

Conductivity measurement *SmarTec S CLD 132*

Transmitter for measurement of conductivity and concentration with inductive sensor



The SmarTec S is a compact measuring system for inductive conductivity measurement, specially designed for measurements in highly conductive liquids. The various process connections of the CLD 132 allow an individual adaption of the transmitter to different mounting situations.

Areas of application

- Alkali/acid concentration control
- Phase separation of product/water and product/product mixes in pipe systems
- Monitoring and control of bottle cleaning systems
- Product monitoring in breweries, dairies and the beverage industry
- CIP system control

Benefits at a glance

- Transmitter housing made of stainless steel, NEMA 6 (IP 67)
- Sensor made of highly resistant synthetic material (PEEK)
- Sterilizable sensor to 284°F (140°C)
- Insensitive to polarization and soiling
- Various mounting possibilities
- Sensor versions for all industrial process connections
- Compact transmitter
- Simple installation
- Easy operation due to logical menu structure
- Large two-line display allows simultaneous display of measured values and temperature
- Direct calibration access via CAL key
- Overvoltage protected according to EN 61000-4-5 provides safe operation
- Alarm contact for error signaling
- Communication interface via HART® or PROFIBUS
- Standard version extendable by:
 - Measuring range remote switching (MRS)
 - Temperature coefficient determination
 - Alarm contact switchable as limit contactor

Endress + Hauser

The Power of Know How



Measuring system

A complete measuring system includes:

- CLD 132 transmitter
- CLS 51 conductivity sensor with integrated temperature and fixed cable
- The compact instrument CLD 132 with integrated CLS 52 conductivity sensor

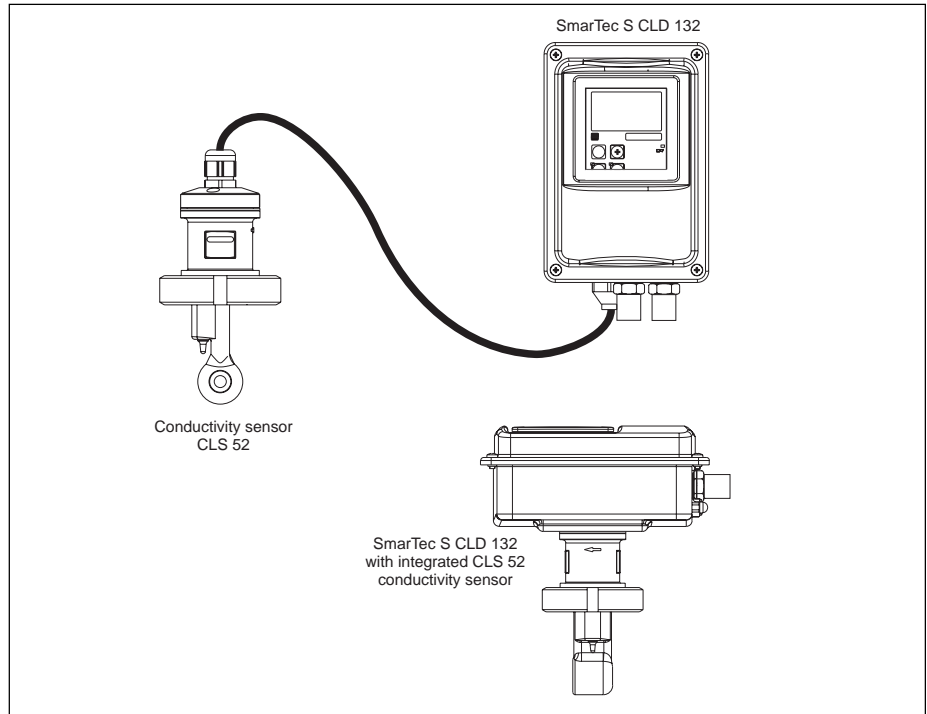
Optional for the separate version:

- CLK 5 extension measuring cable
- VBM junction box
- Mounting kit for pipe mounting

Complete measuring systems with CLD 132 SmarTec S

Top:
Separate version and CLS 52 conductivity sensor

Bottom:
Compact version with integrated CLS 52 conductivity sensor



Basic version and additional functions

Functions of the basic version	Options
<p>MEASUREMENT</p> <p>CALIBRATION of installation factor CALIBRATION of cell constant CALIBRATION of residual coupling</p> <p>Read instrument DATA</p> <p>Linear CURRENT OUTPUT CURRENT OUTPUT simulation</p> <p>CHECK of measuring system by PCS alarm (live check)</p> <p>TEMPERATURE COMPENSATION selectable (1 free table)</p> <p>CONCENTRATION table selectable (4 defined tables, 1 free table)</p> <p>RELAY as alarm contact</p> <p>SERVICE functions</p>	<p>2nd current output for temperature</p> <p>Measuring Range Remote Switching</p> <p>REMOTE SWITCHING of a maximum of 4 measuring ranges</p> <p>TEMPERATURE COMPENSATION selectable (4 free tables)</p> <p>RELAY configurable as alarm or limit contactor</p> <p>TEMPERATURE COEFFICIENTS can be determined</p>

Measurement principle

In inductive conductivity measurement, a transmitting coil generates a magnetic alternating field that induces an electric voltage in a liquid. The ions present in the liquid enable a current flow which increases with increasing ion concentrations.

