TI00237C/07/EN/13.13
71236332

Technical Information
Liquisys M CLM223F
Conductivity Measurement

Transmitter for conductive and inductive sensors

Application
The modular design of the transmitter allows easy adaption of the transmitter to a variety of customer requirements. Starting with the basic version for "measurement and alarm generation", the transmitter can be equipped with additional software and hardware modules for special applications. These modules can also be retrofitted as required.

Application
- Concentration control
- CIP plants control
- Phase separation
- Product quality assurance
- Wash mobiles and cleaning plants

Your benefits

- Panel-mounted housing
- Measuring range switching
  - Selection of separate sets of system configurations via binary inputs
  - Adaption to four predefined media via remote switching
- Universal application
  - Transmitter for conductive or inductive measurement
  - Compensation in demineralized water
- Simple handling
  - Logically arranged menu structure
  - Calibration via CAL key
- Safe operation
  - Excellent immunity to interference
  - Manual contact control
  - User-defined alarm configuration

The basic unit can be extended with:

- 2nd current output for temperature or conductivity
- Contact outputs

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Function and system design

Features of the basic version

Conductive or inductive

Two instrument versions for measurement with conductive (two electrode) sensors or inductive sensors are available. The use of inductive sensors that are less sensitive to soiling than conductive sensors is recommended for high conductivity measurement, concentration measurement or adhering media.

Measuring of conductivity

This is selected via the menu. The **temperature** is displayed at the same time or, if desired, not shown at all.

Temperature compensation

The following temperature compensation selections are available:

- Linear compensation with freely adjustable temperature coefficient α
- Compensation according to IEC 746-3 for NaCl
- Compensation according to four user programmable coefficient tables of max. 10 elements.

Configuration

Different alarms are required depending on application and operator. Therefore the transmitter permits independent **configuration of the alarm contact and error current** for each individual error. Unnecessary or undesirable alarms can be suppressed in this manner. **Up to four contacts** can be used as limit contacts (also for temperature), to implement a P(ID) controller or for cleaning functions. Direct **manual operation of the contacts** (bypassing the menu) provides quick access to limit, control or cleaning contacts, permitting speedy correction of deviations.
The **serial numbers** of the instrument and modules and the order code can be called up on the display. The cell constant can be edited and even **calibrated** for demanding special applications.

Polarization detection

Polarization effects in the boundary layer between the sensor and the medium to be measured limit the measuring range of conductive conductivity sensors.
The transmitter can detect polarization effects using an innovative, intelligent signal evaluation process.

Process Check System (PCS)

This function checks the measuring signal for stagnation. If the measuring signal does not change for some time (several measured values), an alarm is triggered. Soiling, blockage or similar could be the cause of such behaviour.

Concentration measuring

The transmitter can be switched from conductivity operating mode to concentration operating mode. The concentration operating mode provides four freely programmable as well as four predefined concentration curves, especially for common CIP solutions. This enables a direct display of the concentration in %.

Remote parameter set switching

The transmitter is equipped with remote parameter set switching (measuring range switching MRS),

- to cover a wide measuring range.
- to adjust temperature compensation when changing the product.
- to switch between concentration curves.

