Technical
Information
TI 237C/07/en
No. 51505427

Conductivity Measurement liquisys S CLM 223 F

Conductivity and Resistance Transmitter

Due to the modularity of its design, the Liquisys S CLM 223 F transmitter can be adapted to a wide range of customer needs. The basic version can be equipped with additional hardware modules to match specific applications. Retrofitting of expansion modules is also possible.

Areas of application

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

Features and benefits

- Measuring transmitter in panel-mounted housing
- Measuring Range Switching (MRS):
  - selection of separate sets of system configurations with digital inputs
  - adaption to four predefined media via remote switching
- Universal application
  - Conductivity and specific resistance via software switching
  - Transmitters for conductive or inductive measurement
  - Compensation in demineralized water acc. to IEC 746-3 (conductive only)
- Simple handling
  - Logically arranged menu structure with plain text in 6 languages facilitates instrument configuration
  - Large, two-line display indicates measured value and temperature at the same time
  - Calibration via CAL key
- Safe operation
  - Overvoltage protection according to EN 61000-4-5
  - Direct access for manual contact control
  - User-defined alarm configuration for alarm contact and error current
- Easy operation due to logical menu structure
- Large two-line display allows simultaneous display of measured value and temperature
- Direct calibration access via CAL key

The basic unit can be extended with:

- 2nd current output for temperature
- Contact outputs

Endress+Hauser
The Power of Know How

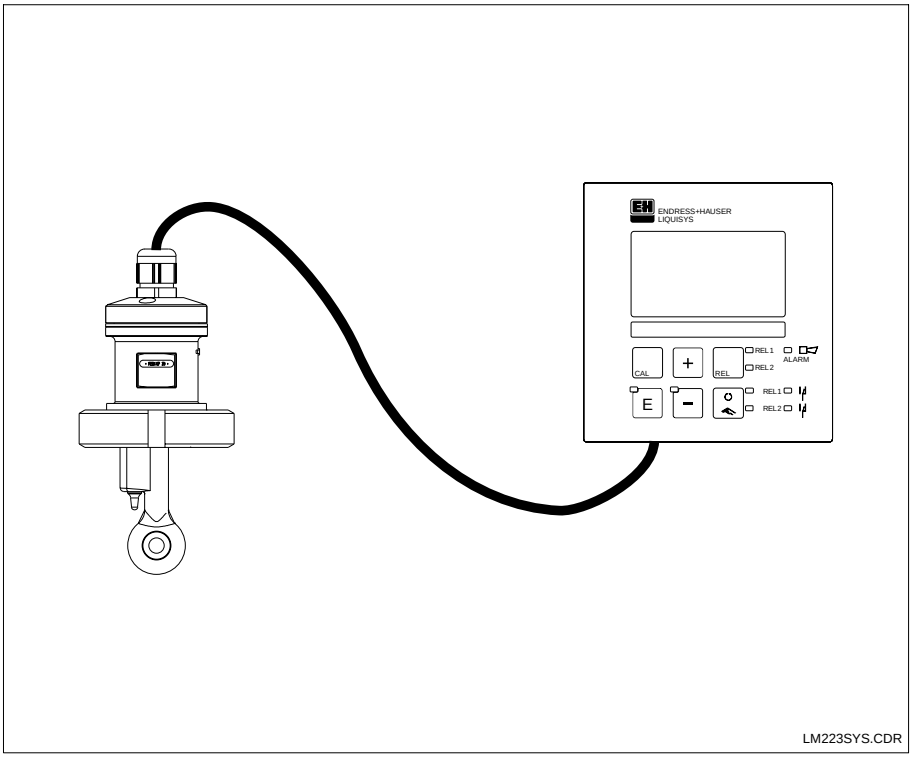
Measuring system

A complete measuring system comprises:

- the transmitter Liquisys S CLM 223 F
- conductivity sensor CLS 52 with integrated temperature sensor and fixed cable for high conductivities or
- CLS 21 for conductivities up to 20 mS/cm (fixed cable or water-proof plug-in head TOP 68)

Optional:

- extension cable CLK 5
- junction box VBM.



Complete measuring system with Liquisys S CLM 223 F and sensor CLS 52

Basic functions

Functions of the basic version	
MEASUREMENT CALIBRATION of installation factor CALIBRATION of cell constant CALIBRATION of residual coupling CALIBRATION of inner resistors Read instrument DATA Linear CURRENT OUTPUT CURRENT OUTPUT simulation CHECK of measuring system by PCS alarm (live check) TEMPERATURE COMPENSATION selectable (1 free table) CONCENTRATION table selectable (4 defined tables, 1 free table) RELAY as alarm contact SERVICE functions	**MEASURING RANGE REMOTE SWITCHING:** REMOTE SWITCHING of max. 4 measuring ranges TEMPERATURE COMPENSATION selectable (4 free tables) CONCENTRATION table selectable (4 defined tables, 4 free tables) Two RELAIS configurable as alarm or limit contactor TEMPERATURE COEFFICIENTS can be determined

