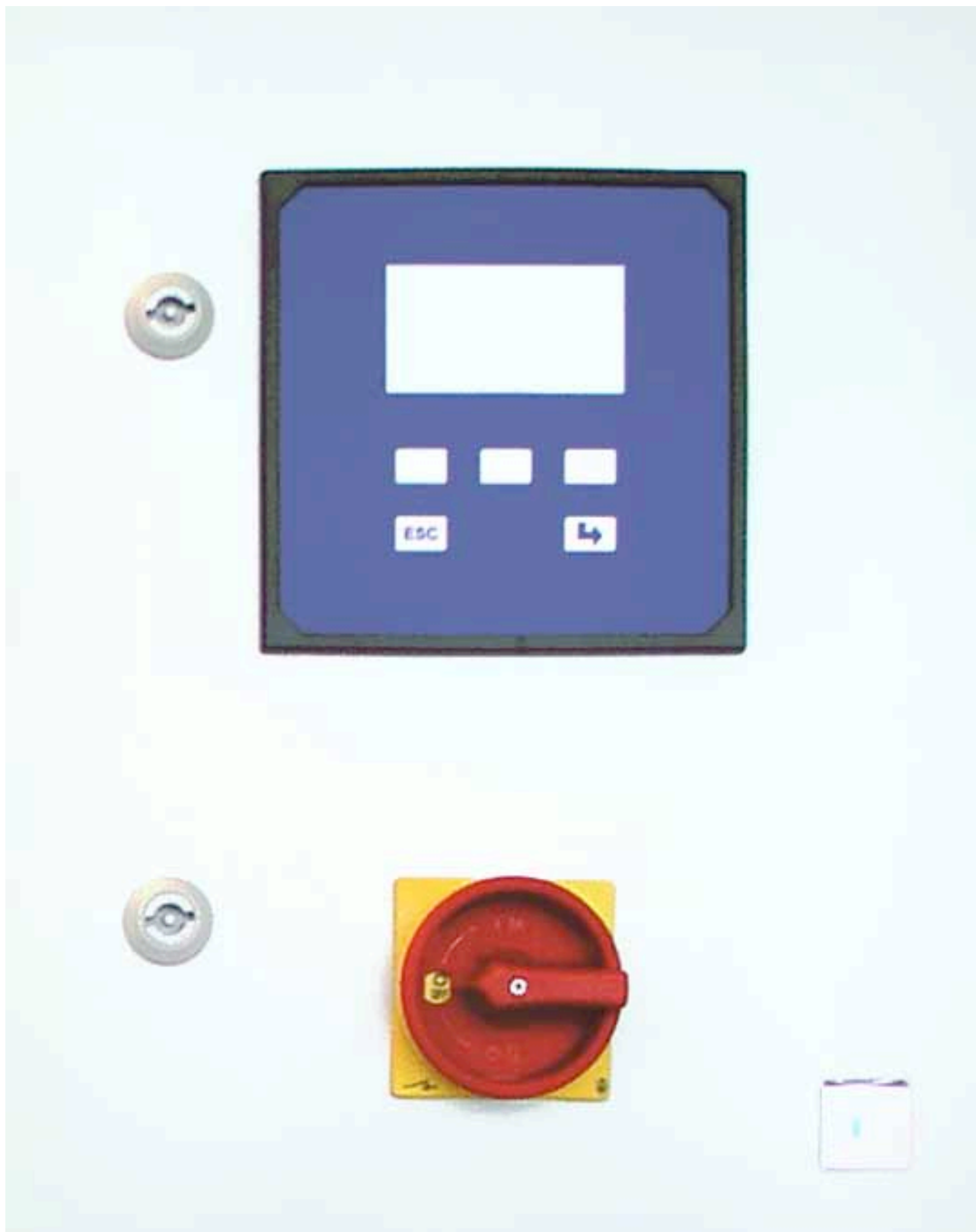
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## General Specification

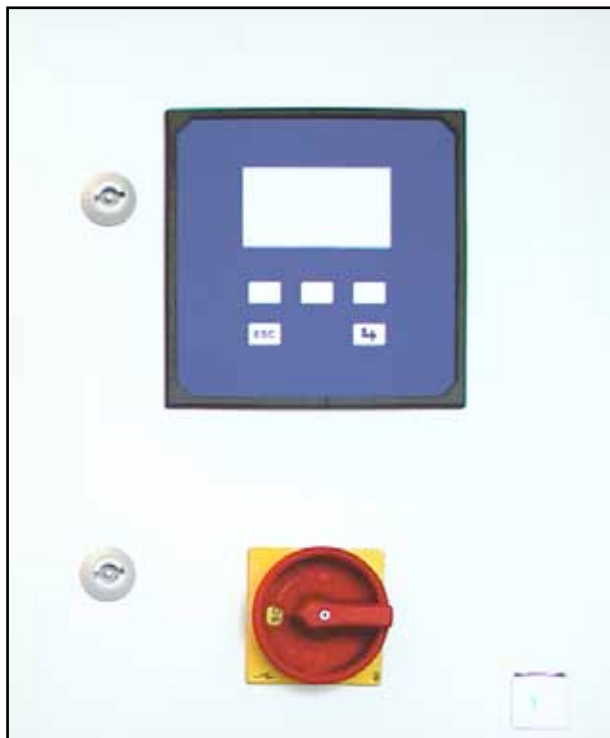
EXAtrac RF20C  
Armature Control



## 1. Product description

### 1.1 Armature Control RF20C

#### Outside view



**Fig.1 : Armature Control (cover)**

- 1) Control panel
- 2) Function keys
- 3) Return key
- 4) ESC key
- 5) Main Switch

#### Function

The control unit RF20C can fully and automatically control and supervise the measuring- and cleaning cycles of a pneumatic retractable fitting. The cleaning- and measuring intervals, starting signals can be set and changed to the process requirements.

#### Inputs

The control unit supervises the position feedback of the retractable armature over integrated inputs. An automatic cleaning can be started on a second input.

#### Inside view



**Fig.2 : Armature Control (Inside)**

- 6) Terminals
- 7) Acknowledgement / push button switch
- 8) Pilot valve
- 9) Entrance multi hose

#### Outputs

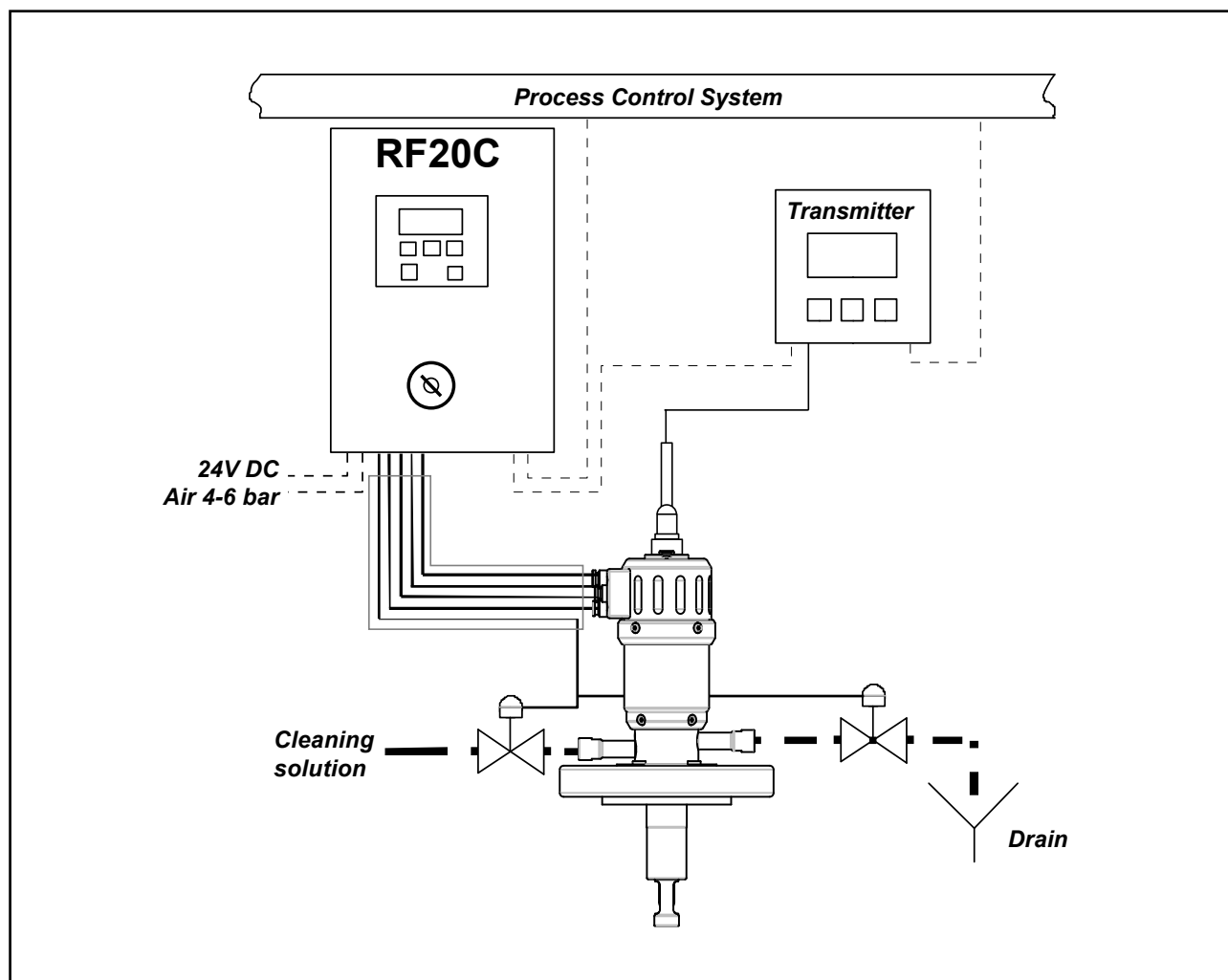
Three contacts are available to output the condition of the retractable fitting and the control unit to a process control system.

#### Retractable fitting

The retractable fitting and the cleaning valves - used for controlling of the cleaning solutions - are connected to the control unit via pneumatic tubing. This should be done by the coordinated multi-hose EXconnect.

### 1.2 Process integration

The control unit RF20C uses a 24V DC power supply and compressed air (4-6 bar). The connection with the retractable armature, the cleaning- and drain valves is made by pneumatic tubing, which are combined in a multi-hose.



**Fig. 3: Process Installation**

The status of the measurement (alarm status, measuring status or cleaning status) can be signalled by means of contacts to a process control system. A digital output signal of a pH transmitter connected to the digital input signal of the control unit can start a cleaning cycle.

The control unit RF20C is autonomous control unit and can be operate without being connected to a transmitter or a process control system.

The control unit has a manual- and automatic mode. In the manual mode, the cleaning valves can be controlled. In automatic mode, the start of a cleaning cycle follows the pre-selected cleaning procedure. After completion of this cycle the retractable fitting will return into the measuring position.

## 2. Program functions

### 2.1 Automatic start of a cleaning cycle

There are in 3 different procedures to start an automatic cleaning cycle, these can also be combined.

#### Loop

By using the internal clock a repeating cycle is started (loop). After setting up an interval time a cleaning is started automatically, for example every 4 hours. After completion of the cleaning cycle, the retractable fitting will return to the measuring position.

#### Real Time Event

At a certain time (Real Time Event), for example each day at 8.15 o'clock, 12,00 o'clock and 16,30 o'clock, an automatic cleaning is started. After completion of the cleaning cycle, the retractable fitting return to the measuring position and remains there until the next "Real Time Event" occurs.

#### External Trigger

An external contact (external trigger) starts a cleaning cycle. After completion of the cleaning and opening of the external contact, the retractable armature will return to its measuring position and remains there until the external contact closes again.

#### Loop + Trigger

Additionally to the normal "Loop cleaning cycle" a cleaning can be started - and the retractable fitting can be held in the "Service" position - by an external contact.

The external contact interrupts the pre-programmed loop cycle. This is useful during downtimes when the sensor needs to be kept in a soaking solution or when the sensor need to be withdrawn from the process to prevent damage when a strong agitator runs in the container.

#### Event + Trigger

Additionally to the normal "Real Time Event cycle" a cleaning can be started - and the retractable fitting can be held in the "Service" position - by an external contact.

The external contact interrupts the pre-programmed loop cycle. This is useful during downtimes when the sensor needs to be kept in a soaking solution or when the sensor need to be withdrawn from the process to prevent damage when a strong agitator runs in the container.

### 2.2 Rinsing water

When the retractable fitting moves from the "Measure" position to the "Service" position a connection between measuring product and rinsing chamber exists for a short time. In this short there is an open connection between the process medium, the rinsing chamber and the flush ports. A rinse function can be programmed during this period.

#### Function

When the rinse function is activated, the valve "Cleaning I" opens before the retractable fitting will retract from the process.

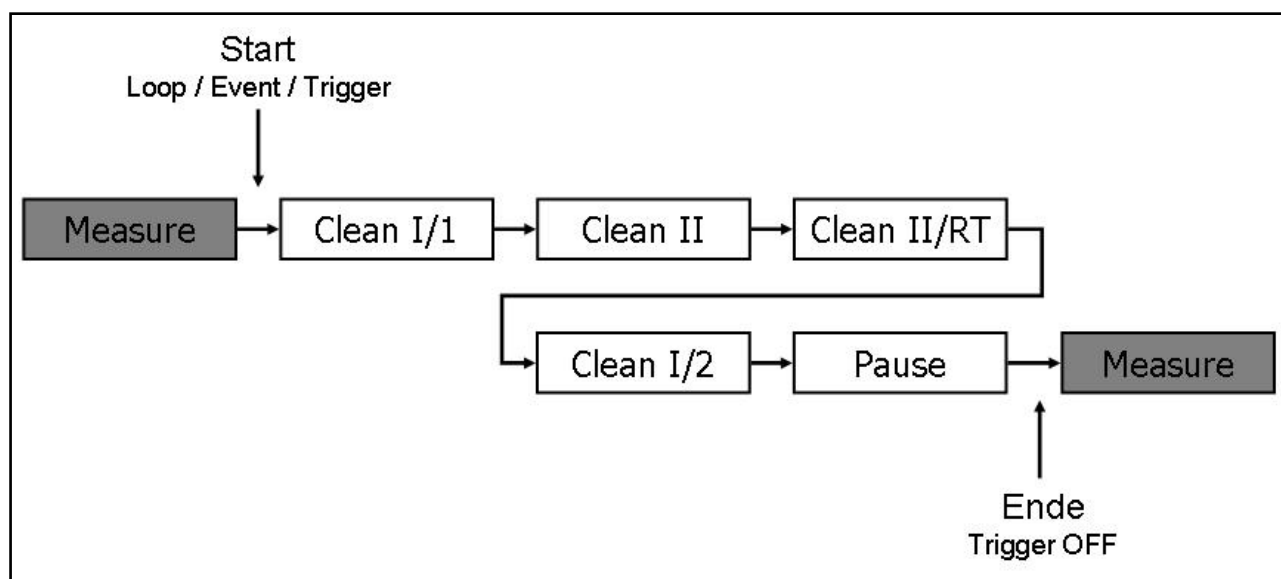
This means that when the pressure of the rinsing liquid attached to valve "Cleaning I" is higher than the process pressure, rinsing liquid will flow into the process, thus prevents that process medium flows into the rinsing chamber and connected flushing ports. At the same time the O-rings (sealing) of the rinsing chamber are rinsed.

The rinsing function provides for a better cleaning of the sensor, takes care of the sealing elements and increases thus the service life of the sensor and seals. This function should always be activated when possible especially in mediums that contain solids and sticky materials.

When rinsing liquid is not allowed or desired in the process medium, this function can be deactivated. The fundamental function of the retractable fitting is not impaired.

### 2.3 Cleaning program

If a cleaning program is started (see 3.1), the following functions run successively:



**Fig. 4: Program cycle**

#### Cleaning I/1

Cleaning with one (1) cleaning solution, e.g. water.

Valve "Cleaning I" and drain valve are opened and closed after the pre-set interval time (10 to 300 seconds.) With the valve "Cleaning I" open, a feed pump can be controlled by using an output contact (No. 21 + 22).

#### Cleaning II

Cleaning with two (2) cleaning solution e.g. acid

Valve "Cleaning II" and drain valve are opened and closed after the pre-set interval time (0 to 300 seconds.) When this time is set to the value zero (0), this program step will be skipped. With the valve "Cleaning II" open, a feed pump can be controlled by using an output contact (No. 23 + 24),

#### Cleaning II RT

Residence Time for 2 cleaning solutions

Cleaning II RT is a residence time for the 2nd cleaning solution. For example cleaning acid which was brought into the rinsing chamber can react with other components present in that chamber. All Cleaning valves and the drain valve remain closed. After the pre-set interval time (0 to 300 seconds) the next program step follows. When the time is set to the value zero (0), this program step will be skipped.

#### Cleaning I/2

Cleaning with one (1) cleaning solution, e.g. water.

Valve "Cleaning I" and the drain valve are opened and closed after the pre-set interval time (0 to 300 seconds.) When the time is set to the value zero (0), this program step will be skipped. With the valve "Cleaning I" open, a feed pump can be controlled by using an output contact (No. 21 + 22).

#### Pause

If the sensor should not be returned into the measuring position after a cleaning, one activates the pausing timer. This is especially suitable when process is highly aggressive and the lifetime of the sensor is shortened. By using short measuring intervals and enough pausing time the immersing duration of the sensor is kept to a minimum and thus the life span increases. The sensor remains in the rinsing chamber, all cleaning valves and the drain valve remain closed. After the pre-set interval time (0 to 999 min.) the sensor returns into the measuring position. When the time is set to the value zero (0), this program step will be skipped.

#### Measure

Measuring intervals. Should be set when using "loop" or "loop + trigger". The sensor will return into the measuring position and remains there for the pre-set interval (1 to 999 min.) This period is interrupted by the external contact. Upon completion of the cleaning cycle the next measuring cycle begins.

3. Mounting

3.1 Panel mounting

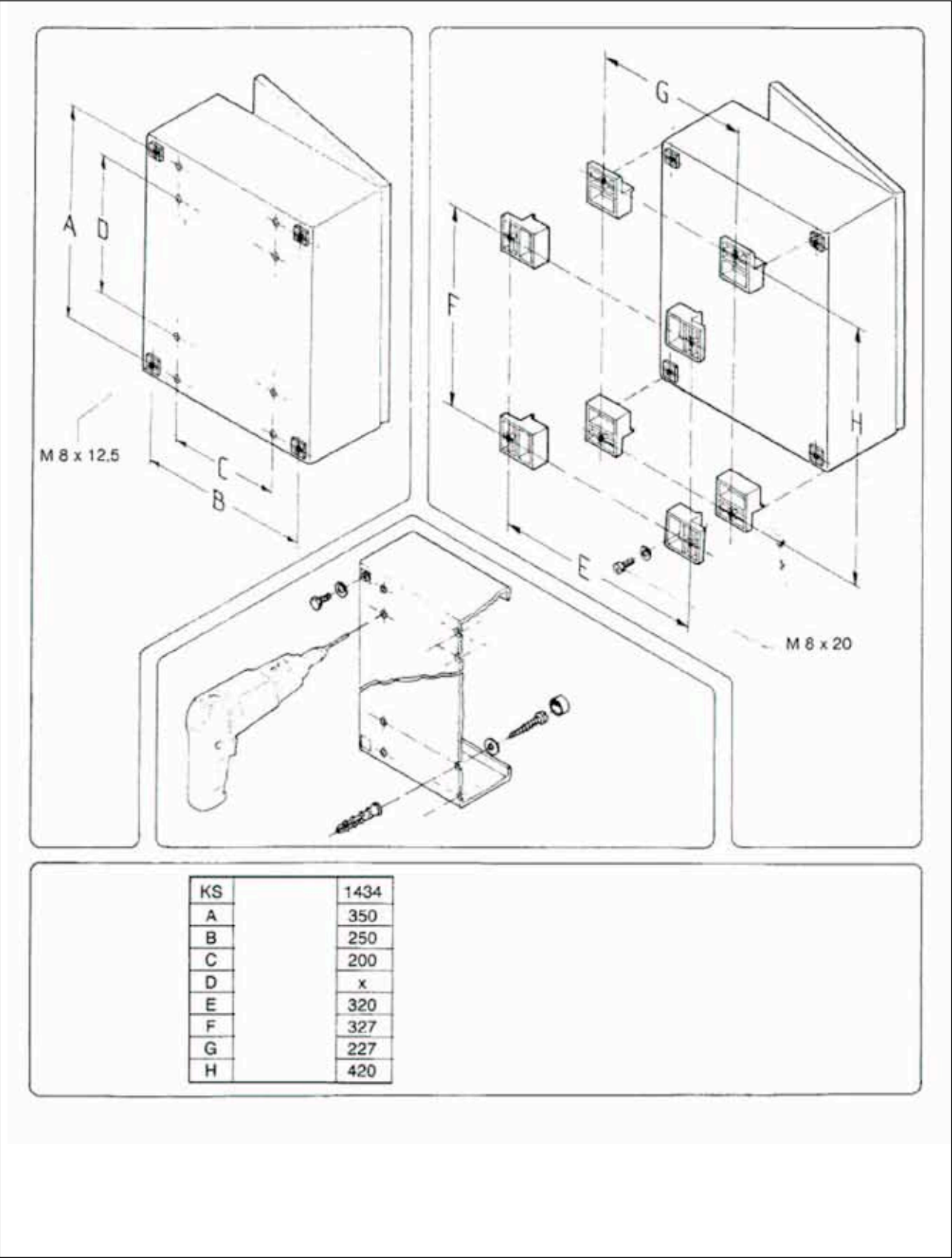


Fig. 5: Panel mounting

GS 12B06K07-E-E

These connections are necessary:

**Fig. 6: Connection overview**

### 3.3 Pneumatic connections

Connection Control unit	Tubing Diam./color	Connection EXtract	Remark
A1 black	6mm black	1	Service
A1 blue	6mm blue	3	Measurement
A2	6mm red	D4	Drain valve
A3	6mm yellow	D2	Cleaning I
A4	6mm green	D3	Cleaning II
A5	4mm black	2	Feedback Measurement
A6	4mm bleu	4	Feedback Service



## 4. Technical data

### 4.1 Norms

Electromagnetic Compatibility (EMC) - Part 6-2:

Generic standards – Immunity for industrial environments: Norm  
EN 61000-6-2

Electromagnetic Compatibility (EMC) - Part 6-4:

Generic standards – Emission standard for  
industrial environments: EN 61000-6-4

### 4.2 Materials

Materials		
Control cabinet		
housing	Glass-reinforced plastic (GRP)	
	Stainless steel	Optional
Control unit	Glass-reinforced plastic (GRP)	housing
	Plexiglass	Cover

### 4.3 Connection values

Electrical connections		
Power supply	24V DC	30 VA
Input for external contacts	24V DC	Input for potential free contact
Output for external relays, cleaning pump I and II	24V DC	80mA max.
Output for Status- and Alarm contacts	24V DC	100mA max.
Controlling pneumatic valves (solenoids)	24V DC	80mA max.

### 4.4 Ambient conditions

Temperature	
Ambient temperature	0 to 55°C
Transport- and storage temperature	-10 to 60°C

Environment	
Relative humidity	10 to 95 % Non-condensing

Rating	
Housing	IP 54
Controlunit with safety doors	IP 54 With closed safety doors

### 4.5 Pneumatic

Pneumatic tubing		
	ø - outside	ø - inside
For driving air	6 mm	4 mm
For position feedback	4 mm	2 mm

Pressurized air	
	filtered 40µm, water- and oilfree
	4 - 6 bar
	No continues air usage

### 4.6 Dimensions

Dimensions		
	Plastic	Stainless Steel
Width	300 mm	300 mm
Height	400 mm	400 mm
Depth	250 mm	250 mm

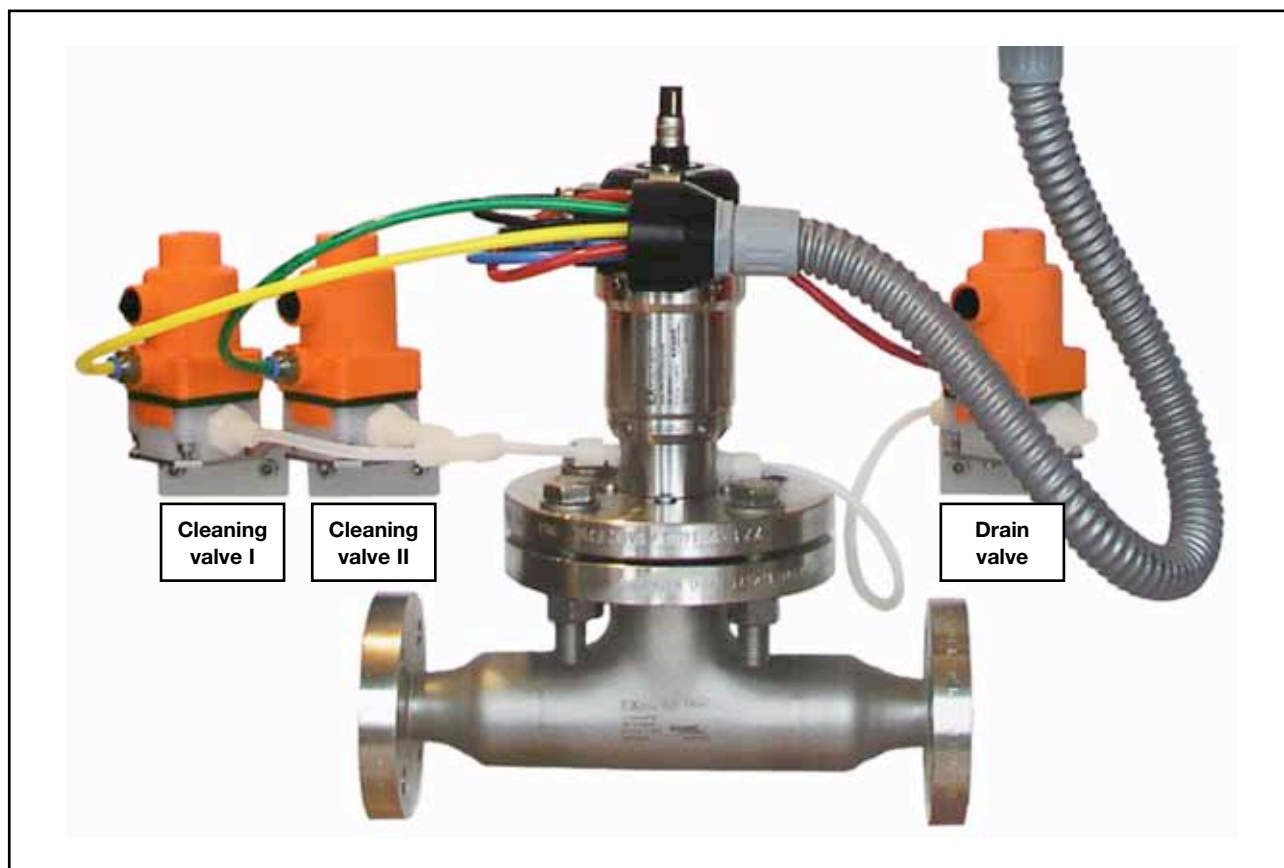
## 5. Order structure RF20C

Modelcode	Suffixcode	Description
<b>RF20C</b>		
<b>Casing</b>	-GF	Plastic glass-reinforce plastic
	-SS	Stainless steel
<b>Cleaning</b>	-C1	for one cleaning solution
	-C2	for two cleaning solutions
<b>Drain valve</b>	-ND	Without drain valve
	-N1	With drain valve
<b>Multi hose</b>	-NH	Without multi hose
	-03	With 3m multi hose
	-05	With 5m multi hose
	-10	With 10m multi hose
<b>Mounting angle</b>	-NF	Without mounting angle
	-EX	EXAtrac mounting angle
	-RE	Retractex mounting angle

## 6. Spare parts and accessories

Spare parts		
Control	Spare part	Order number
RF20C	Complete control unit	10/9-110-00-001
	Solenoid valve 5/2-way G 1/4" 24VDC 3,8W (without plug and cable)	10/9-091-10-001
	Solenoid valve 3/2-way G 1/4" 24VDC 3,8W (without plug and cable)	10/9-091-10-002
	Plug with cable for solenoid valve	10/7-098-20-001
	Pressure switch (indication)	10/9-096-00-001

Accessories		
Control cabinet	Accessory	Order number
	wall mounting plastic cabinet	10/2-083-70-001
	wall mounting stainless steel cabinet	10/2-083-70-002
	pipe mounting cabinet (plastic/stainless steel)	10/2-083-70-003
Cleaning valves	Accessory	Order number
Membrane valve PVDF/FPM G 3/8", DN12 PN6, pneumatic, pressureless closed (NC)	1 valve for cleaning solution or drainage	10/2-095-70-001
	2 valves for cleaning solution and drainage, mounted to mounting angles with all connections and PTFE hose	10/2-095-70-002
	3 valves for two cleaning solutions and drainage, mounted to mounting angles with all connections and PTFE hose	10/2-095-70-003



**Figure 8: Membrane valves as accessories for the retractable fitting**

Please indicate the serial number of your fitting if you order spare parts or accessories.

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# General Specifications

Model FC20  
Cleaning Systems Chemical-, mechani-  
cal cleaning systems

pH/ORP

*For industrial applications and particularly for automatic process measurements it is of the greatest importance that the sensitive part of a glass electrode and the diaphragm of a reference electrode are kept clean.*

*Often it is not practical to interrupt a process for cleaning the electrodes, an accurate indication is required over a long period, replacing the electrodes is difficult, etc. Then an automatic cleaning mechanism may be the solution.*

Yokogawa manufactures two different cleaning systems for pH and/or ORP (Redox) measurements:

- Chemical cleaning.
- Mechanical cleaning.

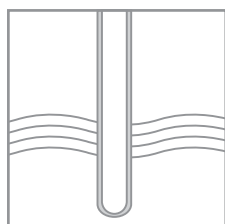
*The cleaning elements have standardised dimensions for mounting in flow-, insertion and immersion fittings.*

## Features

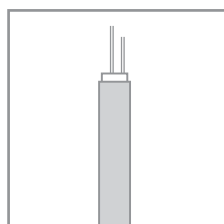
- Designed for in-line electrode cleaning in flow- and immersion fittings of Yokogawa.
- Restricts sediment formation on the electrodes and increases the period between calibrations.
- Optimum cleaning effect.
- Standardised dimensions for mounting in an electrode hole of a fitting.



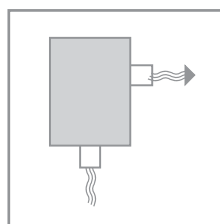
## System Configuration



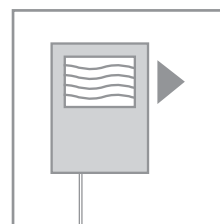
Sensors



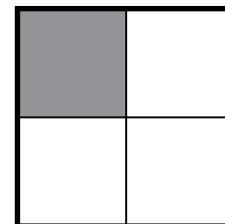
Cables



Fittings



Transmitters



Accessories

## Chemical cleaning system

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 PH402 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.

### Features

- The EXA pH402 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.

### Specifications

#### Materials

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

#### Mounting

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

## Brush cleaning system

The brush in this cleaning system periodically strikes along the sensitive membrane of the measuring electrode, so that this part is wiped frequently, preventing sediment formation on it. The flow of measuring solution is not obstructed and interruption of measurement during cleaning is not necessary. The brush cleaning system is activated electrically or pneumatically. The standardised dimensions allow mounting in the (4-hole) flow- and immersion fittings of Yokogawa.

### Features

- Minimum maintenance by static sealing of brush movement.
- Pneumatically or electrically driven.
- Easy replaceable brush.
- Brush height adjustable for optional cleaning effect.

### Specifications Brush holder

#### Material

Body (see figure 2)	: a. Stainless steel AISI 316 b. Epoxy c. Silicone rubber d. Epoxy resin
Brush	: Horse hair (in PVDF holder)
Process conditions	: Max. 1 MPa (10 bar) at 100°C
Weight	: Approx. 120 g
Mounting	: In flow- and immersion fittings (4-hole) of Yokogawa
Wetted parts	: PVDF, Silicon, Viton, Epoxy

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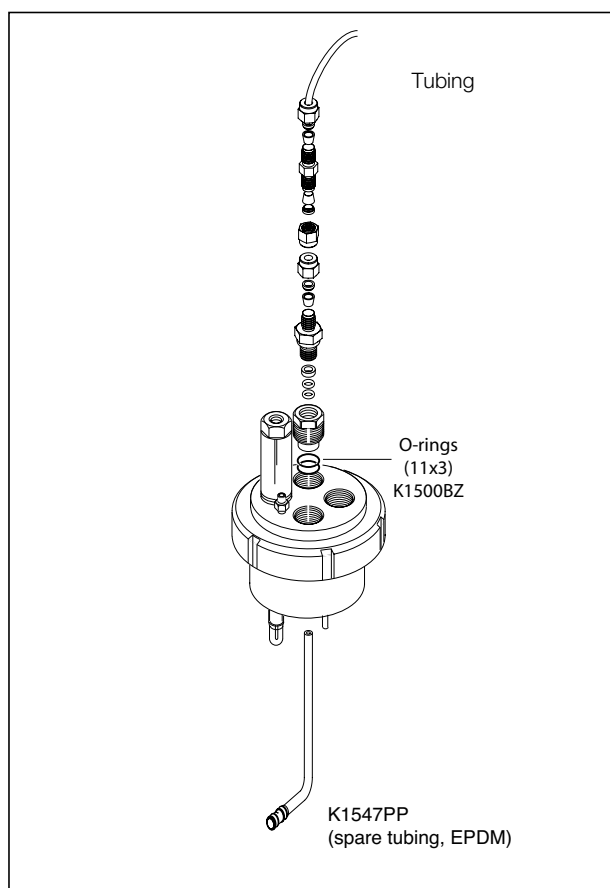


Fig. 1. Chemical cleaning system

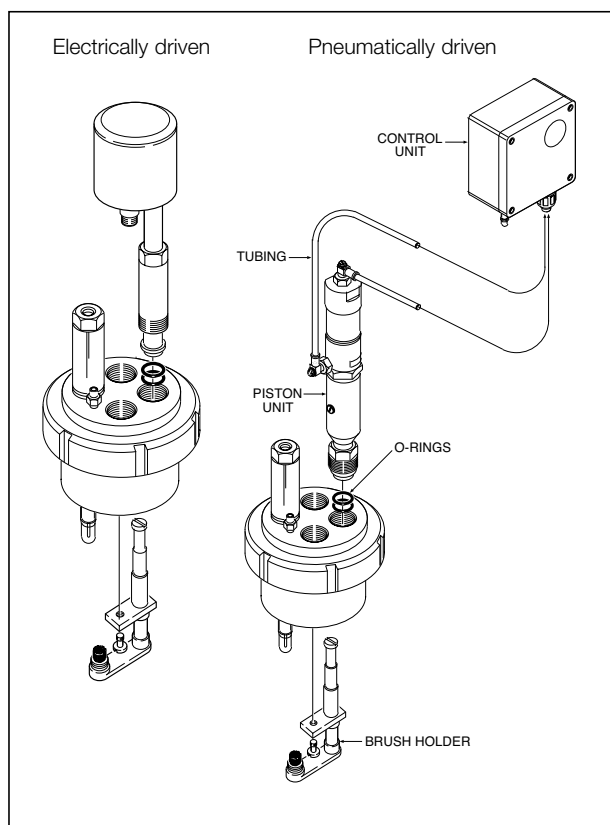


Fig. 2. Electrically/pneumatically driven brush cleaning

**Driving mechanism (electrical)****Supply**

- Voltage : 24 V AC ( $\pm 10\%$ );  
for 10 V/220V AC a power supply,  
type BC10 is available
- Frequency : 50/60 Hz
- Consumption : Max. 4 VA

**Cleaning frequency**

: 2 Strokes per minute

**Angle**: Rotation of  $40^\circ$  (swing)**Electrical connection**: Gold plated spring O connector  
(for standard cable, model WU20)  
screw thread:  $1/4"$  BSPP**Material**

- Driving system : Stainless steel AISI 316
- Driving shaft : Stainless steel AISI 316
- Cap : Silicone rubber
- Connector : Polyvinylidene fluoride (PVDF)
- Mounting nut : Ryton R4

**Weight**

: Approx. 1 kg

**Driving mechanism (pneumatic)****1. Piston unit****Air supply**

: Via the connected control unit

**Cleaning frequency**:  $1/4 \dots 2$  strokes per minute  
(adjustable on the control unit)**Angle**: Rotation  $40^\circ$ **Air connectors****(IN 1 and IN 2)**:  $\varnothing 4$  mm (external)**Material**

- Body : Brass
- Mounting gland : Stainless steel AISI 316

**Weight**

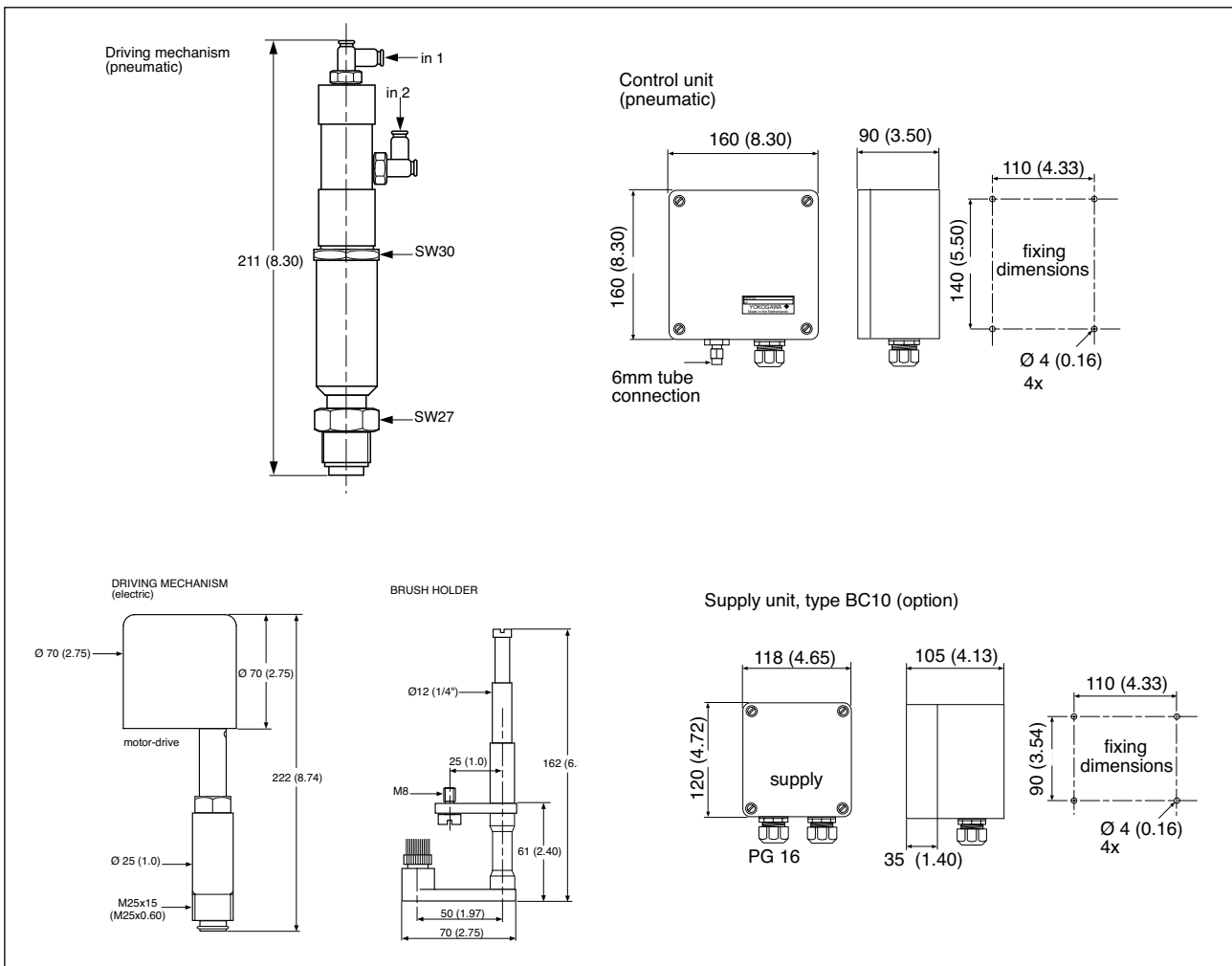
: Approx. 1 kg

**2. Control unit****Air supply**

: 140 kPa (1.4 bar) pressurized air

**Ambient temperature range**:  $-10$  to  $+60^\circ\text{C}$ **Housing**

- Material : Aluminium case with chemical  
resistant lacquer, IP65
- Entries : Air connector  $\varnothing 6$  mm
- Dimensions : See dimensional drawings
- Mounting : Wall mounting (for fixing dimensions  
see dimensional drawings)
- Weight : Approx. 2.5 kg

**Fig 3. Dimensions**

GS 12B6V1-E-E

## Selection criteria

Mechanical Applications with:	Chemical		
	Brush	Acid	Base
Oils, fats			
Resins (wood, pulp)			X
Emulsions of latex	X		
Fibers (paper, textile)	X		
Crystalline precipitations (carbonates)	X	XX	
Amorpheus precipitations (hydroxides)	X	XX	

## Mechanical cleaning system

Model code	Suffix code	Options	Description
FC20			Cleaning system
Design	-VE		Brush cleaning (electrical driven)
-VP		Brush cleaning	(pneumatically driven)
Options		/T	10 mtr. nylon tubing 6.35 mm OD (1/4")

## Chemical cleaning system

Part no.	Description
K1520FJ	5m tubing
K1520FK	10m tubing
K1547PA	Complete cleaning system HCN2, HCN3
K1547PB	Complete cleaning system HCN4
K1547PJ	Complete cleaning system HCNF for back-end mounting on FU20/PH20
K1547PP	EPDM spraying valve HCNX nozzle (5 sets)

## Accessories and options

Part no.	Description
WU20-PC02	COAX-cable (2 m) for FC20-VE
WU20-PC05	COAX-cable (5,5 m) for FC20-VE
WU20-PC10	COAX-cable (10 m) for and FC20-VE
BC10	Supply unit (220/24 V AC) for motor of FC20-VE

## Service parts

Part no.	Description
K1500BZ	O-rings Viton 11x3 (6Pcs)
K1520NA	Tubing (ø 4 mm)
	Brush cleaning (pneumatically driven)
K1500GR	O-ring (11 x 3) for mounting in electrode holes (8 pieces)
FP20-R12	Electrode mounting set (Ryton R4) for mounting electrode holes
K1520NB	Brush for mechanical cleaning
K1520NF	Motor unit for electrically driven brush cleaning
K1520NG	Brush holder for mechanical cleaning
K1520NH	Piston for pneumatically driven brush cleaning
K1520NJ	Control unit for pneumatically driven brush cleaning
K1547PF	Nozzle and mounting set HCN2, HCN3, HCNF
K1547PG	Nozzle and mounting set HCN4
K1547PH	Nylon tube (10 mtr) and tube mounting set for hastelloy cleaning system

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# General Specifications

Model BA10 and WF10  
Junction box and Connecting cable

pH/ORP

*Between measuring plant and control room, especially when the distance between these places is greater than the length of the standard appropriate electrode cables, the connecting equipment can be an expedient method for connecting sensor cables to a measuring instrument.*

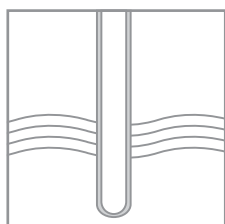
The equipment includes:

1. A junction box.
2. Special purpose connecting cable.

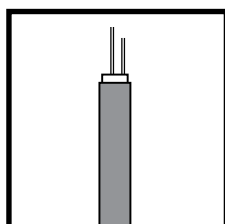
*The items are available for common as well as for Intrinsically safe applications.*



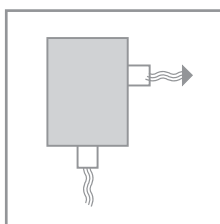
## System Configuration



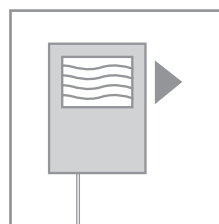
Sensors



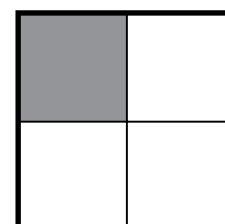
Cables



Fittings



Transmitters



Accessories

## 1. Junction box, type BA10

The junction box is an expedient method for connecting sensor cables to a measuring instrument.

### Note

The special purpose cable, type WF10 should be used to interconnect the junction box and the measuring instrument. To have optimum measuring results the length of this cable may be max. 100 m.

## specifications

**Material** : Cast aluminium case with chemically resistant coating

### Rain- and dust protection

: Meets IP 65

**Terminals** : Wires up to 6 mm<sup>2</sup>

**Cable entries\*** : 2 holes with screw thread for 1 hose connection and a gland PG 16 or 2 glands PG 16

### Colour terminal block

- Normal use : Brown

**Weight** : Ca. 2 kg.

**Dimensions** : See Fig. 3 dimensional drawing

**Fixing** : 140 x 110 mm (indicated on reverse side of the box)

**Note\*** As delivered the box includes a plastic pocket with 2 glands PG 16, a hose connection for a 19 mm I/D protection hose and a grommet for watertight cable input in a gland (3 electrode cables and the liquid earth cable).

## Ordering Instructions

Type	Description
BA10	For normal use

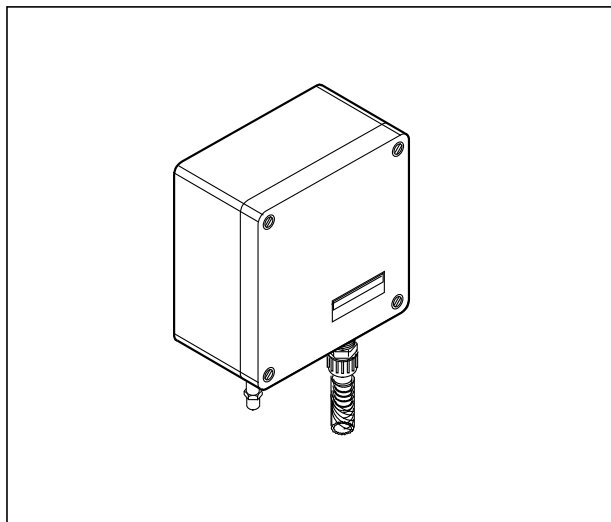


Fig. 1 Junction box

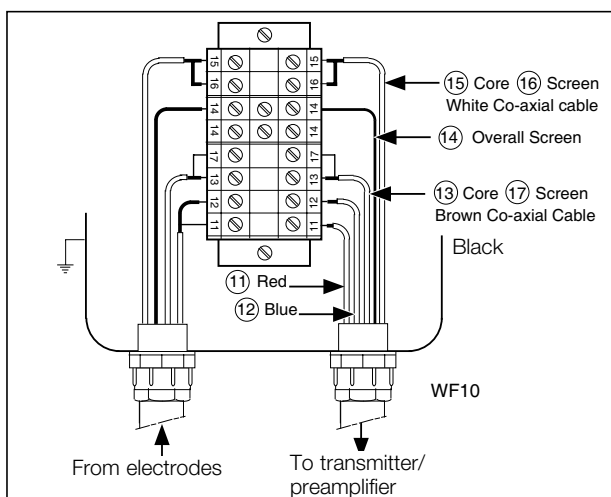
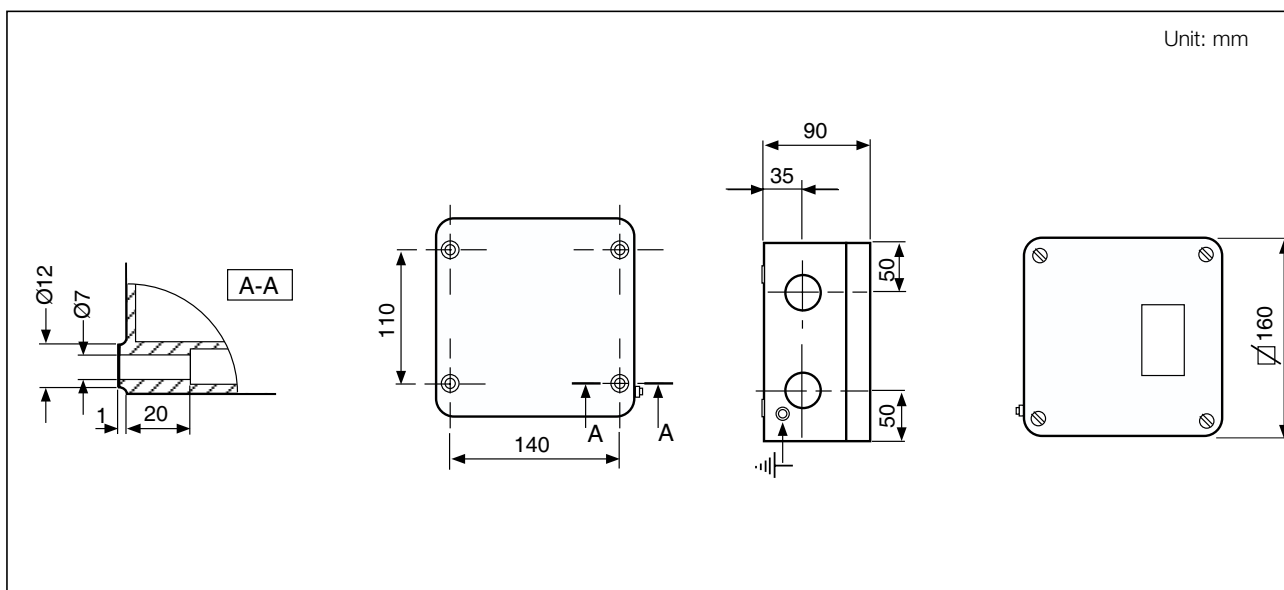


Fig. 2 Connection diagram



## Dimensions/Fixing

GS 12B6W2-01E-E

## 2. Connecting cable, type WF10

This cable satisfies the high requirements of insulating resistance and screening. It suits the application of signal transmission representing low voltage and high impedance level.

The cable is used to interconnect junction box and measuring instrument.

**Note:** Long cable lengths add resistance and capacitance to the measuring loop. These values are specified below. The maximum values for cable length, cable capacity that are specified in the Instruction Manual of the analyzer may not be exceeded. The resistance may introduce a measuring error, especially when using a 100 Ohm RTD. In general the analyzer can be calibrated/adjusted for this error.

### Specifications

<b>Max. temperature</b>	: 110 °C
<b>Material</b>	: Thermoplastic Rubber (T.P.R.)
<b>Bending radius</b>	
- Permanent	: > 83 mm
- Frequently	: > 125 mm
<b>Diameter</b>	: 8.5 mm
<b>Colour</b>	: Black

#### CABLE A/B

**Capacitance between core and screen** : max. 120 pF/m

**Insulation resistance between core and screen** : min.  $15 \times 10^{14}$  Ohm./km

**Resistance** : ca. 80 Ohm/km

**Dielectric** : T.P. Rubber

**Jacket A** : Brown

**Jacket B** : White

#### CABLE C/D

**Resistance** : ca. 35 Ohm/km

**Jacket C** : T.P. Rubber (Red)

**Jacket D** : T.P. Rubber (Blue)

**CABLE E** : Overall shield

### Ordering Instructions

#### Model and Suffix code

Model	Suffix code	Description
WF10	.....	Connecting cable
Cable length	- NN .....	Length in meters between 1 and 200
	-F .....	Finished
	-N .....	Not finished

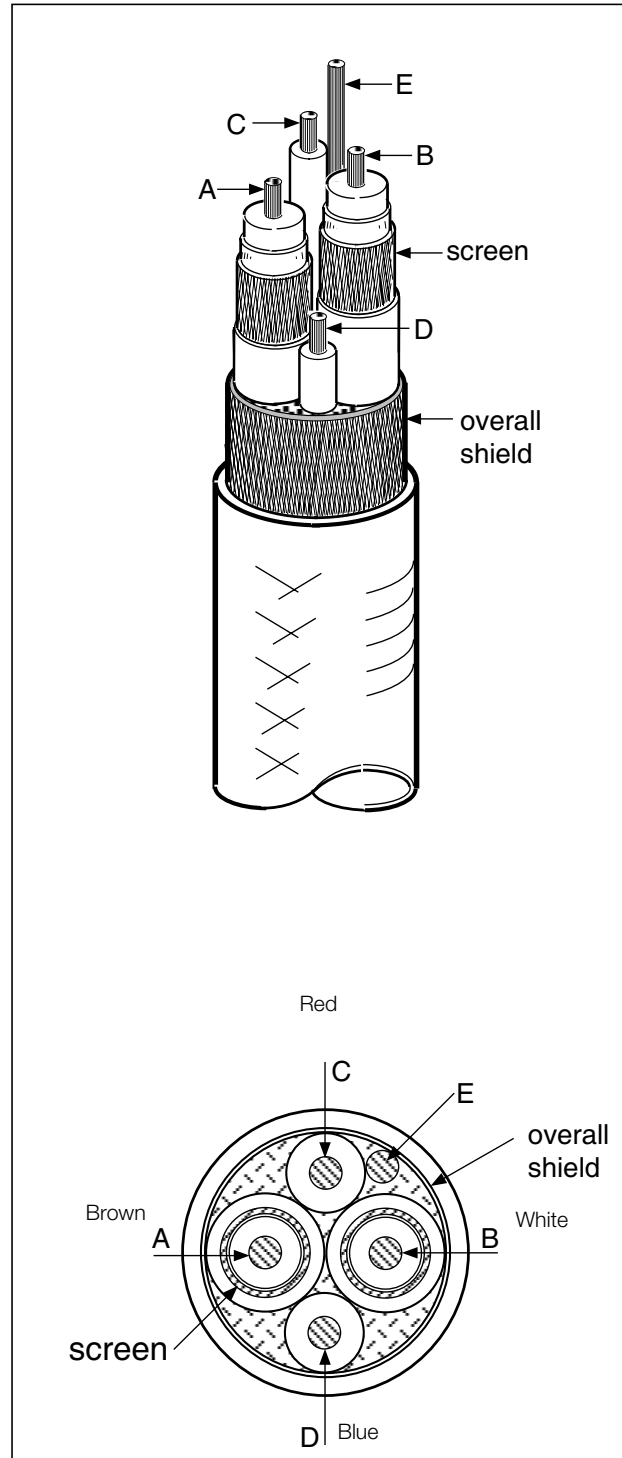


Fig. 4 Connecting cable WF10

## ACCESSORIES AND PARTS

Part no.	Description
K1500FV	Liquid earth cable (10 m)
K1500DU	Liquid earth cable (25 m)
K1500BX	Grommet for watertight cable input in PG 16 gland (3 electrode cables and liquid earth cable)

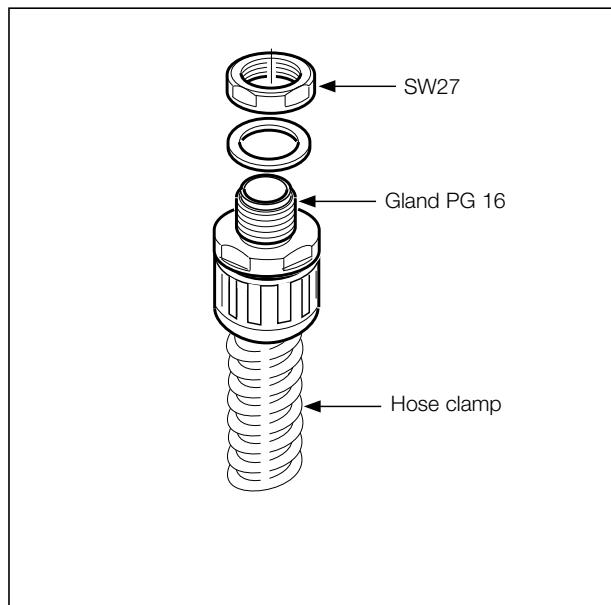


Fig. 5 Hose connection

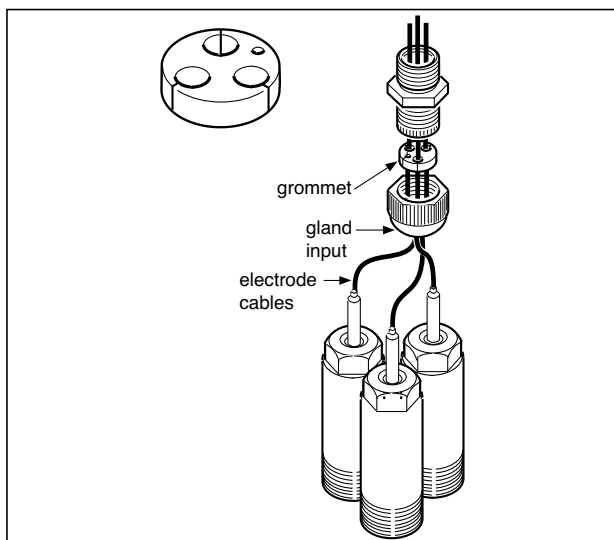


Fig. 6 Mounting

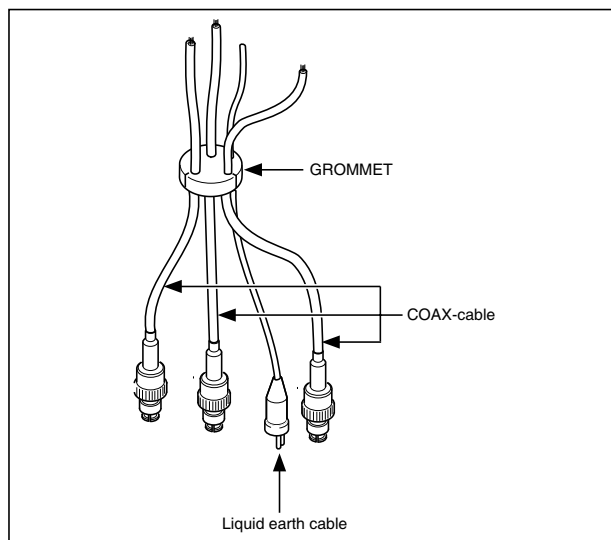


Fig. 7 Cable

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**YOKOGAWA** ◆

## Conductivity Analyzers (contacting)

## Conductivity Analyzers (contacting)

# General Specifications

## Model SC450 Conductivity / Resistivity Analyzer

**EXAxt**

The EXAxt 450 series is designed to combine the superior functionality of the Yokogawa EXA series with the ease of use offered in pocket computers (PDA).

Truly unique is the EXAxt 450 series in the Human Machine Interface. The high resolution graphical display and the touch screen operation make all information visible to the operator. Configuration with the touch screen is as easy as operating a PDA. Simply choose the language of choice and on screen instructions assure that the best configuration for the application is obtained.

The EXAxt 450 offers full functionality with PID control on either mA output(s) or on contact output(s). The contact outputs can be selected as pulse frequency controlled or pulse length controlled contact function to control chemical metering pumps or solenoid valves.

The EXA450 is a family of SMART analyzers: In addition to the two mA outputs a digital HART® signal is superimposed on mA1. This signal supplies up to four process variables and many diagnostic data. This information can be used to generate additional current and contact outputs in the HIM monitor and in maintenance optimisation programs like PRM or AMS. Pactware can be downloaded from Yokogawa WEB pages to enable the user to configure SC450 with a PC.

The SC450 offers the best accuracy in the industry by combining the conductivity measurement with advanced temperature compensation functionality, preloaded calibration standards and cell fouling monitoring.

The EXAxt SC450 is universal. The analyzer accepts sensors with cell constants ranging from 0,005 till 50/cm; 2-electrode sensors as well as 4-electrode sensors; 5 different temperature compensating elements for accurate temperature compensation.

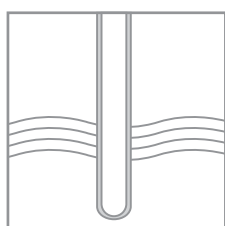
The SC450 offers ultra pure water compensation for demineralised water (default: NaCl), for Steam, Condensate and Boiler water analysis (Cation Conductivity, Ammonia and Morpholine Conductivity) SC450 also offers Matrix compensation and output linearization for accurate analysis of strong acids and alkalis especially for the monitoring of ultra pure water in the pharmaceutical industry the functionality of USP chapter 645, first published in USP23, is implemented.



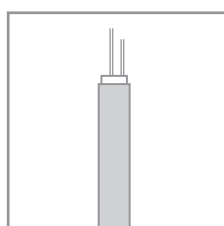
### Features

- IP66/NEMA4X 1/2 DIN enclosure for Field mounting and Panel mounting.
- Unique HMI with menu structure and high resolution graphical display with touch screen
- Interactive display with choice out of 6 languages: English, French, German, Italian Spanish and Swedish.
- Trending display for up to 2 weeks.
- On-screen logbooks store calibration data, configuration changes and events
- Advanced Process Temperature Compensation
- Cell fouling monitoring

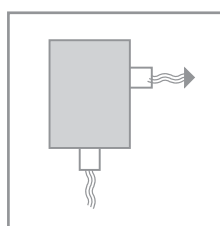
### System Configuration



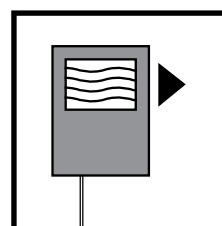
Sensors



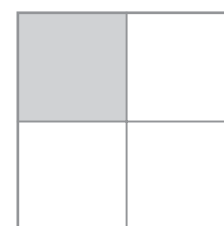
Cables



Fittings



Transmitters



Accessories

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 GS 12D7B5-E-E  
4th Edition

## General Specifications of EXAxt SC450

### A. Input specifications

: Two or four electrodes measurement with square wave excitation, using max 60m (200ft) cable (WU40/WF10) and cell constants from 0.005 to 50.0 cm<sup>-1</sup>

### B. Input ranges

Conductivity : 0.000  $\mu$ S/cm - 2000 mS/cm  
 Minimum : 1 $\mu$ S/cm (underrange 0.00  $\mu$ S x C)  
 Maximum : 200 mS/cm (overrange 2000 mS x C)  
 Resistivity : 0.0  $\Omega$  x cm - 1000 M $\Omega$  x cm  
 Minimum : 5  $\Omega$ /cm (underrange 0.0  $\Omega$ /C)  
 Maximum : 1 M $\Omega$ /cm (overrange 1000 M $\Omega$ /C)  
 Temperature : Pt1000 -20 to 250°C (0-500°F)  
 : Pt100 -20 to 200°C (0-400°F)  
 : Ni100 -20 to 200°C (0-400°F)  
 : NTC 8k55 -10 to 120°C (10-250°F)  
 : Pb36 (JIS NTC 6k) -20 to 120°C (0-250°F)

### C. Accuracy

Conductivity/resistivity :  $\leq$  0.5 % of reading  
 Temperature :  $\leq$  0.3°C ( $\leq$  0.4°C for Pt100)  
 mA outputs :  $\leq$  0.02 mA  
 Ambient temperature influence :  $\pm$  0.05% /°C  
 Step respons :  $\leq$  4 sec for 90% (for a 2 decade step)

### D. Transmission signals

General : Two isolated outputs of 4-20 mA. DC with common negative. Maximum load 600 $\Omega$ . Bi-directional HART® digital communication, superimposed on mA1 (4-20mA) signal.  
 Output Function: Linear or Non linear (21-step table) output for pH, temperature, ORP or rH.  
 Control function : PID control.  
 Burn out function: Burn up (21.0 mA) or burn down (3.6 mA) to signal failure acc. NAMUR NE43.  
 : Adjustable damping  
 : Expire time  
 Hold : The mA-outputs are frozen to the last/fixed value during calibration/commissioning

### E. Contact outputs

General : Four SPDT relay contacts with display indicators. Contact outputs configurable for hysteresis and delay time.  
 Switch capacity : Maximum values 100 VA, 250 VAC, 5 Amps.  
 Maximum values 50 Watts, 250 VDC, 5 Amps.  
 Status : High/Low process alarms, selected from conductivity, resistivity, concentration or temperature. Configurable delay time and hysteresis. PID duty cycle or pulsed frequency control.  
 FAIL alarm  
 Control function : On / Off  
 : Adjustable damping  
 : Expire time  
 Hold : Contact can be used to signal the hold situation.  
 Fail safe : Contact S4 is programmed as fail-safe contact.

GS 12D7B5-E-E

**F. Contact Input** : Remote range switching to 10 times the programmed range.

Contact open : If impedance > 100 k $\Omega$ : Range 1  
 Contact closed : If impedance < 10  $\Omega$ : Range 2  
 (10 x Range 1)

### G. Temperature compensation

: Automatic or manual, for temperature ranges mentioned under C (inputs).  
 Reference temp.: programmable from 0 to 100°C or 30 - 210 °F (default 25°C).

### H. Compensation algorithm

: According IEC 60746-3 NaCl tables (default). Two independent user programmable temperature coefficients, from 0% to 3.5% per °C (°F) by adjustment or calibration.  
 Matrix compensation : With conductivity function of concentration and temperature. Choice out of 13 preprogrammed matrixes and 2 100-points user-programmable matrices.

### I. Calibration

: Semi-automatic calibration using pre-configured OIML (KCl) buffer tables, with automatic stability check. Manual adjustment to grab sample.

### J. Logbook

: Software record of important events and diagnostic data readily available in the display or through HART®.

### K. Display

: Graphical Quarter VGA (320 x 240 pixels) LCD with LED backlight and touchscreen. Plain language messages in English, German, French, Spanish, Italian and Swedish.

### L. Shipping details

Package size : 290 x 300 x 290 mm (L x W x D)  
 (11.5 x 11.8 x 11.5 inch)  
 Package weight : app. 2.5 kg (5.5lbs)

### M. Housing

: Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window. The colour of the case and cover is silvergrey. Cable entry via six M20 polyamide glands. Cable terminals are provided for up to 2.5 mm<sup>2</sup> finished wires. Weather resistant to IP66 and NEMA4X standards. Note that the glands must be installed properly. Pipe, wall or panel mounting, using optional hardware.

**N. Power supply** : 85-265 VAC ( $\pm$ 10%). Max 15VA, 47-63Hz, 9.6-30 VDC ( $\pm$ 10%), max 10W

### O. Regulatory compliance

Safety : EN 61010-1 CSA C22.2 No.61010-1 UL 61010-1 FM3611 Class I, Div.2, Group ABCD,T6 for Ta -20 to 55°C  
 EMC : conforms to EN61326 Class A, AS/NZS CIPR 11  
 Inst. altitude : 2000 m or less Category based on IEC 61010: II (Note) Pollution degree based on IEC 61010: 2 (Note)

**Note:** Installation category, called over-voltage category, specifies impulse withstand voltage. Category II is for electrical equipment. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength. Degree 2 is the normal indoor environment.



FM Class 1, Div. 2, Group ABCD,  
 $T_6$  for  $T_a$  -20 to 55°C  
 Certification for CCSAus, Kema Keur

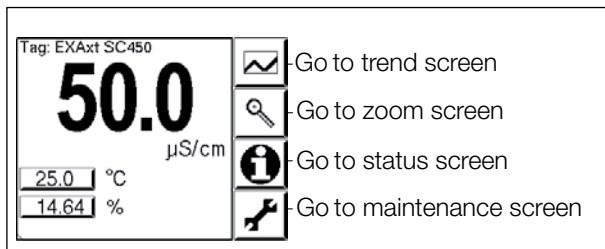
#### P. Environment and operational conditions

Ambient temperature : -20 to +55°C  
 Storage temperature : -30 to +70°C  
 Humidity : 0 to 90% RH (non-condensing)  
 Data protection : EEPROM for configuration data and logbook. Lithium cell for clock.  
 Watchdog timer : Checks microprocessor.  
 Power down : Reset to measurement.  
 Automatic safeguard : Auto return to measuring mode when touchscreen is untouched for 10 min.

#### Display and Operating Interface

The Display is a backlight graphical display with QVGA resolution. Operation is done by a touchscreen. Graphical keys on the right and other area's of the touchscreen respond to contact as virtual push buttons.

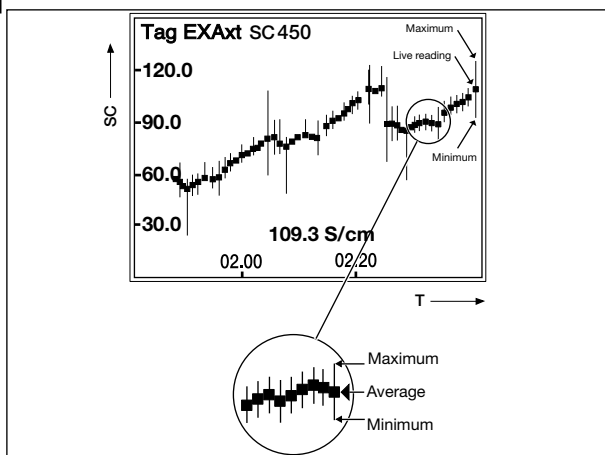
#### Main screen



#### The main screen displays:

- The primary variable in large font (user selectable)
- Other process variable(s) in small font
- Unit symbols
- Tagnumber (user programmable)
- Process description (user programmable)
- Status of contact output(s)
- Status indicator during HOLD and WASH situation
- Main function keys

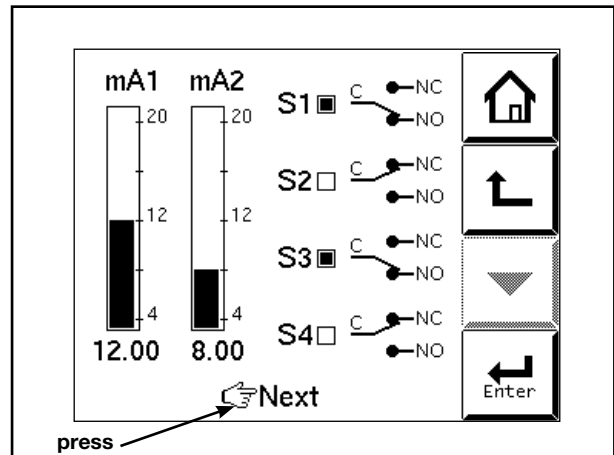
#### Trend screen



#### The trendscreen displays:

- Time scale. User selectable (between 15 minutes and 2 weeks)
- PV scale. User selectable
- TAG number
- Actual PV
- Average, maximum and minimum PV in this interval (time scale / 51)

#### Zoom screen



The zoom screen displays an easy graphic representation of the output functions. When "next" is pressed it will give access to the logbook data.

#### Status screen

The Status screen gives access to diagnostic information with regards to analyzer or sensors.



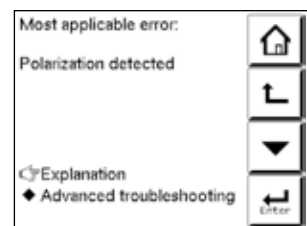
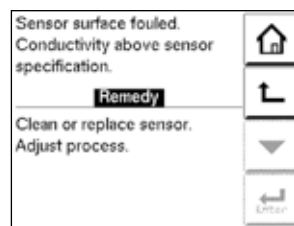
No malfunction detected.



Soft alarm detected. Maintenance is recommended for best accuracy.



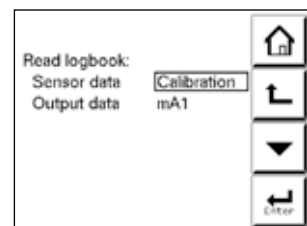
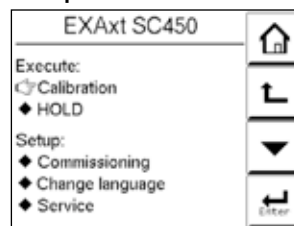
Hard alarm is detected indicating malfunction that is critical for good analysis. When this key is pressed details are displayed with regards to detected malfunction and troubleshooting guidelines are displayed to resolve the malfunction.



#### Maintenance screen

The maintenance screen gives access to calibration, commissioning and setup of the instrument. These levels can be protected by passwords.

#### Example



## Functionality Characteristics

### Safe Operation

EXAxt450 features BURN-OUT functionality according to NAMUR Recommendation 43. This document recommends using the mA output for fault detection by controlling the mA output in the following way:

- 4-20 mA scaled to measuring range
- 3,8 -4 mA for underflow detection
- 20- 20,5 mA for overflow detection
- =<3,6 mA for fault detection
- =>21 mA for fault detection

### Input Circuitry

The conductivity is measured with a square wave AC signal across the sensor with a frequency that is automatically adapted to the conductivity value to minimize the influence of system capacitance and electrode polarization. The conductivity is measured with 4-wire method to eliminate the influence of cable length.

This results in an accurate measurement over a wide range of conductivity values in combination with many sensors.

### Process Temperature Compensation

EXAxt 450 offers automatic temperature compensation and to ensure full compatibility with most commercially available conductivity sensors. Selection is possible out of five different temperature sensing elements. All elements have been calibrated during initialization of the analyzer. The default configuration of the SC450 uses Pt1000 RTD for temperature compensation.

The temperature compensator is used to correct for the influence of temperature on the conductivity of the process fluid. The analyzer readings are at reference temperature: 25°C unless programmed otherwise.

The default temperature compensation follows IEC 746-2 compensation algorithm for diluted solutions of NaCl in water. This default mode (NaCl) includes also compensation for the temperature influence on the dissociation of water molecules. This makes the default compensation mode ideal for salt solutions from ultra pure water up to concentrated salt solutions.

SC450 offers two additional modes for advanced temperature compensation in processes where NaCl compensation does not offer the required accuracy:

1. Linear temperature coefficient setting
2. Matrix temperature compensation

#### Linear temperature coefficient

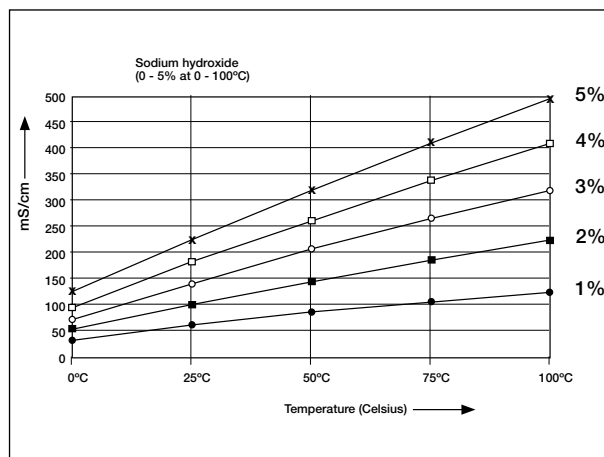
This function is used when the water chemistry is unknown. Therefore the temperature coefficient is determined empirically by taking a sample, reading the conductivity and temperature at two different temperatures. The TC to be programmed is defined as % per /°C.

This coefficient is calculated from two uncompensated measurements at different temperatures and can be calculated with the following equation:

$((SC1 - SC2) / (T1 - T2)) \times 100 / SC2$  in which (T2, SC2) is the measurement at reference temperature.

#### Matrix temperature compensation

This function is used when the empirical method has shown that the temperature coefficient varies within the measuring range of the analyzer. Then a Matrix is built of 100 points, where the conductivity of 10 different samples is recorded for 10 different temperatures.



### Matrix temperature compensation

The SC450 is equipped with a matrix type algorithm (conductivity as a function of concentration and temperature) for accurate temperature compensation in various applications.

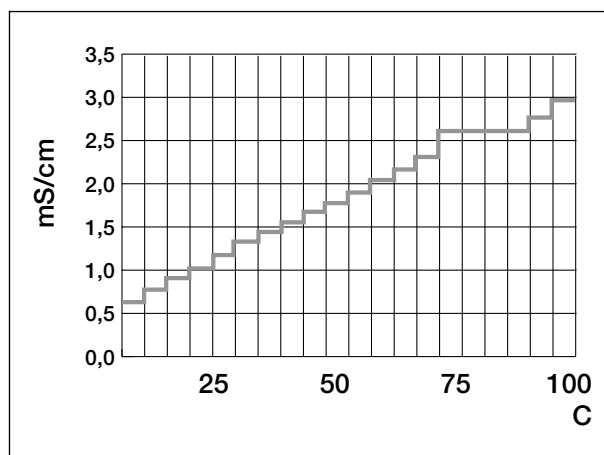
These are:

1. Ammonia in water: 0- 50 ppb @ 0- 90°C (boiler feed water, condensate)
2. Ammonia in water: 15- 30 % @ 10- 50°C
3. Morpholine in water: 0- 500 ppb @ 0- 90°C (boiler feed water, condensate)
4. Sulfuric Acid in water: 0- 27% @ 0- 100°C
5. Sulfuric Acid in water: 39- 85% @ -18- 116°C
6. Sulfuric Acid in water: 93- 100% @ 10- 90°C
7. Sodium Hydroxide in water: 0- 15% @ 0- 100°C
8. Sodium Hydroxide in water: 25- 50 % @ 0- 80°C
9. Hydrochloric Acid in water: 0- 200 ppb @ 0- 100°C (Cation conductivity)
10. Hydrochloric Acid in water: 0- 18% @ -10- 65°C
11. Hydrochloric Acid in water: 24- 44% @ -20- 65°C
12. Nitric Acid in water: 0- 25% @ 0- 80°C
13. Nitric Acid in water: 35- 88% @ -16- 60°C

<sup>1</sup> Although range is 0 - 25%

<sup>2</sup> Compensation range

In addition a free programmable matrix can be selected for applications not covered by these standard ones. Measurement outside the range of the matrix is possible, but can result in inaccuracies dependent on the chemistry of the electrolyte solution.



Matrices are available for the common mineral acids and bases. In addition Ammonia and Morpholine are included. In short by using the matrix method, specialist compensation is available for the majority of applications in the power industry, water treatment, and chemical manufacturing. The following matrices are available initially, but as with all Yokogawa products, we are continually striving to improve both the quality and technological content. Further solutions will be added to this list.

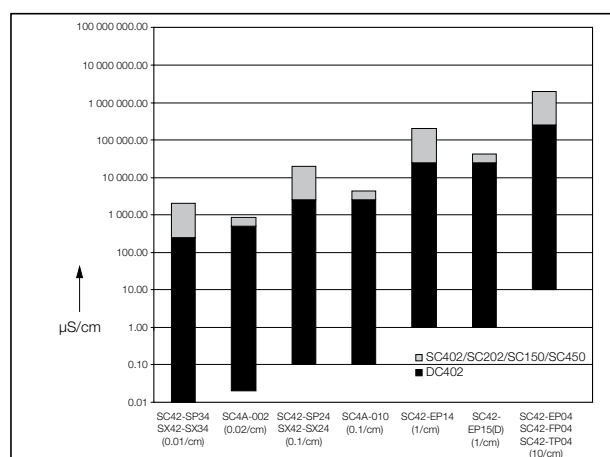
Ammonia	0..50 ppb	0..90°C
Ammonia	15..30%	10..50°C
Morpholine	0..500ppb	0..90°C
H <sub>2</sub> SO <sub>4</sub>	0..27%	0..100°C
H <sub>2</sub> SO <sub>4</sub>	39..85%	-18..116°C
H <sub>2</sub> SO <sub>4</sub>	93..100%	10..90°C
NaOH	0..15%	0..100°C
NaOH	25..50%	0..80°C
HCl	0..200ppb	0..100°C
HCl	0..18%	-10..65°C
HCl	24..44%	-20..65°C
HNO <sub>3</sub>	0..25%	0..80°C
HNO <sub>3</sub>	35..88%	-16-60°C

### WFI monitoring according to USP<645> directives.

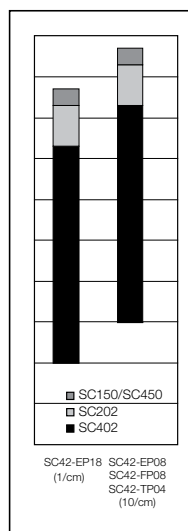
First published in USP23 is the directive for on-line monitoring of water for injection using Conductivity Analyzers. In this standard the purity of the water is classified in 3 levels, of which the first level is monitored by Conductivity Analysis. If the conductivity exceeds the limit, then the user must perform laboratory analysis to verify the quality of the WFI. SC450 has the limits of USP built in the firmware and as soon as the water quality does not meet the requirement of step 1, a fault message is generated; this information can be transmitted through HART®, contact output or High/Low mA output according to NAMUR recommendation 43. It is also possible to program a contact output to close when a preset safety margin is exceeded. The USP functionality is independent on the chosen conductivity range for the mA outputs. The functionality is active in both Conductivity and Resistivity mode.

### Electrode selection

In order to make precise conductivity measurements, there are a number of prerequisites. Most important is the selection of suitable sensors. Special attention should be paid to the choice of the sensors to ensure compatibility with both the chemical composition and the specific conductivity of the fluid to be measured. The installation of the sensor is also very important for a correct measurement. Other Yokogawa specification sheets cover the choice of sensors and holders, and any Yokogawa sales office can provide expert advice.



Measuring range as function of the cell constant



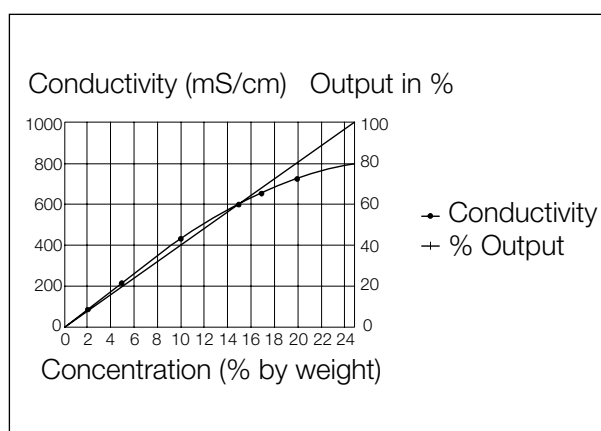
**Note:** With 2-electrode systems, polarization may decrease the conductivity value at higher concentrations. Applications using highly conductive fluids, inductive conductivity measurement should be considered as an alternative because of lower maintenance requirements.

### Output functions

#### Current Outputs

The SC450 offers two isolated 4- 20 mA outputs for indication, recording or control functions. The parameter that is transmitted through the current output(s) can be selected out of:

- Conductivity or Resistivity
- Temperature
- Concentration
- PID control



#### Linearisation of output

Example: 0-25% Sulfuric acid

### Example of Concentration measurement.

The conductivity of a sulfuric acid solution is not linear to the concentration of the acid. Then the user selects TABLE in the Output configuration menu and a 21 point table is generated to linearize the output in concentration units.

Code	Output	mA 4-20	Conc.	Example % H <sub>2</sub> SO <sub>4</sub>	Cond.	Example mS/cm
0	4.0		0		0	
5	4.8		1.25		60	
10	5.6		2.5		113	
15	6.4		3.75		180	
20	7.2		5		211	
25	8.0		6.25		290	
30	8.8		7.5		335	
35	9.6		8.75		383	
40	10.4		10		424	
45	11.2		11.25		466	
50	12.0		12.5		515	
55	12.8		13.75		555	
60	13.6		15		590	
65	14.4		16.25		625	
70	15.2		17.5		655	
75	16.0		18.75		685	
80	16.8		20		718	
85	17.6		21.25		735	
90	18.4		22.5		755	
95	19.2		23.75		775	
100	20.0		25		791	

In addition the current output can be used to transmit a fault condition through the BURN OUT function and it can maintain the last measured value prior to maintenance or a fixed preset value using the HOLD function.

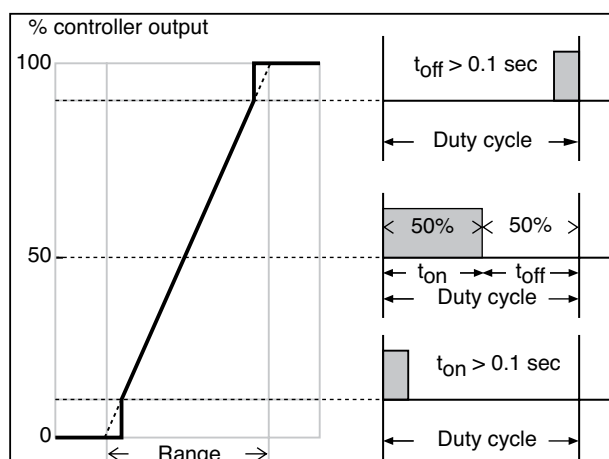
### Contact Outputs

The SC450 offers four SPDT contact outputs. All contact outputs can be configured for Alarm and Control functions. Contact S1, S2 and S3 are in powered condition when the setpoint is exceeded. These contacts are normally used for HI, LO Alarm or Control functions. Contact S4 is in alarm condition when the power is down. This fail-safe contact is normally used to signal a fail situation.

### Control Function

SC450 offers advanced process control. Each of the current outputs and the contact outputs can represent the PID control output.

If a contact is used for process control the contact output can be pulse length controlled or pulse frequency controlled.



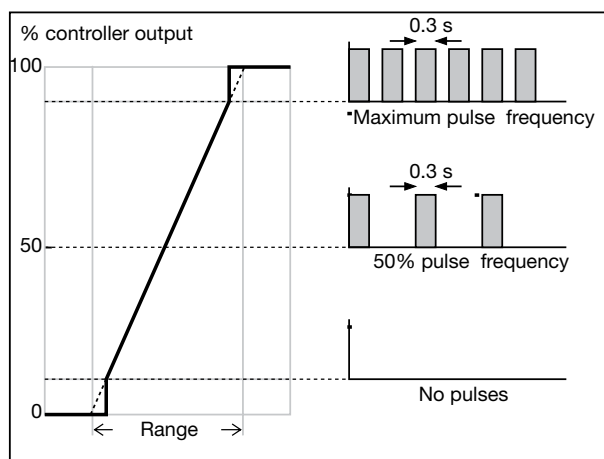
### Duty cycle control

This type of control is normally used to operate solenoid valves or continuously operating dosing pumps. The period of the on/off cycle is selected between 1s and 30 minutes. The on/off ratio (duty cycle) is controlled by the PID control function.

### Pulse frequency control

This function is used when the chemical is dosed with pulsating dosing pumps, where each pulse represents a certain volume of reagent. The maximum number of pulses per minutes is selected, but must be between 1 and 70 pulses per minute. The frequency of pulses is determined by the PID function of the analyzer.

The Proportional Band, the Integral Time and the Derivative Function are set in the control menu of the analyzer.