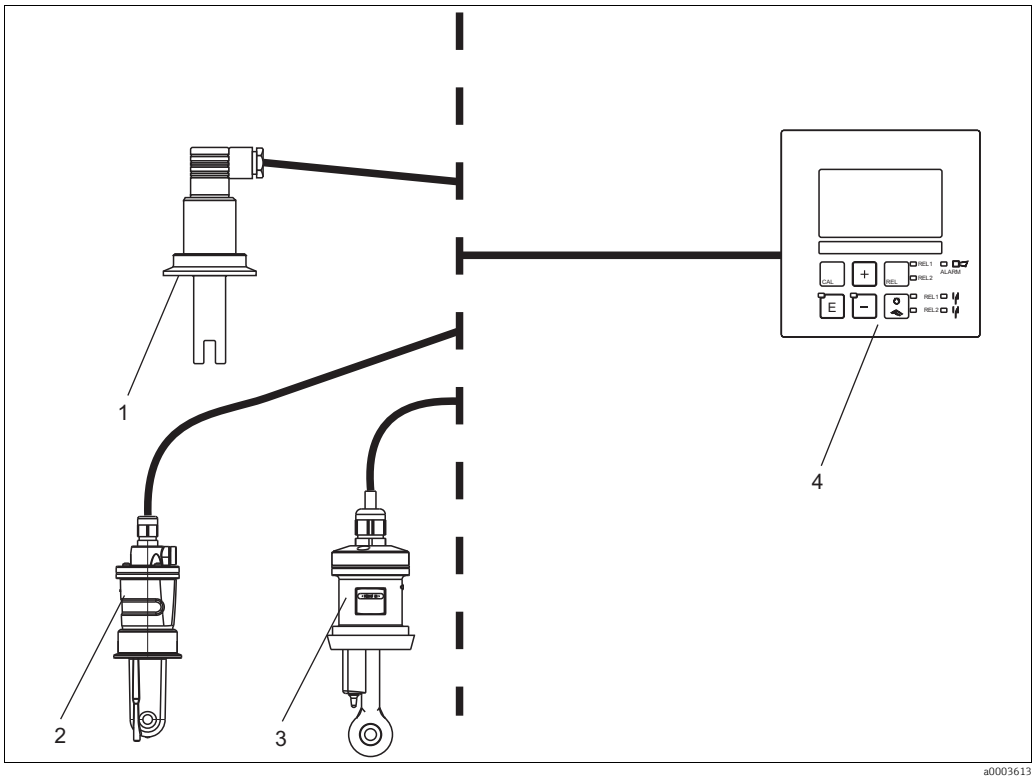
Second current output

The second current output can be configured for temperature.

Measuring system

A complete measuring systems comprises:
- The transmitter Liquisys M CLM223 F
- A sensor with or without an integrated temperature sensor
- A measuring cable CYK71 (conductive) or CLK5 (inductive)