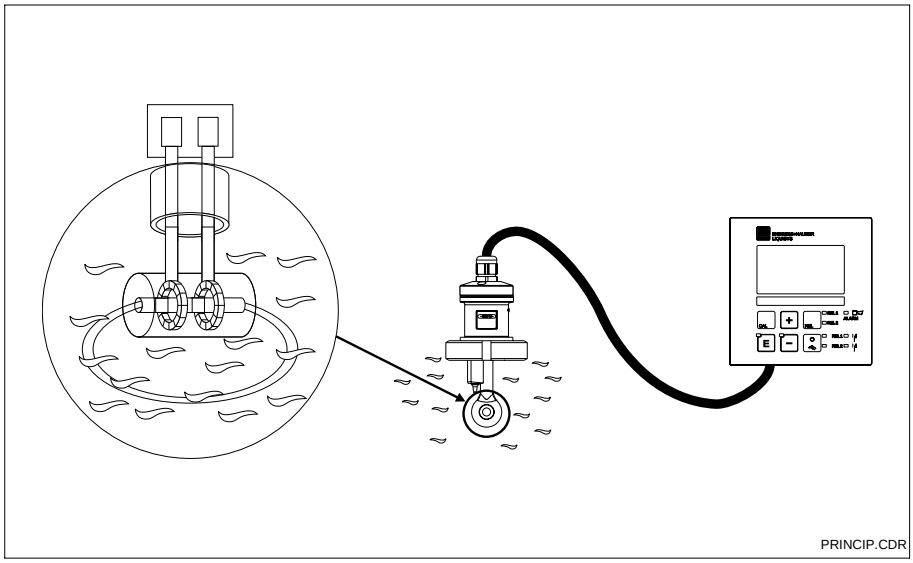
Measurement principle

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.

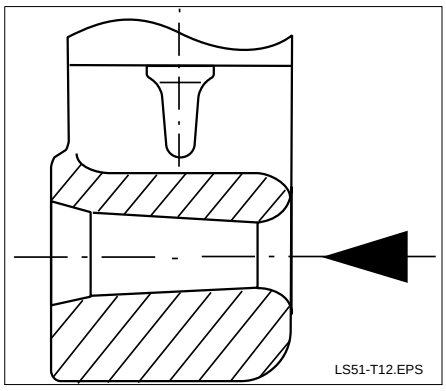
The current in the liquid generates a magnetic alternating field in the receiving coil. The resulting current in the receiving coil is measured and used to determine the conductivity value. The conductivity serves as a measure of ion concentration.

This measurement principle has the following advantages:

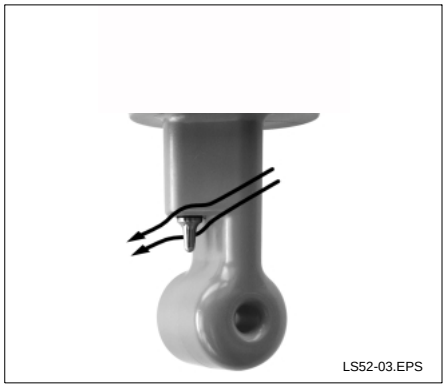
- Insensitive to polarisation due to no measuring surfaces being in contact with mediuem
- Error-free measurement in media with a tendency to sedimentate
- Complete galvanic isolation of measurement from medium.



Measurement and function principle of Liquisys S CLM 223 F



Detail view of the conical measuring channel



Sensor CLS 52 with temperature sensor Pt 100 with flow lines

Measuring technology according to the purity law

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

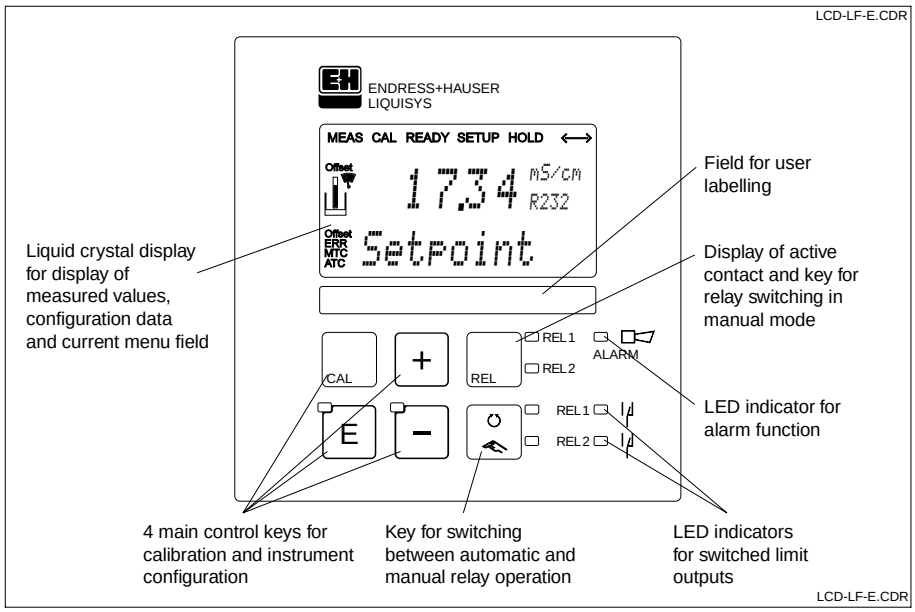
The temperature sensor Pt 100 is in direct thermal contact with the medium via the stainless steel thermal conductivity socket. This assures extremely fast temperature response (t_{90} < 5 s).

