

General Specifications

EXAcal xt Conductivity Master Meter

EXAxt

Introduction

High purity water, free of impurities or contamination, is an essential solvent for many industries. In the pharmaceutical, biotech and medical devices sectors it is a regulated substance vital for the manufacture and use of products and devices. In the power industry it is used for large scale steam generation without damaging high value infra structure such as boiler tubes and turbines.

Pharmaceutical, Biotech and Medical Industry

For Pharmaceutical and Medical purposes the quality of water, as an excipient has been defined by the European Pharmacopoeia (EP) as well as the United States Pharmacopoeia (USP). In order to ship/sell your product in Europe or the United States of America, you must be able to prove that these requirements are met. For Purified Water and Water for Injection (WFI) the USP defines the following requirements to calibrate the Conductivity Transmitters and Sensors

- Meter reports uncompensated Conductivity or uncompensated Resistivity.
- The display resolution is 0.1 $\mu\text{S}/\text{cm}$ or better.
- The meter reads accurate 1 $\mu\text{S}/\text{cm}$ when a 0.1% precision resistor replaces the sensor (to calibrate/ verify the meter).
- The sensor cell constant is calibrated/verified to $\pm 2\%$
- Temperature accurate to 2°C (effective USP 28)

Power Industry

More than 50% of the unplanned shutdowns in Power plants can be attributed to contaminants present in the Steam and water. Monitoring the quality of water is essential. Conductivity is one of the parameters that is used in for example the circulating water systems, steam, cooling and heat recovery systems etc.

Features

- The EXAcalxt is Accurate to 0.37% of Reading for cell constant determination
- Accredited by Danak with Traceability to DFM Standard Reference Materials SRM
- simultaneously displayed Compensated and Uncompensated Raw Values and Temperature readings
- Lightweight and portable for use in the Laboratory or in the Field
- Robust and high quality materials to ensure long term stability and accuracy
- Complies with USP28
- Will calibrate your instruments to comply with EP 169 and USP645

System Configuration



EXAcalxt



Sensors



Calibration Tank



Calibration



Accessoires



General Specifications Model SC450 Conductivity / Resistivity Analyzer

The EXAxt 450 series is designed to combine the superior functionality of the Yokogawa EXA series with the ease of use offered in Smart Phones and tablets.

Truly unique in the EXAxt 450 series is 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 tablet. 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 SC450G 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 HMI monitor and in maintenance optimization programs like PRM and AMS.

The SC450G 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 SC450G 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 SC450G offers ultra pure water compensation for demineralised water, for Steam, Condensate and Boiler water analysis (Cation Conductivity, Ammonia and Morpholine Conductivity). SC450G also offers Matrix compensation and output linearization for accurate analysis of strong acids and alkalis.

Especially for the Water for Injection Monitoring in the pharmaceutical industry the functionality of USP chapter 645 and EP 0169 has been implemented.

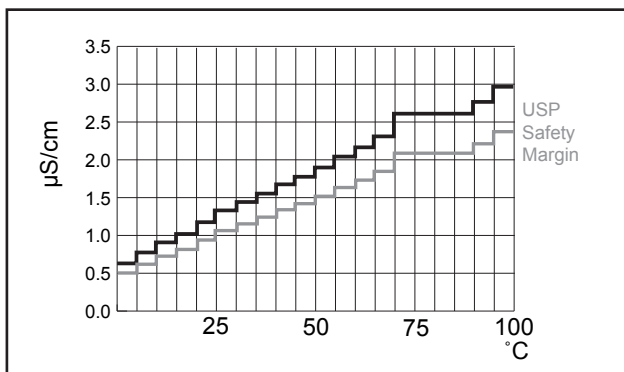


Figure 1 : USP 645 and EP0169 legal conductivity range

EXAxt



Features

- Unique HMI with menu structure and high resolution graphical display with touch screen
- Interactive display with choice out of 8 languages
- Trending display for up to 2 weeks
- On-screen logbooks store calibration data, configuration changes and events
- Advanced Process Temperature Compensation
- USP 645 and EP 0169 limits implemented
- Cell fouling monitoring

General Specifications 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⁻¹

B. Input ranges

Conductivity : 0.000 µS/cm - 2000 mS/cm
 Minimum : 1µS/cm (underrange 0.00 µS x C)
 Maximum : 200 mS/cm (overrange 2000 mS x C)
 Resistivity : 0.0 Ω x cm - 1000 MΩ x cm
 Minimum : 5 Ω/cm (underrange 0.0 Ω/C)
 Maximum : 1 MΩ/cm (overrange 1000 MΩ/C)
Note : "C" means cell constant.
 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 (µS NTC 6k) -20 to 120°C (0-250°F)