### Model and Suffix Codes

Model	Suffix	Option	Description
SC450G			Conductivity/Resistivity transmitter
Power	- A		AC version (85...265 VAC)
- D			DC version (9.6...30 VDC)
- A			General purpose version
- U			FM version
Options*	/ SCT**		Predefined Tagnumber (text only)
	/ UM		Universal Mounting kit (panel, pipe, wall)

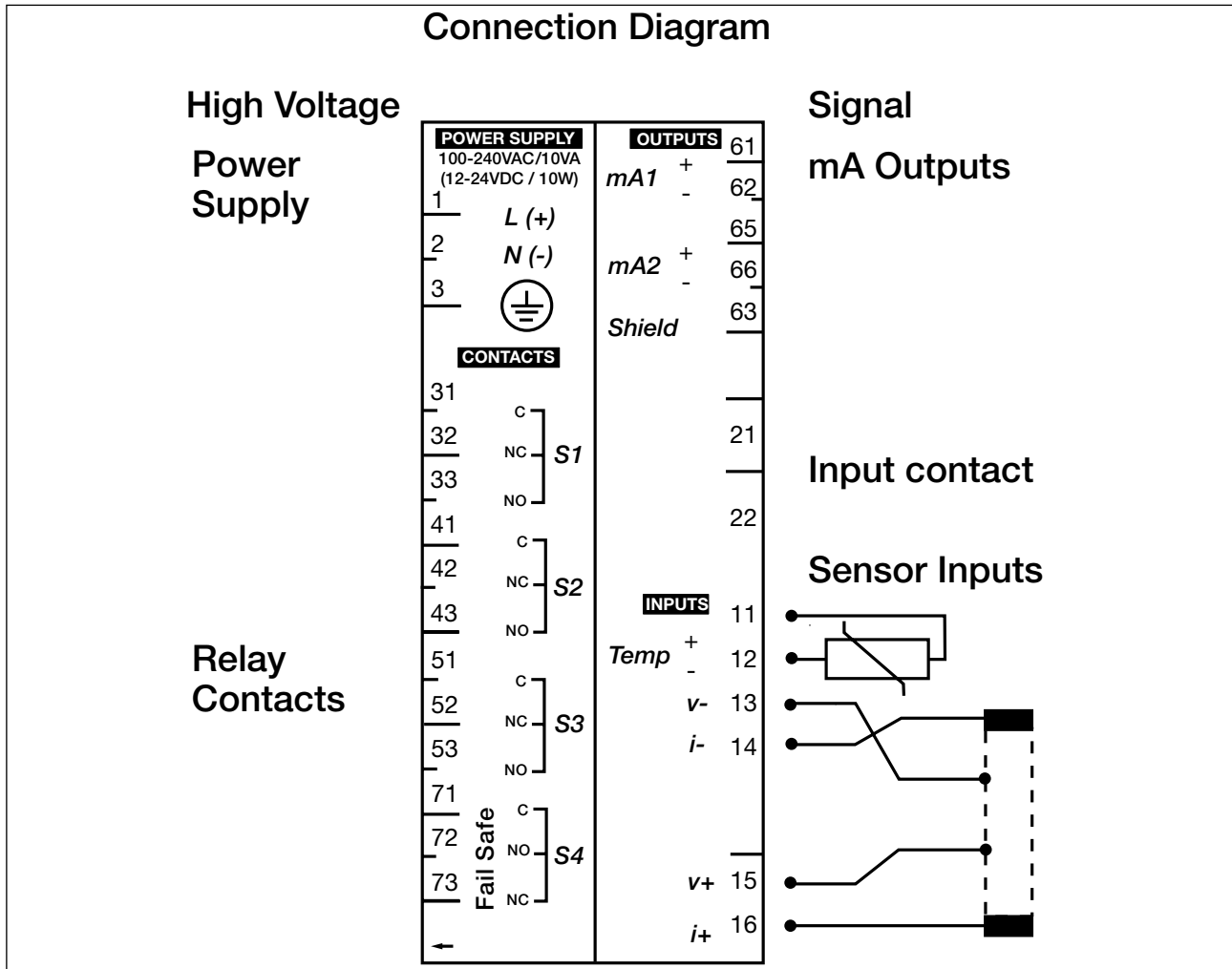
\* /Q: Quality Inspection certificate is always included with the product.

\*\* If the tagnumber is predefined with the purchase, Yokogawa will inscript the tagplate with the specified tagnumber, and program the tagnumber in the transmitter.

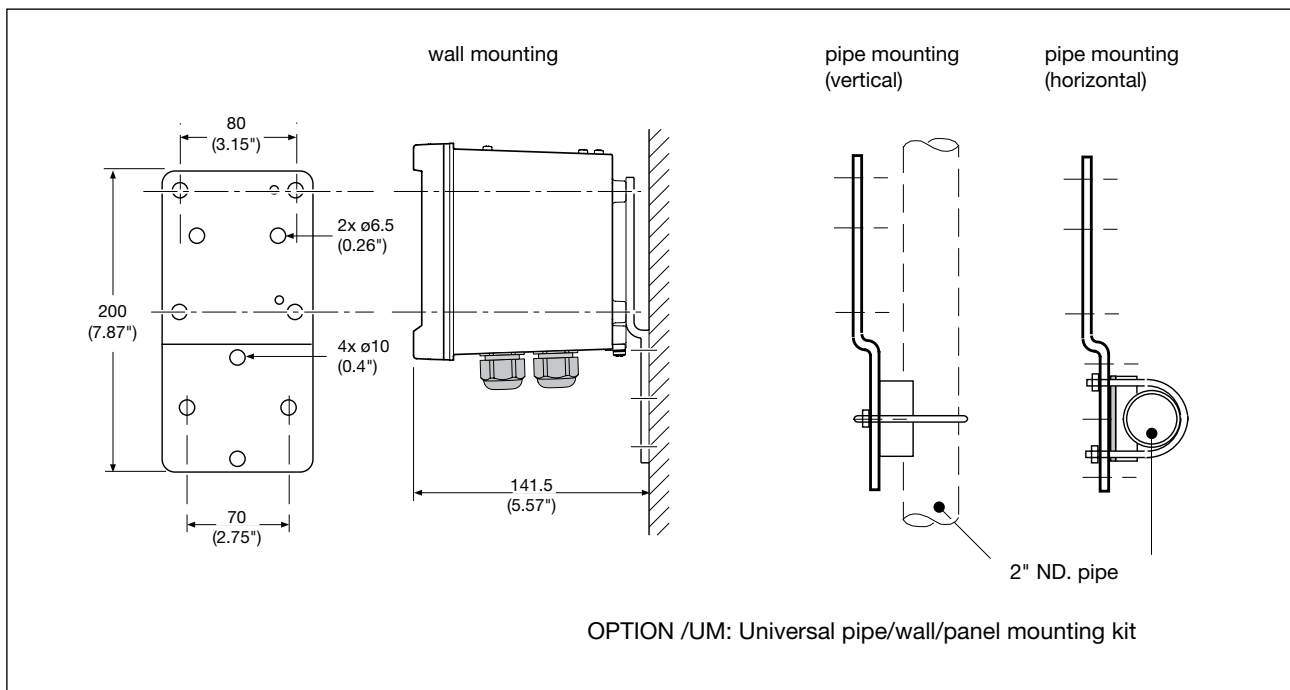
### Spare Parts

Part no.	Description
K1541KR	/PM panelmounting for EXA400/402
K1542KW	/U pipe/wall mounting for EXA
K1548FU	Flash loader kit
K1548MT	Tagplate blank EXAxt450
K1548MV	Glands M20 (6 pcs.)
K1548MW	Grommetset
K1548UM	Universal mounting kit
K1548UQ	Calibration Certificate EXAxt450

## Wiring Diagram

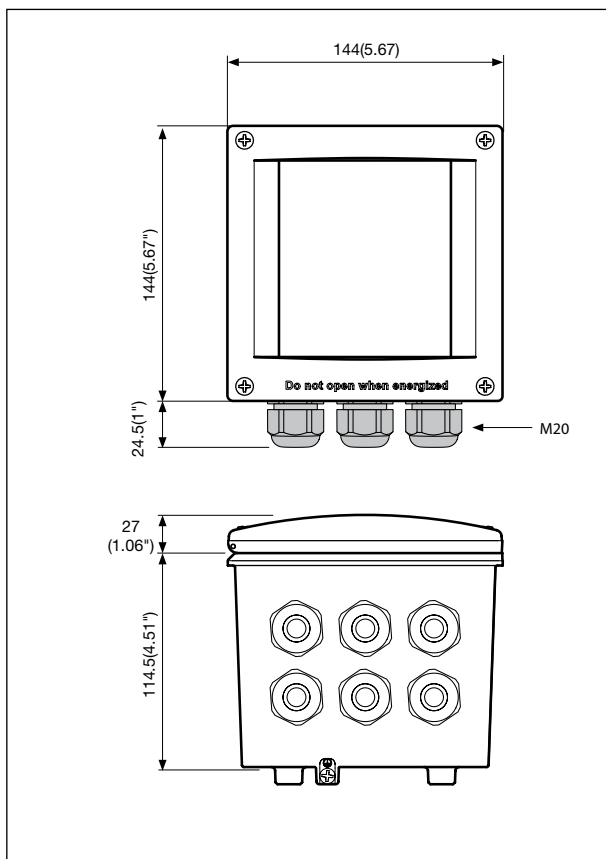


## Dimension and Mounting

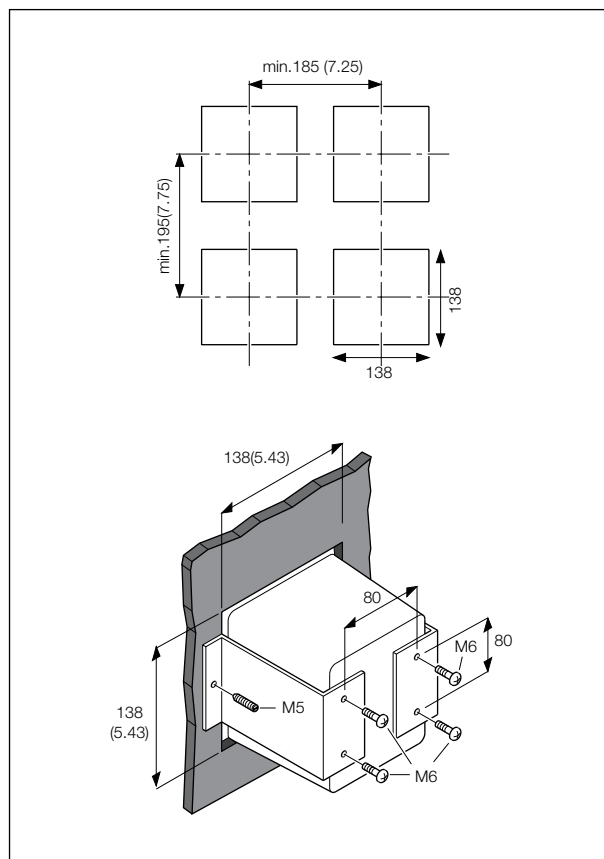


GS 12D7B5-E-E

## Wall and pipe mounting diagram



Housing dimensions and layout of glands



Option/UM. Universal mounting kit, panel mounting diagram

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# General Specifications

## Model SC72 Personal Conductivity Meter

Compact, Easy-to-Use, and Waterproof, the SC72 is designed specifically to meet the needs of both the field and the laboratory. This portable conductivity meter includes advanced features such as Data Memory, Alarm, and Self-Diagnostic functions.

Combined with a wide variety of electrodes, the SC72 offers the flexibility to meet the requirements of nearly any conductivity application.

### Features

- Waterproof (IP67), sealed case and connector cover to keep out moisture
- Autoranging allows 0 to 2000 mS/cm capability
- Large, easy-to-read display
- Automatic Temperature Compensation (NaCl curve or User-defined coefficient)
- Self-Diagnostics warn of fault conditions
- Auto power off extends battery life
- 300 Points of Data Memory (stores conductivity value, temperature, date, and time)
- Audio Alarm Function

### Specifications

#### Measuring Ranges

Conductivity	: 0 to 2000 mS/cm (dependent on sensor selected)
Resistivity	: 0-40.0 M $\Omega$ .cm (high purity sensor only)
Temperature	: 0 to 80°C

**Display** : Digital LCD

#### Resolution

Conductivity	: 0.001 $\mu$ S/cm (for 0 to 2 $\mu$ S/cm range)
Resistivity	: 0.1 M $\Omega$ .cm
Temperature	: 0.1°C

**Repeatability** :  $\pm 2\%$

**Process Temperature** : 0 to 80°C

**Ambient Temperature** : 0 to 50°C

**Power Supply** : Two AA size Alkaline Batteries

#### How to order the SC72

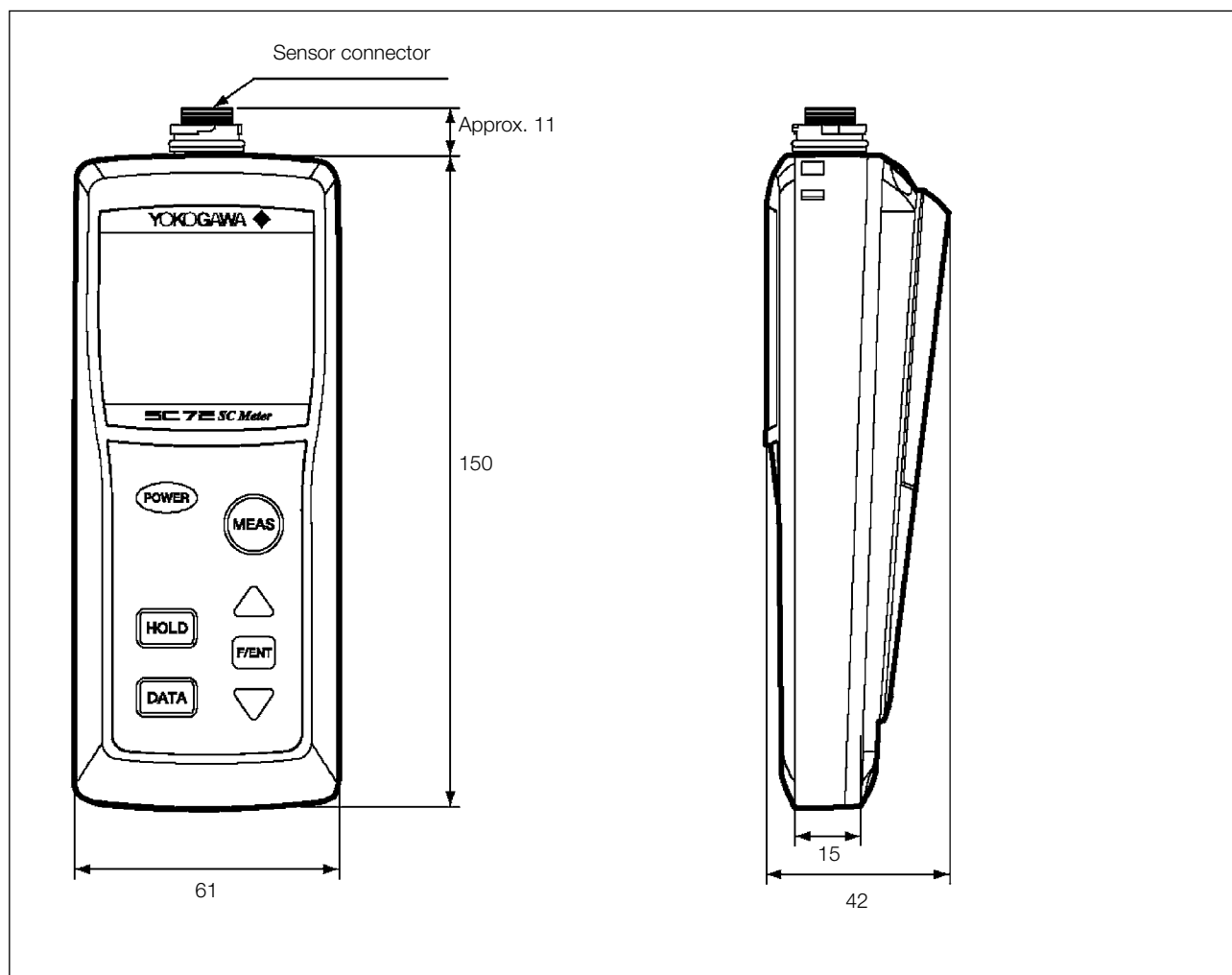
Model Code	Description
SC72-00-E-AA	Hand-Held Conductivity Meter Without Sensor

#### How to order separate conductivity sensors

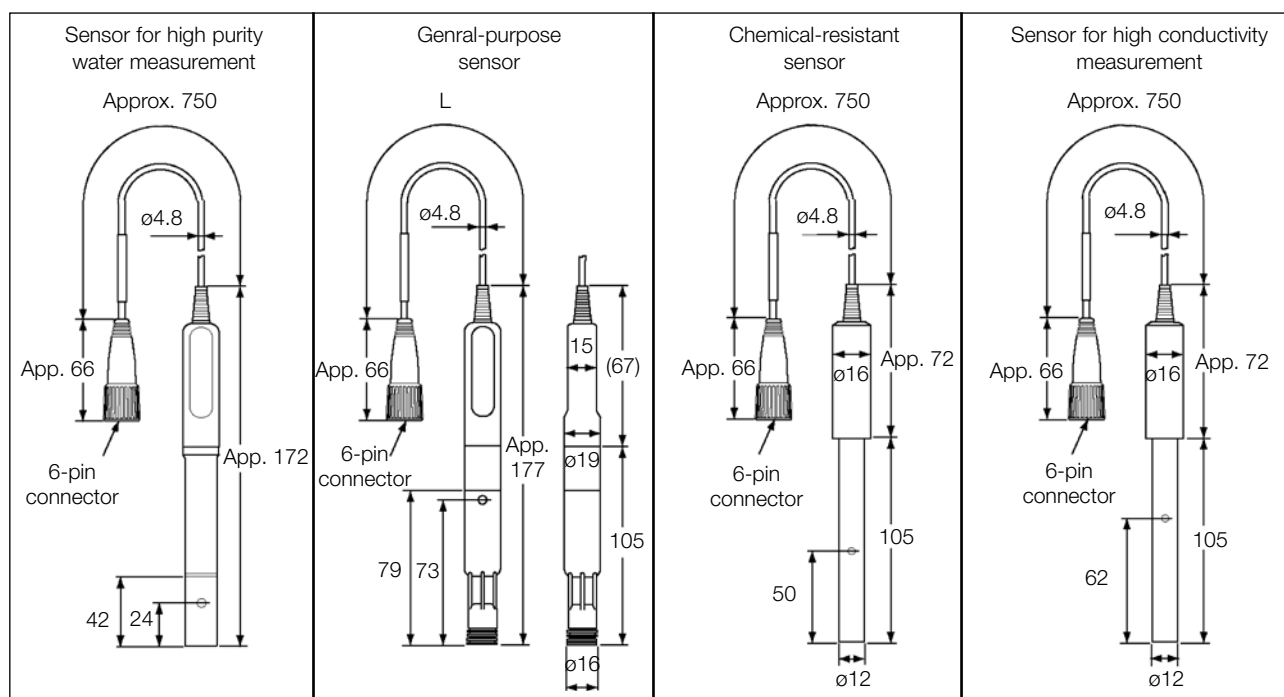
Part Number	Description
SC72SN-21-AA	General Purpose Sensor with 0.75m cable; Integral Temperature Sensor; 0-200mS/cm range
SC72SN-23-AA	General Purpose Sensor with 3.0m cable; Integral Temperature Sensor; 0-200mS/cm range
SC72SN-11-AA	Pure Water Sensor with 0.75m cable; Integral Temperature Sensor; 0-200 $\mu$ S/cm range
SC72SN-31-AA	Chemical Resistant Sensor with 0.75m cable; Integral Temperature Sensor; 0-200mS/cm range
SC72SN-41-AA	High Conductivity Sensor with 0.75m cable; Integral Temperature Sensor; 0-2000mS/cm range



## Dimensions



## Sensors of the SC72



GS 12D03D02-01E-E



## Model and Suffix Codes

### Personal Conductivity meter

Model	Suffix Code	Option Code	Description
SC72			Personal conductivity meter
Conductivity sensors	-00		Without sensor
	-11		With sensor for high purity water measurement (cable length: 75 cm)
	-21		With general-purpose sensor (cable length: 75 cm)
	-23		With general-purpose sensor (cable length: 3 m)
	-31		With chemical-resistant sensor (cable length: 75 cm)
	-41		With sensor for high conductivity measurement (cable length: 75 cm)
	-J		Japanese
	-E		English
	-AA		Always -AA

### Conductivity sensor for personal conductivity meter

Model	Suffix Code	Option Code	Description
SC72SN			Conductivity sensor for personal conductivity meter
Sensor	-11		For SC72: for high purity water measurement (cable length:75 cm)
	-19		For SC82: for high purity water measurement (cable length:75 cm)
	-21		For SC72: general-purpose type (cable length:75 cm)
	-23		For SC72: general-purpose type (cable length:3 m)
	-29		For SC82: general-purpose type (cable length:75 cm)
	-31		For SC72: chemical-resistant type (cable length:75 cm)
	-39		For SC82: chemical-resistant type (cable length:75 cm)
	-41		For SC72: for high conductivity measurement (cable length:75 cm)
	-49		For SC82: for high conductivity measurement (cable length:75 cm)
	-AA		Always -AA

\*Combination of conductivity sensor for SC82 with SC72 meter will not be IP67 waterproof.

## Specifications of Personal Conductivity Meter

Measurement		Conductivity of solution
Unit		S/cm or S/m
Measurement range	Conductivity Resistivity Temperature	0 to 2 $\mu$ S/cm through 0 to 2 S/cm (depends on sensor to be used) x0 to 40.0 M $\Omega$ -cm (Only with sensor SC72SN-11-AA) 0 to 80°C
Resolution	Conductivity Resistivity Temperature	0.05% of full scale * <sub>2</sub> 0.1 M $\Omega$ -cm 0.1°C
Repeatability	Conductivity	±2% (±5% when general-purpose type sensor is used in the range of 0 to 2 mS/cm)
Display		Digital LCD
Indication		Conductivity or resistivity, solution temperature and temperature coefficient (simultaneously), various messages
Range switching		Automatic/manual
Temperature compensation		Temperature coefficient (0 to 9.99%/°C) or NaCl coefficient, reference temperature at 25°C
Ambient temperature		0 to 50°C
Construction		IP67 (JIS C0920)
Weight		Approx. 220 g (without sensor)
Power source		2 size AA dry cell batteries
Battery life		Approx. 200 hours* <sub>3</sub> , Auto Power Off function
Functions		Data memory (300 points), alarm clock

\*1: Resistivity can be measured for reference. In that case repeatability is determined by conductivity.

\*2: When measuring range is set to full scale.

\*3: When alkaline dry cell batteries are used.

## Standard Accessories for Personal Conductivity Meter

AA size dry cell batteries (2 pcs), User's Manual, Quick Manual, non-slip pads (2 pcs), hand strap, cotton swabs Instrument Card

## Specifications of Sensor for Personal Conductivity Meter

Sensor	Model	Measurement range*1	Cell Constant	Wetted Material
For low conductivity measurement*2	SC72SN-11(0.75m)	0 to 2μS/cm, 0 to 20μS/cm, 0 to 200μS/cm, 0 to 40MΩ·cm	0.05cm-1	SUS316 (electrode element), fluoro rubber (O-ring), polypropylene resin (insulated area), PVC (cable)
General-purpose type	SC72SN-21(0.75m)	0 to 20μS/cm, 0 to 200μS/cm, 0 to 2mS/cm, 0 to 20mS/cm, 0 to 200mS/cm	5cm-1	Titanium (sensor), fluoro rubber (O-ring), PVC (cable), polyphenylene sulfite resin, polypropylene resin (insulated area, clear cover)
Chemical-resistant type	SC72SN-23 (3m) SC72SN-31(0.75m)			Glass, platinum black (electrode element), PVC (cable)
For high conductivity measurement	SC72SN-41(0.75m)	0 to 2mS/cm, 0 to 20mS/cm, 0 to 200m/cm, 0 to 2S/cm	50cm-1	Glass, platinum black (electrode element), PVC (cable)

\*1: Fixed range. For automatic range, range is automatically variable.

\*2: Resistivity can be measured for reference. In that case repeatability is determined by conductivity.

## Options (Available Separately)

For pH and conductivity meters in common	Soft carrying case	B9269KJ
	Sensor stand	K9220XN
For conductivity meter	Standard solution (0.1 mol /l NaCl, 250 ml)	K9221ZA

## Spare parts

O-ring and gasket set	K9654AY	Gaskets for battery box (2 pcs) and O-rings for connector (2 pcs)
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# General Specifications

Model SC42 and FF40/FS40/FD40  
2/4-electrode design for Conductivity Flow  
fittings, Subassemblies and Immersion fittings

*The measurement of specific conductivity in aqueous solutions is becoming increasingly important for the determination of impurities in water or the concentration measurement of dissolved chemicals. The accuracy of the measurement is strongly influenced by temperature variations, polarisation effects at the surface of the contacting electrodes, cable capacitances, etc.*

*Yokogawa provides sensors for pure water systems, general applications with a 2-electrode design and applications involving high concentrations of chemicals with a 4-electrode design.*

*To install conductivity sensors in a permanent or semi-permanent location, Yokogawa offers wide a range of flow and immersion fittings. A high degree of standardisation simplifies mounting, servicing and removal or replacement of the sensors.*

*Included are flow fittings and subassemblies for in-line or direct mounting of conductivity sensors in piping systems.*

*The immersion fittings are designed for tanks, open vessels or drains. PVC and stainless steel construction materials suit most process conditions, regarding chemical resistance, pressure and temperature specifications.*

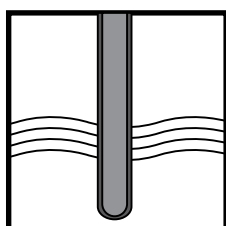
*The fittings of stainless steel might be used in sanitary applications.*



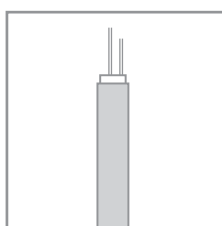
## Features

- Wide range of sensors to suit most process conditions.
- High precision of the cell constant (Field calibration not necessary).
- Sensors for ultra-pure water applications.
- Built-in resistance thermometers Pt 1000 for automatic temperature compensation.
- Material certificate 3.1 according to EN 10024 for stainless steel sensors are always included.
- Optional quality inspection certificate.

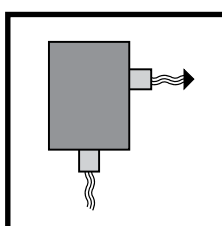
## System Configuration



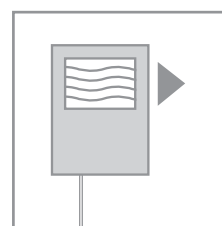
Sensors



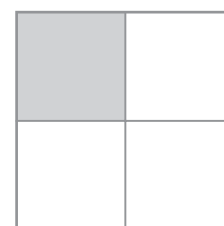
Cables



Fittings



Transmitters



Accessories

## Plug-in flow sensors (SS)

### Stainless steel cells for 2-electrode type with cell constants 0.01 and 0.1 cm<sup>-1</sup>.

These conductivity sensors have a stainless steel body and PEEK (Poly Ether Ether Ketone) inner insulation for high pressure/temperature applications. A special treatment of the electrodes ensures optimal resistance against polarisation. The sensor includes a built-in resistance thermometer Pt1000 for automatic temperature compensation.

The combination sensor plug and cable socket is watertight and temperature resistant up to 100°C (212 °F). It meets the requirements of IP65.

The dimensions of the sensor are standardised for mounting in the standard fitting program of Yokogawa.

## Features

- High precision of the cell constant (individually calibrated).
- Fast temperature response.
- High pressure/temperature specifications.
- Built-in resistance thermometer, Pt1000 RTD
- Plug-socket cable connection for easy installation and maintenance, meeting IP 65.
- Standardised dimensions for mounting in flow- and immersion fittings
- Material certificate 3.1 according to EN 10014 are standard included (only wetted metal parts)

## Typical Applications

### 1. Cell constant = 0.01 cm<sup>-1</sup>

For measurement in very low conductive solutions like pure water, condensate, demineralised water, distilled water, etc.

### 2. Cell constant = 0.1 cm<sup>-1</sup>

For measurement of low conductive solutions like boiler feed water, surface water, etc.

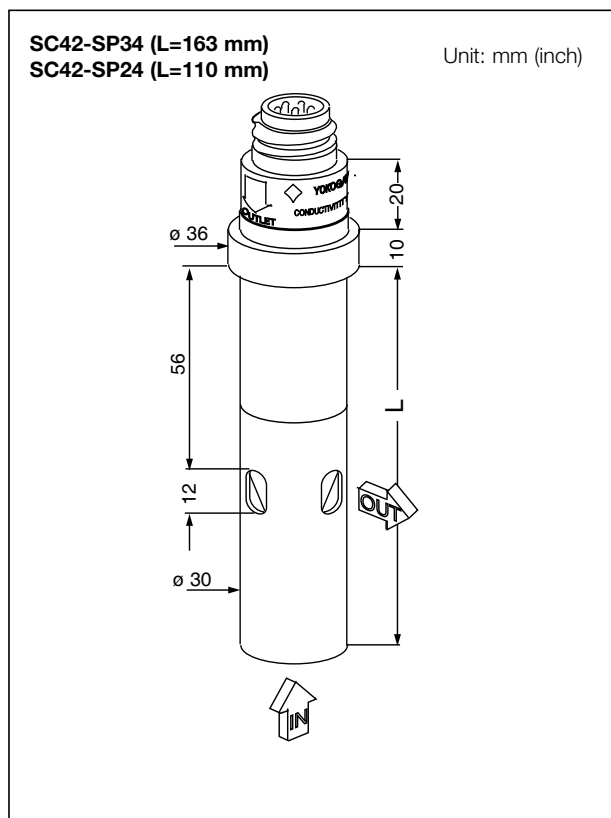


Figure 1 Flow type

## General Specifications

### Materials

#### Wetted parts

- |                        |                                       |
|------------------------|---------------------------------------|
| a. Body                | : Stainless steel AISI 316            |
| b. Insulation          | : PEEK (Poly Ether Ether Ketone)      |
| c. Electrode           | : Stainless steel AISI 316            |
| d. Quad-rings, O-rings | : Viton                               |
| e. Connector           | : Polyamide with gold plated contacts |

### Weight and immersion length (L in figure)

- |                 |                        |
|-----------------|------------------------|
| Model SC42-SP24 | : 440 gram; 110 mm (L) |
| Model SC42-SP34 | : 600 gram; 163 mm (L) |

## Functional Specifications

Model	Temp. element	Cell-constant	Pressure rating	Max. temperature	90% Temp. response	Measurement system
SC42-SP34	Platinum resistor (Pt1000 to DIN)	0.01 cm <sup>-1</sup>	10 bar/142 PSIG	150°C/302 °F	< 1 min.	2-electrode system
SC42-SP24	Platinum resistor (Pt1000 to DIN)	0.1 cm <sup>-1</sup>	10 bar/142 PSIG	150°C/302 °F	< 3 min.	2-electrode system

The maximum pressure and temperature rating also depend on the actual process conditions. Under certain circumstances it is necessary to test the cell in situ. Additional data is available from Yokogawa.

**Note:** Stainless steel cells for 2-electrode systems with cell-constants 0.01 and 0.1 cm<sup>-1</sup> designed for pressure and temperature ratings of up to 40 bar (PSIG) at 250°C (°F) are available upon request.

## Options

Certificate /Q : Quality inspection certificate

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## Plug-in flow sensors (EPOXY)

### Epoxy cells for 2- and 4-electrode type with cell-constants 1 and 10 cm<sup>-1</sup>.

These conductivity sensors have a body of glass-filled epoxy resin. The electrodes are made from graphite impregnated with epoxy resin. This gives the sensors a good chemical resistance and a good reduction of polarisation effects.

### Features

- Good chemical resistance.
- Choice in 2- and 4-electrode types.
- Easy installation

### General Specifications

#### Materials

Wetted parts

- Body : Glass filled epoxy resin
- Electrodes : Graphite impregnated with epoxy resin

Connector plug : Polyamide with gold plated contacts

#### Weight and immersion length (L in figure)

Model SC42-EP0. : 270 gram; 193 mm (L)

Model SC42-EP1. : 220 gram; 160 mm (L)

### Options

Certificate /Q : Quality inspection certificate

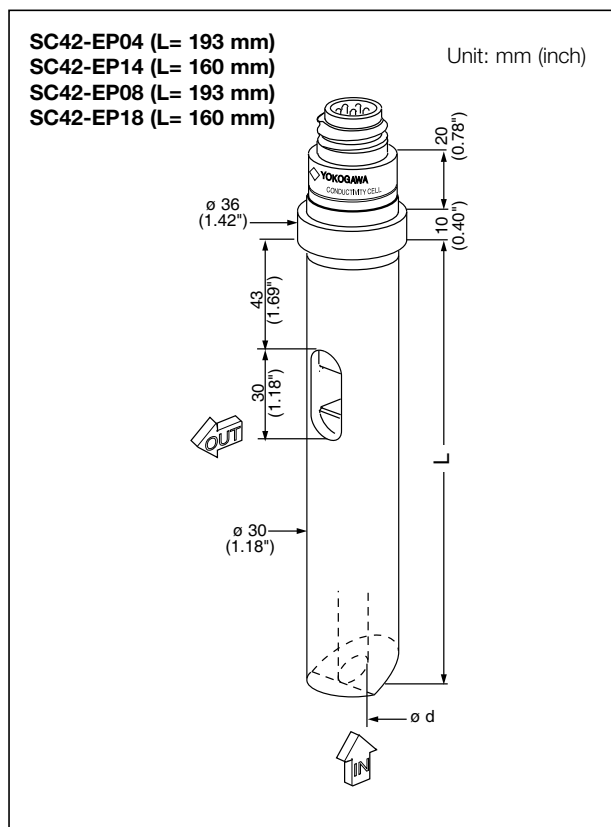


Figure 2 Flow type

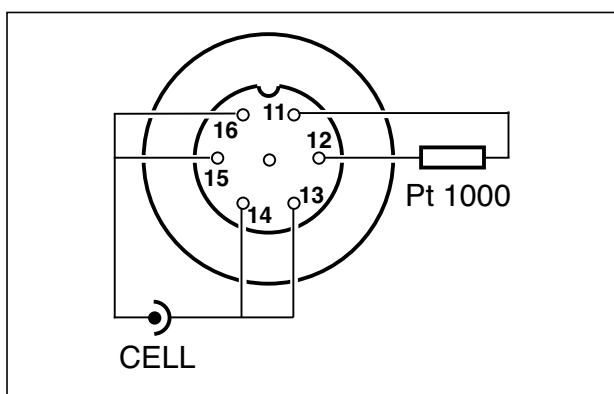


Figure 3 Connector 2-electrode system

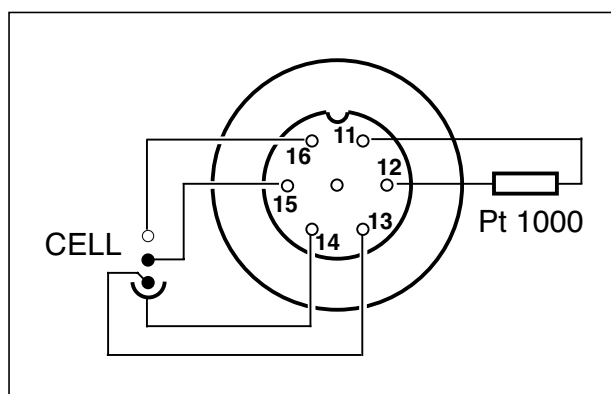


Figure 4 Connector 4-electrode system

### Functional Specifications

Model	Temp. element	Cell constant	Pressure rating	Max. temperature	90% Temp. response	Inlet dø	Meas. system
SC42-EP04	Pt1000	10 cm <sup>-1</sup>	10 bar/142 PSIG	110°C/230 °F	< 3 min.	5 mm	2-el.ectrode
SC42-EP14	Pt1000	1 cm <sup>-1</sup>	10 bar/142 PSIG	110°C/230 °F	< 2 min.	10 mm	2-el.ectrode
SC42-EP08	Pt1000	10 cm <sup>-1</sup>	10 bar/142 PSIG	110°C/230 °F	< 3 min.	5 mm	4-el.ectrode
SC42-EP18	Pt1000	1 cm <sup>-1</sup>	10 bar/142 PSIG	110°C/230 °F	< 2 min.	10 mm	4-el.ectrode

The maximum pressure and temperature rating also depend on the actual process conditions. Under certain circumstances it is necessary to test the cell in situ. Additional data is available from Yokogawa.

### Plug-in flow sensors (PTFE and PVDF)

#### PTFE or PVDF shielded glass-platinum cells for 2- and 4-electrode type with cell constant $10\text{ cm}^{-1}$ .

These conductivity sensors are excellent suited for measurement in aggressive media. The (protection) body consists of PVDF (Kynar) or PTFE (Teflon with 25% glass filling).

The cell itself is made from highly resistant glass with platinum electrodes. The electrodes surfaces of the 2-electrode cells (SC42-P04) are further enhanced by gold plating to minimize the polarisation effects.

The internal sealing between the glass measuring cell and the PTFE/PVDF body (not visible in drawing) is by a KALREZ O-ring (high quality with excellent chemical resistance). A VITON O-ring is supplied with the sensors for sealing the cell in the fitting (visible in drawing). For measurements in strongly oxidizing acids an optional KALREZ O-ring is recommended.

### Features

- Excellent chemical resistance for applications in aggressive media like oleum, concentrated mineral acids, etc.
- Suitable for measurement of highly conductive, strongly polluted solutions.
- Optimum results by gold plating (of 2-electrode version) against polarisation effects.

### Typical applications

- PTFE-cell : Concentrated mineral acids such as: oleum, nitric acid, hydrochloric acid, etc.
- PVDF-cell : All aggressive media with the exception of strongly oxidizing agents.

**Note:** See the chemical resistance list in table 1.

### General specifications

#### Materials

Wetted parts

- Body (shield) : - PVDF (Kynar®) for model SC42-FP04/FP08.  
- PTFE (Teflon® with 25% glass) for model SC42-TP04/TP08
- O-ring : - KALREZ™ for cell-body sealing  
- VITON™ for sealing in het fitting
- Electrodes system : Platinum, Gold plated for 2-electrode
- Inside cell : Glass tube
- Connector plug : Polyamide with gold plated contacts

### Functional Specifications

Model	Temp. element	Cell-constant	Pressure rating	Max. temperature	90% Temp. response	Measurement system
SC42-FP04	PT1000	$10\text{ cm}^{-1}$	10 bar/142 PSIG	110°C/230 °F	< 1 min.	2-electrode system
SC42-TP04	PT1000	$10\text{ cm}^{-1}$	2 bar/28,5 PSIG	110°C/230 °F	< 1 min.	2-electrode system
SC42-FP08	PT1000	$10\text{ cm}^{-1}$	10 bar/142 PSIG	110°C/230 °F	< 1 min.	4-electrode system
SC42-TP08	PT1000	$10\text{ cm}^{-1}$	2 bar/28,5 PSIG	110°C/230 °F	< 1 min.	4-electrode system

The maximum pressure and temperature rating also depend on the actual process conditions. Under certain circumstances it is necessary to test the cell in situ. Additional data is available from Yokogawa.

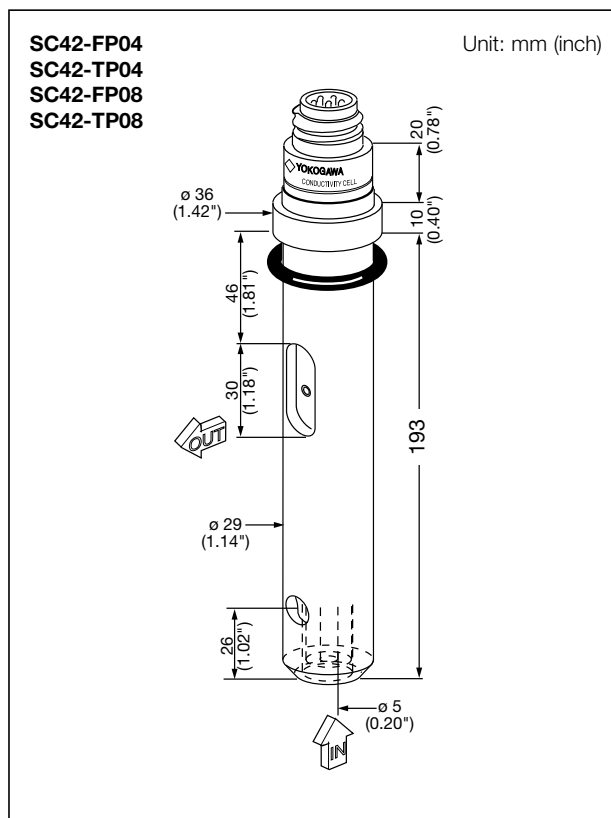


Figure 5 Flow type

#### Weight and immersion length

- Model SC42-FP0 : ca. 270 gram; 193 mm
- Model SC42-TP0 : ca. 320 gram; 193 mm

#### Warning:

Temperature shocks should be avoided

#### Options

- Certificate /Q : Quality inspection certificate

## Insertion Sensors

### Insertion sensors for 2-electrode type with cell constant 1cm<sup>-1</sup>.

The insertion sensors are especially useful in applications where a representative sample flow through the sensor cannot be achieved easily (e.g. in liquids containing solids, direct measurement in pipe-lines). The electrode surfaces are easily accessed for cleaning or maintenance. The model SC4.-EP15D is especially designed for direct mounting in sanitary piping systems. It has a collar piece suitable for mounting with DN 25.

## Features

- No obstacles in the flow-line by short immersion length.
- Easy cleaning.
- Good chemical resistance.
- Low polarisation distortion.

In addition to that the model SC42-EP15D can be directly fitted with a DN25 swivel.

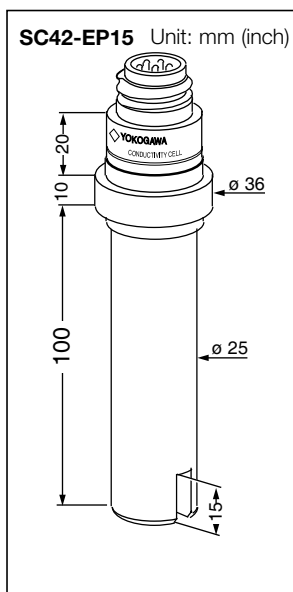


Figure 6 Insertion type

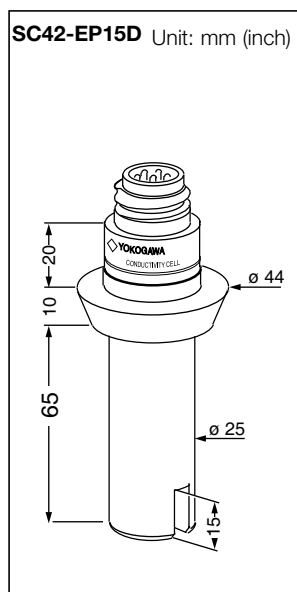


Figure 7 Insertion type (sanitary)

## Applications

For measurement of moderate conductive solutions like surface water, waste water, salt solutions, etc.

## General Specifications

### Materials

Wetted parts

- Body : Glass-filled epoxy resin
- Electrodes : Graphite impregnated with epoxy
- Connector plug : Polyamide with gold plated contacts

### Weight and immersion length (L in figure)

Model SC42-EP15 : 150 gram; 100 mm

Model SC42-EP15D : 150 gram; 65 mm

## Options

Certificate /Q : Quality inspection certificate

## Functional Specifications

Model	Temp. element	Cell-constant	Pressure rating	Max. temperature	90% Temp. response	Measurement system
SC42-EP15	Pt1000	1 cm <sup>-1</sup>	10 bar/142 PSIG	110°C/230 °F	< 3 min.	2-electrode system
SC42-EP15D	Pt1000	1 cm <sup>-1</sup>	10 bar/142 PSIG	110°C/230 °F	< 3 min.	2-electrode system

The maximum pressure and temperature rating also depend on the actual process conditions. Under certain circumstances it is necessary to test the cell in situ. Additional data is available from Yokogawa.

## Parts and Accessories

To connect the conductivity sensors to a transmitter or converter Yokogawa supplies special cables already pretreated and equipped with numbers for easy connection to Yokogawa instruments.

Model	Description	Length
WU40-LH01	Conductivity cable	1.0 m
WU40-LH02	Conductivity cable	2.0 m
WU40-LH05	Conductivity cable	5.5 m
WU40-LH10	Conductivity cable	10 m
WU40-LH15	Conductivity cable	15m
WU40-LH20	Conductivity cable	20 m
WU40-LH25	Conductivity cable	25 m

K1500FX

Set of 5 O-rings for sealing the cell in the fitting material: silicone rubber.

K1500AG

Set of 5 O-rings for sealing the cell in the fitting material: VITON™.

K1500AH

One (1) KALREZ™ O-ring for sealing the cell in the fitting.

## Selection Criteria

A good indication of construction materials can be taken from the piping material used in the process equipment. If this material of better is used no problems by corrosion will occur.

In considering the required sensor, please check all four points listed hereafter:

- The pressure and temperature requirements are within the limits of the cell.
- The selected materials (wetted parts) have a good resistance to corrosion according to practice or table 2.
- The conductivity value at the process temperature is within the application range of the cell (see figure 1).
- A selection is made between 2- or 4-electrode measuring system (see figure 1).



Figure 8 Range ability of conductivity sensors

## Model FF40/FS40 flow fittings and subassemblies for conductivity measuring loops

To install conductivity sensors in a permanent or semi-permanent location, the program of Yokogawa includes a range of flow and immersion fittings.

A high degree of standardisation simplifies mounting, servicing and removal or replacement of the sensors.

The program includes flow fittings and their subassemblies for in-line or direct mounting of conductivity sensors in piping systems.

A wide choice of construction materials gives the user the best solution for any process considering chemical resistance, pressure and temperature specifications.

### Features

- Wide choice of construction materials.
- High degree of standardisation for all cells.
- Easy mounting, service and removal of sensors.
- Electrolytically polished stainless steel designs for optimal corrosion resistance.
- Available with flange adapters.

### A. Flow Fittings

From a practical plant aspect, the best mounting place of a conductivity sensor is in a by-pass with a sample valve. For these applications the flow fittings are ideal.

### Features

- Easy mounting and maintenance of the sensors.
- Changeable liquid outlet position (right or left).
- Wall mounting bracket.
- Blanking plug for mounting and test applications.

### General Specifications

#### Materials

##### Wetted parts

- Body
 

Model FF40-V22	: Polyvinylchloride (PVC)
Model FF40-S22	: Stainless steel AISI 316 (SS)
Model FF40-P22	: Polypropylene (PP)
  - O-rings
 

	: Silicone rubber
--	-------------------
- Mounting brackets for
- |                |                      |
|----------------|----------------------|
| Model FF40-V22 | : Polypropylene (PP) |
| Model FF40-S22 | : Polamide (PA)      |
| Model FF40-P22 | : Polypropylene (PP) |
- Retaining nut for
- |                |                                 |
|----------------|---------------------------------|
| Model FF40-V22 | : Polyvinylchloride (PVC)       |
| Model FF40-S22 | : Stainless steel AISI 304 (SS) |
| Model FF40-P22 | : Polypropylene (PP)            |

#### Volume measuring vessel

- |                         |                  |
|-------------------------|------------------|
| Plastic fittings        | : Approx. 150 ml |
| Stainless steel fitting | : Approx. 150 ml |

#### Mounting connections

- |                         |                  |
|-------------------------|------------------|
| Plastic fittings        | : For screw M6   |
| Stainless steel fitting | : 2x M8 (female) |

### Process connections

- |                 |  |
|-----------------|--|
| PVC fitting     | : PVC tube $\varnothing$ 12 O.D.             |
| PP fitting      | : $\frac{1}{2}$ "- NPT (female)              |
| SS fitting      | : $\frac{1}{2}$ "- NPT (female)              |
| Flange (option) | : $\frac{1}{2}$ " ANSI 150 lbs or DN 15 PN10 |

### Weight

- |                |            |
|----------------|------------|
| Model FF40-V22 | : 770 gram |
| Model FF40-S22 | : 550 gram |
| Model FF40-P22 | : 530 gram |

### Functional Specifications

#### Temperature

- |      |  |
|------|--|
| Min. | : -10°C  |
| Max. | : Depending on material and application (see fig. 2) |

#### Flow rate

- |  |   |
|--|---|
|  | : 0,1 - 10 l/min (depending on application) |
|--|---|

#### Pressure

- |  |              |
|--|--------------|
|  | : See fig. 2 |
|--|--------------|

### Dimensions

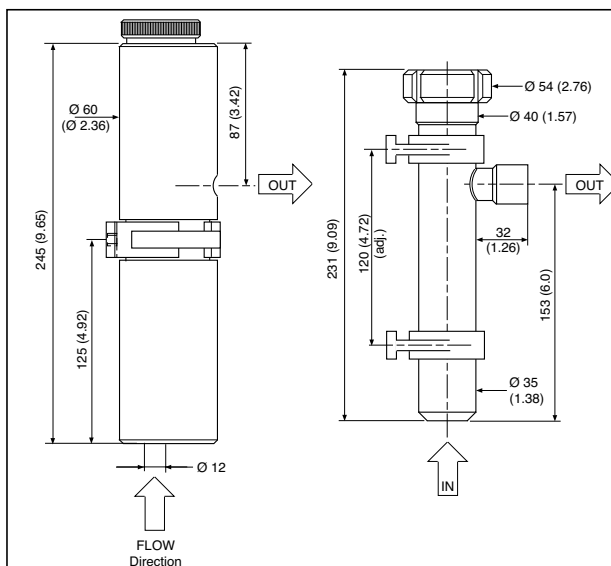


Figure 9 Flow Fittings P/V22 and S22

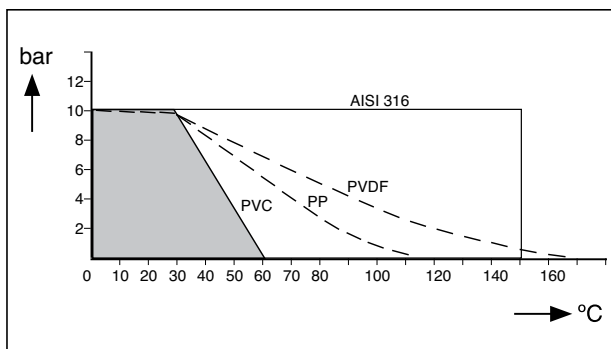


Figure 10 Pressure/temperature class



## Model and Suffix Codes

Model	Suffix	Option	Description
FF40			Flow fitting
Material	-P22		Polypropylene
-S22		Stainless steel	
-V22		Polyvinylchloride	
Options		/FP1	DN15 PN10 PP
Flange adapters		/FP2	DN25 PN10 PP
(NPT 1/2" Male lap joint)		/FP3	1/2" ANSI 150lbs PP
		/FP4	1" ANSI 150lbs PP
		/FS1	DN15 PN10 SS AISI 316
		/FS2	DN25 PN10 SS AISI 316
		/FS3	1/2" ANSI 150lbs AISI 316
		/FS4	1" ANSI 150lbs AISI 316
Certificate		/M	Material certificate 3.1 according to EN 10024 (For SS wetted parts only)

## Spare Parts

Part no.	Description
K1500AK	O-rings EPDM 29.74x3.53 (5)
K1500EG	Mounting clampset for FF40-S22
K1500EH	Mounting clamp for FF40-P/V22
K1500FX	O-rings Sil 70 29.74x3.53 (5)
K1521AD	Flange adapter /FS3
K1521AF	Flange adapter /FP3
K1521AG	Flange adapter /FS4
K1521AJ	Flange adapter /FP4
K1521AK	Flange adapter /FS1
K1521AM	Flange adapter /FP1
K1521AN	Flange adapter /FS2
K1521AQ	Flange adapter /FP2

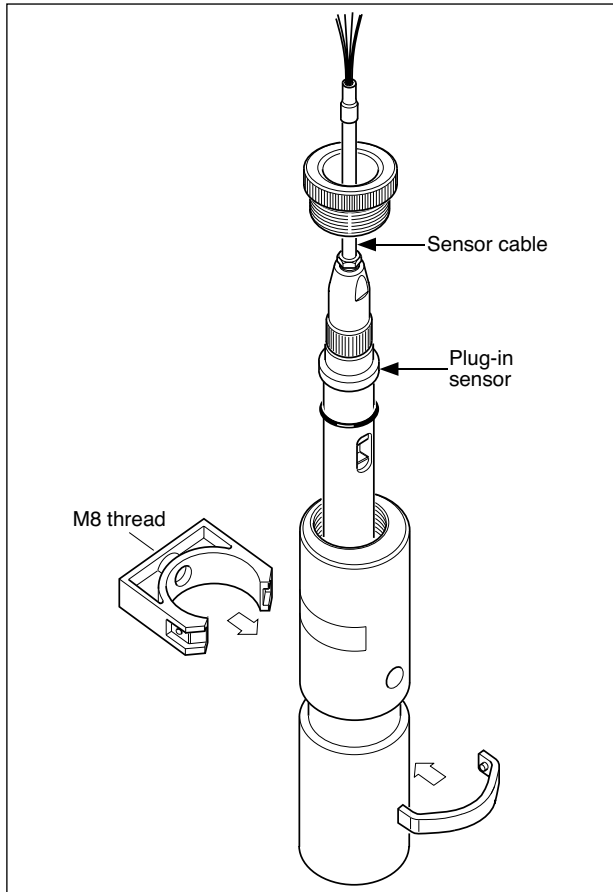


Figure 12 PVC/PP flow fitting

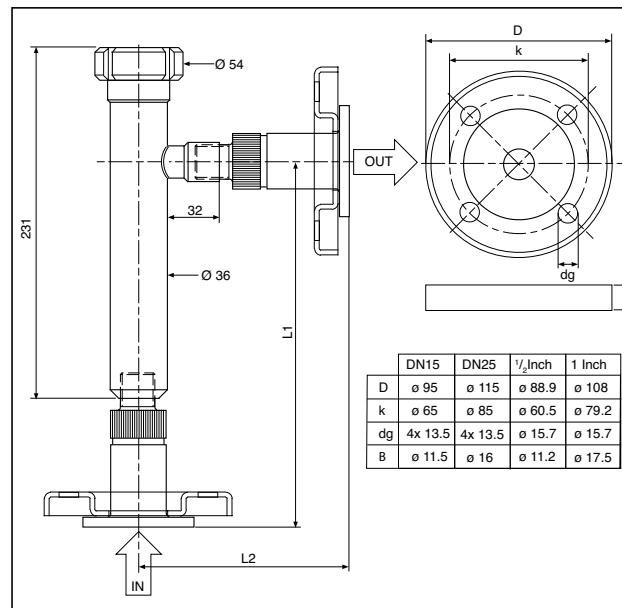


Figure 11 Dimensions of Flange options

Type	DN15PN10		DN25-PN10		1/2" 150 lbs		1" 150 lbs	
	L1	L2	L1	L2	L1	L2	L1	L2
FF40-S22	226	123	236	133	8 7/8"	4 13/16"	9 5/16"	5 1/4"
FF40-P22	247	123	236	112	9 3/4"	4 7/8"	9 5/16"	4 7/16"

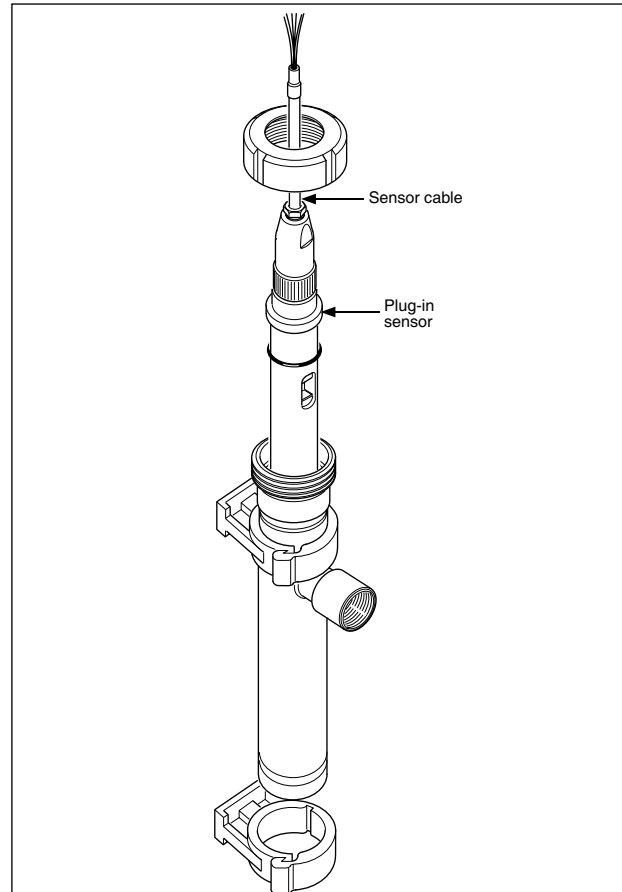


Figure 13 Stainless steel flow fitting

GS 12D7J1-01E-E

## B. Subassemblies

The subassemblies are designed for mounting conductivity sensors in a tank wall or directly into a piping system. They can be easily mounted in the process piping by welding, cementing or screwing.

The stainless steel subassemblies meet the requirements of DIN 11850 and DIN 11851 for sanitary constructions.

### Features

- Suitable for mounting in a T-piece or directly in the piping system.
- Designs for mounting the plug-in type sensor and the insertion type sensor with collar piece DN 25 (D-model).

## General Specifications

### Materials

#### Wetted parts

- a. Body
- |                   |                                  |
|-------------------|----------------------------------|
| Model FS40-S22-WE | : Stainless steel AISI 316 (SS)  |
| Model FS40-S22-TP | : Stainless steel AISI 316 (SS)  |
| Model FS40-S23-DF | : Stainless steel AISI 316(SS)   |
| Model FS40-F22-PA | : Polyvinylidene fluoride (PVDF) |
| Model FS40-F22-TP | : Polyvinylidene fluoride (PVDF) |
| Model FS40-V22-WE | : Polyvinylchloride (PVC)        |
| Model FS40-V22-TP | : Polyvinylchloride (PVC)        |

- b. Sealing ring
- |                   |                          |
|-------------------|--------------------------|
| Silicone rubber   | : DIN/ISO 1629 code VMQ  |
| Buna N            | : DIN/ISO 1629 code NBR  |
| Perfluorelastomer | : DIN/ISO 1629 code PTFM |

### Process connections

- |                   |                               |
|-------------------|-------------------------------|
| Model FS40-S22-WE | : DN32                        |
| Model FS40-S22-TP | : 1 1/4" - 11,5 NPT           |
| Model FS40-S23-DF | : DN25                        |
| Model FS40-F22-PA | : ISO 228/1 - G 1 1/4" (BSPP) |
| Model FS40-F22-TP | : 1 1/4" - 11,5 NPT           |
| Model FS40-V22-WE | : DN32                        |
| Model FS40-V22-TP | : 1 1/4" - 11,5 NPT           |

### Weight

- |                   |           |
|-------------------|-----------|
| Model FS40-S22-WE | : 0.21 kg |
| Model FS40-S22-TP | : 0.30 kg |
| Model FS40-S23-DF | : 0.13 kg |
| Model FS40-F22-PA | : 0.10 kg |
| Model FS40-V22-WE | : 0.45 kg |
| Model FS40-V22-TP | : 0.12 kg |
| Model FS40-F22-PA | : 0.13 kg |

## Functional Specifications

### Temperature

- |      |                                      |
|------|--------------------------------------|
| Min. | : -10°C (14 °F)                      |
| Max. | : Depending on material (see fig. 2) |

- |          |              |
|----------|--------------|
| Pressure | : See fig. 2 |
|----------|--------------|

## Model and Suffix Codes

Model code	Suffix code	Option	Description
FS40			Flow fitting subassembly
Material	-F22		Polyvinylidene fluoride (PVDF)
-S22			Stainless steel (SS)
-V22			Polyvinylchloride (PVC)
-S23			Stainless steel D-Model (SS)
Mounting	-WE		Weld-in socket for S version Glue-in socket for V version.
-PA			Parallel thread, only for PVDF version (ISO 2281- G1 1/4")
-TP			Tapered pipe thread (1 1/4" NPT)
-DF			For insertion type sensor with collar piece DN25 only (only for S23)
Certificate	/M		Material certificate 3.1 according to EN 10024 (only wetted metal parts)

## Spare Parts

Part no.	Description
K1500AH	O-ring Kalrez 29.74x3.53
K1500AR	O-rings Sil 70, FS40-F22-PA (5x)
K1500FX	O-rings Sil 70 29.74x3.53 (5)
K1500HE	O-ring set silicon, FS40-S23

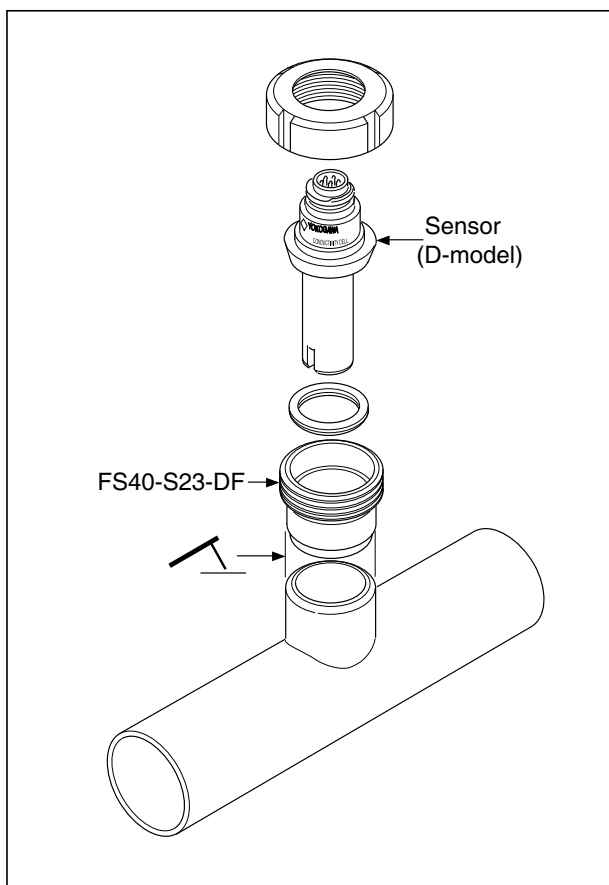
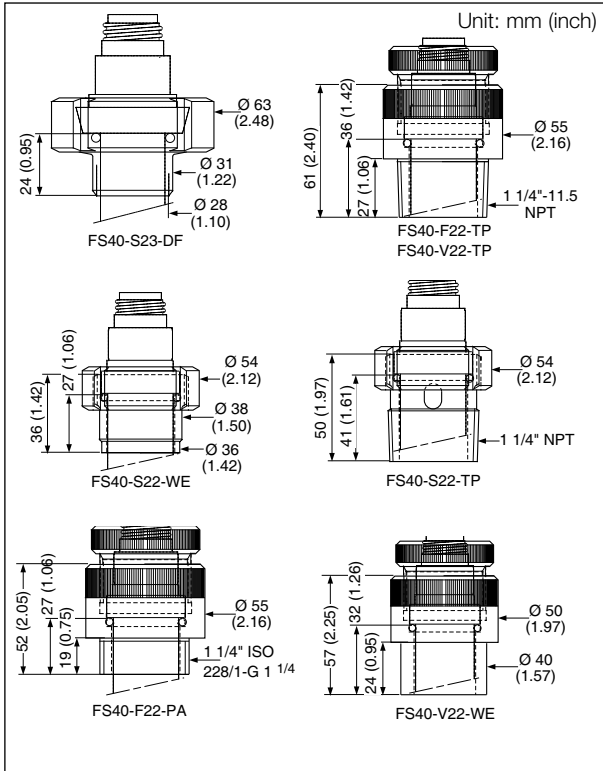
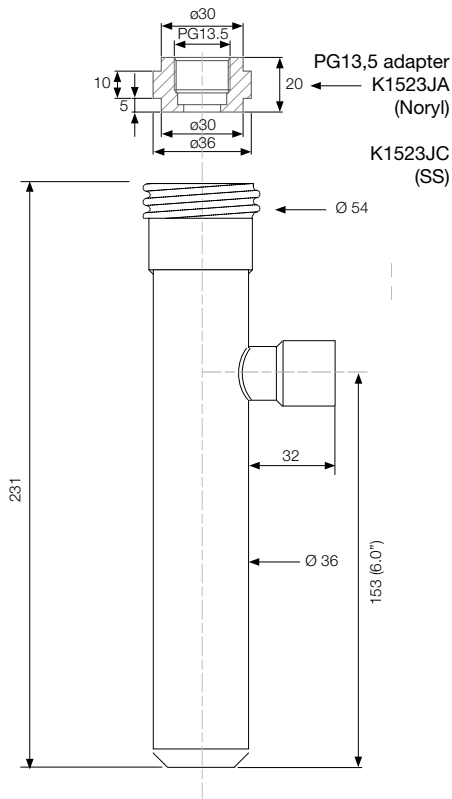


Figure 14 Installation example

## Dimensions

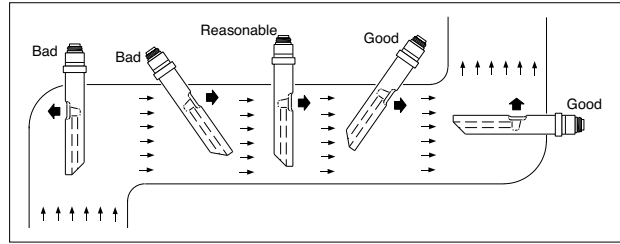


**Figure 15 Flow Fittings subassembly**



**Figure 16 Description K1523JA / K1523JC**

Description: Adapter to fit sensors with a PG13,5 process connection in FF40/FS40 and FD40 fittings. Material: Polypropylene



**Figure 17 Mounting position sensors**

## Accessories and Options

Part no.	Description
WF10	Connecting cable (between connecting box and transmitter)
WU40-LH01	Sensor cable (1 m)
WU40-LH02	Sensor cable (2 m)
WU40-LH05	Sensor cable (5,5 m)
WU40-LH10	Sensor cable (10 m)
WU40-LH15	Sensor cable (15 m)
WU40-LH20	Sensor cable (20 m)
WU40-LH25	Sensor cable (25 m)

## Service Parts

Part no.	Description
K1500AR	Silicone O-rings (42.52 x 2.62) for PVDF subassembly (qty. 5)
K1500HE	Sealing rings (29.74 x 3.53) for SS subassembly (D-model)
K1500FX	Silicone O-rings (29.74 x 3.53) for other fittings and subassemblies (qty. 5)
K1500AH	Perfluorelastomer O-ring (Kalrez) (29.74 x 3.53) for fittings and subassemblies (optional), except for the DF style (qty. 1)
K1500AK	EPDM O-rings (29.74 x 3.53) for fittings and subassemblies (optional), except for the DF model (qty. 5)

## Ordering Instructions

When ordering, specify model and code, item name and part no.:

- Flow fitting : FF40-P22, FF40-S22 or FF40-V22
- Subassembly : FS40-F22-..., FS40-S22-..., FS40-V22-... (flow fitting) or FS40-S23-DF
- Sensor cable, : WU40-LH01, WU40-LH02, WU40-LH05, WU40-LH10 if relevant WU40-LH15, WU40-LH20 and WU40-LH25.
- Connecting box/connecting cable (only when converter is installed a distance from the fitting) : BA10/WF10 or BP10/WF10 (IS Design)
- Accessories : Part name and part number (quantity)
- Service parts : Part name and part number (quantity)

## Model FD40 Immersion Fittings for conductivity measuring loops

For installing conductivity sensors in a permanent or semi-permanent location, the program of Yokogawa includes a range of flow and immersion fittings.

The immersion fittings are for installing conductivity sensors in tanks, open vessels or drains. The constructions of PVC and stainless steel suit most process conditions, considering chemical resistance, pressure and temperature specifications. The fittings of stainless steel might be used in sanitary applications. A mounting flange can be ordered.

### Features

- Designed for mounting conductivity sensors in tanks, open vessels and drains.
- Easy mounting, service and removal or replacement of sensors.
- High pressure and temperature specifications.
- With or without flanged connection.
- Stainless steel construction for sanitary applications.
- Several lengths available.

From a practical plant aspect, the immersion fittings should be installed in a site, where the point of measurement truly represents the entire solution. Avoid areas where the measurement varies significantly. If the fitting is mounted in a tank with agitator, or if it is placed in a fast flowing process, care must be taken that the fitting is adequately supported. Select a mounting place where the sensor is always immersed in the process liquid.

### General Specifications

#### Wetted parts

##### a. Body

#### Materials

: Stainless steel AISI 316 (SS)  
Polyvinylchloride (PVC)  
(refer to model code)

##### b. O-rings

: Silicone rubber (other materials see accessories)

#### Sensor cable

: Six wire multicore, covered with thermoplastic PVC  
length: 5.5 m or 10 m

#### Blanking plug\*

: Ryton R4

#### Weight (without flange)

: a. PVC fitting 1.7 kg  
b. SS fitting 4.5 kg

\* This plug is for test applications only and must be removed before mounting the sensor.

### Functional Specifications

#### Temperature

Min. : -10°C (14 °F)  
Max. : Depending on material and application (see fig. 3)

#### Pressure

: See fig. 3

**Immersion length fitting** : 0.5 to 2.0 m (in steps of 0.1 m)

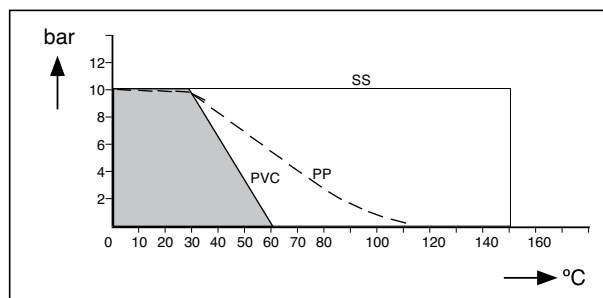


Figure 18 Pressure/temperature class

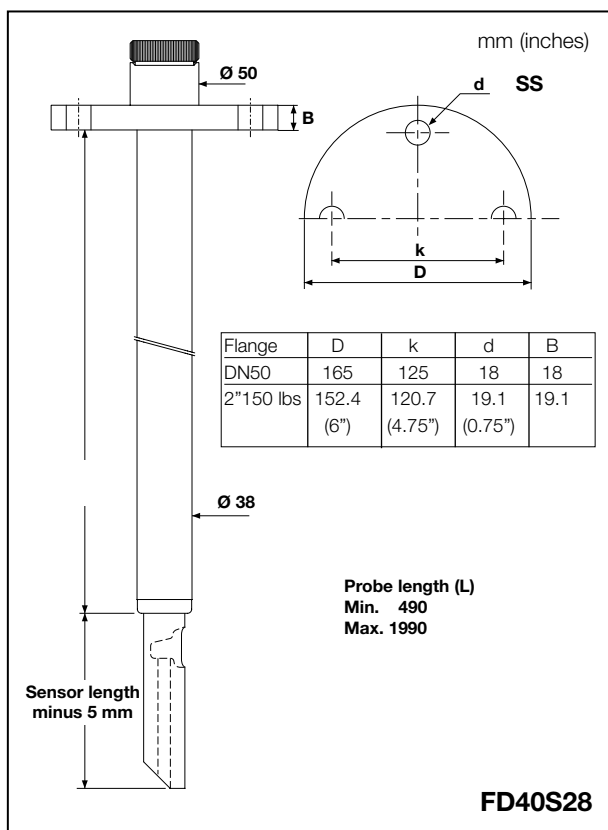


Figure 19

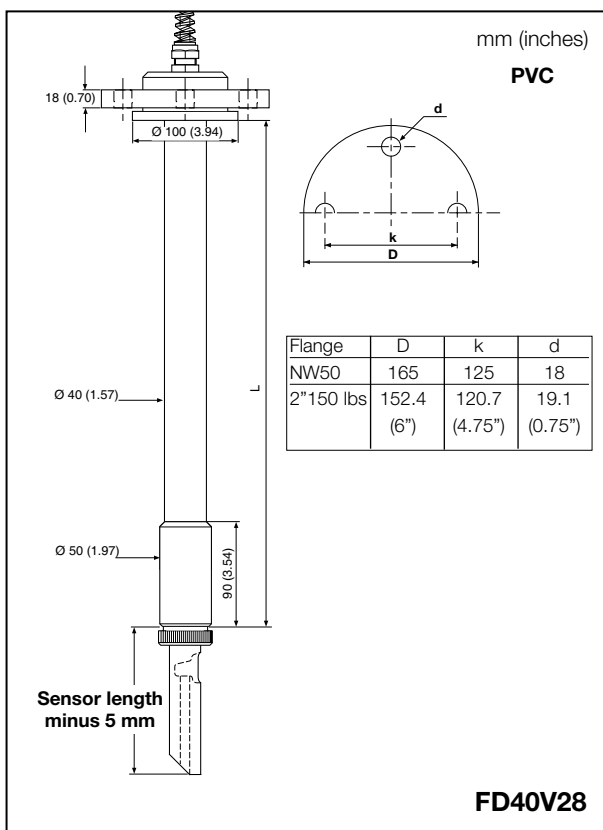


Figure 20

GS 12D7J1-01E-E

## Model and Suffix Codes

Model	Suffix	Option	Description
FD40V28			Immersion fitting PVC
FD40S28			Immersion fitting Stainless steel
Immersion	- □ □		Between 0.5 and 2.0 m length (in dm) example:=- 06 m
	-NC		No cable
	-FN		No flange
	-F1		PVC flange DN50 PN10
	-F2		PVC flange ANSI 2" 150 lbs
	-F3		SS flange DN50 PN10 (AISI 316)
	-F4		SS flange ANSI 2" 150 lbs (AISI 316)
	*B		Style code B
Protection hose	/PH5		For 5,5 m cable
Mounting kit	/PH10		For 10 m cable
Cable	/C05		(Length 5.5 m)
	/C10		(Length 10 m)
Certificate	/M		Material certificate 3.1 according to EN 10024 (on wetted metal parts only)

## Ordering Instructions

When ordering, specify model and code, item name and part numbers:

1. Immersion fitting : FD40V28 or FD40S28
2. Sensor cable, if relevant : WU40-LH05 or WU40-LH10
3. Connecting box/connecting cable (only when converter is installed a distance from the fitting) : BA10/WF10
4. Accesories : Part name and part number (quantity)
5. Service parts : Part name and part number (quantity)

## Accessories and Options

Part no.	Description
BA10	Conn. box (between fitting and transmitter)
WF10	Conn. cable (between conn. box and transmitter)
WU40-LH05	Sensor cable (5,5 m)
WU40-LH10	Sensor cable (10 m)
K1500AB	Cable gland 1/2 inch NPT (10)
K1500AX	Flexible conduit, 10 meter
K1500EM	/PH25 for immersion holders
K1500DN	/PH03 protection hose, 3 meter
K1500DP	/PH05 protection hose, 5 meter
K1500DQ	/PH10 protection hose, 10 meter
K1500DR	/PH15 protection hose, 15 meter
K1500DS	/PH20 protection hose, 20 meter

## Service Parts

Part no.	Description
K1500FX	5x O-rings for mounting the sensor in a fitting
K1500FY	5x O-rings (Silicone) for sealing the cell
K1500AH	1x O-rings (KALREZ)
K1541ZY	/MS1 for FD30 / ISC40FD and FD40

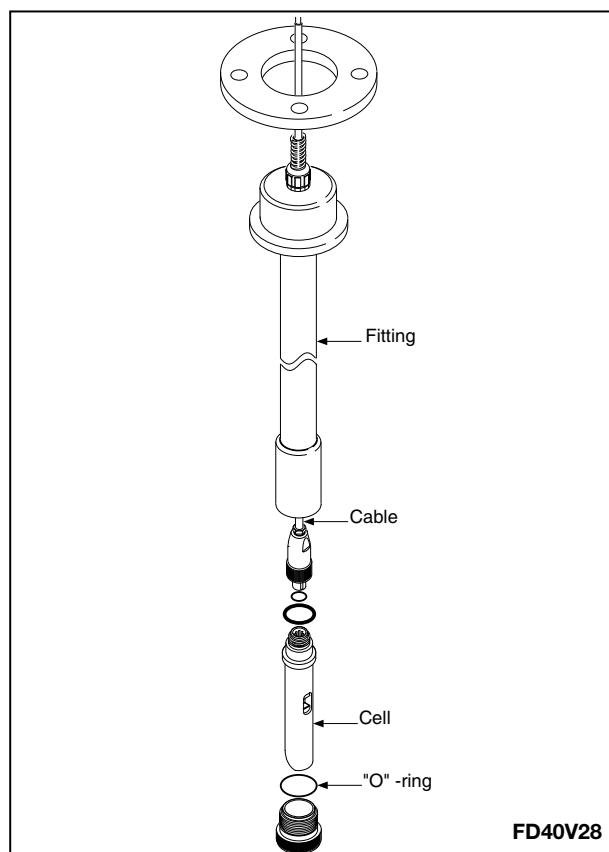


Figure 21

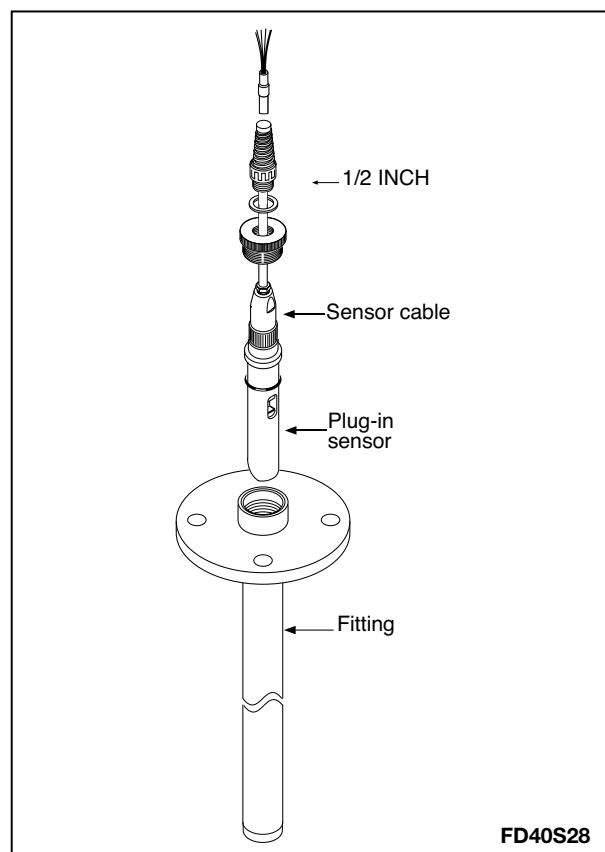


Figure 22

GS 12D7J1-01E-E

Table 1

		Temp. °C % Conc.	Material								
			PTFE (teflon)	PVDF (Kynar)	S.S. 316	EPOXY	VITON	GLASS	PEEK	KALREZ	SILICONE RUBBER
			20 80 100	20 80 100	20 80 100	20 80 100	20 80 100	20 80 100	20 80 100	20 80 100	20 80 100
Inorganic acid	Sulfuric acid	10	000	000	XXX	0XX	000	000	000	000	000
		50	000	000	XXX	XXX	000	000	00X	000	- - -
		95	000	0X -	XXX	- - -	000	000	- - -	000	- - -
		fuming	000	- - -	- - -	- - -	000	000	- - -	000	- - -
	Hydrochloric acid	10	000	000	- - -	0X -	000	000	00X	00X	
		sat.	000	000	- - -	0X -		000	00X	00X	
	Nitric acid	25	000	00X	XXX	0X -	00X	000	000	000	00X
		50	000	00X	XXX	X - -	- - -	000	XXX	000	X - -
		95	000	0X -	000	- - -	- - -	000	- - -	00X	- - -
		fuming	000	- - -	000	- - -	- - -	000	- - -	00X	- - -
	Phosphoric acid	25	000	000	- - -	00X	000	000	000	000	00X
		50	000	000	XXX	00X	000	000	000	000	00X
		95	000	000	000	00X	XX -	000	000	000	0XX
	Hydrofluoric acid	40	000	000	- - -	XX -	000	XXX	- - -	00X	
		75	000	000	- - -	XX -	000	- - -	- - -	00X	
Organic acid	Acetic acid	10	000	000	00X	00X	- - -	000	000	000	000
		glacial	000	0X -	00X	X - -	- - -	000	00X	000	000
	Formic acid	80	000	000	XXX	X - -	- - -	000	XXX	00X	000
	Citric acid	50	000	000	000	X - -	000	000	000	000	000
Alkali	Calcium hydroxide	sat.	000	000	000	000	000	000	000	000	000
	Potassium hydroxide	50	000	00X	000	00X	000	00X	000	000	000
	Sodium hydroxide	40	000	00X	000	00X	XXX	00X	000	000	000
	Ammonia in water	30	000	000	000	000	XXX	00X	000	000	000
Acid salt	Ammonium chloride	sat.	000	000	XXX	0XX	000	000	000	000	000
	Zinc chloride	50	000	000	XXX	00X	000	000	000	000	000
	Iron (III) chloride	50	000	000	- - -	00X	000	000	000	000	000
	Sodium sulfite	sat.	000	000	000	000	- - -	000	000	000	000
Basic salt	Sodium carbonate	sat.	000	000	000	00X	000	000	000	000	000
	Potassium chloride	sat.	000	000	XXX	000	000	000	000	000	000
Neutral salt	Sodium sulfate	sat.	000	000	000	000	000	000	000	000	000
	Calcium chloride	sat.	000	000	XXX	000	000	000	000	000	000
	Sodium chloride	sat.	000	000	XXX	000	000	000	000	000	000
	Sodium nitrate	50	000	000	XXX	000	000	000	000	000	000
	Aluminium chloride	sat.	000	000	- - -	000	000	000	000	000	000
	Hydrogen peroxide	30	000	000	000	00X	000	000	000	000	XXX
Oxidizing agent	Sodium hypochloride	50	000	000	XXX	0XX	00X	000	000	000	000
	Potassium dichromate	sat.	000	000	000	0XX	000	000	000	000	000
	Chlorinated lime		000	0X -	XXX	0XX		000	000	X - -	000
	Ethanol	80	000	00X	000	00X	X - -	000	000	000	000
Organic solvent	Cyclohexane		00	00X	000	00X	000	000	000	000	- - -
	Toluene		000	000	000	00X	- - -	000	000	000	- - -
	Trichloroethane		000	XXX	00X	X - -	XXX	000	000	X - -	- - -
	Water		00x	000	000	00X	000	000	000	00X	000

O = can be used

X = shortens useful life

- = cannot be used

**Note:** There are many variables affecting corrosion, making it virtually impossible to compile a conclusive corrosion table applicable under all possible process conditions. The indications in table 2 cannot be used as a recommendation by Yokogawa for the choice of materials. The selection of a suitable material is the sole responsibility of the user. Yokogawa disclaims any reference to this leaflet on that basis.