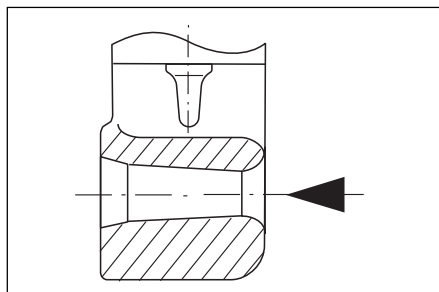
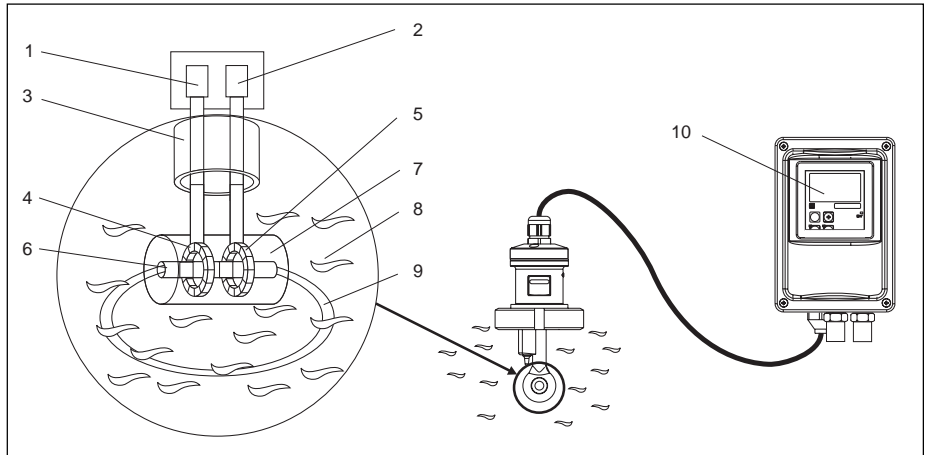
The current in the liquid generates a magnetic alternating field in the receiving coil. The resulting current in the receiving coil is measured and used to determine the conductivity value. The conductivity serves as a measure of ion concentration.

This measurement principle has the following advantages:

- No electrodes, therefore no polarization
- Error-free measurement in media with a tendency to sedimentate
- Complete galvanic isolation of measurement from medium

Measurement and function principle of the SmarTec S

- 1 Oscillator
- 2 Receiver and signal processing
- 3 Cable
- 4 Primary winding
- 5 Secondary winding
- 6 Bore
- 7 Sensor housing
- 8 Process medium
- 9 Induced electric current
- 10 Measuring transmitter



Detail view of the conical measuring channel



CLS 52 sensor with Pt 100 temperature sensor with flow lines

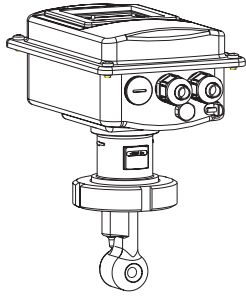
Measuring technology according to the purity law

The sensor, injection-moulded from highly chemically, mechanically and thermally resistant PEEK (polyether ether ketone), does not have any joints or crevices and is biologically safe.

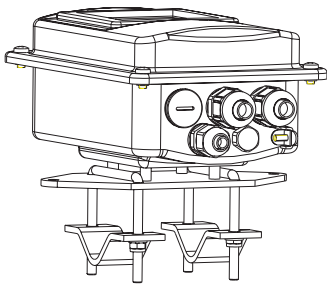
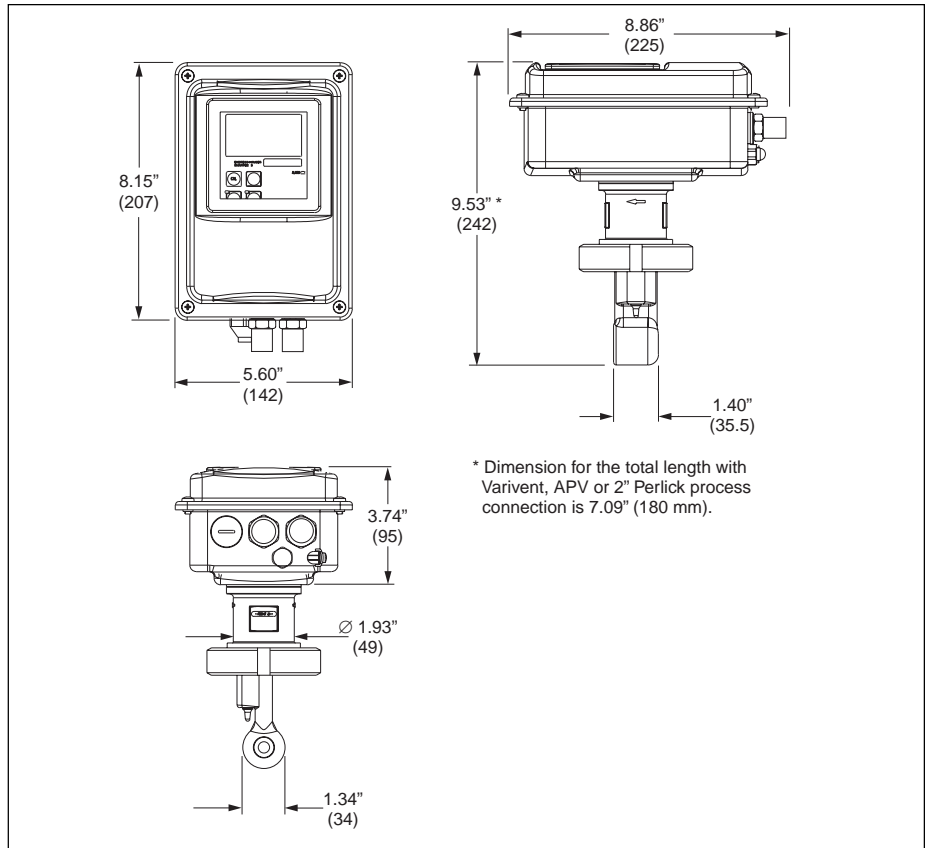
The sensor shaft holds the two induction coils and a Pt 100 temperature sensor. The temperature sensor is in direct thermal contact with the process via the special steel thermal conductivity socket. This assures extremely fast temperature response ($t_{90} < 5$ seconds).

The use of special components and materials makes the measuring cell suitable for continuous exposure to temperatures of 257°F (125°C) and brief exposure (maximum 30 minutes) to 284°F (140°C), for sterilization.