Options: extension cable, junction box VBM



Complete measuring system Liquisys CLM223 F

1 Conductive sensor CLS21
2 Inductive sensor CLS54
3 Inductive sensor CLS52
4 Liquisys M CLM223 F

Input

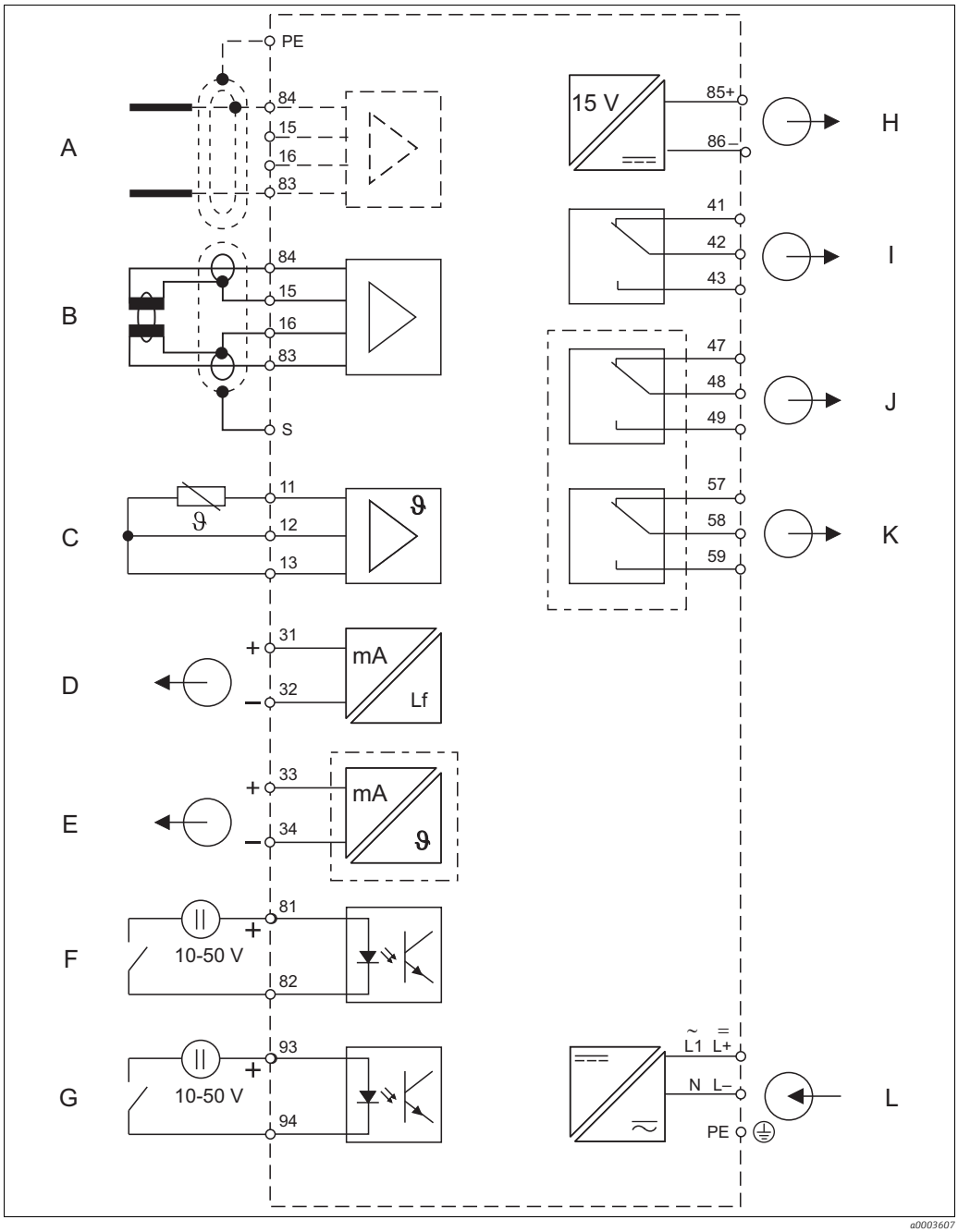
Measured variables	Conductivity, temperature	
Measuring range	Conductivity (conductive): Conductivity (inductive): Concentration: Temperature:	0 to 400 mS/cm (uncompensated) 0 to 2000 mS/cm (uncompensated) 0 to 9999 % -35 to +250 °C (-31 to +482 °F)
Cable specification	Cable length (conductive): Cable length (inductive): Cable resistance CYK71:	conductivity: max. 100 m (328.1 ft) (CYK71) max 55 m (180.46 ft) (CLK5) 165 Ω/km (conductivity measurement)
Cell constant	Adjustable cell constant:	k = 0.0025 to 99.99 cm^{-1}
Temperature sensors	Pt 100, Pt 1000, NTC 30K	
Measuring frequency	Conductivity, resistivity (conductive): Conductivity (inductive):	170 Hz to 2 kHz 2 kHz
Binary inputs	Voltage: Power consumption:	10 to 50 V max. 10 mA
Current input	4 to 20 mA, galvanically separated Load: 260 Ω at 20 mA (voltage drop 5.2 V)	

Output

Output signal	0/4 to 20 mA, galvanically separated, active
Signal on alarm	2.4 or 22 mA in case of an error
Load	maximum 500 Ω
Linearization transmission behaviour	Conductivity: adjustable Temperature: adjustable, Δ10 to Δ100 % of upper range value
Resolution	max. 700 digits/mA
Min. distance for 0 / 4 to 20 mA signal	Conductivity: Measured value 0 to 19.99 µS/cm: 2 µS/cm Measured value 20 to 199.9 µS/cm: 20 µS/cm Measured value 200 to 1999 µS/cm: 200 µS/cm Measured value 2 to 19.99 mS/cm: 2 mS/cm Measured value 20 to 2000 mS/cm: 20 mS/cm Concentration: no minimum distance Temperature: 15 °C
Isolation voltage	max. 350 V_{RMS}/500 V DC
Overvoltage protection	according to EN 61000-4-5
Auxiliary voltage output	Output voltage: 15 V ± 0.6 Output current: max. 10 mA
Contact outputs	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 to 2000 s
Alarm	Function (selectable): Latching/momentary contact Alarm threshold adjustment range: Conductivity, concentration, temperature: complete measuring range Alarm delay: 0 to 2000 s (min)

Power supply

Electrical connection



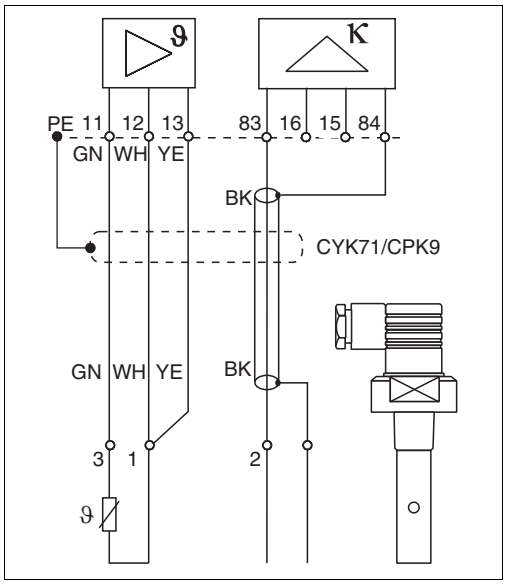
Electrical connection of the transmitter

