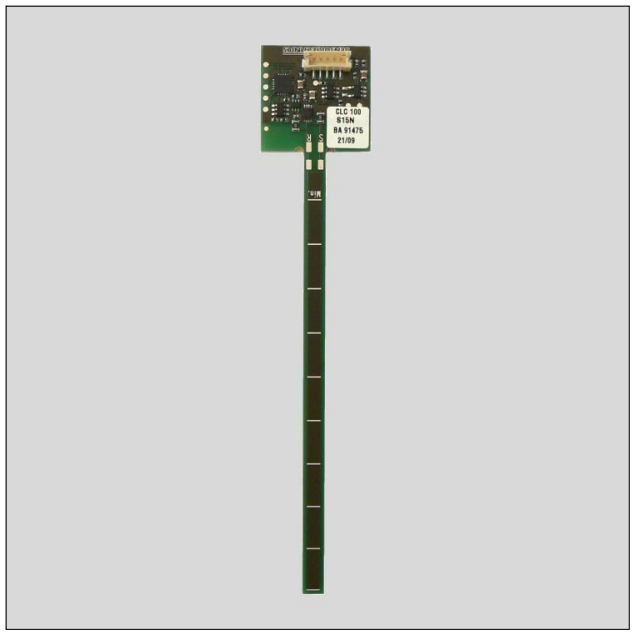
CLC Series

Miniature capacitive continuous liquid level sensors

FEATURES

- **Contact-free measurement of continuous liquid level**
- **Measurement of both metallic and non-metallic substances**
- **Measurement of granular or pulverised materials**
- **Positioning/proximity sensor**
- **Displacement sensor**
- **Easy mounting**
- **RoHS compliant**
- **Quality Management System according to ISO 13485:2003 and ISO 9001:2008**

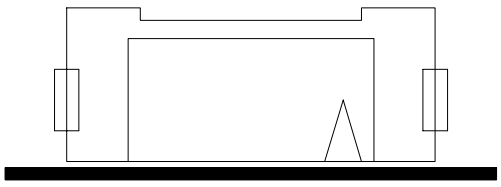


SPECIFICATIONS

Maximum ratings

Supply voltage (V_S)	5.5...15 V_{DC}
Output voltage (R_i=1 kΩ)	5 V
Temperature ranges	
Operating	-20 ... 85 °C
Compensated	±20 °C
	relative to calibration temperature

ELECTRICAL CONNECTION



PERFORMANCE CHARACTERISTICS

Characteristic	Min.	Typ.	Max.	Unit
Measuring range (vertical)	0		100	mm
Resolution[1]		6		bit
Response time	10	50	1000	ms

Note:
1. At 3 mm distance between sensor and medium.

OUTPUT SIGNAL

The sensor calculates an actual measurement value between the Teach-In points 'LOW' and 'HIGH'. LOW corresponds to 0 % and HIGH equals 100 %.

Output	0 %	25 %	50 %	100 %
RS232	0x01	0x3F	0x80	0xFE
Analog	0.5 V	1.5 V	2.5 V	4.5 V

ELECTRICAL CHARACTERISTICS

Pin	Pin name	Explanation	Min.	Typ.	Max.	Unit
1	V_S[4]	Supply pin[2]	5.5	9	15	V
		Current draw of sensor	7	8.5	10	mA
2	Analog[5]	Analog output (R_i=1 kΩ)	0.5		4.5	V
3	1-wire[5]	RS232 Out, 9600, 8N1				
		Output voltage (R_i=1 kΩ)	0		5	V
4	TI	Teach-in[3]	-0.25		5.25	
		Current draw			1	mA
5	GND	Ground				

Note:
2. Length of power supply cable must not exceed 2.5 m.
3. Only for Teach-In, do not connect during operation. (TI_{HIGH}=4.5...5.25 V, TI_{LOW}=-0.25...0.5 V)
4. The quality of the supply voltage (with regards to ripple or other disturbances) may have an impact on the accuracy of the measurement.
5. No protection against electrical surge (e.g. with inductive load)

ELECTRICAL CONNECTION (cont.)

DIGITAL OUTPUT

The Sensor has a TTL RS232 output (only TxD) with 9600 Baud, 8N1.
It can be visualised on a PC, using a TTL RS232 adapter and a terminal programme (i.e. Hyper Terminal).

The protocol always starts with a start byte ‘0x00’ followed by a data byte with the current level value in the range of ‘0x01' = 0% to '0xFE’ = 100%. This range is linearly distributed between the ‘LOW’ and ‘HIGH’ Teach-In points. The data byte must not contain a ’0x00’ to clearly distinguish it from the start byte!