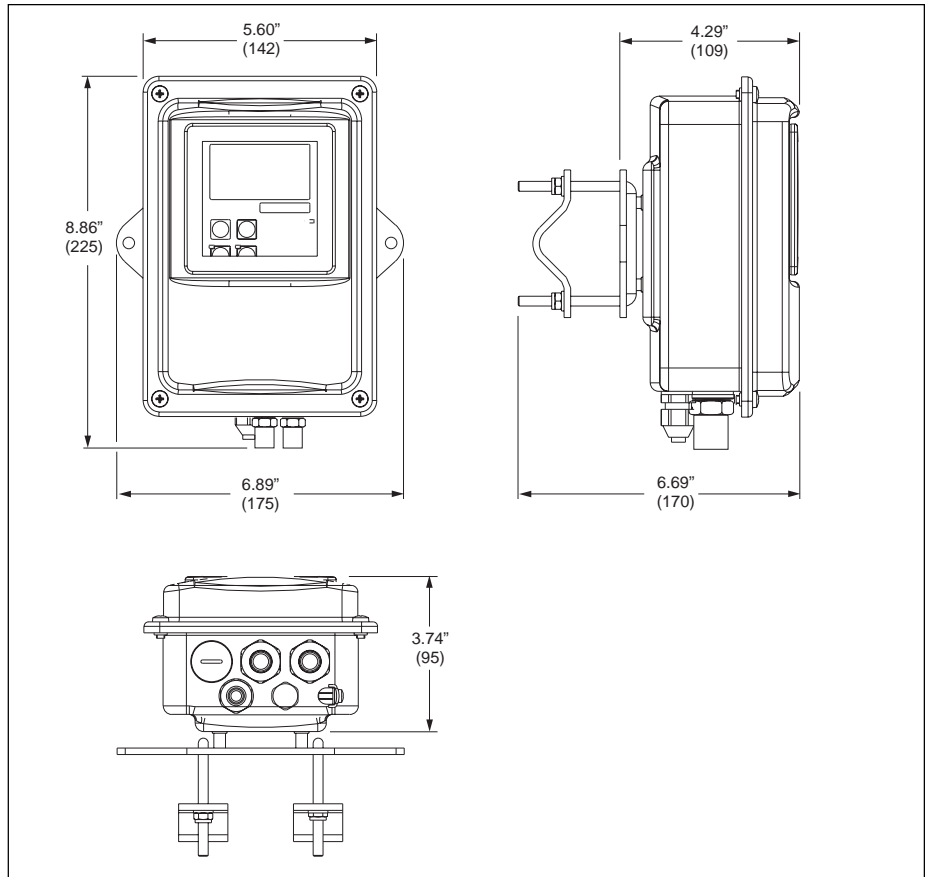
Dimensions



SmarTec S CLD 132
compact version
dimensions

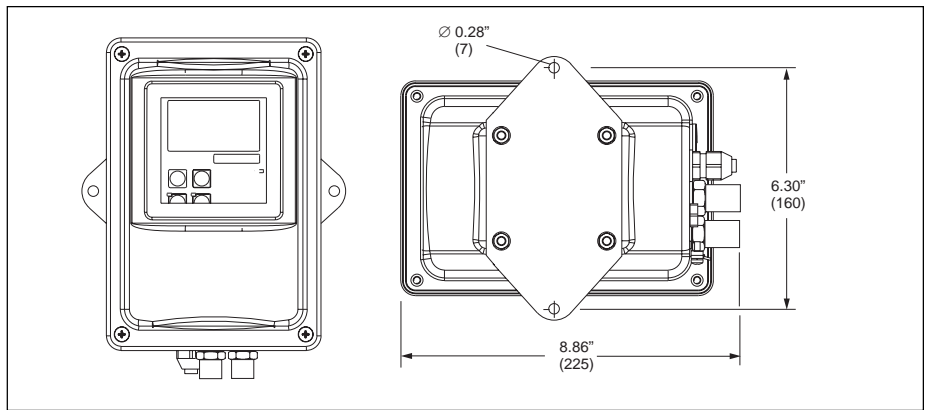


SmarTec S CLD 132
separate transmitter
with post mounting
accessories

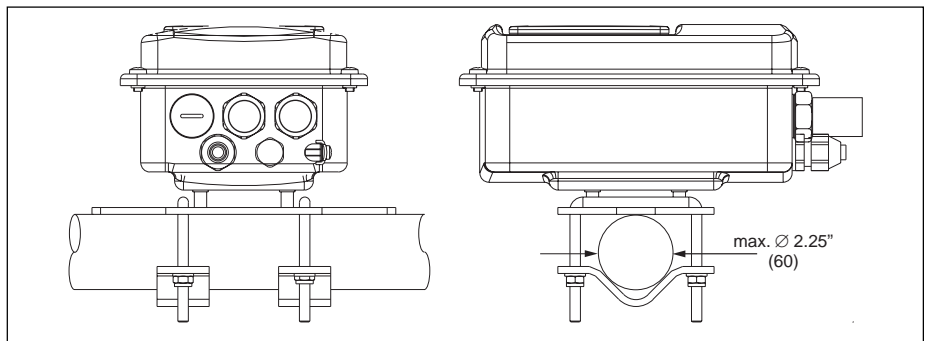


Mounting

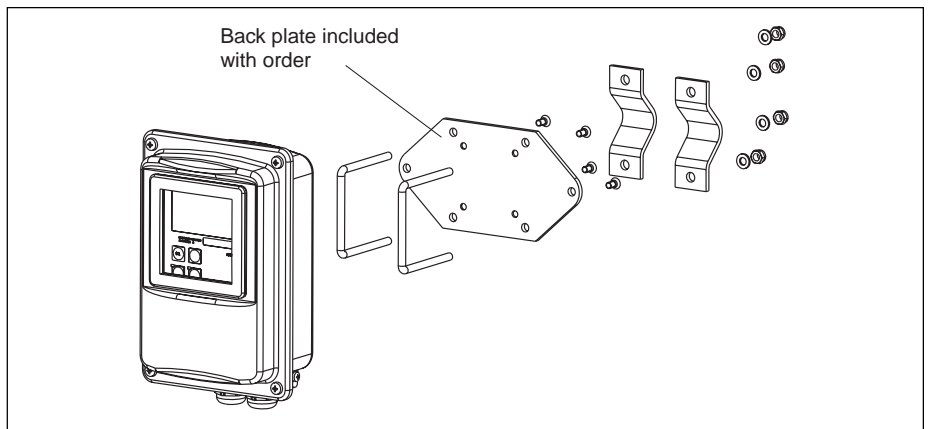
CLD 132 wall mounting
of separate transmitter