The use of special components and materials makes the sensor suitable for continuous exposure to temperatures of +125 °C and brief exposures (max. 30 min) to +140 °C for sterilization.

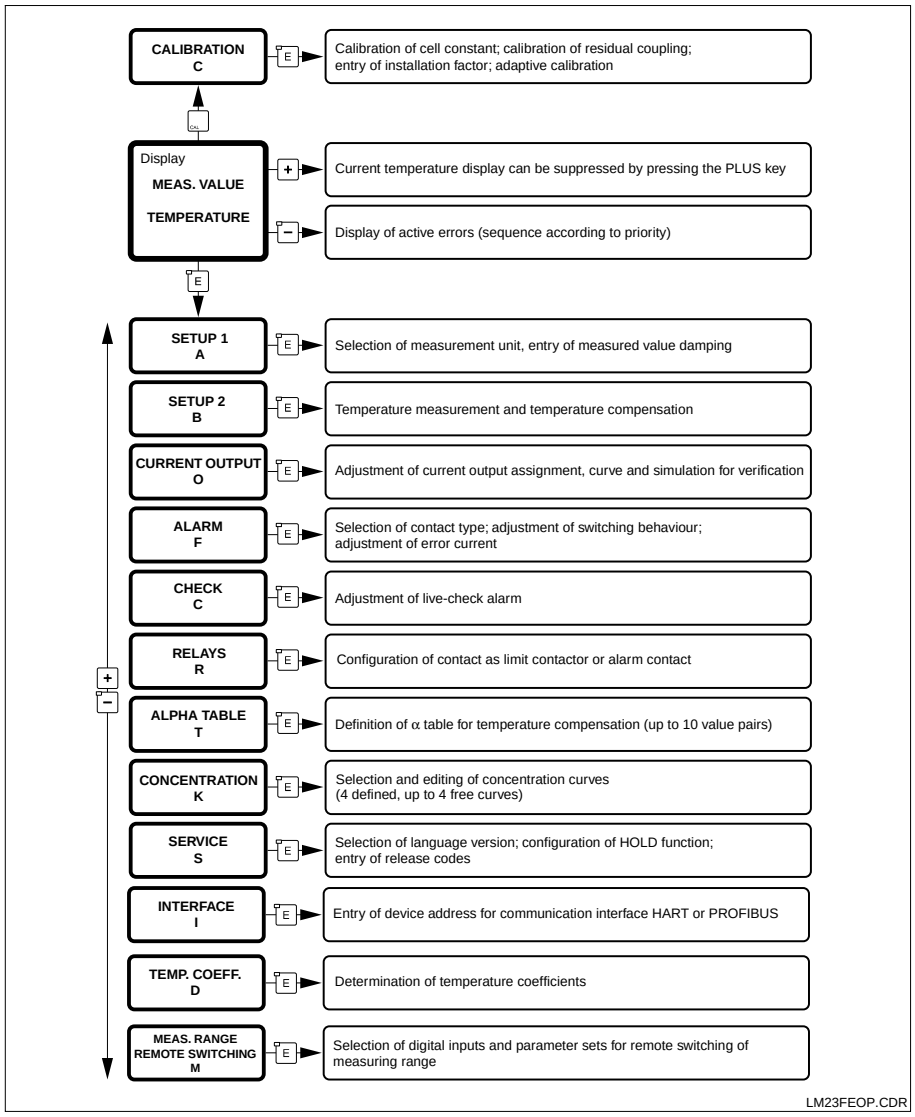
Operation

Everything at a glance
The display simultaneously shows the current measured value and the temperature – the essential process data. Brief informational texts in the configuration menu provide 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 entering the access code. The current position within the menu structure is displayed (as shown in figure below – R232).