C. Accuracy

Conductivity/resistivity : ≤ 0.5 % of reading
 Temperature : ≤ 0.3°C (≤ 0.4°C for Pt100)
 mA outputs : ≤ 0.02 mA
 Ambient temperature influence : ± 0.05% /°C
 Step respons : ≤ 4 sec for 90% (for a 2 decade step)

Note on performance specifications

The following tolerance is added to above performance.
 mA output tolerance: ±0.02 mA of "4-20 mA"

D. Transmission signals

General : Two isolated outputs of 4-20 mA. DC with common negative. Maximum load 600 Ω. Bi-directional HART® (HART 5) digital communication, superimposed on mA1 (4-20 mA) signal.
 Output Function : Linear or non-linear 21-step table for Conductivity/Resistivity, concentration or temperature
 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/fixd 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. (*1)
 Maximum values 50 Watts, 250 VDC, 5 Amps. (*1)
 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 failsafe contact.

Note *1: When contact output current is more than 4 Amps, ambient temperature should be less than 40 °C.

F. Contact Input : Remote range switching to 10 times the programmed range.

Contact open : If impedance > 100 kΩ: 1 x Range
 (When programmed range for mA output is conductivity)

Contact closed : If impedance < 10 Ω: 10 x Range

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 matrixes.

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, Swedish, Portuguese and Japanese.

L. Form

Dimension : 144 (W) x 144 (H) x Approx.144 (D)
 Converter weight: Approx. 1.5 kg

M. Housing

: Cast Aluminim housing with chemically resistant coating; Polycarbonate cover with Polycarbonate flexible window
 : Protection IP66 / NEMA 4X / CSA Type 3S
 Colour : Silver grey
 SC450G-A(D)-A : IP66 cable glands are supplied with the unit
 SC450G-A(D)-U : NEMA 4X close up plugs are mounted in the unused cable entry holes and can be replaced by conduit fittings as required
 Pipe, Panel or Wall mounting using optional hardware

Optional conduit adapter

: G1/2, 1/2NPT or M20 female

N. Power supply

: SC450G-A :
 Ratings : 100-240 V AC
 Acceptable range : 90 to 264 V AC
 Ratings : 50/60 Hz
 Acceptable range : 50 Hz ±5%, 60 Hz ±5%
 Power Cons. : 15 VA

O. Safety, EMC and RoHS conforming standards

Safety : EN 61010-1
 : EN 61010-2-030
 : EN 61010-2-201
 : CAN/CSA C22.2 No.61010-1
 : CAN/CSA C22.2 No.61010-2-030
 : CAN/CSA IEC 61010-2-201
 : UL 61010-1
 : UL 61010-2-030
 : UL 61010-2-201
 EMC : EN 61326-1 Class A, Table 2
 : EN 61326-2-3

: EN 61000-3-2 Class A
 : EN 61000-3-3
 RCM : EN61326-1 Class A
 : Korea Electromagnetic Conformity Standard

Note: This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

RoHS :EN 50581
 FM nonincendive approval (suffix code Type: -U)
 : FM3611 Class I, Div.2, Group ABCD,
 T6 for Ta -20 to 55°C

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.

(P) Environment and operational conditions

Ambient temp. : -20 to +55°C
 Storage temp. : -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.

Plug-in flow sensors (EPOXY)

Epoxy cells for 2- and 4-electrode type with cell-constants 1 and 10 cm⁻¹.

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 : /M : Material certificate

*3.1 Material certificate according EN 10204 is standard delivered with stainless steel version

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

Functional Specifications

Model	Temp. element	Cell constant	Pressure rating	Max. temperature	90% Temp. response	Inlet d ϕ	Meas. system
SC42-EP08	Pt1000	10 cm ⁻¹	10 bar/142 PSIG	110°C/230 °F	< 3 min.	5 mm	4-el.ectrode
SC42-EP18	Pt1000	1 cm ⁻¹	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.