CLD 132 post mounting
of separate transmitter

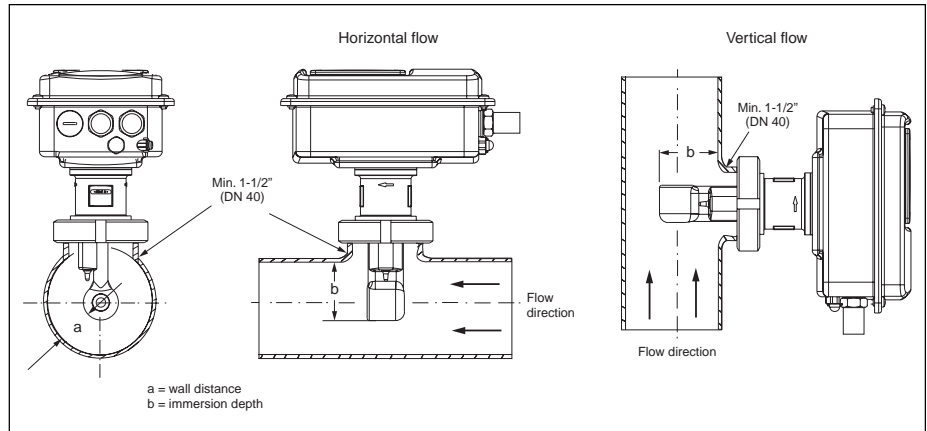


Post mounting kit
(accessories)



Installation

CLS 132 compact version mounted in flow pipe



The diameter of the welded neck is dependent on the process connection used. The sensor has to be installed a minimum immersion depth "b" to avoid turbulences near the welded neck which would influence the measurement (see chart below).

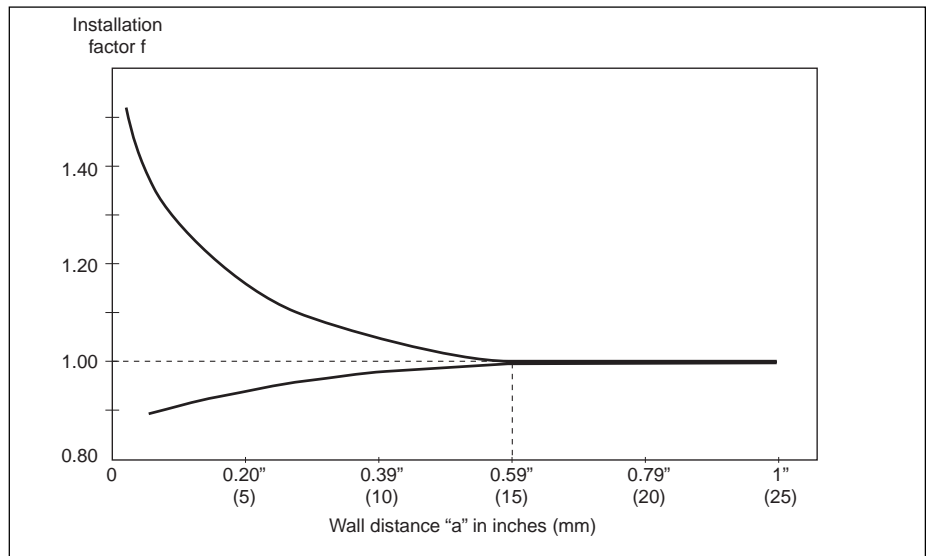
The diameter and the conductivity of the welded neck as well as the distance from the pipe wall influence the size of the installation factor (f). The installation factor is programmed into the transmitter.

Sensor	Diameter of pipe socket	Installation factor
Varivent, 2" Perlick, APV	≥ 1-1/2" (DN 40)	f > 1
Dairy fitting, 2" SMS, G 1-1/2 thread, 2" clamp	≥ 2" (DN 50) ≥ 2-1/2" (DN 65)	f > 1 f = 1