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# General Specifications

Model SX42  
2-electrode Conductivity sensor  
for high temperature

*These high temperature conductivity sensors have a stainless steel body and a ceramic insulation, especially designed to withstand high temperatures and pressures. A special treatment of the electrodes ensures optimal resistance against polarisation.*

*The conductivity cells have extremely high temperature and pressure ratings: the threaded types can handle 16 bar at 200°C and the flanged types can handle 40 bar at 250°C.*

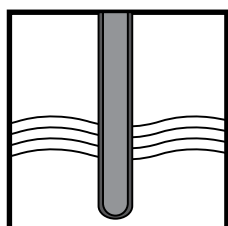
*The combination of the sensor plug and cable is watertight and can handle temperatures upto 100°C. The aluminium connection box of the flanged types has been selected to have a easy connection with high temperature cabling.*

## Features

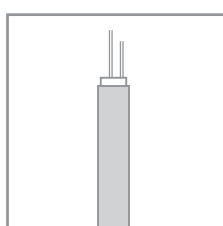
- High temperature and pressure ratings
- Built-in temperature resistor: Pt1000
- High precision of the cell constant
- Fast temperature response
- Plug and cable form a water tight connection to IP65
- Model with flange has an integral connection box
- Threaded models have standardized connections 1" NPT or R1
- Selection of two cell constant 0.1 or 0.01 cm<sup>-1</sup>



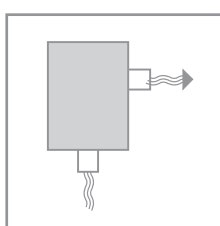
## System Configuration



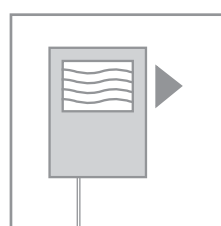
Sensors



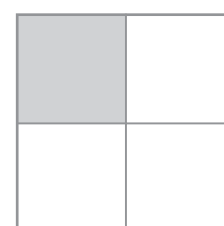
Cables



Fittings



Transmitters



Accessories

## Specifications

### General Specifications

#### Materials

Wetted parts

- Body : stainless steel AISI 316
- Insulation : ceramic (aluminium oxide)
- Electrodes : stainless steel AISI 316
- Lance : stainless steel AISI 316

Electrical connector : PBT reinforced with glass for threaded models or aluminium terminal box for flanged models

Process connections

- Screw-in : R 1 to ISO 7-1 or 1" NPT male
- Flange : Flange to DIN2527 Form E DN50 PN64  
Flange to ANSI B16.5 2" 600 lbs

Shipping weight

- Model : approx. 0.5 kg for SX24-BS or NS
- : approx. 0.7 kg for SX34-BS or NS
- : approx. 5.7 kg for SX24-DF,AF or JF
- : approx. 6.0 kg for SX34-DF,AF or JF

Shipping dimensions

- Threaded models : approx. 27 x 5 x 5 cm
- Flanged models : approx. 40 x 20 x 20 cm

#### Technical specifications

Temperature range : up to 200° C for threaded models

(see figure 1) : up to 250° C for flanged models

Pressure range : up to 16 bar (1.6 MPa) for threaded models

(see figure 1) : up to 40 bar (4.0 MPa) for flanged models

Temperature sensor : Pt1000 to IEC 751

Cell constant : 0.1 cm<sup>-1</sup> for models SX42-SX24- ☐ ☐

: 0.01 cm<sup>-1</sup> for models SX42-SX34- ☐ ☐

Measuring principle : 2 electrodes system

## Model and Suffix Codes

Model Code	Suffix code	Option	Description
SX42		.....	Conductivity cell for high temperature
Cell constant	-SX24	.....	Cell constant 0.1 cm <sup>-1</sup>
	-SX34	.....	Cell constant 0.01 cm <sup>-1</sup>
Process Connection	-BS	.....	ISO 7/1-R 1"
	-NS	.....	1" NPT male
	-DF	.....	DIN flange DN50 PN64
	-AF	.....	ANSI Flange 2" 600 Lbs
Style code	*A	.....	Style A
Certificates	/M	.....	Material certificate 3.1 according to EN 10024
	/Q	.....	Quality Inspection Certificate

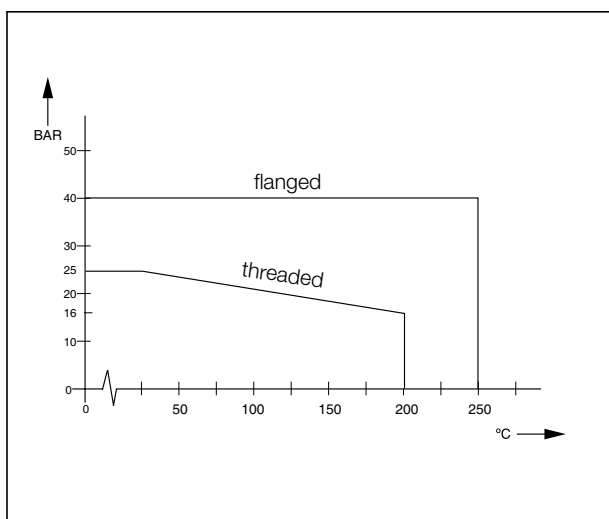


Figure 1. Pressure and temperature diagram

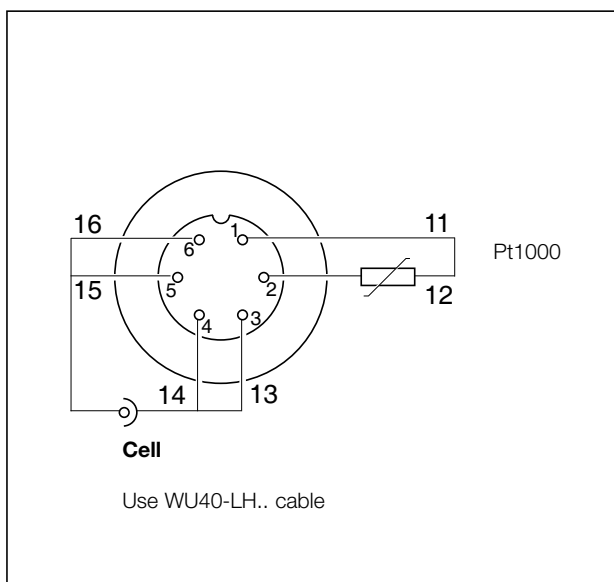


Figure 2. Wiring diagram threaded models

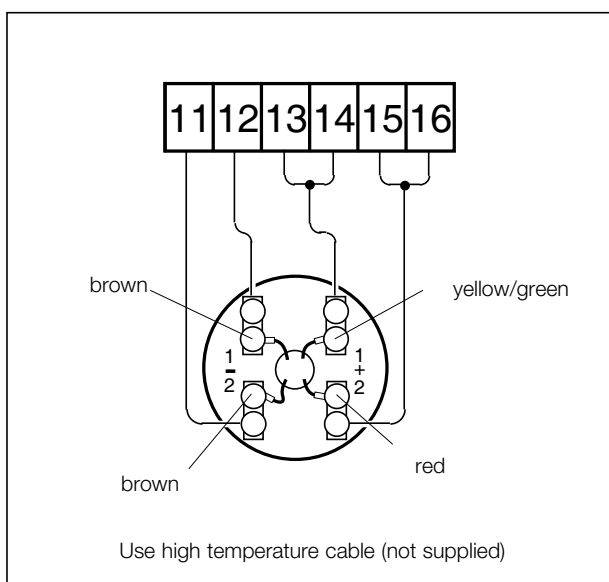


Figure 3. Wiring diagram flanged models



## Dimensions

Units: mm (inch)

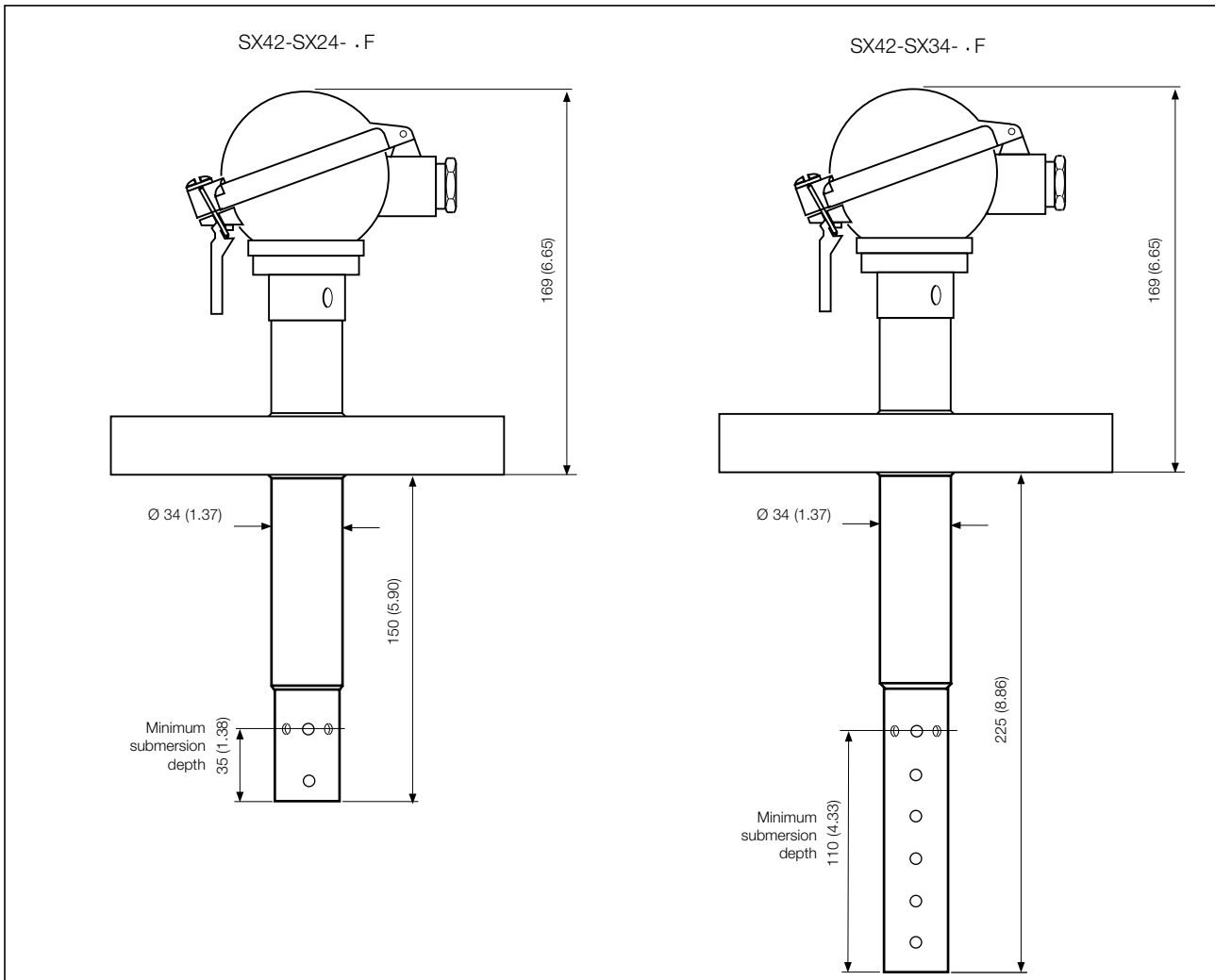


Figure 4. Flanged models (flange dimensions see fig.5)

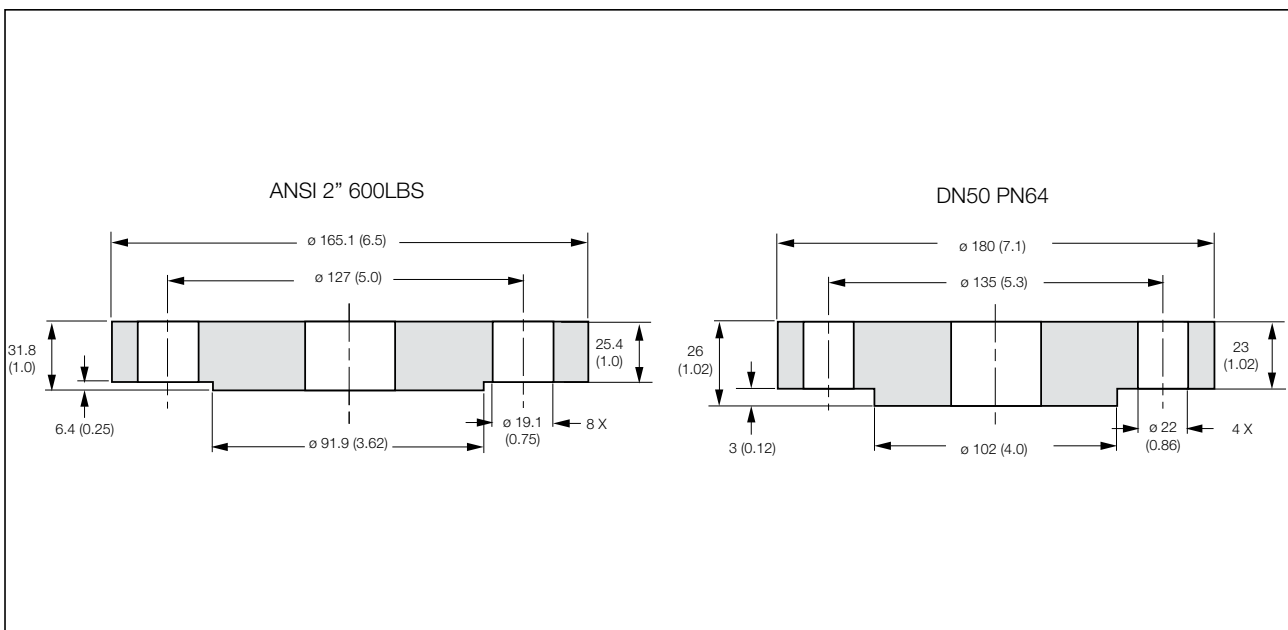


Figure 5. Flanges

GS 12D7J3-E-E

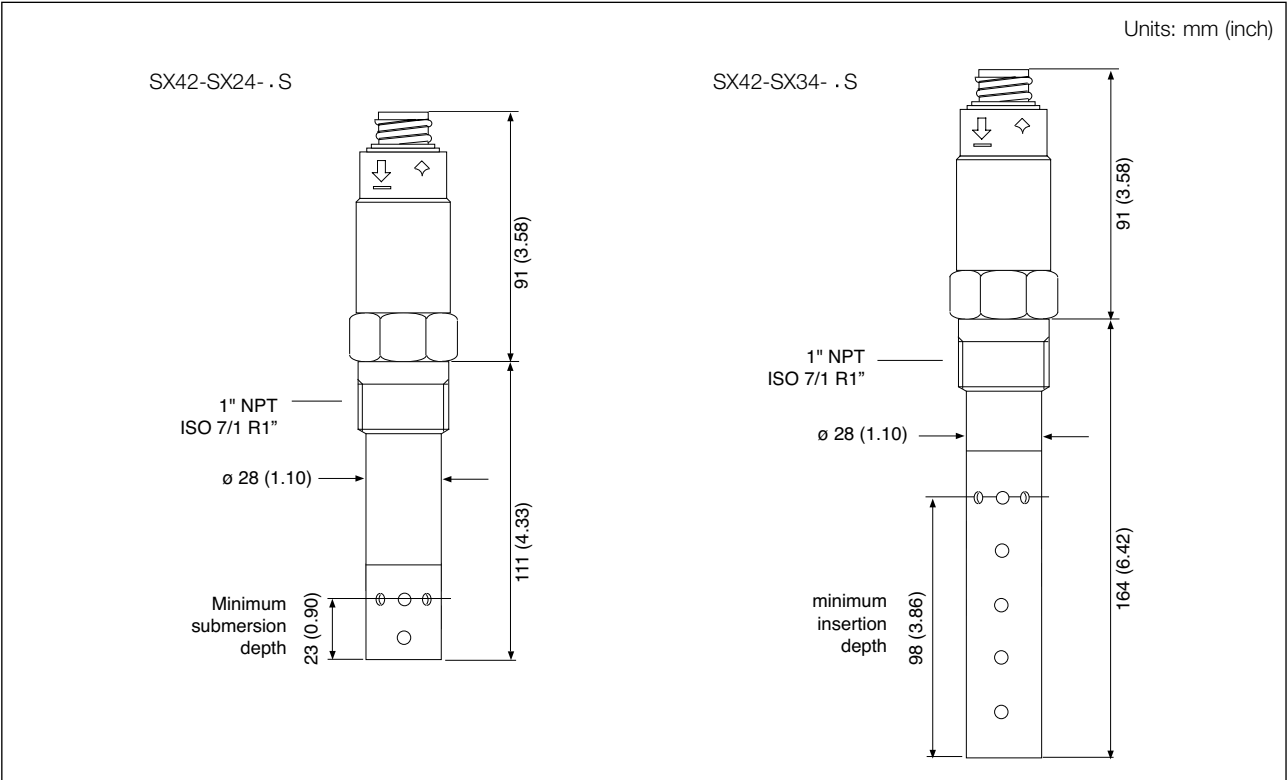


Figure 6. Threaded models

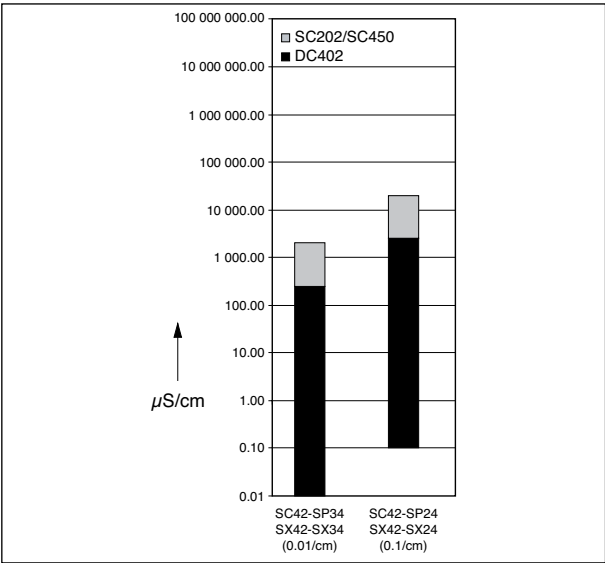


Figure 7. Sensor range

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# General Specifications

## Model SC4A Conductivity Sensors and Fittings for 2-electrode Systems

### Insertion Sensors

Stainless steel or Titanium 2-electrode sensors with cell constants of 0.02 cm<sup>-1</sup>, 0.10 cm<sup>-1</sup>, and fixed cables 3 to 20 meters in length.

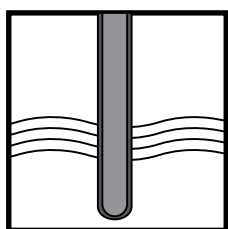
Intended for the low conductivity applications found in the semi-conductor, power, water and pharmaceutical industries, these sensors are designed in a convenient compact style. There are several mounting possibilities, including a compression gland, giving a simple effective method of direct insertion in process pipework. The sensors are made from a combination of wetted materials approved by FDA. This makes them ideally suited for the monitoring of pure water systems used in the preparation of injectable solutions. For this kind of application, sanitary clamp mountings are most often used. As with all Yokogawa conductivity sensors, the cell constants are individually calibrated in our laboratories using an ASTM method traceable to NIST international standards.

### Features

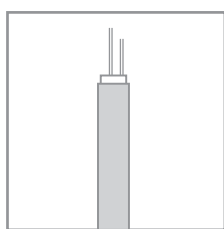
- Precise individually calibrated cell constant.
- Fast temperature response.
- Built-in Pt1000 temperature sensor.
- Fixed cable length 3, 5, 10, 15 or 20 mtr.
- Direct process insertion.
- Wide range of mountings.
- Compatible with PR4A retractably assembly.
- The sensor is polished to meet pharmaceutical requirements.



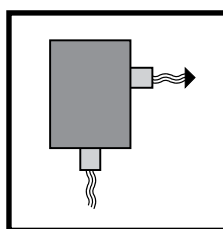
### System Configuration



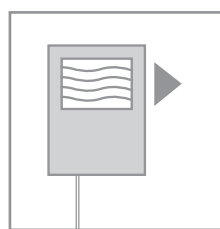
Sensors



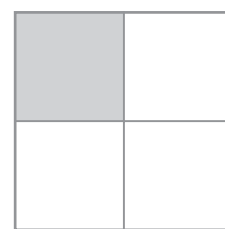
Cables



Fittings



Transmitters



Accessories

## Specifications SC4A-AD

### General Specifications - Materials - Wetted Parts

Body & electrodes	: Stainless steel AISI 316 or Titanium grade 2 or 3
O-ring	: EPDM FDA
Mounting adapter	: PVDF or Stainless steel AISI 316
Insulation	: PEEK (Poly Ether Ether Ketone)
Surface Roughness	: 0.8µm (R432)

### Operating Specifications (Sensor)

Measuring system	: 2-electrode (4-wire)
Maximum pressure	: 10 bar (142 PSIG)
Maximum temperature	: 110°C (230 °F)
Temperature response	: < 1 minute for 90% of a step change
Sterilize	: At 135°C (275 °F)

### Shipping details

Package size	: wxhxd 220 x 220 x 90 cm
wxhxd 215 x 150 x 55 cm	
Package weight	: Approx. 1.6 kg. 3.5 lb

Model	Suffix	Option	Description
SC4A*			19 mm conductivity sensor
-T			Titanium
-S			Stainless steel (EHEDG model)
Fitting-type	-AD		For adapter mounting
Sensor length	-09		9 cm
	-15		15 cm
Cellconstant	-002		0.02/cm
-010			0.1/cm
Cable length	-03		3 mtr
-05			5 mtr
-10			10 mtr
-15			15 mtr
-20			20 mtr
-T1			Pt1000
AD only	/PS		3/4"NPT Stainless Steel adapter
/PF			3/4"NPT PVDF adapter
(option /PS required)	/FF		Stainless Steel flow fitting
Certificates	/Q		Quality Inspection Certificate

\* 3.1 Material certificate according to EN 10024 is standard delivered with this sensor.

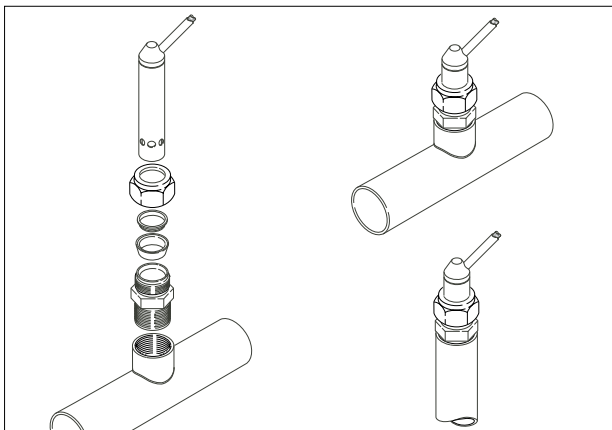
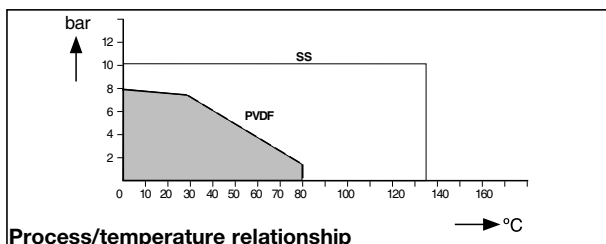


Figure 1. Mounted sensor with the option /PS and /PF

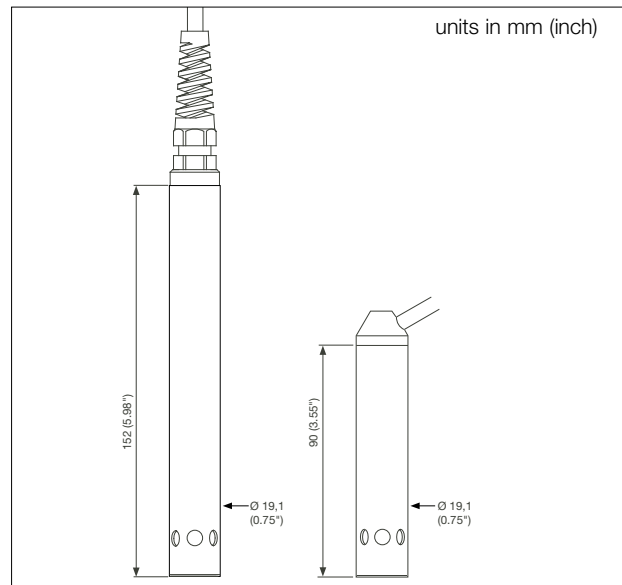


Figure 2. SC4A-AD-15

SC4A-AD-09

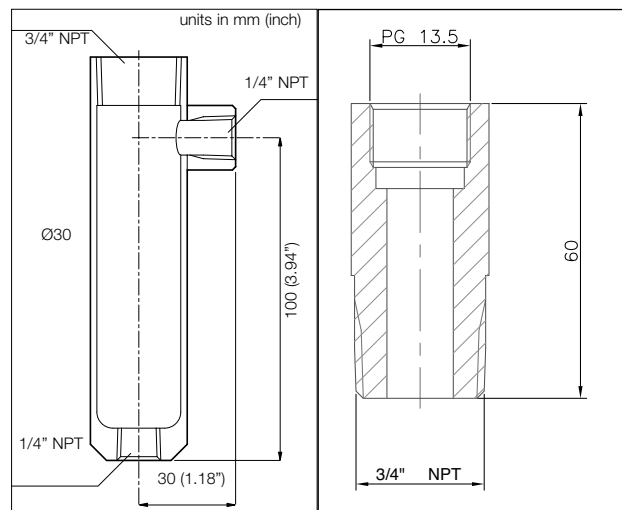


Figure 3. Flow fitting (SS) option /FF K1598 AC (incl. 3.1 B certificate)

Figure 4. Adapter K1598JB (noryl) or K1523JD (SS) to fit sensors with PG13,5 process connection in K1598AC flow fitting

## Specifications SC4A-SA/SB/SC

### General Specifications

The SC4A-E is a FDA approved conductivity sensor with full traceability and supporting documents.

- EPDM O-ring (21 CFR 177.2600)
- SS is 1.4435
- Double O-ring construction (EPDM 21 CFR 177.2450)
- Virgin PEEK isolator (21 CFR 177.2415)
- Surface roughness Ra < 0.4µm (R416)
- Meets EHEDGE/AAA specifications
- 2% accuracy for the Cell constant
- Batch certificate downloadable from Yokogawa website

### Materials

#### Wetted Parts

Body & electrodes	: Stainless steel AISI 316l (1.4435)
O-ring	: EPDM, FDA migration tested 21 CFR 177.2600
Mounting adapter	: Stainless steel AISI 316l Tri-clamp according to ISO 2852-1993
Insulation	: PEEK (Poly Ether Ether Ketone) FDA migration tested 21 CFR 177.2415
Surface Roughness	: 0.5µm

### Operating Specifications (Sensor)

Measuring system	: 2-electrode, 4-wire
Maximum pressure	: 10 bar (142 PSIG)
Maximum temperature	: 110°C (230 °F)
Temperature response	: < 1 minute for 90% of a step change
Sterilize	: At 135°C (275 °F)

### Operating Specifications options /SB1, /SB2, /SA1, /SA2, /SC1

Stainless Steel	
Maximum pressure	: 10 bar (142 gpsi)
Maximum temperature	: 135°C (275°F)

Model Code	Suffix code	Option	Description
SC4A			19 mm conductivity sensor
	-E		EPDM FDA
Fitting-type	-SA		25mm port
	-SB		1-1 1/2" tri-clamp (ISO 2852)
	-SC		2" tri-clamp (ISO 2852)
Always	-NN		fixed length
Cellconstant	-002		0.02/cm
	-010		0.1/cm
Cable length	-03		3 meter
	-05		5 meter
	-10		10 meter
	-15		15 meter
	-20		20 meter
SA only	/SA1		Straight welding socket
	/SA2		Angle welding socket 15°
SB only	/SB1		tri-clamp 1"
	/SB2		tri-clamp 1 1/2"
SC only	/SC1		tri-clamp 2"
	-T1		Pt1000
Certificates	/Q		Quality Inspection Certificate

\* 3.1 Material certificate according to EN 10024 is standard delivered with this sensor.

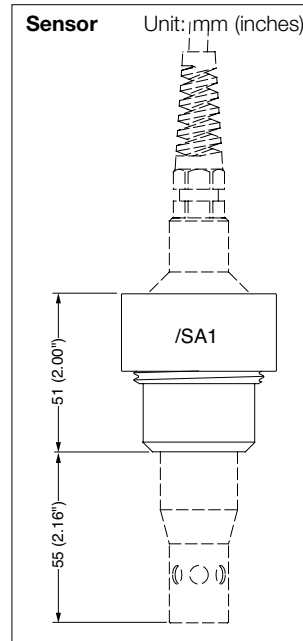


Figure 6. Option /SA1

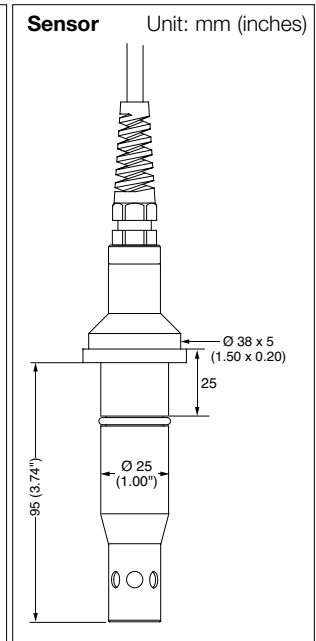


Figure 7. Sensor SC4A-SA

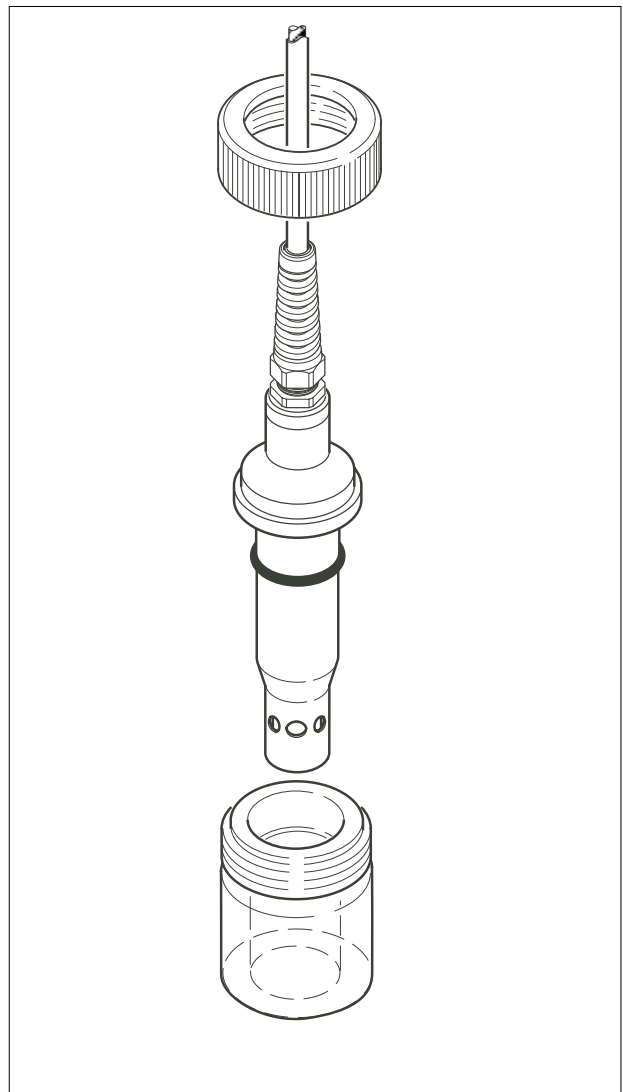
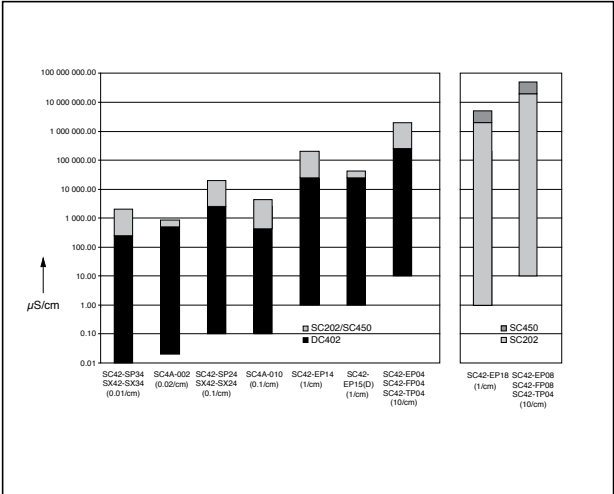
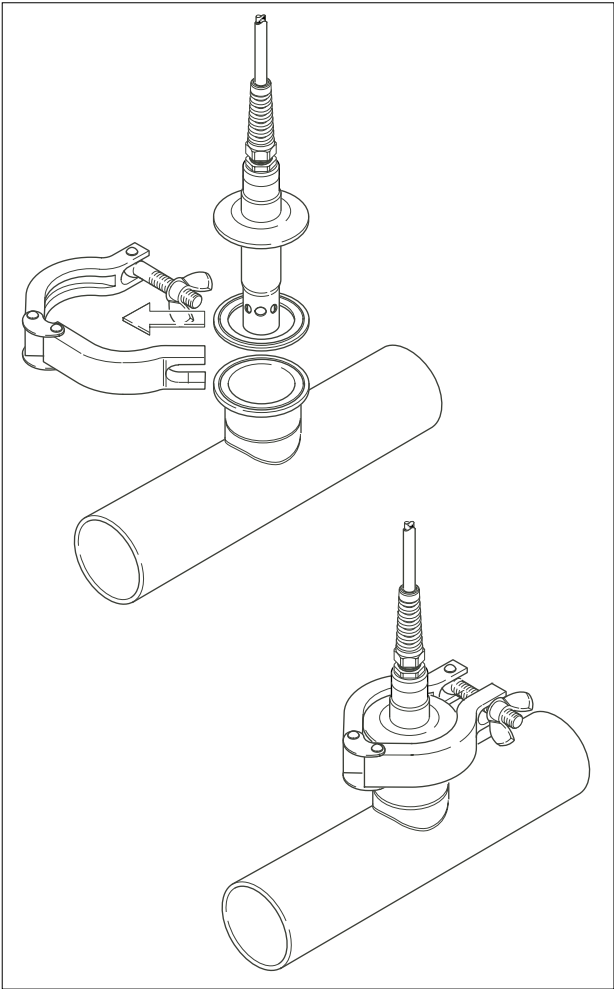
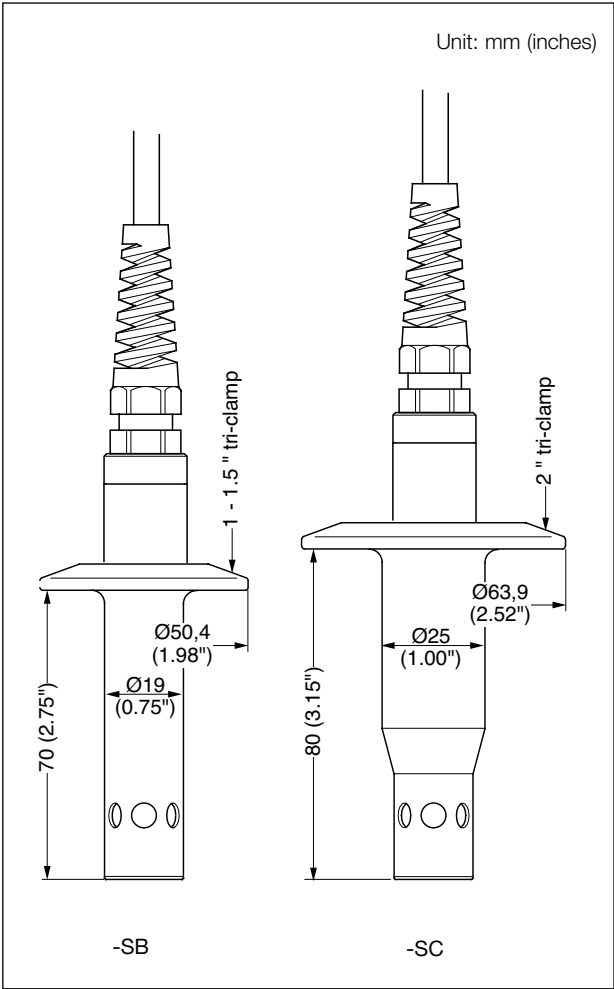


Figure 8. Mounted Sensor SC4A -SA

GS 12D7J4-01E-E



## Specifications SC4A-PR

### General Specifications

#### Materials

#### Wetted Parts

Body & electrodes	: Stainless steel AISI 316 or Titanium grade 2 or 3
O-ring	: Viton
Mounting adapter	: Retractable fitting
Insulations	: PEEK (Poly Ether Ether Ketone)

#### Operating Specifications (Sensor)

Measuring system	: 2-electrode
Maximum pressure	: 10 bar (142 PSig)
Maximum temperature	: 110°C (230 °F)
Temperature response	: < 1 minute for 90% of a step change
Sterilize	: At 135°C (275 °F)
Surface Roughness	: 0.8µm (R432)

#### Shipping details

Package size	: wxhxd 220 x 220 x 90 cm wxhxd 215 x 150 x 55 cm
Package weight	: Approx. 1.6 kg. 3.5 lb

Model Code	Suffix code	Option	Description
SC4A*			19 mm conductivity sensor
	-T		Titanium
	-S		Stainless steel
Fitting-type	-PR		For retractable mounting
Always	-NN		fixed length
Cellconstant	-002		0.02/cm
	-010		0.1/cm
Cable length	-03		3 meter
	-05		5 meter
	-10		10 meter
	-15		15 meter
	-20		20 meter
	-T1		Pt1000
Certificates		/Q*	Quality Inspection Certificate

\* 3.1 Material certificate according to EN 10024 is standard delivered with this sensor.

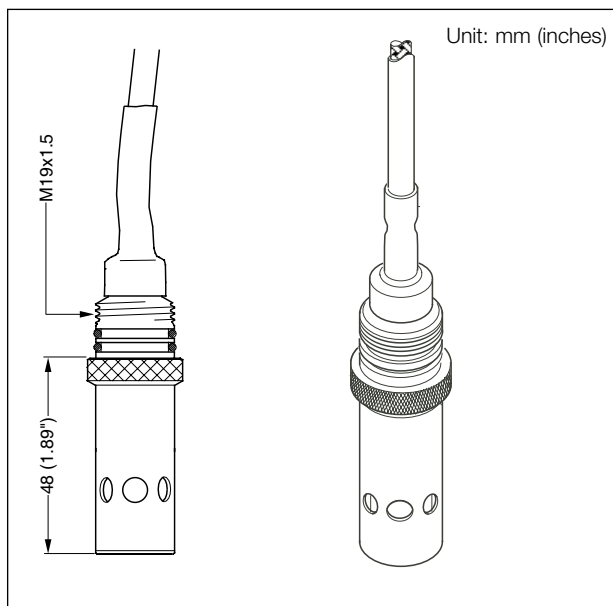


Figure 13. SC4A -PR

## Spare Parts SC4A

Part no.	Description
<b>SC4A-S- AD and SC4A-T-AD</b>	
K1542DF	Compression fitting in Stainless Steel ( /PS)
K1500DY	Ferrule set for K1542DF
K1542CW	3/4" npt adapter PVDF
K1598AC	Flowfitting with 3.1 material certificate
<b>SC4A-E-SA</b>	
K1542FA	Straight welding socket and mounting nut SS
K1500BJ	O-rings in EPDM (5), FDA migration tested
<b>SC4A-E-SB</b>	
K1542FC	Tri-Clamp mounting set for 1" triclamp (welding socket, sealing gasket and clamp ring) (/SB1)
K1500HN	Sealing gasket in EPDM for K1542FC (3), FDA migration tested
K1542FF	Tri-Clamp mounting set for 1,5" triclamp (welding socket, sealing gasket and clamp ring) (/SB2)
K1500BN	Sealing gasket in EPDM for K1542FF (3), FDA migration tested
<b>SC4A-E-SC</b>	
K1542FE	Tri-Clamp mounting set for 2" triclamp (welding socket, sealing gasket and clamp ring) (/SC1)
K1500BP	Sealing gasket in EPDM for K1542FE (3), FDA migration tested
<b>SC4A-T-PR and SC4A-S-PR</b>	
K1500BE	O-rings in Viton (10)
K1500ED	O-rings in Kalrez (2)

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## General Specifications

Model PR10  
Contacting Conductivity  
Retractable fitting

*On-line measurements often present extra challenges, especially when routine maintenance is required. The PR10 is ideally suitable for applications where the sensors must be removed without interrupting or shutting down the process. Without any special tools the PR10 can be retracted safely from the process at pressures up to 5 bar.*

*For ease of use optional flush ports are available. In the retracted position the sensor can be kept moist, cleaned or even calibrated. This can all be done without process interruption or disassembly of the armature.*

### Features

- One model for pH, conductivity and inductive conductivity sensors
- Build in scraper to avoid contamination of the fitting
- Usable for wide range of sensors
- A safe "through the valve" insertion and retraction design
- Simplified installation by optional ball valves with flanged or tapered connections
- Optional flush port for keeping moist, cleaning and calibration



Conductivity  
Analyzers (contacting)

## General Specifications

### A. Wetted materials

- For sensor check Instruction Manual
- Stainless steel AISI 316L
- O-ring seals: Viton 70° shore

### B. Non-wetted materials

- For sensor check Instruction Manual
- Stainless steel AISI 316, 304
- Polypropylene glass filled

### C. Insertion length

- Ref. mechanical drawing page 4.

### D. Pressure/temperature ratings

- Static conditions: see Figure. 1.
- Operating conditions during extraction and insertion max. 500kPa, max. 100°C

### E. Flange ratings:

- DIN flange DN32 PN10
- ANSI flange 1¼" 150 lbs
- DIN flange DN50 PN10
- ANSI flange 2" 150 lbs

### F. Specifications of the sensor used

- Please check sensor specifications

### G. Weight

- Approx 2.5 kg excl. ball valve

### H. Specifications of the SC4A-PR

#### Wetted Parts

Body & electrodes	: SS AISI 316 or Titanium grade 2 or 3
O-ring	: Viton
Mounting adapter	: PR10
Insulations	: PEEK (Poly Ether Ether Ketone)

### I. Operating Specifications

Measuring system	: 2-electrode
Maximum pressure	: 10 bar (142 PSig)
Maximum temp.	: 110°C (230 °F)
Temp. response	: < 1 minute for 90% of a step change
Sterilize	: At 135°C (275 °F)

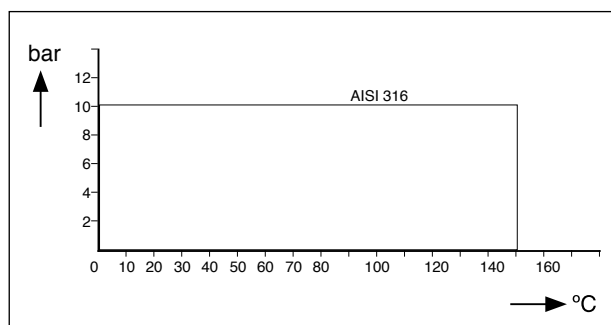
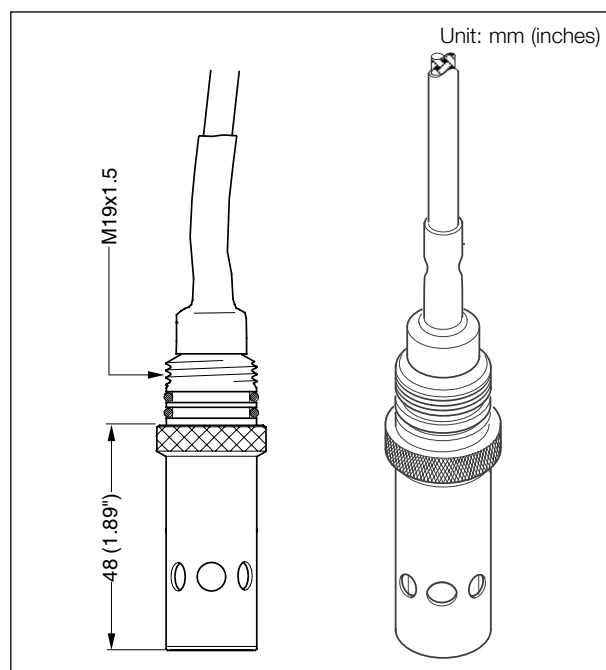


Fig. 1 Pressure / Temperature graphic

Model Code	Suffix code	Option	Description
SC4A*			19 mm conductivity sensor
	-S		Stainless steel
Fitting-type	-PR		For retractable mounting
Always	-NN		fixed length
Cellconstant	-002		0.02/cm
	-010		0.1/cm
Cable length	-03		3 meter
	-05		5 meter
	-10		10 meter
	-15		15 meter
	-20		20 meter
	-T1		Pt1000

**Note:** option Q is now standard delivered

**Note:** option M is now standard delivered



**Fig. 2 SC4A -PR**

### Model- and suffix codes

Model	Suffix	Option	Description
<b>PR10</b>			<b>Retractable Conductivity Fitting 19 mm</b>
Fitting	-S		SS Type AISI 316
O-ring	-V		Viton O-ring sealing
Tube length	-L5		0.5 meter tube length
Connection	-D32		DN32 / 1¼" mounting
	-D50		DN50 / 2" mounting
Sensor adapter for	-SC4A		SC4A
Screw-in adapters (SS AISI 316)	/SA125		ISO 228/1 G1¼ to 1¼" M-NPT
	/SA200		ISO 228/1 G2 to 2" M-NPT
Flange adapters (SS AISI 316)	/FA125		Flange adapter drain 1¼" 150 lbs
	/FN125		Flange adapter no drain 1¼" 150 lbs
	/FA200		Flange adapter drain 2" 150 lbs
	/FN200		Flange adapter no drain 2" 150 lbs
	/FAD32		Flange adapter drain DN32 PN10
	/FND32		Flange adapter no drain DN32 PN10
	/FAD50		Flange adapter drain DN50 PN10
	/FND50		Flange adapter no drain DN50 PN10
Weld-in adapter (SS AISI 316)	/WA125		Straight weld-in adapter ISO 228/1 G1¼
	/WA200		Straight weld-in adapter ISO 228/1 G2
Ball valves (SSI AISI 316)	/BF125		Flanged ball valve 1¼" 150 lbs
	/BF200		Flanged ball valve 2" 150 lbs
	/BFD32		Flanged ball valve DN32 PN10
	/BFD50		Flanged ball valve DN50 PN10
	/BS125		Screw-in ball valve 1¼" F-NPT
	/BS200		Screw-in ball valve 2" F-NPT
Certificate	/M		3.1 according EN 10024 for wetted metal parts

**\*Note:** With a ball valve, either a screw-in or flanged adapter is required

**Note:** for maintenance please order O-ring pick-up tool

## Dimensions

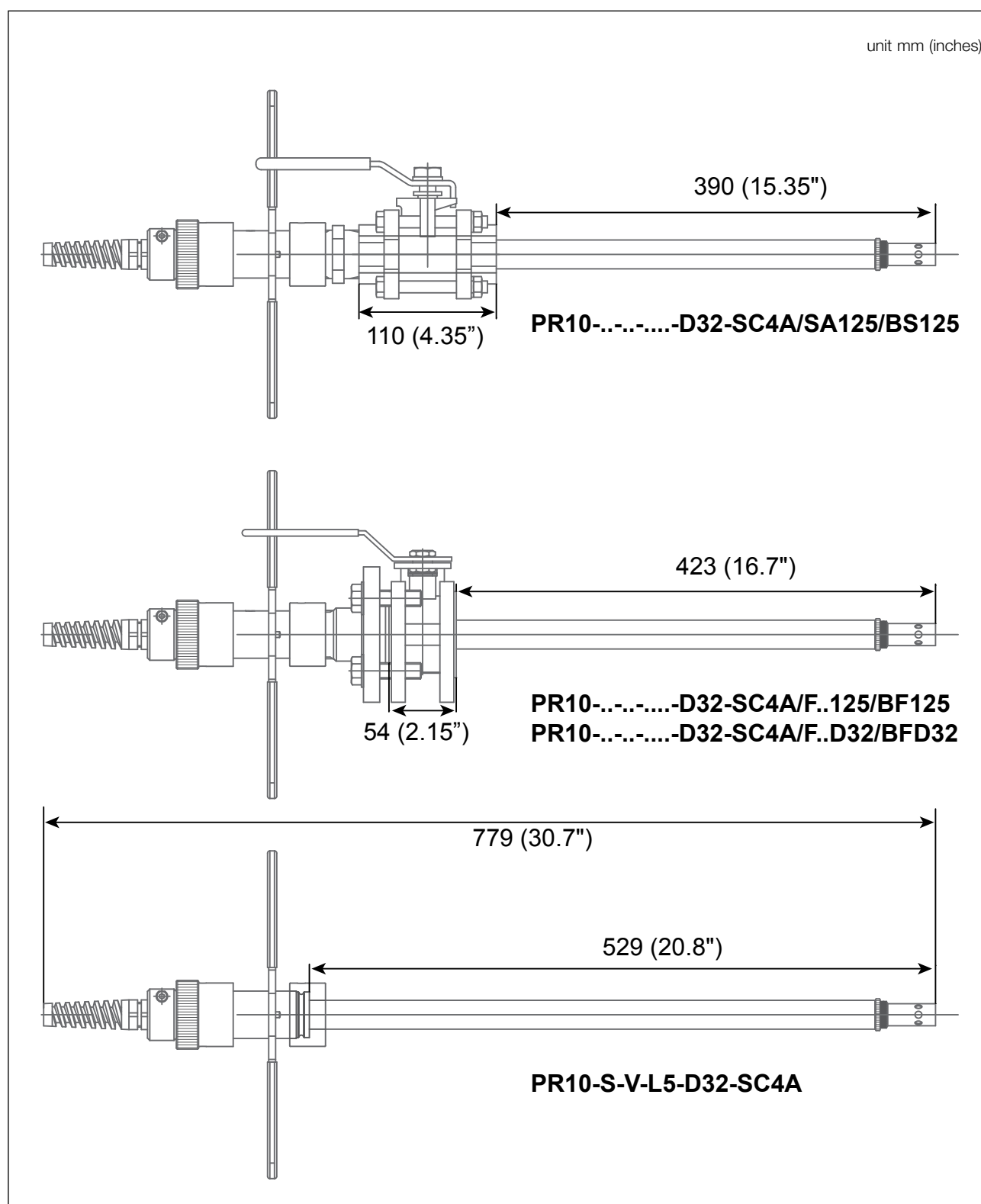
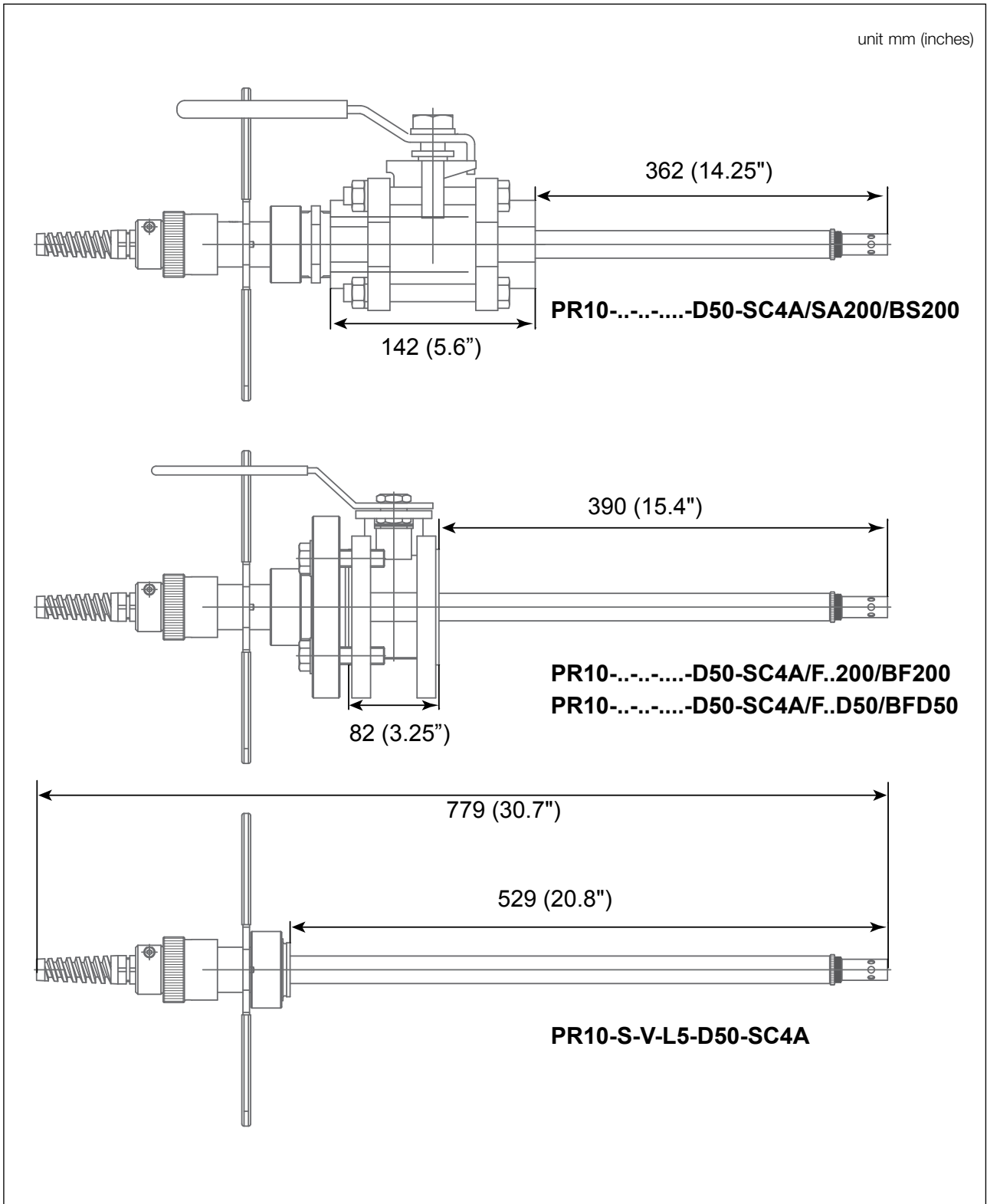


Fig. 3 Dimensional drawing PR10...-D32 with mounted SC4A sensor



**Fig. 3 Dimensional drawing PR10...-D50 with mounted SC4A sensor**

**Note:** with ball valve Bolts and gasket are included

GS 12D7J4-02E-E

# Options PR10

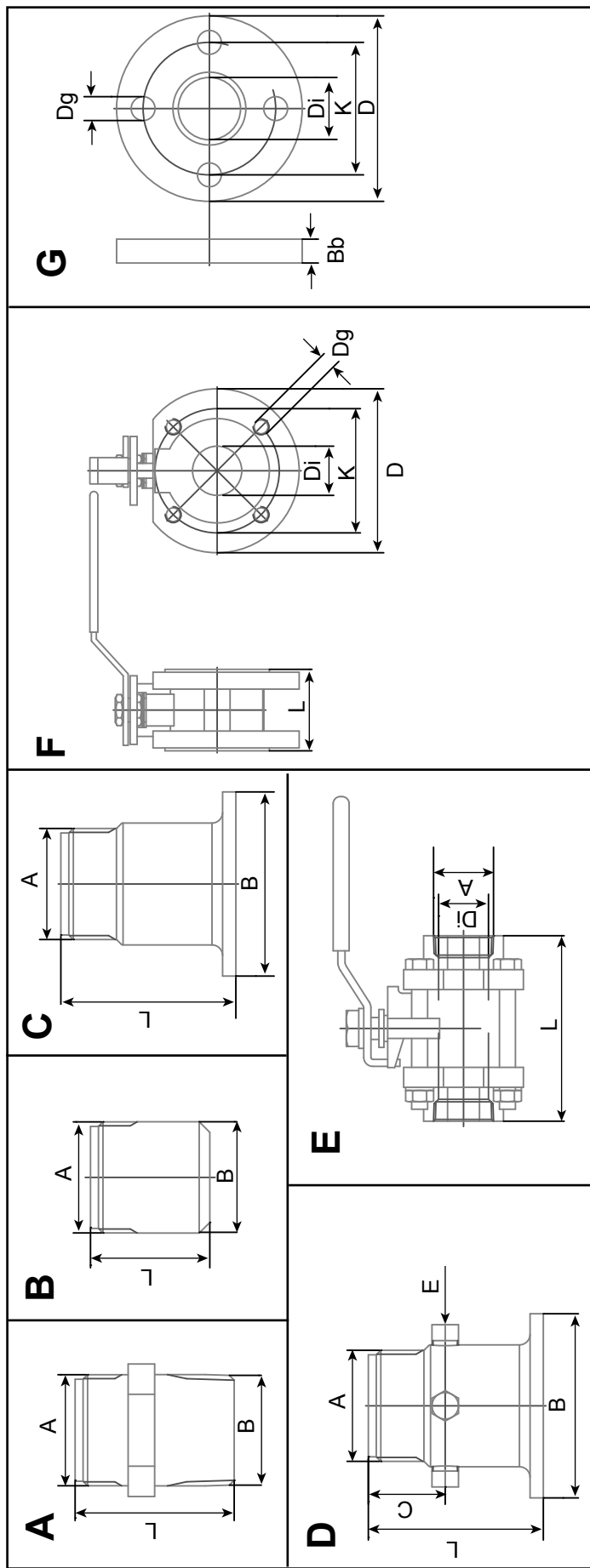


Fig. 5 Dimensions of the PR10 options

Table 2 Dimensions options in mm (inches)

Option	Description	Fig.	A	B	L	C	Bb	D	E	Di	Dg	K
/SA125	ISO 228/1 G1¼ to 1¼" M-NPT	A	ISO 228/1 - G1¼	1¼" NPT	60 (2.4)	29 (1.1)	15.7 (0.6)	117.3 (4.6)	1/8" NPT	47 (1.9)	15.7 (0.6)	88.9 (3.5)
/SA200	ISO 228/1 G2 to 2" M-NPT	A	ISO 228/1 - G2	2" NPT	58 (2.3)	29 (1.1)	15.7 (0.6)	117.3 (4.6)	1/8" NPT	47 (1.9)	15.7 (0.6)	88.9 (3.5)
/FA125	Flange adapter drain 1¼" 150 Lbs	D, G	ISO 228/1 - G1¼	69.5 (2.7)	66 (2.6)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/FN125	Flange adapter no drain 1¼" 150 Lbs	C, G	ISO 228/1 - G1¼	69.5 (2.7)	66 (2.6)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/FA200	Flange adapter drain 2" 150 Lbs	D, G	ISO 228/1 - G2	101 (4)	77 (3)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	47 (1.9)	18 (0.7)	100 (3.9)
/FN200	Flange adapter no drain 2" 150 Lbs	C, G	ISO 228/1 - G2	101 (4)	54 (2.1)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	47 (1.9)	18 (0.7)	100 (3.9)
/FAD32	Flange adapter drain DN32 PN10	D, G	ISO 228/1 - G1¼	69.5 (2.7)	66 (2.6)	29 (1.1)	16 (0.6)	140 (5.5)	1/8" NPT	47 (1.9)	18 (0.7)	100 (3.9)
/FND32	Flange adapter no drain DN32 PN10	C, G	ISO 228/1 - G1¼	69.5 (2.7)	66 (2.6)	29 (1.1)	16 (0.6)	140 (5.5)	1/8" NPT	47 (1.9)	18 (0.7)	100 (3.9)
/FAD50	Flange adapter drain DN50 PN10	D, G	ISO 228/1 - G2	101 (4)	77 (3)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/FND50	Flange adapter no drain DN50 PN10	C, G	ISO 228/1 - G2	101 (4)	54 (2.1)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/WA125	Straight weld-in adapter ISO 228/1 G1¼	B	ISO 228/1 - G1¼	42 (1.7)	45 (1.8)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/WA200	Straight weld-in adapter ISO 228/1 G2	B	ISO 228/1 - G2	49 (1.9)	45 (1.8)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/BF125	Ball-valve flanged 1¼" 150 Lbs	F			54 (2.1)			118 (4.6)		32 (1.3)	M14	89 (3.5)
/BF200	Ball-valve flanged 2" 150 Lbs	F			82 (3.2)			150 (5.9)		50 (2)	M16	121 (4.8)
/BFD32	Ball-valve flanged DN32 PN10	F			54 (2.1)			140 (5.5)		32 (1.3)	M16	100 (3.9)
/BFD50	Ball-valve flanged DN50 PN10	F			82 (3.2)			165 (6.5)		50 (2)	M16	125 (4.9)
/BS125	Ball-valve screw-in 1¼" F-NPT	E	1¼" NPT		110 (4.3)					32 (1.3)		
/BS200	Ball-valve screw-in 2" F-NPT	E	2" NPT		142 (5.6)					50 (2)		

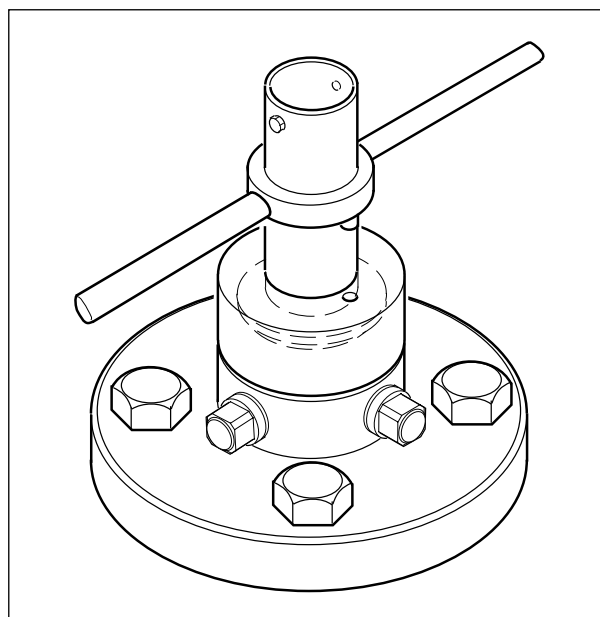
GS 12D7J4-02E-E

**Table 3 Spareparts**

Part no.	Description
K1525AP	Adapter SC4A - ISC40
K1525AA	Outer tube
K1525AF	O-ring pick up tool
K1525BA	O-ring set PR10-S-V-L5-D32
K1525BB	O-ring set PR10-S-V-L5-D50
K1525BC	Key set
K1525BD	Squeezing set
K1525BE	Set M16 bolt & washer (8 pcs)
K1525BF	Set M14 bolt & washer (8 pcs)
K1525BG	Gaskets ball valves - D50 + 2"
K1525BH	Gaskets ball valves - D32 + 1¼"
K1525YA	PR10/SA125
K1525YB	PR10/FA125
K1525YC	PR10/FN125
K1525YD	PR10/FA200 - FAD50
K1525YE	PR10/FN200 - FND50
K1525YF	PR10/FAD32
K1525YG	PR10/FND32
K1525YH	PR10/WA125
K1525YJ	PR10/WA200
K1525YK	PR10/BF125
K1525YL	PR10/BF200
K1525YM	PR10/BFD32
K1525YN	PR10/BFD50
K1525YP	PR10/BS125
K1525YQ	PR10/BS200
K1541EM	Adapter 2" NPT-G2 SS (ISC40PR/B)

**Drain port connection**

The PR10 retractable fitting can be equipped with optional drain (or flush) ports on the flanged adapter. The drain ports are tapered 1/8" NPT female for small diameter connectors.

**Fig. 6 Drain Port Connection**

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# General Specifications

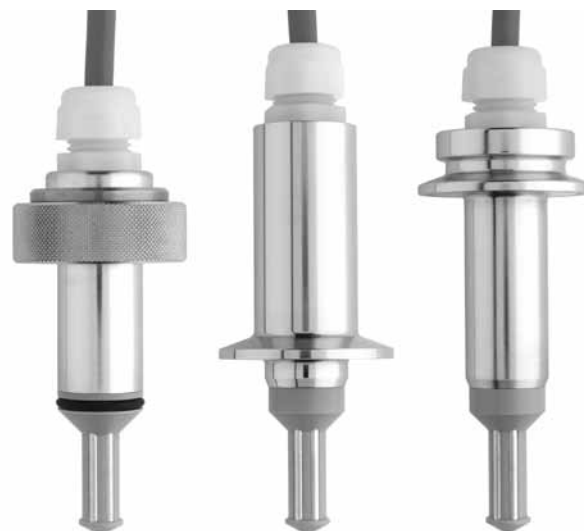
## Hamilton Conductivity Sensors for biotech and pharmaceutical industry

Yokogawa's SC450G and SC202G(S) have proven to work very well over a wide range of conductivity values with suitable 4-electrode sensors. The Hamilton CONDUCELL 4US sensors for Triclover and INGOLD process connections has often been successfully used where the access port is too narrow for the Inductive Sensors.

Now Hamilton has released the CONDUCELL 4USF-PG-120 sensor, which is made of PEEK and fits in a simple PG13,5 process connection. The electrical connection is a VARIOPIN and it is a welcome addition to the program.

These sensors have been designed to measure accurately over an extremely wide conductivity range. They are ideal for the pharmaceutical, food and beverage industries where it is necessary to monitor product and cleaning chemicals within the same process stream.

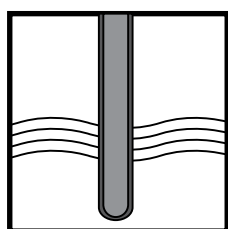
Because of the sanitary requirements in these industries these sensors are suitable for steam sterilisation and CIP cleaning. In addition to that all wetted parts are electro-polished and the materials used are approved by the FDA



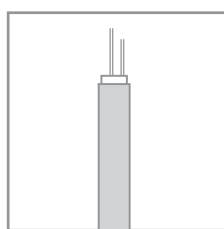
### FEATURES

- Range 0 to 1 S/cm
- Open easy to clean cell geometry
- Surface roughness <N5 (0.4micron)
- Suitable for steam sterilisation & CIP
- Maximum pressure 6 bar G
- Temperature range -20 to 135°C
- Integrated PT1000
- Wetted parts to FDA DIN 1.4435 SS PEEK & EPDM
- VP connector in 4USF model

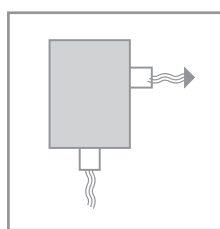
### System Configuration



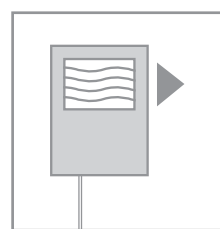
Sensors



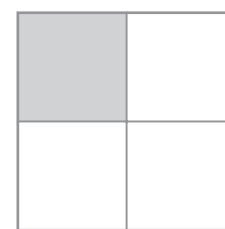
Cables



Fittings



Transmitters



Accessories

## Conducell 4US

These 4-pole conductivity sensors are especially suited for applications with large variations in conductivity. These sensors have been tested extensively and they have a very good linearity over a wide range.

The Conducell 4US is available with a tri-clover and a 25mm port-size process connection. It can be installed without any further need for a fitting.

The Conducell 4USF has a diameter of only 12 mm so it can be inserted in many standard armatures.

### Features

- Suitable for steam sterilization, autoclaving and CIP
- Sanitary: surface quality is N5 (0.4µm) and electro-polished
- All wetted parts are FDA compliant

## General Specifications 4US

### Wetted Parts

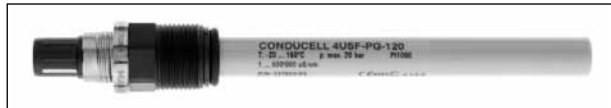
Body and electrodes	DIN 1.4435 SS
Insulators	PEEK
O-ring	EPDM

### Operating Specifications

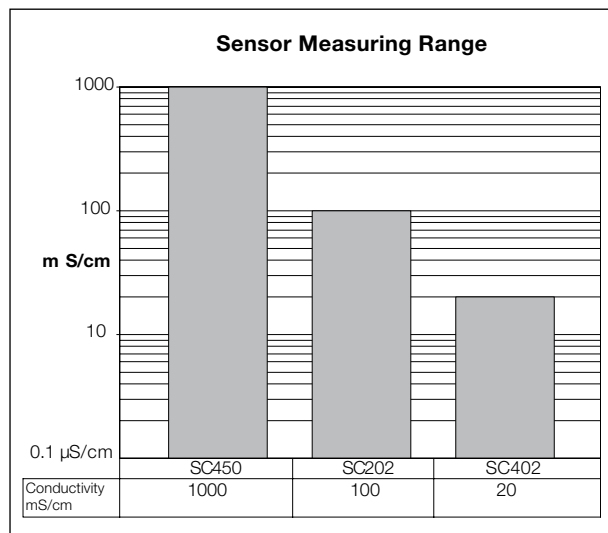
Measuring systems	4 electrode
Measuring range	0.1 micro S/cm to 1 S/cm
Temperature range	-20 to 135°C
Maximum pressure	6 bar @ 135°C

### Physical Specifications

Surface finish	Electro polished N5 (0.4µm)
Cable length	5m



Part No.	Description
10/237600	CONDUCELL 2UP-PG-120
10/237700	CONDUCELL 4US-G125-62/25
10/237750	CONDUCELL 4US-T150-50
10/237760	CONDUCELL 4US-T150-100
10/237620	CONDUCELL 4USF-PG-120 (4 stainless steel electrodes)
10/237627	CONDUCELL 4UHF-PG-120 (4 Hastelloy C electrodes)



GS 12D7J5-E-E

## General Specifications 4USF

### Wetted Parts

Body and electrodes	DIN 1.4435 SS
Insulators	PEEK
O-ring	EPDM

### Operating Specifications

Measuring systems	4 electrode
Measuring range	0.1 micro S/cm to 1 S/cm
Temperature range	-20 to 150°C
Maximum pressure	10 bar @ 150°C / 20 bar @ 135°C

### Physical Specifications

Surface finish	Electro polished N5 (0.4µm)
----------------	-----------------------------



## General Specifications 4USF-VV, -4USF-BC, -4USF-AF 200, -4USF-DF 80

Description same as CONDUCELL 4USF-PG, but there are different process connctions:

- VV - Tuchenhagen Varivent DN50/60
- BC - Neumo Bioconnect
- AF 200 - ANSI flange 2.00"
- DF 80 - DIN flange DN 80mm

### Example: 4US-G125-62/25

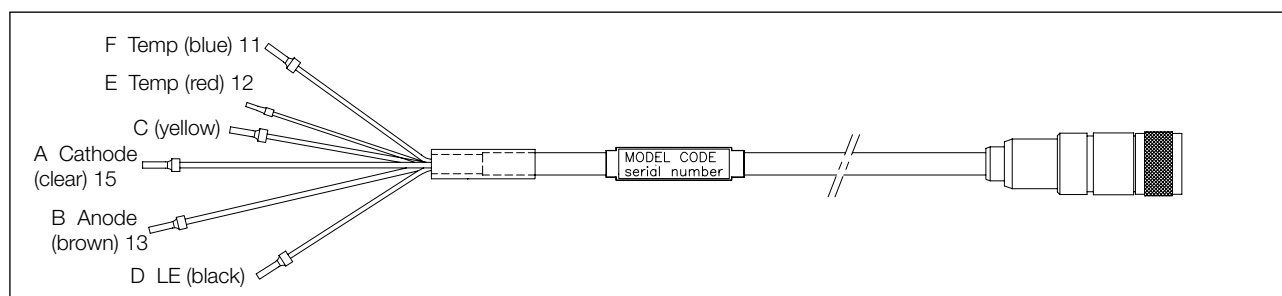
- 4: 4-Pole
- U: Undefined/open field
- S: Stainless steel;
- H: Hastelloy C;
- T: Titanium;
- P: Pt Electrodes
- F: Flat electrode arrangement for easy cleaning
- G125: G1.25";
- T150: Triclamp 1.5" connection;
- PG: PG13.5
- 62: 62 mm shaft length
- /25: (optional) O-ring, seals at 25 mm

Value at 25°C	Accuracy	Stability [Months]	Certified by	Package	Order No.
1.3 $\mu\text{S}/\text{cm}$	$\pm 1$	%12	DFM	Glass bottle 300 mL	238 973
5 $\mu\text{S}/\text{cm}$	$\pm 1$	%36	DFM	Glass bottle 300 mL	238 926
15 $\mu\text{S}/\text{cm}$	$\pm 1$	%36	DFM	Glass bottle 300 mL	238 927
84 $\mu\text{S}/\text{cm}$	$\pm 1$	%18	DFM	1 Calpack bottle 500 mL	238 984
100 $\mu\text{S}/\text{cm}$	$\pm 1$	%36	DFM	Glass bottle 300 mL	238 934
147 $\mu\text{S}/\text{cm}$	$\pm 1$	%18	DFM	1 Calpack bottle 500 mL	238 985
1413 $\mu\text{S}/\text{cm}$	$\pm 1$	%36	DFM	Glass bottle 300 mL	238 928
1413 $\mu\text{S}/\text{cm}$	$\pm 1$	%18	DFM	1 Calpack bottle 500 mL	238 986
12288 $\mu\text{S}/\text{cm}$	$\pm 1$	%18	DFM	1 Calpack bottle 500 mL	238 988

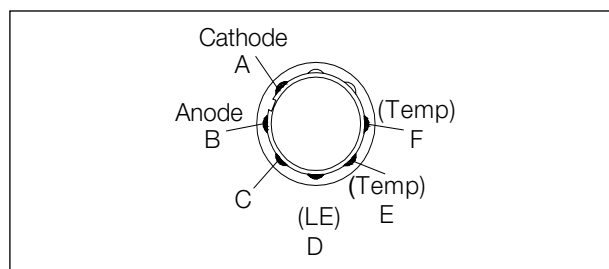
### Cables for Industrial Applications

- Internal anti-noise sheath for accurate measurement.
- Gold plated spring O-connectors parts, for good electrical contact under the most severe conditions.
- Coaxial plug and socket with watertight sealing that meets the requirements of IP 65.
- Cables for industrial appl. and for laboratory use are available.

### Dimensions FU20



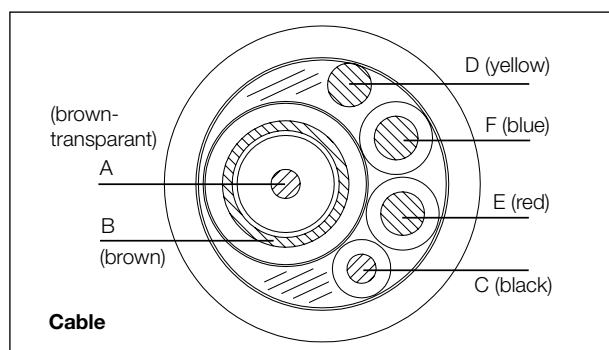
### Connector lay out



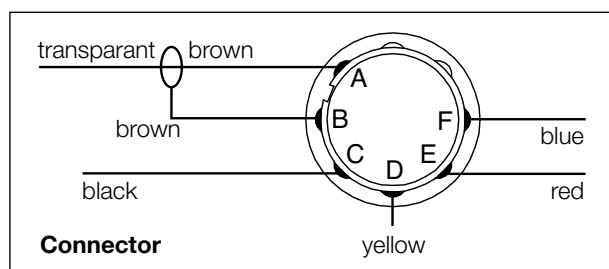
### Model and Suffix codes

Model	Suffix Code	Description
WU10		Universal sensor cable
Connector type	-V	Variopin
Cable type	-S	Single Coax
Cable length	-03	3 meters
-05	5 meters	
-10	10 meters	
-15	15 meters	
-20	20 meters	

### Cable lay out

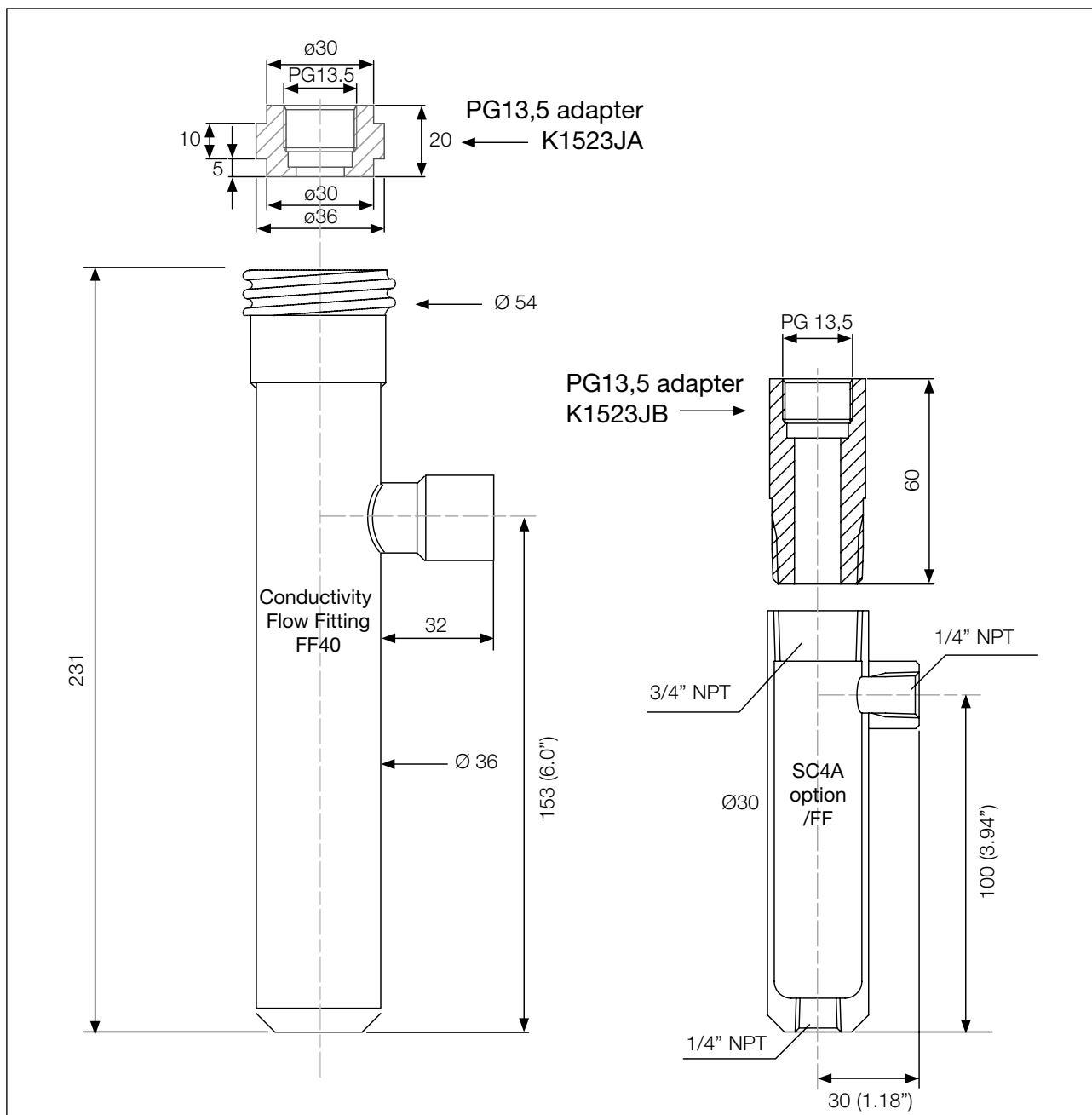


### Connector wiring



### Unique Advantages:

- Stable for at least 1 year (1.3  $\mu\text{S}/\text{cm}$ ), up to 3 years
- Certified standards with traceable calibration from DFM (can be viewed at [www.hamiltoncompany.com/cert](http://www.hamiltoncompany.com/cert))
- Expiration date on every bottle
- Bottles can remain open for up to 60 minutes and retain the certified value.



#### Flow fitting FF40

With Adapter K1523JA to fit sensors with a PG13,5 process connection in FF40/FS40 and FD40 fittings.

Material: Polypropylene

#### Flow fitting K1598AC (incl. 3.1 B certificate)

with Adapter K1523JB to fit sensors with PG13,5 process connection

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GS 12D7J5-E-E

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# General Specifications

Model WU40  
Sensor cables

*These cables are for use with the Yokogawa conductivity cells fitted with a cable connector. The plug/socket connection between cell and cable meets the requirements of IP65.*

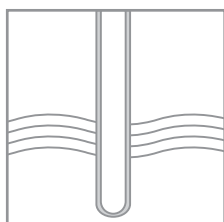
*The connector of the cable has a secure screw connection with simple wiring mode. The gilded contacts ensure good electrical contact to the connector of the conductivity cell.*

*The cable is six wire multicore and covered with a thermoplastic PVC. The wires are also covered with thermoplastic PVC individually and coloured.*

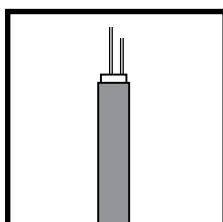
*The cable connections are supplied with 2 mm contact pins for connection to the transmitter, preamplifier or connection box: these pins guarantee a correct and simple connection to the terminals.*



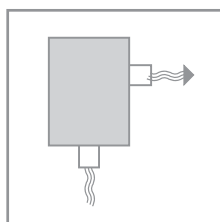
## System Configuration



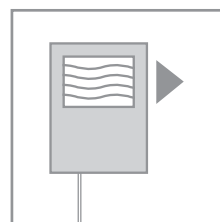
Sensors



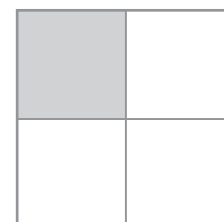
Cables



Fittings



Transmitters



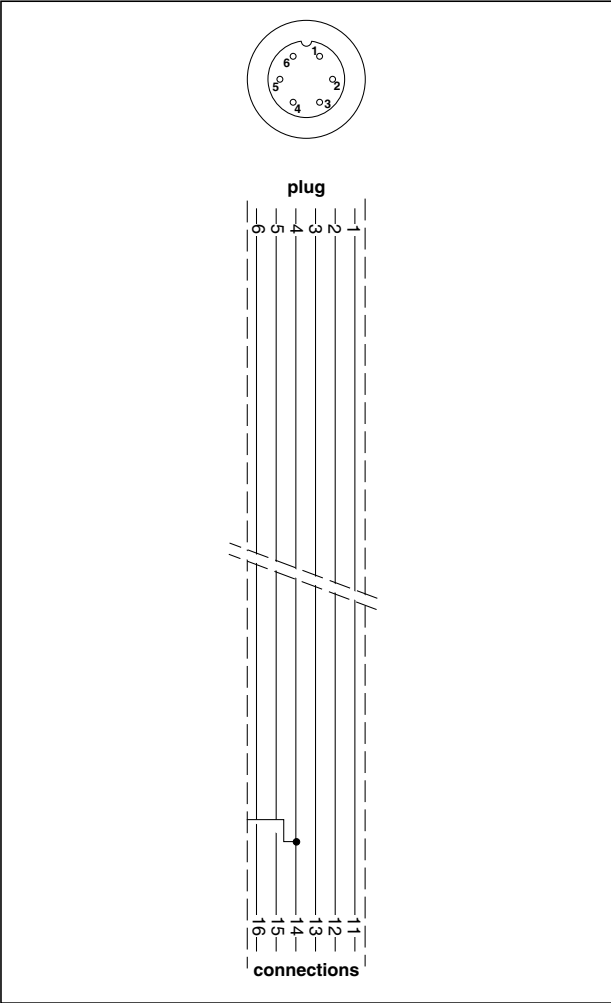
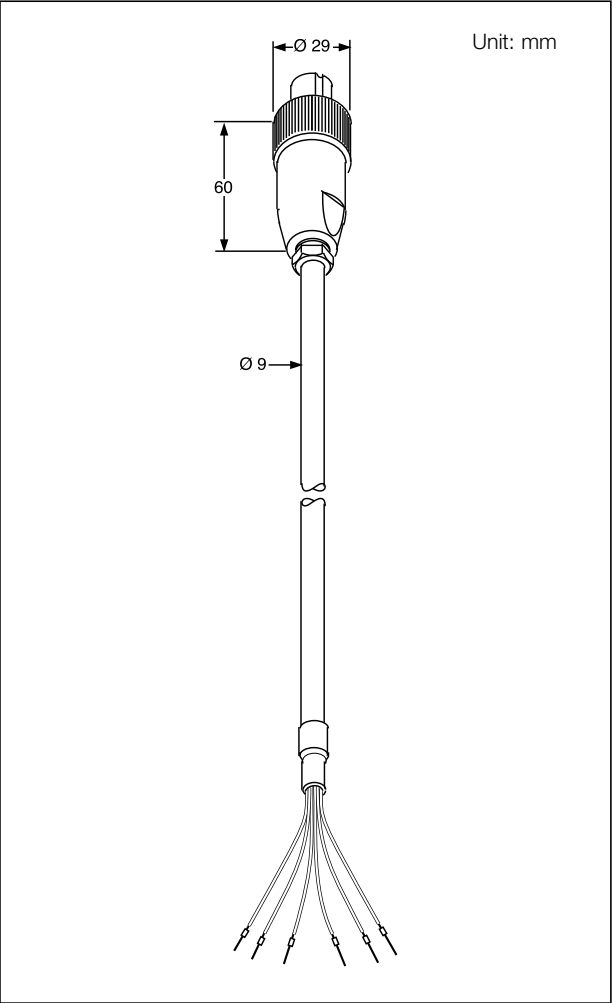
Accessories

# Technical Specifications

<b>Cable length</b>	: 1, 2, 5 1/2, 10, 15, 20 or 25 m
<b>Temperature range</b>	: -10 °C to +80 °C
<b>Wire resistances</b>	: approx. 18.10 <sup>-3</sup> Ω/m
<b>Capacity core/core/screen</b>	: max. 130 pF/m
<b>Isolation resistance between cores and screen</b>	: approx. 10 <sup>9</sup> Ω/m (20 °C)
<b>Connector contact resistance</b>	: < 8 mΩ


# Model and Suffix Codes

Model	Suffix Code	Description
WU40		Sensor cable
Cable length	-LH01	1 meter
	-LH02	2 meter
	-LH05	5,5 meter
	-LH10	10 meter
	-LH15	15 meter
	-LH20	20 meter
	-LH25	25 meter



# Dimensions

# Internal Wiring

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## Conductivity Analyzers (inductive)

## Conductivity Analyzers (inductive)



# General Specifications

Model ISC450G  
Inductive conductivity analyzer

**EXAxt**

The new EXAxt 450 series has been designed to meet the highest market requirements of today's industry. This series of analyzers is unique as it will no longer be the uncertainty factor of your quality demands, but instead will bring you to a higher level. The EXAxt will help you and guide you as the unique Human Machine Interface (HMI) will not only present you reliable process data, but diagnostics, trends, logbooks and step by step calibration routines to become your friend in analytical measurement and help you gaining that higher level of quality.

The instrument is easy to set up, very intuitive and can be used without the need of an instruction manual. The HMI has a clear menu structure in the language of your preference (English, French, German, Spanish, or Italian). The touch screen interface provides access to the display features. The main display gives three process values at the same time.

This makes it possible to provide Conductivity, Concentration and Temperature reading at the same time. Predefined compensation matrices with integrated concentration tables makes it possible to have concentration readings readily available.

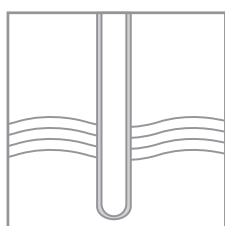
The EXAxt is highly intelligent and continuously checks the software, hardware and sensor system for irregularities. Not only will these irregularities be signaled through the main display as well as a signal output according Namur NE43, the transmitter will provide adequate instructions how to solve the errors.



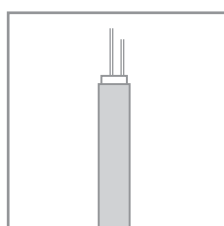
## Features

- Unique intuitive HMI menu structure in 6 languages.
- Process data trending up to 2 weeks.
- Predefined OIML standard solutions.
- Predefined matrices for precise temperature compensation.
- Two mA-outputs and four SPDT relay contacts with display indicators.
- %weight on display.
- HART® Communications.
- FM Class 1, Div. 2, Group ABCD, T6 for Ta -20 to 55°C

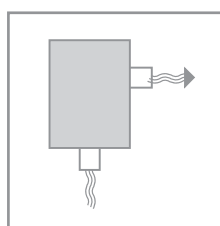
## System Configuration



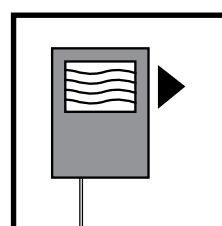
Sensors



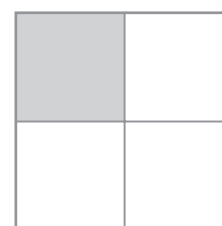
Cables



Fittings



Transmitters



Accessories

**YOKOGAWA** ◆

GS 12D8B5-E-E  
4th Edition

## General Specifications

### General Specifications of EXAxt ISC450

**A. Input specifications:** Compatible with the Yokogawa inductive conductivity ISC40 series with integrated temperature sensor: NTC30k or Pt1000.

### B. Input range

Conductivity	: 0 to 1999 mS/cm at 25°C (77 °F) reference temperature.
Minimum	: 1 µS/cm (at process temperature)
Maximum	: 2 S/cm (at process temperature)
Temperature	: -20 to +140°C (0 to 280 °F).
Cable length	: max. 60 meters (200 feet) 10 meters (35 feet) fixed sensor cable + 50 meters (165 feet) WF10 extension cable. Influence of cable can be adjusted by doing an AIR CAL with the cable connected to a dry cell.

### C. Accuracy:

Conductivity	: $\leq 0.5 \% \pm 1.0 \mu\text{S/cm}$ of reading
Temperature	: $\leq 0.3^\circ\text{C}$ ( $0.6^\circ\text{F}$ )
Temp.compensation	: $\leq 1 \%$ for NaCl, $\leq 3 \%$ for matrix
mA-output circuits	: $\leq 0.02 \text{ mA}$ .
Ambient temperature influence	: $0.05\%/^\circ\text{C} \pm 0.05 \mu\text{S}/^\circ\text{C}$
Step response	: $\leq 4$ seconds for 90 % (for a 2 decade step).

### D. Transmission signal

General	: Two isolated outputs of 4-20 mA. DC with common negative. Maximum load 600Ω. Bi-directional HART® digital communication, superimposed on mA1 (4-20mA) signal.
Output function	: Linear or 21-step table for Conductivity, Concentration or Temperature.
Control function	: PID control.
Burn out function	: Burn up (21.0mA) or burn down (3.6mA) to signal failure. acc. NAMUR NE43.
Parameters	: Adjustable damping : Expire time
Hold	: The mA-outputs are frozen to the last/ fixed value during calibration/ commissioning
Cond. range	: min span $10\mu\text{S/cm} \geq 10\%$ of high valve (20mA) max span 1999 mS/cm

### E. Contact outputs

General	: Four SPDT relay contacts with display indicators.
Switch capacity	: Maximum values 100 VA, 250 VAC, 5 Amps. Maximum values 50 Watts, 250 VDC, 5 Amps.
Status	: High/Low process alarms, selected from conductivity, resistivity, concentration or temperature. Configurable delay time and hysteresis. PID duty cycle or pulsed frequency control. FAIL alarm
Control function	: On / Off

: Adjustable damping

: Expire time

Hold : Contact can be used to signal the Hold situation.

Fail safe : Contact S4 is programmed as fail-safe contact.

### F. Contact input

	: Remote range switching to 10 times the programmed range.
Cont. open	: Conductivity $< 10\mu\text{S} \times \text{C}$ : Range 1
Cont. closed	: Conductivity $< 100\mu\text{S} \times \text{C}$ : Range 2 (10 x Range1)

### G. Temperature compensation

	: Automatic or manual, for temperature ranges mentioned under C (inputs).
- Ref. temp.	: programmable from 0 to 100°C or 30 - 210 °F (default 25°C).

**H. Calibration** : Semi-automatic calibration using pre-configured OIML\* (KCl) stanard tables, with automatic stability check. Manual adjustment to grab sample.

\* Organisation Internationale de Metrologie Legale, international recommendation nr. 56 standard solutions reproducing the conductivities of electrolytes, 1981.

**I. Logbook** : Software record of important events and diagnostic data readily available in the display or through HART®.

**J. Display** : Graphical Quarter VGA (320 x 240 pixels) LCD with LED backlight and touchscreen. Plain language messages in English, German, French, Spanish, Italian and Swedish.

### K. Shipping details

Package size:	293 x 233 x 230 mm (L x W x D) (11.5 x 9.2 x 9.1 inch)
Package weight	: Approx 2.5 kg (5.5lbs)

**L. Housing** : Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window. The colour of the case and cover is silvergrey. Cable entry via six M20 polyamide glands. Cable terminals are provided for up to 2.5 mm<sup>2</sup> finished wires. Weather resistant to IP66 and NEMA4X standards. Pipe, wall or panel mounting, using optional hardware.

### M. Power supply

	: 85-265 VAC ( $\pm 10\%$ ). Max 10VA, 47-63Hz
	: 9.6-30 VDC ( $\pm 10\%$ ), max 10W

### N. Safety and EMC conforming standards

Safety	: EN 61010-1 CSA C22.2 No.61010-1 UL 61010-1 FM3611 Class I, Div.2, Group ABCD,T6 for Ta -20 to 55°C
EMC	: conforms to EN61326 Class A, AS/NZS CIPR 11
Installation alt.	: 2000 m or less Category based on IEC 61010: II (Note) Pollution degree based on IEC 61010: 2 (Note)

**Note:** Installation category, called over-voltage category, specifies impulse withstand voltage. Category II is for electrical equipment. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength. Degree 2 is the normal indoor environment

GS 12D8B5-E-E

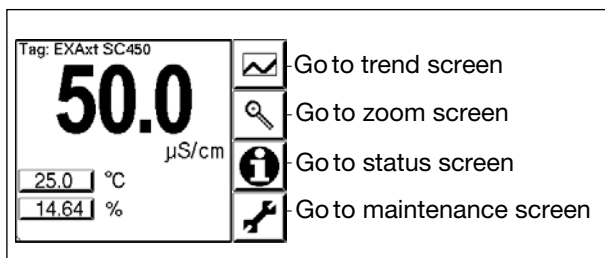
### O) Environment and operational conditions

Ambient temperature: -20 to +55°C (-5 - 130°F)  
 Storage temperature: -30 to +70°C (-20 - 160°F)  
 Humidity : Up to 90% RH at 40°C (100°F)  
 (non-condensing)  
 Data protection : EEPROM for configuration data and  
 logbook. Lithium cell for clock.  
 Watchdog timer : Checks microprocessor.  
 Power down : Reset to measurement.  
 Automatic safeguard : Auto return to measuring mode when  
 touchscreen is not touched for 10 min.