Features

- High precision of the cell constant (individuallycalibrated)
- 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)

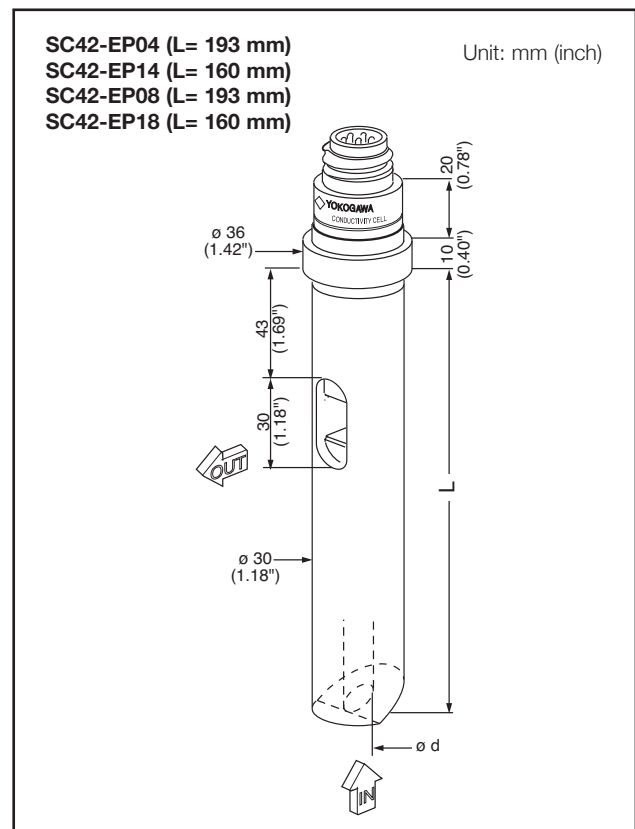


Fig. X Flow type

Typical Applications

1. Cell constant = 0.01 cm⁻¹

For measurement in very low conductive solutions like pure water, condensate, demineralised water, distilled water, etc.

2. Cell constant = 0.1 cm⁻¹

For measurement of low conductive solutions like boiler feed water, surface water, etc.

Plug-in flow sensors (SS)

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.

Features

- Wide range of sensors to suit most process conditions
- High precision of the cell constant
- Sensors for ultra-pure water applications
- Built-in resistance thermometers Pt1000 for automatic temperature compensation
- Material certificate 3.1 according to EN 10024 for stainless steel sensors are always included
- Optional quality inspection certificate
- ATEX and IECEx certified

Typical Applications

1. Cell constant = 0.01 cm⁻¹

For measurement in very low conductive solutions like pure water, condensate, demineralised water, distilled water, etc.

2. Cell constant = 0.1 cm⁻¹

For measurement of low conductive solutions like boiler feed water, surface water, etc.

General Specifications

Materials

Wetted parts

- | | |
|------------------------|--|
| a. Body | : Stainless steel AISI 3016L |
| b. Insulation | : PEEK (Poly Ether Ether Ketone) |
| c. Electrode | : Stainless steel AISI 316L |
| d. Quad-rings, O-rings | : Viton |
| e. Connector | : Gold plated contacts in polyamide plug |

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 ⁻¹	10 bar/142 PSIG	150°C/302 °F	< 1 min.	2-electrode system
SC42-SP24	Platinum resistor (Pt1000 to DIN)	0.1 cm ⁻¹	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⁻¹ 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
 /M : Material certificate *3.1 Material certificate according EN 10204 is standard delivered with stainless steel version