A	*Sensor (conductive)*	*G*	*Binary input 2 (MRS)*
B	*Sensor (inductive)*	*H*	*Aux. voltage output*
C	*Temperature sensor*	*I*	*Alarm (current-free contact position)*
D	*Signal output 1 conductivity*	*J*	*Relay 1 (current-free contact position)*
E	*Signal output 2 temperature*	*K*	*Relay 2 (current-free contact position)*
F	*Binary input 1 (MRS)*	*L*	*Power supply*

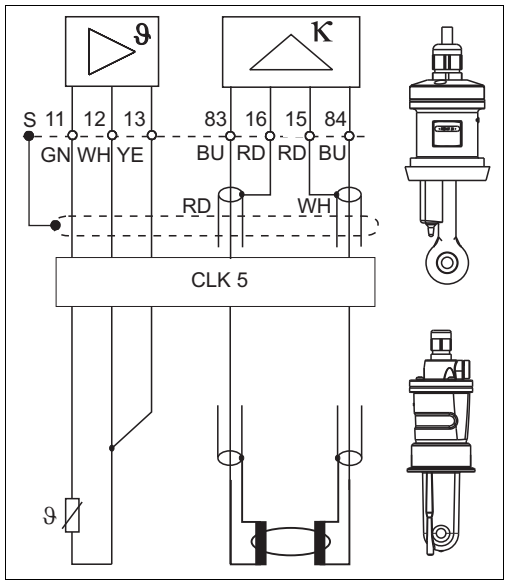
The instrument has protection class II and is generally operated without protective earth connection. To ensure the measuring stability and the function for conductive sensors you have to connect the outer screen of the sensor cable to the PE terminal.

Connection of sensor

You require screened special measuring cables to connect conductivity sensors to the transmitter. To extend the measuring cable, use junction box and extension cable (see accessories).



Connection of conductive sensors



Connection of inductive sensors

Power supply

Depending on ordered version:
100/115/230 V AC +10/-15 %, 48 to 62 Hz
24 V AC/DC +20/-15 %

Power consumption

max. 7.5 VA

Mains protection

Fine-wire fuse, medium-slow blow 250 V/3.15 A

Circuit breaker

NOTICE

The device does not have a power switch

- You must provide a protected circuit breaker in the vicinity of the device.
- This must be a switch or a power-circuit breaker and you must label it as the circuit breaker for the device.
- At the supply point, the power supply for the 24 V versions must be isolated from dangerous live cables by double or reinforced insulation.