### Display and Operating Interface

The display is a backlight graphical display with QVGA resolution. Operation is done by a touchscreen. Graphical keys on the right and other area's of the touchscreen respond to contact as virtual push buttons.

### Main screen

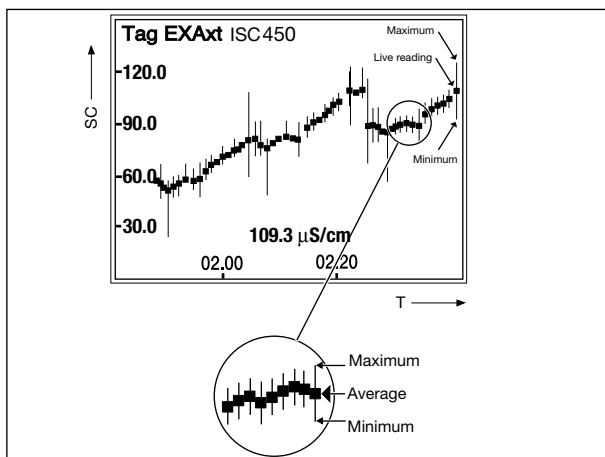


#### The main screen displays:

- The primary variable in large font (user selectable)
- Other process variable(s) in small font
- Unit symbols
- Tagnumber (user programmable)
- Process description (user programmable)
- Status of contact output(s)
- Status indicator during HOLD and WASH situation
- Main function keys



### Trend screen

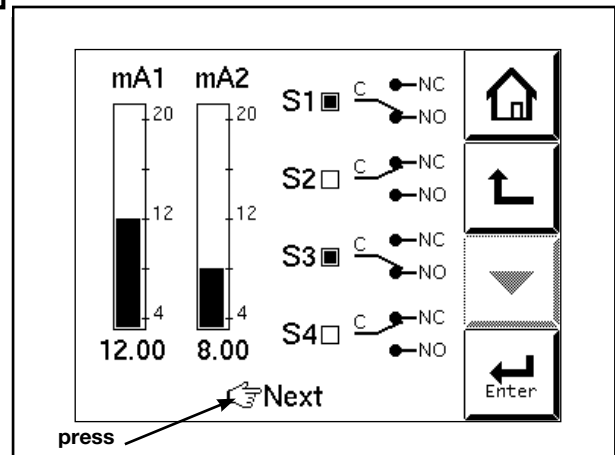


#### The trendscreen displays:

- Time scale. User selectable (between 15 minutes and 2 weeks)
- PV scale. User selectable
- TAG number
- Actual PV
- Average, maximum and minimum PV in this interval (time scale / 51)



### Zoom screen



The zoom screen displays an easy graphic representation of the output functions. When "next" is pressed it will give access to the logbook data.



### Status screen

The status screen gives access to diagnostic information with regards to analyzer or sensors.



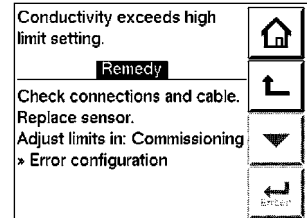
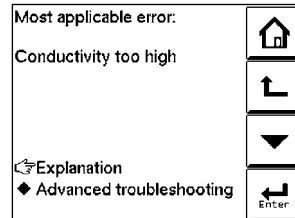
No malfunction detected.



Soft alarm detected. Maintenance is recommended for best accuracy.



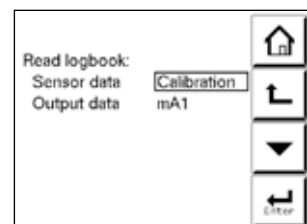
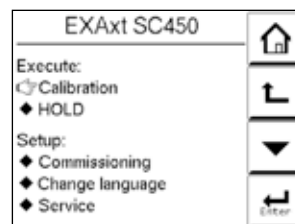
Hard alarm is detected indicating malfunction that is critical for good analysis. When this key is pressed details are displayed with regards to detected malfunction and troubleshooting guidelines are displayed to resolve the malfunction.



### Maintenance screen

The maintenance screen gives access to calibration, commissioning and setup of the instrument. These levels can be protected by passwords.

#### Example:



## Output and Alarm Functions

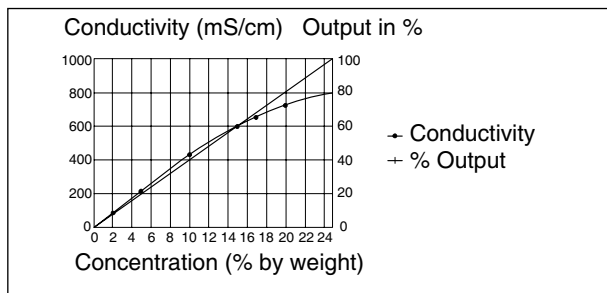
### Output signal

The standard ISC450 features two 4-20 mA current outputs available for registration, and indication or control functions.

The user selectable application can represent:

- the measured conductivity value
- the concentration in wt%
- the measured temperature value

In addition the following output functions are available:



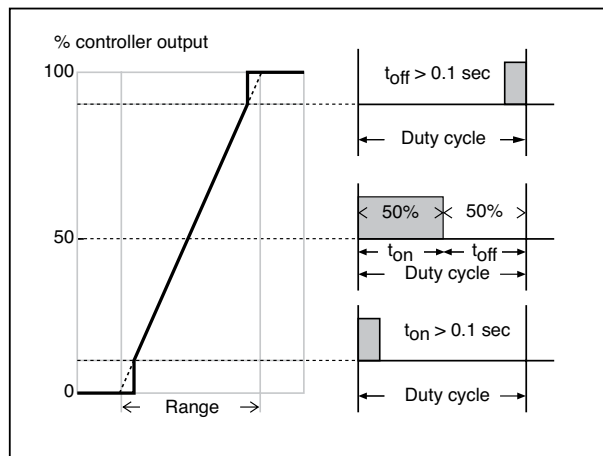
### Linearisation of output

**Example: 0-25% Sulfuric acid**

- a "HOLD" function that maintains process value or a fixed value until return to normal operation
  - a "BURN" function that gives a high or low output at fail status
  - a programmable output function that allows the user to linearise the output(s) when used as a concentration analyzer.
- Two isolated mA outputs are provided, and can be set for linear or scaled output signals. Alternatively PID analogue control is available on either or both mA outputs. The transmitter or control parameter may be SC, concentration or temperature. Control settings are fully configurable.

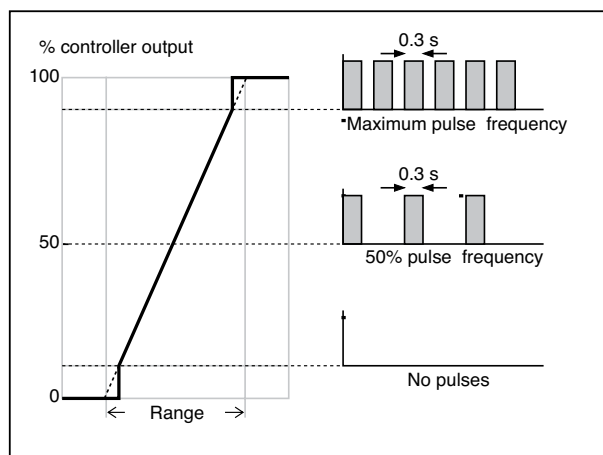
Code	Output	mA	Conc.	Example	Cond.	Example
0	4.0	4-20	0	% H <sub>2</sub> SO <sub>4</sub>	0	mS/cm
5	4.8		1.25		60	
10	5.6		2.5		113	
15	6.4		3.75		180	
20	7.2		5		211	
25	8.0		6.25		290	
30	8.8		7.5		335	
35	9.6		8.75		383	
40	10.4		10		424	
45	11.2		11.25		466	
50	12.0		12.5		515	
55	12.8		13.75		555	
60	13.6		15		590	
65	14.4		16.25		625	
70	15.2		17.5		655	
75	16.0		18.75		685	
80	16.8		20		718	
85	17.6		21.25		735	
90	18.4		22.5		755	
95	19.2		23.75		775	
100	20.0		25		791	

Four SPDT relays are included as standard, and can be configured by the user as conventional process alarms, or in one of 2 control modes:



### 1) PID duty cycle control

In this type of control, the on/off ratio is controlled to vary the dose rate through a solenoid valve. This is a very economic way of achieving PID control.



### 2) PID pulse frequency control

The pulsing frequency is regulated to control electrical valve opening or pump stroke.

In each case the setpoint, PB, I and D terms are all easily adjustable in the ISC450.

### Configuration of contacts

Contact	Normal operation	Alarm situation	Powerdown
S1, S2, S3	C — NO C — NC	C — NO C — NC	C — NO C — NC
S4	C — NO C — NC	C — NO C — NC	C — NO C — NC

## Measurement Principle

Unlike 2- or 4-electrode conductivity systems, the EXA ISC450G analyses the conductivity without any contact between electrodes and process fluid. The measurement is based on inductive coupling of 2 ring transformers (toroids) by the liquid. The EXA ISC450 supplies a reference voltage ( $V_1$ ) at a high frequency to the "drive coil". The core of this coil is of a high permeability magnetic material, and a strong magnetic field is generated in the toroid. The liquid passes through the hole in the toroid and can be considered as a "one turn" secondary winding.

The magnetic field induces a voltage ( $V_2$ ) in this liquid winding. The induced current thus made to flow is proportional to this voltage and the conductance of the liquid "one turn winding" is according to Ohm's law.

The conductance ( $G=1/R$ ) is proportional to the specific conductivity and a constant factor that is determined by the geometry of the sensor (length divided by surface area of the hole in the toroid) and the installation of the sensor.

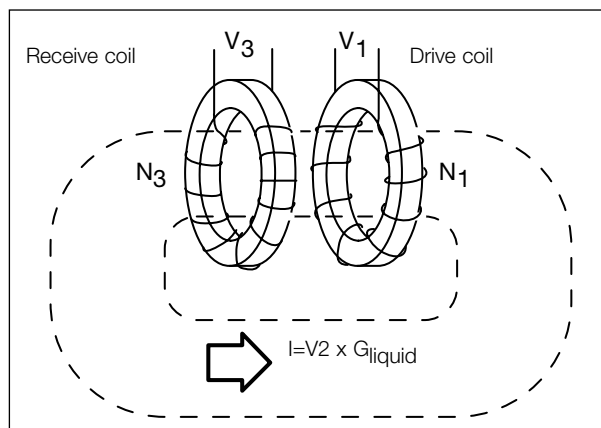
There are 2 toroids mounted in the doughnut shaped sensor. The liquid also flows through the second toroid and therefore the liquid turn can be considered as a primary winding of the second ring transformer. The current in the liquid will create a magnetic field in the second toroid. The induced voltage ( $V_3$ ) being the result of this magnetic field can be measured as an output. The output voltage of this "receive coil" is therefore proportional to the specific conductivity of the process liquid.

## Functional Description

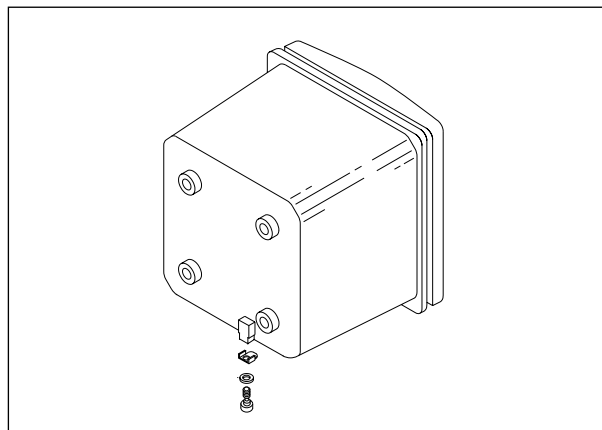
The EXA ISC450G is real time micro-controller operated conductivity-analyzing system. It uses a dedicated micro-controller to control all functions necessary in such a system. The input and output functions are concentrated in the analog section of the instrument. Even these functions are operated through special interfaces designed to minimize interference with the digital functions. All functions are executed separately.

The power of the microprocessor is used for:

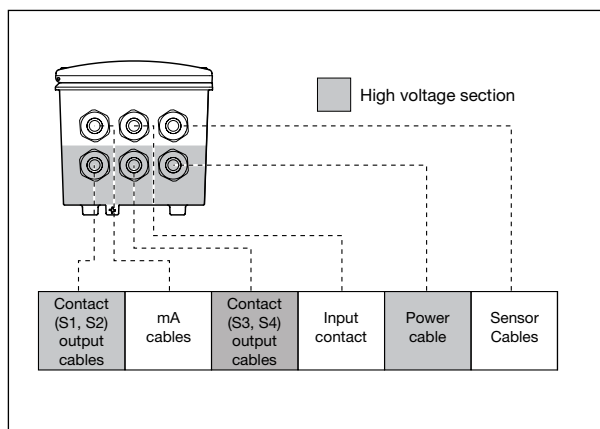
- Diagnostic functions to increase the dependability of the instrument.
- A self-tuning preamplifier to increase the rangeability to cover almost all conductivity applications.
- Input/output flexibility to offer the user solutions to compatibility problems and to non-linearity characteristics of some electrolytes.
- Auto zeroing to ensure long term stability
- Sophisticated temperature compensation to achieve temperature independent readings for even the most difficult processes like Sulfuric Acid and Sodium Hydroxide.



Inductive conductivity measurement principle



Grounding



Glands to be used for cabling

## Installation and Wiring

### Installation site

The converter is a rain-tight type, and can be installed inside or outside. It should, however, be installed as close as possible to the sensors to avoid long cable lengths between sensors and transmitter. Select an installation site where:

- Mechanical vibrations and shocks are negligible.
  - No relay/power switches are in the direct environment.
  - The transmitter is not mounted in direct sunlight and severe weather conditions.
  - Maintenance activities are possible (no corrosive atmospheres).
- The ambient temperature and humidity of the installation environment must be within the limits of the instrument specifications.

### Mounting methods

The EXA ISC450G transmitter has universal mounting possibilities:

- Panel mounting using optional brackets.
- Surface mounting on a plate (by bolts from the back).
- Wall mounting on a bracket (e.g. thick brick wall).
- Pipe mounting using a bracket on a horizontal or vertical pipe (maximum diameter 50 mm).

### Installation of the sensor

The ISC40 is a doughnut shaped sensor. Ideally, the process flows through the hole of the doughnut with the temperature compensator up-stream. For minimal obstruction of the flow and for accurate measurement without the need for calibration of the installation factor, the process should flow freely around the doughnut. This is effected by allowing a minimum distance of 25 mm (1 in) between donut and process piping (d)).

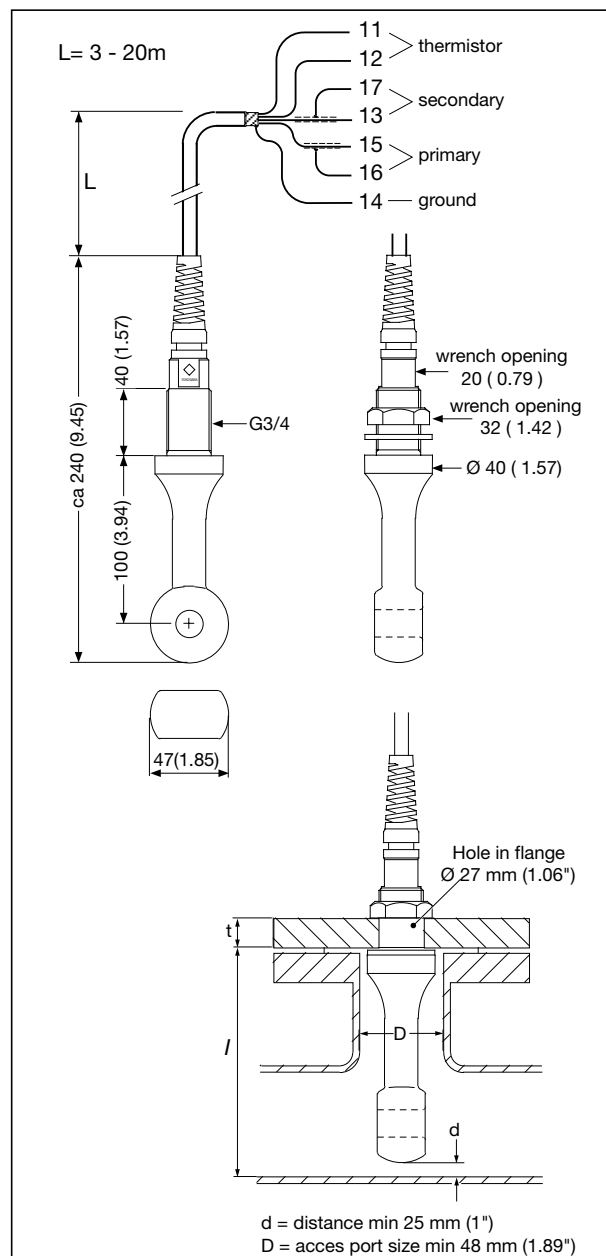
The sensor is provided with a gasket and retaining nut. This allows "bulkhead mounting" in tank wall or standard flange through a hole of 27 mm (1.1 in) diameter (A). The insertion depth is 125 mm. Two flats are provided with wrench size 20 mm (0.8 in) to allow easy mounting and alignment of the sensor. The model identification on one flat aligns with the "up-stream" position of the sensor.

It is recommended to use Yokogawa supplied mounting options, flowfittings, immersion fittings or subassemblies. These holders feature double O-ring seals to prevent that chemical attack of the seal will damage the sensor by ingress of process liquid in the sensor.

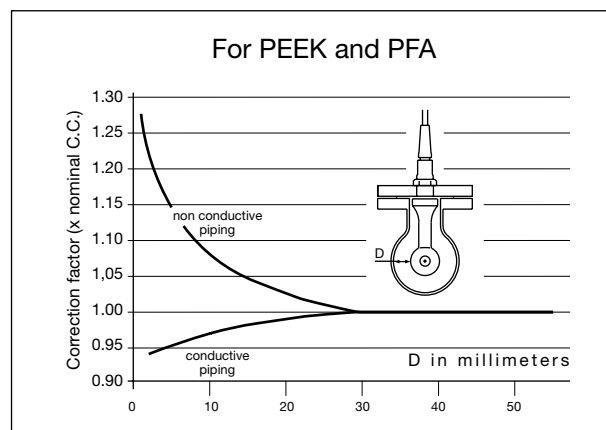
- For on-line mounting, adapters are available for standard 2" process connection (Gas thread, NPT, ANSI-flange, DIN-flange).
- For by-pass measurement, flow fittings are available in Polypropylene, Polyvinylidene Fluoride and Stainless Steel.
- For measurements in open ducts or vessels, an immersion fitting in CPVC is available.

For easy wiring the sensor should be located within 2 or 10m (16 or 32ft) from the transmitter using the integral sensor cabling. Up to 50 meters of WF10 extension cable may be used with a BA10 junction box. The installation factor of the ISC40 is the ratio of the measured conductivity at the sensor and the specific conductivity of the solution. The unit is cm-1 just as the cell constant of a contact electrode system. This factor is 1.88 cm-1 for the ISC40 if the sensor is installed with a minimum of 25 mm (1 in) of process fluid surrounding the donut.

- Installed in an ISC40FF-S stainless steel flow cell, the factor is 1.7 cm-1.
- Installed in an ISC40FF-P polypropylene flow cell, the factor is 1.88 cm-1.
- The factor may be estimated from diagram (PEEK and PFA) for actual installations not using the standard flow assemblies.
- The I.F. or cellcontact of ISC40 sensors made of PFA is 3.0/cm.



**Dimensions and installation instructions bulk-head mounting**



**Installation factor as a function of free distance around donut**

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### Wiring

When wiring the converter, the following guidelines should be used for cable selection, in order to ensure the correct sealing of the cable glands and the correct operation of the terminals.

Overall cable diameter : 7-11 mm (9/32"-15/32")

Conductor cross section : 0.13 mm<sup>2</sup> - 4.0 mm<sup>2</sup> (26-12 AWG)

### Model and Suffix codes

Model	Suffix Code	Option code	Description
ISC450G			Inductive/Conductivity transmitter
Power	- A		AC version (85...265 VAC)
	- D		DC version (9.6...30 VDC)
	- A		General purpose version
Options*		/ SCT**	Predefined tagnumber (text only)
		/ U	FM version
		/ UM	Universal mounting kit (panel, pipe, wall)

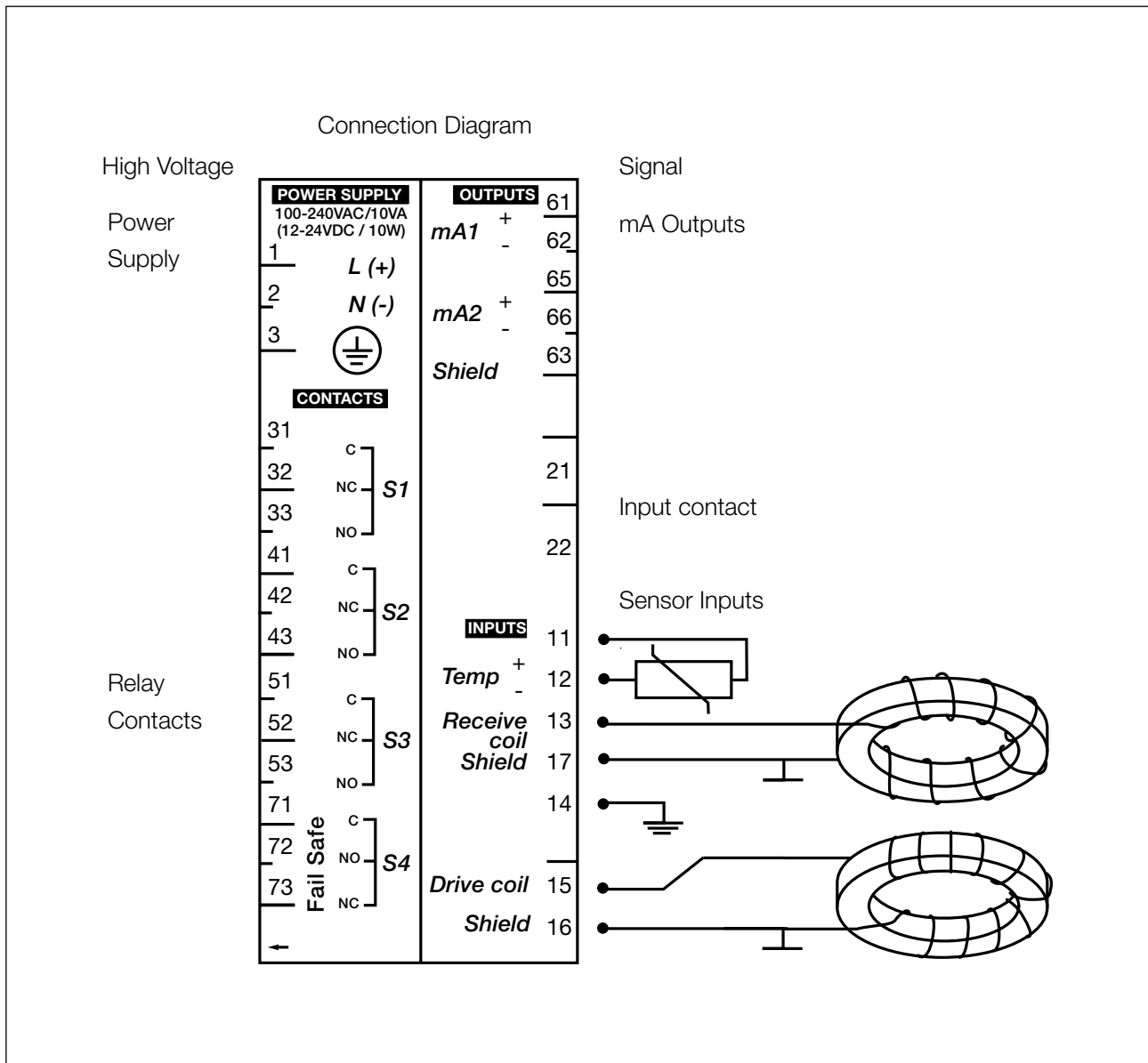
\* /Q: Quality Inspection certificate is always included with the product.

\*\*If the tagnumber is predefined with the purchase, Yokogawa will inscript the tagplate with the specified tagnumber and program the tagnumber in the transmitter.

### Spare Parts

Part no.	Description
K1541KR	/PM panelmounting for EXA400/402
K1542KW	/U pipe/wall mounting for EXA
K1548FU	Flashloader kit (only for FF and Profibus version)
K1548MT	Tagplate blank EXAxt450
K1548MV	Glands M20 (6 pcs.)

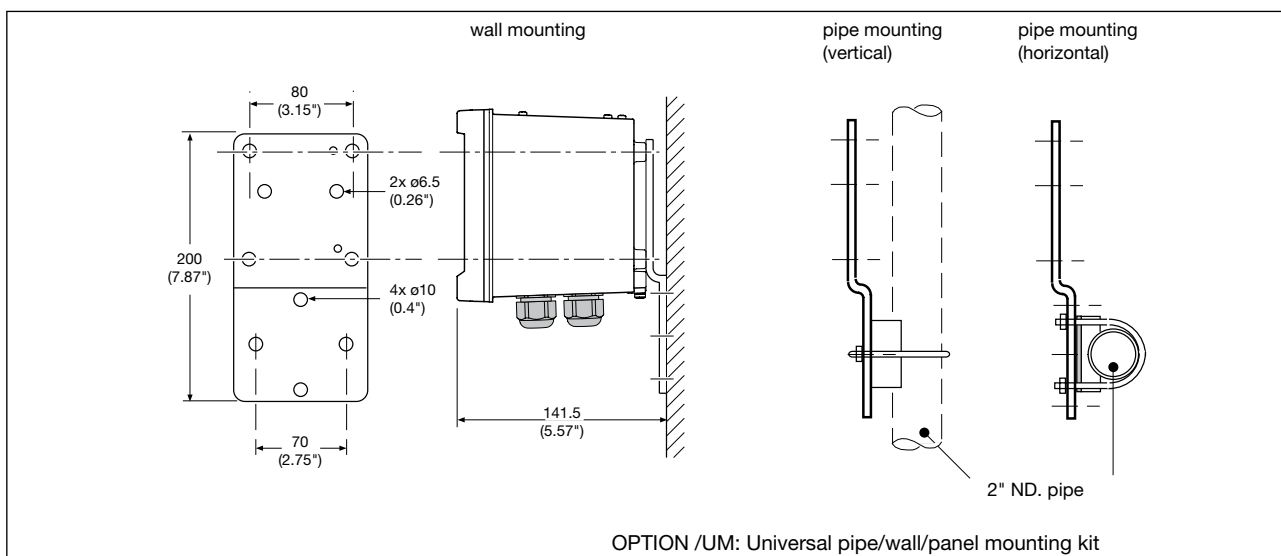
### Wiring Diagram



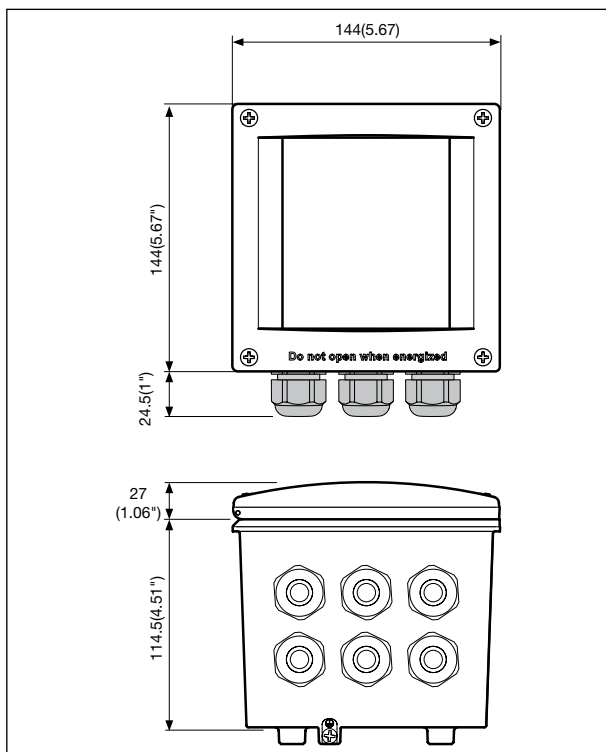
GS 12D8B5-E-E



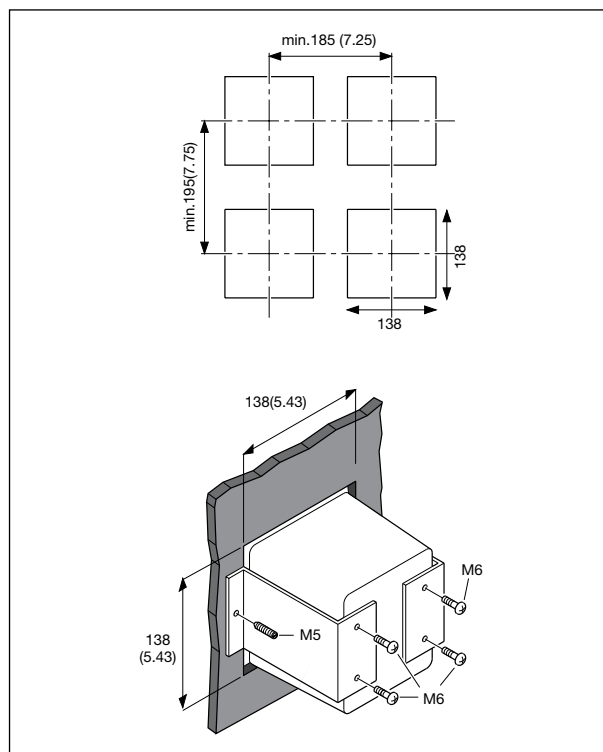
## Dimension and mounting



## Wall and pipe mounting diagram



Housing dimensions and layout of glands



Option/UM. Universal mounting kit, panel mounting diagram

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# General Specifications

## Model ISC40G (S) Inductive Conductivity sensor and fittings

The model ISC40 sensors are designed for use with the EXA: ISC40G(S) 2-wire transmitters and the EXA: ISC450G 4-wire analyzers. This combination exceeds all expectations for conductivity measurement in terms of: reliability, accuracy, rangeability and price performance.

The accuracy is 0.5% of reading plus 0.5  $\mu\text{S}/\text{cm}$  for any conductivity value: whether measured in rinse water or in concentrated acids. The materials of construction guarantee a long life under harsh industrial conditions:

- The erosion/abrasion resistant PEEK (Poly Ether Ether Ketone), which also features excellent chemical resistance in all solutions except fluoric acid or oxidizing concentrated acids.
- The ultimate material in terms of chemical resistance: PFA for applications in hydrofluoric acid and oxidizing concentrated acids (nitric, sulfuric, oleum).

The PEEK sensor is provided with a rugged Stainless Steel mounting thread, nut and gasket combination for ultimate flexibility in installation using bulk head installation technique. There is also a wide range of holders and options available for reliable in-line or off-line installation with double O-ring seals for long service life of the sensor. Additional models are available for use in Ball-Valve Insertion applications and in Sanitary Flange installations.

The PFA sensor comes with an integral lap-joint flange, because in applications, where this sensor is used, it is very difficult to find O-rings that are resistant to the process.

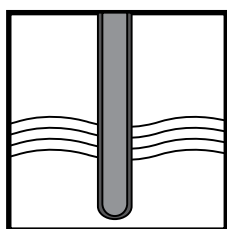
Both sensors have a large bore for optimal resistance to fouling processes and when properly installed, the flow will keep the sensor clean preventing measuring errors.



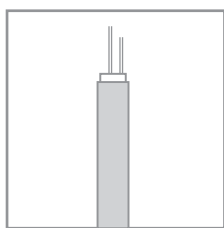
### Features and Applications

- Inductive Conductivity technique for elimination of fouling and polarization errors.
- Wide bore sensors for long term stability.
- Installation flexibility by wide range of holders and by the use of universal bulkhead construction.
- Wide rangeability in terms of conductivity (1  $\mu\text{S}/\text{cm}$  to 2 S/cm) and temperature (-20 to 130°C).
- All applications where severe electrode fouling prevents the use of contacting electrodes.
- All ranges except the (ultra) pure water applications.
- All slurry applications where conventional systems suffer from plugging or erosion.
- All applications where the 6 decade rangeability is necessary for accurate process control.

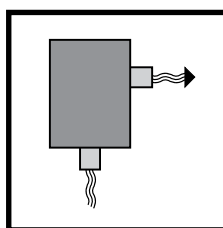
### System Configuration



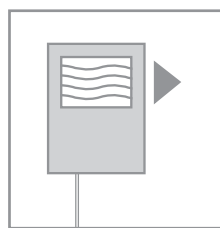
Sensors



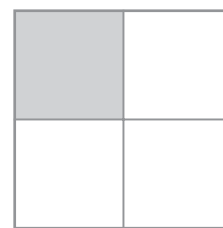
Cables



Fittings



Transmitters

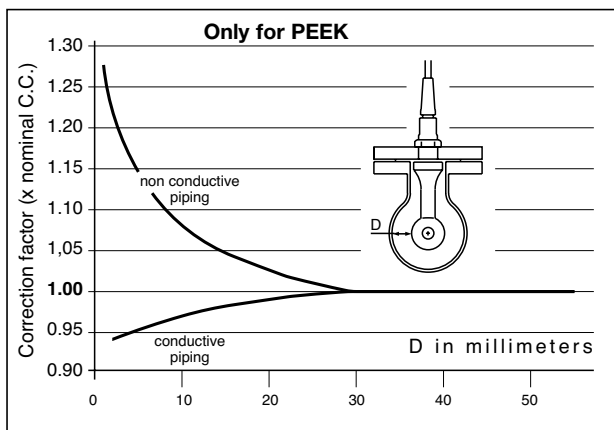


Accessories

## General Specifications

### Model ISC40 Inductive conductivity sensor

- A. Compatibility** : ISC40G is suitable for use with both ISC450G and I(S)C202G(S) inductive conductivity transmitter.
- B. Hazardous area** : ISC40S is suitable for use with the I(S)C202S conform to ATEX, FM and CSA intrinsic safety standards
- ATEX intrinsic safety : II 1 G EEx ib [ia] IIC T6 for ambient temp. -10 to 40°C  
: II 1 G EEx ib [ia] IIC T4 for ambient temp. -10 to 55°C
  - ATEX certificate no. : KEMA 00 ATEX 1067 X
  - FM intrinsic safety : IS CL1, DIV1, GP ABCD T3B for ambient temp. (ta)  
-10°C to 55°C and T4 for ambient temp. (ta) -10°C to 40°C.
  - FM approval report : J.L. 1Y1A7.AX
  - CSA intrinsic safety : Ex [ia] Class I, Division 1, Groups C and D, T4a
  - CSA approval file : LR 102851-1
- C. Measuring range** : 0- 2000 mS/cm at actual process temperatures. The sensor has an error of 0.5  $\mu$ S/cm (PEEK sensors) or 1  $\mu$ S/cm (PFA sensor) that must be considered when application range is chosen.
- D. Installation factor** : Cellconstant: The nominal cell constant of the sensor is 1.88/cm for the PEEK sensor types and 3.00/cm for the PFA sensor. The calibrated values are indicated on the cable markers and the actual installation can change this factor. If there is less than 25 mm spacing between sensor and holder, in-situ calibration is necessary to meet the specified accuracies. An indication is given in figure.



Actual installed cell-constant as function of spacing around the sensor.

### E. Process temperature range

- Peek : -20 to 130°C (0 to 270 °F) for Response time 5 min. (90%)
- PFA : -20 to 100°C (0 to 212 °F) Response time 10 min. (90%)

### F. Process pressure

- Peek : Maximum 20 bar (300 psi) dependant on installation.

PFA :		°C	°F	°C	°F
		100	212	20	36
	BAR (PSI)	72	71	145	142

### G. Materials

- Sensor wetted parts : Victrex PEEK (Poly-Ether-Ether-Ketone)  
: Complies with the FDA regulations for plastic for food contact of the FDA.21 CFR 177.2415  
: PFA (High purity Perfluoro alkoxy alkane)
- Sealing gasket : Viton for PEEK  
: Gore tex for PFA
- Process adapters : AISI 316 SS, PVC or PVDF (only for PEEK)

- H. Process connection** : Process connection are made in combination with a variety of adapters and fittings. See relevant sections in this document.

### I. Cables

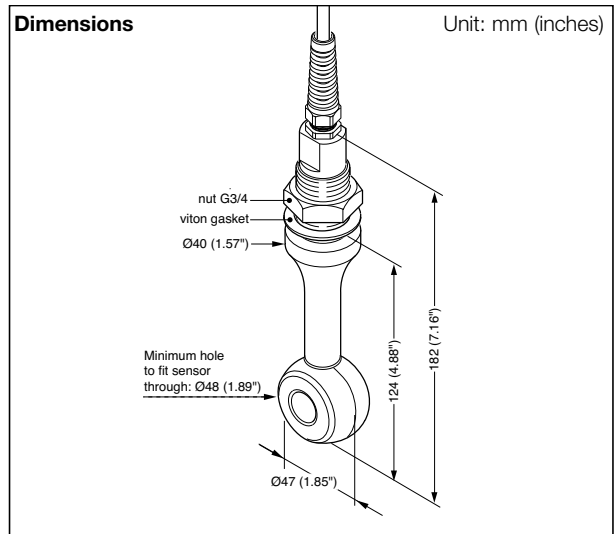
- Connection cable : Integral connection cable in a variety of lengths up to 20 meter.
- Extension cable : Extension cable with WF10 junction box BA10 can be used to a total of 50 meters (fixed cable and extension cable).

### J. Shipping details

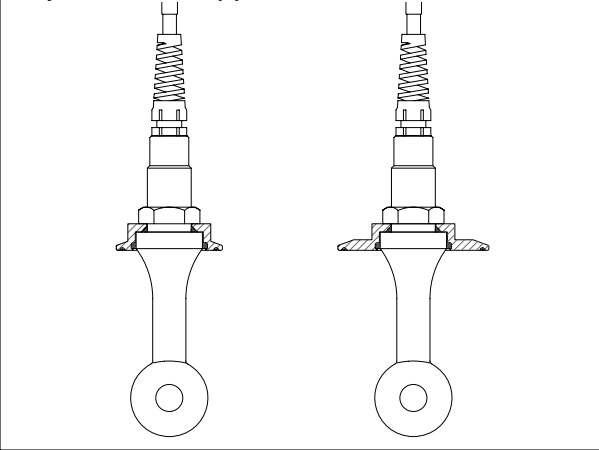
- Package
- 3-5 meters : WxHxD = 350x270x50 mm
- 10-20 meters : WxHxD = 320x240x110 mm
- Packed weight approx.
- 03 m : 1.0 kg
- 05 m : 1.3 kg
- 10 m : 1.6 kg
- 15 m : 2.1 kg
- 20 m : 2.5 kg
- protection hose : 0.8 kg (approx.)

### ISC40G(S)-GG Model

Model	Suffix	Option	Description
ISC40G			General purpose inductive conductivity sensor
ISC40S			Intrinsically safe inductive conductivity sensor
Sensor type	-GG		Glass filled PEEK, general model
Temperature sensor	-T1 -T3		Pt1000 30k thermistor, for IC200 select only T3
Cable length	-03 -05 -10 -15 -20	03 meter 05 meter 10 meter 15 meter 20 meter	
Options for Sensor		Material	Proc.Connection
Flange adapters -GG		/SFA	AISI 316 SS 2" ANSI 150 lbs
		/SFD	AISI 316 SS NW50-PN16
		/STW	AISI 316 SS 3" tri-clamp
		/S2W	AISI 316 SS 2" tri-clamp
Certificates		/M	Material certificate Not for -GR
		/Q	Quality certificate



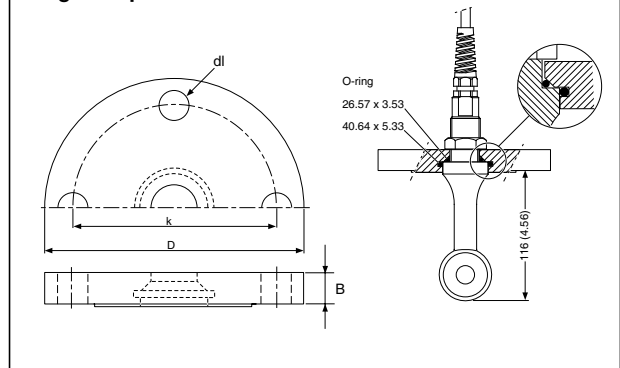
#### Adapters for ISC40G(S)-GG



Partno.	Description
K1541KB	3" Triclap (STW) (ISO 2852)
K1541KC	2" Triclap (S2W) (ISO 2852)
K1542FE	Weld-in 2" Triclover (incl. clamp)
K1542FH	Weld-in 3" Triclover (incl. clamp)

**Note:** clamp not included

#### Flange Adapters for -GG sensor



#### Flange adapter for -GG sensor

##### DIMENSIONS mm (inches)

d	D1	D2	Material	
/SFA	Ø 19 (0.75)	121 (4.75)	152 (6.0)	SS
/SFD	Ø 18 (0.71)	125 (5.00)	165 (6.5)	SS

#### O-rings spare parts for ISC40 sensor & Options as spare parts

Dimensions	O-ring material				Quantity
	EPDM	Viton	Silicon	KALREZ	
<b>O-rings for option /SFA /SFD</b> 40.64 x 5.33 / 26.57 x 3.53	K1500CA	K1500CB	K1500CC	K1500CD K1500CH	5 sets of 2 O-rings
<b>O- rings for K1541KC (/S2W)</b> 40.87 x 3.53 / 26.57 x 2.62 2" seal-clamp	K1541ZH	K1500DJ	K1500DK		2 sets of 3 O-rings
<b>O- rings for K1541KB (/STW)°</b> 40.87 x 3.53 / 26.57 x 2.62 3" seal-clamp	K1541ZK	K1500DL	K1500DM		2 sets of 3 O-rings
<b>O-rings for old models</b> Viton gasket		K1500AM			5 O-rings

GS 12D8J2-E-E

## Fittings for ISC40G(S)-GG Inductive Conductivity Sensors

For liquid analysis, the sensors are frequently mounted in either a flow or an immersion fitting. Yokogawa supplies for the model ISC40 inductive conductivity sensors a full range of fittings with particular emphasis on designs that reduce installation and maintenance time and consequently save operation costs.

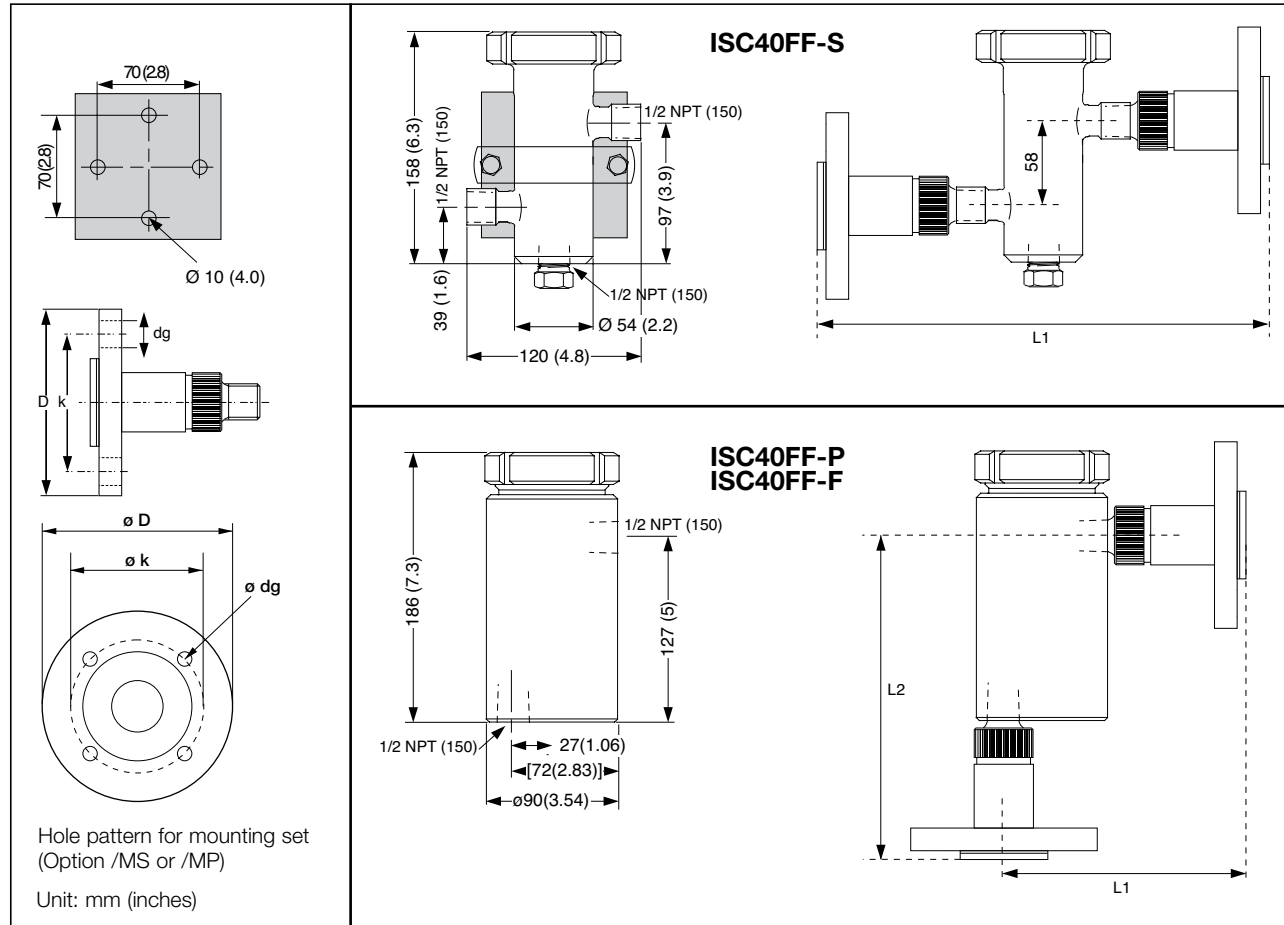
A wide choice of construction materials gives the user the optimal solution for any process considering chemical resistance, pressure and temperature specifications.

The flow fittings are used for installation of the sensors in sample by-pass lines. This makes maintenance easy without having to interrupt the main process stream. The subassemblies simplifies mounting of the sensors direct into process lines or vessels. This is particularly important where sample lines give problems, for instance with settling slurries.

### Features

- Wide choice of construction materials.
- Built in drain on stainless steel flow fitting.
- Quick disconnect direct insertion sub assemblies.
- High temperature PVC immersion fitting with optional flanged process connection for adjustable insertion depth.
- High pressure and temperature specifications.
- Electrolytically polished stainless steel fittings for optimal corrosion resistance.

### Dimensions in mm (inches)



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## Model ISC40FF Flow fitting

### A. Process temperature

- Model ISC40FF-S : Maximum 150°C (300°F)
- Model ISC40FF-P : Maximum 100°C (210°F)
- Model ISC40FF-F : Maximum 130°C (270°F)

### B. Process pressure

- Model ISC40FF-S : Max. 1.0 MPa (150 psi) at 150°C (300 °F)
- Model ISC40FF-P : Max. 0.6 MPa (90 psi) at 20°C (70°F)  
Max. 0.1 MPa (15 psi) at 100°C (210°F)
- Model ISC40 FF-F : Max. 1.0 MPa (150 psi) at 20°C (70°F)  
Max. 0.1 MPa (15 psi) at 120°C (250°F)

### C. Wetted materials

- Model ISC40FF-S : AISI 316 Stainless Steel
- Model ISC40FF-P : Polypropylene
- Model ISC40FF-F : PVDF (KYNAR®)

### Non-wetted materials

- Nut : AISI 304 stainless steel.
- Mounting set : AISI 304 Stainless Steel (optional)
- Flange adapters : AISI 304 Stainless Steel (optional)

### Adapter dimensions

L1	L2	L3	
FP1 - FF1	161	216	
FP2 - FF2	151	206	
FP3 - FF3	163	218	
FP4 - FF4	149	204	
FS1	278		112
FS2	298		122
FS3	274		110
FS4	298		122

### Flange dimensions

	D	k	dg
DN25	ø115	ø85	ø13.5
1 Inch	ø108	ø79.2	ø15.7
1/2 Inch	ø88.7	ø66.6	ø15.7
DN15	ø95	ø65	ø13.5

### Panel dimensions

100x100, holes 70x70 Ø10mm

### Model and Suffix Codes

Model	Suffix	Option	Description
ISC40FF			flow fitting
Material	-S		AISI 316 stainless steel
-P			Polypropylene (PP)
-F			PVDF (KYNAR®)
Process connection	-A		NPT
1/2"NPT Flange adapters	/FF1		PVDF, DN15 PN10
	/FF2		PVDF, DN25 PN10
	/FF3		PVDF, ANSI 1/2"-150lbs
	/FF4		PVDF, ANSI 1"-150lbs
	/FP1		PP, DN15 PN10
	/FP2		PP, DN25 PN10
	/FP3		PP, ANSI 1/2"-150lbs
	/FP4		PP, ANSI 1"-150lbs
	/FS1		AISI 316 SS, DN15 PN10
	/FS2		AISI 316 SS, DN25 PN10
	/FS3		AISI 316 SS, ANSI 1/2"- 150lbs
	/FS4		AISI 316 SS, ANSI 1"- 150lbs
Mounting set	/MS		Wall/pipe for SS flow fitting
	/MP		Wall/pipe for PP or PVDF flow fitting
Material certificate	/M		3.1. according EN 10024 for wetted metal parts only

### Model ISC40FS Direct insertion subassemblies

#### A. Process temperature

- Model ISC40FS/SCS: Maximum 150°C (300 °F)
- Model ISC40FS-PCS: Maximum 100°C (210 °F)
- Model ISC40FS-FCS: Maximum 130°C (270 °F)

#### B. Process pressure

- Model ISC40FS/SCS : Max. 1.0 MPa (150 psi) at 150°C (300°F)
- Model ISC40FS-PCS : Max. 0.6 MPa (90 psi) at 20°C (70°F)
- Max. 0.1 MPa (15 psi) at 100°C (210°F)
- Model ISC40FS-FCS : Max. 1.0 MPa (150 psi) at 20°C (70°F)
- Max. 0.1 MPa (15 psi) at 120°C (250°F)

#### C. Wetted materials

- Model ISC40FS/SCS: AISI 316 Stainless steel
- Model ISC40FS-PCS: Polypropylene
- Model ISC40FS-FCS: PVDF (KYNAR®)
- All models : Viton O-ring, EPDM (only S2WN and STWN)

#### Non wetted materials

- Nut : AISI 304 Stainless steel

#### D. Process connection

- Model ISC40FS-SCS/PCS/FCS : 2" screw-in coupling

#### E. Shipping details

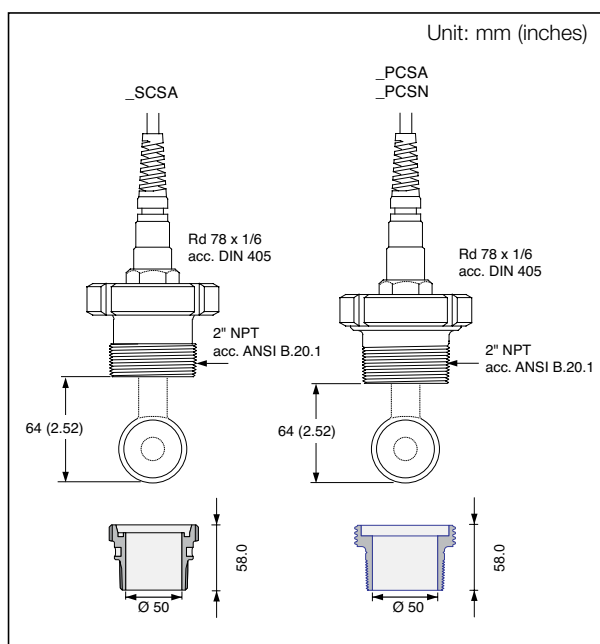
- Dimensions : Refer to section Dimensions
- Package : Normally packed with sensor
- Weight : 500 g. (1 lbs)

### Model and Suffix Codes

Model	Suffix	Option	Description
ISC40FS			Flow fitting subassembly
Material	-F		PVDF
-P			Polypropylene
-S			Stainless Steel
Process connection	-CS		Dairy Coupling screw-in*
	-CW		Dairy Coupling welded*
Thread type	-A		NPT
NPT or R	-N		No thread (for weld-in couplings)
Options	/M		Material certificate 3.1. EN 10024 (for wetted metal parts only)

\* Note: according to Din 11851

### Dimensions



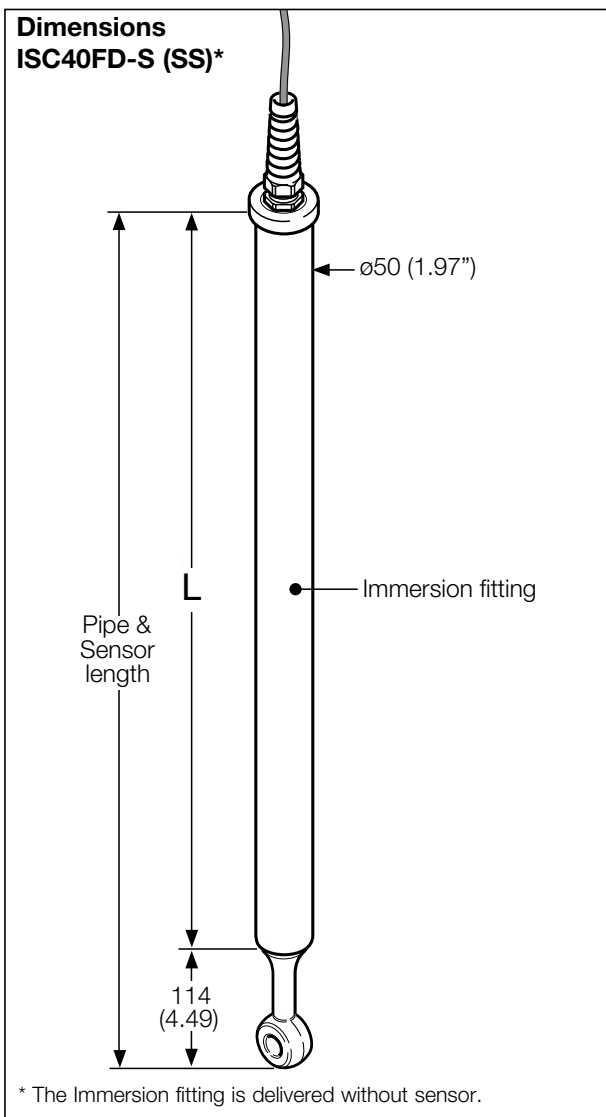
### Model ISC40FD Immersion fitting

- A. Process temperature** : Max. 80°C (180 °F) PVC  
: Max. 150°C (300 °F)  
AISI 316 Stainless steel
- B. Process pressure**  
- PVC : Max. 0.2 MPa (30 PSI) at 20°C (70°F)  
Max. 0.1 MPa (15 PSI) at 80°C (180°F)  
- AISI316 Stainless steel : 10 bar
- C. Wetted materials**  
- Probe tube : C-PVC  
- Process sealing O-ring : Viton  
- Flange : PVC (Optional)
- Non wetted materials**  
- Cable insulation : Thermoplastic rubber
- D. Process connection** :  
- Adjustable flange : Hole pattern according to DIN DN50-PN10 and ANSI 2" 150 lbs. Only for the PVC (Optional).  
- Mounting set : Galvanized steel (Optional).

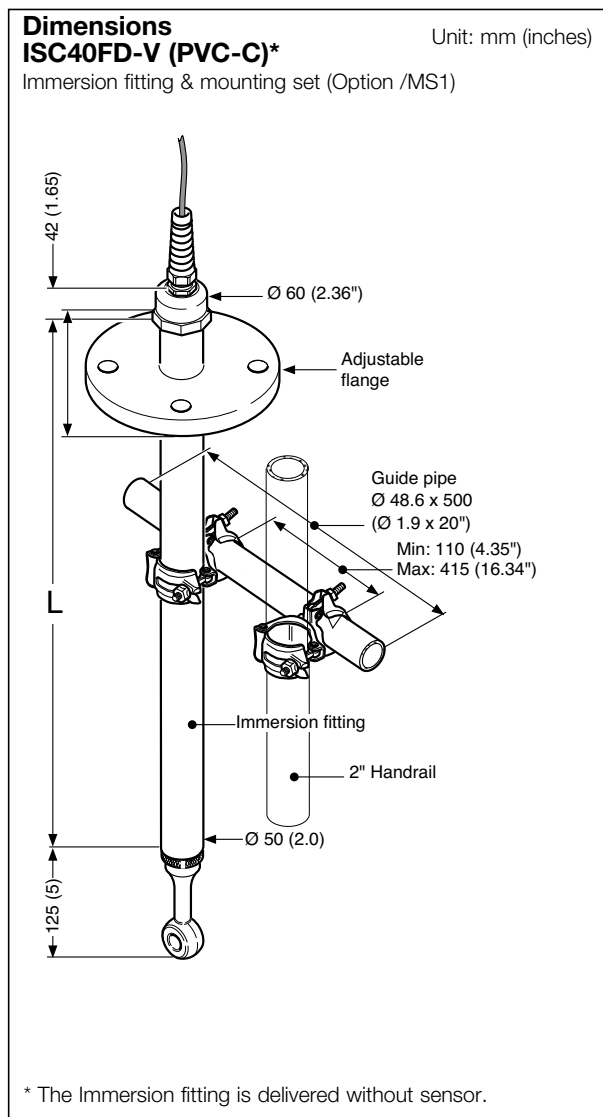
Note: Adjustable flange (/FA) is only for the PVC fitting

### Model and Suffix Codes

Model code	Suffix code	Option	Description
ISC40FD			Immersion fitting
Material -V	-S	PVC-C	AISI 316 Stainless steel
Pipe length	- □ □		Between 05 to 20 meter Example: 05 = 0.5 m
Flange -SFA -SFD	-NFL		No flange AISI316 SS 2" AISI316 SS DN50
Options	/MS1		Pipe mounting set (Carbon steel)
	/FA		Adjustable flange with DIN DN50-PN10 and ANSI 2" 150 lbs hole pattern (only for PVC)
	/PH5		Protection hose for 5 m cable
	/PH10		Protection hose for 10 m cable
Material certificate	/M		3.1. according EN 10204 (for wetted metal parts only)



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## ISC40G(S)-TF Model

### Model and Suffix Codes

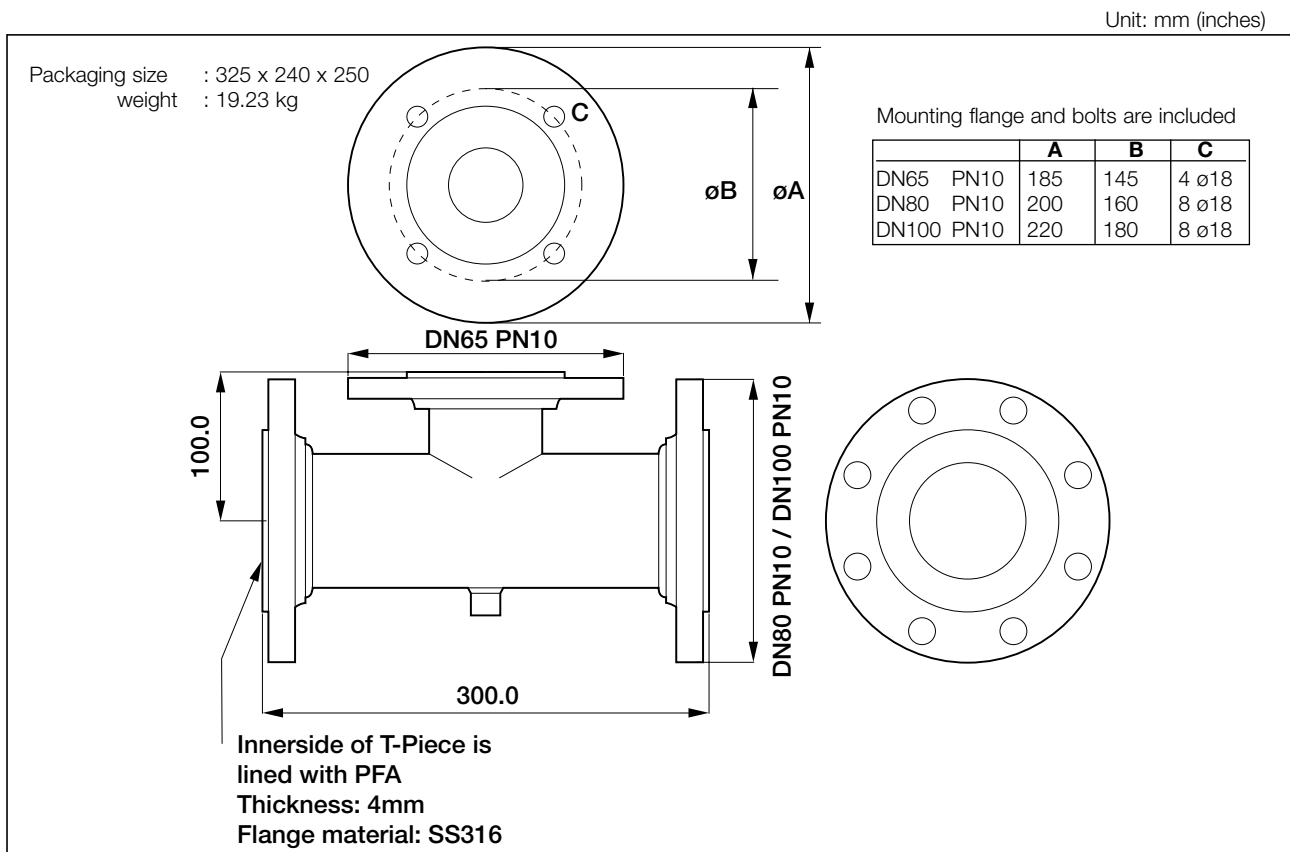
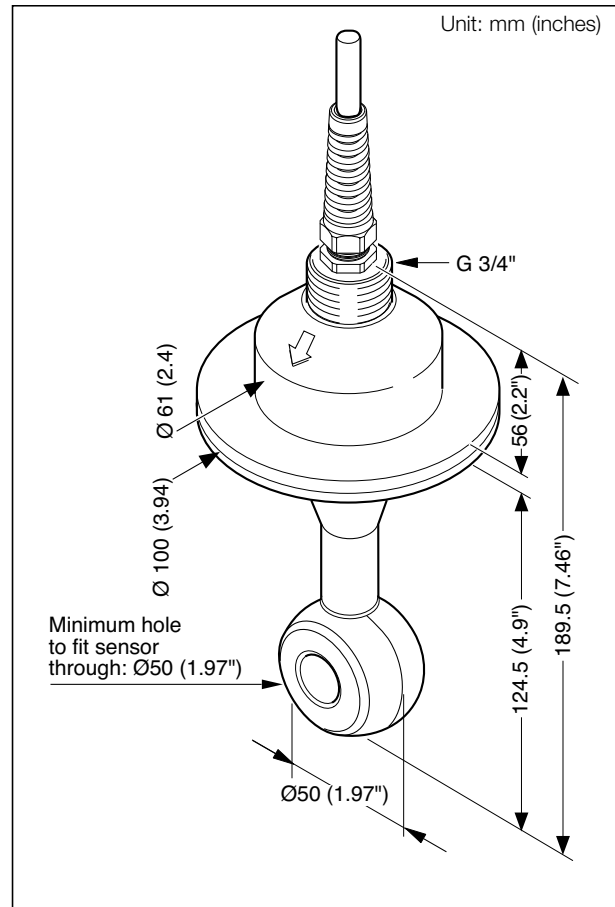
Model	Suffix	Option	Description
ISC40G-TF			General purpose, PFA, flange model
ISC40S-TF			Intrinsically safe, PFA, flange model
Temperature sensor	-T1		Pt1000
	-T3		30kNTC
Cable length	-03		03 mtr
	-05		05 mtr
	-10		10 mtr
	-15		15 mtr
	-20		20 mtr
Protection hose for -TF sensor	/PH□□		03m, 05m, 10m, 15m, 20m (the same length as the cable)
Certificates	/M		Material certificate (only apply to SS316 wetted part)
	/Q		Quality certificate

Part no.	Option	Description
K1500CJ	/PH05	05 meter protection hose
K1500CK	/PH10	10 meter protection hose
K1500EM	/PH25	25 meter protection hose

### T-Piece ISC40-TF

Partno.	Flanges	Description
K1500HG	DN80 PN10	T-Piece, DN80 Flange
K1500HF	DN100 PN10	T-Piece, DN100 Flange
K1500HP	DN65	Gore-Tex seal for ISC40-TF (DN50)
K1541GX	DN65	DN65, DN10 Flange

## ISC40-TF



T-Piece for ISC40-TF Inductive Conductivity sensor

GS 12D8J2-E-E

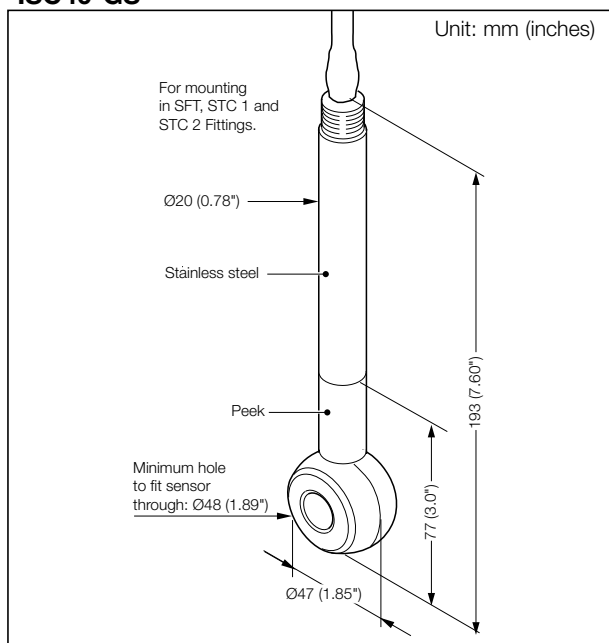
## ISC40G(S)-GS Model

### Model and Suffix Codes

Model	Suffix	Option	Description
ISC40G-GS			General purpose, glass filled PEEK, shaft model
ISC40S-GS			Intrinsically safe, glass filled PEEK, shaft model
Temp. sensor	-T1 -T3		Pt1000 30kNTC
Cable length	-03 -05 -10 -15 -20		03 mtr 05 mtr 10 mtr 15 mtr 20 mtr
Flange adapters for -GS sensor	/SFT1 /STC1 /STC2		AIS316 SS Sanitary Tuchenhausen AIS316 SS Sanitary 2" Tri-clamp* AIS316 SS Tri-clamp*
Certificates	/M /Q		Material certificate (only applies to SS316 wetted part) Quality certificate

\* according to ISO 2852

### ISC40-GS

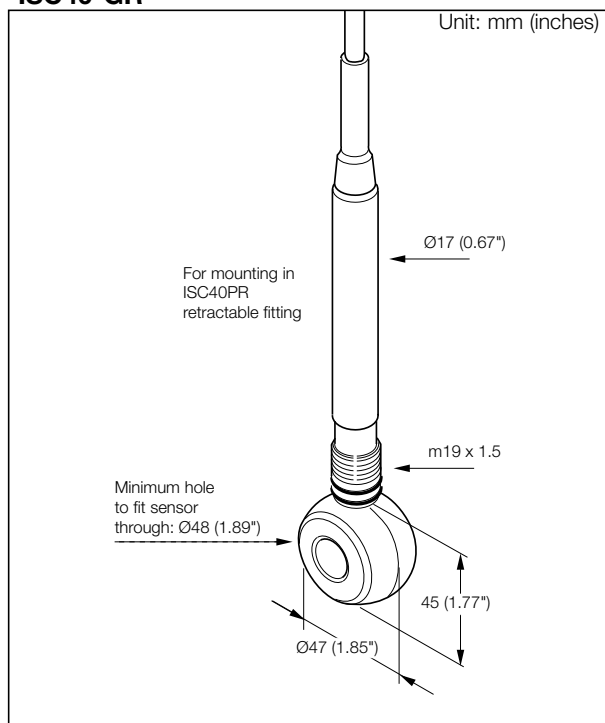


## ISC40G(S)-GR Model

### Model and Suffix Codes

Model	Suffix	Option	Description
ISC40G-GR			General purpose, glass filled PEEK, retractable model
ISC40S-GR			Intrinsically safe, glass filled PEEK, retractable model
Temp. sensor	-T1 -T3		Pt1000 30kNTC
Cable length	-03 -05 -10 -15 -20		03 mtr 05 mtr 10 mtr 15 mtr 20 mtr
Certificates	/M /Q		Material certificate (only applies to SS316 wetted part) Quality certificate

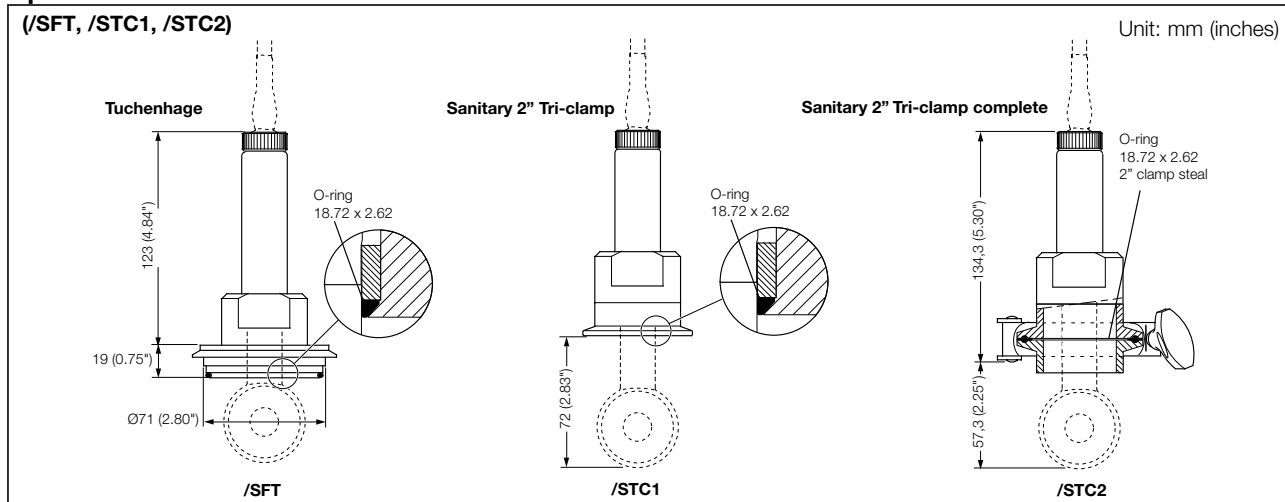
### ISC40-GR



**Note:** for retractable fitting PR10 please check GS12D8J2-01E-E

### Options for -GS Sensor

(/SFT, /STC1, /STC2)



GS 12D8J2-E-E



**Chemical Compatibility Chart**

			Material						
			PVDF (Kynar)	S.S. 316	VITON	PEEK	PP	PVC	PFA
			Temp. °C % Conc.	20 60 100	20 60 100	20 60 100	20 60 100	20 60	20 60
Inorganic acid	Sulfuric acid	10	0 0 0	X X X	0 0 0	0 0 0	0 0	0 X	0 0 0
		50	0 0 0	X X X	0 0 0	0 0 X	0 0	0 0	0 0 0
		95	0 X -	X X X	0 0 0	- - -	X -	X X	0 0 0
		fuming	- - -	- - -	0 0 0	- - -	- -	- -	0 0 0
	Hydrochloric acid	10	0 0 0	- - -	0 0 0	0 0 X	0 0	0 X	0 0 0
		sat.	0 0 0	- - -		0 0 X	0 0	0 0	0 0 0
	Nitric acid	25	0 0 X	X X X	0 0 X	0 0 0	0 0	0 X	0 0 0
		50	0 0 X	X X X	- - -	X X X	X -	0 X	0 0 0
		95	0 X -	0 0 0	- - -	- - -	- -	- -	0 0 0
		fuming	- - -	0 0 0	- - -	- - -	- -	- -	0 0 0
	Phosphoric acid	25	0 0 0	- - -	0 0 0	0 0 0	0 0	0 X	0 0 0
		50	0 0 0	X X X	0 0 0	0 0 0	0 0	0 0	0 0 0
95		0 0 0	0 0 0	X X -	0 0 0	0 0	0 0	0 0 0	
Hydrofluoric acid	40	0 0 0	- - -	0 0 0	- - -	0 0	0 X	0 0 0	
	75	0 0 0	- - -	0 0 0	- - -	0 0	X X	0 0 0	
	Organic acid	Acetic acid	10	0 0 0	0 0 X	- - -	0 0 0	0 0	0 X
glacial			0 X -	0 0 X	- - -	0 0 X	0 X	X X	0 0 0
Formic acid		80	0 0 0	X X X	- - -	X X X	0 0	0 -	0 0 X
Citric acid		50	0 0 0	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0 0
Alkali	Calcium hydroxide	sat.	0 0 0	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0 0
	Potassium hydroxide	50	0 0 X	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0 0
	Sodium hydroxide	40	0 0 X	0 0 0	X X X	0 0 0	0 0	0 X	0 0 0
	Ammonia in water	30	0 0 0	0 0 0	X X X	0 0 0	0 0	0 X	0 0 0
Acid salt	Ammonium chloride	sat.	0 0 0	X X X	0 0 0	0 0 0	0 0	0 0	0 0 0
	Zinc chloride	50	0 0 0	X X X	0 0 0	0 0 0	0 0	0 0	0 0 0
	Iron (III) chloride	50	0 0 0	- - -	0 0 0	0 0 0	0 0	0 0	0 0 0
Basic salt	Sodium sulfite	sat.	0 0 0	0 0 0	- - -	0 0 0	0 0	0 0	0 0 0
	Sodium carbonate	sat.	0 0 0	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0 0
	Neutral salt	Potassium chloride	sat.	0 0 0	X X X	0 0 0	0 0 0	0 0	0 0
Sodium sulfate		sat.	0 0 0	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0 0
Calcium chloride		sat.	0 0 0	X X X	0 0 0	0 0 0	0 0	0 0	0 0 0
Sodium chloride		sat.	0 0 0	X X X	0 0 0	0 0 0	0 0	0 0	0 0 0
Sodium nitrate		50	0 0 0	X X X	0 0 0	0 0 0	0 0	0 0	0 0 0
Aluminium chloride		sat.	0 0 0	- - -	0 0 0	0 0 0	0 0	0 0	0 0 0
Oxidizing agent	Hydrogen peroxide	30	0 0 0	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0 0
	Sodium hypochloride	50	0 0 0	X X X	0 0 X	0 0 0	X X	X X	0 0 0
	Potassium dichromate	sat.	0 0 0	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0 0
	Chlorinated lime		0 X -	X X X		X X X	- -	0 0	0 0 0
Organic solvent	Ethanol	80	0 0 X	0 0 0	X - -	0 0 0	0 0	0 X	0 0 0
	Cyclohexane		0 0 X	0 0 0	0 0 0	0 0 0	- -	0 0	0 0 0
	Toluene		0 0 0	0 0 0	- - -	0 0 0	X -	- -	0 0 0
	Trichloroethane		X X X	0 0 X	X X X	0 0 0	- -	- -	0 0 0
	Water		0 0 0	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0 0

O = can be used,  
 X = shortens useful life,  
 - = cannot be used

**Note:** Information in this list is based on our general experience and literature data and given in good faith.  
 However Yokogawa is unable to accept responsibility for claims related to this information.

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# General Specifications

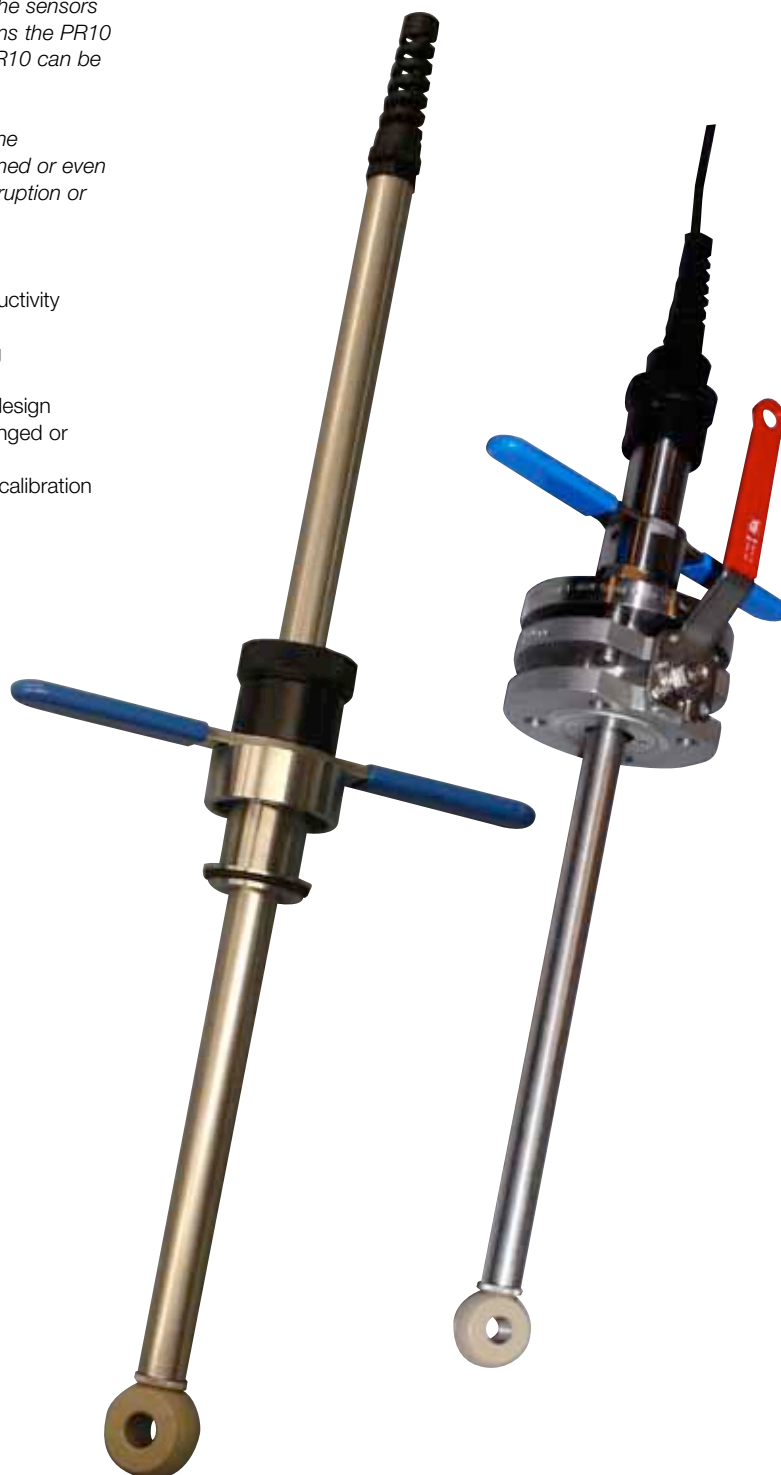
Model PR10  
Inductive Conductivity  
Retractable fitting

*On-line measurements always present extra challenges compared to at-line measurements. For example when maintenance needs to be done. Applications where the sensors has to be removed without interruptions or shut-downs the PR10 is especially suitable. Without any special tools the PR10 can be retracted safely from the process up to 5 bar.*

*For easy of use optional flush ports are available. In the retracted position the sensor can be kept moist, cleaned or even calibrated. This can all be done without process interruption or disassembly of the armature.*

## Features

- One model for pH, conductivity and inductive conductivity sensors
- Build in scraper to avoid contamination of the fitting
- Usable for wide range of sensors
- A safe "through the valve" insertion and retraction design
- Simplified installation by optional ball valves with flanged or tapered connections
- Optional flush port for keeping moist, cleaning and calibration



## General Specifications

### A. Wetted materials

- For sensor check Instruction Manual
- Stainless steel AISI 316L
- O-ring seals: Viton 70° shore

### B. Non-wetted materials

- For sensor check Instruction Manual
- Stainless steel AISI 316, 304
- Polypropylene glass filled

### C. Insertion length

- Ref. mechanical drawing Fig. 2 - 5.