User interface: Display and keys

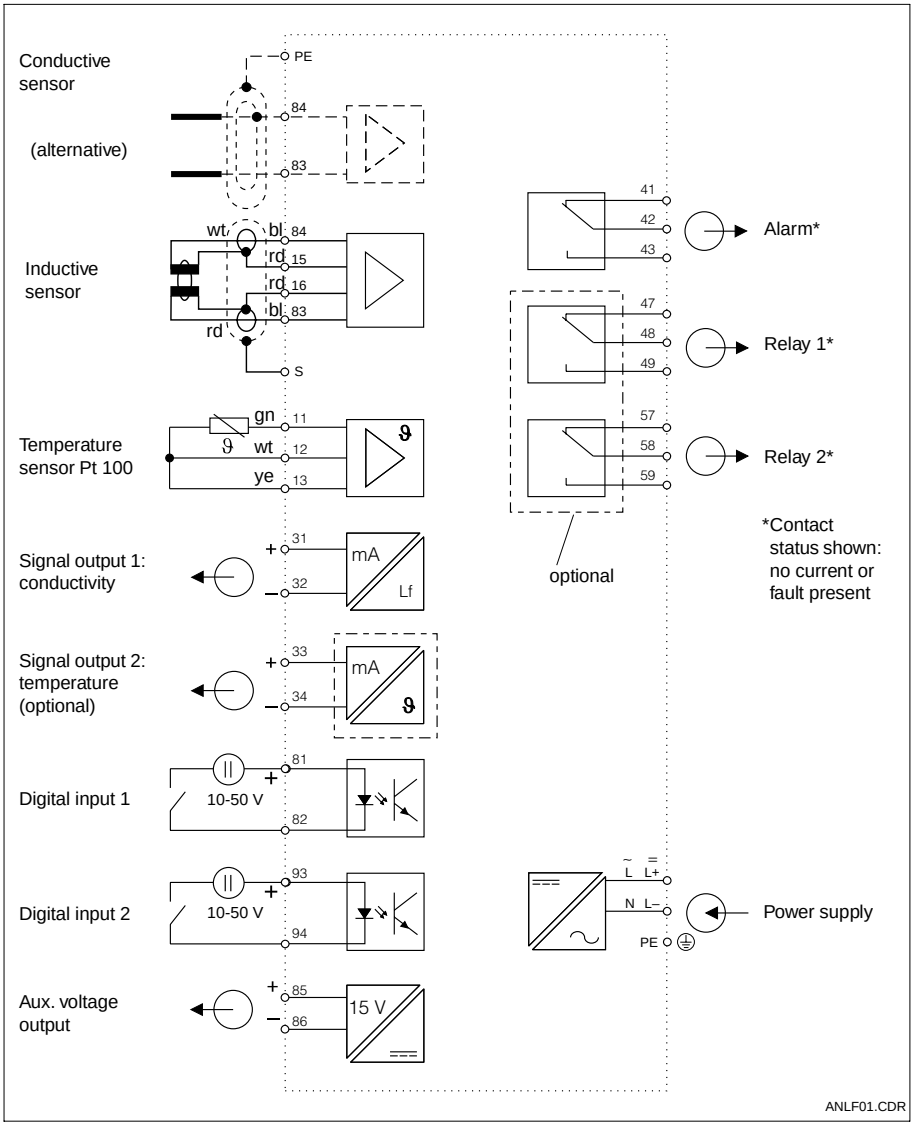


Overview of Liquisys S CLM 223 F menu. This overview covers all the options that can be installed.

Electrical connection

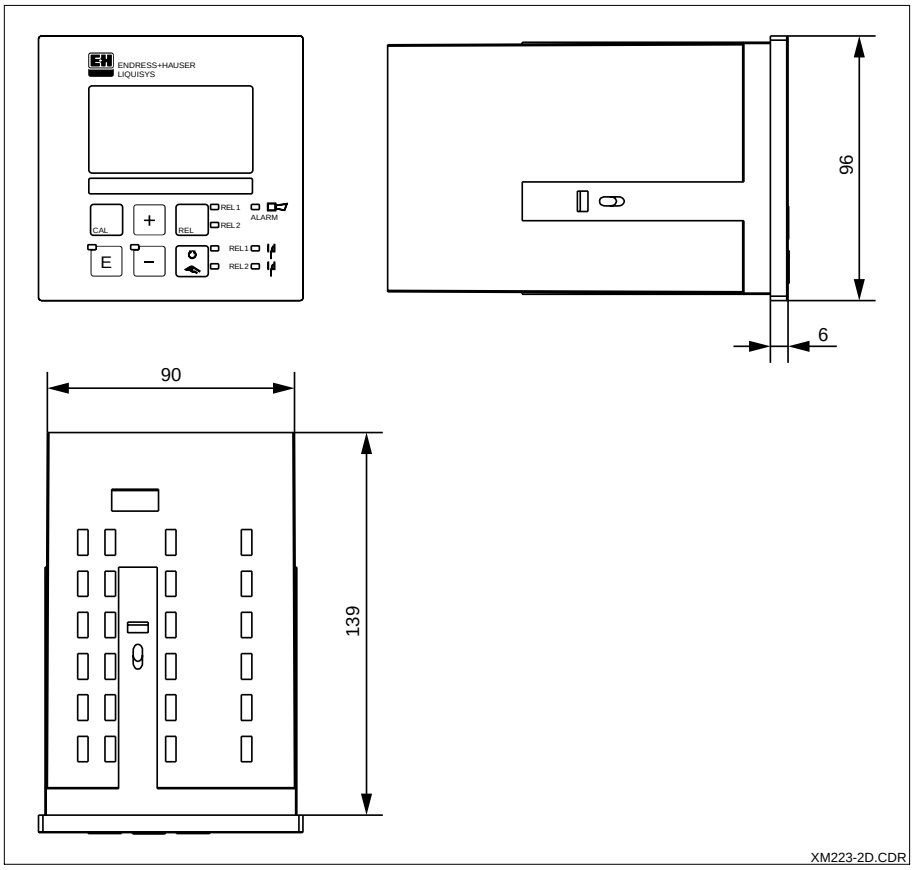
All connections to the panel-mounted instrument CLM 223 F are established via the terminal strips on the rear.

