



## LCS-1

Teachable capacitive sensors with IO-Link



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Leuze electronic GmbH + Co. KG

In der Braike 1

D-73277 Owen / Germany

Phone: +49 7021 573-0

Fax: +49 7021 573-199

<http://www.leuze.com>

[info@leuze.de](mailto:info@leuze.de)

<b>1</b>	<b>About these instructions .....</b>	<b>5</b>
1.1	Target groups .....	5
1.2	Explanation of icons.....	5
1.3	Other documents.....	6
<b>2</b>	<b>Information on product .....</b>	<b>7</b>
2.1	Identification of product .....	7
2.2	Scope of delivery.....	7
2.3	Legal requirements .....	7
2.4	Manufacturer and maintenance.....	7
<b>3</b>	<b>For your safety .....</b>	<b>8</b>
3.1	Intended use.....	8
3.2	Obvious misuse .....	8
3.3	General safety notices .....	8
<b>4</b>	<b>Product description.....</b>	<b>9</b>
4.1	Device overview .....	9
4.1.1	Display elements.....	9
4.1.2	Operational controls.....	9
4.2	Characteristics and features.....	10
4.3	Operating principle.....	10
4.4	Functions and operating modes .....	10
4.4.1	Configuration options.....	10
4.4.2	"Medium present" mode (full teach).....	10
4.4.3	"Medium not present" mode (empty teach).....	10
4.4.4	"Switching point between medium present and medium not present" mode (complete teach) .....	10
4.4.5	Internal voltage and temperature monitoring.....	11
4.5	Technical accessories.....	10
<b>5</b>	<b>Mounting.....</b>	<b>12</b>
<b>6</b>	<b>Connection.....</b>	<b>13</b>
6.1	Connection diagrams.....	13
<b>7</b>	<b>Starting up the device.....</b>	<b>13</b>
<b>8</b>	<b>Operating .....</b>	<b>14</b>
8.1	Operation in IO-Link mode – LED indicators .....	14
<b>9</b>	<b>Configuration.....</b>	<b>15</b>
9.1	Configuration via manual bridging.....	15
9.2	Configuration via buttons.....	16
9.3	Configuration via IO-Link .....	17
9.3.1	IO-Link parameters.....	17
9.4	Application example: Configuring sensor for poorly detectable media .....	17

<b>10</b>	<b>Eliminating faults .....</b>	<b>18</b>
<b>11</b>	<b>Maintenance .....</b>	<b>18</b>
<b>12</b>	<b>Repair .....</b>	<b>18</b>
<b>13</b>	<b>Decommissioning.....</b>	<b>18</b>
<b>14</b>	<b>Disposing .....</b>	<b>18</b>
<b>15</b>	<b>Technical data .....</b>	<b>19</b>

## 1 About these instructions

The instructions describe the design, functions and use of the product and will help ensure that the product is operated as intended. Read these instructions carefully before using the product; keep the instructions for as long as the device is in use. If you pass the product on to another user, remember also to pass on these instructions.

### 1.1 Target groups

These instructions are intended for properly trained personnel and must be read carefully by all persons who install, commission, operate, maintain, remove or dispose of the device.

### 1.2 Explanation of icons

The following icons are used in these instructions:

**DANGER**

DANGER indicates an imminently hazardous situation with a high risk of fatal or severe injury if the situation is not avoided.

**WARNING**

WARNING indicates a potentially hazardous situation with a medium risk of fatal or severe injury if the situation is not avoided.

**ATTENTION**

ATTENTION indicates a situation which could potentially result in property damage if the situation is not avoided.

**NOTE**

Under NOTE you will find tips, recommendations and important information. The notes make work easier, contain information on special steps and will help avoid extra work due to incorrect action.

**PROMPT FOR ACTION**

This symbol indicates action steps which the user must carry out.

**RESULT OF ACTION**

This symbol indicates relevant results of actions and sequences of actions.

### 1.3 Other documents

In addition to these instructions, you will also find the following documents on the Internet at [www.leuze.com](http://www.leuze.com):

- Data sheet of the respective device
- IODD file

All necessary Leuze software components and the IODD can be downloaded at [www.leuze.com](http://www.leuze.com). The software is available under Contact & Support - Downloads - Software.