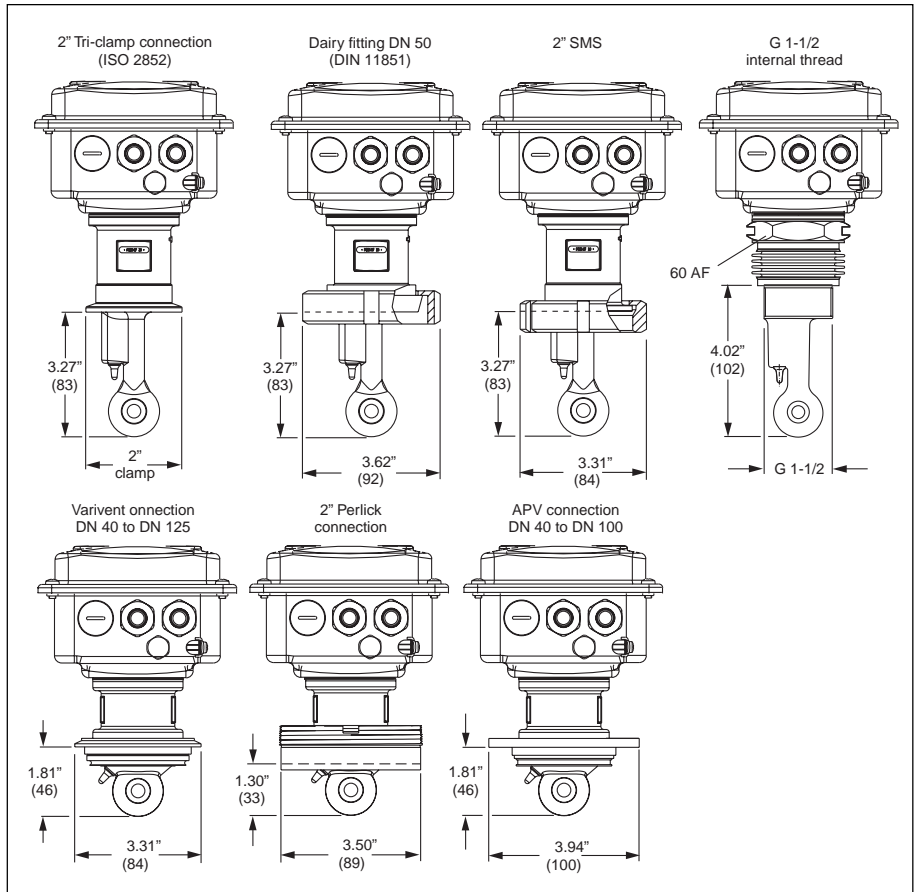
The electrical conductivity of the liquid primarily depends on the ion concentration. However, insatallation and sensor geometry are factors that need to be taken into account. In terms of measurement technique, the cell constant describes the geometry of the sensor.

If the distance from the wall is sufficient, $a > 1.3"$ (33 mm), it is not necessary to consider the installation factor ($f = 1.00$). If the distance from the wall is smaller, the installation factor increases in the case of electrically insulating pipes ($f > 1$) and decreases in the case of electrically conductive pipes (< 1).

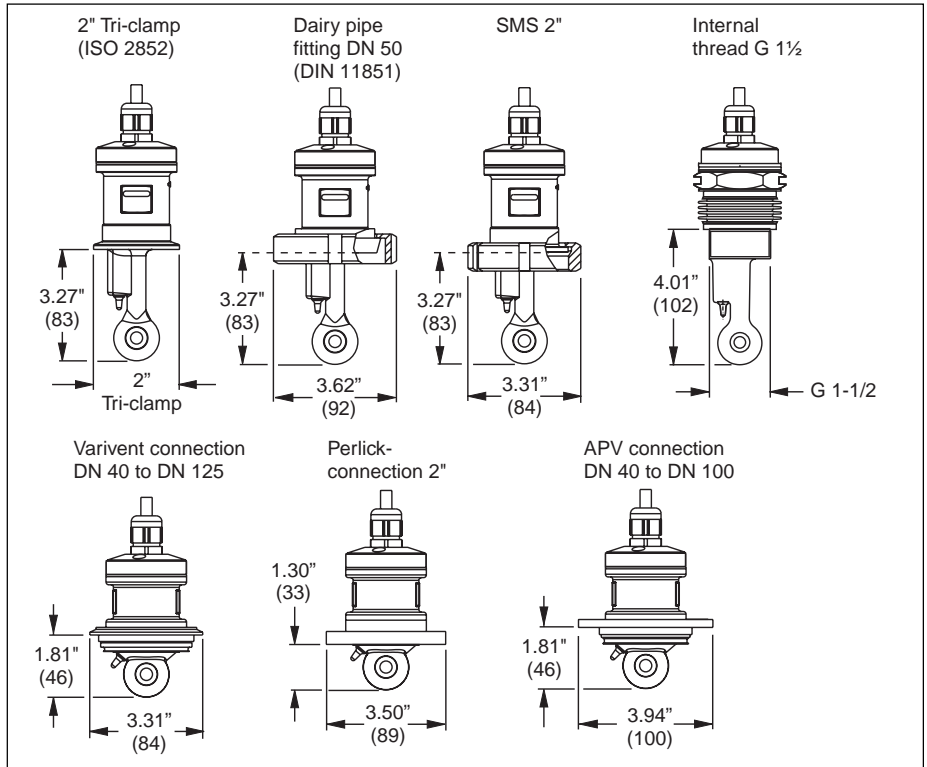
Installation factor "f" on distance from pipe wall "a"
 1 Conductive pipe
 2 Insulating pipe