### D. Pressure/temperature ratings

- Static conditions: see FIG. 1.
- Operating conditions during extraction and insertion max. 500kPa, max. 100°C

### E. Flange ratings:

- DIN flange DN50 PN10
- ANSI flange 2" 150 lbs

### F. Specifications of the sensor used

- Please check sensor specifications

### G. Weight

- Approx 2.5 kg excl. ball valve

### H. ISC40G(S)-GR

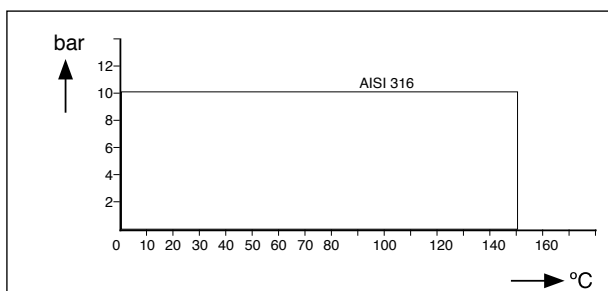
Wetted parts

- Sensor : Victrex PEEK
- Sealing gasket : Viton
- Process adapters : PR10

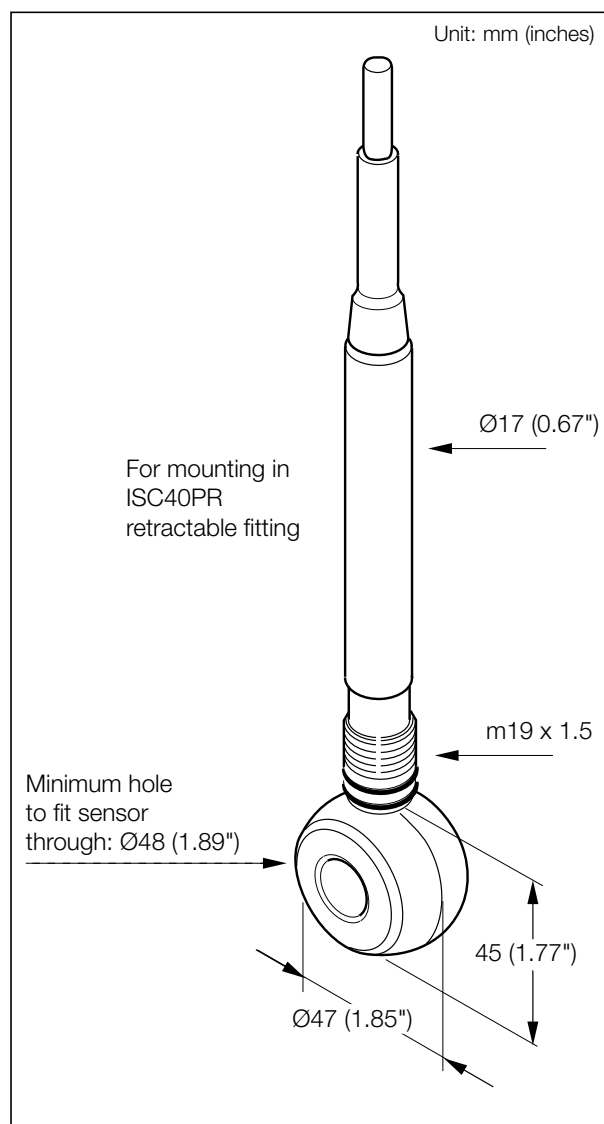
**Table 1 Model and Suffix Codes**

Model	Suffix	Option	Description
ISC40G-GR			General purpose, glass filled PEEK, retractable model
ISC40S-GR			Intrinsically safe, glass filled PEEK, retractable model
Temp. sensor	-T1 -T3		Pt1000 30kNTC
Cable length	-03 -05 -10 -15 -20		03 mtr 05 mtr 10 mtr 15 mtr 20 mtr

**Note:** option Q is now standard delivered



**FIG. 1 Pressure / Temperature graphic**



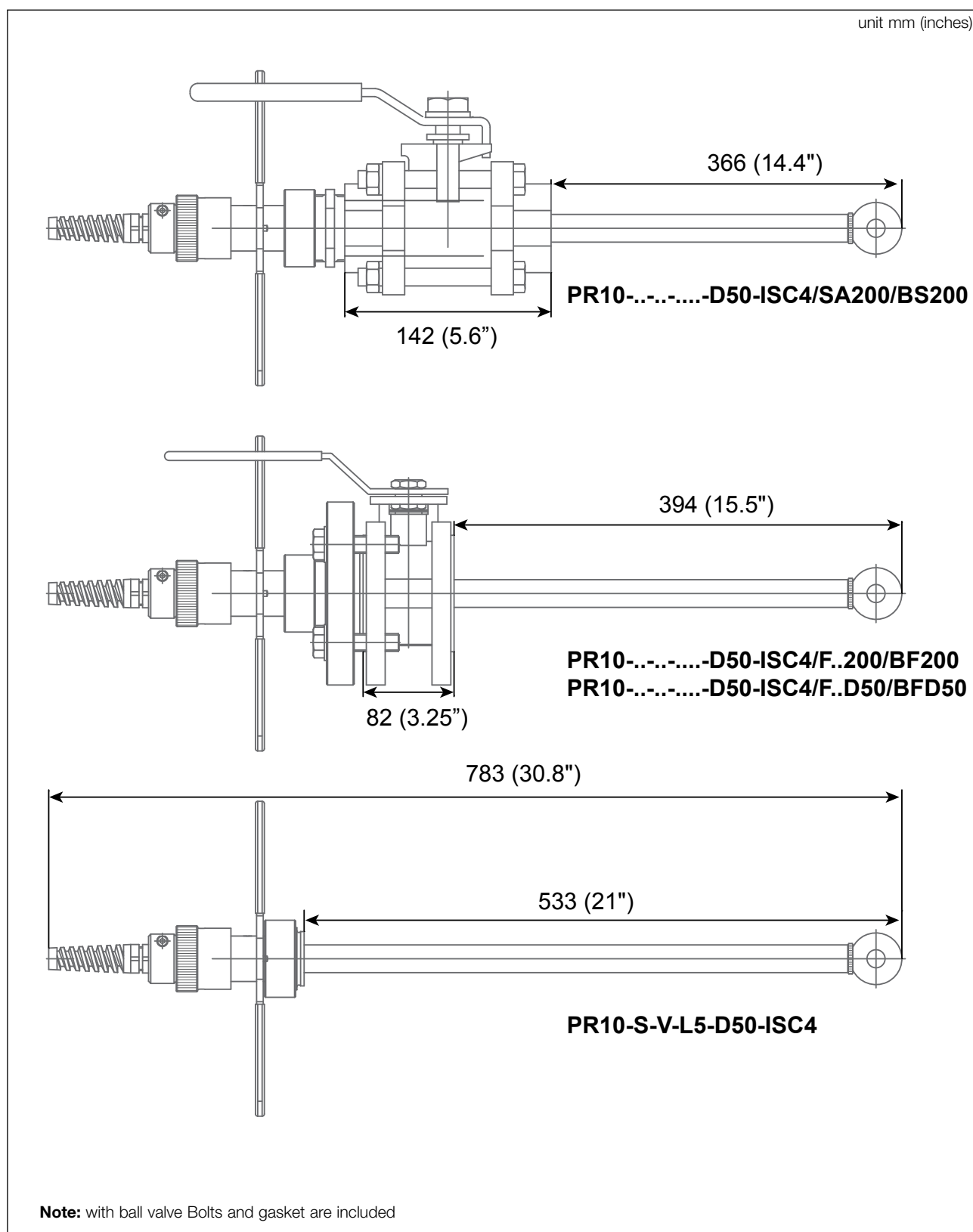
**Fig. 2 ISC40-GR**

**Table 2 Model and suffix codes**

Model	Suffix	Option	Description
<b>PR10</b>			<b>Retractable Conductivity Fitting 19 mm</b>
Fitting	-S		SS Type AISI 316
O-ring	-V		Viton O-ring sealing
Tube length	-L5		0.5 meter tube length
Connection	-D50		DN50 / 2" mounting
Sensor adapter for	-ISC4		ISC40
Screw-in adapters (SS AISI 316)		/SA200	ISO 228/1 G2 to 2" M-NPT
Flange adapters (SS AISI 316)		/FA200 /FN200 /FAD50 /FND50	Flange adapter drain 2" 150 lbs Flange adapter no drain 2" 150 lbs Flange adapter drain DN50 PN10 Flange adapter no drain DN50 PN10
Weld-in adapter (SS AISI 316)		/WA200	Straight weld-in adapter ISO 228/1 G2
Ball valves (SSI AISI 316)		/BF200 /BFD50 /BS200	Flanged ball valve 2" 150 lbs Flanged ball valve DN50 PN10 Screw-in ball valve 2" F-NPT
Certificate		/M	3.1 according EN 10024 for wetted metal parts

**\*Note:** With a ball valve, either a screw-in or flanged adapter is required  
**Note:** Please order the K1525AF O-ring pick-up tool for maintenance purposes

## Dimensions



**Fig. 3 Dimensional drawing PR10...-D50 with mounted ISC40 sensor**

# Options PR10

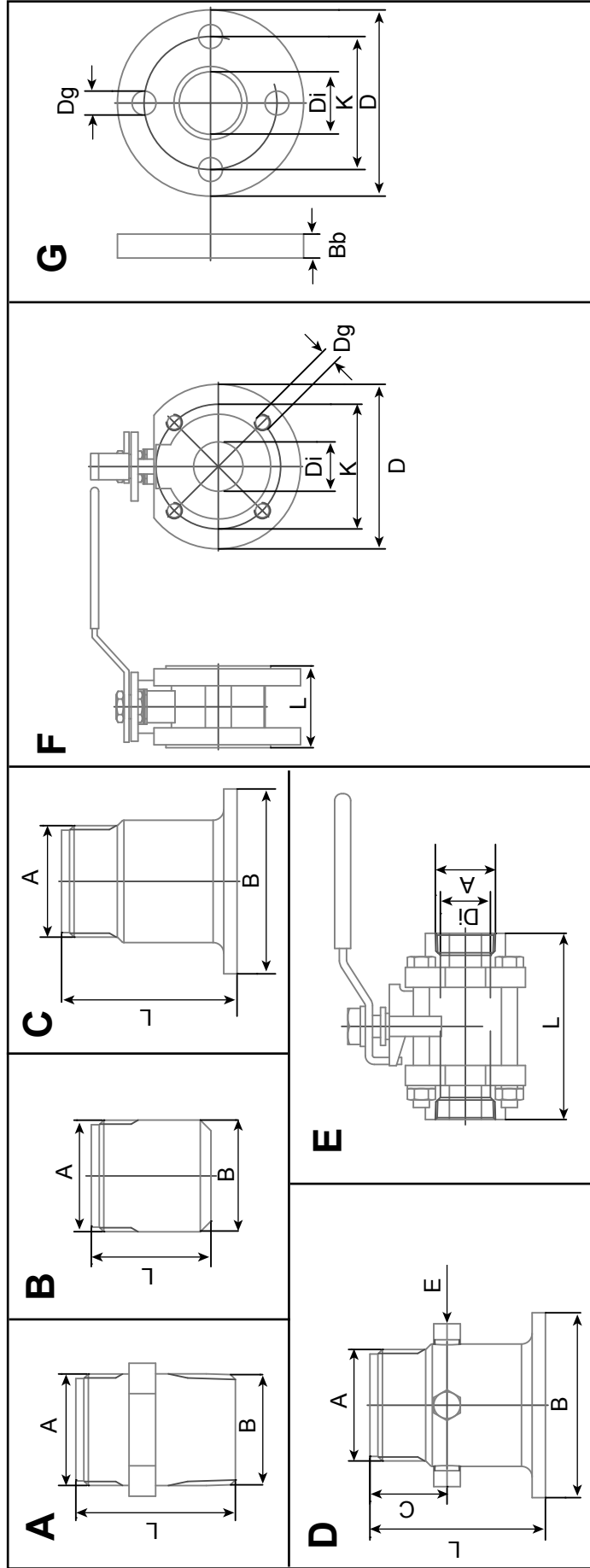


FIG. 4 Dimensions of the PR10 options

Table 3 Dimensions options in mm (inches)

Option	Description	Fig.	A	B	L	C	Bb	D	E	Di	Dg	K
/SA200	ISO 228/1 G2 to 2" M-NPT	A	ISO 228/1 - G2	2" NPT	58 (2.3)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/FA200	Flange adapter drain 2" 150 Lbs	D, G	ISO 228/1 - G2	101 (4)	77 (3)	32 (1.3)	25 (1)	165 (6.5)		73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/FN200	Flange adapter no drain 2" 150 Lbs	C, G	ISO 228/1 - G2	101 (4)	54 (2.1)	32 (1.3)	25 (1)	165 (6.5)		73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/FAD50	Flange adapter drain DN50 PN10	D, G	ISO 228/1 - G2	101 (4)	77 (3)	32 (1.3)	25 (1)	165 (6.5)	1/8" NPT	73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/FND50	Flange adapter no drain DN50 PN10	C, G	ISO 228/1 - G2	101 (4)	54 (2.1)	32 (1.3)	25 (1)	165 (6.5)		73 (2.9)	19 (0.7)	120-125 (4.7)-(4.9)
/WA200	Straight weld-in adapter ISO 228/1 G2	B	ISO 228/1 - G2	49 (1.9)	45 (1.8)			150 (5.9)		50 (2)	M16	121 (4.8)
/BF200	Ball-valve flanged 2" 150 Lbs	F			82 (3.2)			165 (6.5)		50 (2)	M16	125 (4.9)
/BFD50	Ball-valve flanged DN50 PN10	F			82 (3.2)					50 (2)		
/BS200	Ball-valve screw-in 2" F-NPT	E	2" NPT		142 (5.6)							

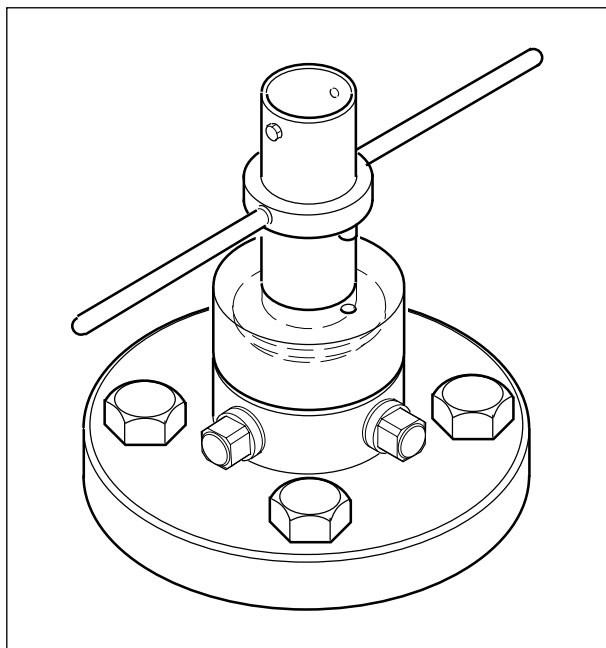
GS 12D8J2-01E-E

**Table 4 Spareparts**

K1525AP	Adapter SC4A - ISC40
K1525AA	Outer tube
K1525AF	O-ring pick up tool
K1525BB	O-ring set PR10-S-V-L5-D50
K1525BC	Key set
K1525BD	Squeezing set
K1525BE	Set M16 bolt & washer (8 pcs)
K1525BF	Set M14 bolt & washer (8 pcs)
K1525BG	Gaskets ball valves - D50 + 2"
K1525YD	PR10/FA200 - FAD50
K1525YE	PR10/FN200 - FND50
K1525YJ	PR10/WA200
K1525YL	PR10/BF200
K1525YN	PR10/BFD50
K1525YQ	PR10/BS200
K1541EM	Adapter 2" NPT-G2 SS (ISC40PR/B)

**Drain port connection**

The PR10 retractable fitting can be equipped with optional drain (or flush) ports on the flanged adapter. The drain ports are tapered 1/8" NPT female for small diameter connectors.

**Fig. 5 Drain Port Connection**





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## Dissolved Oxygen Analyzers

## Dissolved Oxygen Analyzers

# General Specifications

Model DO402G  
Converter for Dissolved Oxygen

EXA  
CE

*Flexibility, reliability and low maintenance are among the benefits provided by the EXA DO402G dissolved oxygen converter. Designed to meet the exacting requirements of measuring dissolved oxygen in the modern industrial environment, it contains many features to ensure the best precision whatever the application.*

*This 4-wire converter is housed in a robust IP65 field mountable case. Two mA outputs, four relays, digital communication and a clear LCD make the DO402G a truly comprehensive package.*

*The DO402G features PI control on both the auxiliary mA output and the pulse proportional relay outputs, thus avoiding the need for a separate controller.*

*The famous EXA sensor diagnostics are now expanded with a logbook facility in combination with the RS485 two wire communication software option. This can be used to record events like calibration and diagnostic messages, and to update configuration of the converter remotely.*

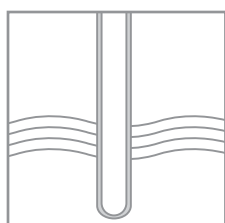
*The DO402G accepts inputs from both galvanic and polarographic sensors. Percent saturation, mg oxygen/l water, and ppm DO can be displayed and transmitted. Compensation for atmospheric pressure altitude, salinity and temperature are included for the best accuracy of measurement.*



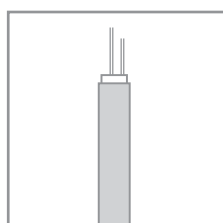
## Features

- Versatile sensor inputs
- On-line sensor checking monitors integrity of membrane
- RS485 communications interface
- Event logbook in software
- Four fully configurable SPDT contact outputs
- Two fully configurable mA outputs
- Built-in PI controller
- Easy to use EXA control panel

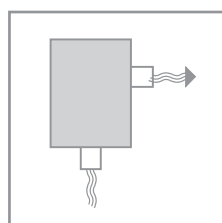
## System configuration



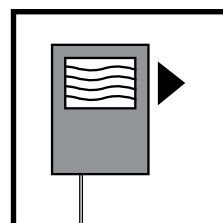
Sensors



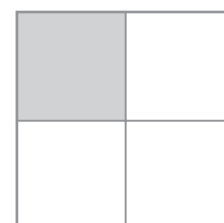
Cables



Fittings



Transmitters



Accessories

YOKOGAWA ◆

GS 12J6B3-E-E  
6th Edition

## Accurate dissolved oxygen

### Operating principles

The DO402G uses membrane covered electrochemical sensors for the detection of dissolved oxygen in water. Dissolved gaseous oxygen diffuses through the membrane, and gives rise to a reaction at the electrodes. The resulting current is proportional to the oxygen concentration in the process solution. The DO402G can be used with both galvanic and polarographic sensors, giving added flexibility in a wide range of applications.

### Display functions and ranges

The display continuously gives you all necessary information at a glance. The process values are shown in easy readable programmable units. Either mg/l, % saturation or ppm can be chosen.

The user-interface is simplified to a basic set of 6 keys accessible through the flexible window cover. It uses a simple step by step, question and answer style to communicate with the operator by giving messages on the second line of the display and indicating which keys are to be pressed in the display.

### Automatic air calibration

Calibration for a dissolved oxygen instrument is performed by simple air calibration.

Criteria for automatic calibration (stabilization time, DO values) can be set to suit the sensor.

In addition to the air calibration three additional calibration procedures can be used:

1. Span calibration using air saturated water
2. Zero calibration using sulfite saturated water
3. Process calibration using laboratory reference method

### Automatic wash cleaning

The DO402G can be used to generate a contact closure to control a wash cleaning cycle. The interval, wash and recovery times are adjustable for optimum operation. Yokogawa immersion assemblies can be supplied with wash cleaning nozzles to provide on line cleaning for the sensor membrane.

### Salinity compensation

In order to take the effect of salinity into account for oxygen measurement an average chloride concentration can be programmed. The chloride concentration value is set manually via the service level. The EXA DO402G takes account of the effects of salinity and temperature simultaneously. The advantage of this is the influence of salt concentration temperature have on the solubility of oxygen is automatically compensated, for highly accurate analyses, without the need for a conversion table.

### Spare parts DO402G

Part no.	Description
K1500AU	Gland set 1/2 inch for EXA's
K1541KR	/PM panelmounting for EXA400/402
K1542KW	/U pipe/wall mounting for EXA
K1543AC	Securing screw set, EXA402
K1543BE	Eprom + latest software DO402G
K1543KS	Hingepin for EXA400/402
K1543ST	/SCT for EXA400/402
K1543WM	Sparepart RS485 converter

### Temperature compensation

The micro-processor makes an accurate temperature compensation possible that performs well over the entire range of the instrument. No further adjustment tables are required.

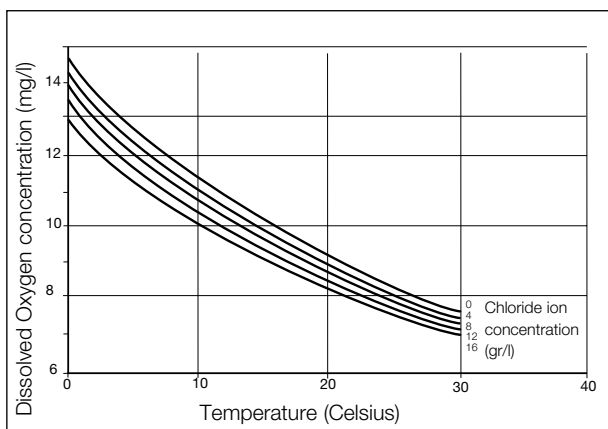
### Barometric air pressure compensation

Air pressure differences, due to weather conditions or altitude, can cause a variation up to 20 % in the dissolved oxygen concentration. A built-in air pressure sensor automatically compensates for barometric influences between 900 to 1100 mbar (90 to 110 kPa).

### Sensor diagnostics

The YOKOGAWA DO sensor is checked for low impedance between the silver electrode and an earth connection in the liquid, to detect membrane integrity. Temperature sensor connections and sensor connections are checked for impedance. These faults are signaled by the FAIL contact and can be signaled to the control room by an output of 22 mA or 3.5 mA (0 mA) (Burn out). The fault is also signaled by a special marker held on the display, a LED on the front and an error code in the message display. During calibration of a DO measuring system the slope deviation from nominal value (%) and sensor output (µA) at 0 mg/l are calculated and checked.

If any of these are outside the limits, an error is signaled.



## Output signals

The standard DO402G features two 0-20 mA or 4-20 mA current outputs available for recording, and indication or control functions. The user selectable outputs can represent:

- dissolved oxygen mg/l or ppm
- saturation value %
- measured temperature value

In addition the following output functions are available:

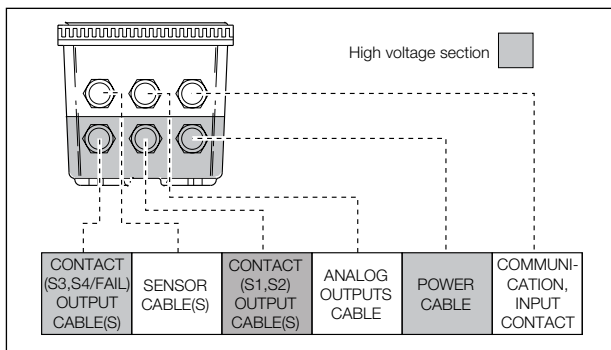
- a "HOLD" function that maintains last measured value or a fixed value until return to normal operation
- a "BURN" function that gives a high or low output at fail status
- a programmable output function that allows the user to linearize the output(s).
- a damping time constant can be set to even out random process fluctuations that can make the real value difficult to see.

The EXA DO402G is equipped with RS485 communication ability. Communication lines are isolated from the input and output signals. Communication speed is selectable from 1200, 2400, 4800, 9600 baud. The format is selectable for even, odd, and no parity. The DO402G can be configured over this 2-way communication link.

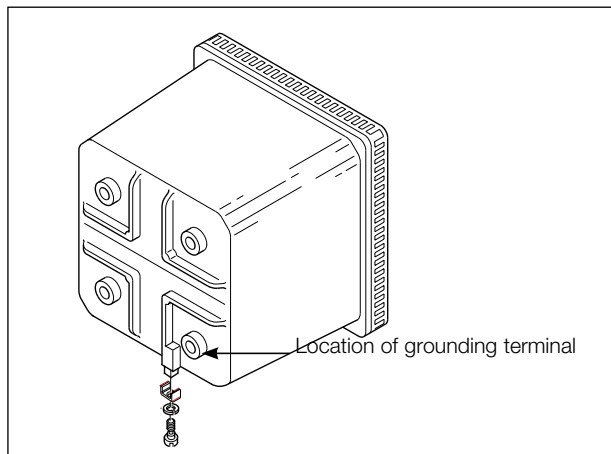
## Cables and terminals

The DO402G is equipped with terminals suitable for the connection of finished cables in the size range of 0.13 to 4 mm<sup>2</sup> (26 to 12 AWG)

The glands will form a tight seal on cables of outside diameter in the range 7 to 12 mm ( $\frac{9}{32}$ " to  $\frac{15}{32}$ ").



## Glands to be used for cabling

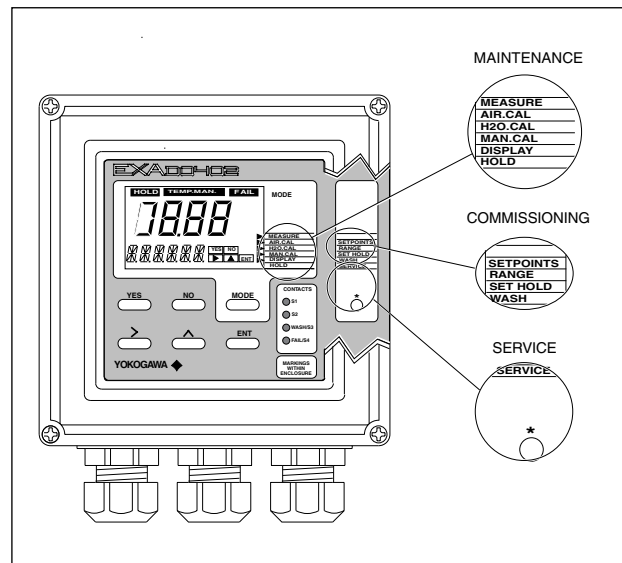


## Grounding

## Three level operation

The EXA DO402G converter uses a 3-level operating system to take full advantage of the microprocessor while retaining the traditional simplicity of analog converters. Advanced functions are separated from conventional operation to avoid confusion. They can be activated as required for each individual application.

1. The normal maintenance functions are accessible through the flexible window by pushing the keys underneath.
2. Functions required to commission the instrument are hidden to discourage unauthorized tampering. The front cover is removed to reveal the commissioning menu and the hidden access key (marked \*).
3. Specialized functions can be adjusted via the SERVICE menu. In this case access is by using "service codes."



## Three level operation

### MAINTENANCE level

- Use : Normal operation and checking  
 How : Simple operation by dialog through the closed front cover  
 Example : Calibration

### COMMISSIONING level

- Use : For normal commissioning  
 How : Removal of the front cover reveals the access key and second menu  
 Example : Output range setting

### SERVICE level

- Use : Only for specialized functions  
 How : Through special service code entries  
 Example : Selecting salinity compensation

With this 3-level user-friendly approach, the instrument can be operated by anyone. Commissioning is straight-forward and needs no calibration equipment compared to analog instruments. Special functions available via access codes are invisible during normal operation. All three levels can be separately protected against unauthorized access by a password system using a three digit code.

## General Specifications

**A. Input specifications:** The DO402G Dissolved Oxygen converter measures the current that is generated by the Dissolved Oxygen sensor. The flexibility of the input circuit allows the use of many commercially available sensors, whether they are of the Galvanic type (Driving Voltage generated internally) or Polarographic type (driving voltage supplied by converter). The input range varies from 0.0 nA up to 500 nA for polarographic sensors and 0.0 to 50  $\mu$ A for galvanic sensors. Temperature measurement for automatic temperature compensation utilizes Pt100, Pt1000, 22k NTC or Pb36 NTC as used in DOX8 and DO30 sensors.

### B. Input ranges

- Dissolved Oxygen : 0- 50 mg/l (ppm)
- Temperature : 0- 50 °C (32- 122 °F)

### C. Span

- DO concentration : minimum: 1 mg/l (ppm)  
maximum: 50 mg/l (ppm)
- % saturation : minimum: 10 %  
maximum: 300 %
- Temperature : minimum: 0 °C (32 °F)  
maximum: 50 °C (122 °F)

### D. Transmission signals

- : Two isolated outputs of 0/4-20 mA DC with common negative. Maximum load 600  $\Omega$ . Auxiliary output can be chosen from temperature, DO, PI control, table, burn up (22 mA) or burn down (0 or 3.5 mA) to signal failure.

### E. Temperature compensation

- : 0-50 °C
- Sensor types: Pt100, Pt1000, Pb36 NTC (Yokogawa compatible), 22k NTC (Ingold compatible)
- Automatic or Manual temperature compensation.

### F. Calibration

- : Semi-automatic calibration with automatic compensation for influence of barometric pressure and altitude on partial pressure of Oxygen in air (or solubility of Oxygen in water). Automatic compensation for influence of salinity of water on solubility of Oxygen in water is programmable. The correction for pressure, salinity and temperature meets ISO 5814

Possible calibration routines are:

- Slope (span) calibration in ambient air. The calibration table is based on 70% rH and is determined empirically.
- Slope (span) calibration in water, saturated with air: according ISO 5814
- Zero calibration (normally inactive)

### G. Serial communication

- : Bi-directional according to the EIA-485 standard using HART®-protocol and PC402 software.

### H. Logbook

- : Software record of important events and diagnostic data. Available through RS485, with key diagnostic information available in the display.

### I. Display

- : Custom liquid crystal display, with a main display of 31/2 digits 12.5 mm high. Message display of 6 alpha-numeric characters, 7 mm high.

### J. Contact outputs

- General : Four (4) SPDT relay contacts with LED indicators. For S1, S2, and S3, the LED is on when relay is powered.

**Note:** For S4 (FAIL) LED lights when power is removed (Fail safe).

- Contact outputs configurable for hysteresis and delay time.
- Switch capacity : Maximum values 100 VA, 250 VAC, 5 Amps.  
Maximum values 50 Watts, 250 VDC, 5 Amps.

- Status : High/low process alarms, selected from process parameter and temperature.  
Contact output is also available to signal "Hold active"

- Control function : On / Off  
PI pulsed : Proportional duty cycle control with integral term.

- PI frequency : Proportional frequency control with integral term. In addition wash cleaning control signal on S3, and FAIL alarm for system and diagnostic errors on S4.

### K. Contact input

- : Remote wash cycle start.

### L. Power supply

- : 230 VAC  $\pm$ 15%, 50/60 Hz, maximum consumption 10 VA.  
115 VAC  $\pm$ 15%, 50/60 Hz, maximum consumption 10 VA.  
100 VAC  $\pm$ 15%, 50/60 Hz, maximum consumption 10 VA.  
24 VDC -20% / +30%, maximum consumption 10 Watts.

### M. Shipping details

- : Package size w x h x d  
290 x 225 x 170 mm.  
11.5 x 8.9 x 6.7 in.  
Packed weight approx. 2.5 kg (5 lb).



## Operating Specifications

### A. Performance : DO (at t process = 25 °C)

- Linearity :  $\leq 0.03 \text{ mg/l} \pm 0.02 \text{ mA}$
- Repeatability :  $\leq 0.03 \text{ mg/l} \pm 0.02 \text{ mA}$
- Accuracy :  $\leq 0.05 \text{ mg/l} \pm 0.02 \text{ mA}$

### B. Performance : Temperature (Pt1000, Pb36 NTC, 22k NTC)

- Linearity :  $\leq 0.3 \text{ °C} \pm 0.02 \text{ mA}$
- Repeatability :  $\leq 0.1 \text{ °C} \pm 0.02 \text{ mA}$
- Accuracy :  $\leq 0.3 \text{ °C} \pm 0.02 \text{ mA}$

#### Performance : Temperature (Pt100)

- Linearity :  $\leq 0.4 \text{ °C} \pm 0.02 \text{ mA}$
- Repeatability :  $\leq 0.1 \text{ °C} \pm 0.02 \text{ mA}$
- Accuracy :  $\leq 0.4 \text{ °C} \pm 0.02 \text{ mA}$

### C. Response time

- 0- 90% : 10 s

**Note:** The specifications are expressed with simulated inputs, because the DO402G can be used with many different sensors with their unique characteristics.

### D. Ambient operating temperature

- : -10 to + 55 °C (10 to 131 °F)
- Excursions to -30 °C do not influence the current output function, and excursions to +70 °C are acceptable too.

### E. Storage temperature

- : -30 to +70 °C (-20 to 160 °F)

### F. Humidity

- : 10 to 90% RH non-condensing.

### G. Housing

- Case : Cast aluminum with chemically resistant coating
- Cover : Flexible polycarbonate window
- Case color : Off-white
- Cover color : Moss green
- Cable entry : Via six 1/2" polyamide glands
- Cable terminals : For up to 2.5 mm<sup>2</sup> finished wires
- Protection : Weather resistant to IP65 and NEMA 4X standards
- Mounting : Pipe wall or panel, using optional hardware.

### H. Data protection

- : Non-volatile memory for configuration and logbook, and lithium battery for clock support.

### I. Watchdog timer

- : Checks microprocessor.

### J. Automatic safeguard

- : Return to measuring mode when no keystroke is made for 10 min.

### K. Power interruption

- : Less than 50 milliseconds no effect. More than 50 milliseconds reset to measurement.

### L. Operation protection

- : 3-digit programmable password.

### M. Safety and EMC conforming standards

- Safety : conforms to EN 61010-1  
CSA C22.2 No. 1010.1 certified
- EMC : EN 61326-1 Class A, Table 2  
(For use in industrial locations)  
EN 61326-2-3  
EN 61000-3-2 Class A  
EN 61000-3-3
- Installation altitude : 2000 m or less
- Category based on IEC 61010 : II (Note)
- Pollution degree based on IEC 61010 : 2 (Note)

**Note:** Installation category, called overvoltage category, specifies impulse withstand voltage. Category II is for electrical equipment. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength. Degree 2 is the normal indoor environment.

### N. Connection cable

- : Using WF10 extension cable and BA10 junction box the distance between sensor and transmitter can be up to 50 meters

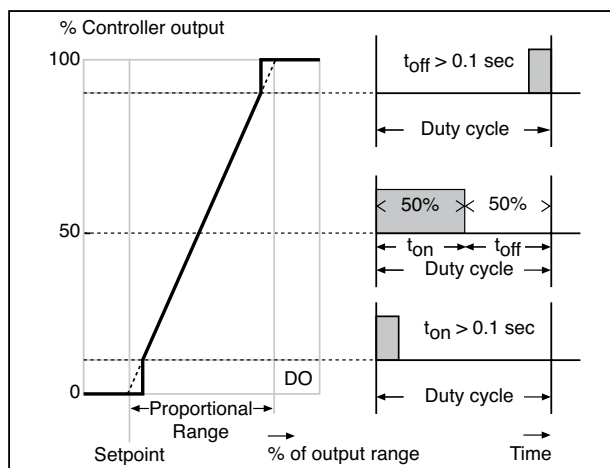
## Model and suffix codes

Model code	Suffix code	Option	Description
DO402G			Converter for dissolved oxygen
-1			Always E
Supply voltage	-1		115 Volts 50/60 Hz
	-2		230 Volts 50/60 Hz
-5			100 Volts 50/60 Hz
Instruction manual	-E		English language*
Options		/U	Pipe and wall mounting hardware
	/PM		Panel mounting hardware
	/Q		Quality certificate
	/SCT		Stainless steel tag
	/X1		Epoxy baked finish
	/H3		Sun protection (carbon steel)
	/H4		Sun protection (stainless steel)
	/AFTG		G1/2 conductivity adapter
	/ANSI		NPT1/2 conductivity adapter

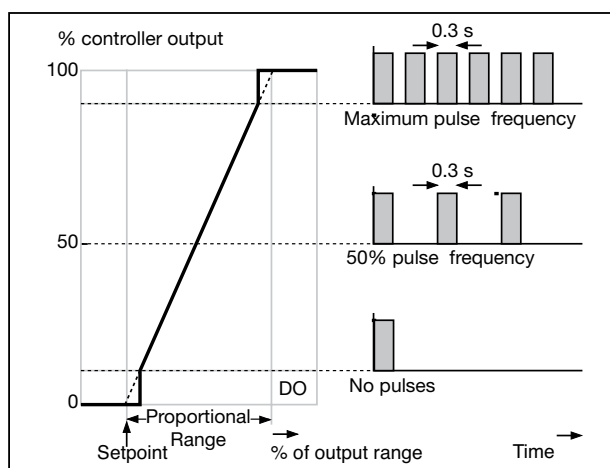
\* For other languages contact local sales office

## Control and Alarm Functions

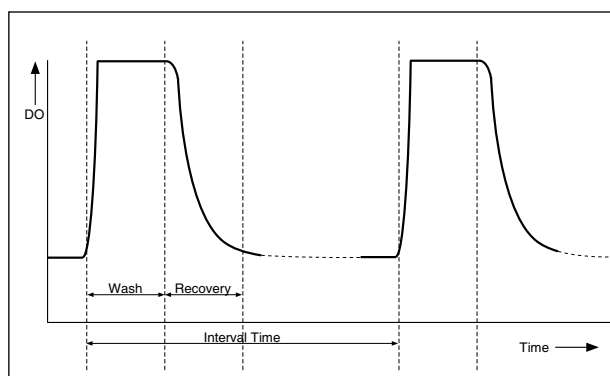
- Control output (mA)** : PI control on the 2nd mA output.  
The 2nd mA output can be configured to give a PI (proportional and integral) control output.  
The setpoint, proportional band and integral time are each fully programmable.
- Adjustable parameters : Setpoint, proportional range and integral time.
- Process alarm** : The contact will be switched when the process value reaches a limit. This can either be a high or low limit.
- Adjustable parameters : Setpoint for the process value  
Hysteresis of the switching action  
Delay time of the relay (0 to 200 s)
- PI duty cycle control** : The contact is used to control the time a solenoid dosing valve is opened. The proportional control is achieved by opening and closing the solenoid valve and varying the ratio of on and off time (ton, toff).
- Adjustable parameters : Setpoint, proportional range and integral time. Total period of the pulse period (5 to 100 s)
- PI pulse frequency control** : The contact is used to control a pulse-driven dosing pump. The frequency of pulses regulates the pump speed.
- Adjustable parameters : Setpoint, proportional range & integral time.  
Maximum pulse frequency (50 to 120/min.)
- Wash cleaning of sensors** : Contact S3 is used to control the wash cycle, or as a process alarm.
- Adjustable parameters : Cleaning time or washing time (tw)  
Recovery time after washing (tr)  
Interval time for wash cycle.  
The graph shows a typical response curve during washing. The wash and recovery times need to be set to suit the process.
- Fault alarm** : Contact S4 by default set to function as an alarm, indicating that the EXA has found a fault in the measuring loop. If the self diagnostics of the EXA indicate a fault or error, the FAIL contact will be switched. In most cases this will be caused by a malfunction of the measuring loop. The FAIL contact is also closed when the power is removed. The "FAIL" contact may also be configured as a fourth process alarm.



Duty cycle control

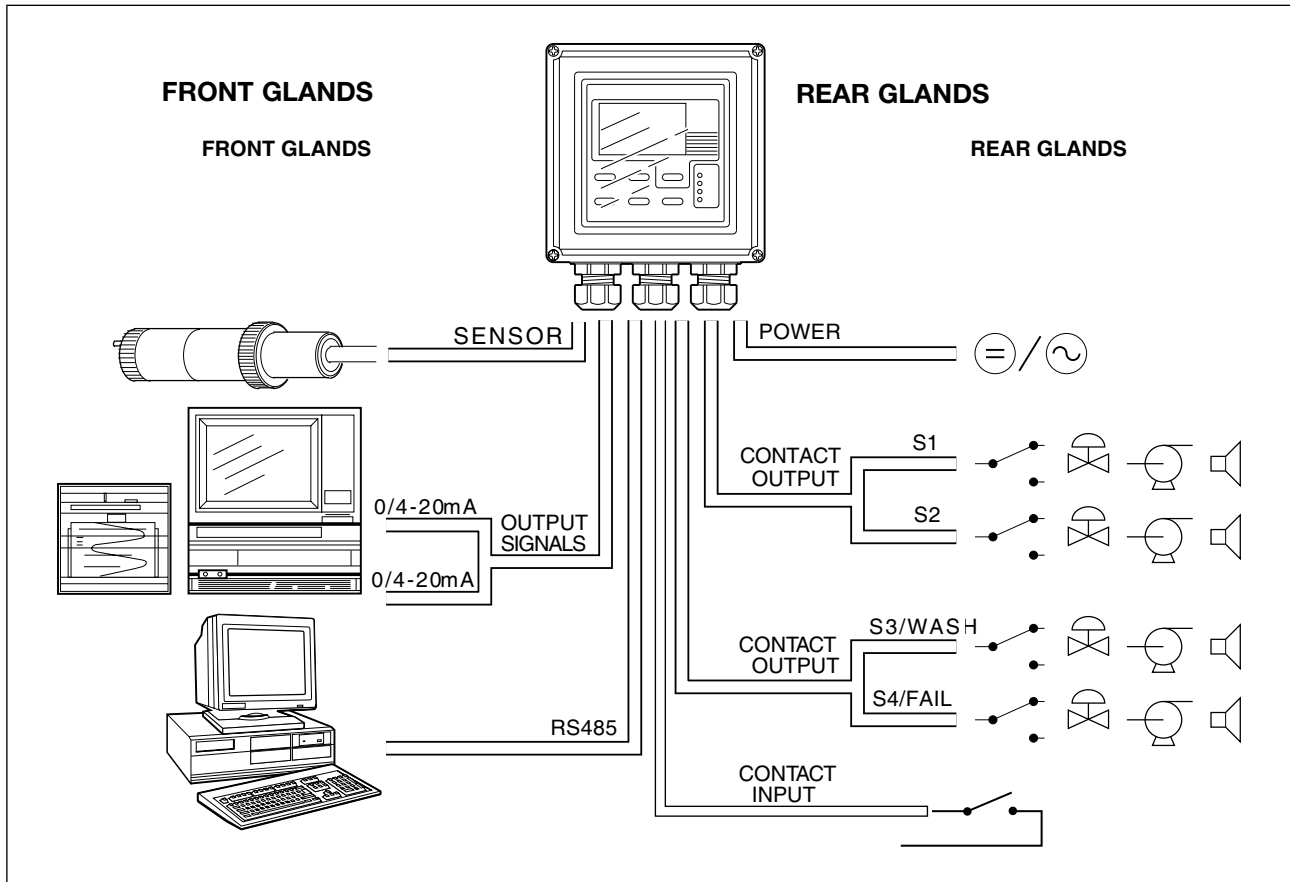


Pulse frequency control

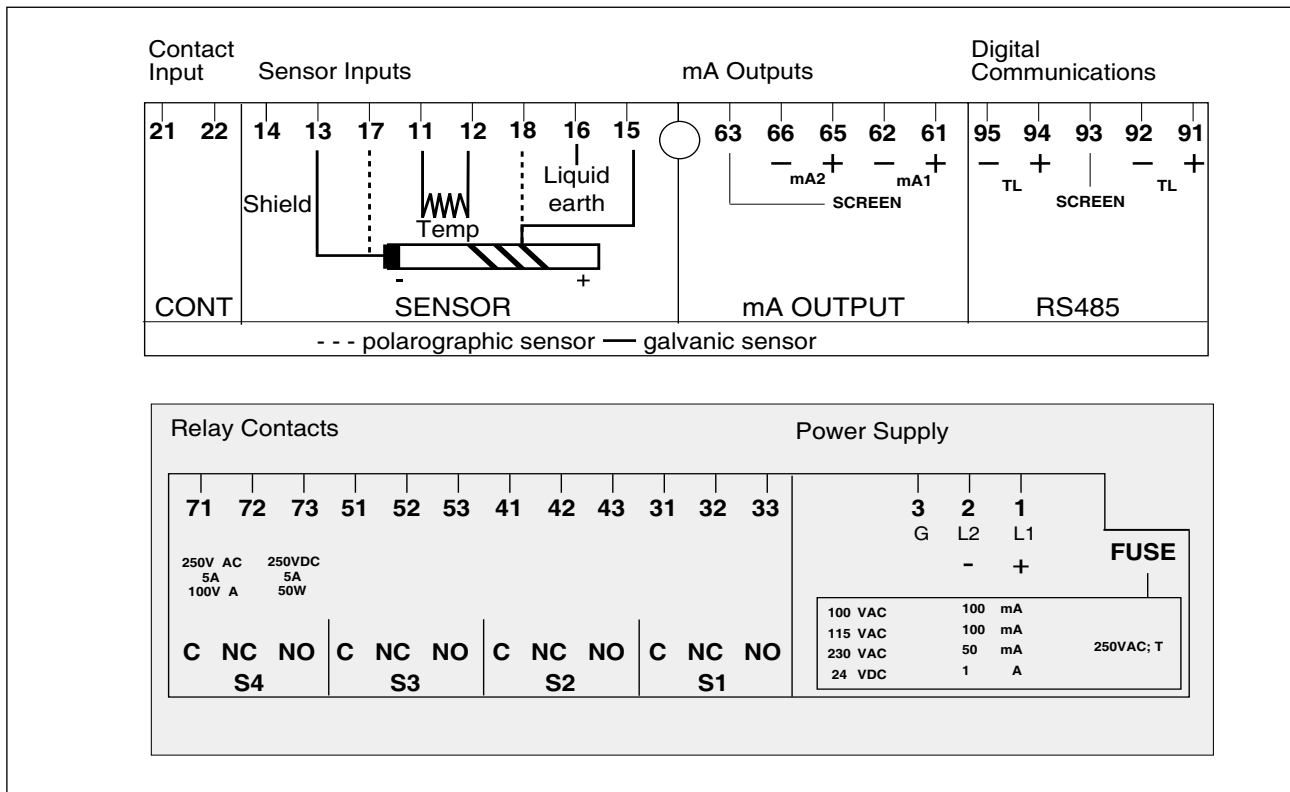


Dynamic response during wash

## System Configuration

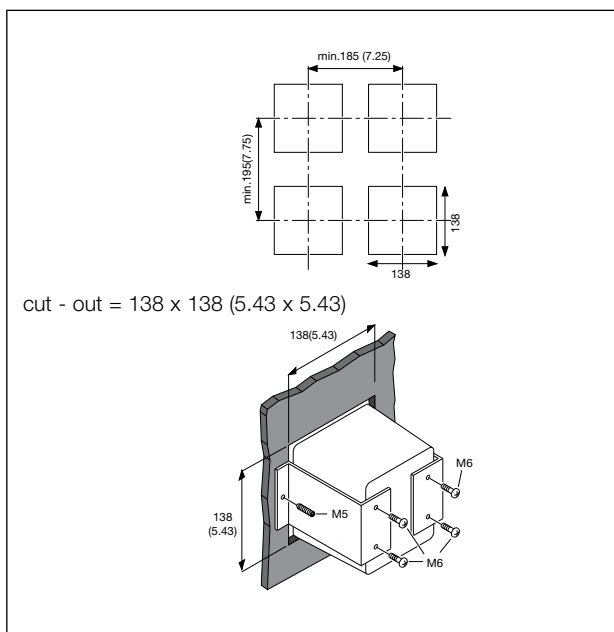


## Input and Output Connections

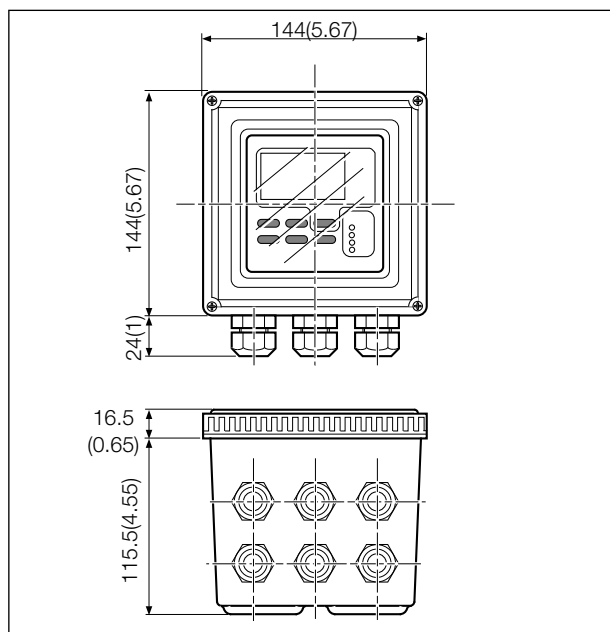


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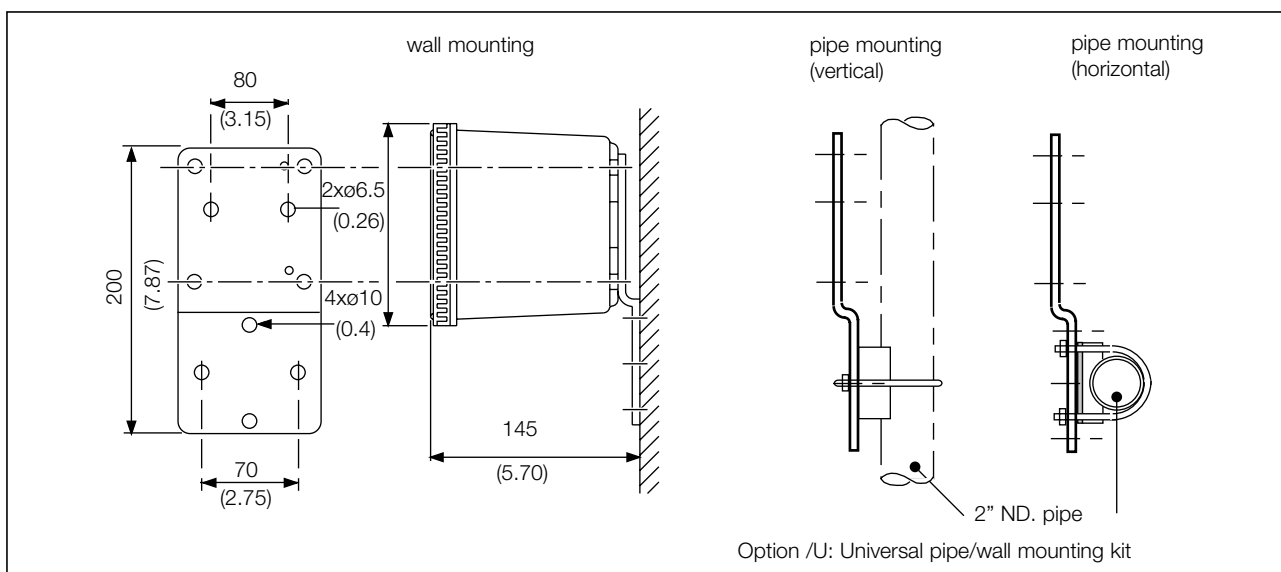
## Dimensions and Mounting



Panel cut-out, spacing and mounting



Dimensions



Universal pipe/wall mounting

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# General Specifications

Model DO30G and FD30/PB30  
Sensor and fittings for Dissolved Oxygen

DO

**The DO30G sensor** for dissolved oxygen is designed for use in water treatment plants such as sewage treatment works, effluent activated sludge process, and potable water treatment. It is also effective in river monitoring, intake protection, fish farming and other fields where water quality is important.

This galvanic cell has a fast response time and good long term stability, and features replaceable diaphragm and cable for easy maintenance. A temperature sensor is incorporated for compensation. The DO30G sensor can be used in either the PB30 floating ball fitting or in the FD30 immersion fitting.

**The PB30 floating ball holder** for the DO30G features a design which minimises fouling by the process. A brass ring around the sensor facilitates a check for membrane integrity, and helps to eliminate any deposits of algae, making a cleaning system unnecessary for the model PB30. Maintenance is very simple, with only periodic inspection and calibration needed.

**The FD30 PVC immersion fitting** is designed for installing the DO30G sensor in tanks, open vessels and drains. It can be supplied in lengths between 0.5 and 2.0 meter. Flange mounting is also possible.

In applications with a heavy load of solids the use of a cleaning system is recommended, so an option, a "jet cleaner" is available for the immersion fitting. The use of this device can extend the continuous measurement period and eases maintenance.



## Features

### DO30G • Fast response time

- Good long term stability
- Easy membrane change

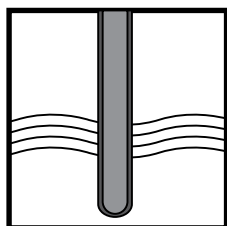
### PB30

- Easy to install
- Easy calibration
- Sensor diagnosis for membrane integrity

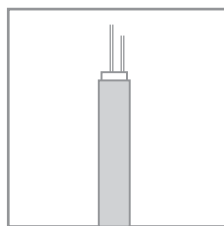
### FD30

- Various immersion depths
- Flange mounting possible
- Cleaner option
- Sensor diagnosis for membrane integrity

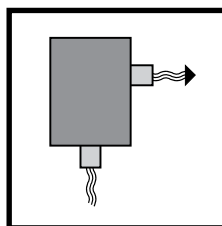
## System configuration



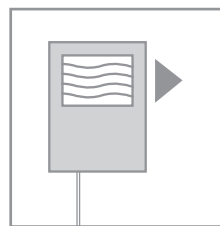
Sensors



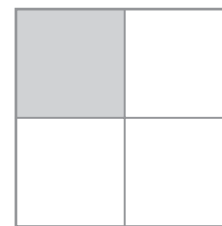
Cables



Fittings



Transmitters



Accessories

## DO30G Sensor

The DO30G sensor, which replaces the previous model DOX8SM, is the heart of Yokogawa's Dissolved Oxygen measuring loop. It can be supplied with membrane thicknesses of 25 or 50 µm. The detachable connection cable comes in 5 different lengths between 3 meters and 20 meters. For convenience both the cell assembly and the cable are available as spare parts, as are the membrane sets and O-rings.

## Specifications

### General

Measuring	: Dissolved Oxygen
Measuring Principle	: Galvanic cell method
Measuring Range	
- Minimum	: 0-2.5 ppm
- Maximum	: 0 to 20 ppm

### Liquid operating conditions

- Temperature	: 0 to 40°C
- Pressure	: atmosphere
- Flow velocity	: Minimum 5 cm/sec

Response time : < 60 sec

### Sensor

Temperature compensation sensor	: Pt1000
Wetted part materials	: Hard PVC Fluorinated polymer (FEP) Stainless steel (SUS304) Nitrile rubber Soft PVC Polycarbonate
Membrane	: 25 or 50 µm

### Shipping details

Weight :	: Approx. 0.9 kg (with cable length of 5m) Weight of the sensor is approx. 0.1 kg
Package size	: 295 x 230 x 165 mm

## Model and Suffix Code

### DO Sensor

Model	Suffix Code	Description
DO30G		DO Sensor
Membrane type	-S25 -S50	25 micron 50 micron
Cable length	-03 -05 -10 -15 -20	3 mtr 5 mtr 10 mtr 15 mtr 20 mtr

## Accessories

### Parts set for maintenance

Part no.	Description
K1530UH	Accessory kit for 50 micron membrane
K1530UJ	Accessory kit for 25 micron membrane

### Accessories (parts for maintenance)

#### Contents

- Electrolyte for sensor (50 ml), 1 bottle
- Membrane, O-ring, 3 sets
- Syringe for replacing electrolyte, 1 piece

## Dimensions

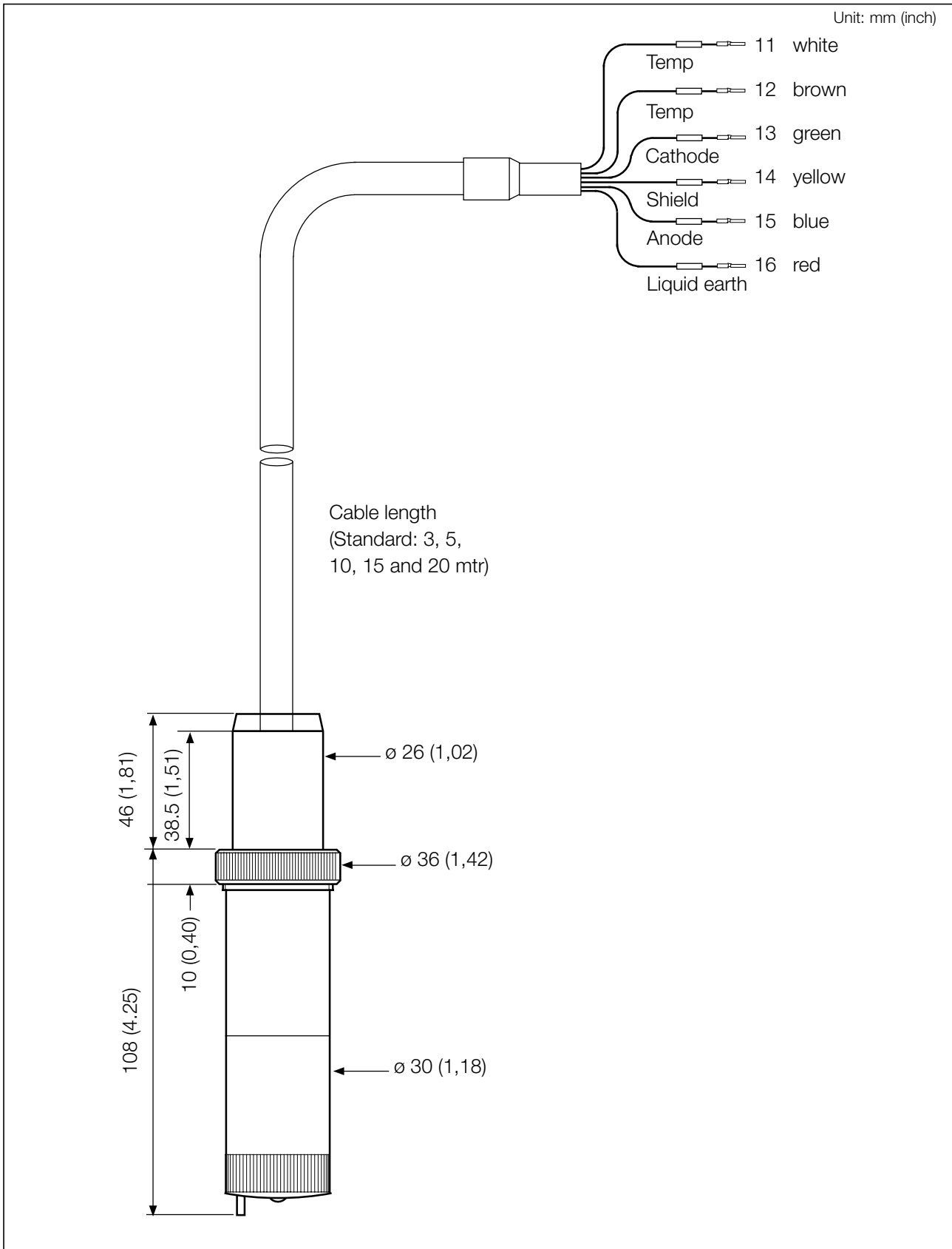


Figure 1. DO30G sensor

GS 12J6K4-E-E

## FD30 Immersion Holder

Intended to mount the sensor in tanks, the immersion fittings should be installed where the point of measurement truly represents the entire solution. Avoid areas where the measurement value varies significantly e.g. stagnant corners. Select a place where the sensor is always immersed in the process liquid. The FD30 fitting is standard equipped with membrane check-facility and can be specified with or without a flange. Cable length and sensor membrane can also be specified in the MS code. For types without a flange, a mounting set and a jet cleaner are available as options.

## /JC Jet Cleaner

This optional cleaner gives the opportunity to avoid build up of deposits and consequent fouling on the sensor membrane. This is achieved by spraying water (or air) onto the membrane of the DO-sensor. The spray head is equipped with a built-in (non-return) valve to avoid penetration of the process liquid into the cleaning system. The EXA DO400 has a built-in wash timer with programmable washtime, interval time and recovery time for the automatic cleaning of the sensor.

## Specifications

### General

#### Wetted materials

#### Fitting

- Body & flange : Polyvinylchloride (PVC)
- O-rings : Silicone rubber
- Blanking plug : Ryton R4 (remove before use!)
- Conductive bushing : Brass

#### Options

- Sensor/cable : See DO30G
- Flex. conduit : PVC and Nylon
- Jet cleaner : PVC, Nylon, PVDF and PTFE
- Mounting : Galvanized steel

#### Weight

- Without flange : 1.35 kg + 0.2 kg per 0.5 meter
- With flange : 0.5 kg extra

### Functional

#### Fitting

- Temperature : Min. : -10°C  
Max. : +50°C
- Pressure : Max. 2 bar
- Immersion length : 0.5 to 2.0 m (10 cm steps)  
When ordered as a subassembly (pipe length 00), a tube with PVC cement will be delivered with the holder.

#### Cleaner (optional)

- Temperature : As FD30V27
- Pressure : As FD30V27
- Immersion length : Additional + 4 cm.

## Model and Suffix Codes

### Immersion Fitting

Model	Suffix	Option	Description
FD30V27			Immersion Fitting PVC
Immersion length	-00 -xx		Pipe supplied by user Between 0.5 and 2.0 (in steps of 0.1m) Example: 06 = 0.6 m
Mounting flange -F2	-FN -F1		No flange DIN DN50 PN10
*A		ANSI 2" 150 lbs	
Cable		Style A	
/C10		/C05	5 mtr
Protection hose		10 mtr	
/PH10		/PH5	5 meter
Cell-assembly		10 mtr	
/S50		/S25	25 µm membrane
Jet Cleaner		50 µm membrane	
Mounting set		/JC	*
		/MS1	*

\* Not available with flanged versions.

## Accessoires

### Accessories and Options (for sensor & cable see DO30G)

Part no.	Description
K1530YZ	Jet Cleaner (/JC)
K1541ZY	Mounting set (/MS1)
K1500CJ	5 meter Protection hose kit (/PH5)
K1500CK	10 meter Protection hose kit (/PH10)

### Spare Parts (for sensor & cable see DO30G)

Part no.	Description
K1530UK	Spray nozzle for Jet Cleaner
K1530UL	Tubing 1/4" for Jet Cleaner, 10 meter
K1500AW	Flexible conduit 5 meter
K1500AX	Flexible conduit 10 meter
K1500AY	Connection parts for flexible conduit
K1500AZ	Nozzle parts
K1500FX	O-ring set (5 pieces, silicone) for sealing the sensor
K1500FY	O-ring set (5 pieces, silicone) for mounting the sensor in the fitting



## Dimensions

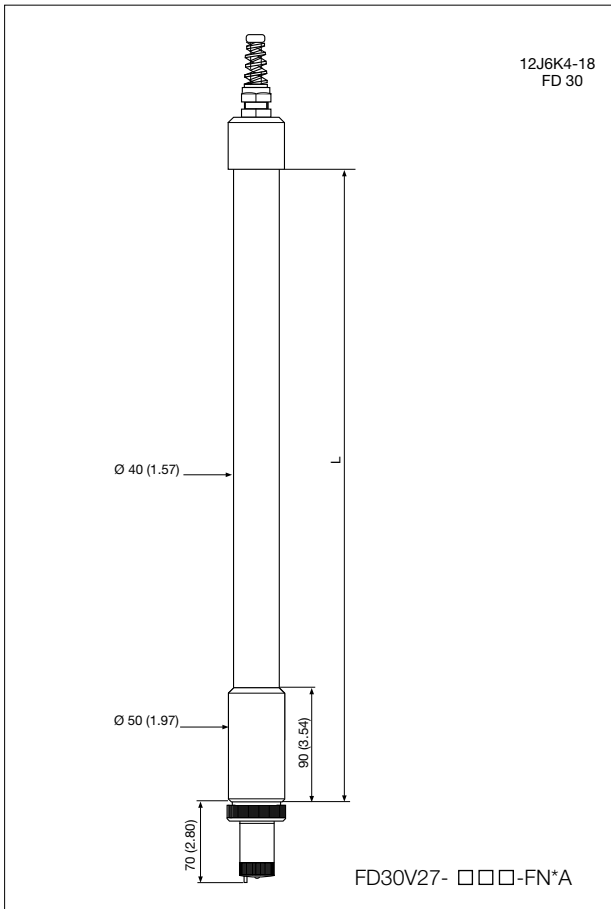


Figure 2. Immersion assembly without flange

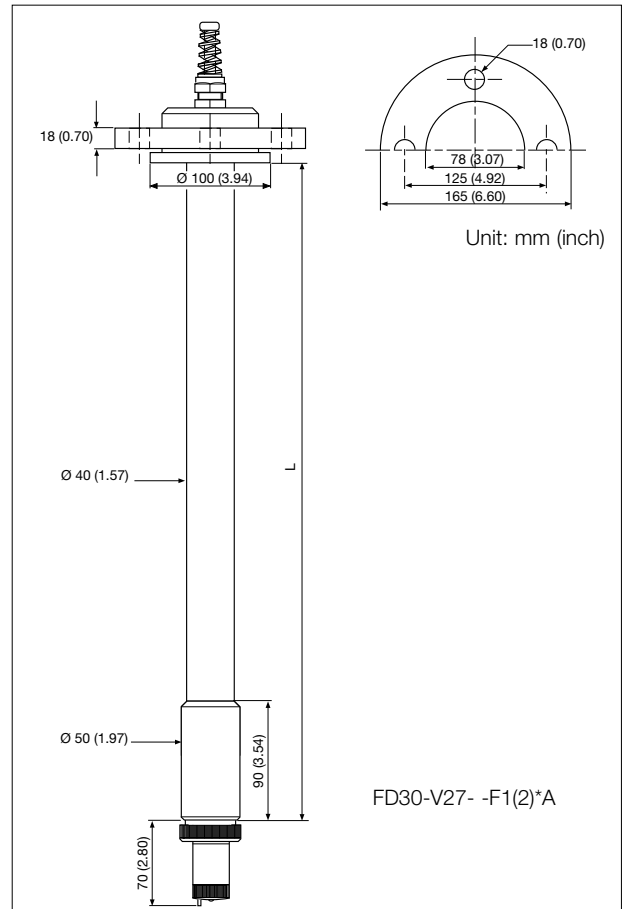


Figure 3. Immersion assembly with flange

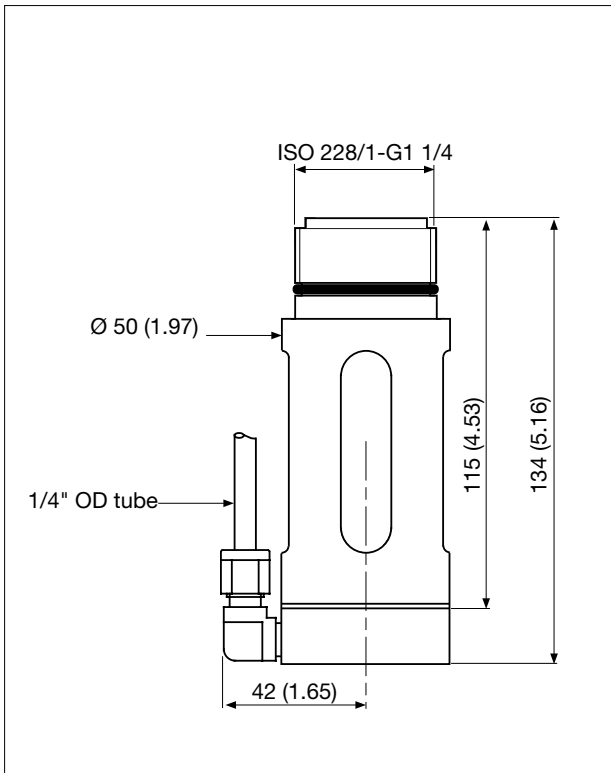


Figure 4. Option /JC Jet cleaner

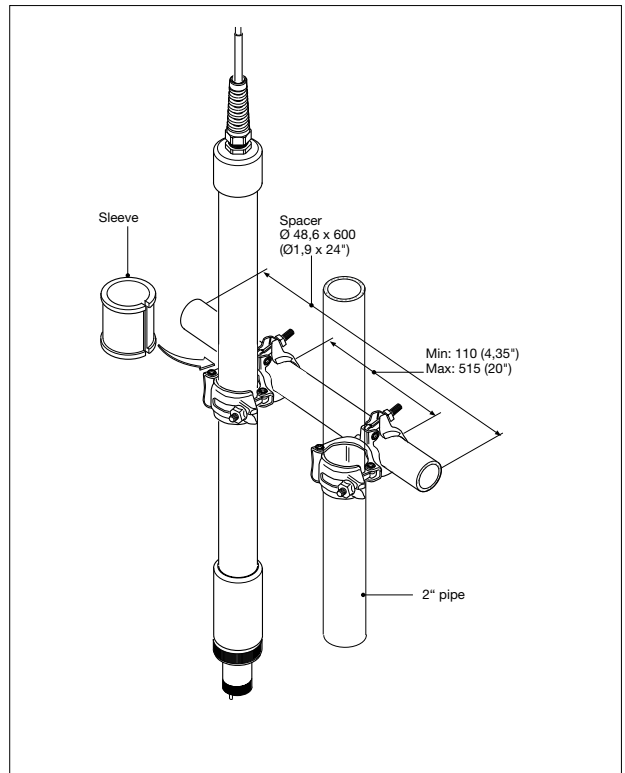


Figure 5. Option /MS1 Mounting set

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## PB30 Floating Ball

The design of the PB30 floating ball ensures minimum user maintenance. The constant movement of the ball with the action of waves on the surface of the tank provides a good flow of sample at the membrane surface. Constant measurement depth is also assured. The solution ground ring in brass, gives the facility of a membrane check, while also minimising algae growth on the sensor. For convenience, the PB30 includes a winch mounting mechanism, and is normally specified as a unit complete with sensor and cable.

## Specifications

### Fitting

- Wetted parts : High impact polystyrene, PVC & Brass
- Temperature : 0-40°C
- Mounting bracket : Galvanised steel, for rail, or surface mounting.
- Sensor/cable : See DO30G

### Note:

The standard pipe used for PB30 has a 50 mm outer diameter. For 1½" pipe it is necessary to use the 1½" adapters delivered with the PB30-00.

### Shipping details

- Weight : Approx 12.5 kg.
- Package size : 490x320x340 mm
- Main support arm : 2.5 m

## Dimensions

## Model and Suffix Codes

### Floating Ball

Model	Suffix Code	Description
PB30		Floating Ball Fitting
Pipe length	-00	Pipe supplied by user
-25	2.5 meter	
Sensor type	-SNN	No sensor
-S25	With 25 µm membrane	
-S50	With 50 µm membrane	
Cable length	-00	No cable
-05	5 mtr	
-10	10 mtr	
-15	15 mtr	
-20	20 mtr	

## ACCESSORIES

### Spare Parts (for sensor & cable see DO30G)

Part no.	Description
K1530DQ	Mounting bracket for PB30
K1500AV	O-ring set for PB30 25.3x3.2 (5x)
K1530SA	Floating ball ass.

**Note:** The standard pipe used for PB30 has a 50 mm outer diameter. For 1½" pipe it is necessary to use the 1½" adapters delivered with the PB30-00.

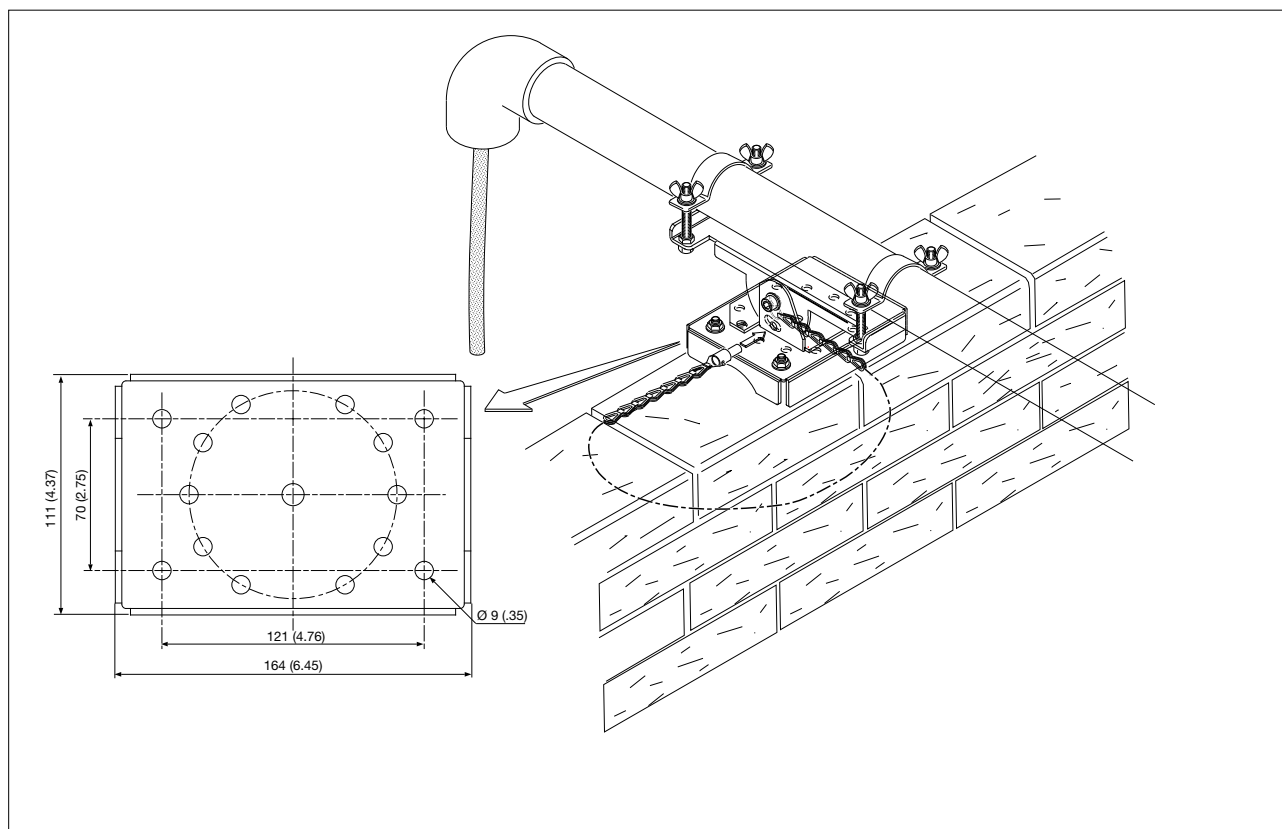


Figure 6.

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## Dimensions

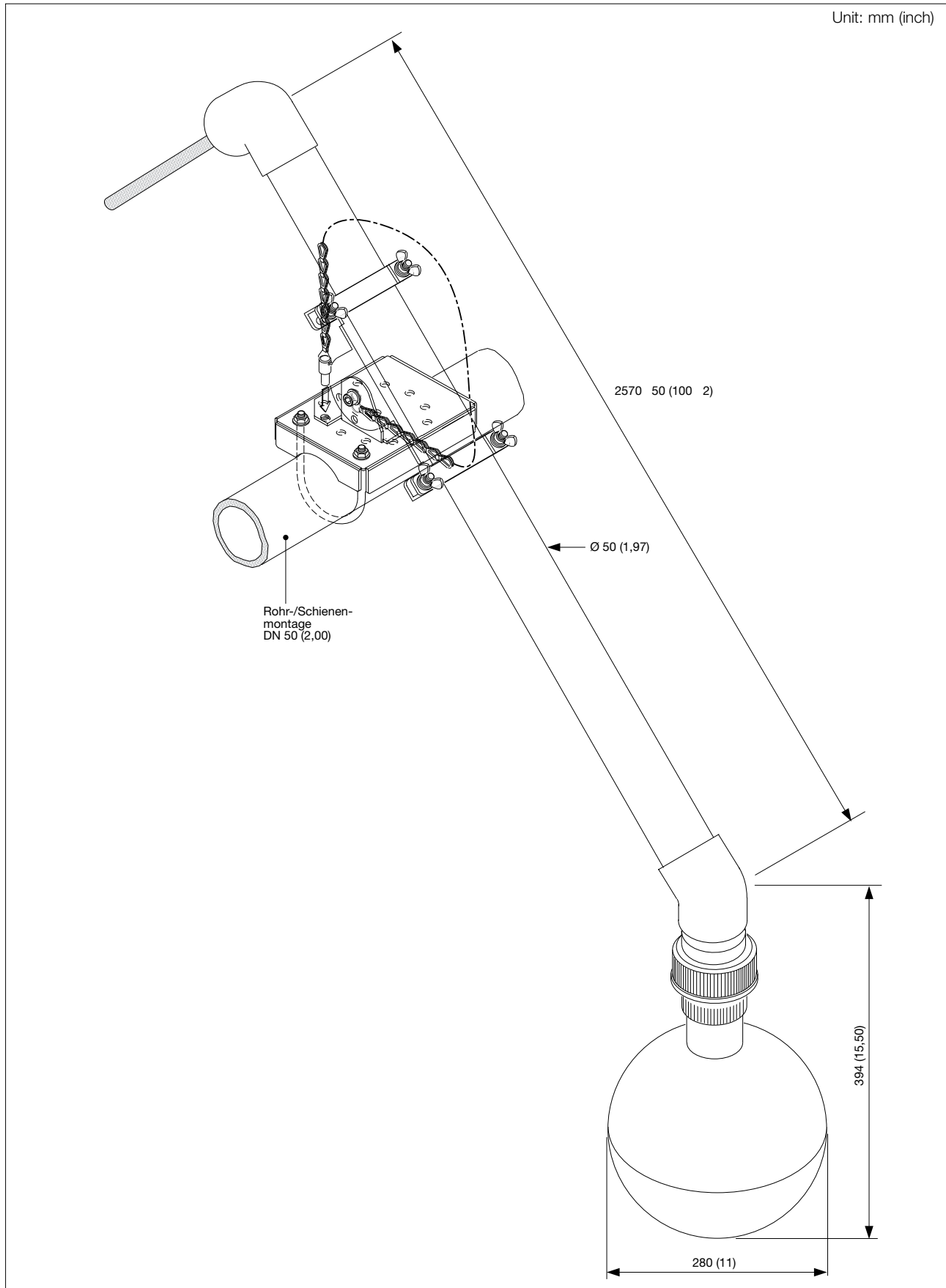


Figure 7. Universal mounting assembly for floating ball fitting

GS 12J6K4-E-E

## Accessories

Part no.	Description	DO30G	FD30	PB30
K1530YZ	Jet Cleaner (/JC)		x	
K1541ZY	Mounting set (/MS1)		x	
K1500CJ	Flexible conduit 5 meter and connection set (/PH5)		x	
K1500CK	Flexible conduit 10 meter and connection set (/PH10)		x	
K1530UH	Accessory kit for 50 micron membrane	x	x	x
K1530UJ	Accessory kit for 25 micron membrane	x	x	x

## Service Parts

Part no.	Description	DO30G	FD30	PB30
K1530UK	Spray nozzle for Jet Cleaner		x	
K1530UL	Tubing 1/4" for Jet Cleaner, 10 meter		x	
K1500AW	Flexible conduit 5 meter		x	
K1500AX	Flexible conduit 10 meter		x	
K1500AY	Connection parts for flexible conduit		x	
K1500AZ	Nozzle parts		x	
K1500FX	O-ring set (5 pieces, silicone) for sealing the sensor		x	
K1500FY	O-ring set (5 pieces, silicone) for mounting the sensor in the fitting		x	
K1530QA	Lower support for PB30			x
K1530DQ	Mounting bracket for PB30			x
K1500AV	O-ring set for PB30			x
K1530SA	PB30 assembly			x

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# General Specifications

## Hamilton Dissolved Oxygen Sensors

The measurement of Dissolved Oxygen is one of the key analysis methods to monitor, but most users complain of unreliable sensor performance, high maintenance requirements and therefore high costs or a short lifetime. The Hamilton Dissolved oxygen sensors are designed to meet the severe requirements of the Biotechnology industry in terms of long term stability and low maintenance.

Most low maintenance dissolved oxygen sensors operate on the principle of the reduction of oxygen at the surface of a noble metal electrode, the cathode, but this design can exhibit problems during calibration including interference from other substances. In the Oxygold and Oxyferm electrodes, the sensor is covered with a gas permeable membrane to address these problems. The unique technology of the membrane is the real secret to achieving the desired quality of DO measurement.

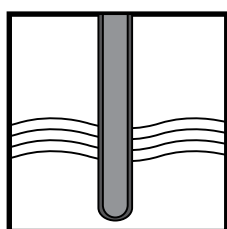
The Dissolved Oxygen sensor is a membrane covered polarographic sensor. Normally these sensors utilize TEFLON or FEP material, which features high selectivity towards Oxygen. For Biotechnical applications this material is not suitable due to mechanical deformation of the membrane in the vigorously agitated reactors or during steam sterilization. Other models use silicone rubber which has excellent elastic properties but poor oxygen selectivity. The Oxygold and Oxyferm feature a laminated membrane with a thin layer of TEFLON for high selectivity and fast response, silicone rubber for elasticity and steel mesh for mechanical stability



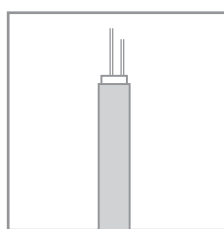
### Features

- Rapid stabilisation to minimise maintenance time.
- Ruggedised design guarantees stability even after numerous sterilisation cycles.
- Low limit detection down to 2 ppb.
- Sterilisable and autoclavable
- Can be mounted inverted
- ATEX certified sensors and fittings
- Certificates downloadable from [www.hamiltoncompany.com](http://www.hamiltoncompany.com)
- Innerbody can be replaced by user
- Up side down mounting possible
- Mechanically robust membranes that combine fast response, low flow dependance and an ability to function under harsh application conditions.

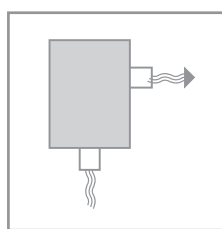
### System Configuration



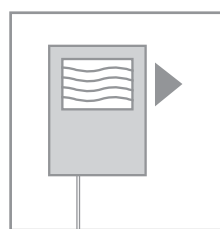
Sensors



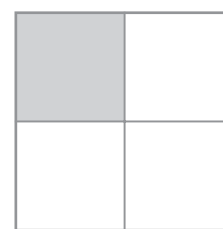
Cables



Fittings



Transmitters



Accessories

## Dissolved Oxygen sensors

Maintenance is rarely necessary due to the improved design of the sensor. The construction of the electrode guarantees excellent stability even after numerous sterilization cycles. A selection of membrane materials (standard, CIP and FDA membrane) are available and a selection of different membrane body shapes, with a protective edge or rounded are all available.

### General features

- Cable: VP-plug
- EX-label: II 1/2 G EEx IAIC T4/T5/T6
- Delivered with test and 3.1 certificate
- Adapter: PG13,5 tread
- Integrated 22 KOhm NTC temperature sensor
- Protection class: IP68

### Oxyferm

#### Operating conditions Oxyferm

O<sub>2</sub> 10 ppb to saturation  
 Temperature 0...130°C  
 Pressure Maximum 4barG  
 Minimum flow 0.002 m/sec

#### Additional features Oxyferm

- Suitable for steam sterilization, autoclaving and CIP
- Shaft and membrane have their own serial and melt numbers
- Sanitary feature: the silicon membrane seals without a gap to steel membrane body (no additional o-ring)
- Little drift, fast response, short polarization time
- OXYFERM FDA is shipped with a replacement FDA membrane body
- Material and test certificate by series
- Unique feature: upside-down insertion is possible when using OXYLYTE USD electrolyte. This is very useful for measurements in nearly empty tanks/containers.



Oxyferm FDA



Oxyferm VP

Part no.	Description
10/237450	OXYFERM FDA 120
10/237452	OXYFERM FDA 225
10/237400	OXYFERM VP 120
10/237401	OXYFERM VP 225
10/355087	Cable for Oxyferm Sensor 1 m open end
10/355088	Cable for Oxyferm Sensor 3 m open end
10/355089	Cable for Oxyferm Sensor 5 m open end
10/355136	Cable for Oxygen Sensors 10 m open end

### Consumables

Part no.	Description
10/237306	Replacement Cathode Oxyferm
10/237118	Oxylite Electrolyte for Oxyferm, 50ml
10/237126	Membrane kit CIP
10/237140	Membrane kit FDA
10/237123	Oxyferm Membrane kit

## Oxygold

Oxygold G and Oxygold B sensors are trace level dissolved oxygen probes. Both have a fast response time with  $t_{90}$  smaller than 60 sec.

The Oxygold G electrode is optimized for the measurement of trace quantities of dissolved oxygen. Its lower detection limit is 2 ppb. Designed for use in power generation, water treatment, chemical, pharmaceutical and semiconductor industries  
The Oxygold B electrode is designed for measurements in media containing acidic gases  $\text{CO}_2$  like in breweries, other beverages and specific chemical processes.

### General Features

- Designed for trace level DO measurements
- 12mm Shaft with VP plug
- IP68 VP connectorhead
- Suitable for use high at temperatures and high pressure

## Oxygold G

### Operating conditions

$\text{O}_2$	2 ppb to saturation
Temperature	0...130°C
Pressure	Maximum 12 barG
Minimum flow	0.1 m/sec

### Additione features Oxygold G

- Developed for use in power plants or chemical, pharmaceutical and semiconductor industries
- Easy to maintain
- Little flow sensitivity
- Fast response time  $t_{90} < 60$  sec
- Supplied with material and test certificate

## Oxygold B

Dissolved  $\text{O}_2$  sensor for measurements in fluids containing acidic gases, for example  $\text{CO}_2$

### Operating conditions

$\text{O}_2$	8 ppb to saturation
Temperature	0...100°C
Pressure	Maximum 12 barG
Minimum flow	0.1 m/sec

### Additione features Oxygold B

- Developed for use in brewing, soft drink, fruit juice, sparkling water and wine processes
- No cross sensitivity to  $\text{CO}_2$
- Pressure and CIP stable
- Fast response time  $t_{98} < 60$  sec
- Supplied with material and test certificate
- Easy maintenance using the same polarisation voltages for calibration and measurement



Oxygold G



Oxygold B

Part no.	Description
10/237180	OXYGOLD B 120
10/237185	OXYGOLD B 225
10/237395-03	Oxygold G VP 120
10/237396-03	Oxygold G VP 225

## Consumables Oxygold G

Part no.	Description
10/237135	Oxygold Membrane Kit
10/237136	Oxylite USD 50 ml
10/237139	Oxylite "G" Electrolyte for OXYGOLD, 50 ml
10/237350	Polarizatio module G
10/237427	Replacement Cathode Oxygold G

## Consumables Oxygold B

Part no.	Description
10/237126	Membrane kit CIP
10/237135	Oxygold Membrane kit
10/237138	Oxylite B 50ml
10/237140	Membrane kit FDA
10/237360	Replacement Cathode Oxygold B
10/237437	Polarization module B

## Fittings and Armatures

### Retractofit

This armature allows the user to install maintenance-free electrodes in critical processes. The main advantage of this design is that the sensor can be withdrawn while the process is running (i.e. for cleaning, calibration or even to replace the electrode), without interrupting the process. The armature is very easy to use and maintain. Two tube connectors allow access to the rinsing chamber. A closed insertion tube converts these armatures a sampling system for diverse applications. Both accessories can easily be exchanged for the standard insertion tube using only gentle hand pressure.

### Features Retractofit Bio

- This armature is designed for applications where sanitary concerns are critical.
- The armature is steam sterilizable and autoclavable.
- The SS DIN 1.4435 (SS 316) and the FDA approved EPDM O-rings withstand typical CIP cleanings.
- Check with your dealer for the right O-ring position or weld-in socket!

### Sanitary Non-Retractable Armatures

Maintenance-free sensors with a standard 12 x 120 mm design and PG 13.5 thread will fit perfectly.

Steam sterilizable, autoclavable and CIP compatible cleaning are possible with the sanitary design. The materials used are SS DIN 1.4435 (SS 316) and the EPDM O-rings are FDA approved.

### Features Flexifit Bio

- G1 1/4" process connection
- The surface quality is N5 (Ra = 0.4 µm) electropolished.
- The armature comes with a material certificate.
- Good sensor protection with 3 protection rods
- Good sanitary design (easy cleaning and no sensor clogging).

Part no.	Description
10/237202	Weld-In Socket 15°, for armatures with o-ring at 25 mm
10/237230	Blind Plug for Weld-In socket
10/237338	Service Kit for Flexifit Bio & Retractofit Bio
10/237239	Service Kit for Retractofit & Retractomaster
10/237339	Kalrez Kit for Retractofit, Retractomatic & Retractomaster
10/237252	Pressure Adapter
10/237255	Insertion tube short for Retractofit/-matic
10/237278	Insertion tube closed for Retractofit/-matic
10/237290	Service Kit for Retractomatic
10/237440	Retractofit Bio
10/237202	Weld-In Socket 15°, for armatures with o-ring at 25 mm
10/237219	Service Kit for Flexifit
10/237230	Blind Plug for Weld-In socket
10/237331-OP*	Flexifit Bio
10/237338	Service Kit for Flexifit Bio & Retractofit Bio

\* Please specify the desired O-ring position (OP) in your order.

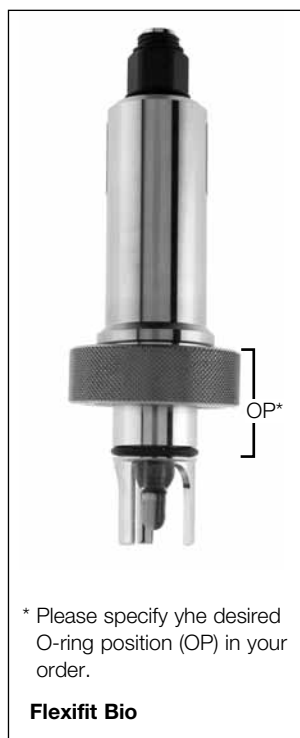
### Plugs for weld-in sockets

Enables weld-in sockets to be capped when the armature is removed. Seals at 25 mm. Other dimensions on request!

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**Retractofit Bio**



\* Please specify the desired O-ring position (OP) in your order.

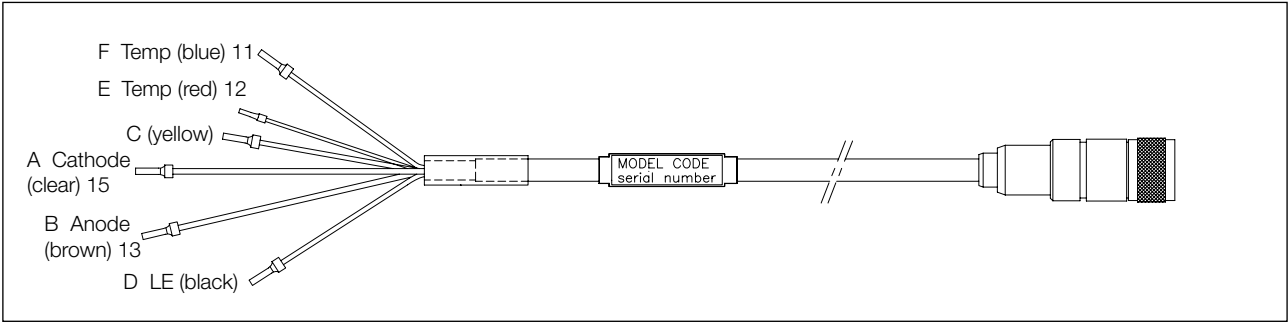
**Flexifit Bio**



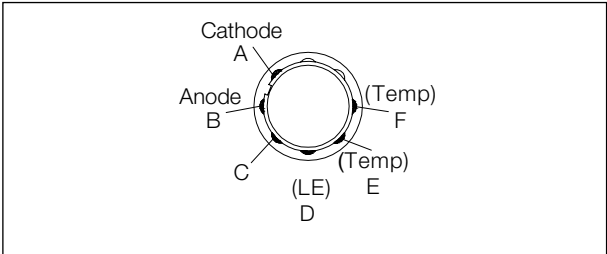


Cables for Industrial Applications

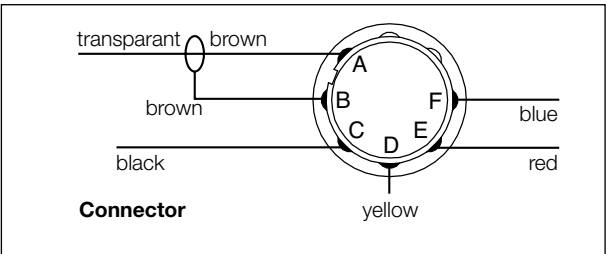
- Internal anti-noise sheath for accurate measurement.
- Gold plated spring O-connectors parts, for good electrical contact under the most severe conditions.
- Coaxial plug and socket with watertight sealing that meets the requirements of IP 65.
- Cables for industrial appl. and for laboratory use are available.