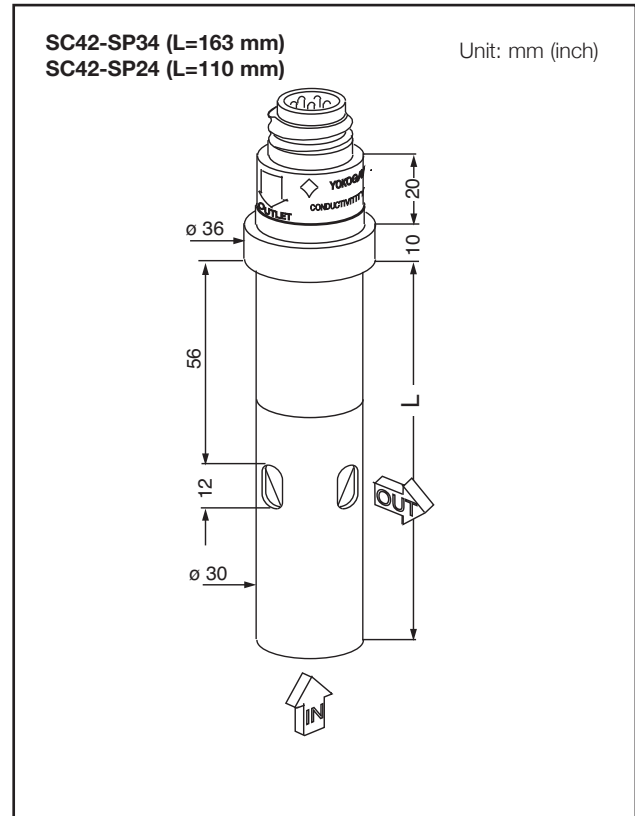


Fig. X Flow type

Flowfittings & WU40 cable

To install SC42 conductivity sensors in a permanent or semi-permanent location Yokogawa can supply a wide range of flow fittings. A high degree of standardisation simplifies mounting, servicing and removal or replacement of the sensors.

General Specifications

- Wetted parts FF40-S22: Stainless steel AISI 316 (SS)
- Wetted parts FF40-P22: Polypropylene (PP)
- Volume measuring vessel SS and PP : Approx. 150 ml

Mounting connections

- Stainless Steel fittings : 2x M8 (female)
- Plastic fittings : screw M6

Process connections

- SS fitting : 1/2" - NPT (female)
- PP fitting : 1/2" - NPT (female)

Weight

- SS fitting : 550 gram
- PP fitting : 530 gram

Functional Specifications

- Temperature SS fitting : -10°C up to 150°C
- Pressure SS fitting : 0 – 10 bar
- Flow rate : 0,1 - 10 l/min (depending on application)
- PP fitting please see figure

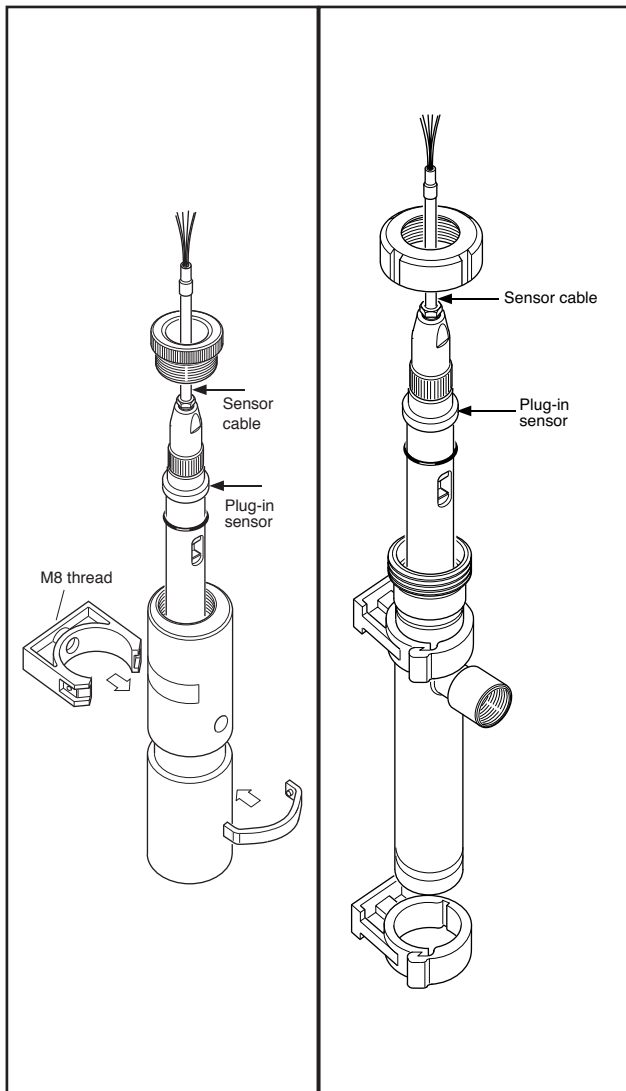


Fig. X Flow fitting PVC/PP

Fig. X Flow fitting SS

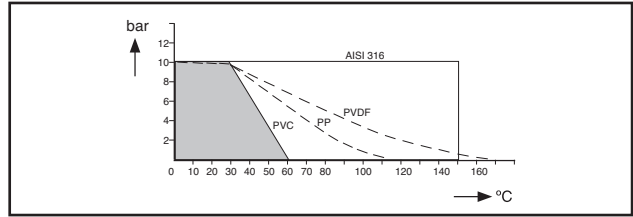


Fig. X Pressure/temperature class

Model and Suffix Codes FF40

Model	Suffix	Option	Description
FF40			Flow fitting
Material	-P22		Polypropylene (PP)
	-S22		Stainless steel (Aisi316L)
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)