Process connections

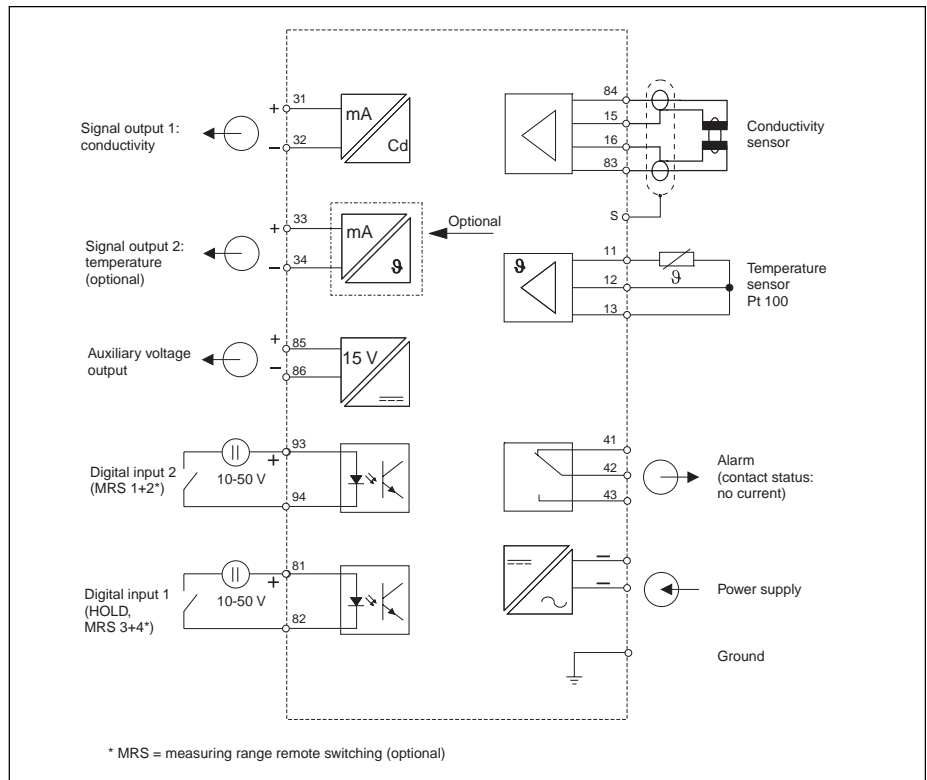


CLD 132 compact process connections



CLS 52 conductivity process connections

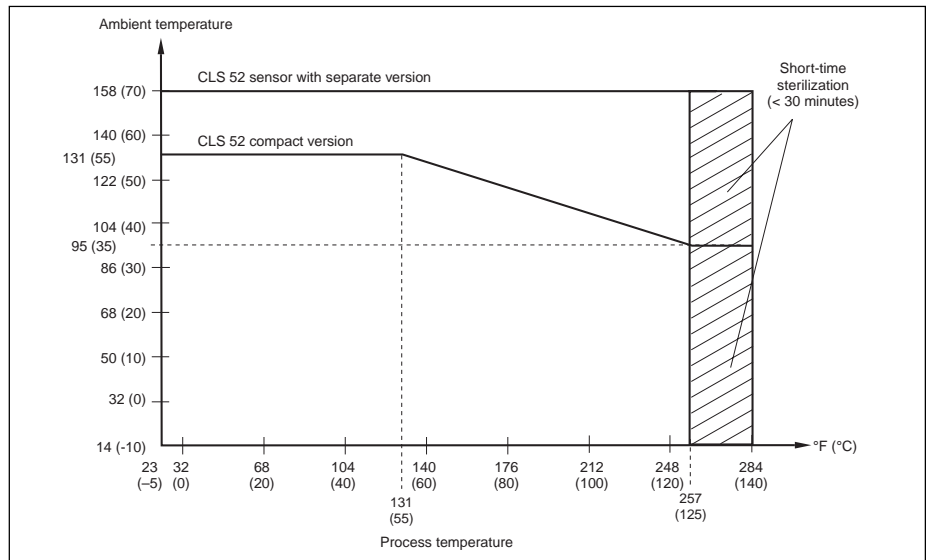
Wiring connections



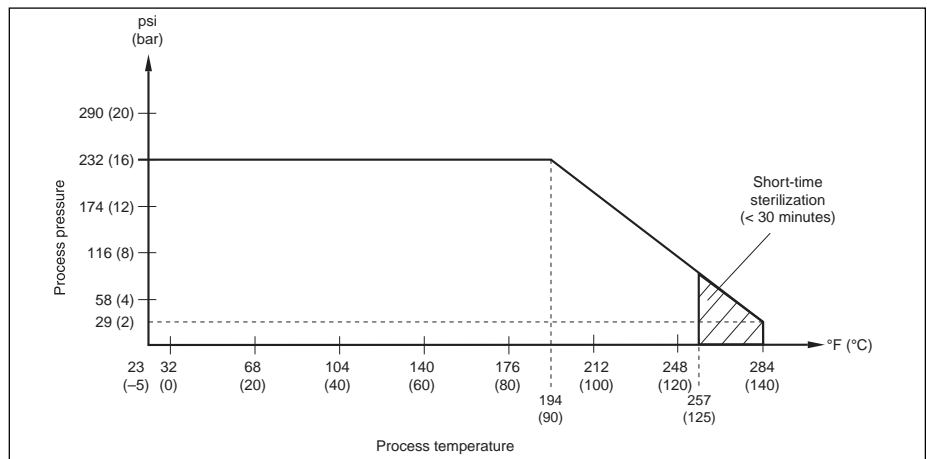
CLD 132 wiring

Pressure and temperature ranges

Permissible temperature ranges compared to ambient temperatures for CLD 132



Permissible pressure and temperature ranges for CLS 52 sensor



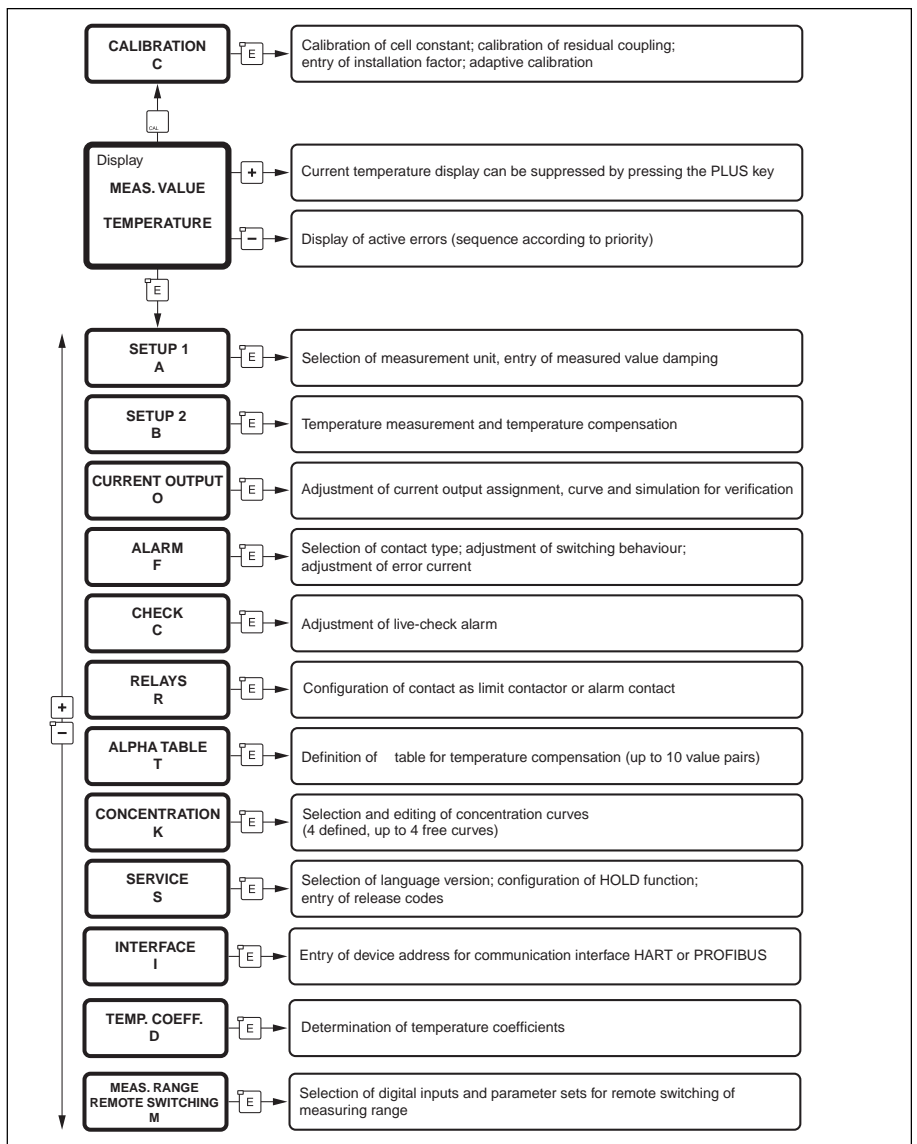
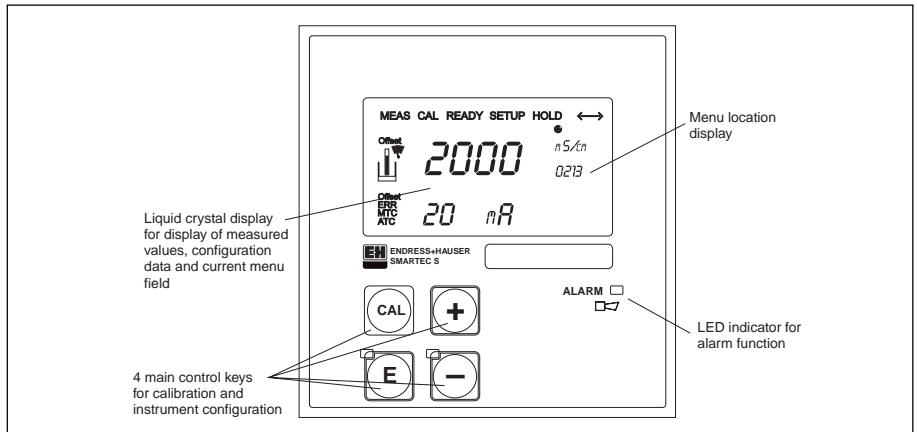
Operation

Everything at a glance

The display simultaneously shows the current measured value and the temperature - the essential process data. Brief informational text in the configuration menu provides assistance with parameter configuration.

Intelligent and simple

All instrument control functions are arranged in a logical menu structure. The individual parameters can only be modified by following the access code entry. The current position within the menu structure is displayed (as shown in the figure below - 0213).



Technical data

Physical data / design

Dimensions	Refer to page 7
Weight	Approximately 6 lbs (2.5 kg)
Weight with CLS 52 sensor	Approximately 6.6 lbs (3 kg)
Measured value display	LCD, two-line, five and nine digits for text, current status display

Materials

Housing	304 SS
Front window	Polycarbonate
CLS 52 sensor	PEEK

Input

Measured quantities	Conductivity, concentration, temperature