Example:

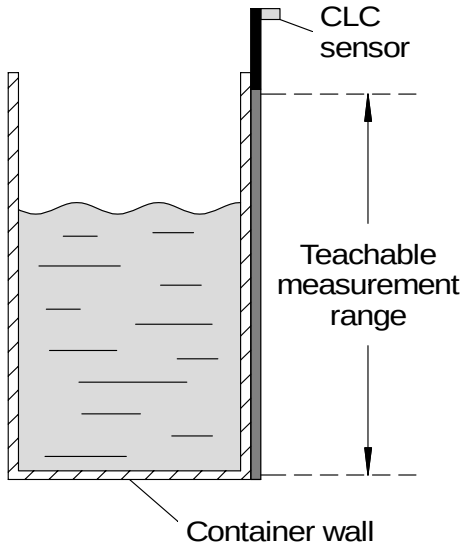
Byte	**1**	**2**	**3**	**4**	**5**	**6**	**...**	**n**	**n+1**
Mode	**Start**	**Data**	**Start**	**Data**	**Start**	**Data**	**...**	**Start**	**Data**
Output (Hex)	0x00	0x89	0x00	0x90	0x00	0x89	...	0x00	0x89

MECHANICAL CHARACTERISTICS

Wall thickness (glass) without air gap	max. 5 mm
Wall thickness (unfoamed plastic) without air gap	max. 5 mm
Connection output	5 pin JST connector (V_S, Analog out, 1-wire digital out, Teach-in and GND)
Mechanical fixation	Double-sided adhesive tape

MOUNTING

- The optimal distance between sensor and medium is <2 mm.
- The maximum distance between sensor and medium is 5 mm of which 80 % must be of plastic or glass (less than 20 % air gap).
- The sensor must be fixed on a surface free of grease or bubbles.



Note:
Please be aware that the sensor needs to be taught in the application with its specific mounting and environmental conditions. Any change in those conditions may result in erroneous measurements. Environmental conditions are defined by the presence, absence or position of objects in the vicinity of the sensor and/ or changes of electrical potentials.

GROUND REFERENCE

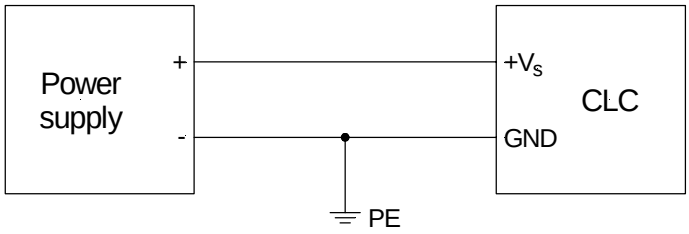
The CLC sensor needs a proper ground reference (GND) to achieve optimum results.

Toroidal transformer
If a toroidal transformer is used as a power supply, the capacitive coupling between primary and secondary coil is sufficient to ensure proper grounding.

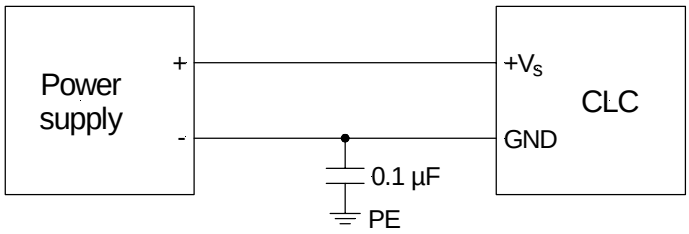
Switched power supply
In case a switched power supply is used (which is usually floating), the ground reference could be oscillating by as much as 50 % of the mains voltage, potentially resulting in erroneous measurements.

Solutions:

Non-floating ground reference
To ensure non-floating of the ground reference, the sensor's GND pin has to be connected to earth potential (PE). However, this setup could result in a leakage current causing the residual current circuit breaker to switch. Further, a galvanic connection does exist between the sensor and PE.



Virtual ground reference
A capacitor between the sensor's GND pin and earth potential (PE) will solve the problem of leakage current and should be used in most cases. In this setup a galvanic isolation is established between the sensor and PE.



TEACH-IN

The Teach-In (TI) mode allows for a permanent storage (EEPROM) of both low and high level values of the measurement range. This range is determined by the sensor pad. The TI_{LOW} mode stores the value for the empty or low level container and adapts to the corresponding application conditions. The TI_{HIGH} mode stores the value of the container filled to the desired max. level. By factory default the sensor is 'formatted' and needs to be taught to provide an output signal.