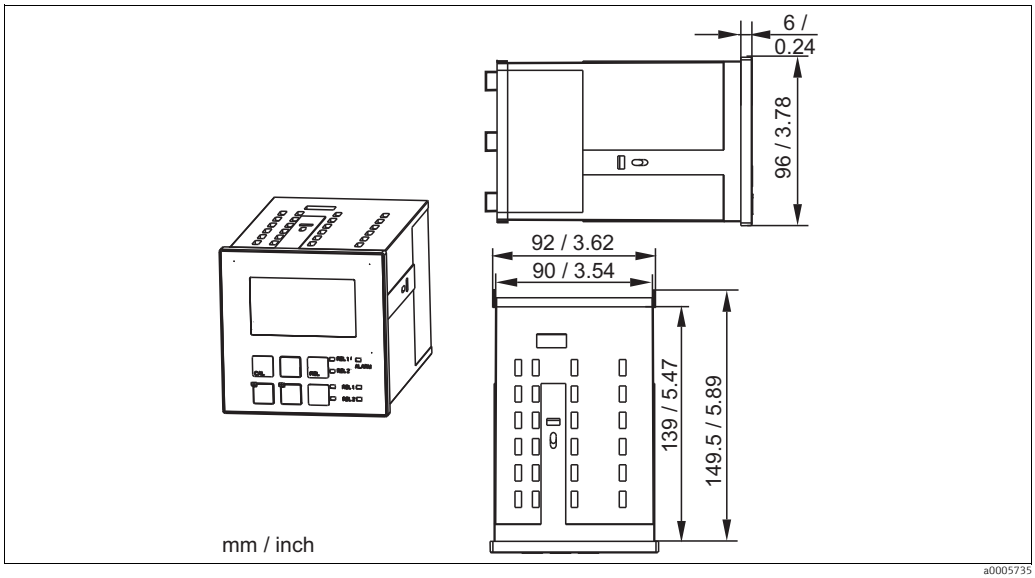
Performance characteristics

Reference temperature	25 °C (77 °F)	
Resolution	Temperature:	0.1 °C
Maximum measured error[1)]	Conductivity:	
	Display:	max. 0.5 % of measured value ± 4 digits
	Conductivity signal output:	max. 0.75 % of current output range
	Temperature:	
	Display:	max. 1.0 % of measuring range
	Temperature signal output:	max. 1.25 % of current output range
Repeatability[1)]	Conductivity:	max. 0.2 % of measured value ± 2 digits
Temperature compensation	Range:	-35 to +250 °C (-31 to +482 °F)
	Types of compensation:	linear, NaCl, table
Temperature offset	±5 °C; for the adjustment of the temperature display	

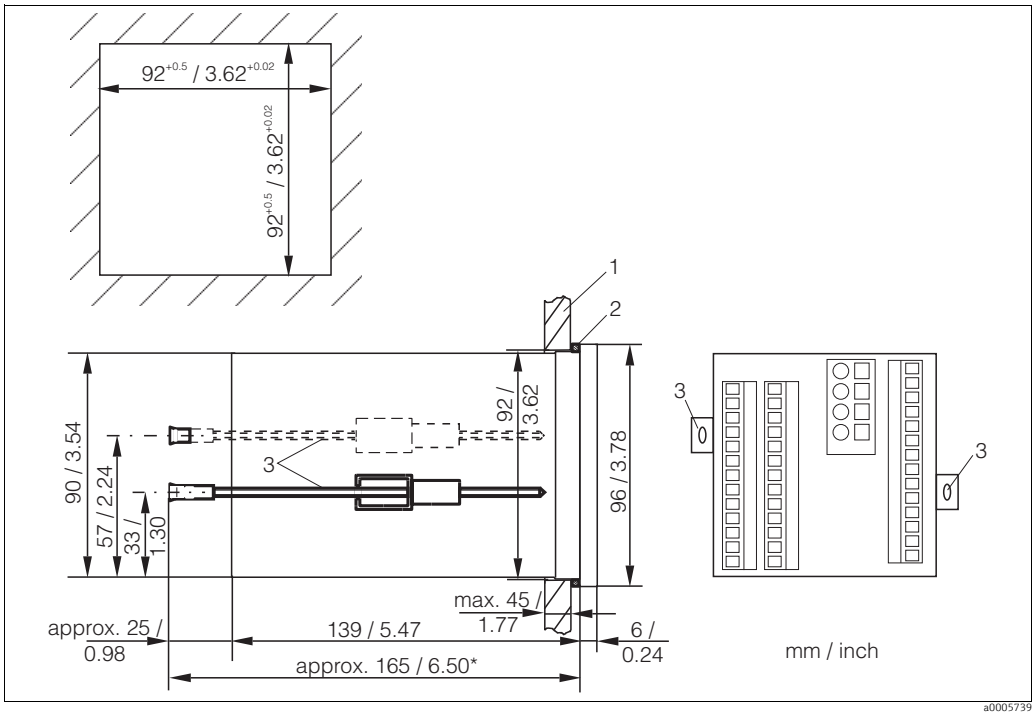
1) acc. to IEC 746-1, for nominal operating conditions

Installation

Installation instructions



Dimensions panel-mounted instrument



Installation of the panel mounted instrument

1 Wall of control cabinet
2 Gasket
3 Tensioning screws
** Required installation depth*

Environment

Ambient temperature	-10 to +55 °C (+14 to +131 °F)	
Ambient temperature limit	–20 to +60 °C (-4 to +140 °F)	
Storage and transport temperature	–25 to +65 °C (-13 to +149 °F)	
Electromagnetic compatibility	Interference emission and interference immunity acc. to EN 61326: 1997 / A1: 1998	
Ingress protection	Panel mounted instrument:	IP 54 (front), IP 30 (housing)
Relative humidity	10 to 95%, non-condensing	