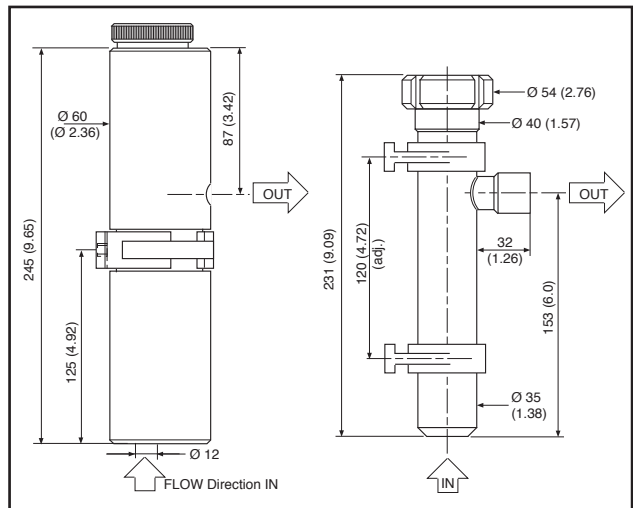


Fig. X Dimensions of FF40 P22 & S22

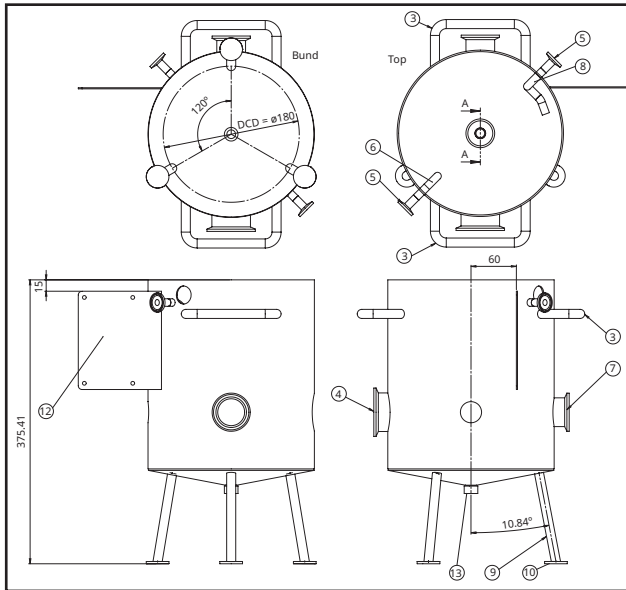
Technical Specifications WU40

- Cable length : 1, 2, 5 1/2, 10, 15, 20 or 25 m
- Temperature range : -10 °C to +80 °C
- Wire resistances : approx. 18.10⁻³ Ω/m
- Capacity core/core/screen : max. 130 pF/m
- Isolation resistance between cores and screen : approx. 10⁹ Ω/m (20 °C)
- Connector contact resistance : < 8 mΩ

Model and Suffix Codes WU40

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

Specifications EXAcalxt calibration tank



Item number	Part number	Description N	Quantity
1	st d .131 .10 1	Svøb	1
2	st d .131 .102	Bund	1
3	st d .131 .103	Handtag	2
4	std .131 .104	2" Clamp Ferrule	1
5	5815010- 6	"Beskrivelse "	2
6	std .131 .105	"Beskrivelse "	1
7	std .131 .10 6	1½" Clamp Ferrule	1
8	std .131 .10 7	"Be skrivelse "	1
9	std .131 .108	Ben	3
10	std .131 .109	Fod	3
1 1	std .131 .1 10		1
12	std .131 .1 1 1	Beslag	1
13	std .131 .1 1 2	"Beskrivelse "	1

Fig. X Dimensions of EXAcalxt calibration tank

Model Code	Suffix Code	Option Code	Description
EXAcalxt R-SC4-5			portable conductivity meter in stainless case with handle
	-220		90-220V UK plug
	-110		110V USA version
Sensor			
	-1		SC42-SP34 range 0.0 to 400 uS /cm cc: 0.01cm LOW
	-2		SC42 -EP18 range 500uS to 100 mS/cm cc: 1cm MEDIUM
	-3		SC42-EP08 range 500usS to 300mS cc: 10 cm H IGH
Cable		c2	WU40-LH02 interconnecting cable
		c5	WU40-LH05 Interconnecting Cable
Flow and Protective Fitting			
		FF40S22NPT	1/2 NPT steel flow fitting
		FF40S22TC	1 1/2 inch Triclamp Flow Fitting e lectropolished
		FF40P	Polypro Protective holder only
Transport Case		I-CASE	Pelican Transit Case with wheels
Calibration Option			
		K5.6 ACR	Full Accredited Calibration of sensor by SRM <0.5% ACCURACY
		K5.7 COMPARISON	Comparison Calibration by reference to other meter <1% ACCURACY
		K5.5 TEMP	5 point temperature calibration
		KF5.9 CALONEL	enhanced ACCURACY by transmitter calibration