Liquisys S
CLM 223 F,
connections on the rear
of the instrument



Electrical connection of
Liquisys S CLM 223 F

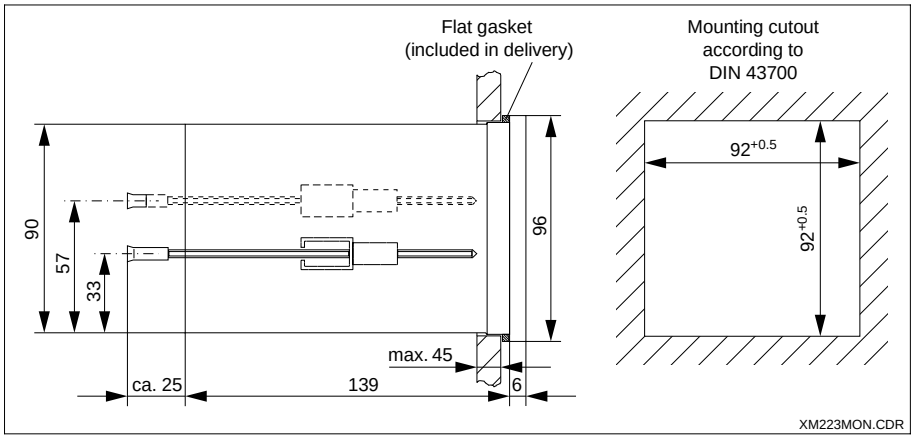
Dimensions



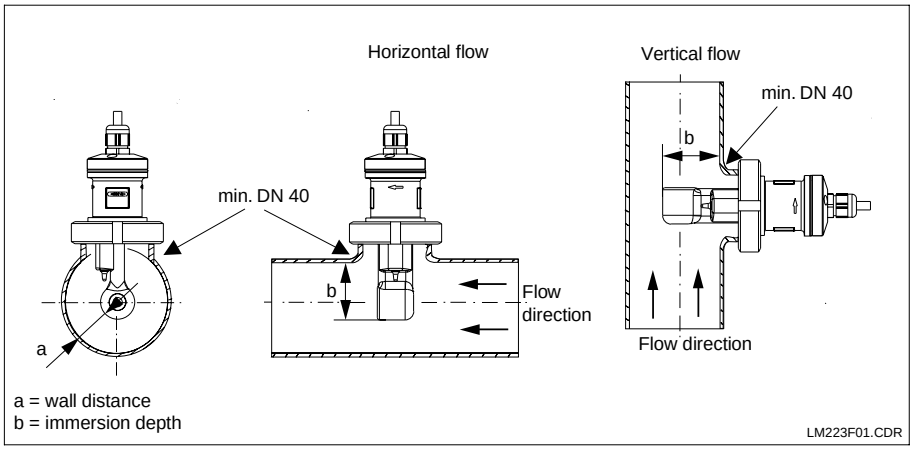
Dimensions of
Liquisys S CLM 223 F

Mounting

The panel-mounted Liquisys S CLM 223 F is mounted using the supplied tensioning screws.
The required overall mounting depth is approx. 165 mm.



Installation of panel-
mounted housing



Mounting of the sensor CLS 52 in flow pipes

The minimum pipe socket diameter depends on the sensor used.