## 2 Information on product

### 2.1 Identification of product

Part number code	Part no.
LCS-1M18P-F05PNP-M12-LT	50135720
LCS-1M18P-F05NNP-M12-LT	50135721
LCS-1M30P-F10PNP-M12-LT	50135738
LCS-1M30P-F10NNP-M12-LT	50135739

### 2.2 Scope of delivery

The device and two mounting nuts are supplied.

### 2.3 Legal requirements

The product is subject to the following EU directive:

- 2014/30/EU (EMC directive)

You can download the EU Declaration of Conformity at [www.leuze.com](http://www.leuze.com).

### 2.4 Manufacturer and maintenance

Leuze electronic provides you with support for your projects – from initial analysis to commissioning of your application. In the Leuze electronic product database, you will find data sheets and CAD files.

24-hour on-call service at:  
+49 7021 573-0

Service hotline:  
+49 7021 573-123

E-mail:  
**[service.erkennen@leuze.de](mailto:service.erkennen@leuze.de)**

Return address for repairs:  
Service center  
Leuze electronic GmbH + Co. KG  
In der Braike 1  
D-73277 Owen / Germany

### **3 For your safety**

The product has been designed according to the state of the art. There are, however, residual hazards. To avoid injury and damage, you must observe the safety and warning notices. Leuze electronic shall not accept liability for damage which was the result of failure to observe safety and warning notices.

#### **3.1 Intended use**

The devices are intended for use in industrial applications only. The capacitive sensors are used for the contactless detection of solid or liquid objects. All other uses are deemed as contrary to the intended use; Leuze electronic shall not accept liability for damage resulting from such use.

#### **3.2 Obvious misuse**

The devices are not safety components and must not be used for the protection of persons and property.

#### **3.3 General safety notices**

- The device only meets the EMC requirements for industrial environments and is not suitable for use in residential areas.
- Only properly trained personnel are permitted to mount, install, operate, configure and repair the device.
- Use the device only in compliance with the applicable national and international regulations, standards and laws.
- The sensor does not detect all objects equally well. Before commencing regular operation, check whether the desired object is detected.



## 4 Product description

### 4.1 Device overview

The capacitive sensors are housed in a cylindrical plastic housing with M18 or M30 external thread. The front of the device can be embedded so that it is flush with the installation environment. All devices have an M12 connector for connection of the sensor cable.

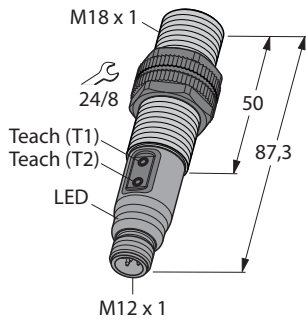


Abb. 1: Dimensioned drawing LCS-1M18P-F05PNP-M12-LT and LCS-1M18P-F05NNP-M12-LT (with teach button)

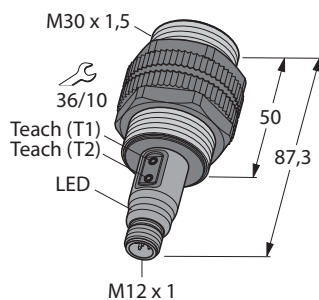


Abb. 2: Dimensioned drawing LCS-1M30P-F10PNP-M12-LT and LCS-1M30P-F10NNP-M12-LT (with teach button)

#### 4.1.1 Display elements

The capacitive sensors have a 2-color LED indicator (green/yellow).

#### 4.1.2 Operational controls

This sensor version has an integrated teach button.

## 4.2 Characteristics and features

- Threaded tube M18 × 1 or M30 × 1.5
- Embedded installation
- Plastic, PA12-GF30, PEI
- Configuration via IO-Link, teach button or manual bridging (pin 5, please use 5-wire cable for this purpose)

## 4.3 Operating principle

The sensors are used to detect the fill levels of liquids or bulk materials – either in direct contact with the medium or also through a non-metallic container wall. The capacitive sensors are also able to detect both metallic (electrically conductive) and non-metallic (electrically non-conductive) objects contactless and free from wear.

## 4.4 Functions and operating modes

In its delivery state, the device behaves like a proximity switch with a rated switching distance of 5 mm (LCS-1M18P-...-LT) or 10 mm (LCS-1M30P-...-LT). Additional functions can be taught by the user.

### 4.4.1 Configuration options

The devices can be configured via IO-Link using Sensor Studio.