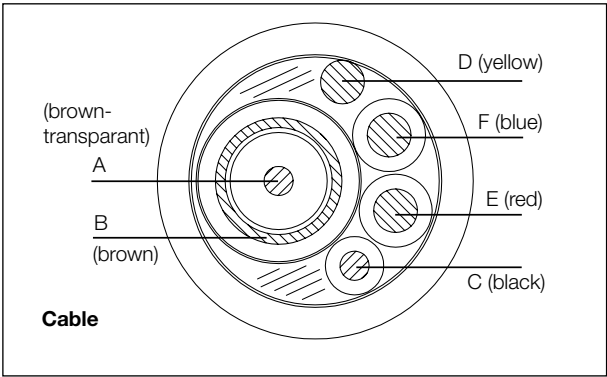
Dimensions



Connector wiring



Connector lay out



Cable lay out

Model and Suffix codes

Model	Suffix Code	Description
WU10		Universal sensor cable
Connector type	-V	Variopin
Cable type	-S	Single Coax
Cable length	-03	3 meters
-05	5 meters	
-10	10 meters	
-15	15 meters	
-20	20 meters	

## Accessoires



### OXYGOLD Membrane Kit

3 OXYGOLD membranes, spare o-ring, pipette. Electrolyte must be ordered separately.



### Membrane Kit FDA

FDA membrane material and rounded design to prevent accumulation of gas bubbles



### OXYFERM Membrane Kit

3 membrane bodies, Oxylyte, pipette, spare o-ring, polishing strip



### Polarization Modules

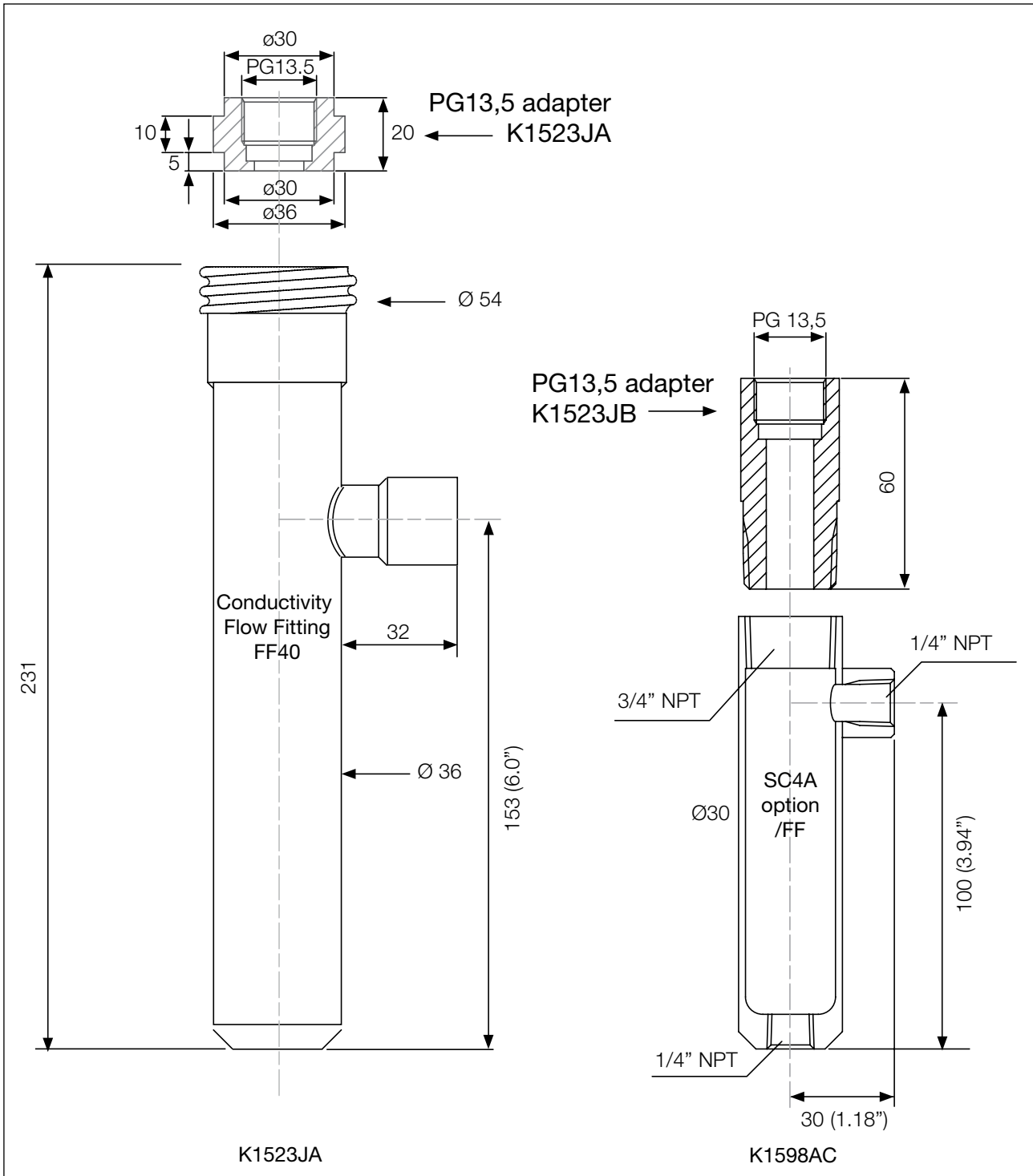
These prepare replacement sensors not connected to an amplifier for immediate use



### Membrane Kit CIP

As above, but with a special membrane for intensive CIP cleaning

GS 12J6K5-E-E



**Flow fitting FF40**  
 With Adapter K1523JA to fit sensors with a PG13,5 process connection in FF40/FS40 and FD40 fittings.  
 Material: Polypropylene

**Flow fitting K1598AC (incl. 3.1 B certificate)**  
 with Adapter K1523JB to fit sensors with PG13,5 process connection

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# General Specifications

Hamilton Visiferm  
Optical DO sensor

**HAMILTON**  
THE MEASURE OF EXCELLENCE™

*Dissolved oxygen is required for the survival and growth of many aquatic organisms, including fish. The concentration of dissolved oxygen may also be associated with corrosive and photosynthetic activity. The absence of oxygen may permit anaerobic decay of organic matter and the production of toxic and undesirable esthetic materials in the water. Main applications for this sensor are biotechnology, chemical industry, air surveillance, fish farming, water management and sewage water (gas and liquid phase).*

*The Visiferm utilizes luminescent technology and eliminates the typical drawbacks of membrane components. The measurement is unaffected by sample fouling or poisoning and virtually maintenance free with no membranes to replace, no electrolyte solution to replenish, no anode or cathode to clean or replace and long calibration intervals.*



## Features

- Steam sterilizable, autoclavable and CIP suited
- LDO technology is approved by ASTM as standard method (D888-05) for DO and BOD measurement
- No electrolyte solutions
- No membranes on concerns about air bubbles,
- Does not consume oxygen so passive fouling will not affect DO readings
- Measurement not affected by sample color or turbidity



## General

The Visiferm sensor is coated with a luminescent material. Blue light from an LED is transmitted to the sensor surface. The blue light excites the luminescent material. As the material relaxes and falls back into its ground state, it emits red light.

The time from when the blue light was sent and the red light is emitted is measured. The more oxygen that is present the shorter the time it takes for the red light to be emitted. The time delay can be expressed as a phase shift between the wave patterns of the Blue LED light and the Fluoresced light. This phase shift is inversely proportional to the oxygen concentration in the fluid.

## Calibration

Most calibration techniques may be used, including air calibration, zero calibration, calibration by comparison to a hand-held DO analyzer or concurrent calibration of two sensors. In most moderate applications it is rarely necessary to calibrate the Visiferm, but still the frequency of calibration needs to be determined by site conditions and customer requirements. The Visiferm can be calibrated in Air or in an oxygen-free environment (zero point). A solution with 0 ppb O<sub>2</sub> can be created by dissolving 2 gram of Sodium Sulfite (Na<sub>2</sub>SO<sub>3</sub>) in a beaker or cup with 100 ml water.

## Functional specifications

<b>Measuring range</b>	: 4 ppb / 0.05% up to 300% air saturation
<b>Accuracy</b>	: 80 ppb ± 4 ppb / 21 ± 0.2%vol / 50 ± 0.5%vol
<b>Temperature</b>	: -10°C.....80°C
<b>Pressure</b>	: -1 ....12 bar (press spikes up to 80 bar)
<b>Flow</b>	: No minimal flow required
<b>Storage Temperature</b>	: -10 ...50°C

## Dynamic specifications

<b>T response 98%</b>	: < 30 sec at 25°C, from air to Nitrogen
<b>Drift</b>	: <0.2% vol Oxygen per week in air at 30°C

## Sensor specifications

<b>Wetted parts</b>	: SS 316L DIN1.4435 Silicone FDA approved* EPDM FDA approved*
---------------------	---

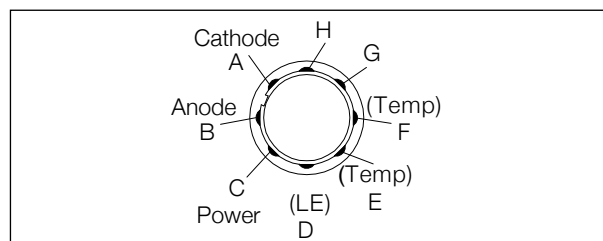
\* **Note:** FDA approval for these materials can be downloaded from [www.hamiltoncompany.com/eu.sensors/certificate\\_page.asp](http://www.hamiltoncompany.com/eu.sensors/certificate_page.asp)

<b>Mounting</b>	: PG13,5 thread
<b>Sensor length</b>	: 120,160, 215, 325 and 425 mm are available
<b>Surface Roughness</b>	: Ra = 0.4 µm / N5
<b>Connector</b>	: Variopin 8.0 double coax
<b>Temperature sensor</b>	: 22k NTC

## Electrical connection

<b>ECS mode</b>	: When the sensor is setup for ECS mode this means the sensor will simulate an Electrical Chemical Sensor (ECS).
<b>4-20 mA mode</b>	: This mode enables a direct connection of the Visiferm with a data recorder, indicator, control unit, SPS or process control system.
<b>RS485 Interface</b>	: In order to configure the sensor a USB RS485 modbus convertor can be used together with the Visiconfigurator program.

- A Cathode - only in ECS (Electro Chemical Sensor) mode)
- B Anode in ECS mode, 4-20mA mode
- C Power Supply : +24 VDC
- D Power Supply : ground
- E Temperature sensor NTC 22K for ECS mode
- F Temperature sensor NTC 22K for ECS mode
- G RS485 (A)
- H RS485 (B)



## Partnumbers

Part no.	Description
10/242450	Visiferm DO 120
10/242451	Visiferm DO 160
10/242452	Visiferm DO 225
10/242453	Visiferm DO 325
10/242454	Visiferm DO 425
10/242427	Visiferm DO sensor Cap
10/424773	USB-RS484 ModBus Converter
10/355194	Visiferm DO Demo Cable
10/4-20 mA	Galvanic Isolator M1

## Fittings

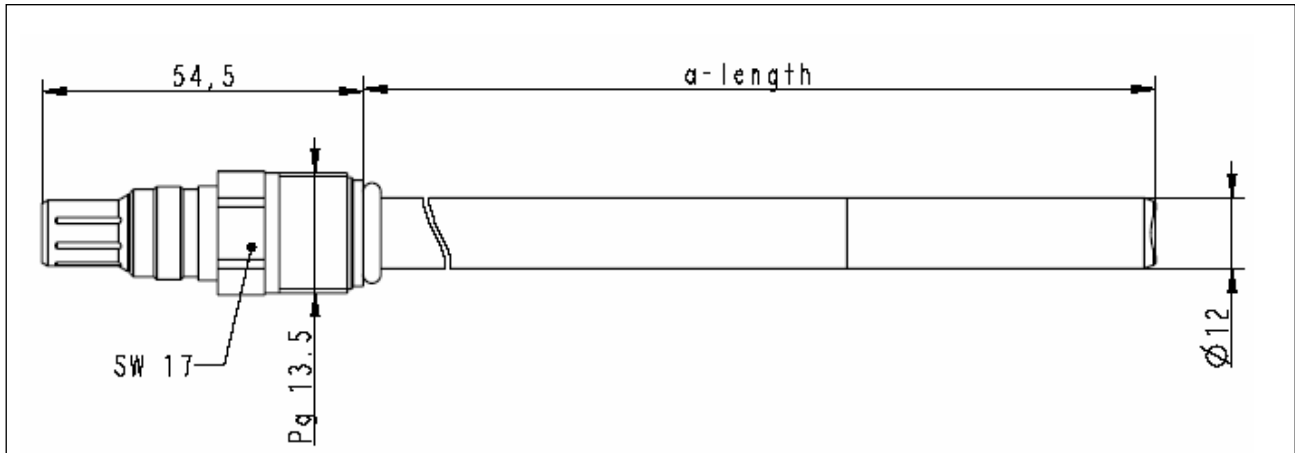
The Visiferm is equipped with a PG13,5 adapter. Together with our PG13,5 -> M25 adapter this sensor can be installed in all our 3 and 4-hole pH fittings :

FF20 / PF20*1	: pH flowfitting max. sensor length 120mm
FD20 / PD20*1	: immersion fitting
FS20 / PS20*1	: Subassembly
K1598AC	: Small version flowfitting, With this fitting the K1598JB adapter is needed (see drawing 1.2)
PG13.5	m25 adapters
K1520JN	PVC
K1500DV	PVDF
K1520JP	SS

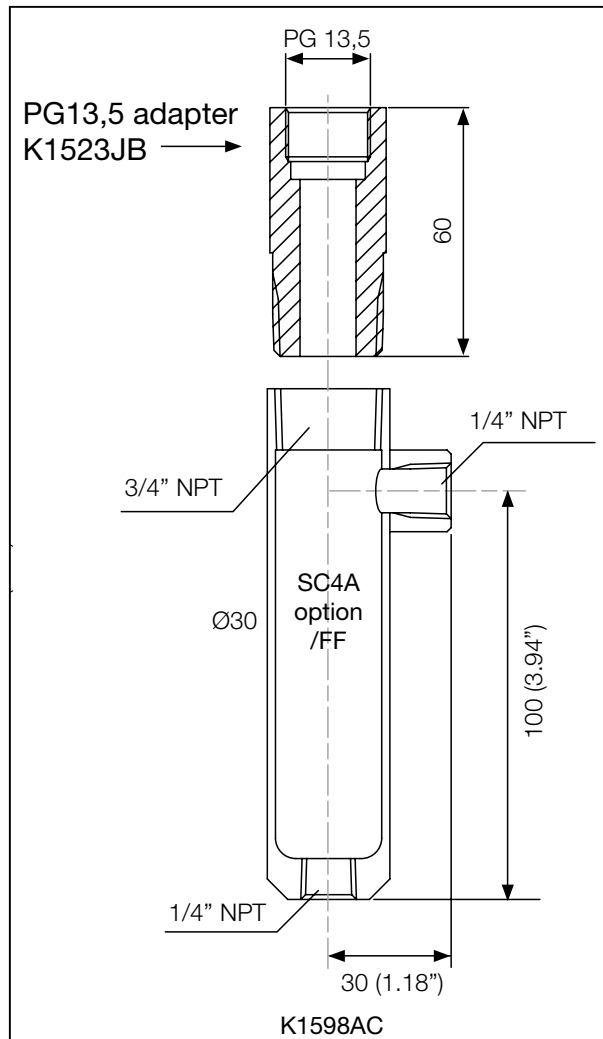
\*1 **Note :** The liquid earth cable delivered with the pH fittings does not need to be connected. (see drawing 1.3)

## Dimensions

### 1.1 Visiform external Dimensions

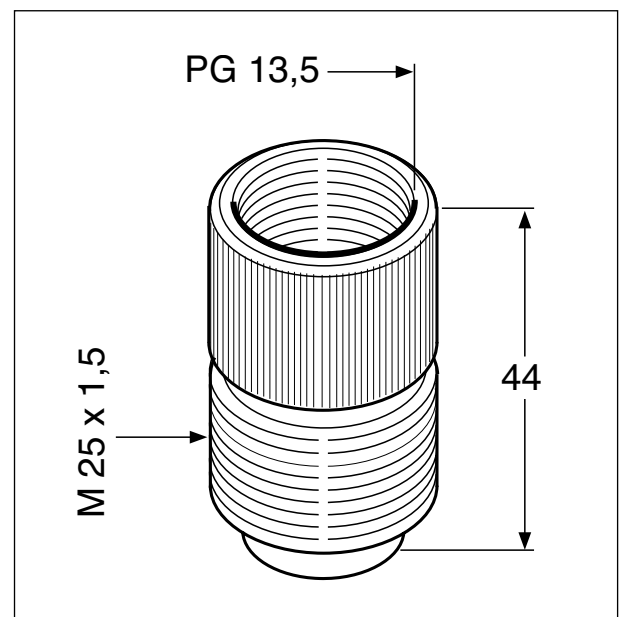


### 1.2 K1598 AB flowfitting



K1598 AC  
K1598 AB

### 1.3 PG13,5 > M25 adapter



K1520 JN  
K1500 DV  
K1520 JP

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## Advanced Analyzers

## Advanced Analyzers



# GC8000 Process Gas Chromatograph



# GC8000

## Process Gas Chromatograph

Bulletin 11B08A01-01E

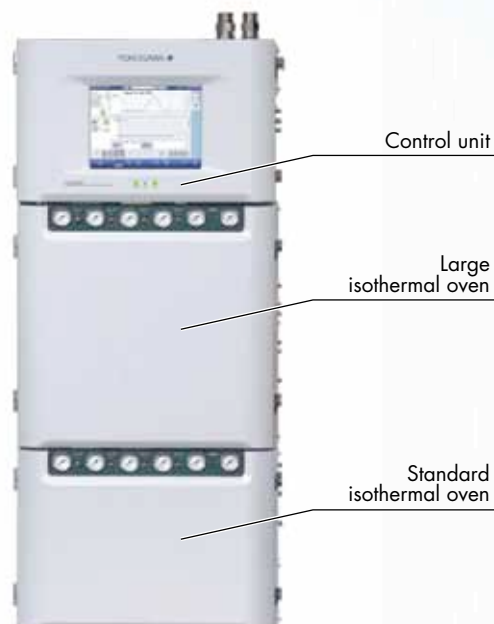
[www.yokogawa.com/an/](http://www.yokogawa.com/an/)

## Configurations

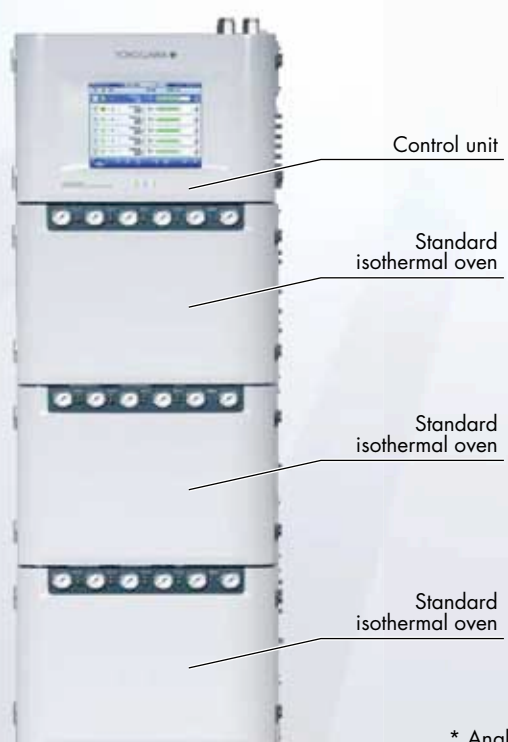
Type 1



Type 2



Type 3



Type 4 (to be announced)



\* Analyzer base sampling unit (GCSMP) can be installed in self-standing type.

# Standard Specifications

## General specifications

Measurable object:  
Gas or volatile liquid (400°C or lower boiling point)

Analysis method:  
Gas chromatography

Measurable range:  
Depends on analysis conditions

TCD: 1 ppm to 100%

FID: 1 ppm to 100%

FID (with methanizer):  
1 ppm to 0.1%

FPD: 1 ppm to 0.1%

Number of components to be measured:  
Maximum of 999 (total number of components in all streams including standard sample streams)

Number of streams to be measured:  
Maximum of 31 (including standard sample streams)

Analysis period:  
Maximum of 21600.0 seconds (six hours)

## Analysis Specifications

Explosion-proof structure:  
Pressurized apparatus and flameproof enclosure, or no explosion-proof structure

Certification standard (organization):  
FM, ATEX (DEKRA), TIIS

FM:  
Type X Purging and Explosionproof for Class I, Division 1, Groups B, C and D. T1 to T4  
Type X and Y Purging for Class I, Division 1, Groups B, C and D. T1 to T4

ATEX: II2G Ex d px IIB+H<sub>2</sub> T4...T1 Gb

TIIS: Ex pd IIB+H<sub>2</sub> T1 to T4

Ambient condition during operation:  
-10 to 50°C, 95%RH or less (no condensation)

Weight:  
Type 1: Approximately 100 kg  
Type 2: Approximately 155 kg  
Type 3: Approximately 200 kg

## Input and Output Specifications

Ethernet communication  
Standard: Ethernet  
Connection type:  
IEEE802.3U  
100Base-TX (RJ-45 twisted pair) or  
100Base-FX (SC fiber-optics)  
Channel: 1 or 2  
Protocol: TCP/IP, FTP, Modbus TCP/IP

DCS communication  
Communication standard: RS-422  
Protocol: MODBUS, Y-Protocol  
(GC1000/GC8, GC6, BTU for Japan)

Analog Output: maximum of 32  
Analog Input: maximum of 16  
Contact Output: maximum of 20  
Contact Input: maximum of 32

## Utility

Power supply:  
100/110/115/120/200/220/230/240 V AC  
±10%, 50/60 Hz ±5%

Power consumption:  
Type 1: 1.2 to 1.6 kVA  
Type 2: 2.0 to 2.5 kVA  
Type 3: 3.0 to 3.7 kVA

Instrument air  
Pressure: 350 to 900 kPa  
Flowrate:  
Type 1: 100 to 140 L/min  
Type1 with FPD: 130 to 200 L/min  
Type 2: 150 to 210 L/min  
Type2 with FPD: 180 to 270 L/min  
Type 3: 200 to 280 L/min

Carrier gas  
Kinds: H<sub>2</sub>, N<sub>2</sub>, He, or Ar  
Purity:  
Range from 0 to 10 ppm or more:  
99.99% minimum (water: 10 ppm or less, organic components: 5 ppm or less)  
Range from 0 to less than 10 ppm:  
99.999% minimum (water: 5 ppm or less, organic components: 0.1 ppm or less)

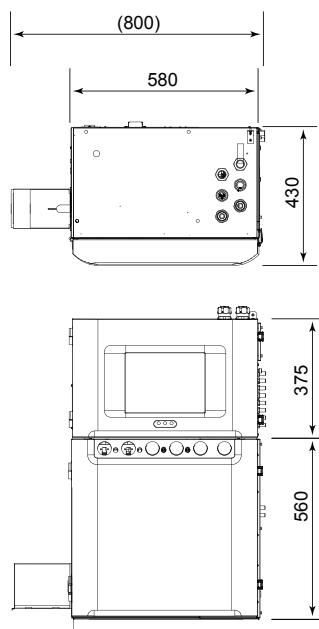
Pressure:  
H<sub>2</sub>: 500 kPa (72.5 psi) (supplied with extra-regulator for explosion-proof certification)  
Other than H<sub>2</sub>:  
400 to 700 kPa

Consumption:  
60 to 300 mL/min per isothermal oven

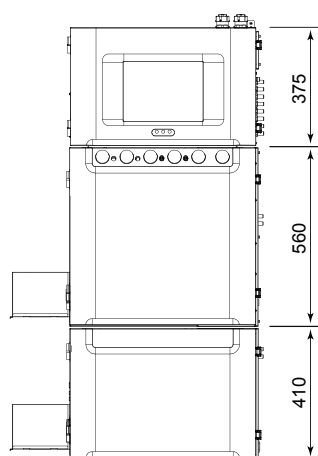
# Dimensions

Unit : mm

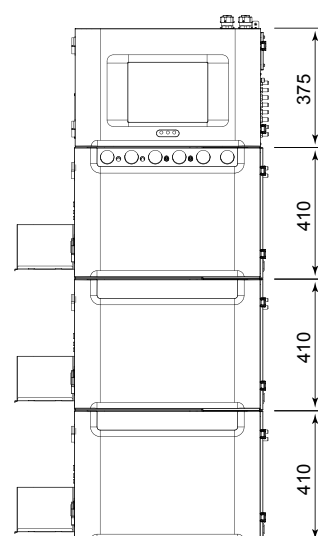
Type 1



Type 2



Type 3



\* For details, refer to GS 11B08A01-01E.

See more information on: [www.gc8000.com](http://www.gc8000.com)

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Vig-PMK-G-NL-10E

Printed in Japan, 106 (KP) [Ed : 01/b]

# General Specifications

## Model GC1000 MarkII Process Gas Chromatograph

A Gas Chromatograph analyzes a gas or volatile liquid sample by separating components for detection. The discrete separation and positive identification of components and measurement of the composition with no interference is a positive advantage of the gas chromatograph. Making good use of this advantage, the process gas chromatograph is widely used in many industries.

YOKOGAWA manufactures two models of GC1000 Process Gas Chromatographs: the GC1000 S/E/C (isothermal oven type) and the GC1000 D/T/W (programmed temperature type). The GC1000 S/E/C can analyze gas and liquid samples from room temperature up to elevated temperatures corresponding to their boiling points. The GC 1000 D/T/W is capable of performing high resolution analysis by using capillary columns similar to laboratory gas chromatograph.

### Features

- Capabilities of analyzing PIONA and the Distillation points  
Techniques for laboratory analyses can also be utilized in the GC1000 series by configuring and installation of high resolution capillary columns. This allows for the analysis of properties such as PIONA and Distillation points.
- **Capability of analyzing high boiling point liquid samples**  
The liquid sampling valve with vaporizer having a tight seal provides highly accurate liquid sampling. The liquid sample is vaporized by an internal heater and introduced to the columns. This allows for highly consistent sample volume and excellent reproducibility.
- **Capability of analyzing samples in a very wide range of boiling points**  
In the thermostatic oven, temperature is accurately controlled within  $\pm 0.03^{\circ}\text{C}$  by an air-bath and circulation fan. For wide boiling point range samples, the programmed temperature oven enables the GC1000 to analyze these samples with high resolution.
- **Easy operation via User Friendly Displays**  
User friendly keyboard and display allows easy operation and display of analysis data. Many functions can easily be accessed to the user including auto gate tracking, column end-of-life warning and auto gain setting.
- **Enhanced maintenance using PC operation**  
With our maintenance terminal software (GCMT/ASMT), the GC1000 can be operated from remote location like the control room or office. In addition, the analyzer bus allows for total maintenance management system to include other field analyzers and data acquisition capabilities.
- **Achievement of High Sensitivity TCD**  
Most analysis which normally requires FID detector can now be done using the new high sensitivity TCD detector. This eliminates the requirement of fuel gas and presence of flame as in the FID.
- **Expectation of the effective result by EPC**  
EPC (Electronic Pressure Control) controls the utility gas pressure by electronics and software, providing the same efficiency as programmed temperature analysis.



### Examples of Applications in Industries

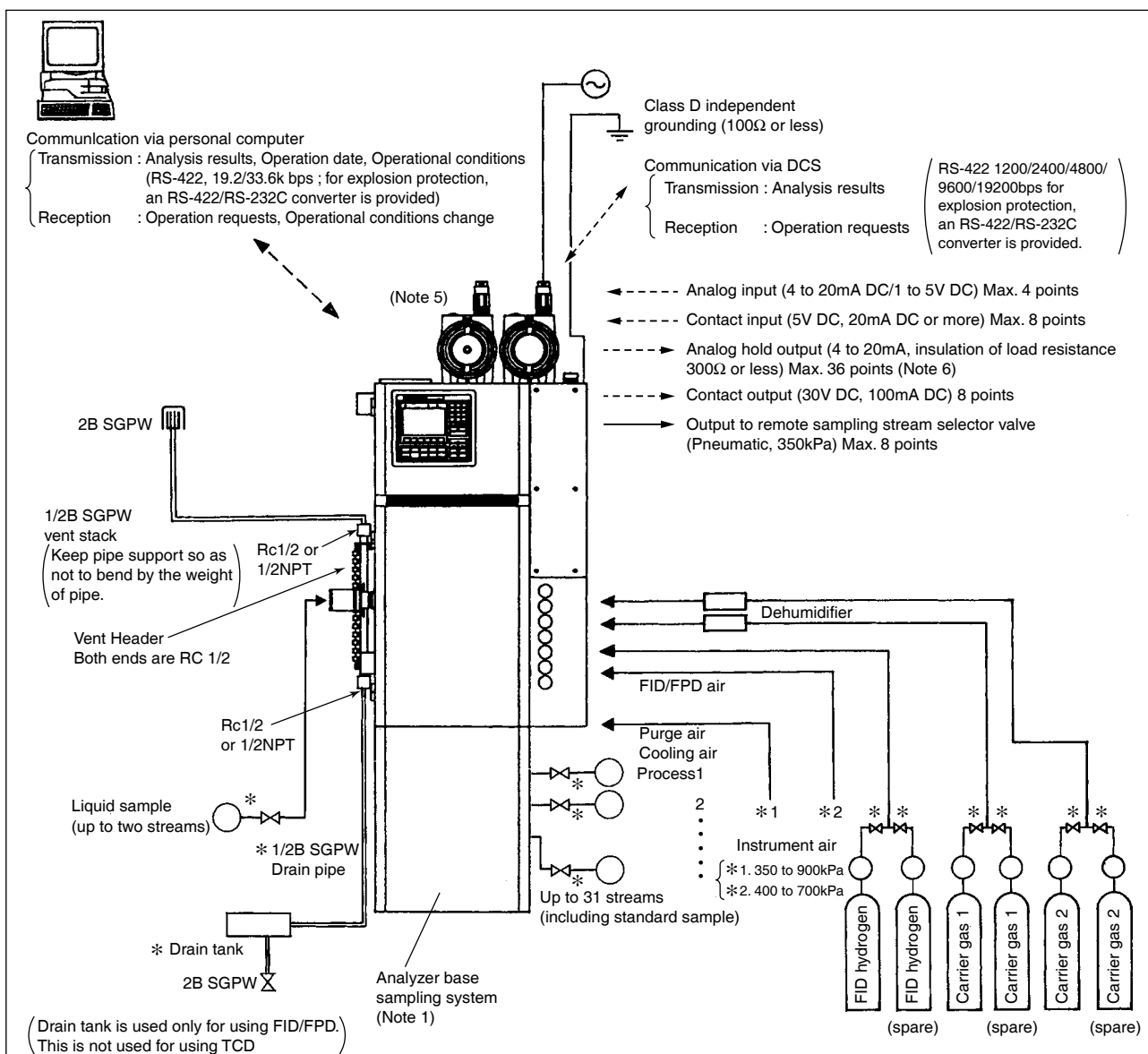
The GC1000 can be used for monitoring and quality control in following industries and applications.

- Petrochemistry: Ethylene, Polypropylene, Polyethylene, BTX, Butadiene, Vinyl chloride, Styrene, Alcohol, Aldehyde, Ester, and Vinyl acetate
- Petroleum refinery: Distillation point analysis, PNA/ PINA analysis, FCC, Sulfur Recovery
- Chemistry: Silicone, Chlorides, Fluorine compounds, Formalin, Methanol, Ures, Ammonia, Phenol
- Electric power/gas: Fuel gas, Exhaust gases, Coal gasification/ liquefaction, Fuel cell
- Iron and steel: Blast furnace, Coke oven
- Air plant: Inorganic gas analyses
- Chemicals: Chemicals, Agricultural Chemicals
- Environmental monitoring: Air pollution observation, Plant/Work environmental analyses

The GC1000 can, of course, respond to many other applications.



## (1) Using Vent Stack



**Note 1:** As an analyzer base sampling system is provided, in many cases, most applications require no external sampling equipment.

In addition, optimum sampling systems are prepared depending on various conditions. (For details, consult Yokogawa. Optimal sampling systems will be offered.)

**Note 2:** For piping air purging, use stainless steel pipe of 1/2 inch or more. For another piping, see subsection External Dimensions 6 to 11 pages.) Wiring cables, piping and installation materials marked with an \* should be supplied by the user.

**Note 3:** For I/O cables, see Subsection 2.2.3, "Recommended Cables".

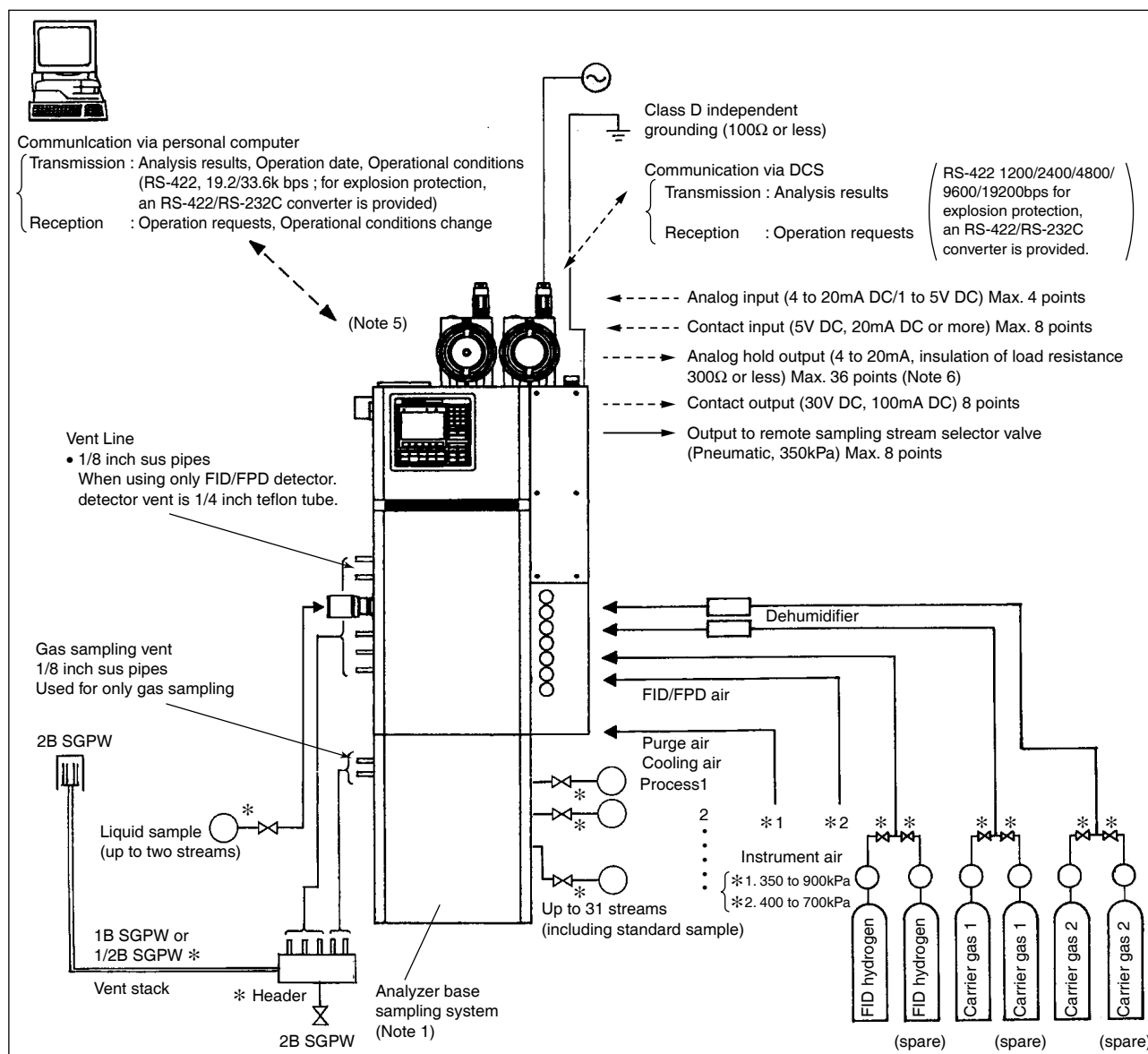
**Note 4:** Fix venting pipes properly so that the dead load of the venting pipes does not apply to the assembling vents of this analyzer.

**Note 5:** The specification decides the number of flameproof enclosure. No enclosure is applied for the general purpose or Y-purge type.

**Note 6:** There is a case of analog output by via GCCU. GCCU is a computing unit to handle various types of signal such as A/O, analog serial output, trend output, digital output and so on. Refer to GS 11B03S03-01E for detail.



## (2) Using no Vent Stack



**Note 1:** As an analyzer base sampling system is provided, in many cases, most applications require no external sampling equipment.

In addition, optimum sampling systems are prepared depending on various conditions. (For details, consult Yokogawa. Optimal sampling systems will be offered.)

**Note 2:** For piping air purging, use stainless steel pipe of 1/2 inch or more. For another piping, see subsection External Dimensions (6 and 7 pages.) Wiring cables, piping and installation materials with an \* should be supplied by the user.

**Note 3:** For I/O cables, see Table 1 "Recommended Cables".

**Note 4:** Fix venting pipes properly so that the dead load of the venting pipes does not apply to the assembling vents of this analyzer.

**Note 5:** The specification decides the number of flameproof enclosure. No enclosure is applied for the general purpose or Y-purge type.

**Note 6:** There is a case of analog output by via GCCU. GCCU is a computing unit to handle various types of signal such as A/O, analog serial output, trend output, digital output and so on. Refer to GS 11B03S03-01E for detail.

## General Specifications

**Measurable object** Gas or liquid

### Measurement principle

Component separation by elution  
Detection TCD, FID, FPD

### Measurable ranges

TCD 1ppm to 100%  
FID 1ppm to 100%  
FPD 1ppm to 0.1%

### Number of streams to be measured

Maximum of 31 (including standard sample)

### Number of components to be measured

Maximum of 255

**Analysis period** Maximum of 99999.9 sec

### Quantifying method

Absolute calibration  
Sensitivity-corrected absolute calibration  
Corrected area normalization

### Material of the sample-contact parts

Stainless steel SS316, polytetrafluoroethylene (PTFE),  
luorocarbon rubber, and glass

**Repeatability** 1% of full scale (2)

\* The value may vary depending on the specifications  
and conditions. For details, contact Yokogawa.

## 1. Analyzer

### 1.1 Specifications

Area classification TIIS (JIS) Ex pd IIB+H2, T1 to T4 X  
FM/CSA X-purging, Y-purging class1,  
Div1, Groups B, C and D, T1 to T4  
CENELEC ATEX(KEMA) II2G EEx pd  
IIB+H2, T1 to T4  
Construction Drip-proof and dust-proof construction  
(NEMA 3R, equivalent to IP53)  
Display Liquid crystal display (LCD)  
Operating ambient conditions  
-10 to 50°C, 95% RH or less  
Storage conditions -10 to 85°C, No moisture condensation  
Coating Epoxy resin coating  
Analyzer coating color 2.5Y 8.4 / 1.2  
(GC1000 analyzer)  
0.8Y 2.5 / 0.4 (flow control section and  
terminals)  
Mass Approx. 120 kg  
(with analyzer base sampling system)

### 1.2 Isothermal Oven (GC1000S/E/W)

Volume 40L (27L: with programmed Temp.  
Oven)  
Temperature setting at fixed set point  
Setting temperature range  
55 to 225°C (Temperature can be set  
in one degree steps.)  
Temperature control accuracy  
±0.03°C  
Temperature control PID control  
Temperature sensor Pt100W RTD with over-heating  
prevention function

### 1.3 Programmed Temperature Oven (GC1000D/T/C)

Volume 8.6L  
Temperature setting Fixed point or programmed setting  
Temperature setting range  
60 to 320°C without cooler  
5 to 320°C with cooler  
Heating program Maximum of three steps  
Heating rate 1 to 30°C / min  
(Temperature can be set in one degree  
steps.)  
Temperature stability ±0.03°C at a control point in the  
steady state.  
Stability to ambient temperatures  
±0.1°C / 10°C  
Stability to supply voltage variation  
0.03°C / 10%  
Temperature control PID control  
Temperature sensor Pt100W RTD with over-heating  
prevention function.

### 1.4 Liquid Sampling Valve with Vaporizer

Sample pressure 0 to 3MPa  
Sample temperature 150°C or less  
Sample volumes 0.1, 0.2, 0.5, 1, 2, and 3ml  
**<Vaporizing section>**  
Temperature setting range  
oven temperature +5 to 250°C  
Temperature setting step  
1°C  
Temperature stability ±1°C  
Temperature control PID control  
Temperature sensor Pt100W RTD with overheating  
prevention function

### 1.5 Cooler

The cooler serves for fixed point control of the thermostatic oven  
at the room temperature or below, or to force the oven to be  
cooled after analysis.

Mounting Externally mounted  
Cooling method By vortex tube

## 2. Utility

Power supply 100 to 120V AC±10%, 50 / 60 Hz±5%  
(for GC1000S/E/W), or 200 to 250V  
AC, 50 / 60Hz±5% (for GC1000D/T/C)  
Power consumption Maximum of 3.1kVA (for GC1000D/  
T/C) Maximum of 1.5kVA or 0.7kVA  
(for GC1000S/E/W) (It may vary  
depending on the specifications)  
Instrument air Standard (without cooler)  
Pressure 350 to 900kPa  
Flowrate 150 L/min or more (for GC1000D/T/C)  
100 L/min or more (for GC1000S/E/W)  
Dew point -20°C or less (It may vary depending  
on the specifications)  
With cooler  
Pressure 500 to 900kPa  
Flowrate 300 L/min or more  
Dew point -20°C or less  
(It may vary depending on the  
specifications)

Carrier gas	
Supplied method	EPC (Electric Pressure Controller) or Regulator
Kinds	Any one or two of H <sub>2</sub> , N <sub>2</sub> , He, or Ar
Purity	99.99% minimum
(Dew point -60°C or less)	
Organic components	5ppm or less
Pressure	500 to 700kPa
Consumption	60 to 300mL/min
Hydrogen gas for FID/FPD	
Purity	99.99% minimum
(Dew point -60°C or less)	
Organic components	5ppm or less
Pressure	500 to 700kPa
Consumption	Approximately 40mL/min per detector
Air for FID/FPD	
Purity	99.99% minimum
(Dew point -60°C or less)	
Organic components	5ppm or less
Pressure	400 to 700kPa
Consumption	Approximately 300mL/min per detector

### 3. Externally Input and Output Signal list

#### 3.1 Input

Item	Signal level	No.	Description
Analog Input	Isolated 4-20mA DC 1-5V DC 4-20mA DC (with 24 or 28V DC of Power) <sup>*1)</sup>	4	Accuracy : 0.5%FS (-10 to 50°C) Function : Output of Current value <sup>*2)</sup> and Average value <sup>*3)</sup>
Contact Input	Specification : 5V DC, 20mA DC or more Input ON signal: 200 or less OFF signal: 100k or more On operation: NC or NO (selectable)	8	Function : Alarm from outside Following command request Stream sequence assign Stream (cont.) assign Stream (1 cycle) assign Cal (Val) assign Change of Operation mode

#### 3.2 Output

Item	Signal level	No.	Description
Analog Output	Isolated or No-isolated 4-20mA DC Load: 300 or less	MAX. 36	Analysis result <sup>*4)</sup>
Contact Output	Specification (relay) : Voltage: 30V DC Current: 100mA DC On operation: NO or NC (selectable)	8	System alarm1 System alarm2 Component alarm (Conc./RT) Timing signal Code signal for stream ID (Max. 5 points)
Air output for stream valve	Air press : 350kPa	MAX. 8	Binary code signal for 9 to 31 stream (max.)

#### 3.3 Communication

Item	Signal level	No.	Description
DCS communication	Standard : RS422 (4wires, Full-Duplex) Specification : Start bit 1, Stop bit 1, Parity 1, ASCII7 bit, Without procedure or Hand shake Speed : 1200/2400/4800/9600/19200 bps(selectable) For explosion protection : RS422/RS232C converter is provided.(2 wires of power line is needed except the signal line) The transmission type is full duplex for RS232C.	1	Transmission : Analysis result <sup>*4)</sup> Calibration coefficient Alarm Reception : Operation request <sup>*5)</sup>
PC communication	Standard : RS422 (4wires, Full-Duplex) Speed : 19.6/33.6kbps For explosion protection : RS422/RS232C converter is provided.(2 wires of power line is needed except the signal line) The transmission type is full duplex for RS232C.	1	GCMT (GC Maintenance Terminal) Transmission : Analysis result <sup>*4)</sup> Operation information <sup>*6)</sup> Parameter list Reception : Operation request <sup>*5)</sup> Change of Parameter list

\*1) : 2-wires transmitter

\*2) : It means the data which is averaged by every 1 second after filtered by a constant which the analog data is scanned by every 200msec. It can be output by DCS communication (Modbus protocol).

\*3) : It means the current value which is set time in a cycle time.

\*4) : Analysis result (concentration, simulated distillation result, base level, signal level, noise level, Deviation calculation, Liner calculation1-5, Ratio, Separation coefficient, Calorific value, Density, Compressive factor, Wobbe Index)

\*5) : Operation request, (Stream sequence assign, Stream (cont.) assign, Run command, Stop command, Pause command, Range change)

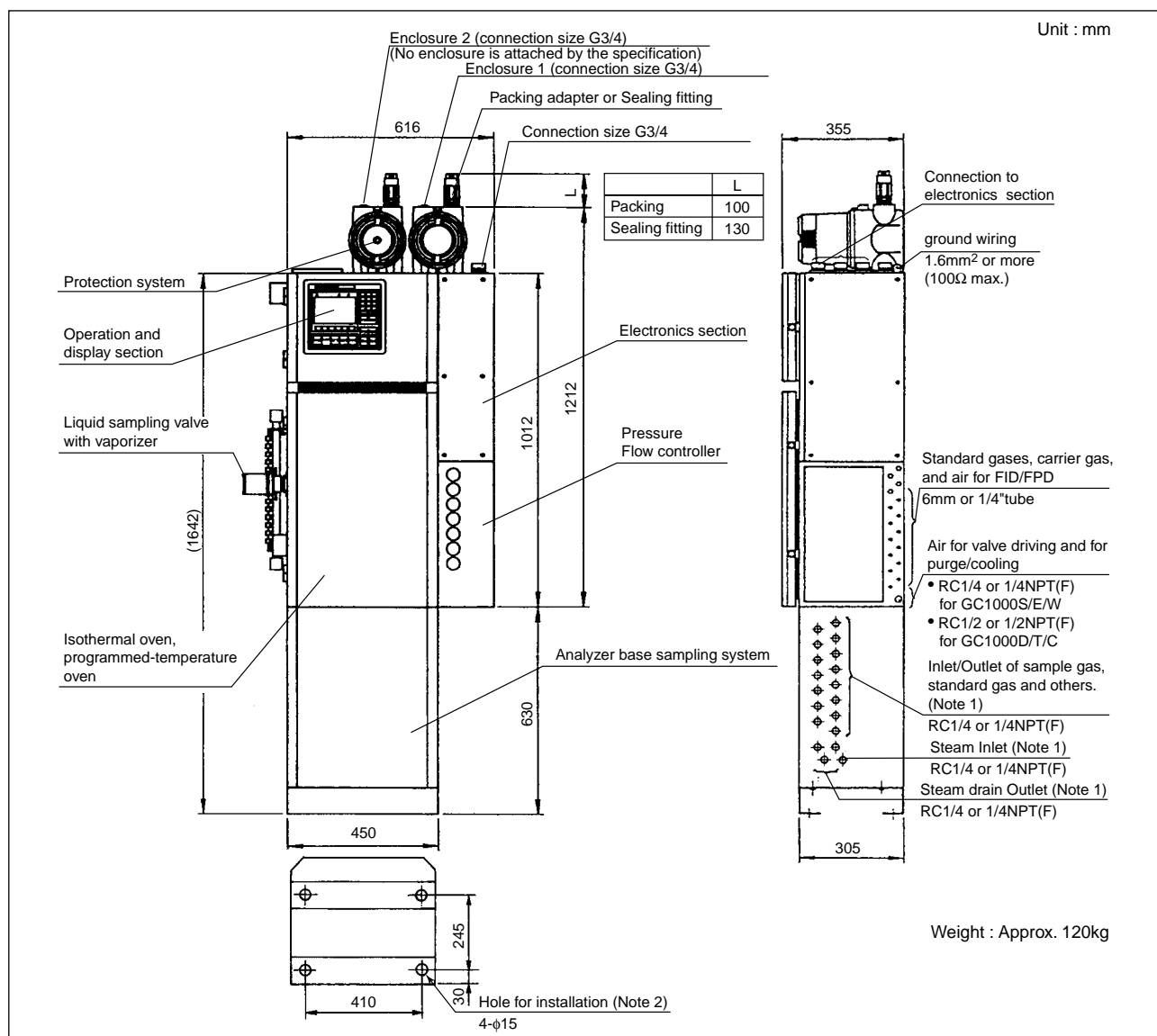
\*6) : Operation Information (Chromatogram, Oven temperature, measuring stream, Valve ON/OFF etc...)

#### 3.4 Network

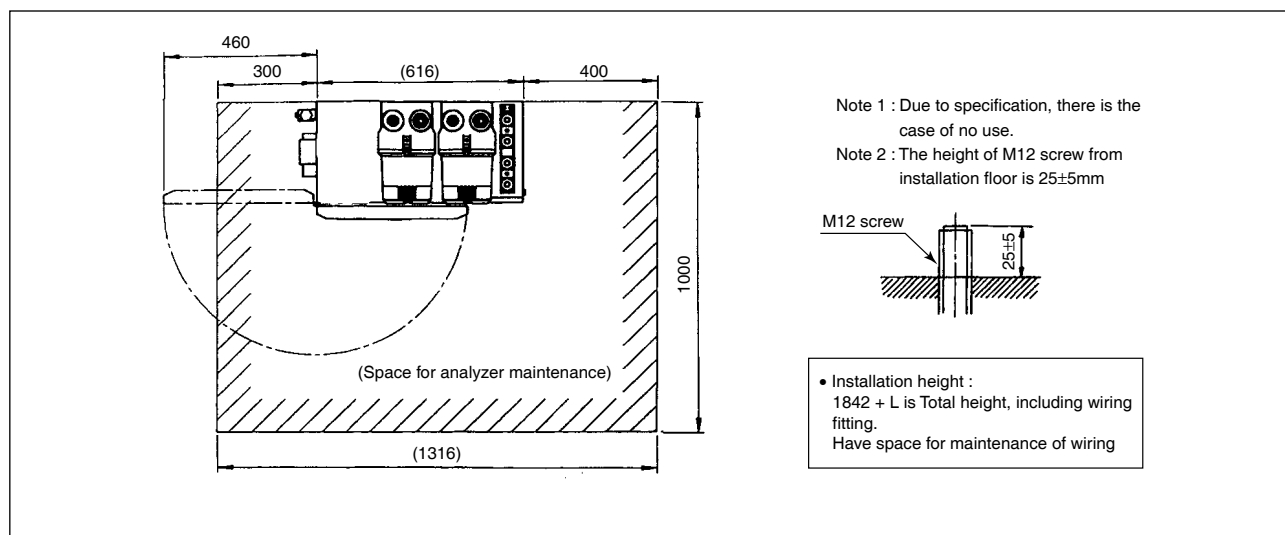
Refer to GC 11B05A01-01E.

## 4. EXTERNAL DIMENSIONS

### (1) GC1000D/GC1000S with analyzer base sampling system

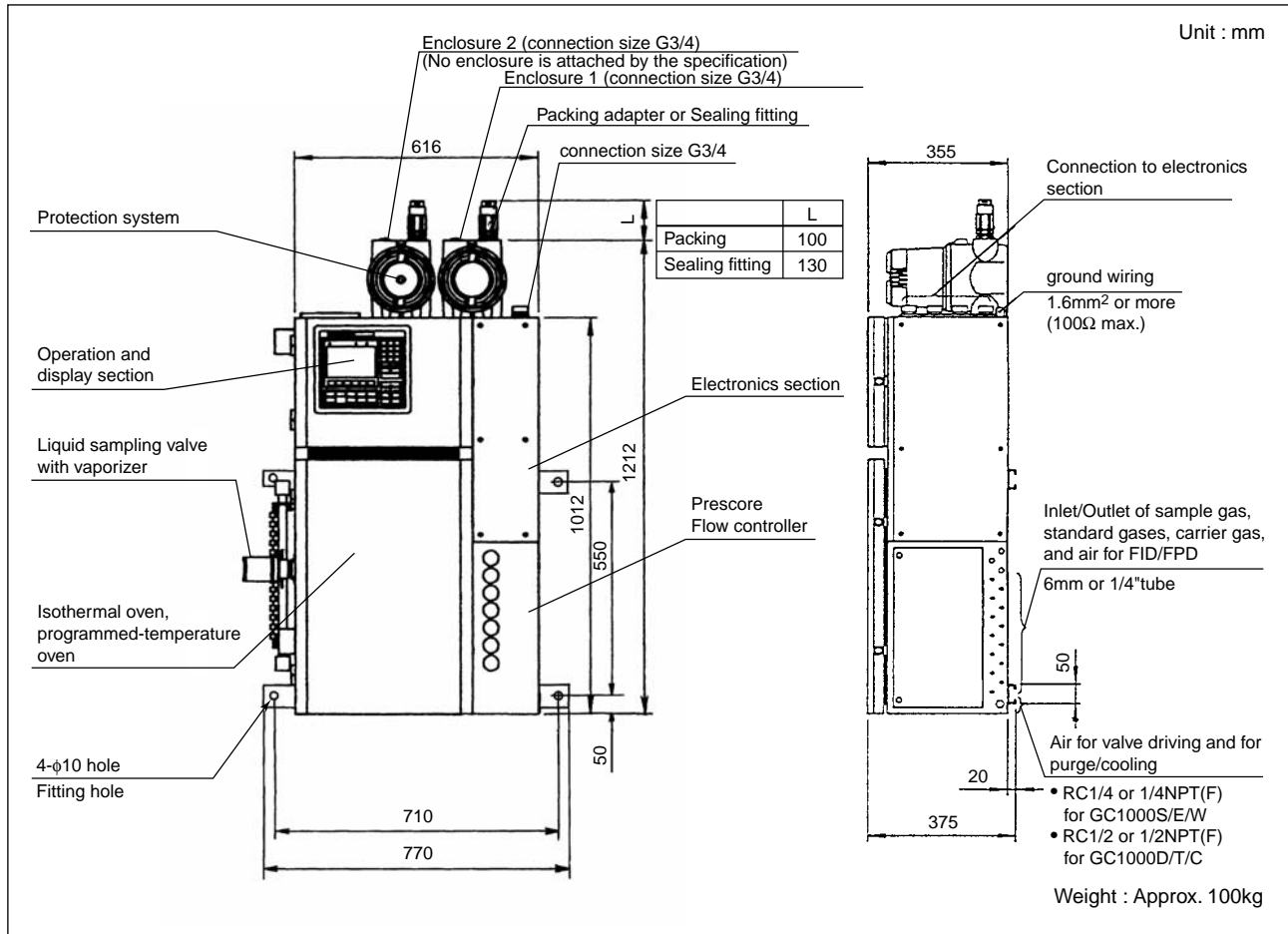


### Space for analyzer maintenance

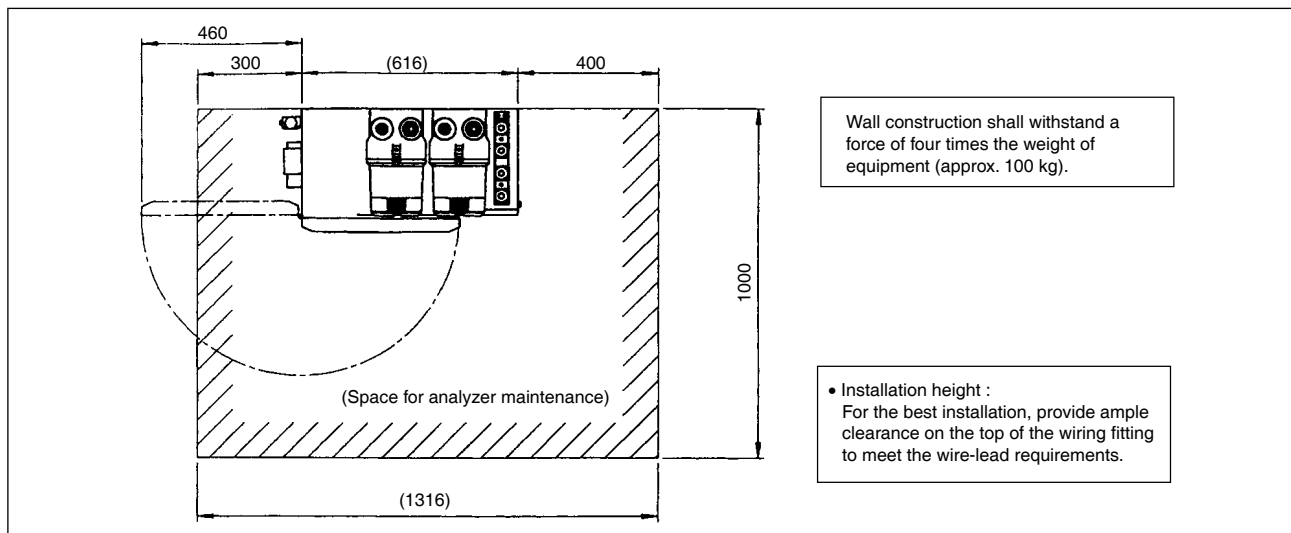


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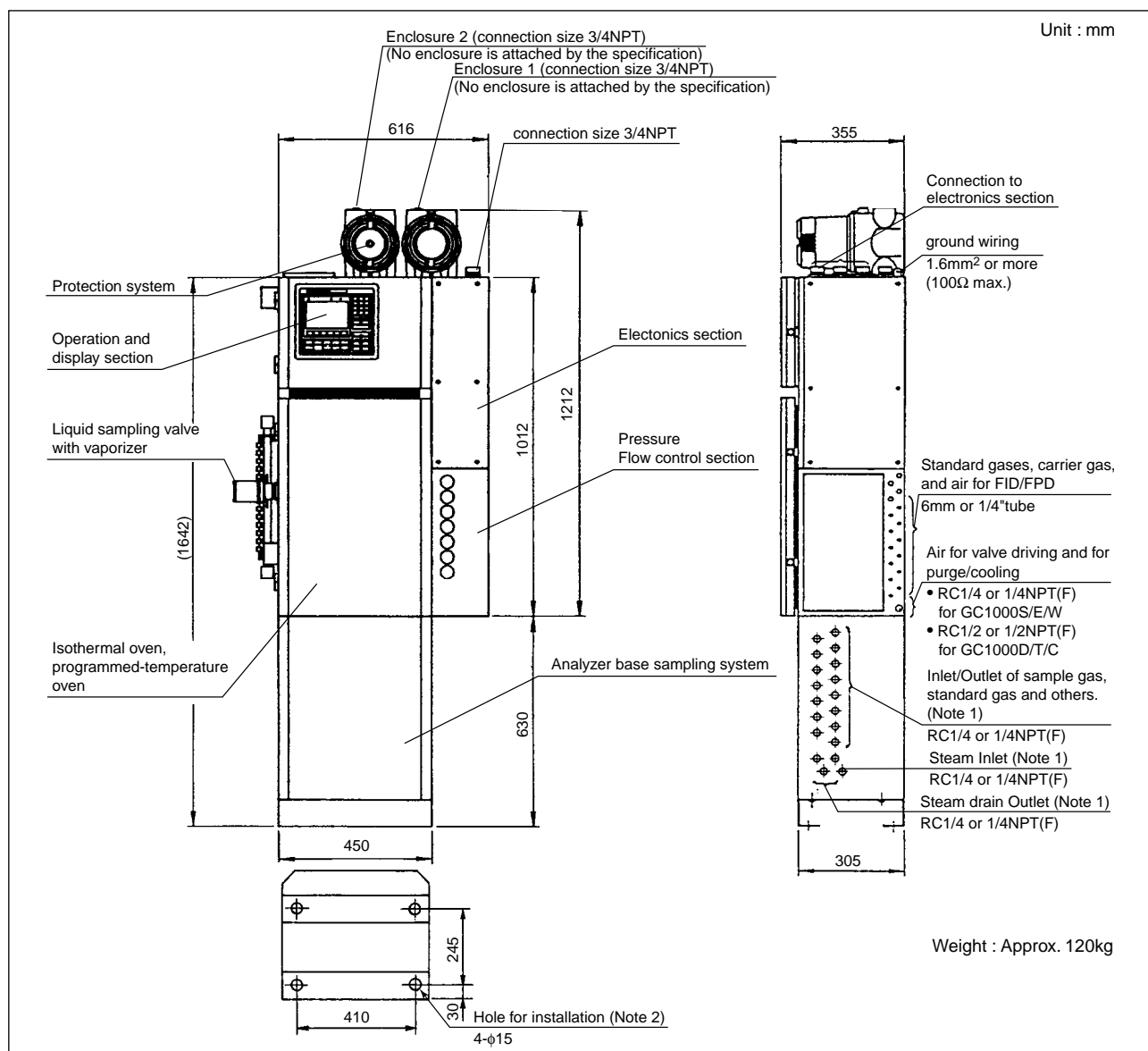
(2) GC1000D/GC1000S without analyzer base sampling system



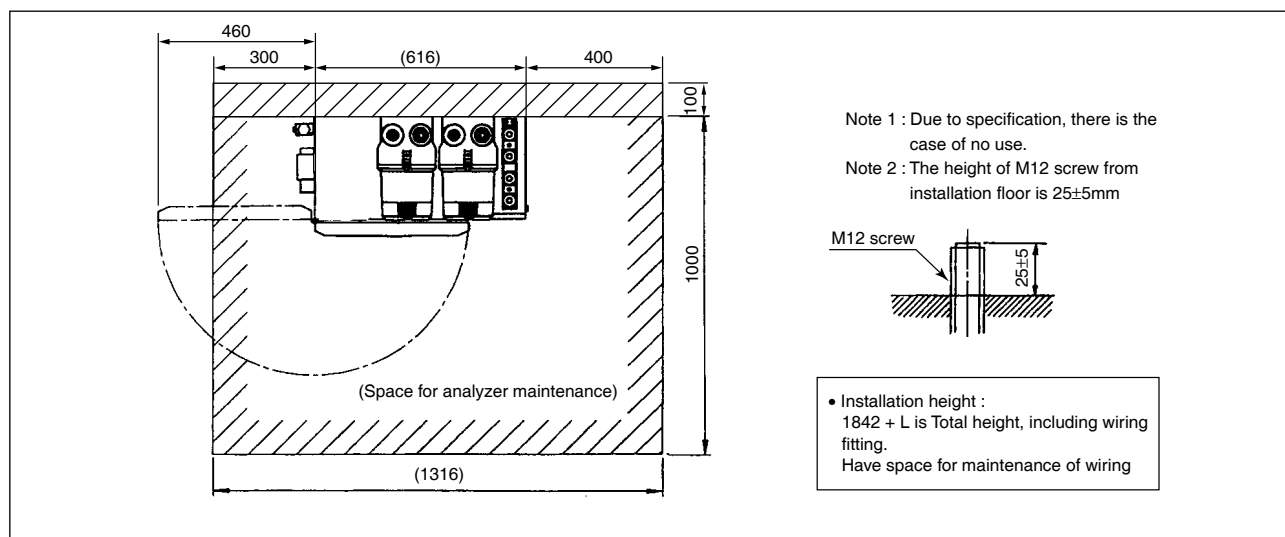
Space for analyzer maintenance



## (3) GC1000T/GC1000E with analyzer base sampling system

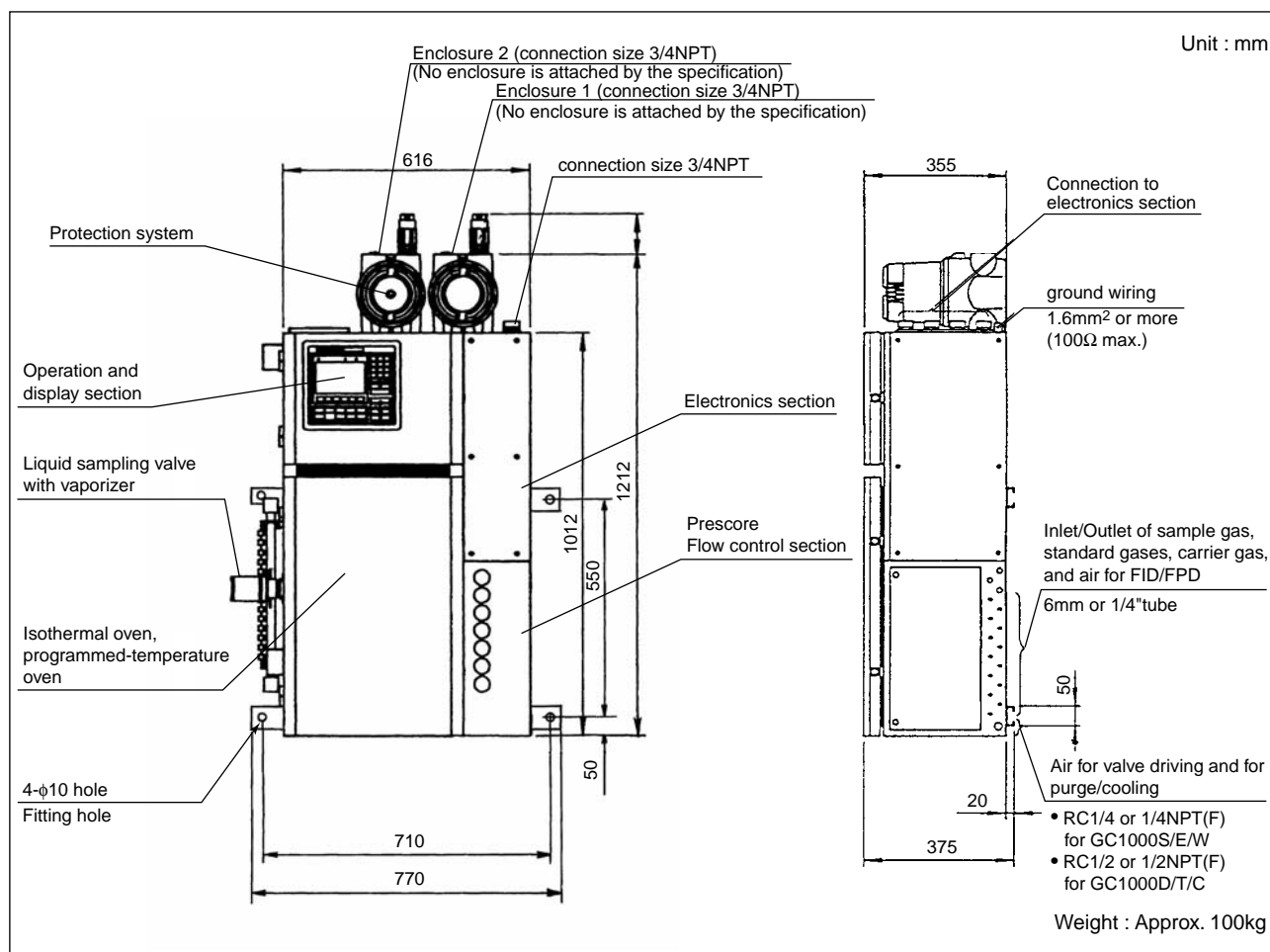


## Space for analyzer maintenance

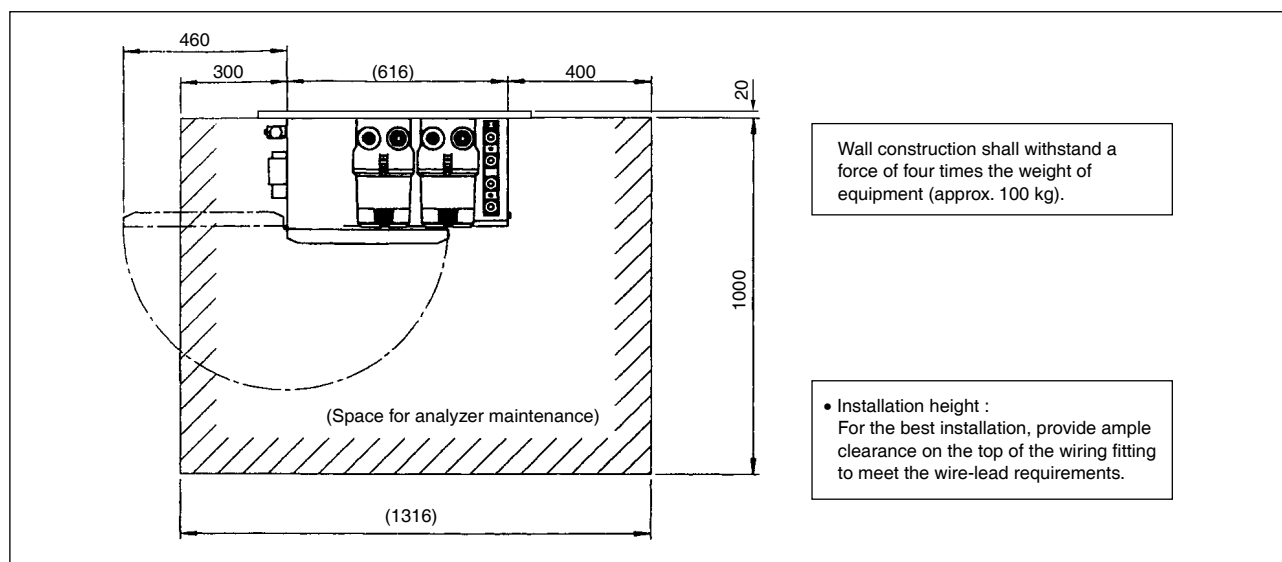


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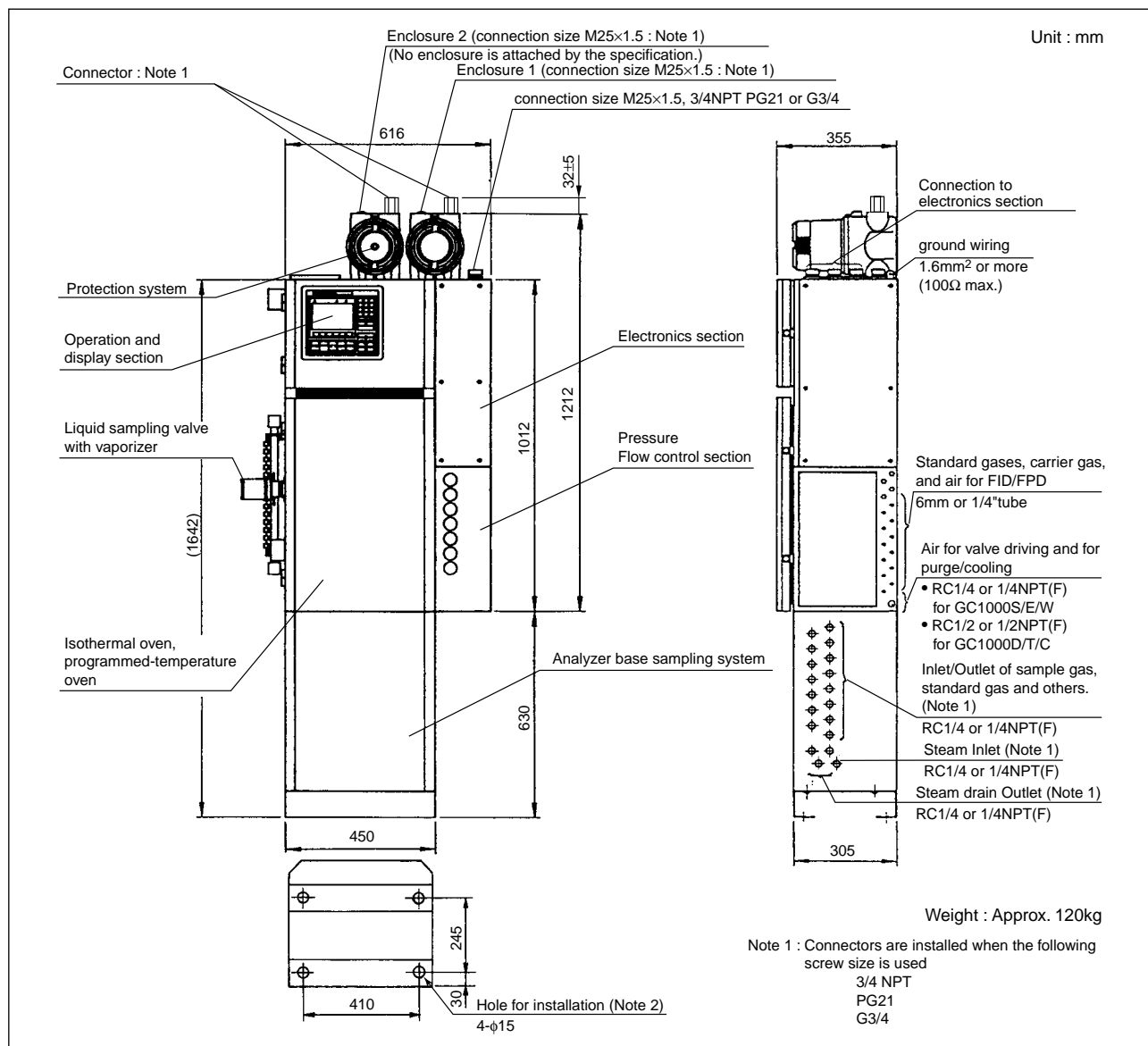
(4) GC1000T/GC1000E without analyzer base sampling system



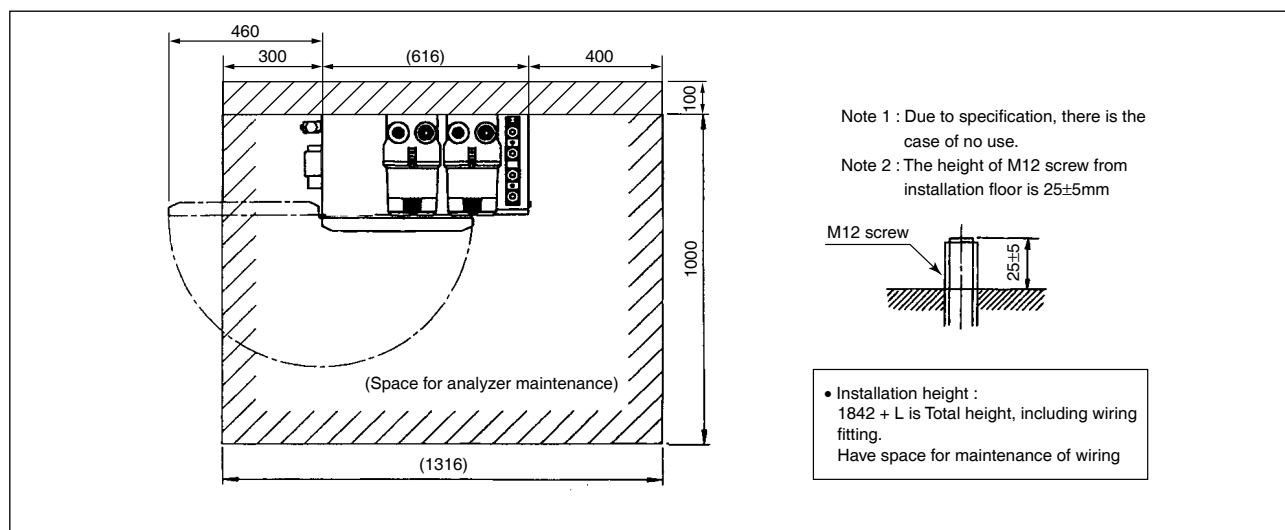
Space for analyzer maintenance



## (5) GC1000W/GC1000C with analyzer base sampling system



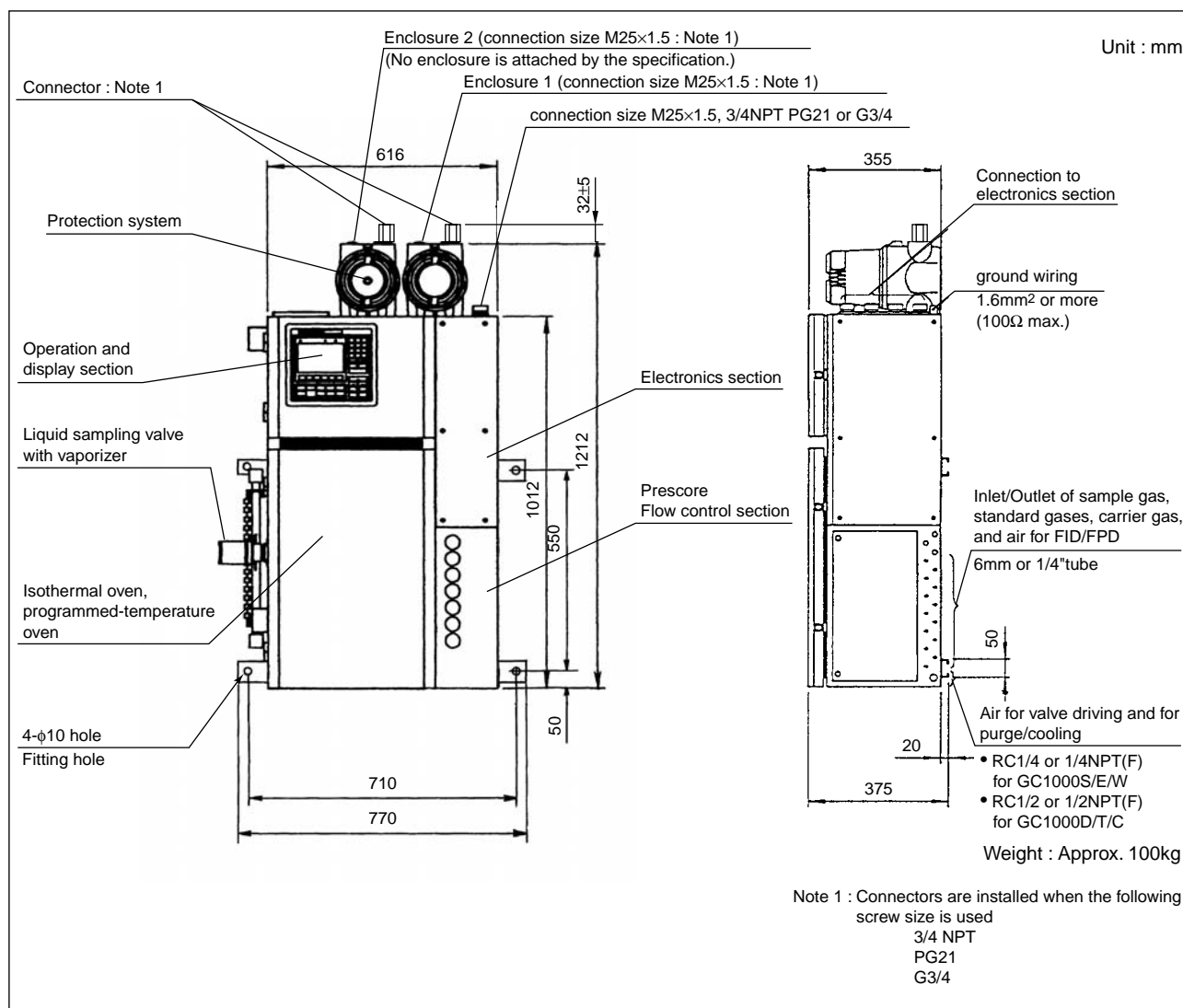
## Space for analyzer maintenance



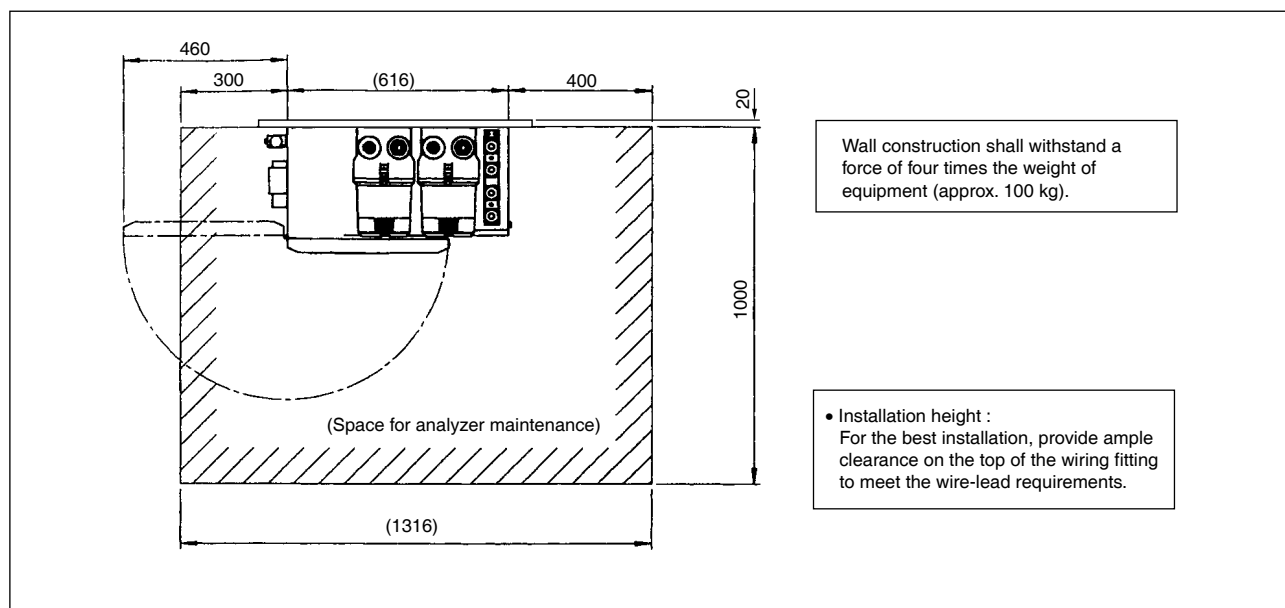
GS 11B03A03-01E-E



(6) GC1000W/GC1000C without analyzer base sampling system



Space for analyzer maintenance



GS 11B03A03-01E-E

Table 1. Recommended Cables

Wiring Connections	Wiring Inlet Cables Used	Cables	Wiring	Cable O.D. and Length	Cable Shield
Protection System	Two inlets for each enclosure	8 to 15.9mm dia. for flameproof packing adapter	Two enclosures (A) Heater power line (B) Electrical circuitry power line	3.5mm <sup>2</sup> to 5.5mm <sup>2</sup> max. 1.25mm <sup>2</sup> to 5.5mm <sup>2</sup> max.	Not required
			One enclosure (C) Power line	1.25mm <sup>2</sup> to 5.5mm <sup>2</sup> max.	
			(D) Contact output line (8 points max.)	0.75mm <sup>2</sup> to 1.5mm <sup>2</sup> max. cable length 1km max.	Required
			(E) Analog input line (4 points max.)	0.75mm <sup>2</sup> to 1.5mm <sup>2</sup> max. cable length 1km max.	Required
Electronics section	Four inlets	10 to 15.9mm dia. for packing adapter	(A) Heater power line (B) Electrical circuitry power line (C) Power line	3.5mm <sup>2</sup> to 5.5mm <sup>2</sup> max. 1.25mm <sup>2</sup> to 5.5mm <sup>2</sup> max. 1.25mm <sup>2</sup> to 5.5mm <sup>2</sup> max.	Not required
			(H) Contact input line (8 points max.)	0.75mm <sup>2</sup> to 1.5mm <sup>2</sup> max. cable length 1km max.	Required
			(I) Serial communications line	0.75mm <sup>2</sup> to 1.5mm <sup>2</sup> max. cable length 1km max. twisted pair cable	Required
			(J) Analog output line (36 points max.)	0.5mm <sup>2</sup> to 1.5mm <sup>2</sup> max. cable length 1km max.	Required
			(K) Grounding wire	5.5mm <sup>2</sup> or more; grounding resistance up to 100Ω	Not required
			(L) Analyzer bus line (max of 2 point)	For use twisted pair cable 0.2mm <sup>2</sup> to 1.5mm <sup>2</sup> max. 300m or less	Required

**Note 1:** Wiring to Protection System and Terminal section

<JIS> It is available to use which sealing fitting or flameproof packing adapter. I.D. of the metal conduit for sealing fitting is 22mm.

Cable size is of ø 8 to ø 15.9mm for flameproof packing adapter. Select packing seal according to cable size.

<FM/CSA> It is only available to use sealing fitting.

<CENELEC> It is only available to use flameproof packing adapter.

**Note 2:** When shield is required, provide the shield to connecting side. (In GC1000, no shield terminal is supplied as standard.)

**Note 3:** Use "MKKDSN" Series terminals (manufactured by Phoenix Contact K.K.) for the contact output line (D), analog input line (E), contact input line (H), serial communications line (I), analog output line (J), and detector output line (K).

For these wiring connections, use AI Series crimp-on terminals also manufactured by the company. Four types of crimp-on terminals are used to meet wire diameters.

Please peel off the cover of wire by 5 mm if you do not use the terminal and contact with the terminal.

**Note 4:** There is no protection system when FM/CSA with Y-purge is applied, Terminal section is used for all wiring.

## 5. Analyzer Base Sampling System

In order to ensure the process gas chromatograph operate stable over a long period of time, it is necessary to select the most appropriate sampling system corresponding to sample properties in addition to analyzer stability and reliability.

The GC1000 process gas chromatograph can accommodate an analyzer base sampling system in its analyzer, which contains the essence of sampling techniques utilizing long-term experience. This system not only enables the analyzer and sampling system to be operated and maintained integrally but also makes the system configuration simple.

The analyzer base sampling system should be selected as shown below.

- (1) As sample properties and the number of air operated valves, pressure regulators, and flowmeters to be mounted are limited, see Section 5.1, "Limitation in Selecting a Sampling System" when selecting the sampling system.
- (2) According to Section 5.2, "Flow Selection Diagrams," select the sample conditioning system, sample suction system, sample heating system, and / or standard gas (standard solution) introducing system.
- (3) Specify the analyzer base sampling system code depending on the system selected.

The sample flow diagram of the sampling section is a combination of the basic flow diagram, specified sample conditioning system, sample suction system, sample heating system and standard gas (standard solution) introducing system.

### 5.1 Limitation in Selecting a Sampling System

Sample properties that can be conditioned in the analyzer base sampling system are as follows: In addition, the specifications for the maximum number of air-operated valves, pressure regulators, and flowmeters are limited. The sample properties and specifications exceeding these limits necessitate preparing an external sampling system.

#### 5.1.1 Sample Properties

Sample	Temperature	Pressure	Dust	Mist	Boiling Point
Gas	150°C or less	0.01 to 3MPa	0.01g/Nm <sup>3</sup> or less	None	——
Liquid ; the rotary sampling valve is used.	Normal temperature	0.2 to 3MPa	None	——	270°C or less
Liquid ; the liquid sampling valve with a vaporizer is used.	150°C or less	0.2 to 3MPa	None	——	450°C or less

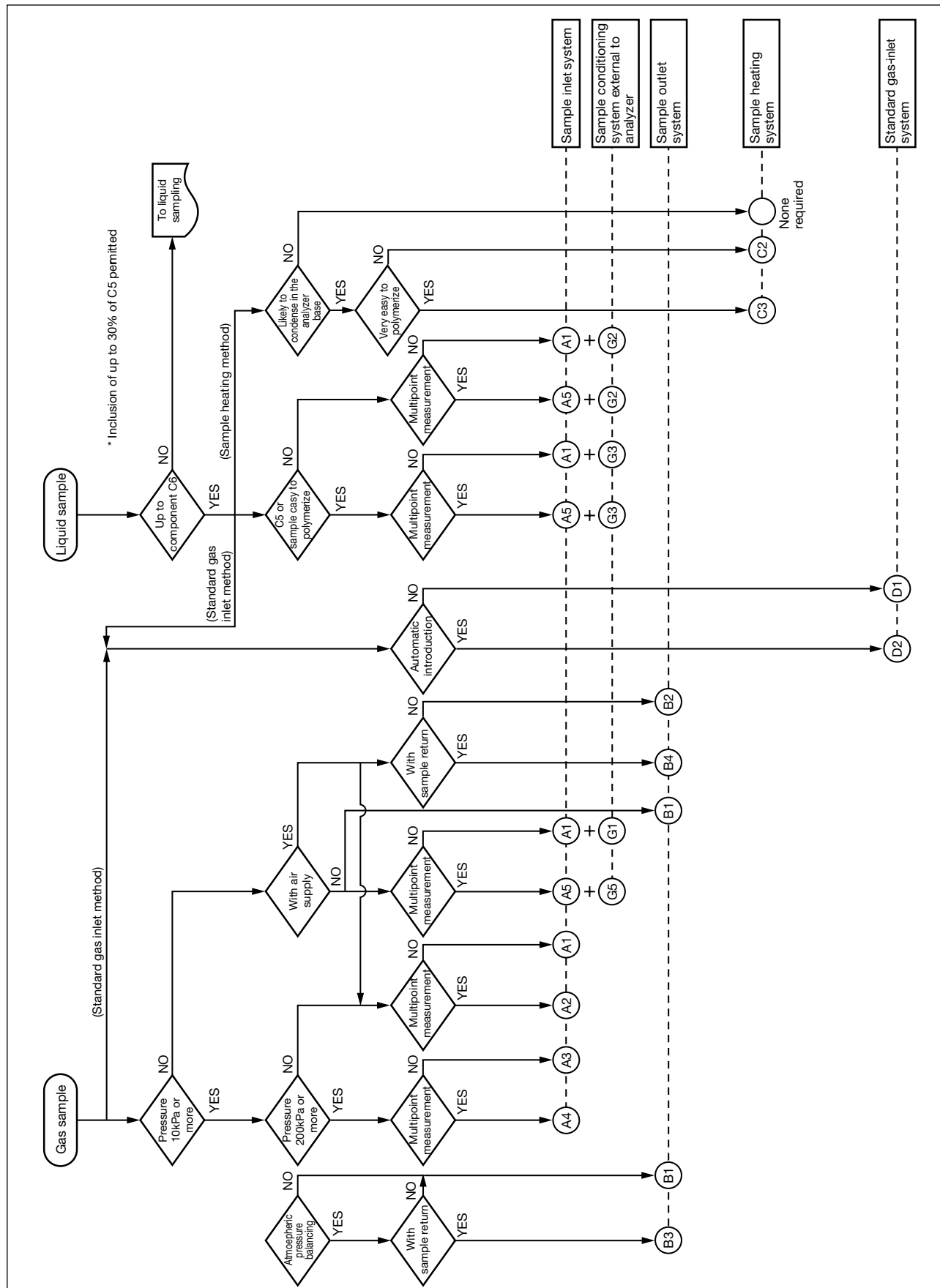
#### 5.1.2 Limitation of Specifications Related to the Maximum Mountable Number of Air-operation Valves

Purpose of Air-operation Valve	Number of Mountable Valves
Automatic stream switching (1 to 8 streams)(including standard gas line) *1	1 for 1 stream A maximum of 8 *2
Atmospheric pressure balancing	1 for 1 stream A maximum of 2

- \*1: • If the number of automatically switched streams exceeds 8, use an external sampling system.  
By using the external sampling system, the number of automatic stream switching can be extended up to 31.  
The external sampling system is driven by a pneumatic signal of 350kPa sent out from the analyzer.
- The number of streams for automatic stream switching is up to 6.
- \*2: The following cases have a maximum of 7 for mountable valves.
- Sample outlet system is B1 without any sample heating system and 2 independent sample line.
  - Sample outlet system is B1 with sample heating system.
  - Sample outlet system is B1 with 2 independent sample line.