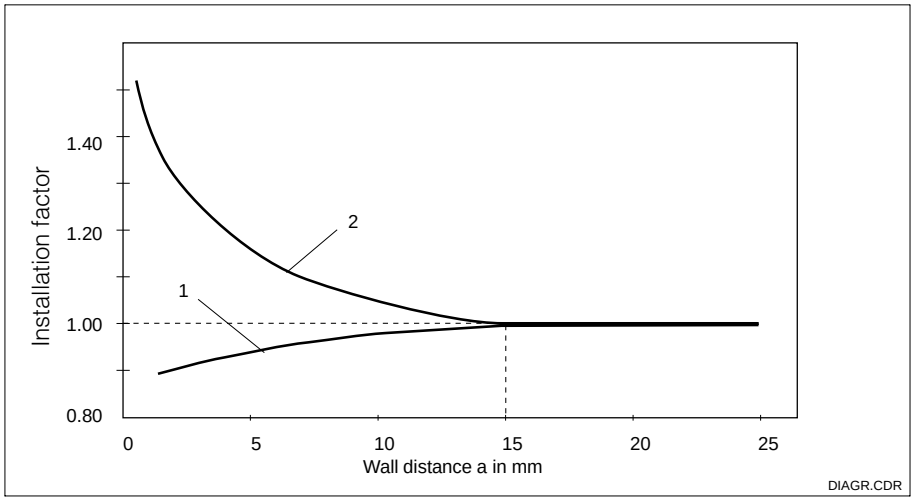
The pipe socket and the wall distance of the built-in sensor determine the installation factor.

Sensor connection	Diameter pipe socket	Installation factor
Varivent, 2 " Perlick , APV	≥ DN 40	$f > 1$
Dairy fitting, 2" SMS, G 1 ½ thread, 2" Clamp	≥ DN 50	$f > 1$
no influence of diameter	≥ DN 65	$f = 1$

Installation factor

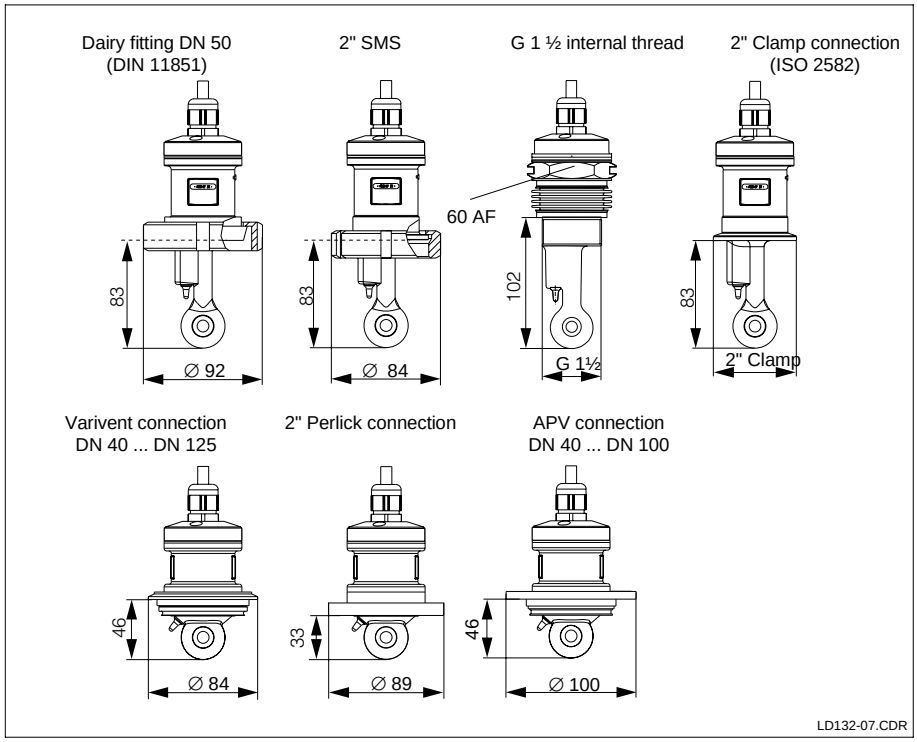
The electrical conductivity of the liquid primarily depends on the ion concentration. However, installation and sensor geometry must also be taken into account for measurement. The cell constant completely describes the sensor geometry.

If the distance from the wall is sufficient ($a > 15$ mm), then it is not necessary to consider the installation factor for inductive sensors ($f = 1.00$). If the distance from the wall is smaller, then the installation factor increases in the case of electrically insulating pipes ($f > 1$) and decreases in the case of electrically conductive pipes ($f < 1$).