The capacitive sensors have other configuration options:

- Configuration via manual bridging of pin 5 to  $U_B$  or pin 5 to GND
- Configuration via buttons

### 4.4.2 "Medium present" mode (full teach)

In the "Medium present" mode (full teach), the device operates with the lowest possible sensitivity. Possible uses are applications with easily detectable media. In this case, a switching point is taught when a medium or an object is in the detection range of the sensor.

The switching threshold is set for the "Medium present" mode automatically so that a safety reserve relative to the switch-off limit is provided. The safety reserve can be configured via FDT/IODD. The switching point is below the measured capacitance. In the "Medium present" mode, environmental influences such as temperature fluctuations, condensation, film formation or soiling have little effect on the signal. The switching point can be configured using the "Medium present" teach. The time interval between two teach events can be any length.

### 4.4.3 "Medium not present" mode (empty teach)

In the "Medium not present" mode (empty teach), the device operates with maximum sensitivity. Possible uses are e.g. applications in which pre-actuation due to environmental influences is to be avoided. The switching point is taught when no medium or object is in the detection range of the sensor.

The switching threshold is set for the "Medium not present" mode automatically so that a safety reserve relative to the switch-off limit is provided. The safety reserve can be configured via FDT/IODD. The switching point is above the measured capacitance. In the "Medium present" mode, environmental influences such as temperature fluctuations, condensation, film formation or soiling have little effect on the signal. The switching point can be configured using the "Medium not present" teach. The time interval between two teach events can be any length.

### 4.4.4 "Switching point between medium present and medium not present" mode (complete teach)

The "Switching point between medium present and medium not present" mode is suitable for applications with difficult environmental conditions or media with little contrast. In this case, the teach events "Medium present" and "Medium not present" are performed one after the other. The switching point is midway between the capacitances measured for the two teach events.

In the "Switching point between medium present and medium not present" mode, a difference between the full and empty state of a container can be detected.

### 4.4.5 Internal voltage and temperature monitoring

The device has internal voltage and temperature monitoring. The monitoring functions allow assessment of the load on the sensor and of the sensor's failure probability.

**4.5 Technical accessories**

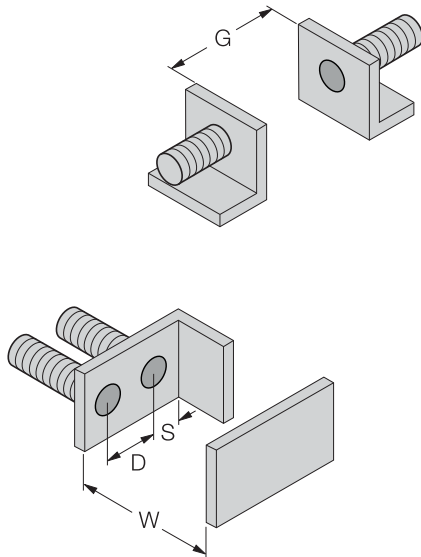
Suitable accessories can be purchased on the Leuze home page:

- Selection of suitable connection cables
- Various mounting systems
- USB IO-Link master 2.0 (Part no. 50121098).

## 5 Mounting

The sensors can be mounted in any position (orientation). The maximum tightening torque for mounting the sensor is 2 Nm (LCS-1M18P-...-LT) or 5 Nm (LCS-1M30P-...-LT).

- Clean the mounting surface and mounting environment.
- If a mounting aid is used: Secure the sensor in the mounting aid.
- Mount the sensor or the mounting aid at the intended operating location.
- Make sure that the connector on the rear of the sensor remains accessible.
- Observe the minimum mounting distances.



	LCS-1M18P-...-LT	LCS-1M30P-...-LT
Distance D	36 mm	60 mm
Distance W	15 mm	30 mm
Distance S	27 mm	45 mm
Distance G	30 mm	60 mm

Abb. 3: Minimum mounting distances

- If more than one sensor is used in the application: Avoid overlapping of the electrical fields. Overlapping can occur if two sensors are mounted closer than 36 mm (LCS-1M18P-...-LT) or 60 mm (LCS-1M30P-...-LT) to each other.

## 6 Connection

- Connect the socket of the connection cable to the connector of the sensor.
- Connect the open end of the connection cable to the power source and/or evaluation units.

### 6.1 Connection diagrams

#### -PNP version

Pin	Pin assignment	Connection diagram
Pin 1	$U_B$	
Pin 3	GND	
Pin 4	IO-Link output or switching output	
Pin 5	Teach-in	

#### -NPN version

Pin	Pin assignment	Connection diagram
Pin 1	$U_B$	
Pin 3	GND	
Pin 4	IO-Link output or switching output	
Pin 5	Teach-in	

## 7 Starting up the device

When the cables have been connected, the device starts to operate as soon as the supply voltage is applied.