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Minimum distance of 0/4 to 20 mA signal

	Measured value	Minimum
For conductivity measurement	0 to 19.99 $\mu\text{S/cm}$:	2 $\mu\text{S/cm}$
	20 to 199.9 $\mu\text{S/cm}$:	20 $\mu\text{S/cm}$
	200 to 1999 $\mu\text{S/cm}$:	200 $\mu\text{S/cm}$
	2 to 19.99 mS/cm	2 mS/cm
	20 to 200 mS/cm	20 mS/cm
	200 to 2000 mS/cm	200 mS/cm
For concentration measurement	No minimum distances	

Conductivity measurement

Measuring range	10 $\mu\text{S/cm}$ to 2000 mS/cm
Cell constant	k = 5.9/cm
Maximum cable length	CLK 5 cable, 180 ft (55 m)
Measuring frequency	2 kHz

Temperature measurement

Temperature sensor	Pt 100, class A according to IEC 60751
Measuring range	14° to 302°F (-10° to 150°C)
Temperature offset range	$\pm 41^\circ\text{F}$ (5°C)

Temperature compensation

Compensation types	None ($\alpha = 0$), linear, table, NaCl
Range	14° to 302°F (-10° to 150°C)
Minimum distance	1 K
Reference temperature	77°F (25°C)

Digital inputs 1 and 2

Voltage	10 to 50 V
Current consumption	Maximum 10 mA at 50 V

Output

Conductivity signal output (not with PROFIBUS)

Current range	0/4 to 20 mA, galvanically isolated, error current 2.4 / 22 mA
Load	Maximum 500 Ω
Maximum resolution	700 digits/mA
Transmission range	Adjustable
Separation voltage	Maximum 350 V_{off} / 500 VDC
Overvoltage (lightning) protection	According to EN 61000-4-5: 1995

Temperature signal output (optional, not with PROFIBUS)