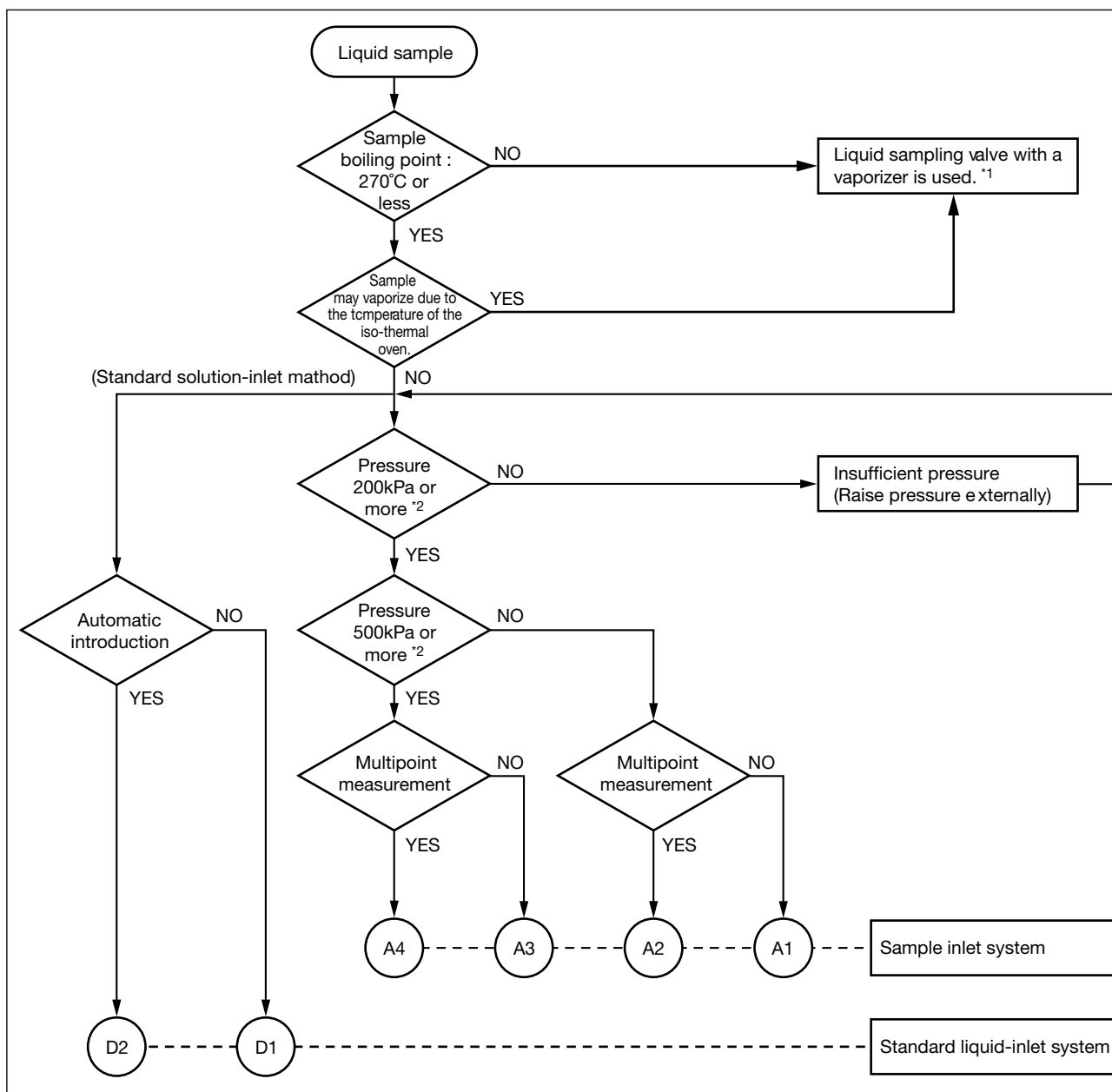
## 5.2 Flow Selection Diagrams

### 5.2.1 Gas Sampling



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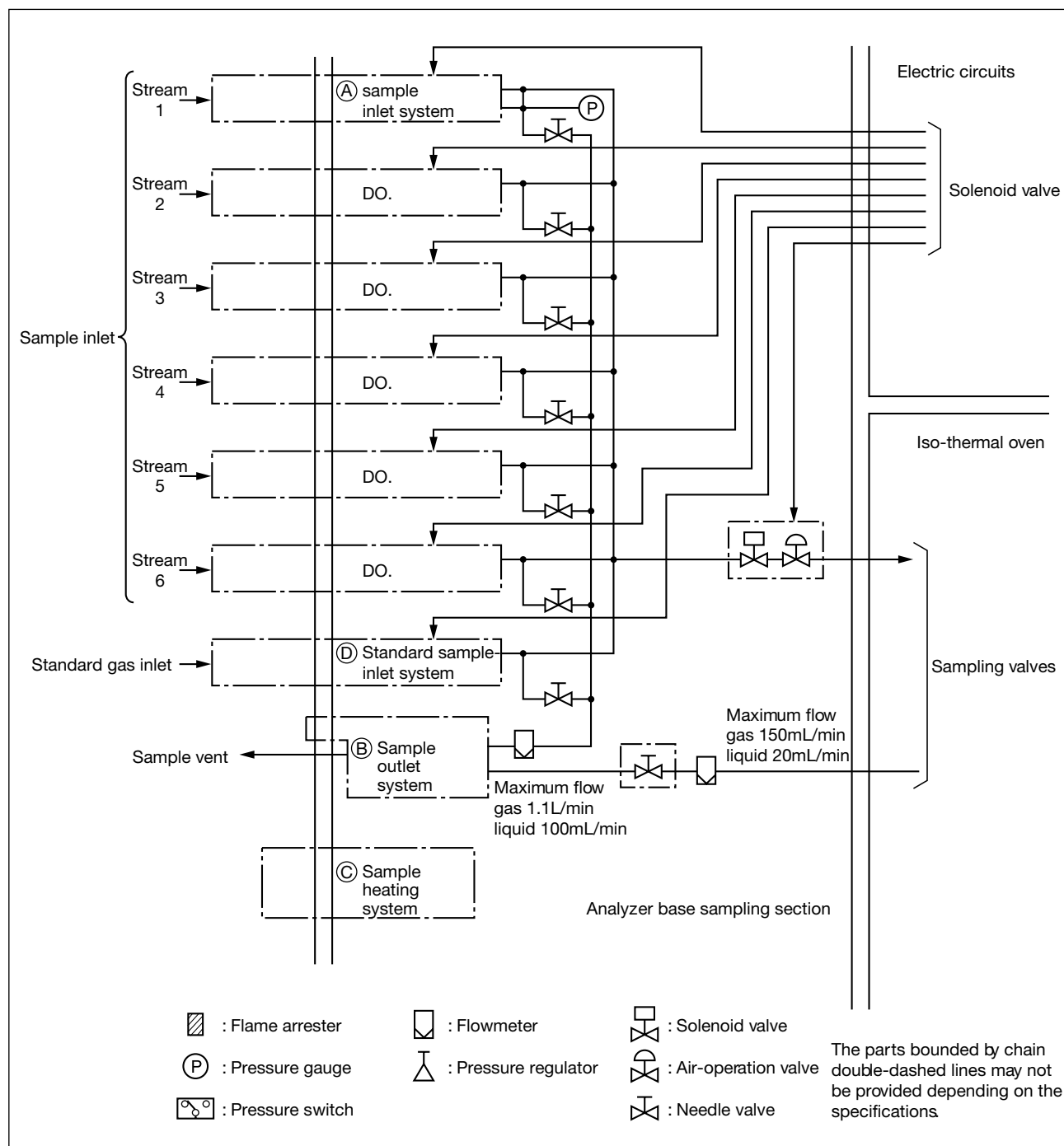
## 5.2.2 Liquid Sampling



\*1: If a liquid sampling valve with a vaporizer is to be used, consult Yokogawa.

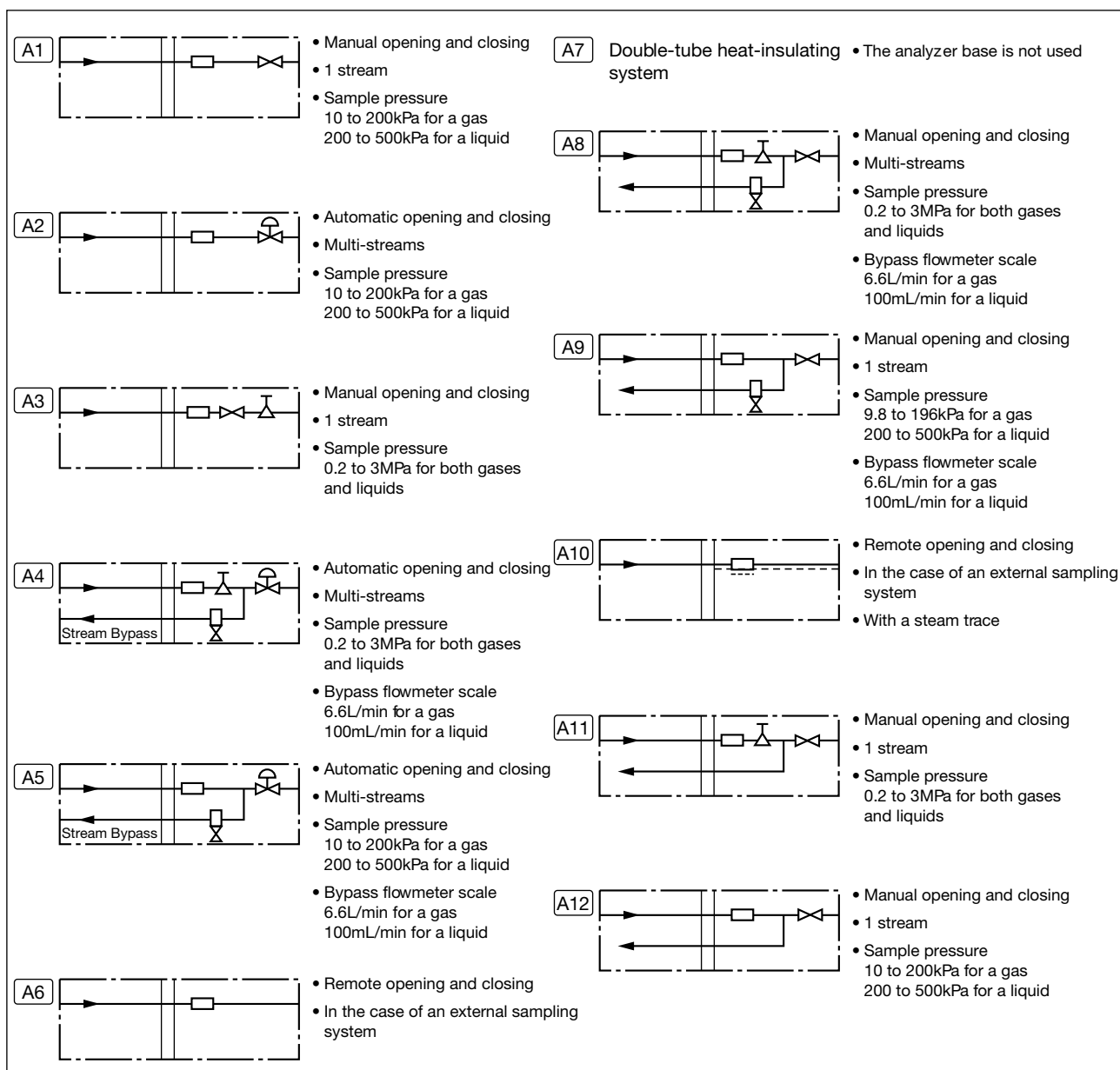
\*2: The sample pressure should be set at about slightly more than the lowest pressure for maintaining a liquid state also for the purpose of sample valve protection. For this reason, a pressure regulator may be inserted even in the range of 200 to 500 kPa.

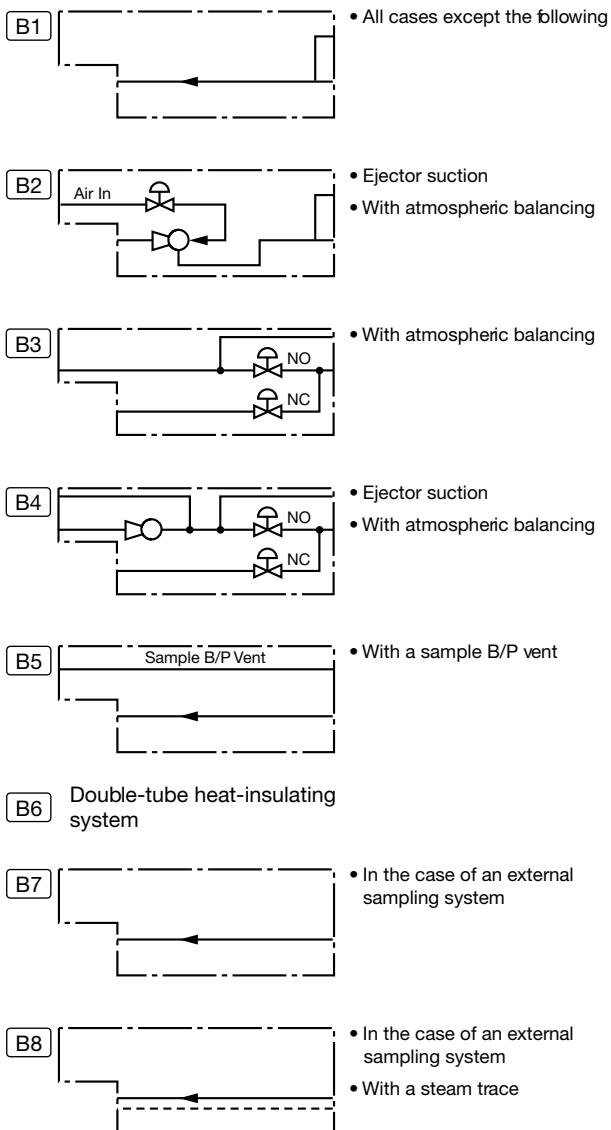
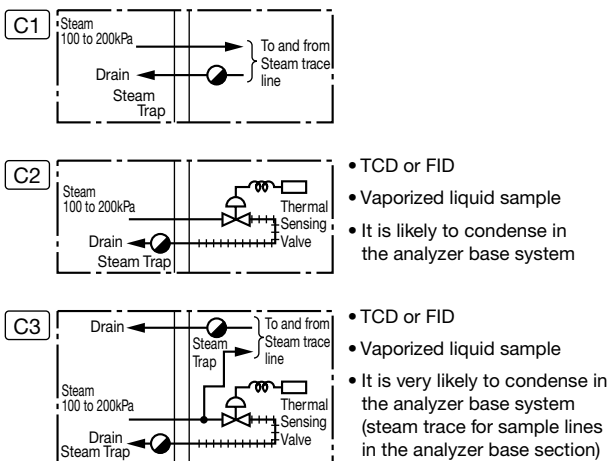
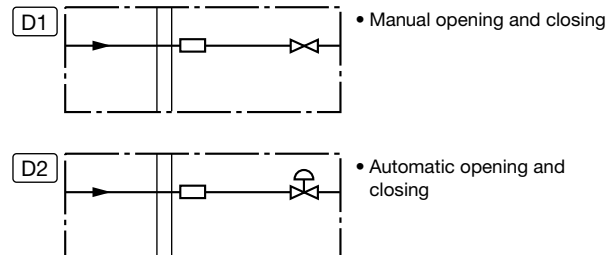
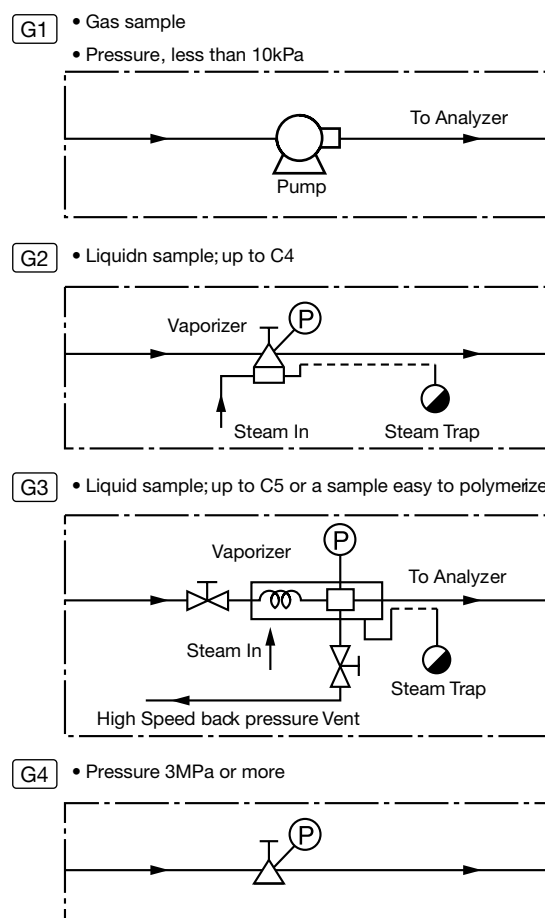
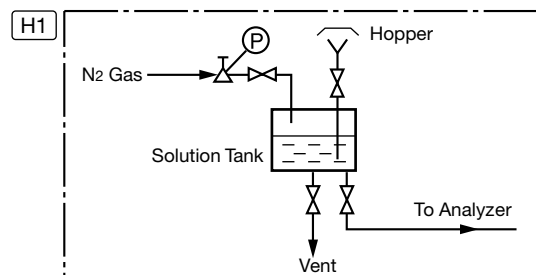
## 5.3 Sample Flow Diagram



## 5.4 Standard Sampling System

### A. Sample inlet system



**B. Sample outlet system****C. Sample heating system****D. Standard gas inlet system****[Reference]****G. Examples of sample-conditioning system outside the analyzer****H. Standard solution-introducing system outside the analyzer**



## Items to be specified when ordering a GC1000 Series Analyzer

### 1. General

User's name : \_\_\_\_\_

Plant name : ☐ \_\_\_\_\_

Document : ☐ English ☒ Japanese

### 2. Utilities and Installation Conditions

Power supply : ☐ V AC± %; Hz± %

Instrument air : Pressure kPa

Cooling air : Pressure kPa

Steam : Pressure kPa

### 3. Specifications

Explosion protection : ☐ JIS ☐ FM ☐ CSA ☐ CENELEC

Number of streams to be measured : \_\_\_\_\_

Number of standard sample streams : \_\_\_\_\_

Carrier gas desired ☐ Any (manufacture's choice)  
☐ H<sub>2</sub> uN<sub>2</sub> uHe uAr

Desired analysis cycle minutes/stream \_\_\_\_\_

Input Analog input \_\_\_\_\_ points  
Contact input \_\_\_\_\_ points

Output Analog hold \_\_\_\_\_ points  
Contact output \_\_\_\_\_ points

Stream switching valve points \_\_\_\_\_

Communication: ☐ Communication via DCS  
☐ MODBUS ☐ Y-Protocol ☐ GCCU  
☐ Communication via personal computer  
☐ Network: GCAS  
set \_\_\_\_\_  
GCHUB \_\_\_\_\_ set  
GCIU \_\_\_\_\_ set

### 4. Installation Conditions

Ambient Temperature : Max. \_\_\_\_\_ °C Min. \_\_\_\_\_ °C

Corrosive gases : ☐ None ☐ Present

Vibration : ☐ No ☐ Yes

Location of analyzer and sampling system  
☐ Indoors ☐ Outdoors ☐ \_\_\_\_\_

### 5. Estimate of Items Needed

1 Gas chromatograph (GC)	_____	Number
2 Accessories for gas chromatograph	_____	1 set
3 Spare column	_____	type / GC
4 Carrier gas cylinder	_____	/ GC
5 Carrier gas pressure regulator	_____	/ GC
6 Hydrogen (FID/FPD) gas cylinder	_____	/ GC
7 Hydrogen gas pressure regulator	_____	/ GC
8 Standard gas cylinder	_____	/ GC
9 Standard gas pressure regulator	_____	/ GC
10 Standard solution tank (for liquid samples)	_____	/ GC
11 Standard solution pressure regulator	_____	/ GC
12 Carrier gas dehumidifier	_____	/ GC
13 Sample conditioner	_____	set
14 Instruction manual copies	_____	/ GC
15 Operation data copies	_____	/ GC
16 Others	_____	

### 6. Process Condition and Measuring Range Please fill out the next form.

## Process Conditions and Measuring Range.

Stream Name		Stream No. /					Stream No. /				
		Concentration( )			Measuring Range	Priority	Concentration( )			Measuring Range	Priority
No.	Component	Min.	Norm.	Max.	( )		Min.	Norm.	Max.	( )	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
Inlet Phase		<input type="checkbox"/> Vapor <input type="checkbox"/> Liquid					<input type="checkbox"/> Vapor <input type="checkbox"/> Liquid				
Process Press.(kPa) Max. Norm. Min.											
Process Temp.(°C) Max. Norm. Min.											
Corrosive Components: Acid											
Dust: amount and particle size											
Stability: polymerizes, decomposes											
Moisture Contents (mol.%)		<input type="checkbox"/> vol.% <input type="checkbox"/> °C saturated					<input type="checkbox"/> vol.% <input type="checkbox"/> °C saturated				
Distance between sample point and GC		m					m				
Return Point: pressure / phase											
<p>Notes *1: It is needed to fill out not only the measuring components but also all components existed in the sample.</p> <p>*2: The priority stands for the mark as follows.            ◎: MUST, ○: Hopefully, △: If possible</p> <p>*3: Please copy and use this sheet when there are more than 3 streams.</p>											

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# General Specifications

## GC1000 Ethernet Analyzer Bus System

GC1000 MarkII

GS 11B06A01-01E

### ■ GENERAL

*Process analyzers are typically maintained by maintenance personnel from the front of the analyzer. However, with the implementation of an analyzer bus system, maintenance can now be done entirely by monitoring and operating the analyzers from a remote location. A personal computer can be used as a terminal for controlling the analyzers, enabling the maintenance person to operate the gas chromatograph and field analyzers from a comprehensive computer screen interface instead of the conventional gas chromatograph processor panel and chromatographic recorder.*

*The analyzer bus system offers the following benefits:*

- Comprehensive and centrally located remote maintenance of analyzers.
- Reduction in the cost of wiring (among field analyzer to control room).
- Ease of expansion that is not limited by the physical number of available DCS process inputs.

### ■ FEATURES

- Easy Maintenance of Analyzers  
Status of multiple analyzers can be monitored on a PC connected to the network. Data are continuously stored in a server, allowing traceability of information necessary for maintenance.

Stored data include chromatograms of detector signals as well as measured values and alarms. Even after observation of an alarm or a change in measured value, chromatograms can be checked retrospectively. Other functions include data storage, parameter uploading/downloading, and network monitoring, with regard to the analyzers connected.

- Reduced Wiring Costs  
The analyzer bus system eliminates the need for wiring between the individual field analyzers and the associated devices, such as a DCS or other host computers, and a PC for analyzer maintenance. Ethernet allows hubs and other general networking equipment to be used.
- Network Scalability  
Ethernet facilitates connection to your network, thereby enabling remote monitoring. (To ensure the safety of your network, firewalls or other network security measures should be taken as appropriate.)
- High-Speed Network  
Fast Ethernet supports data transfer rates of 100 Mbps, providing real-time monitoring of not only measured values and alarm information but also chromatograms.
- Optical Communication  
The analyzer is available with either shielded twisted pair wire or optical fiber. The optical fiber can be advantageously used in long distance networks and electrically noisy environments.
- Redundant System for Increased Reliability  
A redundant system is available for connection of analyzers with host computers such as a server and DCS.

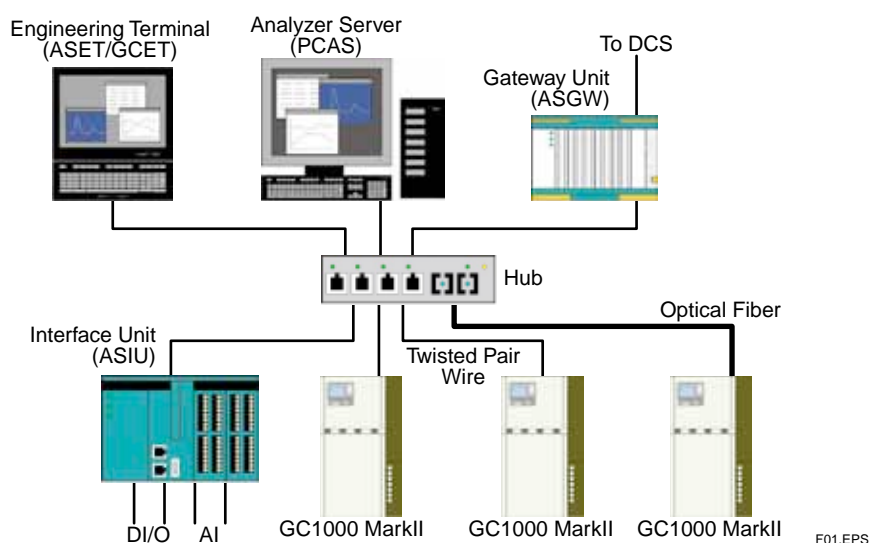


Figure 1 Typical System Configuration

## ■ SYSTEM CONFIGURATION

A typical network configuration of analyzer bus is shown in Figure 1.

The network consists of process gas chromatograph (GC), server, hub, etc.

### (1) Process Gas Chromatograph (GC1000 Mark II)

Analyzers that is installed in the field and connected to Ethernet network.

### (2) Analyzer Server

Controls network and stores the data. It is composed of PC and application software. PC is connected to analyzers with Ethernet network.

### (3) Engineering Terminal

A human machine interface for analyzer control and data view. Its software runs on a PC connected to network.

Two types of software are available for engineering terminal: Analyzer Server Engineering Terminal (ASET) that can handle multiple analyzers via analyzer network and GC Engineering Terminal (GCET) that provides one-to-one communication with analyzer.

### (4) Gateway Unit

Exchanges data with the host systems. It is necessary for redundant network or address mapping.

### (5) Interface Unit

Interfaces field analyzers other than GC with network. Equipped with analog inputs and contact inputs/outputs.

## ■ SPECIFICATIONS

### 1. Network (Ethernet)

Type: IEEE802.3u 100Base-TX, 100Base-FX  
Protocol: TCP/IP  
Communication rate: 100 Mbps  
Cabling: Shielded twisted pair wire or optical fiber  
Max. number of nodes: 254  
Max. distance: 100 m (100Base-TX)  
2 km (100Base-FX)  
Total distance can be extended using multiple levels of switching hubs\* in cascade connection.  
\*Refer to the switching hub.

#### Redundant Network:

Two communication paths are provided. Both are equal and which is used is determined by device engaged in the communication.  
GC1000 Mark II should have dual channel Ethernet outputs and server PC has two Ethernet ports. Analyzer server, gateway unit, GC1000 Mark II and interface unit can be connected to a redundant network, but engineering terminals cannot.

## 2. Devices

### 2.1 Process Gas Chromatograph

GC1000 Mark II which connects to Ethernet network needs to be equipped to Ethernet communication ports.

Instrument specifications:

Analyzer type and style:

GC1000 Mark II Style 6.01 or higher

Connection type: Ethernet communication ports of GC1000 Mark II should be specified.

Twisted pair: RJ-45 1 or 2 ports

Optical fiber: SC 1 or 2 ports

Max. number of GC1000 Mark II connected to a network: 240 units

Number of analyzer servers one GC1000 MARK II can access: 2 servers

Functions: Ethernet connection allows commands, status detection and data acquisition from analyzer server.

For other functions, refer to General Specifications of the GC1000 Mark II, GS 11B03A03-01E.

### 2.2 Analyzer Server

Realized by analyzer server software (PCAS) installed on PC.

PC specifications

Type: IBM PC compatible desktop computer

Hard disk drive: 10 GB or more free space

Display: SVGA (1024x768)

OS: Windows 2000 SP4, Windows XP Professional Edition SP2 Japanese edition/English edition

Ethernet port: 1 port (100Base-TX or 100Base-FX) for non-redundant configuration  
2 ports (100Base-TX or 100Base-FX) for redundant configuration

Others: CD drive

PC analyzer Server software (PCAS) specifications

Analyzer bus connection:

Max. number of connected analyzers and analyzer bus interface units (FCN): 64 sets

Max. number of PCAS in one network : 14 sets

Automatic data storage:

Data of GC1000 Mark II and analyzer bus interface unit are stored on the server PC.

Storage Data	Description	Remarks
Analysis results	Detailed analysis results are stored for one year. Based on this, historical data of concentration and retention time are made.	Storage capacity depends on hardware and settings.
Chromatogram history (1)	Chromatograms for every cycle for the past 2 months.	ditto
Chromatogram history (2)	Every 10 times of chromatograms for one year.	ditto
Alarm history		100 kbyte
Event history		100 kbyte

T01.EPS

Stored data are read with analyzer bus engineering terminal software (ASET).

Network monitoring screen:

Analyzer server communication status is monitored for troubleshooting purpose.

## 2.3 Analyzer Server Engineering Terminal

Realized by engineering terminal software (ASET) installed on PC.

### PC specifications

Type: IBM PC compatible desktop computer  
Hard disk drive: 10 GB or more free space  
Display: SVGA (1024x768)  
OS: Windows 2000SP4, WindowsXP Professional Edition SP2  
Japanese edition/English edition  
Ethernet port: 1 port (100Base-TX or 100Base-FX)  
Others: CD drive

### Analyzer server engineering terminal software (ASET) specifications

Function: ·Display of the status of GC1000 Mark II, Analyzer bus interface unit (FCN) and network.  
·Display of the results and alarms stored on the servers (PCAS).  
·Operation of GC1000 Mark II and analyzer bus interface unit.

Screen display: a) Overview  
b) Analyzer Operation  
c) Analysis Result  
d) Chromatogram  
e) Alarm Status  
f) LCD Emulator (EtherLCD)  
Max. number of EtherLCD is 4.

### Analyzer server connection:

Max. number of ASET connected to one PCAS: 4 sets  
ASET is connectable to PCAS on the same PC.  
One ASET is activated on one PC.  
ASET is not activated with GCET on the same PC.

## 2.4 GC Engineering Terminal

Realized by GC engineering terminal software (GCET) installed on PC.

### PC specifications

Type: IBM PC compatible desktop computer  
Hard disk drive: 10 GB or more free space  
Display: SVGA (1024x768)  
OS: Windows 2000SP4, WindowsXP Professional Edition SP2  
Japanese edition/English edition

Ethernet port: 1 port (100Base-TX or 100Base-FX)  
Others: CD drive

### GC engineering terminal software (GCET) specifications

Function: ·Display of the status of GC1000 Mark II  
·Display of the results and alarms stored on the same PC.  
·Operation of GC1000 Mark II  
GCET communicates with one GC1000 Mark II at once.  
GCET is not activated with ASET on the same PC.

Screen display: a) Analyzer Operation  
b) Analysis Result  
c) Chromatogram  
d) Alarm Status  
e) LCD Emulator (EtherLCD)

## 2.5 Analyzer Bus Gateway Unit

Established by Yokogawa's FCJ Autonomous Controller and analyzer server gateway unit software (ASGW).

Interfaces with DCS or other host system as a Modbus RTU slave.

### Instrument specifications

Analyzer bus connection:  
Max. number of connected GC1000 Mark II and interface units: 31 sets

### DCS connection

Serial connection: Modbus RTU slave, 2 ports available

### Hardware specifications

#### Serial communication:

Function: transmit and receive data.  
Type: RS232-C  
Number of port: 2 ports  
Protocol: Modbus  
Transmission rate: 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 115200 bps  
Data length: 8 bits  
Parity bit: selectable  
Stop bit: 1 bit

### Compliant standards

EMC standards: CE Mark  
Standard for hazardous location equipment: Non-Incendive

Refer to the specifications of FCJ.

### Hardware

Model Name	Item	Remarks
NFJT100-S10x	FCJ	

T02.EPS

### Software license

License Code	Item	Remarks
NT711AJ-LM03E	FCN/FCJ basic software for single CPU including JAVA	Required for each ASGW
NT8035J-LW11A	Modbus Portfolio	Required for each ASGW

T03.EPS

### Software media

CR-ROM Code	Item	Remarks
NT203AJ-PC11E	Software media	Loading a license for installation Modification of IP address

T04.EPS

### Analyzer server gateway software (ASGW):

Data mapping of GC1000 Mark II, interface unit and host system such as DCS for interface with host system.  
Capable of commanding, detecting status, and reading data as follows.

#### (a) Commands for

##### GC1000 Mark II:

- Request of collective analyzer clock setting (all connected analyzers)
- Request of individual analyzer clock setting (specified analyzers)

GC1000 Mark II through mapping:

- Run command
- Stop command
- Stream sequence assign
- Calibration (validation) command
- Stream (continuous) assign

Interface unit through mapping

- DO on command
- DO off command

(b) Status detection of

GC1000 Mark II and interface unit in common

- In operation
- Communication error
- Write error

GC1000 Mark II

- Analyzer normality/failure
- Change of analyzer alarm status
- Measurement, stop, or maintenance status
- Progress of stream sequence
- Rejection of request of stream (continuous)
- Rejection of request of calibration/validation
- Data update
- Calibration coefficient update
- Data validity
- Each alarm condition
- Concentration alarm of each peak, retention time alarm, variation coefficient alarm, tailing coefficient alarm

Interface unit

- Unit normality/failure
- Main power supply failure, 24 V DC failure, IO module failure
- DI data
- DO data
- AI IOP
- IOP occurs when value exceeds 106.3 % of input range or is below -0.63 %. If IOP occurs, the previous value will be held as AI data.

(c) Data of

GC1000 Mark II

- Stream number
- First peak number
- Number of peak
- Sampling time
- Analysis result
- Retention time
- Calibration coefficient

Interface unit

- AI read data
- (Actual number in 2 words: Range 0.0-1.0)
- When multiple requests are received in update period, the last request is executed.

## 2.6 Analyzer Bus Interface Unit

Realized by Yokogawa's FCN Autonomous Controller and analyzer server interface unit software (ASIU).

Function: Read and Write I/O interface data every 200 ms.

Hardware specifications

Max. number of contact inputs: 16  
Max. number of contact outputs: 16  
Max. number of analog inputs: 16

Specification	Item	Remarks
NFBU200-Sxx	Back board	
NFCP100-S0x	CPU	
NFPW441-1x	Power card	100-120 VAC
NFPW442-1x		220-240 VAC
NFPW444-1x		
NFDV151-P10/B5S00	DI card	32 points, 24 VDC
NFDV551-P10/D5S00	DO card	32 points, 24 VDC
NFDR541-P00/C4S70	Relay output card	16 points, 24-110 VDC /100-240 VAC
NFA1135	AI card	4-20 mA 8 points
NFA1143	AI card	4-20 mA 16 points
NFFCV01	Dummy cover	for I/O card
NFFCV00	Dummy cover	for power card

T05.EPS

## Software license

License Code	Item	Remarks
NT711AJ-LS03E	FCN/FCJ basic software for single CPU excluding JAVA	Required for each ASIU
NT8035J-LW11A	Modbus Portfolio	Required for each ASIU

T06.EPS

## Software media

CR-ROM Code	Item	Remarks
NT203AJ-PC11E	Software media	Loading a license for installation Modification of IP address

T04.EPS

## Analyzer server interface unit software (ASIU)

Capable of commanding, detecting status, and reading data as follows.

- (a) Command
  - DO on/off command
- (b) Status detection
  - Unit normality/failure
  - Main power supply failure, 24 V AC failure, IO module failure
  - DI data
  - DO data
  - AI IOP
  - IOP occurs when value exceeds 106.3 % of input range or is below -0.63 %. If IOP occurs, the previous value will be held as AI data.
- (c) Data
  - AI read data
  - (Actual number in 2 words: Range 0.0-1.0)

## 2.7 Network Components

### (a) Hub

Switching type 100Base hub is recommended.

example; MOXA made P/N:EDS-308-MM-SC (multi mode, wave length 1310 nm 100Base-FX (SC connector) 2 ports, TP (RJ45) 6 ports)  
(Area classification: class 1 Div 2/Zone 2)



**(b) Cable****• Optical Fiber Cable**

It is recommended to use optical fiber cable when extending distance, wiring between separate buildings or using the device in electrically noisy environments.

Optical fiber cable does not require an "Electric energy blocking-off circuit" for explosion proof.

The type of optical fiber is the multi mode which core diameter is 50/125  $\mu\text{m}$  or 62.5/125  $\mu\text{m}$ .

GC1000 Mark II has port(s) with 100Base-FX SC connector.

**• Twisted Pair Cable**

GC1000 Mark II has port(s) with RJ-45 connector for twisted pair output.

Use Category 5 or higher of ScTP (Screened twisted pair) or STP cable. CE Mark is declared on the condition with ScTP or STP cable.

Twisted pair cable requires an "Electric energy blocking-off circuit" for explosion proof. Refer to section 2.11, Explosion-proof.

There are two types of pair cables: straight-through or cross-over. Generally, a straight-through cable is used to connect between a node and a hub, a cross-over cable is used to directly connect between nodes.

**(c) Media Converter**

Since gateway interface unit (FCJ) and general PC do not have optical interface. For connection to an optical fiber network, media converter interface is required.

Select the appropriate devices according to the conditions of infrastructures.

example; MOXA made P/N:IMC-101-M-SC  
(multi mode, wave length 1310 nm  
100Base-FX (SC connector) 1 ports,  
TP (RJ45) 1 ports)  
(Area classification: class 1 Div 2/Zone 2)

**2.8 Analyzer Bus Network****(a) Redundancy**

In a redundant network, if one of the paths fails, communication line of analyzed data information is switched to the other automatically, minimizing the influence.

Redundant network requires analyzer bus gateway unit (FCJ) and its software (ASGW).

The following licenses and media are required to duplicate server PC.

**License Code**

Licence Code	Item	Remarks
NT783AJ-LM11A	Redundant network function license for FCN/FCJ OPC Server (media:NT203AJ)	Required for each PC

T07.EPS

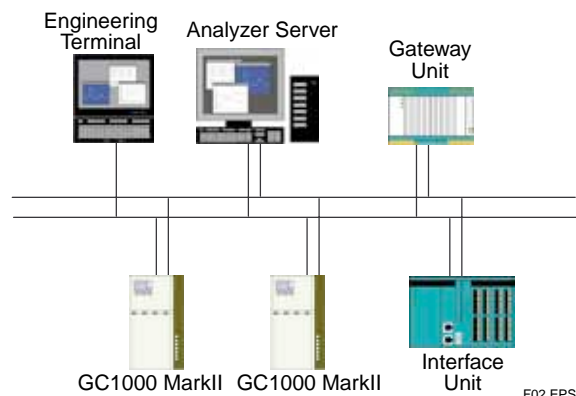
**Software media**

CR-ROM Code	Item	Remarks
NT203AJ-PC11E	media	Available for ASGW or ASIU.

T08.EPS

Communication lines of server PC, gateway unit (FCJ), GC1000 MarkII and interface unit (FCN) are duplicated.

Communication line of engineering terminal PC (ASET or GCET) is not duplicated



F02.EPS

**(b) Restrictions on Total Distances of Network**

According to the 100Base-TX standards, cables of up to 100 meters can be used. Total distance can be extended using multiple levels of switching hubs\* in cascade connections.

\*Refer to the switching hub.

**2.9 Modbus Communication**

Realized by the following methods.

**(a) Connection with analyzer bus gateway unit (FCJ)**

Analyzer server gateway unit can interface as a Modbus RTU slave. Refer to section 2.5, Analyzer Bus Gateway Unit.

**(b) Direct connection to GC1000 Mark II**

Ethernet communication of GC1000 Mark II and analyzer server interface unit support Modbus/TCP client.

**2.10 OPC**

OPC requires analyzer bus gateway unit (FCJ) and OPC server software.

Refer to "FCN/FCJ OPC for Windows" (GS 34P02Q61-01E).

In addition, redundant network function license for FCN/FCJ OPC Server software is required for connecting to the redundant network.

**2.11 Explosion-proof**

The following conditions should be satisfied.

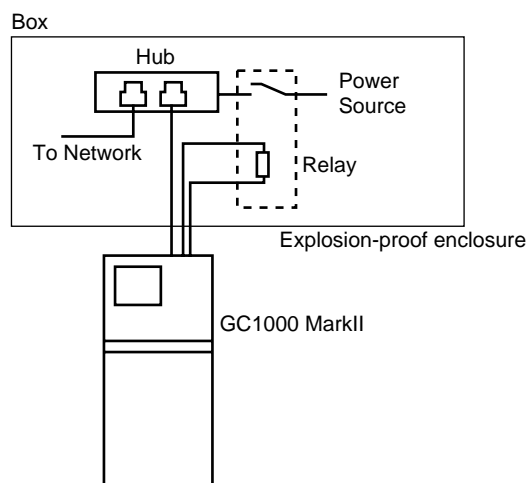
**(a) Process Gas Chromatograph (GC1000 Mark II)**

Refer to the General Specifications of GC1000 Mark II (GS11B03A03-01E)

**(b) Twisted Pair Wiring**

Twisted pair line should be disconnected when the explosion-proof status is not kept at the GC1000 Mark II side.

A 12 V DC output of the analyzer should be used to turn on the power line of the hub. (Figure 3)



F03.EPS

Figure 3

**(c) Optical Fiber**

Optical fiber cable does not require an "Electric energy blocking-off circuit" for explosion proof.

**(d) Hub**

Non-incendive certified hubs can be installed in Class 1 Division 2 hazardous areas. For compliance with the standard, the hubs must be installed in a cabinet approved by local explosion-proof testing organization. Select the appropriate devices according to the conditions of location and wiring.

**(e) Analyzer Bus Interface Unit**

FCN used as analyzer bus interface unit is approved that the product meets the non-incendive requirements of the FM Standards.

Refer to the General Specifications of FCN/FCJ (GS 34P02Q01E).

**2.12 Security**

PC should be protected against computer viruses. Accesses from external network should be restricted by fire-wall.



## MODEL AND SUFFIX CODES

### 1. Process Gas Chromatograph (GC1000)

Any of the following Suffix Codes should be specified for Ethernet analyzer bus.

Model	Suffix Code	Option Code	Description
GC1000□	-----	-----	Gas chromatograph
...	...	-----	(Note)
Analyzer bus	A	-----	Ethernet twisted pair dual-channel
	B	-----	Ethernet optical fiber dual-channel
	C	-----	Ethernet twisted pair single-channel
	D	-----	Ethernet optical fiber single-channel

T\_GC1000.EPS

Note: For specifications other than GC1000 Mark II analyzer bus's, consult our salesperson or representative.

### 2. PC Analyzer Server Software (PCAS)

Model	Suffix Code	Option Code	Description
PCAS	-----	-----	Software package
Function	-A01	-----	Standard
Language	E	-----	English
	J	-----	Japanese
—	-N	-----	Always -N
—	N	-----	Always N

T\_PCAS.EPS

### 3. Analyzer Server Engineering Terminal Software (ASET)

Model	Suffix Code	Option Code	Description
ASET	-----	-----	Software package
Function	-A01	-----	Standard
Language	E	-----	English
	J	-----	Japanese
—	-N	-----	Always -N
—	N	-----	Always N

T\_ASET.EPS

### 4. GC Engineering Terminal Software (GCET)

Model	Suffix Code	Option Code	Description
GCET	-----	-----	Software package
Function	-A01	-----	Standard
Language	E	-----	English
	J	-----	Japanese
—	-N	-----	Always -N
—	N	-----	Always N

T\_GCET.EPS

### 5. Analyzer Server Gateway software (ASGW)

Model	Suffix Code	Option Code	Description
ASGW	-----	-----	Software package
Function	-A01	-----	Standard
Language	E	-----	English
	J	-----	Japanese
—	-N	-----	Always -N
—	N	-----	Always N

T\_ASGW.EPS

### 6. Analyzer Server Interface Unit Software (ASIU)

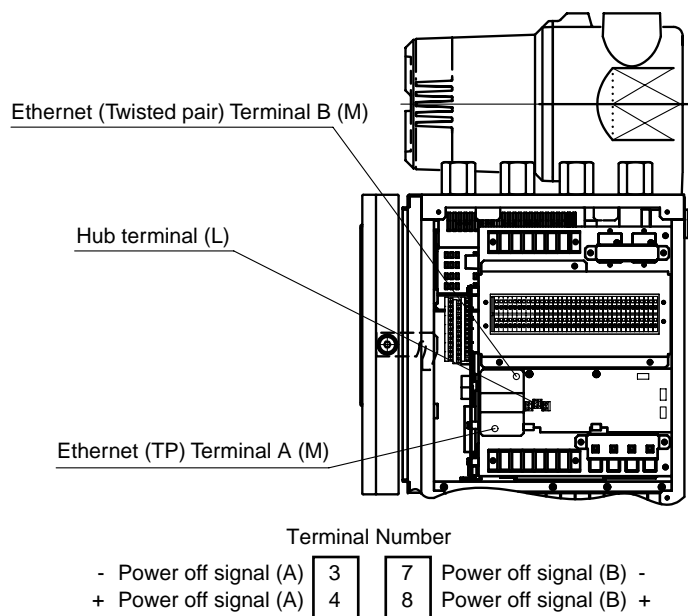
Model	Suffix Code	Option Code	Description
ASIU	-----	-----	Software package
Function	-A01	-----	Standard
Language	E	-----	English
	J	-----	Japanese
—	-N	-----	Always -N
—	N	-----	Always N

T\_ASIU.EPS

## ■ TERMINAL ARRANGEMENT

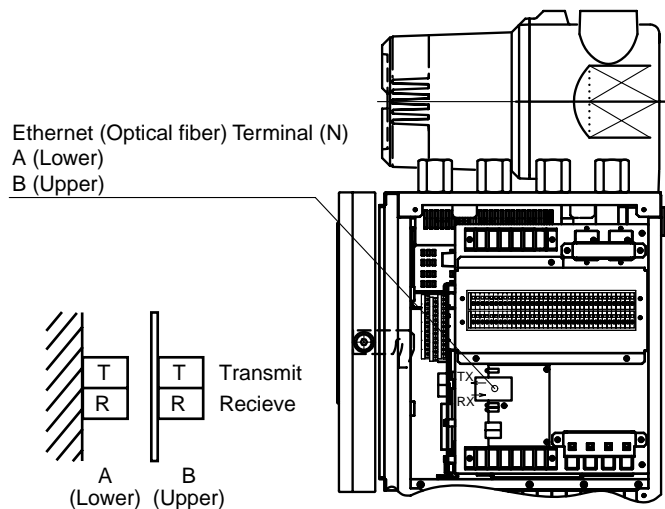
### 1. Process Gas Chromatograph GC1000 Mark II

#### 1.1 Ethernet (Twisted Pair Wiring)



F04.EPS

#### 1.2 Ethernet (Optical Fiber Wiring)



F05.EPS

### 2. Analyzer Bus Gateway Unit

Please refer to the General Specifications, "FCN/FCJ Autonomous Controller Functions" GS 34P02Q01-01E.

### 3. Analyzer Bus Interface Unit

Please refer to the General Specifications, "FCN/FCJ Autonomous Controller Functions" GS 34P02Q01-01E.

# General Specifications

## InfraSpec NR800 Fourier Transform Near-Infrared Analyzers

The InfraSpec NR800 achieves high-resolution, high S/N (signal-to-noise) ratio, and wide wavelength scanning range measurement with its newly developed interferometer and detector. The NR800 also offers exceptional stability, vibration resistance, and durability, inheriting features from earlier successful models. It includes improved usability features such as measurement channel and output configuration as well.

The NR800 allows online, real-time, continuous, multiple, and simultaneous measurement for properties and component concentration of various processes.

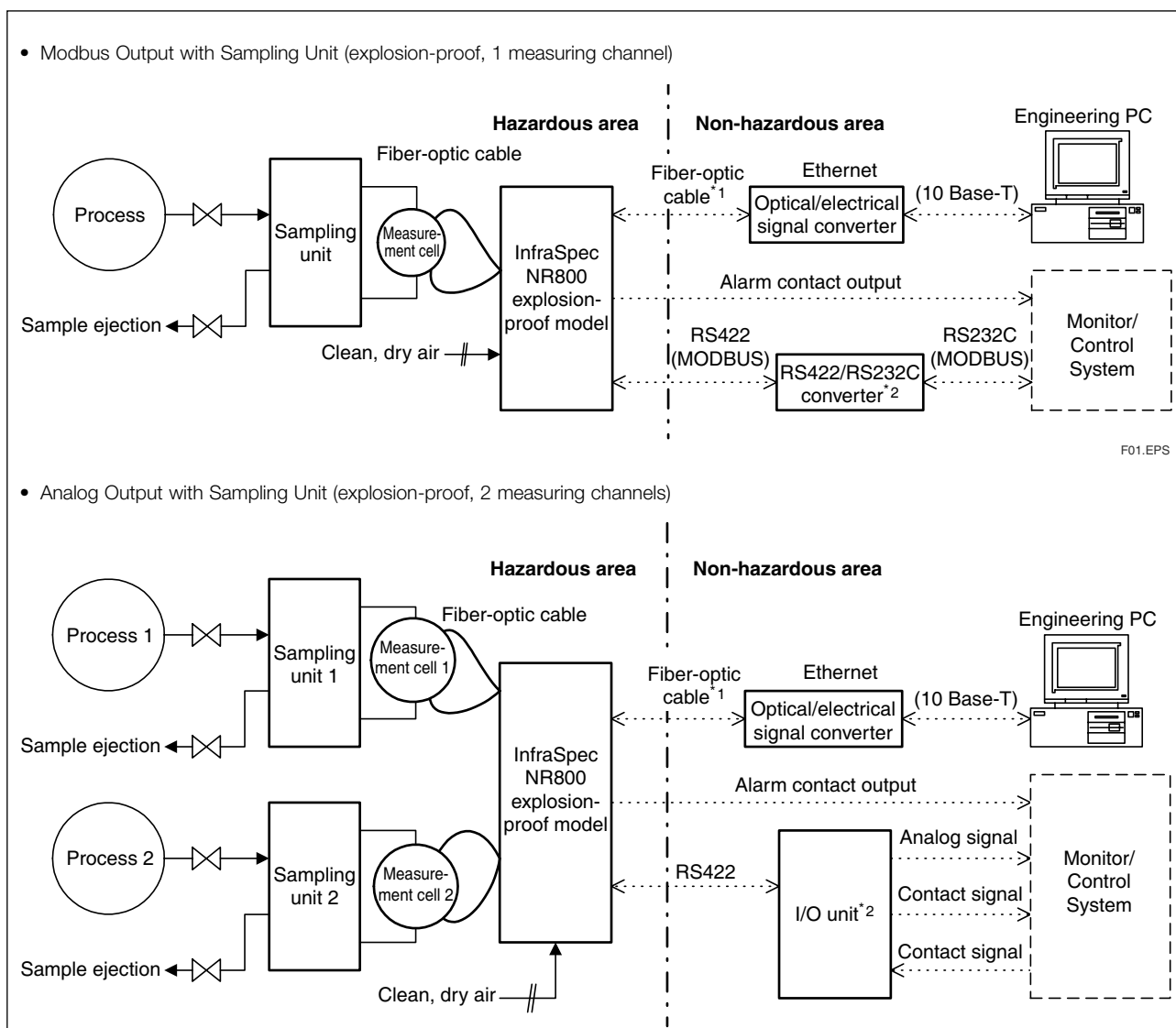
### Features

- Newly developed interferometer and detector  
Can be used for a variety of applications, ranging from over to combination tone.
- High resolution: Up to 4 cm<sup>-1</sup>, user selectable setting
- High S/N ratio: 2250:1 (RMS, 4 cm<sup>-1</sup> resolution, 4100 to 4200 cm<sup>-1</sup>, 1 sec.)
- Wide wavelengths scanning range 900 to 2500 nm (11,000 to 4000 cm<sup>-1</sup>)
- Wavelength reproducibility: 0.007 cm<sup>-1</sup>
- Wavelength accuracy: 0.04 cm<sup>-1</sup>
- Enhanced environmental resistance, durability, and reliability
- Provides high vibration resistance by a unique design free of sliding parts
- Features a multichannel measurement optical system free of moving parts
- Eliminates the need for a PC for continuous operation.  
A PC is now only necessary for generating the calibration model and loading data.
- Outstanding wavelength accuracy allows calibration model transport between NR800s
- Outlier detection and self-diagnostic features come as standard function
- Various standard features and available options for optimal system configuration
- Dust-proof and drip-proof: IP53 equivalent
- Optional Explosion-proof Enclosure:  
JIS Exd II B+H2 T5
- Length of fiber-optic cable: up to 300 m
- Non-moving multichannel measurement:  
Expandable to 4 channels
- Up to 12 items can be measured per stream:  
limited to 64 items/unit
- The optional I/O unit offers a variety of inputs/outputs:  
analog output (up to 40 points), analog input, and contact input/output
- Communication output: RS422 (Modbus), 2 channels
- Fast Ethernet communication between Engineering PC and the analyzer
- Optional remote maintenance support
- Related equipment  
NR801JL Near-infrared spectroscopic analyzer for laboratory use (GS 12Y3A3-02E)



## 1. System Configuration

### 1.1 Configuration Examples



**Notes:** (Common to the above 2 examples)

\*1: Always use a fiber-optic cable for an explosion-proof model, an electric cable cannot be used. For a general purpose model, the type of cable depends on the length.

- Cable length less than 40 m: Either an electric or fiber-optic cable can be used.
- Cable length of 40 m or longer: Use a fiber-optic cable. An electric cable cannot be used.

\*2: Only use the RS422 output of an explosion-proof model in combination with an I/O unit (see section 2.2) or RS422/RS232C converter (see section 2.5). These units will block the communication signal upon receiving a purge failure signal from the analyzer, thus ensuring the explosion-proof integrity of the analyzer.

## 1.2 Components, Software, and Calibration Model Generation

Item		Requirement* <sup>1</sup>	Model	Description	Reference
1)	InfraSpec NR800 analyzer	✓	NR801EG	General purpose model	2.1
			NR805EG	Explosion-proof model	2.1
2)	I/O unit	□	NR893JG	Provides hardwired Interface (A I/O, D I/O). Also blocks the communication signal upon receiving a Purge failure signal from an analyzer, thus ensuring the explosion-proof integrity.	2.2
3)	Measurement cell	✓	NR510	Flow through cell	2.3.1
			NR512	Flow through cell with constant temperature water tube	2.3.2
			-	In-situ probe	2.3.3
4)	Fiber-optic cable	✓	NR821	Applicable wavelength range: 900 to 2100 nm, Cable length: 300 m max., single	2.4.1
			NR822	Applicable wavelength range: 900 to 2100 nm, Cable length: 300 m max., dual	2.4.1
			NR823	Applicable wavelength range: 900 to 2500 nm, Cable length: 20 m max., single	2.4.2
			NR824	Applicable wavelength range: 900 to 2500 nm, Cable length: 20 m max., dual	2.4.2
5)	RS422/RS232C converter	□	-	Converts the RS422 signal from the Analyzer into RS232C. Also blocks the communication signal upon receiving a Purge failure signal from an analyzer, thus ensuring the explosion-proof integrity.	2.5
6)	Ethernet cable* <sup>2</sup>	□	NR895	Fiber-optic cable* <sup>3</sup>	2.6
		□	-	Electric cable, provided by user	2.7
7)	Software	✓	NR831	SpectLand 2 for data management and maintenance	2.8
		□	NR530	Chemometrics software	2.9
8)	Sampling unit	□	J439	Yokogawa will propose an optimum unit based on sample pressure, temperature, properties, and measurement items.	2.10
9)	On-site guidance of calibration model generation	□	J964	Hands-on practice and guidance for model generation on site.	5.1
10)	Calibration model generation	□	J965	Calibration model generation by Yokogawa based on user-provided sample with laboratory analysis results	5.2
11)	Engineering PC	✓	-	Provided by user. See recommended specifications.	6
12)	Optical/electrical signal converter for Ethernet	□	-	Converts optical signals for an Ethernet output into electrical signals for Engineering PC Interface. Provided by user.	7
13)	Customer inspection	□	J962	Customer inspection of an analyzer system without the sampling unit conducted at a Yokogawa factory.	-
		□	J443	Customer inspection of an analyzer system with the sampling unit conducted at a Yokogawa factory.	-
14)	Equipment start-up	□	-	Start-up work for analyzers and sampling units.	-

**Notes:** \*1: ✓ Required, □ optional

\*2: An ethernet cable is required. Choose either a fiber-optic cable or electric cable depending on the following conditions: Only use a fiber-optic cable for an explosion-proof model, an electric cable cannot be used. For a general purpose model, the type of cable depends on the length of cable:

- Cable length less than 40 m: Either an electric or fiber-optic cable can be used.
- Cable length of 40 m or longer: Use a fiber-optic cable. An electric cable cannot be used.

\*3: For a total cable distance of 20 m or longer, an additional fiber-optic cable (fitted with ST connectors) shall be provided by the user. In this case, specify the /JB (junction box) option for connection between an NR895 fiber-optic cable and the additional cable.

## 2. Component Specifications (including options)

### 2.1 NR800 Fourier Transform Near-Infrared Analyzers

#### 2.1.1 Hardware Specifications

- Principle : Fourier-transform remote measurement via fiber-optic cable
- Measurement method : Optical transmission absorption
- Measured sample : Liquid
- Beam source : Halogen lamp (recommended replacement interval for continuous operation: 5000 hours)
- Detector : InGaAs (indium gallium arsenide), effective wavelength range: 900 to 2500 nm
- Number of measuring channels : 1 to 4 (non-moving)
- Housing structure :
  - a. General Purpose : Field suitable, with full, hinged front door, dust-proof and drip-proof equivalent to IP53
  - b. Optional Explosion-proof : Pressurized enclosure for explosion-proof applications (JIS Expt II B+H2 T5)
- Air connection for purge : Rc1/4 or 1/4 NPT
- Fiber-optic cable connectors:
  - a. Measurement : FC
  - b. Ethernet : ST
- Electric cable connector:
  - a. General Purpose : Cable gland
  - b. Explosion-proof : Pressure-proof packing cable gland or conduit seal fitting
- Display : LED
- Keyboard : Covered with water-proof sheeting
- Operating location requirements : See chapter 4.
- Grounding type : Class D
- Insulation resistance: 10 MΩ or more, 500 V DC
- Withstand voltage : 1500 V AC for 1 min.
- Weight:
  - a. General Purpose : Approx. 50 kg
  - b. Explosion-proof : Approx. 65 kg

#### 2.1.2 Performance

- Wavelength scanning range : 900 to 2500 nm (11,000 to 4000  $\text{cm}^{-1}$ )
- Wavelength resolution : 4, 8, 16, 32, and 64  $\text{cm}^{-1}$  (user selectable)
- Wavelength reproducibility : 0.007  $\text{cm}^{-1}$
- Wavelength accuracy: 0.04  $\text{cm}^{-1}$
- S/N ratio : 500:1 (peak to peak, 4100 to 4200  $\text{cm}^{-1}$ , 1 sec.)

#### 2.1.3 Inputs/Outputs (see also section 2.2)

- Communication Interface:
  - a. Engineering PC : 1 channel (Ethernet)
  - b. DCS/, I/O unit : 2 channels (RS422, Modbus):
    - 1 channel for DCS and another for I/O unit; or
    - 2 channels for I/O unit
- Contact outputs:
  - a. Purge failure : 1 point (explosion-proof model)
- Specification: NC/NO selectable

- Rating : 0.5 A, 30 V DC or less

#### • Action:

**On:** When the analyzer is powered and the housing internal pressure is within predefined level or more after the purging period elapses.

**Off:** When the analyzer is not powered or analyzer is powered but the internal pressure is lower than the predefined level or until the purging period elapses after the internal pressure recovers to a predefined level.

- b. Analyzer failure : 1 point

- Specification : NC/NO selectable

- Rating : 0.5 A, 30 V DC or less

#### • Action:

**On:** When the analyzer is powered and an analyzer failure does not occur.

**Off:** When the analyzer is not powered or an analyzer failure occurs.

#### 2.1.4 Operating Modes\*1

Basic Operating Mode and Description		Channel Operating Mode	
		No.	Auto/Man *3
Maintenance*2	Spectrum analysis of a reference sample, equipment maintenance	-	-
Run	On-line measurement (allows spectrum analysis on selected channels)	1	AUTO
			MANUAL
		2	AUTO
			MANUAL
		3	AUTO
			MANUAL
		4	AUTO
			MANUAL

#### Notes:

\*1: When the power is turned on, the analyzer starts according to a predefined operating mode.

\*2: Can perform spectrum analysis (not continuous measurement).

\*3: Auto: Performs continuous measurement; Manual: Can perform spectrum analysis (not continuous measurement).

#### 2.1.5 Changing and Setting Operating Mode

User Level	Abbreviation	Description	Changing/Setting Mode
User A	(UA)	For operator.	Unauthorized
User B	(UB)	For equipment supervisor.	Authorized
User C	(UC)	For maintenance.	Authorized

Some operations are prohibited depending on the user level.

- DCS can perform UB level operations.
- A user level can be switched on the front console panel of the analyzer or from SpectLand 2 screen of an Engineering PC.
- A password is required to switch levels from UA to UB and switch from UA or UB to UC.

## 2.1.6 Sample Measurement

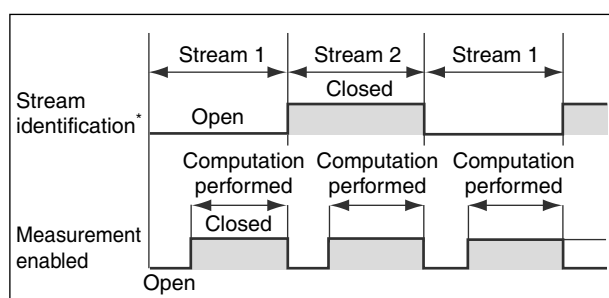
### Continuous measurement

- Number of measuring channels: 1 to 4
- Data updating period: 4 seconds or longer (depending on the number of averaging and measuring channels, as well as measurement items)
- Number of measurement items: Up to 12 per channel (48 max. per analyzer)
- Number of outlier detection items: Up to 12 per channel (48 max. per analyzer)
- Separate maintenance is available for each channel (except for common hardware).

### Stream switching by contact input

Calibration model set for the each channel can be changed by external contact inputs. This function is used for multi-stream application or multi sample application.

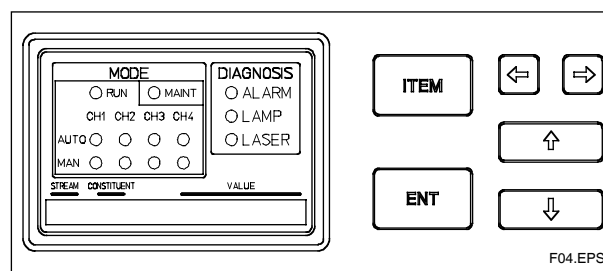
- Stream switching
  - Number of streams to switch: Up to 16 using 8 contact inputs coded by contact status (open or close)
  - Switching patterns: See table 1 of section 2.1.8.
  - Number of contact inputs and their specifications: See section 2.2.
- Data updating period: 8 seconds or longer (depending on the switching pattern, numbers of averaging and measuring channels, and stream configuration)
- Number of measurement items: Up to 12 per stream (64 max. per analyzer)
- Number of outlier detection items: Up to 12 per stream (64 max. per analyzer)
- Separate maintenance is available for each channel (except for common hardware).
- Contact input signals and measurement computation sequence
  - Stream identification: Used to identify the selected sample. The analyzer will choose a calibration model set to suite for the relevant stream based on this signal.
  - Measurement enabled (valid sample): When closed, the analyzer performs measurement using the calibration model specified by the sample identification signal above.
  - Schematic timing chart of measurement and computation sequence (e.g. 2 streams)



**Notes:** \* A stream number is defined by a combination of open/closed states of an identification contact signal.

## 2.1.7 Console Panel

### Display items



### a. Operating mode LEDs (MODE)

The following LEDs indicates the current basic operating mode:

- RUN: Lit when in the Run mode;
- MAINT: Lit when in the Maintenance mode.

The current channel operating modes are displayed by LEDs when in the Run mode. Two LEDs are provided for each channel, amounting to a total of 8 LEDs:

- AUTO: Lit when in the Auto mode;
- MAN: Lit when in the Manual mode.

### b. Self-diagnosis LEDs (DIAGNOSIS)

- ALARM: Lit when an alarm occurs.
- LAMP: Lit when a lamp has burned out or after a time period defined by the service life setting elapses.
- LASER: Lit when the laser has burned out or after a time period defined by the service life setting elapses.

### c. LED display (16 digits, STREAM/CONSTITUENT/VALUE)

The content depends on the operating status or operation.

### d. Operation keys

The following six keys are provided:

- ITEM: Used to change items;
- ENT: Used to confirm the entry;
- Arrow keys: Used to move the cursor or change display.

### Analyzer behavior for each basic operating mode

#### a. Maintenance mode

- Basic operating mode LEDs: Only MAINT lights up.
- Channel operating mode LEDs: Lit in accordance with each setting.
- Self-diagnosis LEDs: Lit in accordance with the results of self-diagnosis.
- LED display: The display depends on the operating status.

#### b. Run mode

- Basic operating mode LEDs: Only RUN lights up.
- Channel operating mode LEDs: Lit in accordance with each setting.
- Self-diagnosis LEDs: Lit in accordance with the results of self-diagnosis.
- LED display: The display depends on the operating status.

### 2.1.8 Other Functions

- a. Baseline compensation: Up to 10 points
- b. On-line measurement spectra saving
- c. Remote maintenance: Requires a dial-up router.

Table 1. Stream numbers assignable to measuring channels corresponding to switching patterns

Stream Switch		Measuring Channel No.* <sup>3</sup>				Total Streams	Applicable Channel No.
Case	Pattern No.	1	2	3	4		
None	0	1	2	3	4	4 max.	1 to 4
Stream switching per channel <sup>2</sup>	1 <sup>*1</sup>	1 to (17-N)	18-N	19-N	20-N	16 max.	1 to 4
	2	1 to 8	9 to 16			16 max.	1 and 2
	3	1 to 4	5 to 8	9 to 12	13 to 16	16 max.	1 to 4

**Notes:** \*1: N: Maximum number of measuring channels included within the analyzer.

\*2: The stream number for a measuring channel that does not switch paths must be the smallest number in the relevant column.

\*3: Measuring channel numbers that equal the number of measuring channels included within the analyzer or smaller are valid.

### 2.1.9 Model and Suffix Codes, and External Dimensions

- General Purpose Model

#### a. Model and Suffix Codes

Model	Suffix Code	Option Code	Description
NR801JG			NR800 FT-NIR Analyzer, General Purpose model
Nameplate	-J		Japanese
	-E		English
Power supply	1		100 V AC $\pm 10\%$ , 50/60 Hz
	2		110 V AC $\pm 10\%$ , 50/60 Hz
	3		115 V AC $\pm 10\%$ , 50/60 Hz
	4		200 V AC $\pm 10\%$ , 50/60 Hz
	5		220 V AC $\pm 10\%$ , 50/60 Hz
	6		230 V AC $\pm 10\%$ , 50/60 Hz
—	-N-N		Always “-N-N”
Number of measuring channels	-S1		1 channel
	-M1		Expandable to 4 channels, comes with 1 channel
	-M2		Expandable to 4 channels, comes with 2 channels
	-M3		Expandable to 4 channels, comes with 3 channels
	-M4		4 channels
Wavelength scanning range	W1		900 to 2100 nm
	W2		900 to 2500 nm
Fiber-optic cable	-1		Single cable
	-2		Dual cable
—	-00		Always “-00”
Ethernet output cable	1		Electric cable, only for general purpose model and less than 40 m
	2		Fiber-optic cable
Mounting	A		Without brackets
	B		With wall-mounting brackets
	C		With free standing rack
	-N-N		Always “-N-N”
	-00		Always “-00”
Option		/SS	With stream switch input function

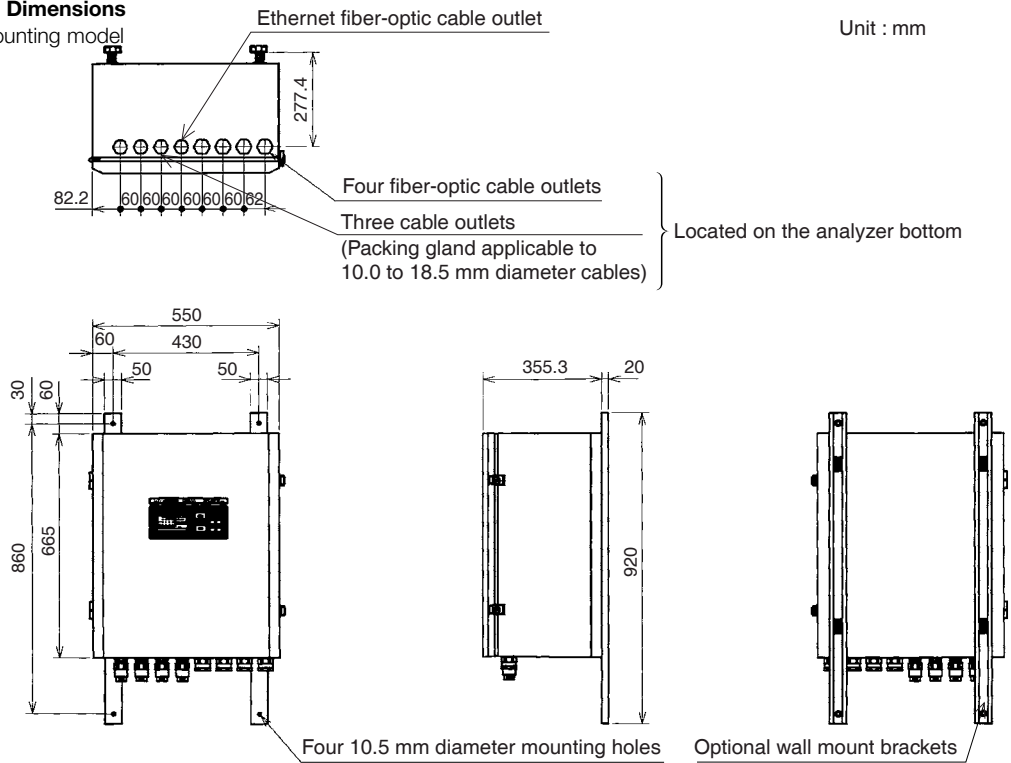
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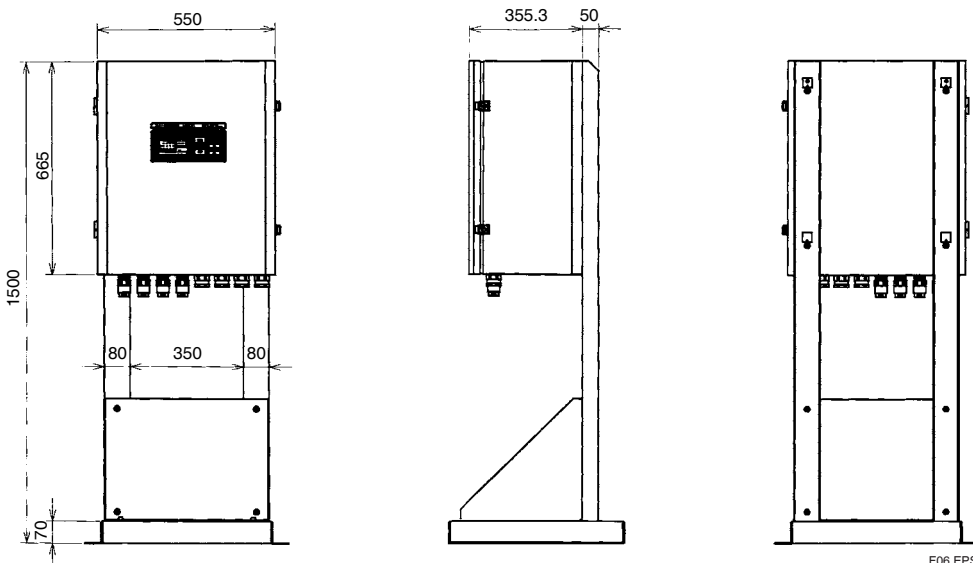
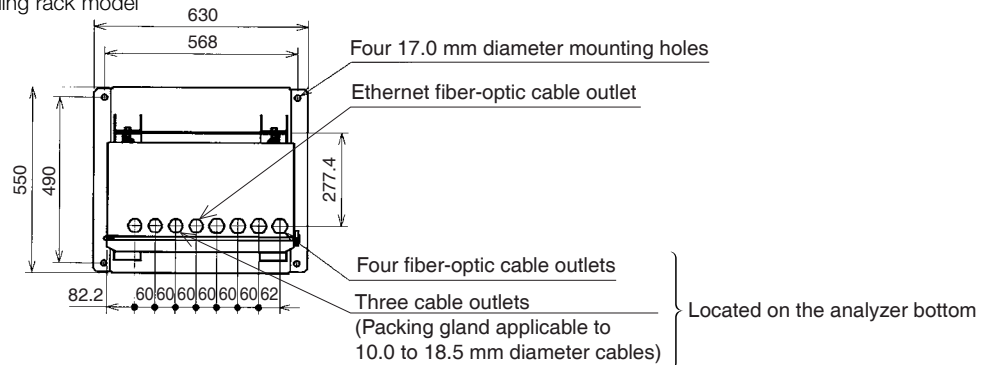
## b. External Dimensions

### • Wall-mounting model

Unit : mm



### • Free standing rack model

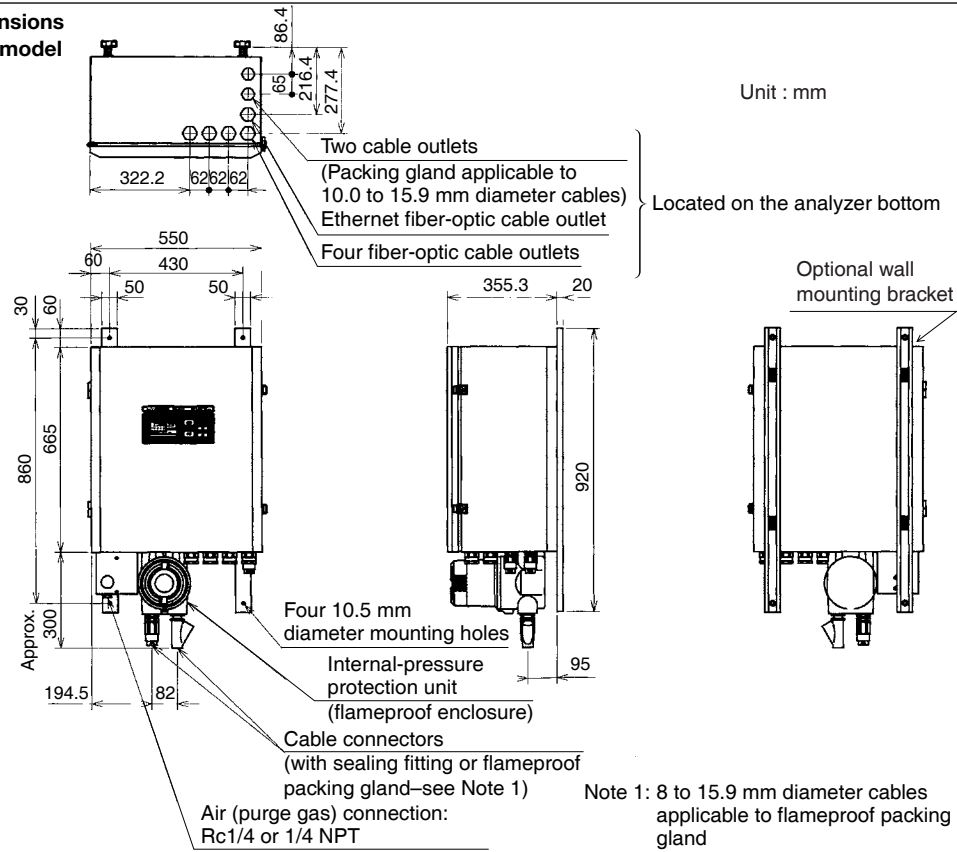


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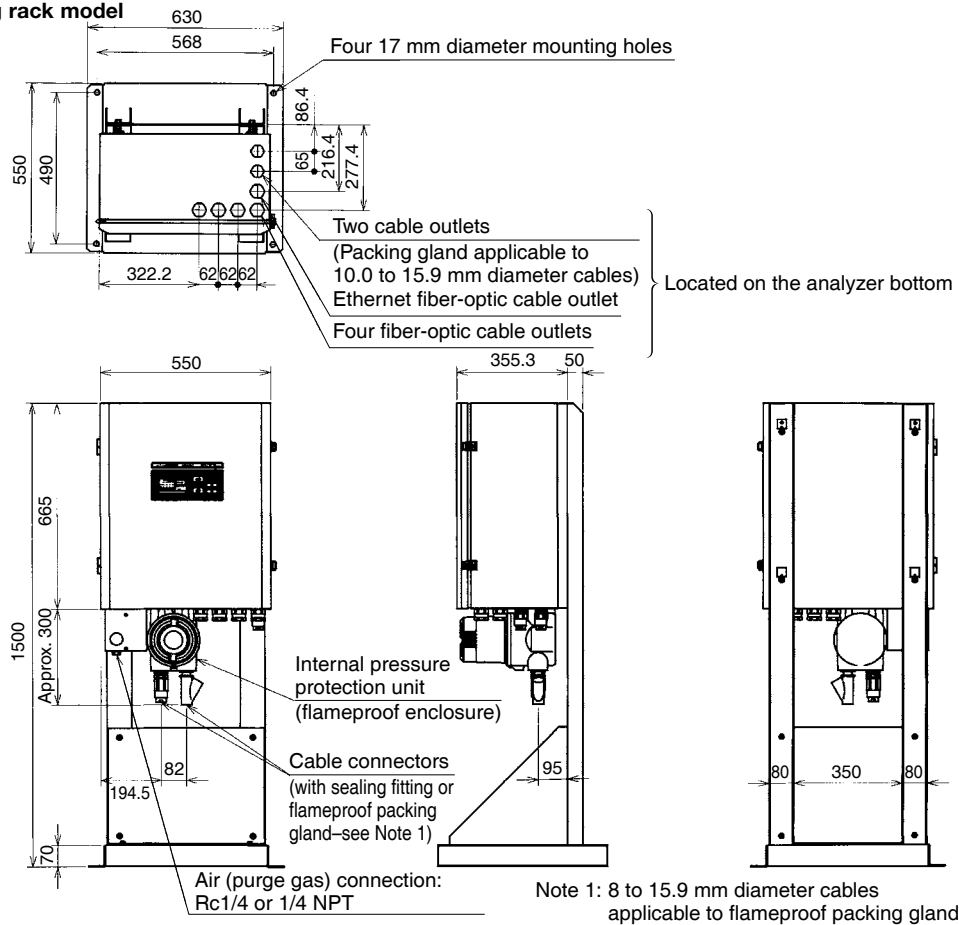
**Explosion-proof Model****a. Model and Suffix Codes**

Model	Suffix Code	Option Code	Description
NR805JG			NR800, FT-NIR Analyzer Explosion-proof model
Nameplate	-J		Japanese
	-E		English
Power supply	1		100 V AC $\pm 10\%$ , 50/60 Hz
	2		110 V AC $\pm 10\%$ , 50/60 Hz
	3		115 V AC $\pm 10\%$ , 50/60 Hz
	4		200 V AC $\pm 10\%$ , 50/60 Hz
	5		220 V AC $\pm 10\%$ , 50/60 Hz
	6		230 V AC $\pm 10\%$ , 50/60 Hz
—	-N-N		Always “-N-N”
Number of measuring channels	-S1		1 channel
	-M1		Expandable to 4 channels, comes with 1 channel
	-M2		Expandable to 4 channels, comes with 2 channels
	-M3		Expandable to 4 channels, comes with 3 channels
	-M4		4 channels
Wavelength scanning range	W1		900 to 2100 nm
	W2		900 to 2500 nm
Fiber-optic cable	-1		Single cable
	-2		Dual cable
—	-00		Always “-00”
Ethernet output cable	2		Fiber-optic cable
Mounting	A		Without brackets
	B		With wall-mounting brackets
	C		With free standing rack
—	-N-N		Always “-N-N”
Cable entrance	-1		Metal conduit (PF)
	-2		Metal conduit (NPF)
	-3		Flameproof packing (PF)
	-4		Flameproof packing (NPT)
Purge air connection	1		Female Rc1/4
	2		Female 1/4 NPT
Option		/SS	With stream switch input function

**b. External Dimensions**  
**• Wall-mounting model**



**• Free standing rack model**



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## 2.2 I/O Unit

### 2.2.1 Overview

The I/O unit is an input/output interface between the analyzer and external monitor/control system such as DCS. Up to two I/O units can be connected to the analyzer, and one of which can incorporate the contact input for stream switching and analog input for compensation options.

### 2.2.2 Specifications

- Power supply: See chapter 3.
- Insulation resistance: 5 M $\Omega$  or more, 500 V DC
- Withstand voltage: 1500 V AC for 1 min.
- Housing colors: Light cobalt blue (Munsell 6.2PB4.6/8.8 or equivalent), lamp black (Munsell 0.8Y2.5/0.4 or equivalent)
- Analog output:
  - a. Output data: Measurement results (properties and concentration)
  - b. Number of outputs: 0 to 40
  - c. Output specifications
  - d. Separate 24V DC power supply required (see chapter 3).

Item	Description
Output range	4 to 20 mA DC (3.0 to 21.0 mA DC, floating-common type)
Isolation method	<ul style="list-style-type: none"> <li>• Between output terminals and internal circuit: photocoupler isolation</li> <li>• Between output terminals: non-isolated, common negative</li> </ul>
Withstand voltage	500 V DC for 1 min.
Allowable load resistance	600 $\Omega$ or less
12-bit D/A converter resolution	5.7 $\mu$ A
System accuracy	$\pm 0.5\%$ of full scale at 0°C to 55°C

- Contact output:
  - a. Alarms and output quantity:
  - b. Output specifications: See table 2.

Alarm	Quantity of outputs	Alarm	Quantity of outputs
General	1	Outlier	4
Communication failure	1	I/O unit failure	1
Operating mode	5		

- Contact input:
  - a. Description:
    - Stream identification for multi-stream sampling unit: 8 points, status signals to identify sample streams that pass through measurement cells.
    - Measurement enabled (stream valid): 4 points, status signals to confirm that samples inside the measurement cells are ready for measurement.
  - b. Input specifications

Item	Description
Input type	Voltage free contact
Common terminal	Common to 8 points
Isolation method	Transformer isolation
Withstand voltage	Between external connectors collectively and internal circuit: 500 V DC for 1 min.
Off-state open-circuit voltage	5 to 7 V
On-state load current	1 to 3 mA
On-state load resistance	200 $\Omega$ or smaller
Off-state load resistance	100 $\Omega$ or larger

- Analog input:
  - a. Input data and number: Analog output compensation signal, 4 points
  - b. Input specifications

Item	Description
Input range (actual)	1 to 5 V DC (-0.25 to 5.25 V DC)
Isolation method	<ul style="list-style-type: none"> <li>• Between input terminals and internal circuit: photocoupler isolation</li> <li>• Between input terminals: non-isolated, negative common</li> </ul>
Withstand voltage	500 V DC for 1 min.
Input resistance	1 M $\Omega$
12-bit A/D converter resolution	1 to 5 V DC: 1.4 mV
System accuracy	$\pm 0.5\%$ of full scale at 0°C to 40°C

- Installation requirements: See chapter 4.
- Mounting: Wall mounting
- External connection terminal: M3.5 screw
- External dimensions and weight: Depends on the number of analog outputs installed as follows:

Number of Analog Outputs	Dimensions*	Approximate Weight
12 or less	322 x 88.5 x 100 mm	2.5 kg
13 to 28	439 x 88.5 x 100 mm	3.5 kg
29 to 40	527 x 88.5 x 100 mm	4.5 kg

\* : Width x depth x height

### 2.2.3 Model and Suffix Codes

Model	Suffix Code	Option Code	Description
NR893JG			I/O unit
Nameplate	-J		Japanese
	-E		English
Analyzer	1		Explosion-proof model*
	2		General Purpose model
Contact input for stream switching	A		Available
	B		None
Analog input for compensation	A		Available
	B		None
Number of analog outputs**	-00		None
	-04		4
	-08		8
	-12		12
	-16		16
	-20		20
	-24		24
	-28		28
	-32		32
	-36		36
	-40		40
—	-N-N		Always -N-N
Option			

\* Always specify 1 for connectors to an explosion-proof model. This blocks the communication signal upon receiving a power-off signal from the analyzer, thus ensuring the explosion-proof integrity of the main unit.

\*\* Separate 24V DC power supply required when using an analog output (see chapter 3).

**Table 2. Contact Output Specifications**

Item		Description
I/O unit failure	Rating	24 V DC. 0.3 A
	Action and number	1 normally open and 1 normally closed (shared common)
Alarm, operating mode, and outlier detection	Insulation method	Mechanical isolation
	Rated load voltage	DC 24 V
		AC 100 to 240 V
	Maximum load current	2 Amps/point, 8 Amps/common
	Servicing life	Mechanical At least 20 million actions
		Electrical At least 100 thousand actions
	Surge killer	None
	Number per common	8 points/common
	External power supply	Not required.