## 8 Operating



**WARNING!**

The sensors are not safety devices.

**Risk of injury as a result of improper use!**

- ▶ Do not use sensors to protect persons and machinery

The switching distance of the sensor is factory-set to  $S_n$  (see the data sheet; you can download the data sheet at [www.leuze.com](http://www.leuze.com)). The output function is NO (normally open contact).

### Operation as a sensor

When the device is operated as a sensor, the LEDs have the following display functions:

LED indicator	Meaning
Yellow, steady light	Sensor actuated
Green, steady light	Sensor not actuated
Lights up briefly	Button acknowledgment
Goes out for approx. 0.5 s	Teach event successful. The sensor switches to normal operation.
Green flashes rapidly for approx. 1 s	Teach event failed

### 8.1 Operation in IO-Link mode – LED indicators

When the device is operating in IO-Link mode, the LEDs have the following output function:

LED indicator	Meaning
Green, steady light with short interruptions	IO-Link mode started

## 9 Configuration

The capacitive sensor has a switching output with adjustable switching point. After a successful teach event, the sensor operates automatically in normal operation. The time interval between two teach events can be any length.



### NOTE

If a determined switching point is outside the assured operating distance, the taught value is rejected. The device signals an error and returns to normal operation without changes being applied.

The devices can be taught as follows:

	Switching point: Medium present <sup>1</sup>	Switching point: Medium not present <sup>1</sup>	Switch between NC contact/NO contact	Reset
IO-Link	All operating modes are teachable via FDT/IODD.			
Teach button T1/T2	Press T1 for 2...9 s	Press T2 for 2...9 s	Press T1 for > 10 s	Press T2 for > 10 s
Manual bridging (pin 5)	Connect to U <sub>B</sub> for 2...9 s	Connect to GND for 2...9 s	Connect to U <sub>B</sub> for > 10 s	Connect to GND for > 10 s

<sup>1</sup> If the switching point is to be set centrally between "Medium present" and "Medium not present": Both media statuses must be taught in consecutively.

### 9.1 Configuration via manual bridging

#### "Medium present" teach

- Define object/fill level for switching point.
- Connect pin 5 to U<sub>B</sub> for 2...9 s.
  - If the LED goes out for approx. 0.5 s and the sensor changes to normal operation, the teach event has been completed successfully. The switching point is 20 % below the capacitance measured during the teach.
  - If the green LED flashes rapidly for approx. 1 s, the teach event has failed and must be repeated.

#### "Medium not present" teach

- Define object/fill level for switching point.
- Connect pin 5 to GND for 2...9 s.
  - If the LED goes out for approx. 0.5 s and the sensor changes to normal operation, the teach event has been completed successfully. The switching point is 20 % above the capacitance measured during the teach.
  - If the green LED flashes rapidly for approx. 1 s, the teach event has failed and must be repeated.

#### Invert output function (NO contact/NC contact)

- Define object/fill level for switching point.
- Connect pin 5 to U<sub>B</sub> for longer than 10 s.
  - If the LED goes out for approx. 0.5 s and the sensor changes to normal operation, the teach event has been completed successfully.
  - If the green LED flashes rapidly for approx. 1 s, the teach event has failed and must be repeated.

### Resetting to factory settings

- Define object/fill level for switching point.
- Connect pin 5 to GND for longer than 10 s.
  - ➔ If the LED goes out for approx. 0.5 s and the sensor changes to normal operation, the teach event has been completed successfully.
  - ➔ If the green LED flashes rapidly for approx. 1 s, the teach event has failed and must be repeated.

### Setting switching point between "Medium present" and "Medium not present"

- Resetting the sensor to factory setting.
- Perform "Medium present" teach.
- Perform "Medium not present" teach.
  - ➔ The switching point is midway between the capacitances measured for the teach events "Medium present" and "Medium not present".



#### NOTE

The teach events "Medium present" and "Medium not present" can be performed in any order and with any time interval.

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## 9.2 Configuration via buttons

### "Medium present" teach

- Define object/fill level for switching point.
- Press button 1 for 2...9 s.
  - ➔ If the LED goes out for approx. 0.5 s and the sensor changes to normal operation, the teach event has been completed successfully. The switching point is 20 % below the capacitance measured during the teach.
  - ➔ If the green LED flashes rapidly for approx. 1 s, the teach event has failed and must be repeated.