Current range	0/4 to 20 mA
Load	Maximum 500 Ω
Maximum resolution	700 digits/mA
Transmission range	Adjustable, $\Delta 10$ to $\Delta 100\%$ of measuring range
Separation voltage	Maximum 350 V_{off} / 500 VDC
Overvoltage protection	According to EN 61000-4-5: 1995

Auxiliary voltage output

Output voltage	15V $\pm 0.6\text{V}$
Output current	Maximum 10 mA

Contact outputs

Switching current	With ohmic load ($\cos \varphi = 1$), maximum 2A
Switching current	With inductive load ($\cos \varphi = 0.4$), maximum 2A
Switching voltage	Maximum 250 VAC, 30 VDC
Switching power	With ohmic load ($\cos \varphi = 1$), maximum 1250 VAC, 150 W DC
Switching power	With inductive load ($\cos \varphi = 0.4$), maximum 500 VAC, 90 W DC

Limit contactor

Pickup / dropout delay	0 to 2000 seconds
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Alarm

Function (switchable)	Steady contact / fleeting contact
Alarm delay	0 to 2000 seconds (min)

Accuracy**Conductivity measurement**

Deviation of indication	Maximum 0.5% of measured \pm 4 digits (according to IEC 60746-1, for normal operating conditions)
Reproducibility	Maximum 0.2% of measured \pm 2 digits
Measurement deviation	Conductivity signal output, 0.75% of current output range (according to IEC 60746-1, for normal operating conditions)

Temperature measurement

Resolution	0.1°C
Deviation of indication	Maximum 0.6% of measuring range (according to IEC 60746-1, for normal operating conditions)
Measurement deviation	Temperature signal output, 0.75% of current output range (according to IEC 60746-1, for normal operating conditions)

Power supply

Supply voltage	100 / 115 / 230 VAC, +10% / -15%, 48 to 62 Hz 24 VAC/DC, +20% / -15%
Power consumption	Maximum 7.5 VA
Fuse protection	Fine-wire fuse, medium blow, 250 VAC / 3.15 A

Operating data, compact version

Operating temperature	Maximum 131° at 131°F ambient (55°C at 55°C) Maximum 240°F (140°C) for 30 minutes at 95°F (35°C) ambient
Operating pressure	Maximum 232 psi (16 bar) at 194°F (90°C)

Ambient conditions

Storage and transport temperature	-13° to 158°F (-25° to 70°C)
Relative humidity	5 to 95%, non-condensing, nominal operating conditions
Housing ingress protection	NEMA 6 (IP 67)
Electromagnetic compatibility	Interference emission and interference immunity according to EN 61326-1: 1997

Vibrational resistance according to IEC 770

Mounting place	Pipe
Vibration frequency	10 to 60 Hz
Peak amplitude	0.008" (0.21 mm)

Impact test

Impact strength of display window	6.6 pound force-foot (9 J)
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CLS 52 sensor data

Conductivity measuring range	10 μ S/cm to 2000 mS/cm
Cell constant	k = 5.9/cm
Temperature sensor	Pt 100, class A according to IEC 60751
Temperature measuring range	Pt 100, 23° to 284°F (-5° to 140°C)
Temperature response time	$t_{90} < 5$ seconds
Measuring value deviation	$\pm 10 \mu$ S/cm + 0.5% of measured value at 23° to 212°F (-5° to 100°C) $\pm 30 \mu$ S/cm + 0.5% of measured value at $> 212^\circ\text{F}$ (100°C)
Maximum cable length	180 ft (55 m)
Wetted material	PEEK, 316L SS, Chemraz
Ambient temperature	14° to 158°F (-10° to 70°C)
Maximum operating temperature	240°F (140°C) for maximum 30 minutes
Maximum operating pressure	232 psi (16 bar) at 194°F (90°C)
Ingress protection	NEMA 6 (IP 67)

Supplemental documentation

- CLS 52 sensor Technical information TI 167C/24/ae
 CLD 132 operation and installation manual BA 207C/07/en

Accessories

Mounting kit

Post mounting kit for mounting field housing on horizontal or vertical pipe.

Maximum diameter, 2.36" (60 mm)

Material: 304 SS PN: 50062121

Cable extension

CLK 5 extension cable for conductivity sensors, maximum 180 ft (55 m)

PN: 50085473

VBM junction box

VBM junction box with 10 screw terminals for CLK 5 extension cable.

NEMA 4 (IP 65)

1/2" NPT entry PN: 50003987
Pg 13.5 entry PN: 51500177

Ordering information

SmarTec S CLD 132

CLD 132 - 1 2 3 4 5 6

- 1 Sensor type
 - P Compact version
 - S Separate version, 65 ft (20 m) cable
 - W Separate version, 16 ft (5 m)
 - X Separate version, 33 ft (10 m)
- 2 Process connection
 - MV1 Dairy fitting, DN 50, DIN 11851
 - CS1 2" Tri-clamp®, ISO 2852
 - GE1 G 1/12 connection
 - VA1 Varivent fitting, DN 40 to DN 125
 - AP1 APV connection, DN 40 to DN 100
 - SMS 2" SMS connection
 - PER 2" Perlick connection
- 3 Cable entry
 - 1 Pg 13.5 cable entry
 - 3 M20 x 1.5 cable entry
 - 5 1/2" NPT cable entry
- 4 Power supply
 - 0 230 VAC
 - 1 115 VAC
 - 5 100 VAC
 - 8 24 V AC/DC
- 5 Communication / current output
 - AA No communication, with current output
 - AB No communication, with current output and temperature
 - HA HART® communication, with current output
 - HB HART® communication, with current output and temperature
 - PE PROFIBUS-PA, no current output
 - PF PROFIBUS-PA, M12-plug-in, no current output
 - PP PROFIBUS-DP, no current output
- 6 Additional features
 - 1 Standard version
 - 2 Measurement range switching, extended functionality

For application and selection assistance,
in the U.S. call 888-ENDRESS

For total support of your installed base, 24 hours
a day, in the U.S. call 800-642-8737

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