## 2.3 Measurement Cells

### 2.3.1 Flow through Cell

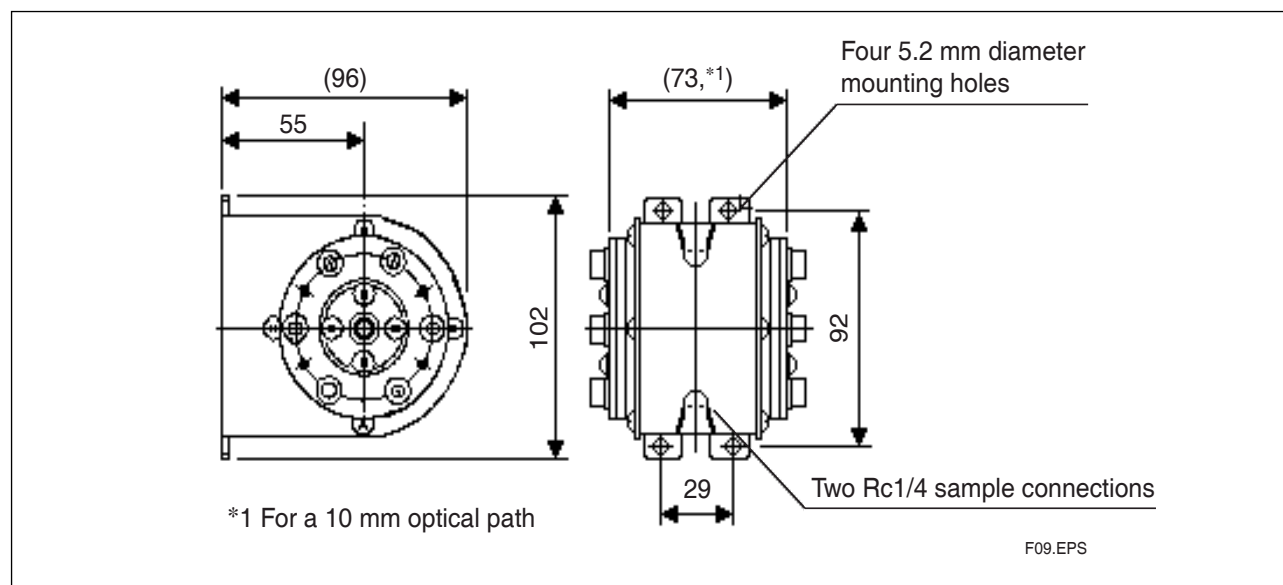
#### Specifications

a. Optical path length:	1, 2, 5, 10, or 20 mm
b. Fiber-optic connector:	FC type
c. Wetted part material:	Viton, Kalrez, 316 S.S., Borosilicate crown glass, or Sapphire
d. Sample pressure range:	Atmospheric pressure up to 1.9 MPa G
e. Sample temperature range:	-5°C to +80°C
f. Sample connection:	Female Rc1/4
g. Installation angle:	Vertical
h. Installation location requirements:	See chapter 4.
i. Weight:	Approx. 3 kg

#### Model and Suffix Codes

Model	Suffix Code	Option Code	Description
NR510			Flow through cell
Window material and optical path length	-B00		Borosilicate crown glass, 10 mm, with variable optical path adapter (1, 2, 5, or 20 mm)
	-B01		Borosilicate crown glass, 1 mm
	-B02		Borosilicate crown glass, 2 mm
	-B05		Borosilicate crown glass, 5 mm
	-B10		Borosilicate crown glass, 10 mm
	-B20		Borosilicate crown glass, 20 mm
	-S00		Sapphire, 10 mm, with variable optical path adapter (1, 2, 5, or 20 mm)
	-S01		Sapphire, 1 mm
	-S02		Sapphire, 2 mm
	-S05		Sapphire, 5 mm
	-S10		Sapphire, 10 mm
	-S20		Sapphire, 20 mm
Body material	SUS		316 S.S.
O-ring material	-B		Viton
	-K		Kalrez
—	-N-N		Always -N-N
Option			

#### External Dimensions



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### 2.3.2 Flow through Cell with Constant Temperature Water Tube

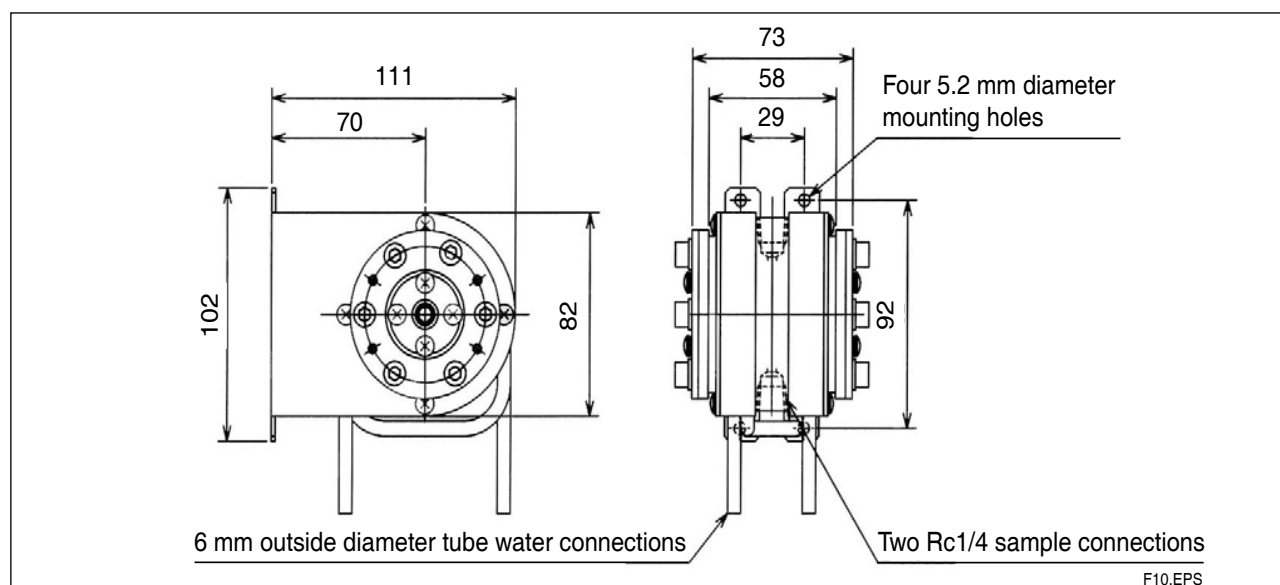
#### Specifications

a. Optical path length:	1, 2, 5, 10, or 20 mm
b. Fiber-optic connector:	FC type
c. Wetted part material:	Viton, Kalrez, 316 S.S., Borosilicate crown glass, or Sapphire
d. Sample pressure range:	Atmospheric pressure up to 0.19 MPa
e. Sample temperature range:	+5°C to +80°C
f. Constant water temperature range:	+5°C to +80°C
g. Sample connection:	Female Rc1/4
h. Connection for water with constant temp.:	6-mm outside diameter, copper tube
i. Installation angle:	Vertical
j. Installation location requirements:	See chapter 4.
k. Weight:	Approx. 3 kg

#### Model and Suffix Codes

Model	Suffix Code	Option Code	Description
NR512			Flow through cell with constant temperature water tube
Window material and optical path length	-B00		Borosilicate crown glass, 10 mm, with variable optical path adapter (1, 2, 5, or 20 mm)
	-B01		Borosilicate crown glass, 1 mm
	-B02		Borosilicate crown glass, 2 mm
	-B05		Borosilicate crown glass, 5 mm
	-B10		Borosilicate crown glass, 10 mm
	-B20		Borosilicate crown glass, 20 mm
	-S00		Sapphire, 10 mm, with variable optical path adapter (1, 2, 5, or 20 mm)
	-S01		Sapphire, 1 mm
	-S02		Sapphire, 2 mm
	-S05		Sapphire, 5 mm
	-S10		Sapphire, 10 mm
	-S20		Sapphire, 20 mm
Body material	SUS		316 S.S.
O-ring material	-B		Viton
	-K		Kalrez
—	-N-N		Always -N-N
Option			

#### External Dimensions



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### 2.3.3 In-situ probe

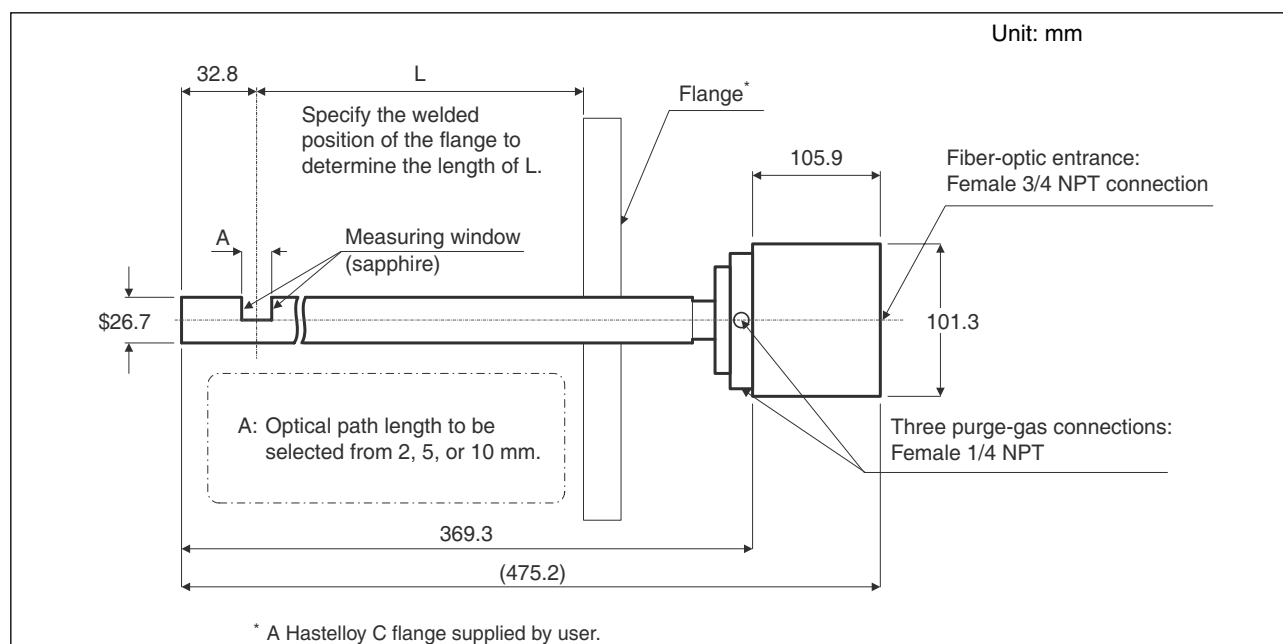
#### Specifications

- |  |   |
|--|---|
| a. Fiber-optic connector:              | FC type                                 |
| b. Wetted part material:               | Hastelloy C, Kalrez, 316 S.S., Sapphire |
| c. Sample pressure range:              | Atmospheric pressure to 1.9 MPa         |
| d. Sample temperature range:           | -5°C to +80°C                           |
| e. Installation angle:                 | Horizontal                              |
| f. Purge gas connection:               | Female 1/4 NPT                          |
| g. Installation location requirements: | See chapter 4                           |
| h. Weight:                             | Approx. 4 kg (excluding flange)         |

#### Model and Suffix Codes

PARTS=FIR1000=PROBE10

#### External Dimensions



### 2.4 Fiber-optic Cables

#### 2.4.1 Silica Fiber-optic Cable

##### Specifications

- Applicable wavelength range: 900 to 2100 nm
- Connector: Double-end FC or FC-SMA type
- Structure: Dual (for sample and reference) or single (sample), two-core, protected by stainless flexible tube
- Minimum bending radius: 100 mm. To reduce optical attenuation, make the radiuses along the cable as large as possible when laying cables.
- Installation location requirements: See chapter 4.
- Cabling: Conduit protected cabling is recommended.



**Model and Suffix Codes (Model code to include fibers for Analyzer–Cell(probe)–Analyzer)**

**a. Single fiber-optic cable**

Model	Suffix Code	Option Code	Description
NR821			Single fiber-optic cable for wavelength of 900 to 2100 nm
Connector	-FF		Double-end FC type
	-FS		FC type on analyzer side and SMA type on measurement cell side
Cable length	-L005		5 m
	-L010		10 m
	-L020		20 m
	-L030		30 m
	-L050		50 m
	-L100		100 m
	-L150		150 m
	-L200		200 m
	-L300		300 m
—	-000		Always -000
Option			

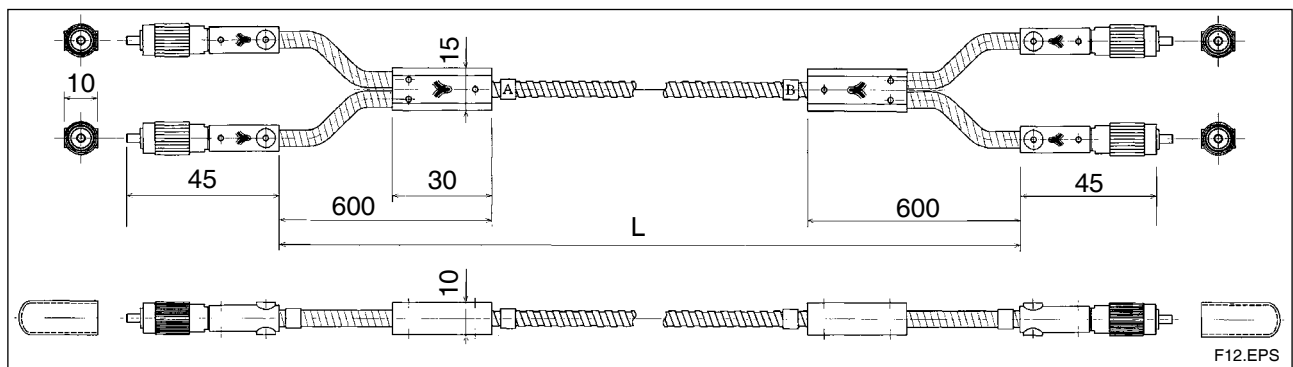
**b. Dual fiber-optic cable (includes fiber for Meas. and Ref.)**

Model	Suffix Code	Option Code	Description
NR822			Dual fiber-optic cable for wavelength of 900 to 2100 nm
Connector	-FF		Double-end FC type
	-FS		FC type on analyzer side and SMA type on measurement cell side
Cable length	-L005		5 m
	-L010		10 m
	-L020		20 m
	-L030		30 m
	-L050		50 m
	-L100		100 m
	-L150		150 m
	-L200		200 m
	-L300		300 m
—	-000		Always -000
Option			

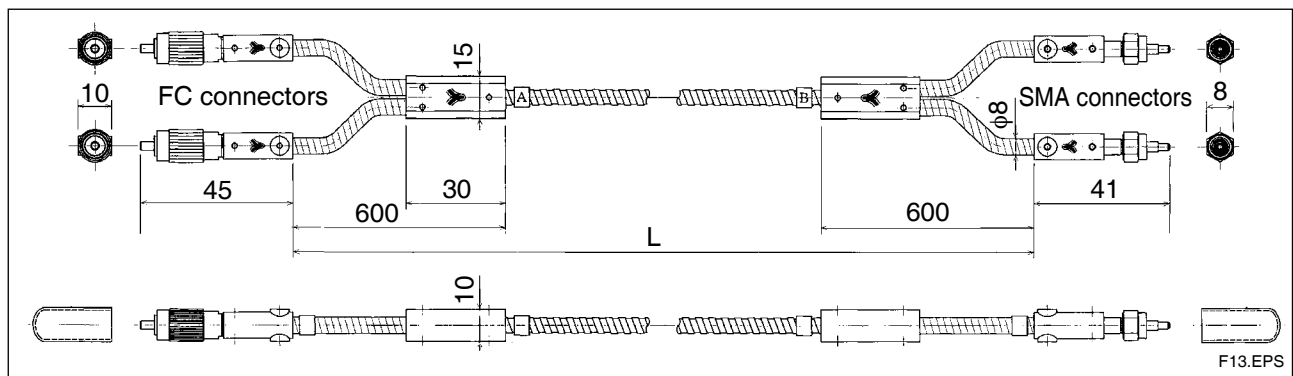
**External Dimensions**

A dual fiber-optic cable comprises two single cables. The dimensions for each single cable are the same.

- Double-end FC connector



- FC (analyzer) - SMA (measurement cell) connector



## 2.4.2 Fluoride Fiber-optic Cable

### Specifications

- Applicable wavelength range: 900 to 2500 nm
- Length: Up to 20 m
- Connector: Double-end FC type or FC-SMA type
- Structure: Dual (for sample and reference) or single (sample), two-core, protected by stainless flexible tube

- Minimum bending radius: 120 mm. To reduce optical attenuation, make the radii along the cable as large as possible when laying cables.
- Installation location requirements: See chapter 4.
- Cabling: Conduit protected cabling is recommended.

### Model and Suffix Codes (Model code to include fibers for Analyzer–Cell(probe)–Analyzer)

#### a. Single fiber-optic cable

T19.EPS

Model	Suffix Code	Option Code	Description
NR823			Single fiber-optic cable for wavelength of 900 to 2500 nm
Connector	-FF		Double-end FC type
	-FS		FC type on analyzer side and SMA type on measurement cell side
Length	-L005		5 m
	-L010		10 m
	-L020		20 m
—	-000		Always -000
Option			

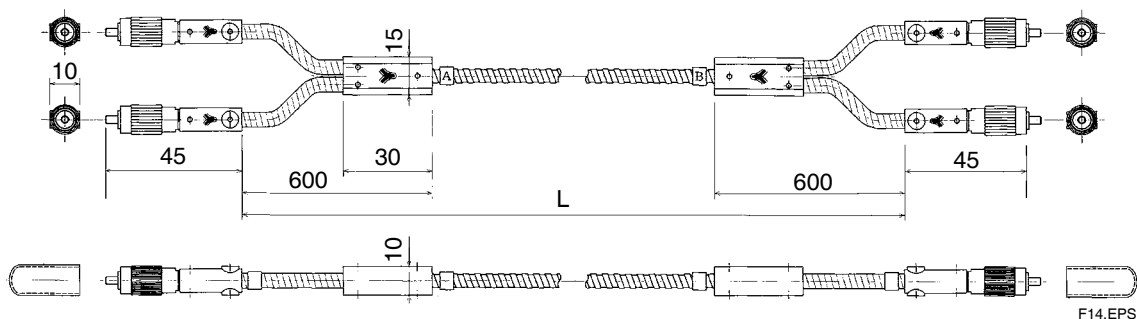
#### b. Dual fiber-optic cable

Model	Suffix Code	Option Code	Description
NR824			Dual fiber-optic cable for wavelength of 900 to 2500 nm
Connector	-FF		Double-end FC type
	-FS		FC type on analyzer side and SMA type on measurement cell side
Length	-L005		5 m
	-L010		10 m
	-L020		20 m
—	-000		Always -000
Option			

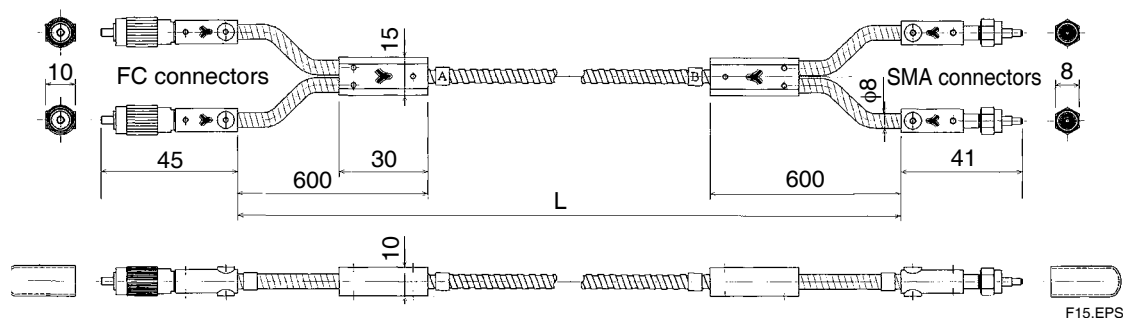
### External Dimensions

A dual fiber-optic cable comprises two single cables. The dimensions for each single cable are the same.

#### • Double-end FC connector



#### • FC (analyzer) - SMA (measurement cell) connector

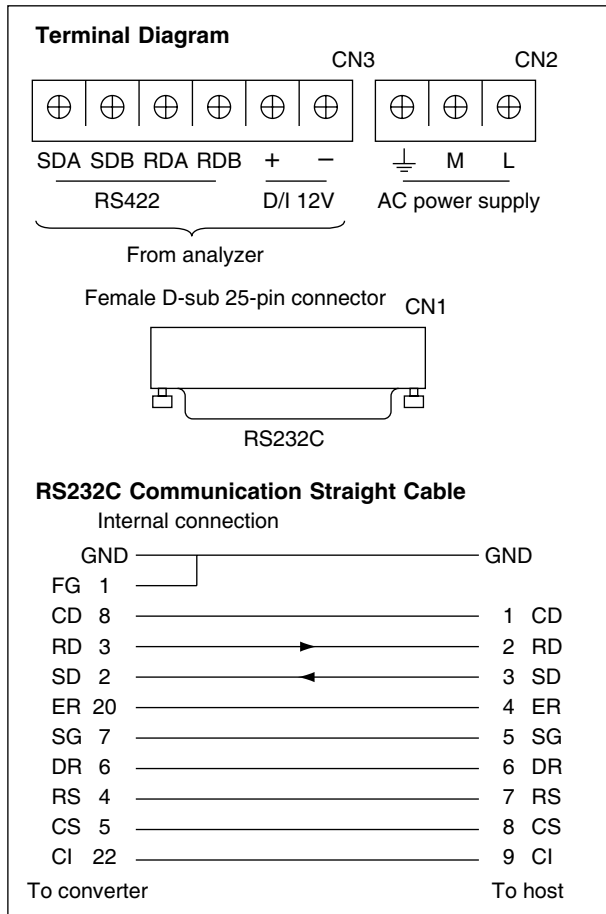


## 2.5 RS422-to-RS232C Converter (Part Number: K9404LA)

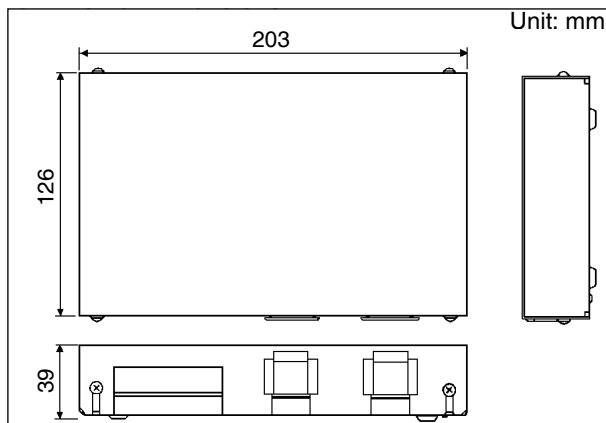
This unit converts output signals of the analyzer main unit from the RS422 format to the RS232C format for personal computer or DCS communication and also blocks communication signals when it receives a power-off signal from the analyzer, thus ensuring the explosion-proof integrity.

### Specifications

- Power supply: See chapter 3.
- Signal terminals: Analyzer main unit side (RS422): M4, output side (RS232C): Female Dsub 25-pin
- Grounding type: Class D
- Installation location requirements: See chapter 4.
- Housing structure: Desktop
- Weight: Approx. 1 kg



### External Dimensions



## 2.6 Ethernet Fiber-optic Cable

### Specifications

- Length: Up to 20 m
- Connector: ST type
- Structure: Two-core, protected by stainless flexible tube
- Installation location requirements: See chapter 4.
- Minimum bending radius: 50 mm. To reduce optical attenuation, make the radiuses along the cable as large as possible when laying cables.

### Model and Suffix Codes

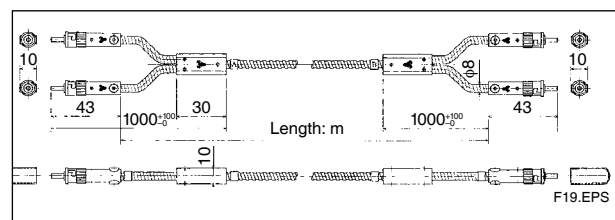
Model	Suffix Code	Option Code	Description
NR895			Ethernet fiber-optic cable
Length*	-L003		3 m
	-L005		5 m
	-L010		10 m
	-L020		20 m
	-000		Always -000
Option		/JB	With junction box*

\*: For a total cable distance of 20 m or longer, an additional fiberoptic cable (fitted with ST connectors) must be provided by the user. In this case, be sure to specify the /JB (junction box) option for connection between an NR895 fiber-optic cable and the additional cable.

Requirements for additional cable provided by user

- Material and connector: Silica glass fiber with ST connectors
- Mode: Multi-mode GI
- Number of cores: 2
- Core/Clad diameters: 50/125  $\mu$ m
- Applicable wavelength: 850 nm
- Length: 1000 m or less in total including an NR895 fiber-optic cable

### External Dimensions



## 2.7 Ethernet Cable

User furnished a cable that satisfies the following requirements:

- Type: 10BaseT, 8-core shielded
- Length: Up to 40 m
- Finished outer diameter: 5.0 to 7.4 mm

## 2.8 SpectLand 2 Measurement and Maintenance Software

### 2.8.1 Overview

SpectLand 2 is an application software that controls NR800 operation and monitoring on a PC. It displays the analyzer status, and instructs measurement and sets parameters for the analyzer. To use SpectLand 2, first install it in the Engineering PC.

#### Main Features

- Instructs the analyzer to measure spectra, save data and display. The measured spectra can be used to generate calibration models.
- Shows trend graphs of the measurements and saves them to files during a continuous measurement.
- Sets parameters for continuous measurement.
- Displays various data of the analyzer, such as operating modes, alarm status, and maintenance data.
- Instructs the analyzer to perform such tasks as operation mode change, spectra measurement, and setting property information, calibration models, or measurement conditions.

### 2.8.2 Main Windows

#### • Manual Spectrum Window

Enables the analyzer to measure spectra, which are to be processed by Chemometrics (calibration model generation software). Also allows data to be saved to files and displayed.

#### • Auto Spectrum Window

Allows the user to upload spectra data to the Engineering PC during continuous measurement upon receiving a signal at periodic intervals, outlier detection, or a property value variation failure. This data is displayed for each measuring channel.

#### • Power Spectrum Window

This window is available for UB level (equipment supervisor) users. It displays power spectra.

#### • Interferogram Window

This window is available for UB level users. It displays interferogram data collected.

#### • Real-time Trend Windows

Display measurement values of Nos. 1 to 6 and Nos. 7 to 12 components in two separate trend graph windows for each stream. Up to 10 windows can be open at the same time.

#### • Historical Trend Windows

Display historical trend data saved. Trend data of 24 hours for each stream is saved to a file. Up to 4 windows can be open at the same time.

#### • Parameter Window

Displays the current parameter settings for the analyzer. In addition, UB level users can change the settings.

#### • Alarm Status/History Windows

The Alarm Status window displays the active alarms for the analyzer, while the Alarm History window displays all the past alarms. The alarm history can be deleted with commands.

#### • Tab-controlled Maintenance Window

Displays the A/D reference value and servo-related data of the analyzer. This window is available for UC level users.

#### • Tab-controlled Communication Status Window

Displays the communication status between the personal computer and the analyzer. This window is available for UC level users.

### 2.8.3 Model and Suffix Codes

Model	Suffix Code	Option Code	Description
NR831			SpectLand 2 measurement and maintenance software
Language	-J		Japanese
	-E		English
—	-N-N		Always -N-N
Option			

#### Package contents

- One 3.5-inch floppy disk
- One instruction manual

## 2.9 Unscrambler Analysis and Calibration Model Generating Software

### 2.9.1 Specifications

- Calibration model generating technique: Partial least square (PLS) and others
- Package contents
- Five 3.5-inch floppy disks
- One instruction manual
- One set of user registration document

### 2.9.2 Model and Suffix Codes

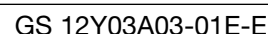
Model	Suffix Code	Option Code	Description
NR530			Unscrambler analysis and calibration model generating software
Language	-J		Japanese
	-E		English
—	-N-N		Always -N-N
Option			

Use of a sampling unit is highly recommended to ensure compatibility of the user's process sample with the measurement cell. In addition, it allows separation of the measurement cell (probe) apart from the analyzer with a fiber-optic cable up to 300 m in length. This enables selection of a measurement location independent of the analyzer. The optimum sampling unit is prepared for individual application requirements. Contact Yokogawa for further information.

The following introduces a conceptual sampling unit for measuring the properties (RON, RVP, Distillation etc.) of gasoline blending in a petroleum refinery. Note that each sampling unit should be designed for each application; designs will vary.

Item			Condition
a	Fluid to be measured		Gasoline
b	Sample inlet/ outlet condition	Inlet pressure	0.3 to 0.9 MPa G
		Outlet pressure	0.3 to 0.9 MPa G
		Inlet temperature	0°C to +40°C

- 1: When samples do not contain free water content, a coalescer is not required.
- 2: When samples do not have bubbles, no degasser is required.
- 3: If the pressure difference between the sample inlet and outlet is greater than 0.3 MPa, no sampling pump is required.



### 3. Utility Specifications

#### 3.1 Power Supplies

##### NR800 analyzer

Item	Description
Power supply	100, 110, 115, 200, 220, 230 V AC, single phase, 50/60 Hz*
Voltage fluctuation	Rating $\pm 10\%$ , 50/60 $\pm 2$ Hz
Power consumption	Approx. 250 VA

\* : To be specified. See the corresponding model and suffix codes for details.

##### RS422/RS232C converter

Item	Description
Power supply	100 to 120 V AC $\pm 10\%$ or 200 to 240 V AC $\pm 10\%$ , single phase, 50/60 Hz
Voltage fluctuation	Rating $\pm 10\%$ , 50/60 $\pm 2$ Hz
Power consumption	Approx. 15 VA

##### I/O unit

Item		Description
AC	Power supply	100 to 230 V AC $\pm 10\%$ , single phase, 50/60 Hz
	Voltage fluctuation	85 to 264 V AC, 50/60 $\pm 3$ Hz
	Power consumption	Approx. 100 VA
DC	Power supply	24 V DC
	Voltage fluctuation	24 V DC $\pm 10\%$
	Power consumption	Approx. 180 mVA / AO 4 points

#### 3.2 Others

##### Clean, dry air for analyzer purge (explosion-proof model)

Item	Description
Temperature	-10°C to +40°C
Pressure	0.3 to 0.9 MPa
Dew point	-20°C or lower (at supplied pressure)
Cleanliness	Must be free from dust, corrosive, and toxic elements.
Volume	Approx. 70 Nl/min.

##### Water for flow through cell with water tube utility for sampling unit (when used)

### 4. Installation Location Requirements

Avoid unnecessary physical shock as it may cause damage to the equipment.

##### NR800 analyzer, measurement cell, and fiber-optic cable

Item	Description
Location	Hazardous/non-hazardous area, indoor/outdoor Avoid direct exposure to wind and rain, sunlight, or radiation heat.
Ambient temperature	-10°C to +40°C
Ambient humidity	5% to 95% RH (no condensation)
Vibration	Install the equipment in a place with minimum vibration (vibration acceleration of 2 m/s <sup>2</sup> or less).
Atmosphere	Must not contain corrosive or toxic substances.

##### RS422/RS232C converter and I/O unit

Item	Description
Location	Non-hazardous area, indoor
Ambient temperature	+5°C to +35°C
Ambient humidity	5% to 95% RH (no condensation)
Vibration	Install the equipment in a place with minimum vibration (vibration acceleration of 2 m/s <sup>2</sup> or less).
Atmosphere	Must not contain corrosive or toxic substances.

### 5. Support for Calibration Model Generation

#### 5.1 On-site Guidance of Calibration Model Generation

A Yokogawa engineer will train the user's site personnel in the procedure to generate a calibration model for one measured item using a user-provided sample with its laboratory analysis results.

#### 5.2 Calibration Model Generation

Yokogawa generates a calibration model using the necessary quantity of user-provided samples with laboratory analysis results. A predefined SEP (standard error of prediction) value of 1 will be used as the measurement target value. The target value, sample quantity, and other details are determined separately for each application.

#### 5.3 Others

Other support options for calibration model generation and maintenance include:

- Sampling test for potential users
- Maintenance contracts
- Sampling/model generation/maintenance consulting service.

Contact a Yokogawa sales representative for further information, and advice on the best solution for your needs.

## 6. Recommended Specifications for Engineering PC

### PC

- Model: IBM PC-compatible
- CPU: Intel Pentium 500 MHz or superior
- Operating system: Microsoft Windows 2000/NT4.0/98/Me
- Memory: At least 64 MB
- Hard disk: At least 10 GB of free space (program and data storage)
- Ethernet adapter: 10BaseT

### Color Monitor

Resolution: At least 1024 x 768 pixels

### Color printer

### Connection cables and other devices and consumables

## 7. Optical-to-electrical Signal Converter

Provide a converter and cables compatible with Ethernet 2.0, 10BaseT, and IEEE 802.3 10BaseFL standards, fitted with ST connectors, for multi-mode fiber cables. Contact a Yokogawa sales representative for recommended models with test-proven operation or other information.

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**YOKOGAWA** ◆



# General Specifications

## InfraSpec NR801EL Fourier Transform Near-Infrared Analyzer, At-line model



The InfraSpec NR801 EL is the at-line model of NR800 series FT-NIR analyzer. It employs exactly the same hardware in the heart of the system (interferometer and detector) as NR800 process model and thus realizing high S/N (signal-to-noise) ratio, high wave number resolution and wide wave number scanning range those done in the NR800 process model. Direct model transfer to/from the NR800 series including process model is another key feature. This model's transfer capability will drastically cut down model implementation time and cost at project stage while it provides more flexible and efficient model upgrade during routine operation. Software specially developed for at-line model, SpectLand 2 At-line, will make operation simple and user-friendly and will improve the work efficiency for at-line and Laboratory measurement application.

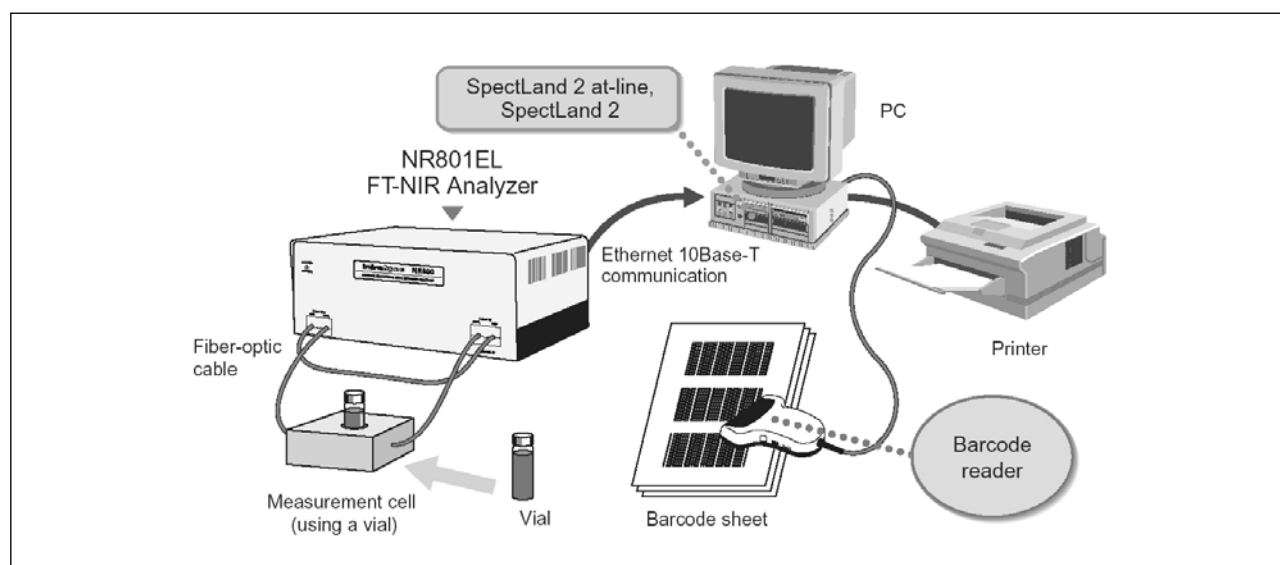


### Features

- Newly developed high-performance interferometer and detector
- High resolution: up to 4 cm<sup>-1</sup>, user-selectable setting
- High S/N ratio: 2250:1 (RMS, 4 cm<sup>-1</sup> resolution, 4100 to 4200 cm<sup>-1</sup>, 1 sec.)
- Wide wavelength scanning range: 900 to 2500 nm (11,000 to 4000 cm<sup>-1</sup>)
- Wavelength reproducibility: 0.007 cm<sup>-1</sup>
- Wavelength accuracy: 0.04 cm<sup>-1</sup>
- Calibration model transfer and share between NR800 series \*1
- Various types of measurement cells (cuvette, vial, probe, and flow-through, etc.,)
- High-speed Ethernet communication between PC and the analyzer
- At-line analysis software (SpectLand 2 at-line) for simple operation.

\*1 This feature is available for analyzers employing identical optical system.

### System Configuration Example (for Vial Cell Measurement)



## 1. Specifications

The following specifications are based on the standard test procedure of Yokogawa Electric Corporation. Also refer to chapter 5, "Model and Suffix Codes".

### 1.1 NR801EL Analyzer

#### 1.1.1 Hardware Specifications

- 1) Principle: Fourier-transform Spectroscope
- 2) Enclosure: Desktop type
- 3) Measurement method: Transmission
- 4) Sample to be measured: Liquid
- 5) Light source: Halogen lamp (recommended replacement interval for continuous operation: 5000 hours)
- 6) Detector: InGaAs
- 7) Fiber-optic cable connector at analyzer: FC type
- 8) Output: Ethernet (10Base-T) 3 1
- 9) Length of Ethernet communication cable: 3 to 40 m
- 10) Installation location requirements: Refer to chapter 3, "Installation Location Requirements"
- 11) Utilities: Refer to chapter 2, "Power Supply"
- 12) Mass: Approx. 30 kg
- 13) Wavelength scanning range: 900 to 2500 nm (11,000 to 4000  $\text{cm}^{-1}$ )
- 14) Wavelength resolution: 4, 8, 16, 32, and 64  $\text{cm}^{-1}$  (user-selectable)
- 15) Wavelength reproducibility: 0.007  $\text{cm}^{-1}$
- 16) Wavelength accuracy: 0.04  $\text{cm}^{-1}$
- 17) S/N ratio: 2250:1 (RMS, 4  $\text{cm}^{-1}$  resolution, 4100 to 4200  $\text{cm}^{-1}$ , 1 sec.)

#### 1.1.2 Standard Compliance

- 1) Safety requirements: Complies with EN61010-1: 1993, Low Voltage Directive, Category II Installation and Pollution Degree 2
- 2) EMC requirements: Complies with following standards
  - a. EN61326: 1997+A1: 1998, Electrical equipment for measurement, control and laboratory use-EMC requirements
  - b. EN61000-3-2: 1995, Class A, Parts 3. Limits Section 2. Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)
  - c. EN61000-3-3: 1995, Parts 3. Limits section 3. Limitation of voltage fluctuations and flicker in low voltage supply for equipment with rated current  $\leq 16$  A

#### 1.1.3 Other Functions

- 1) Baseline compensation: Up to 10 points
- 2) Measurement spectrum saving

## 1.2 Fiber-optic Cable for Desktop Measurement

### 1.2.1 Silica Fiber-optic Cable (NR825)

- Applicable wavelength range: 900 to 2100 nm
- Connectors: An FC connector on both ends, or an FC connector on one end and SMA connector on the other (however, the reference cable must have an FC connector on both ends).
- Structure: Single core, flexible type
- Configuration: 2 cables for measurement and 1 cable for reference
- Length: To be specified for measurement cable; fixed at 65 cm for reference cable
- Minimum bending radius: 100 mm.

### 1.2.2 Fluoride Fiber-optic Cable (NR826)

- Applicable wavelength range: 900 to 2500 nm
- Connectors: An FC connector on both ends, or an FC connector on one end and SMA connector on the other (however, the reference cable must have an FC connector on both ends). Either must be specified.
- Structure: Single core, flexible type
- Configuration: 2 cables for measurement and 1 cable for reference
- Length: To be specified for measurement cable; fixed at 75 cm for reference cable
- Minimum bending radius: 120 mm.

## 1.3 Software

### 1.3.1 SpectLand 2 at-line (NR832)

At-line Routine Analysis Software

#### 1) Outline

The Spectland 2 at-line is to be installed in PC to be connected to NR801EL and provides man-machine interface of NR801EL model. This software is specially developed for at-line model to suite the needs in operation and maintenance for at-line/Lab. use. It also enables simplified and easy operation/maintenance of NR801EL.

#### 2) Major Functions

- a. Communication Function Communication link to NR801EL via Ethernet (10Base-T)
- b. Measurement
 

Provides the following measurement options: sample measurement, blank measurement, and measurement verification (performance test with standard liquid). It allows users to decide measurement result against the criteria and if the results are acceptable, then save the data and print it (in specified print forms). The print items are selected in the Print dialog box.
- c. Alarming
 

Outlier, Hi/Low limit detection for measurement value, and various system diagnostic alarms are provided.
- d. Barcode reader interface
 

Barcode reader interface is provided and all the measurement conditions together with sample name are automatically set by barcode input.
- e. Measurement condition/parameter Set Allows users to set various conditions and parameters for communication, measurement, operator, and printing.

### 1.3.2 SpectLand 2 (NR831)

Measurement and Maintenance Software

#### 1) Outline

SPECTLAND 2 is operation and maintenance software for NR800 series FT-NIR Analyzer.

Basic engineering and maintenance of NR800 is to be done through this software.

SPECTLAND 2 is to be installed in the Engineering PC to be connected to the analyzer.

#### 2) Main Windows

- a. Manual Spectrum Window  
Enables the analyzer to measure spectra for Chemometrics (calibration model generation software). Spectra data is saved in the file and displayed.
- b. Auto Spectrum Window  
Allows users to upload spectra data to the PC during continuous measurement (Run/Auto mode) at periodic intervals, upon outlier detection, or measurement value variation failure. This data is saved and displayed.
- c. Power Spectrum Window  
This window is available for C level users (maintenance personnel) and displays power spectra data.
- d. Interferogram Window  
This window is available for C level users and displays collected interferogram data.
- e. Real-time Trend Windows  
Display measurement values of Nos. 1 to 6 and Nos. 7 to 12 components in two separate trend graph windows for each stream. Up to 10 windows can be open at the same time.
- f. Historical Trend Windows  
Display historical trend data. Trend data of 24 hours for each stream is saved to a file. Up to 4 windows can be open at the same time.
- g. Parameter Window  
Displays the current parameter settings for the analyzer. User B or C level users can change the settings.
- h. Tab-controlled Alarm Status/History Windows  
The Alarm Status window displays the active alarms for the analyzer, while the Alarm History window displays all the past alarms. The alarm history can be deleted with commands.
- i. Tab-controlled Maintenance Window  
Displays the A/D reference value and servo-related data of the analyzer. This window is available for C level users.
- j. Tab-controlled Communication Status Window  
Display the communication status between the PC and the analyzer. This window is available for C level users.

### 1.3.3 Chemometrics Software (NR530)

#### 1) Outline

The NR530 is chemometrics software to generate calibration models as well as model evaluation and validation. The software to be installed on the PC.

#### 2) Specifications

- a. Technique for Generating Calibration Models Partial least square (PLS)
- b. Package Contents
  - CD-ROM 3 1
  - Instruction manual 3 1
  - User registration form 3 1

## 2. Power Supply

Item	Specifications
Power supply voltage	100, 115, 200 or 230V AC, single phase, 50/60Hz <sup>*1</sup>
Voltage fluctuation	rating 10%, 50/60 2Hz
Power consumption	Approx. 200VA

<sup>\*1</sup> To be specified for ordering. For details, refer to "Model and Suffix Codes."

## 3. Installation Location Requirements

Item	Requirements
Location	Non-hazardous location indoors, where the analyzer shall not be exposed to weather, sunlight or radiant heat.
Ambient temperature	0 to 35°C
Ambient humidity	0% to 80% rH (no-condensation)
Vibration	Minimum vibration (vibration acceleration of 2 m/s <sup>2</sup> or less).
Atmosphere	Minimum dust and no corrosive or toxic substances.
Altitude	Up to 2000m above sea level.

**Note:** Avoid physical impact as it may result in a malfunction.

## 4. Recommended Specifications for PC

### 4.1 PC

- Model: IBM PC-compatible desktop
- OS: Microsoft Windows 2000/XP
- CPU: 1 GHz Intel Pentium III or superior <sup>\*1</sup>
- Memory: At least 256 MB <sup>\*1</sup>
- Hard disk: At least 10 GB of free disk space (for program and data storage)
- CD-ROM drive
- 3.5-inch floppy disk drive
- Ethernet adapter: 10Base-T
- USB port

<sup>\*1</sup>: The CPU must meet the requirements of the operating system used.

### 4.2 Display

Resolution: 1024 3 768 pixels or greater

### 4.3 Connection Cables and other Devices

Ethernet cross over cable for peer-to-peer connection  
Ethernet hub (4 or 8 port ) and ethernet connection cables

### 4.4 Electrical Cable for Ethernet

Specifications: 10Base-T, 8 core shielded  
Length: 3 to 40 m

### 4.5 Barcode Reader

- Interface: USB
- Reading width: At least 65 mm
- Resolution: At least 0.125 mm
- Reading code: CODE39

## 5. Model and Suffix Codes

### 5.1 NR801EL Desktop Analyzer with CE Marking

Model	Suffix Code	Option Code	Description
NR801EL			FT-NIR Analyzer, At-line model with CE marking
Language	±E		English
Power supply	1		AC100V, 50/60 Hz
	3		AC115V, 50/60 Hz
	4		AC200V, 50/60 Hz
	6		AC230V, 50/60 Hz
Power Cable	±00		No power cable attached
	±01		For U.S.A. and Japan (UL/CSA)
	±02		For Germany (VDE)
	±03		For Australia (SAA)
	±04		For UK (BS)
No. of channel	±S1		Single channel
Wavelength range	W1		900nm to 2100 nm
	W2		900nm to 2500 nm
±	±21		Always "±21"
±	±00		Always "±00"
±	0		Always "0"
±	±0000		Always "±0000"
Option			

### 5.2 Fiber-optic Cable for Desktop Measurement

#### 5.2.1 Silica Fiber-optic Cable

Model	Suffix Code	Option Code	Description
NR825			Silica fiber for At-line model
Connector	±FF		FC connector at both ends
	±FS		FC at analyzer, SMA at cell/probe
Length (cm)	±L065		65
	±L150		150
	±L250		250
	±000		Always "±000"
Option		±	±

### 5.2.2 Fluoride Fiber-optic Cable

Model	Suffix Code	Option Code	Description
<b>NR826</b>			Fluoride fiber for At-line model
Connector	±FF		FC connector at both ends
	±FS		FC at analyzer, SMA at cell/probe
Length (cm)	±L075		75
	±L150		150
	±L250		250
	±000		Always "±000"
Option		±	±

## 5.3 Software

### 5.3.1 SpectLand 2 at-line

Model	Suffix Code	Option Code	Description
<b>NR832</b>			At-line/Routine Analysis Software
Language	±E		English
±	±N±N		Always "-N-N"
Option		±	±

### 5.3.2 SpectLand 2

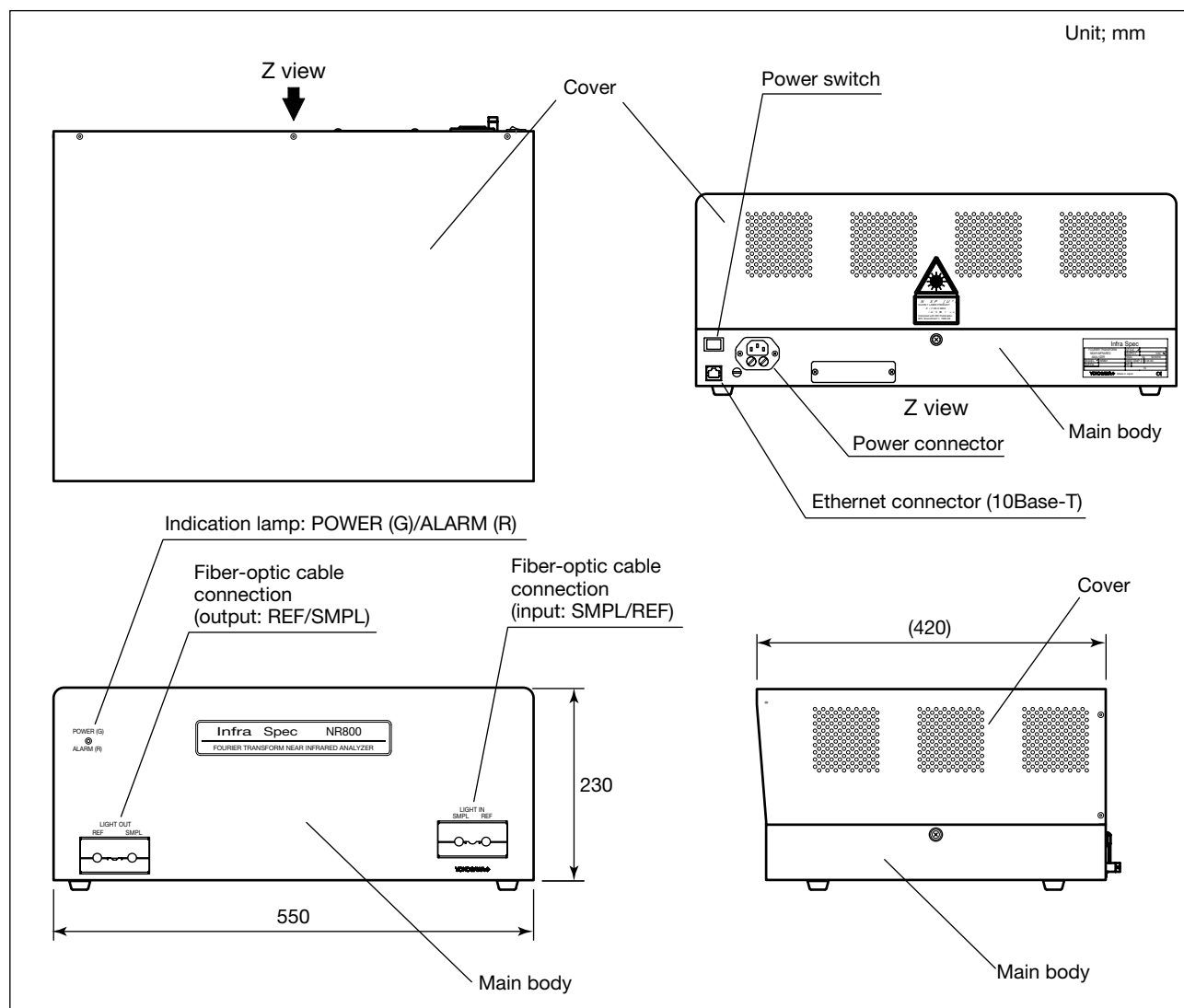
Model	Suffix Code	Option Code	Description
<b>NR831</b>			Measurement and Maintenance Software
Language	±E		English
±	±N±N		Always "-N-N"
Option		±	±

### 5.3.3 Chemometrics Software

Model	Suffix Code	Option Code	Description
<b>NR530</b>			Chemometrics Software
Language	±E		English
±	±N±N		Always "-N-N"
Option		±	±

## 6. Outline Drawing

### 6.1 Analyzer (NR801EL)

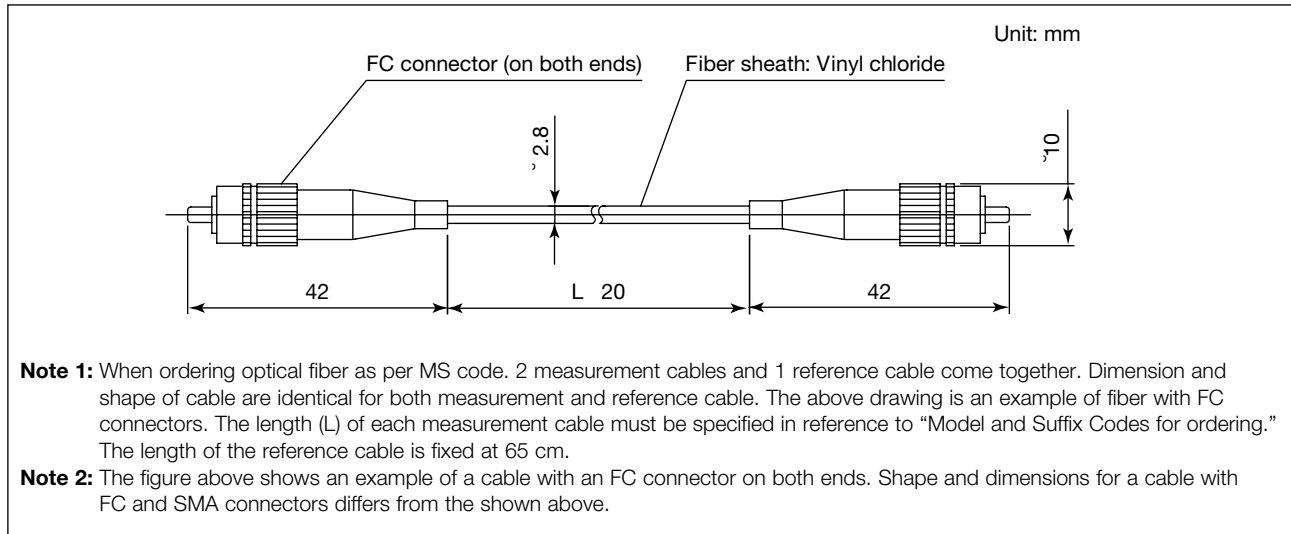


#### Coating Color

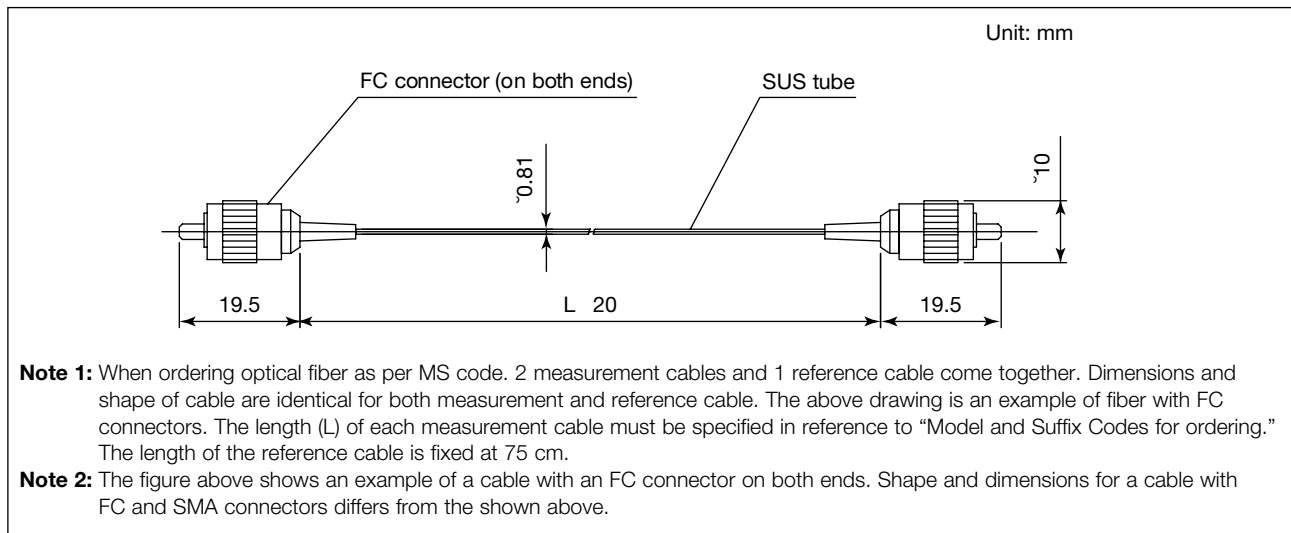
- Cover: Frosty white (Munsell No.: 2.5Y 8.4/1.2)
- Main body: Lamp blank (Munsell No.: 08Y 2.5/0.4)

## 6.2 Fiber-optic Cable

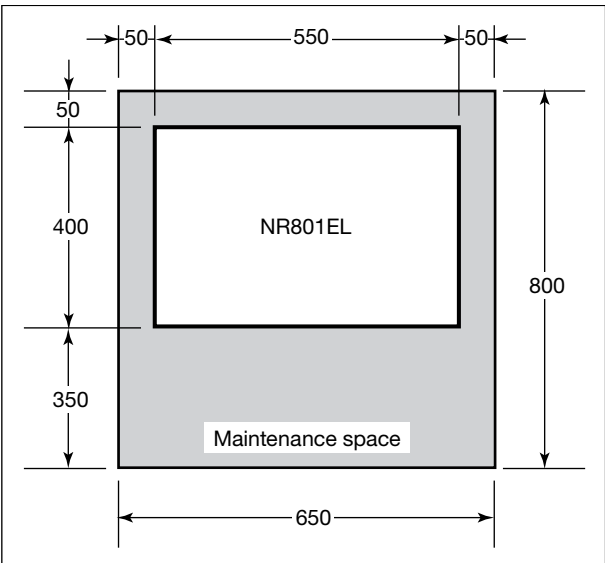
### 6.2.1 Silica Fiber-optic Cable for At-line Model (NR825)



### 6.2.2 Fluoride Fiber-optic Cable for At-line Mark (NR826)



## 7. Installation Space



## 8. Calibration Model Implementation

### 8.1 On-site Hands-on Training


In case customer intends to prepare the model by themselves, Yokogawa offers on-site training by using customer's analyzer at customer's place. Yokogawa engineer to conduct the hands-on training for model implementation and evaluation at customer's place based on the samples prepared by customer in advance. Designated number of trainee is one personnel and number of measurement is one as well.


### 8.2 Model Implementation by Yokogawa

Yokogawa is to undertake the model implementation work. Samples and Reference analysis of samples are to be prepared/ done by customer. Model performance is to be evaluated by Standard error of prediction (SEP) (1 sigma). Desired SEP and number of samples required are to be discussed and agreed in advance.

### 8.3 Other Related Services

In addition to the above, Yokogawa offers various support programs for every phase of project and model implementation. Those are to include Sample test as for feasibility study for the measurement, Annual maintenance support for both hardware and model, Consultation for modeling and others.

 Be sure to carefully read the instruction manual to ensure safe use of this product.

 Do not look into the laser beam.

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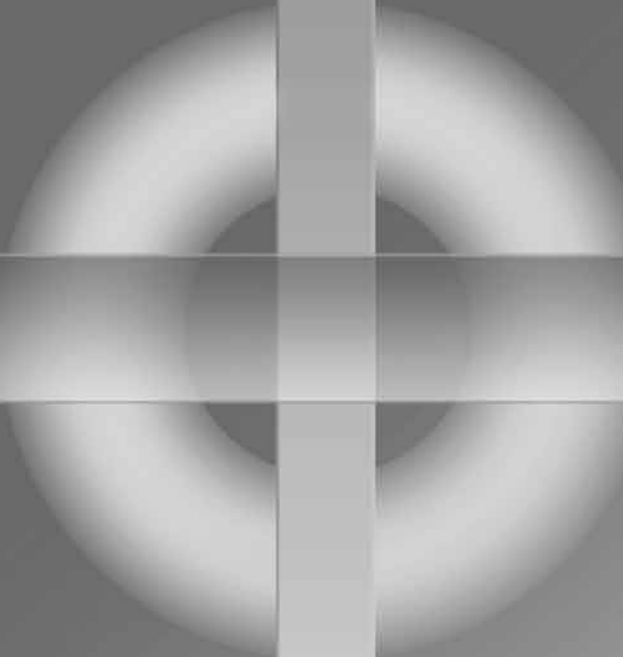
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# Rotameters

# Rotameters



# Rotameter Overview

## Trust your own eyes: Rotameter RGC & RQC Series

The flow tube is transparent giving you full insight into process and position of the float – a scale located on the tube indicates the true flow rate.

The Rotameter gets its name from the rotating float which was developed by ROTA to provide self stabilization.

A Rotameter is truly modular flowmeter. The variety in cones, floats and scales combine to make the Yokogawa Rotameter suitable for a very wide range of Applications.



RGC1 series  
Glass Rotameter



RGC2 series  
Glass Rotameter



RQC1 series  
Plastic Rotameter

BU 01A08A08  
1st Edition

# RGC1 MODEL Without adjustment valve

## Metering tube: 75mm

### Description

This type of Rotameter is designed for measurement of low liquid and gas flows.

### Benefits

- Cost-effective solution
- Space-saving design
- Negligible pressure loss

### Applications

- Visual fluid monitoring
- Flow / No-flow indication
- Gas analysis
- ...



### Technical data

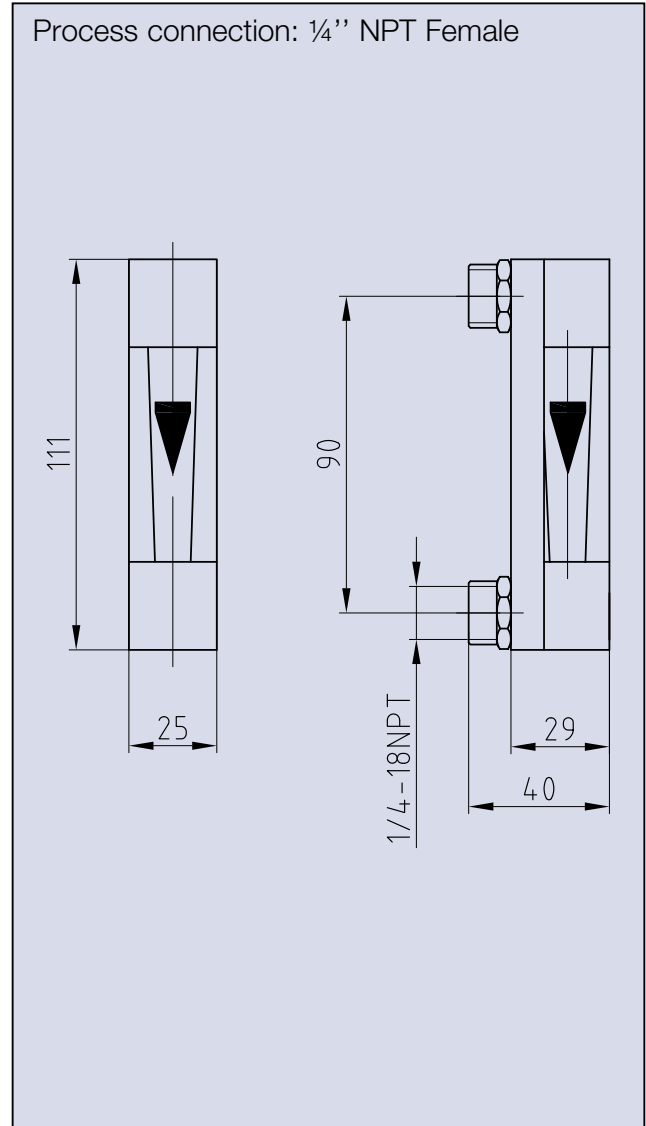
<b>Process Connection</b>	Size: ¼" NPT female Material: Polypropylene
<b>Metering tube</b>	Length: 75 mm Material: Borosilicate (Duran 50)
<b>Float material</b>	for liquid: Stainless Steel for gas: Glass ball
<b>Gasket material</b>	Buna (NBR)
<b>Permitted operating conditions</b>	Max. 16 bar (@20°C), Max. 80°C
<b>Measuring span</b>	10:1
<b>Measuring accuracy</b>	4% ( $q_G=50\%$ )
Acc. Directive VDI/VDE 3513, sheet 2	

## Flow Tables

Water (20°C)	
Max. Flow [l/h]	Part number
1	RGC1000
2,5	RGC1001
4	RGC1002
6	RGC1003
10	RGC1004
15	RGC1005
26	RGC1006
40	RGC1007
63	RGC1008
110	RGC1009

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	Part number
16	RGC1020
40	RGC1021
65	RGC1022
100	RGC1023
160	RGC1024
250	RGC1025
400	RGC1026
630	RGC1027
1000	RGC1028
1600	RGC1029

## Dimensions [mm] RGC1 without valve



# RGC1 MODEL With built-in adjustment valve

## Metering tube: 75mm

### Description

This type of Rotameter is designed for measurement of low liquid and gas flows. A needle valve is integrated on the inlet of the Rotameter for flow adjustment.

### Benefits

- Cost-effective solution
- Space-saving design
- Negligible pressure loss
- Fine adjustment of flow

### Applications

- Visual fluid monitoring
- Flow / No-flow indication
- Gas analysis
- ...

### Technical data

<b>Process Connection</b>	Size: 1/4" NPT female Material: Polypropylene
<b>Metering tube</b>	Length: 75 mm Material: Borosilicate (Duran 50)
<b>Float material</b>	for liquid: Stainless Steel for gas: Glass ball
<b>Gasket material</b>	Buna (NBR)
<b>Valve material</b>	Silver seat; Buna gasket Stainless steel spindle
<b>Permitted operating conditions</b>	Max. 16 bar (@20°C) Max. 80°C
<b>Measuring span</b>	10:1
<b>Measuring accuracy</b>	4% ( $q_G=50\%$ )
Acc. Directive VDI/VDE 3513, sheet 2	



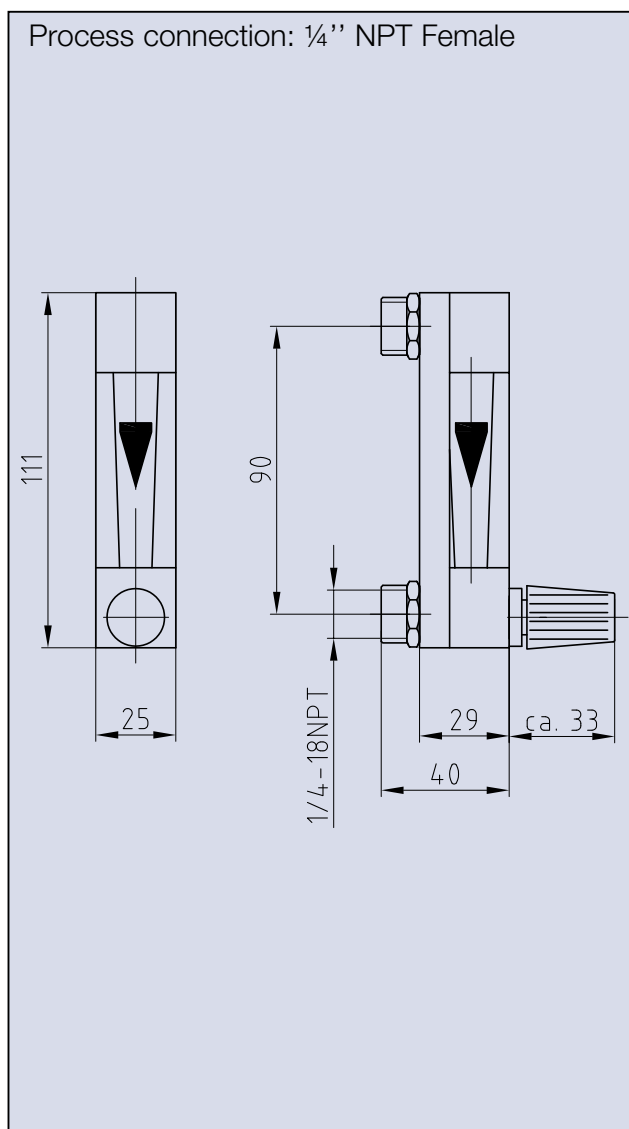
## Flow Tables

Water (20°C)	
Max. Flow [l/h]	Part number
1	RGC1040
2,5	RGC1041
4	RGC1042
6	RGC1043
10	RGC1044
15	RGC1045
26	RGC1046
40	RGC1047
63	RGC1048
110	RGC1049

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	Part number
16	RGC1060
40	RGC1061
63	RGC1062
100	RGC1063
160	RGC1064
250	RGC1065
400	RGC1066
630	RGC1067
1000	RGC1068
1600	RGC1069

## Dimensions [mm]

## RGC1 with valve



# RGC1 MODEL Without adjustment valve

Metering tube: 150mm

## Description

This type of Rotameter is designed for measurement of low liquid and gas flows.

## Benefits

- Cost-effective solution
- Negligible pressure loss
- Better accuracy & readability due to longer metering tube

## Applications

- Visual fluid monitoring
- Laboratory process
- Gas analysis
- ...



## Technical data

<b>Process Connection</b>	Size: ¼" NPT female Material: Polypropylene
<b>Metering tube</b>	Length: 150 mm Material: Borosilicate (Duran 50)
<b>Float material</b>	for liquid & gas : Titanium
<b>Gasket material</b>	Buna (NBR)
<b>Permitted operating conditions</b>	Max. 16 bar (@20°C) Max. 80°C
<b>Measuring span</b>	10:1
<b>Measuring accuracy</b>	2.5% ( $q_G=50\%$ )
Acc. Directive VDI/VDE 3513, sheet 2	



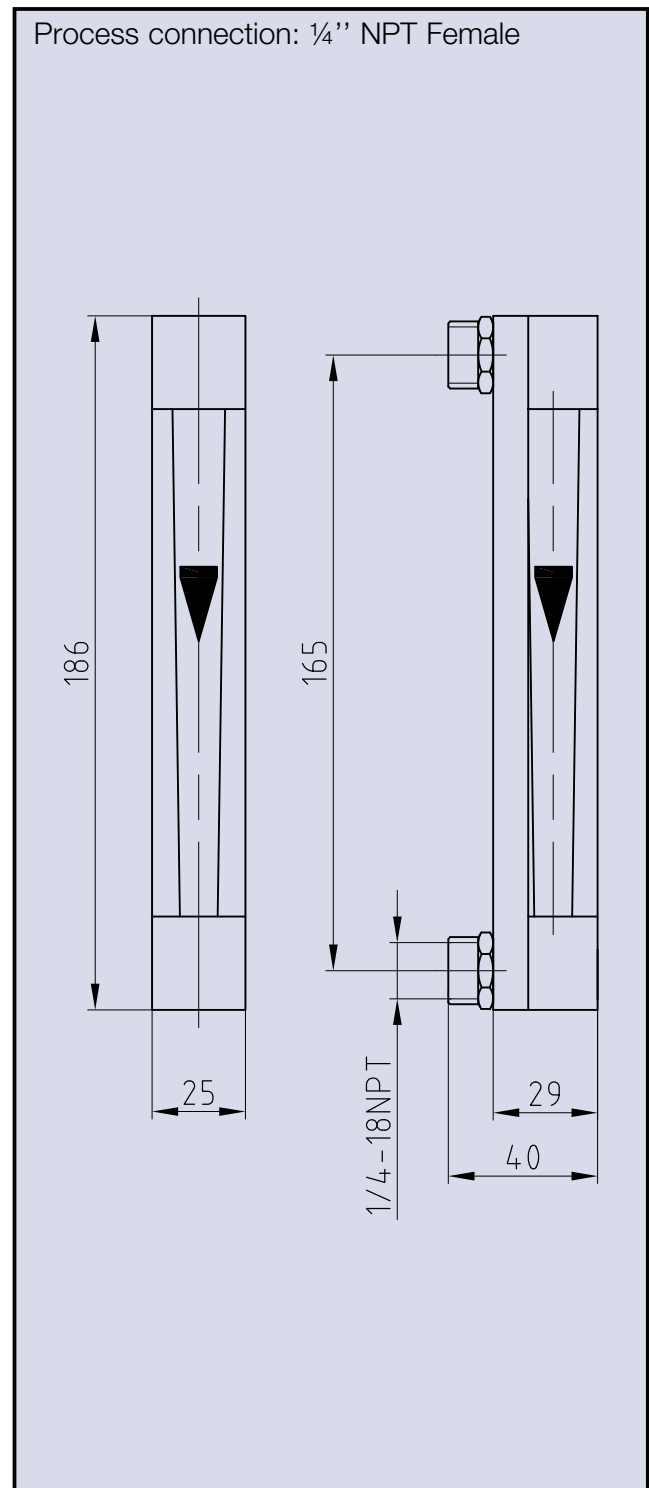
## Flow Tables

Water (20°C)	
Max. Flow [l/h]	Part number
25 (ml/h)	RGC1200
63 (ml/h)	RGC1201
160 (ml/h)	RGC1202
400 (ml/h)	RGC1203
1	RGC1204
1,6	RGC1205
2,5	RGC1206
4	RGC1207
6,3	RGC1208
10	RGC1209
16	RGC1210
25	RGC1211
40	RGC1212
63	RGC1213

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	Part number
1,9	RGC1220
4,4	RGC1221
10	RGC1222
23	RGC1223
50	RGC1224
70	RGC1225
100	RGC1226
180	RGC1227
250	RGC1228
400	RGC1229
630	RGC1230
1000	RGC1231
1600	RGC1232
2400	RGC1233

## Dimensions [mm]

## RGC1 without valve



# RGC1 MODEL With built-in adjustment valve

## Metering tube: 150mm

### Description

This type of Rotameter is designed for measurement of low liquid and gas flows.

A needle valve is integrated on the inlet of the Rotameter for flow adjustment.

### Benefits

- Cost-effective solution
- Negligible pressure loss
- Better accuracy & readability due to longer metering tube

### Applications

- Visual fluid monitoring
- Laboratory process
- Gas analysis
- ...



### Technical data

<b>Process Connection</b>	Size: ¼" NPT female Material: Polypropylene
<b>Metering tube</b>	Length: 150 mm Material: Borosilicate (Duran 50)
<b>Float material</b>	for liquid & gas : Titanium
<b>Gasket material</b>	Buna (NBR)
<b>Valve material</b>	Silver seat; Buna gasket Stainless steel spindle
<b>Permitted operating conditions</b>	Max. 16 bar (@20°C) Max. 80°C
<b>Measuring span</b>	10:1
<b>Measuring accuracy</b>	2.5% ( $q_G=50\%$ )
Acc. Directive VDI/VDE 3513, sheet 2	



# RGC2 MODEL With built-in adjustment valve

## Metering tube: 150mm

### Description

This type of Rotameter is designed for measurement of low liquid and gas flows.

A needle valve is integrated on the inlet of the Rotameter for flow adjustment.

### Benefits

- Easy assembly & disassembly of the metering tube without disconnecting Rotameter
- Designed for aggressive applications
- Negligible pressure loss

### Applications

- Laboratory processes
- Chemical processes
- Gas analysis
- ...



### Technical data

<b>Process Connection</b>	Size: 1/4" Rp female Material: Stainless Steel
<b>Metering tube</b>	Length: 150 mm Material: Borosilicate (Duran 50)
<b>Float material</b>	for liquid & gas : Titanium
<b>Gasket material</b>	PTFE/Viton (FPM)
<b>Valve material</b>	Silver seat; Viton gasket Stainless steel spindle
<b>Permitted operating conditions</b>	Max. 16 bar (@20°C) Max. 80°C
<b>Measuring span</b>	10:1
<b>Measuring accuracy</b>	2.5% (qG=50%)
Acc. Directive VDI/VDE 3513, sheet 2	

## Flow Tables

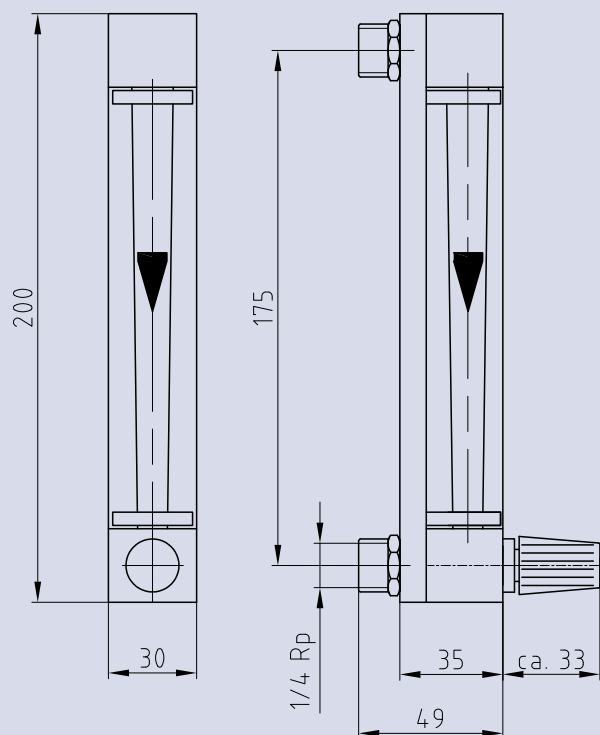
Water (20°C)	
Max. Flow [l/h]	Part number
25 (ml/h)	RGC2200
63 (ml/h)	RGC2201
160 (ml/h)	RGC2202
400 (ml/h)	RGC2203
1	RGC2204
1,6	RGC2205
2,5	RGC2206
4	RGC2207
6,3	RGC2208
10	RGC2209
16	RGC2210
25	RGC2211
40	RGC2212
63	RGC2213

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	Part number
1,9	RGC2220
4,4	RGC2221
10	RGC2222
23	RGC2223
50	RGC2224
70	RGC2225
100	RGC2226
180	RGC2227
250	RGC2228
400	RGC2229
630	RGC2230
1000	RGC2231
1600	RGC2232
2400	RGC2233

## Dimensions [mm]

## RGC2 without valve

Process connection: 1/4" Rp Female



# RGC2 MODEL With built-in adjustment valve

## Metering tube: 300mm

### Description

This type of Rotameter is designed for measurement of low liquid and gas flows.

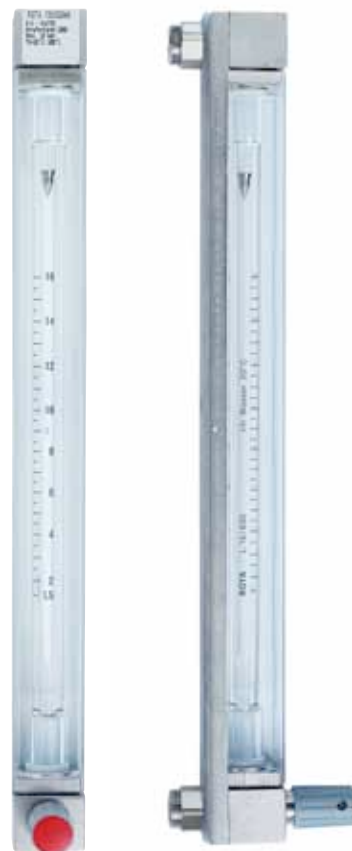
A needle valve is integrated on the inlet of the Rotameter for flow adjustment.

### Benefits

- Easy assembly & disassembly of the metering tube without disconnecting Rotameter
- Designed for aggressive applications
- Negligible pressure loss

### Applications

- Laboratory processes
- Chemical processes
- Gas analysis
- ...



### Technical data

<b>Process Connection</b>	Size: 1/4" Rp female Material: Stainless Steel
<b>Metering tube</b>	Length: 300 mm Material: Borosilicate (Duran 50)
<b>Float material</b>	for liquid & gas : Titanium
<b>Gasket material</b>	PTFE/Viton (FPM)
<b>Valve material</b>	Silver seat; Viton(FPM) gasket Stainless steel spindle
<b>Permitted operating conditions</b>	Max. 16 bar (@20°C) Max. 80°C
<b>Measuring span</b>	10:1
<b>Measuring accuracy</b>	1.6% ( $q_G=50\%$ )
Acc. Directive VDI/VDE 3513, sheet 2	

## Flow Tables

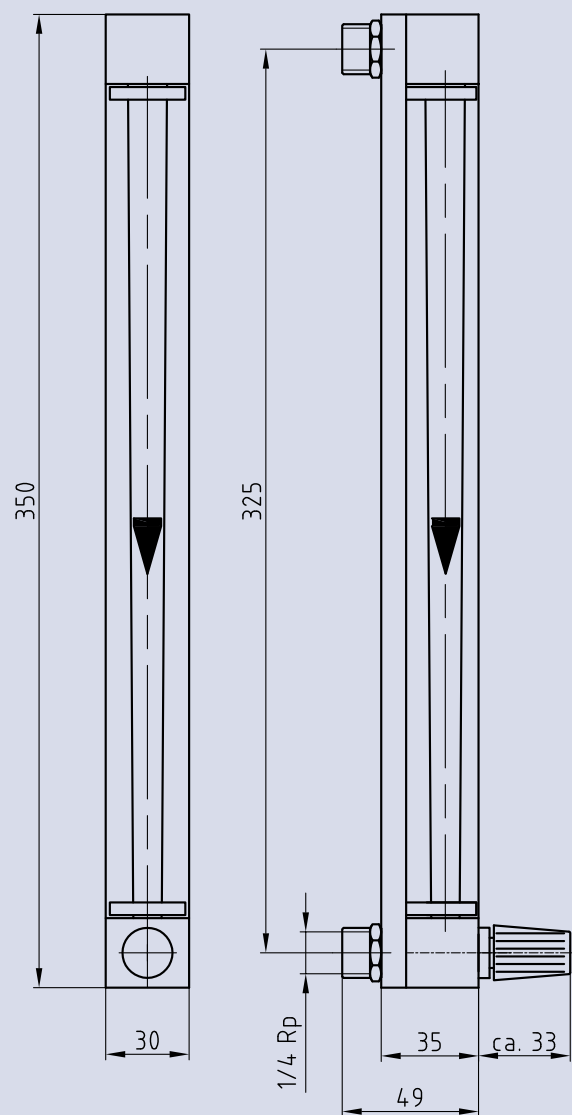
Water (20°C)	
Max. Flow [l/h]	Part number
25 (ml/h)	RGC2400
63 (ml/h)	RGC2401
160 (ml/h)	RGC2402
400 (ml/h)	RGC2403
1	RGC2404
1,6	RGC2405
2,5	RGC2406
4	RGC2407
6,3	RGC2408
10	RGC2409
16	RGC2410
25	RGC2411
40	RGC2412
63	RGC2413

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	Part number
1,9	RGC2420
4,4	RGC2421
10	RGC2422
23	RGC2423
50	RGC2424
70	RGC2425
100	RGC2426
180	RGC2427
250	RGC2428
400	RGC2429
630	RGC2430
1000	RGC2431
1600	RGC2432
2400	RGC2433

## Dimensions [mm]

## RGC2 without valve

Process connection: 1/4" Rp Female



# RQC1 MODEL Without adjustment valve

## Metering tube: 75mm

### Description

This type of Rotameter is especially designed for measurement of gas flows.

### Benefits

- Low cost solution
- Space-saving design
- Negligible pressure loss

### Applications

- Visual fluid monitoring
- Control panels
- Flow / No-flow indication
- ...



### Technical data

<b>Process Connection</b>	Size: 1/4" Rp female Material: Polyamide
<b>Metering tube</b>	Length: 75 mm Material: Polyamide
<b>Float material</b>	Niro Ball
<b>Gasket material</b>	Buna (NBR)
<b>Permitted operating conditions</b>	Max. 10 bar (@20°C) Max. 60°C
<b>Measuring span</b>	10:1
<b>Measuring accuracy</b>	4% ( $q_G=50\%$ )
Acc. Directive VDI/VDE 3513, sheet 2	

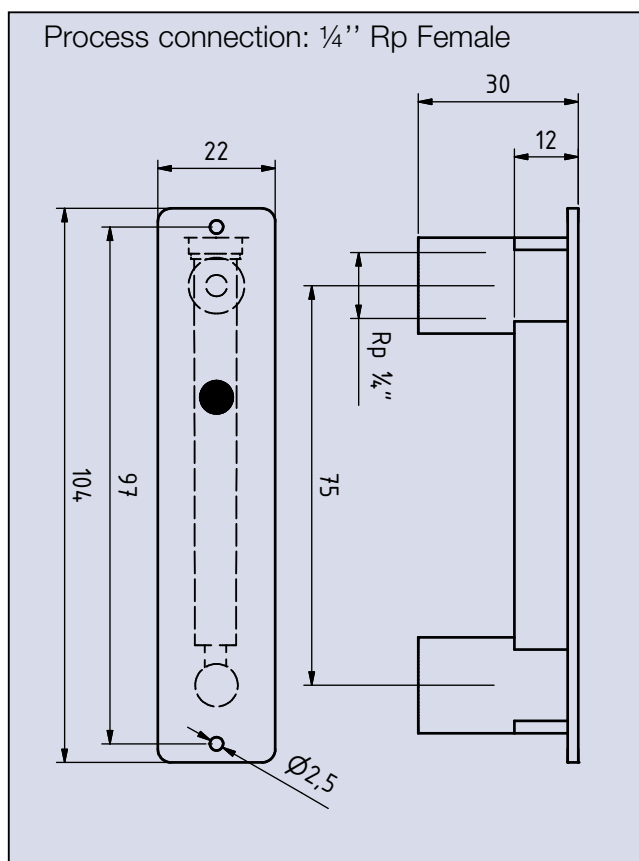


## Flow Table

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	Part number
180	RQC1000
250	RQC1001
400	RQC1002
630	RQC1003
1000	RQC1004
1600	RQC1005

## Dimensions [mm]

### RQC1 without valve



# RQC1 MODEL With built-in adjustment valve

## Metering tube: 75mm

### Description

This type of Rotameter is especially designed for measurement of gas flows.

A needle valve is integrated on the inlet of the Rotameter for flow adjustment.

### Benefits

- Low cost solution
- Space-saving design
- Negligible pressure loss

### Applications

- Visual fluid monitoring
- Control panels
- Flow / No-flow indication
- ...



### Technical data

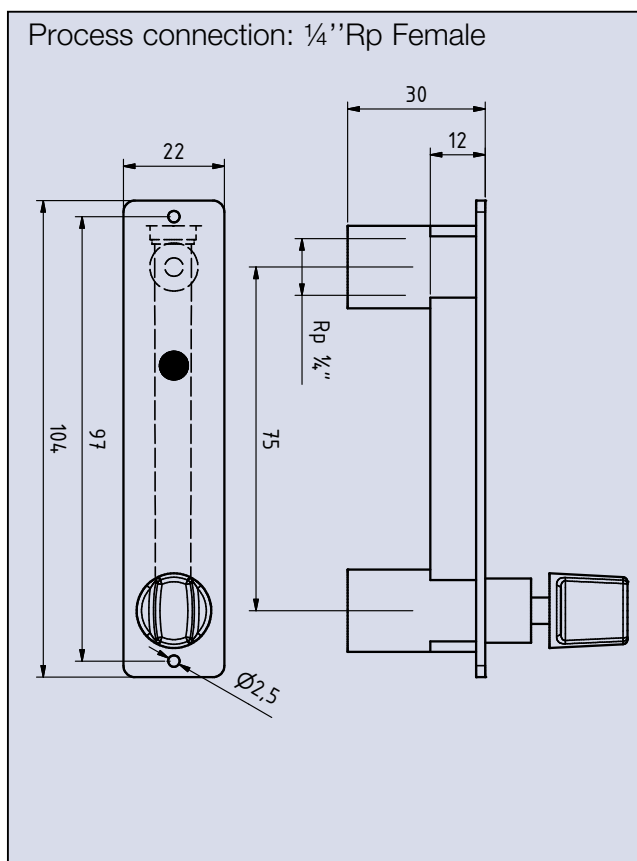
<b>Process Connection</b>	Size: ¼" Rp female Material: Polyamide
<b>Metering tube</b>	Length: 75 mm Material: Polyamide
<b>Float material</b>	Niro Ball
<b>Gasket material</b>	Buna (NBR)
<b>Valve material</b>	Polyamide seat; Buna gasket Stainless steel spindle
<b>Permitted operating conditions</b>	Max. 10 bar (@20°C) Max. 60°C
<b>Measuring span</b>	10:1
<b>Measuring accuracy</b>	4% ( $q_G=50\%$ )
Acc. Directive VDI/VDE 3513, sheet 2	

## Flow Table

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	Part number
180	RQC1200
250	RQC1201
400	RQC1202
630	RQC1203
1000	RQC1204
1600	RQC1205

## Dimensions [mm]

### RQC1 with valve





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