### "Medium not present" teach

- Define object/fill level for switching point.
- Press button 2 for 2...9 s.
  - ➔ If the LED goes out for approx. 0.5 s and the sensor changes to normal operation, the teach event has been completed successfully. The switching point is 20 % above the capacitance measured during the teach.
  - ➔ If the green LED flashes rapidly for approx. 1 s, the teach event has failed and must be repeated.

### Invert output function (NO contact/NC contact)

- Define object/fill level for switching point.
- Press button 1 for more than 10 s.
  - ➔ If the LED goes out for approx. 0.5 s and the sensor changes to normal operation, the teach event has been completed successfully.
  - ➔ If the green LED flashes rapidly for approx. 1 s, the teach event has failed and must be repeated.

### Resetting to factory settings

- Define object/fill level for switching point.
- Press button 2 for more than 10 s.
  - ➔ If the LED goes out for approx. 0.5 s and the sensor changes to normal operation, the teach event has been completed successfully.
  - ➔ If the green LED flashes rapidly for approx. 1 s, the teach event has failed and must be repeated.

### Setting switching point between "Medium present" and "Medium not present"

- Resetting the sensor to factory setting.
- Perform "Medium present" teach.



- Perform "Medium not present" teach.
  - The switching point is midway between the capacitances measured for the teach events "Medium present" and "Medium not present".



**NOTE**

The teach events "Medium present" and "Medium not present" can be performed in any order and with any time interval.

**9.3 Configuration via IO-Link**

The following components are required for configuring the device via IO-Link:

Hardware	Software
USB IO-Link master 2.0 (Part no. 50121098)	Sensor Studio configuration software
	DTM IODD interpreter
	Configuration file IODD for capacitive sensors LCS-1

**9.3.1 IO-Link parameters**

The IO-Link interface allows various parameters to be set for specific applications.

Parameter	Meaning
Data memory	Use IO-Link data storage mode: Transfer parameter data from the device to the IO-Link master. When a device is replaced, the data can be transferred from the master to the replacement device.
Data memory lock	Lock and unlock the data memory
Local configuration lock	Lock and unlock the buttons on the sensor
Switching point	Configure the safety reserve between the measured capacitance and the taught switching point
Sensor teach state	Indicates the operating mode last taught
<b>Switching point behavior</b>	
Output function	Switch over the output function (NC contact/NO contact)
Mode selection	Selection between one switching point (single mode) and two switching points (window mode)
Hysteresis value	Fixed default value for the hysteresis

**9.4 Application example: Configuring sensor for poorly detectable media**

In this example, the sensor is to be taught to detect poorly detectable media (e.g. sticky, adhesive liquids) in a tank. For this purpose, a switching point is taught between "Medium present" and "Medium not present".

- Resetting the sensor to factory setting.
- Fill level detection – Calibrate sensor with full tank: Perform "Medium present" teach.
- Fill level detection – Suppress container wall with empty tank: Perform "Medium not present" teach.
  - The switching point is midway between the capacitances measured for the teach events "Medium present" and "Medium not present".



**NOTE**

The teach events "Medium present" and "Medium not present" can be performed in any order and with any time interval.

**10 Eliminating faults**

If the device does not function as expected, first check whether any environmental interference is present. If there is no environment-related interference, check the connections of the device for faults.

If no faults are found, the device is defective. In this case, take the device out of operation and replace it with a new device of the same type.

**11 Maintenance**

The connectors and cables must be checked regularly to ensure that they are in good condition.

The devices do not require maintenance; clean with a damp cloth as required.

**12 Repair**

The device is not designed to allow repair by the user. If the device is defective, take it out of operation and return it to Leuze electronic. Here it is important to observe the specific warranty conditions agreed upon with delivery of the product.

**13 Decommissioning**

- Disconnect the interconnection cable from the power supply and/or evaluation units.
- Disconnect the interconnection cable from the sensor.
- Detach the sensor or, if applicable, the mounting aid from the installation environment.
- If applicable, detach the sensor from the mounting aid.

**14 Disposing**

The devices must be disposed of properly; they do not belong in ordinary household waste.

**15 Technical data**

The technical data can be found in the data sheet. The data sheet can be downloaded at [www.leuze.com](http://www.leuze.com).