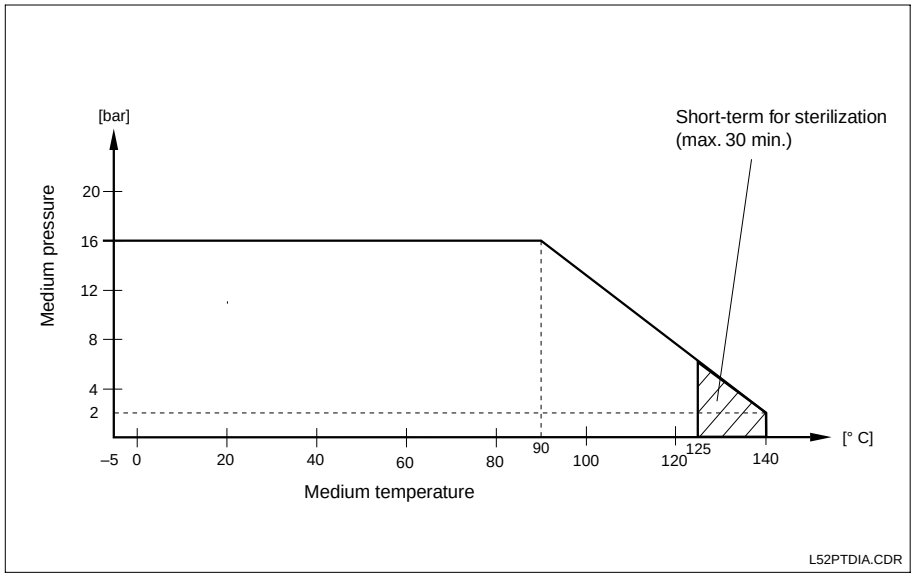
Installation factor f is dependent on distance a from pipe wall
1 Electrically conductive pipe
2 Insulating pipe

Process Connections



Process connections of conductivity sensors CLS 52

Pressure and temperature range



Permissible pressure and temperature ranges of sensor CLS 52

Technical data

General specifications

Manufacturer	Endress+Hauser
Product designation	Liquisys S CLM 223 F

Input

Measured quantities	conductivity, resistance, concentration, temperature

Minimum distance for 0 / 4 ... 20 mA signal

Conductivity measurement	meas. value betw. 0 and 19.99 µS/cm: 2 µS/cm meas. value betw. 20 and 199.9 µS/cm: 20 µS/cm meas. value betw. 200 and 1999 µS/cm: 200 µS/cm meas. value betw. 2 and 19.99 mS/cm: 2 mS/cm meas. value betw. 20 and 2000 mS/cm: 20 mS/cm
Resistance measurement	meas. value betw. 0 and 199.9 kΩ·cm: 20 kΩ·cm meas. value betw. 200 and 1999 kΩ·cm: 200 kΩ·cm meas. value betw. 2 and 19.99 MΩ·cm: 2 MΩ·cm meas. value betw. 20 and 200 MΩ·cm: 20 MΩ·cm
Concentration measurement	no minimum distance

Conductive conductivity/resistance measurement

Measuring range	conductivity: 0 ... 600 mS/cm (uncompensated) resistance: 0 ... 200 MΩ·cm concentration: 0 ... 9999 (%, ppm, mg/l, TDS)
Usable cell constant	k = 0.0025 ... 99.99 cm^{-1}
Max. length of cable to sensor	conductivity: 100 m resistance: 20 m
Measuring frequency	conductivity: 170 ... 2000 Hz resistance: 170 ... 2000 Hz

Inductive conductivity measurement

Measuring range	0 ... 2000 mS/cm (uncompensated)
Usable cell constant	k = 0.0025 ... 99.99 cm^{-1}
Max. length of cable to sensor	55 m (CLK 5)
Measuring frequency	2 kHz

Temperature measurement

Temperature sensor	Pt 100, Pt 1000, NTC
Measuring range	–35 ... +250 °C
Temperature offset range	±5.0 °C

Temperature compensation

Compensation types	linear, NaCl, table acc. to IEC 746-3, conductive only: in demineralized water
Range	–35 ... +250 °C
Reference temperature	25 °C

Digital inputs 1 and 2

Voltage	10 ... 50 V
Current consumption	max. 10 mA

Output

Conductivity/resistance signal output

Current range	0 / 4 ... 20 mA, galvanically separated; error current 2.4 / 22 mA
Load	max. 500 Ω
Max. resolution	700 digits/mA
Output range	adjustable
Separation voltage	max. 350 V_{rms} / 500 V DC
Overvoltage (lightning) protection	acc. to EN 61000-4-5:1995

Temperature signal output (optional)

Current range	0 / 4 ... 20 mA, galvanically separated
Load	max. 500 Ω
Max. resolution	700 digits/mA
Output range	adjustable, Δ 10 ... Δ 100% of upper range value
Separation voltage	max. 350 V_{rms} / 500 V DC
Overvoltage (lightning) protection	acc. to EN 61000-4-5:1995

Auxiliary voltage output

Output voltage	15 V ± 0.6 V
Output current	max. 10 mA

Technical data (continued)

Output (continued)

Contact outputs (potential-free changeover contacts)

Switching current with ohmic load (cos φ = 1)	max. 2 A
Switching current with inductive load (cos φ = 0.4)	max. 2 A
Switching voltage	max. 250 V AC, 30 V DC
Switching power with ohmic load (cos φ = 1)	max. 500 VA AC, 60 W DC
Switching power with inductive load (cos φ = 0.4)	max. 500 VA AC, 60 W DC