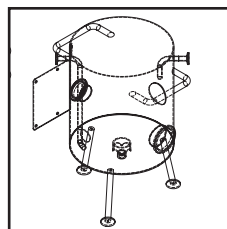
Accessories	Suffix Code	Option Code	Description
EXAcalxt-T9-4			9 LITRE EXAcalxt calibration tank Stainless - with 3 process connections
			Volume: 9 litres
			Electro polished
	-220		Power Supply 220 VAC UK plug
	-110		Power Supply 110 V AC U SA USA plug
			Pump Centrifugal pump REC-TL-B11,5
process connection - standard is 1 1/2 in ch 2 inch and 21/2 triclamp			
		TC2	Process connection TRI-Clamp 2"
		TC1.5	Process connection TRI-Clamp 1½"
		Ing	Process connection Welding socket PF18 DN25 – OPL 40mm
		pg13.5	Process connection Hamilton Hygienic Socket Sanitært – part no. 242545



Cables



Tubing



Calibration Tank



Carry case



Magnetic Stirers

GS12D06D10-E-E

Calibration specifications - all carried out at accredited laboratory

Measurement	Measuring Range	Uncertainty	Standard Reference Material Value (SRM)	Method
Temperature	0.01degC to 90 °C	+/- 0.041 °C		KF 5.5
Conductivity - cell constant determination	100 uS/cm	0.34%	DFM 100	KF 5.6
Conductivity - cell constant determination	1 mS/cm 1000 uS/cm	0.27%	DFM 1000	KF 5.6
Conductivity - cell constant determination	10mS/cm	0.26%	DFM 10000	KF 5.6
Conductivity - cell constant determination	100 mS/cm	0.34%	DFM 100000	KF 5.6
Conductivity - by Comparison	1.300 uS to 99.9 uS/cm	0.96%	against reference sensors	KF 5.7
Conductivity - by Comparison	100.0uS to 239 mS/cm	0.53%	against reference sensors	KF 5.7

How to perform a Conductivity Calibration

Every installation and application is different. That means that also for each installation a different type of calibration method is applicable. There are three highly accurate calibration methods :

- In-situ
- Replicating the installation
- Direct comparison

1. In Situ – Least impact on maintenance

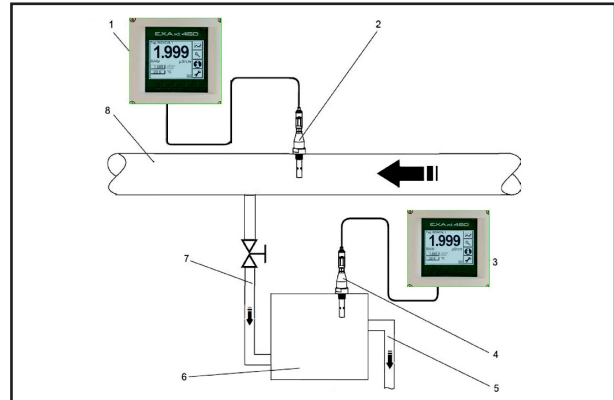
- No need to take the sensor out of the process
- One point calibration: cell constant is just a single point
- Meets calibration requirements
- Cell constant 2% with 4:1 TAR (Test Accuracy Ratio)
- Check transmitter with decade box or precision resistors

2. Replicating the installation – Best option for open type and Inductive conductivity sensors

- Use a Recirculation Tank
- Best option for Open type conductivity Sensors and Inductive conductivity type sensors. The cell constant or installation factor of these sensors are influenced by how and where they are installed.
- It simulates the installation of open sensor as it is in the process.
- Easy Multi point calibration possible by changing the conductivity values in the tank

3. Direct Comparison – Best way to calibrate

- Installed in an agitated beaker
- preferably 1.5 litres or greater (to stop ambient temperature effect)
- The sensors are stable and seeing the exact same sample
- You can increase and decrease values of conductivity in the container
- You can test the sensor across its full operating range
- Do not over agitate – to not ripple surface as CO2 can change sample value



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