Mechanical construction

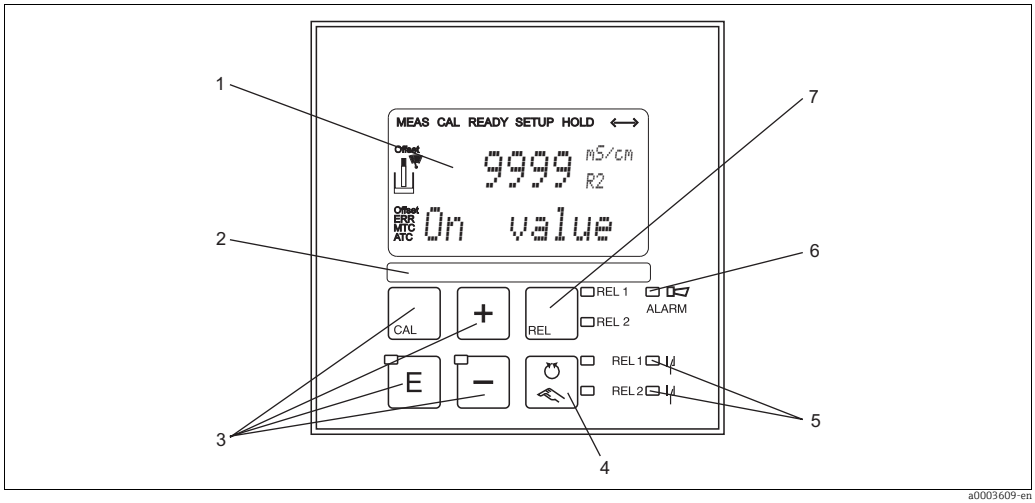
Dimensions	Panel-mounted instrument:	L x W x D: 96 x 96 x 145 mm (3.78" x 3.78" x 5.71") Installation depth: approx. 165 mm (6.50")
Weight	Panel-mounted instrument:	max. 0.7 kg (1.54 lbs)
Material	Housing: Front membrane:	Polycarbonate Polyester, UV-resistant
Terminals	Cross section	max. 2.5 mm^2 (14 AWG)

Operability

Operating conditions

All instrument control functions are arranged in a logical menu structure. Following access code entry, the individual parameters can be easily selected and modified as needed.

Display elements



Operating elements

1 LC display for display of measured values, configuration data and current menu field
2 Field for user labeling
3 4 main control keys for calibration and instrument configuration
4 Key for switching between automatic/manual operation of the relays
5 LED indicators for limit contactor relay (switch status)
6 LED indicator for alarm function
7 Display of active contact and key for relay switching in manual mode

The display simultaneously shows the current measured value and the temperature - the essential process data. Brief information texts in the configuration menu provide assistance with parameter configuration.

Certificates and approvals

CE symbol

Declaration of conformity
The product meets the legal requirements of the harmonized European standards.
The manufacturer confirms compliance with the standards by affixing the CE symbol.

CSA General Purpose

CSA General Purpose
The products listed below are eligible to bear the CSA Mark shown with adjacent indicators "C" and "US":

Version	Approval
CLM223F-..2... CLM223F-..3... CLM223F-..7...	CSA Mark for Canada and USA

Ordering information

Product structure

Input, software version						
CF	Conductive sensor					
IF	Inductive sensor					
		Power supply				
		0	230 V AC			
		1	115 V AC			
		2	230 V AC, CSA Gen. Purp.			
		3	115 V AC, CSA Gen. Purp.			
		5	100 V AC			
		7	24 V AC/DC, CSA Gen. Purp.			
		8	24 V AC/DC			
			Output			
			0	1 x 20 mA, primary value		
			1	2 x 20 mA, primary value + secondary value		
				Additional contacts		
				05	not selected	
				10	2 relays (limit/P(ID)/timer)	
					Marking	
					1	Tagging (Tag), see additional spec.
CLM223F-						complete order code

Scope of delivery

The delivery of the panel mounted instrument includes:
- 1 transmitter CLM223 F
- 1 test resistor
- 1 set of plug-in screw terminals
- 2 tensioning screws
- 1 Operating Instructions BA00237C/07/EN