Limit contactor

Pickup / dropout delay	0 ... 2000 s

Alarm

Function (switchable)	steady / fleeting contact
Alarm threshold adjustment range	conductivity / resistance / concentration / temperature: complete measuring range
Alarm delay	0 ... 2000 s (min)

Accuracy

Conductivity measurement

Deviation of indication[1]	max. 0.5% of measured value ± 4 digits
Reproducibility	max. 0.2% of measured value ± 2 digits
Measurement deviation[1], conductivity signal output	0.75% of current output range

Resistance measurement

Deviation of indication[1]	max. 0.5% of measured value ± 4 digits
Reproducibility	max. 0.2% of measured value ± 2 digits
Measurement deviation[1], resistance signal output	0.75% of current output range

Temperature measurement

Resolution	0.1 °C
Deviation of indication[1]	max. 1.0% of measuring range
Measurement deviation[1], temperature signal output	max. 1.25% of current output range

Ambient conditions

Ambient temperature (nominal operating conditions)	–10 ... +55 °C
Ambient temperature (limit operating conditions)	–20 ... +60 °C
Storage and transport temperature	–25 ... +65 °C
Relative humidity (nominal operating conditions)	10 ... 95%, non-condensing
Protection class	IP 54 (front), IP 30 (housing)
Electromagnetic compatibility	interference emission and interference immunity acc. to EN 61326:1997 A1:1998

Physical data / design

Dimensions of panel-mounted unit (H × W × D)	96 × 96 × 145 mm
Mounting depth	approx. 165 mm
Weight	max. 0.7 kg
Display	LC display, two lines, five and nine digits, with status indicators

Materials

Housing	polycarbonate
Front membrane	polyester, UV-resistant

Power requirements

Supply voltage	100 / 115 / 230 V AC +10 / –15%, 48 ... 62 Hz 24 V AC/DC +20 / –15%
Power consumption	max. 7.5 VA
Fuse protection	fine-wire fuse, medium time-lag, 250 V / 3.15 A

[1]acc. to IEC 746-1, for nominal operating conditions

Technical data, continued

Sensor data CLS 52

Conductivity measuring range	0 ... 2000 mS/cm
Cell constant	k = 5.9 cm^{-1}
Temperature sensor	Pt 100, class A acc. to IEC 60751
Temperature measuring range Pt 100	–5 ... +140 °C
Temperature response time	t_{90} < 5 s
Measuring value deviation	±10 µS/cm + 0.5% of meas. value at –5 ... 100 °C ±30 µS/cm + 0.5% of meas. value at > 100 °C
max. cable length	55 m
Material in contact with medium	PEEK, stainless steel SS 316S, CHEMRAZ
Ambient temperature	–10 ... +70 °C
max. operating temperature	140 °C (max. 30 min.)
max. operating pressure	max. 16 bar (90 °C)
Ingress protection	IP 67

Supplementary documentation

Technical Information CLS 52	order no.: 50086110

Subject to modifications.

Accessories

Two-electrode conductivity sensors (selection)

Type	Features	Applications
CLS 15	Cell constant: k = 0.1 cm^{-1} or 0.01 cm^{-1} Process connections: NPT ½", NPT ¾", 1½" clamp	Condensate, ion exchangers
CLS 21	Cell constant: k = 1 cm^{-1} Process connections: G 1, DN 25 and DN 40 dairy pipe fitting, 2" clamp	Service water, boiler feed water

Inductive conductivity sensor

Type	Features	Applications
CLS 52	Cell constant: $k \approx 5.9$ cm^{-1} Process connections: Varivent, dairy fitting, APV, Clamp 2" (incl. 5 m attached cable)	Concentration measurement, product monitoring

Cables

Type	Features	Order number
CYK 71	Standard measuring cable for connection of two-electrode-sensors with and without Pt 100 (also usable for extension)	50085333
CLK 5	Extension cable for inductive sensors	50085473
VS	Junction box for conductive measuring cables	50001054
VBM	Junction box for inductive measuring cables	50003987

Assemblies

Type	Features	Applications
CYA 611	Immersion assembly with G 1, G ¾ or NPT ¾" thread	Sewage, water
Dipsys CLA 140	Immersion assembly with flange DN 80 PN 16, ANSI 3" 150 lbs or JIS 10K 80A; sensor holder with bayonet lock	Sewage, paper industry

Product structure

Conductivity and resistance transmitter Liquisys S CLM 223 F

Version

CF Conductivity measurement (two-electrode sensor)
IF Conductivity measurement (inductive sensor)

Power supply

0 230 V AC
1 115 V AC
5 100 V AC
8 24 V AC/DC

Measurement output

0 Conductivity
1 Conductivity and temperature

Contacts

05 No additional contacts
10 2 contacts (limit / P(ID) / timer)

CLM 223 F-					complete order code for CLM 223 F

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TI 237C/07/en/12.00
Printed in Germany / DT / CV5 (51505427)