Preconditions for successful Teach-In

- **Do not touch** the sensor or container during the Teach-In or measuring process.
- The sensor must be in original mounting position.
- After connecting to V_S the sensor must level off for 2 sec.
- **Important:** The sensor must **first be taught LOW** to adapt to the ambient conditions, **then HIGH**.
- The TI_{HIGH} value must not be lower than the TI_{LOW} value.
- Best results will be achieved when GND is connected to earth potential (see GROUND REFERENCE).

Note: The maximum tolerable voltage range for the TI pin is -0.25…+5.25 V.

TI_{LOW} mode:

Apply voltage between 0 and 0.5 V for at least 500 ms at the Teach-In pin.
After 1 sec. the value is stored in the EEPROM.

TI_{HIGH} mode:

Apply voltage between 4.5 and 5 V for at least 500 ms at the Teach-In pin.
After 1 sec. the value is stored in the EEPROM.

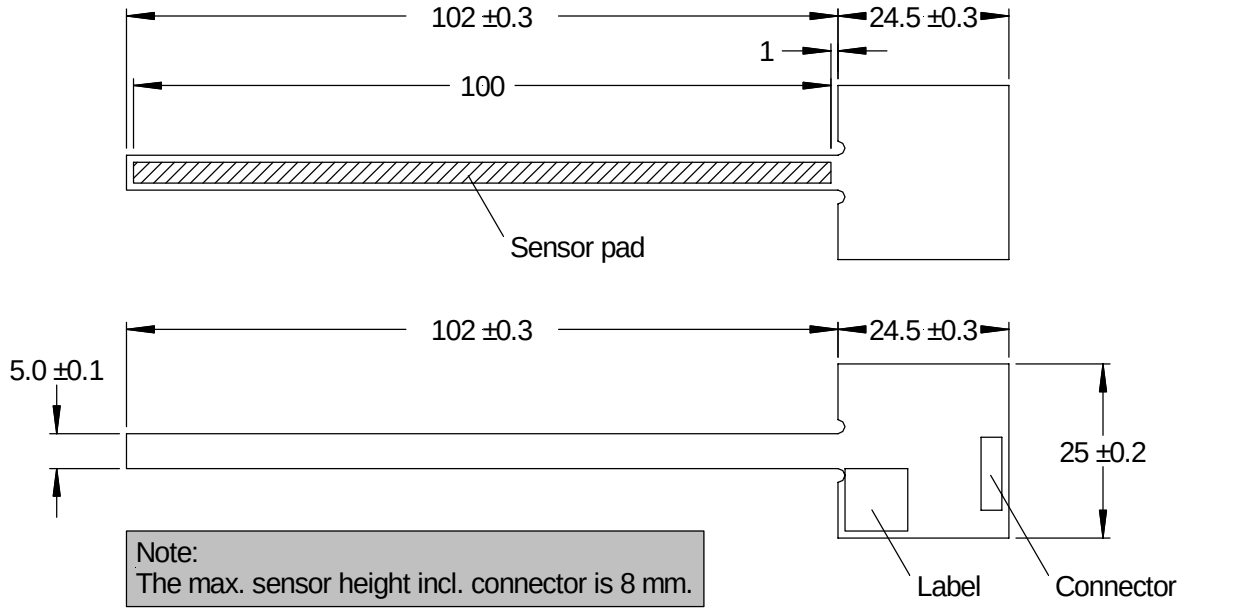
Under normal conditions, the TI-Pin delivers 2.5 V.

It is possible to re-teach the HIGH level only (in case, the LOW level remains the same). A re-teaching is only possible after having disconnected the supply voltage. However, if the LOW level needs to be changed, the sensor first has to be formatted (see Reset).

Reset

The sensor can be reset to factory default ('format') as follows:
1. Disconnect the sensor from V_S .
2. Connect the TI-Pin (pin 4) to GND.
3. Connect the sensor to V_S for at least 2 sec.
4. Disconnect the sensor from V_S and formatting is completed.

OUTLINE DRAWING



dimensions in mm

ORDERING INFORMATION

	Series		Measuring range		Output		Supply		Housing	
Options	**CLC**	**100**	100 mm	**S***	RS232 and 0.5...4.5 V	**15**	5.5...15 V	**N**	No housing
				* R_i=1 kΩ					
Example:	**CLC**	**100**		**S**		**15**		**N**	

Note: Custom specific options are available. Please contact First Sensor for further information.

Accessory

(Not included in delivery! Please order separately.)

Order No.	Description
ZK000133	JST connector/cable assembly (approx. 29 cm cable length)