Accessories

Sensors

Condumax W CLS12
- Conductive conductivity sensor for standard, Ex and high-temperature applications;
- Ordering acc. to product structure, www.products.endress.com/cls12
- Technical Information TI00082C/07/EN

Condumax W CLS13
- Conductive conductivity sensor for standard, Ex and high-temperature applications;
- Ordering acc. to product structure, www.products.endress.com/cls13
- Technical Information TI00083C/07/EN

Condumax W CLS15
- Conductive conductivity sensor for pure and ultra-pure water applications (incl. Ex);
- Ordering acc. to product structure, www.products.endress.com/cls15
- Technical Information TI00109C/07/EN

Condumax H CLS16
- Hygienic conductive conductivity sensor for pure and ultra-pure water applications (incl. Ex);
- Ordering acc. to product structure, www.products.endress.com/cls16
- Technical Information TI00227C/07/EN

Condumax W CLS19
- Conductive conductivity sensor for pure and ultra-pure water applications;
- Ordering acc. to product structure, www.products.endress.com/cls19
- Technical Information TI00110C/07/EN

Condumax W CLS21
- Conductive conductivity sensor for applications with middle to high conductivity (incl. Ex);
- Ordering acc. to product structure, www.products.endress.com/cls21
- Technical Information TI00085C/07/EN

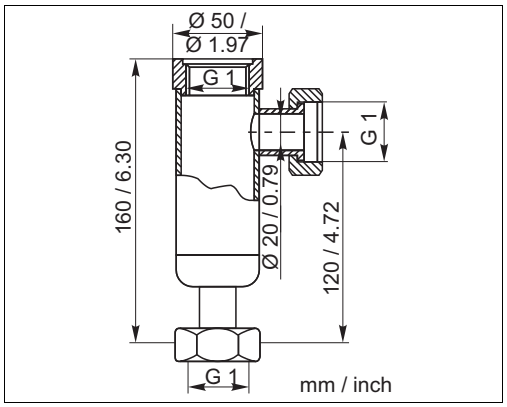
Indumax P CLS50
- Inductive conductivity sensor for standard, Ex and high-temperature applications
- Ordering acc. to product structure, www.products.endress.com/cls50
- Technical Information TI00118C/07/EN

Indumax H CLS52
- Inductive conductivity sensor with short response time for food applications
- Ordering acc. to product structure, www.products.endress.com/cls52
- Technical Information TI00167C/07/EN

Indumax H CLS54
- Inductive conductivity sensor for standard, Ex and in hygienic design for applications in food, beverages, pharmaceuticals and biotechnology
- Ordering acc. to product structure, www.products.endress.com/cls54
- Technical Information TI00400C/07/EN

Assemblies

- CLA751 flow assembly



CLA751 flow assembly

For installation of conductivity sensors with G 1 thread.
Inlet (bottom) and outlet (lateral) DN 20 with union nuts G 1.
Stainless steel 1.4571 (AISI 316Ti)
Max. temperature: 160 °C / 320 °F
Max. pressure: 12 bar / 174 psi
Order no.: 50004201

Connection accessories

CYK71 measuring cable
- non-terminated cable for the connection of sensors or the extension of sensor cables
- sold by the meter, order number: 50085333

- Extension cable CLK5
  for inductive conductivity sensors, for cable extension via junction box VBM;
  (sold by the metre), order no. 50085473

Junction box VBM
- For cable extension, with 10 terminals
- IP 65 / NEMA 4X
- Material: aluminum
- Order numbers:
  – cable entry Pg 13.5: 50003987
  – cable entry NPT ½": 51500177

Buffer solutions

Precision calibration solutions, acc. to SRM (Standard reference material) of NIST, error limit ± 0.5 %, reference temperature 25 °C (77 °F), with temperature table
- CLY11-A, 74.0 µS/cm, 500 ml (0.132 Us.gal); order no. 50081902
- CLY11-B, 149.6 µS/cm, 500 ml (0.132 Us.gal); order no. 50081903
- CLY11-C, 1.406 mS/cm, 500 ml (0.132 Us.gal); order no. 50081904
- CLY11-D, 12.64 mS/cm, 500 ml (0.132 Us.gal); order no. 50081905
- CLY11-E, 107.0 mS/cm, 500 ml (0.132 Us.gal); order no. 50081906

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